Review of the Regional Transit Plan

December, 1994

prepared for the King County Council

John T. Doolittle & Associates, Inc.

in association with:

Toronto Transit Consultants, Ltd.

MacDorman & Associates

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December 23, 1994

Mr. Stevan Gorcester
Transportation Staff Advisor
King County Council
402 King County Courthouse
Seattle, WA 98104

Dear Mr. Gorcester:

Doolittle & Associates is pleased to submit this final report on our review of the RTA's Master Plan for the King County Council. I appreciate the advice and support provided by you, David Hopkins, and others of the County Council staff. I also appreciate the openness and cooperation of the RTA staff in addressing our needs for information during the review.

The report was prepared by the consultant team. Besides me, the team included Brian McCollom (MacDorman & Associates), Ken Knight (Toronto Transit Consultants, Ltd.), and Ben Porter (Porter & Associates, Inc.). Mr. McCollom was responsible for the bus/rail integration chapter. Mr. Knight prepared the capital costs chapter, and Mr. Porter prepared the financial plan chapter. Please feel free to contact me or any member of the consultant team if you need any further information, or if you have any questions regarding the content of the report.

Thank you for this opportunity to have been of service to the King County Council.

Sincerely,

John T. Doolittle, Jr.

John T. Doolittle, Jr., BDP
President

REVIEW OF THE REGIONAL TRANSIT PLAN

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1. Summary

On October 29, 1994, the Central Puget Sound Regional Transit Authority (RTA) adopted a Master Plan to serve as the basis for a referendum to be placed before voters within the RTA district in March, 1995. The Master Plan proposes a $6.7 billion transit program, the most prominent features of which are light rail and commuter rail lines connecting the principal population centers of King, Pierce, and Snohomish counties. Implementation of the RTA Master Plan will have potentially far-reaching effects on how this new development in the region will be accommodated.

Adoption of the Master Plan culminates years of debate about the form and extent of a regional rail system. Although roots of the plan date from the 1968 Forward Thrust rail referendum, it was the region's adoption of **Vision 2020** in 1990 and subsequent development of a regional transit plan by the Joint Regional Policy Committee (JRPC) that shaped today's debate about what the rail system should accomplish.

Due to the potentially far-reaching effects of the RTA Master Plan, the RTA's enabling legislation specified that the legislative authorities of each county confirm their continued participation in the RTA, given the extensive modifications to the JRPC plan in the now-adopted RTA Master Plan.

This report documents information presented to the King County Council during its consideration of this decision. This information was shared with the Council at a joint meeting of the Regional Transit Committee and the Transportation, Transit, and Regional Governance Committee on December 1, 1994. Based on the joint committee's recommendation, and following public discussion at its December 5, 1994 meeting, the Council decided on December 12, 1994 to continue participation in the RTA.

The contents of this report are as follows:

- **The Plan's relative scale and performance** – the RTA plan was compared to the JRPC plan and to other rail transit systems in the U.S.
- **Operating issues** – presents implementation issues likely to arise with the LRT system, commuter rail system, and bus services which should be addressed in the next phase of planning.
- **Bus/rail integration** – presents an assessment of the impact on Metro bus operations associated with full implementation of the rail system.
- **Capital costs** – presents an assessment of the capital cost methods and results as presented in the RTA Master Plan.
- **Financing plan** – presents a review of the reasonableness of the methods and assumptions used in preparing the RTA's financial plan.

These sections of the report are followed by appendices which provide additional technical information.

2. The Plan's Relative Scale and Performance

Because the RTA's rail plan would be the first passenger rail system in the Puget Sound region, it is both interesting and useful to place the projected performance of the plan is some context that would facilitate its evaluation. This section of the report presents a comparison of the RTA plan to the plan previously adopted by the JRPC, and to other rail systems across the U.S.

2.1 Comparison to the JRPC Plan

The JRPC plan, adopted in May, 1993, served as the predecessor for the RTA Master Plan. The JRPC Plan also was a necessary interim step in the formation of the RTA.

The RTA Master Plan shares some similarities with the JRPC plan, but differs from the JRPC in several important ways (see Appendix A for maps of both plans). Within King County, the rail components of the RTA plan follow similar horizontal alignments in the North and South corridors. The vertical alignments have changed considerably in the South corridor, and both the horizontal and vertical alignments have changed considerably in the East corridor. Another important difference is the RTA plan's decreased emphasis on regional bus improvements. Whereas the JRPC plan would devote approximately 25% of local tax revenues to bus service and bus-related improvements, the RTA Master Plan devotes approximately 17% of local tax revenues to these purposes. Collectively, these changes reduced the cost of the plan by about half – from approximately $13 billion to $6.7 billion. Precise comparisons of the overall costs of the two plans are limited by the brevity of the final financing plan which accompanied the JRPC plan.

Most of the discussion regarding a comparison of the two plans has focused on costs. Somewhat less discussion has occurred regarding the relative performance of the two plans, especially where rail alignments were similar. Questions regarding this type of performance comparison arose in part due to the RTA plan's emphasis on at-grade rail construction.

Exhibit 2-1 presents a comparison of the rail components of the RTA Master Plan and the JRPC plan. The JRPC plan data has been modified to allow a reasonably direct comparison to the RTA plan. The major adjustments included: (1) converting the JRPC plan cost to 1995 dollars; and (2) deleting those segments of the LRT system in the JRPC plan which are excluded from the RTA plan (i.e., extension of the East line to Totem Lake, the Renton extension from the South line, the North line north of SW 164th Street in Snohomish County, and the South line south of Tacoma). Adjustments were also made to the JRPC plan ridership, beyond those needed for the comparable segments. These adjustments included: (1) discounting the ridership to 2010 from 2020; and (2) discounting of the baseline ridership which had overstated the JRPC ridership estimates relative to the ridership methodology now used by the RTA.

Exhibit 2-1:
Comparison of the RTA and JRPC Plans

Plan Element	RTA Plan	JRPC Plan: As Adopted	JRPC Plan: Comparable Segments	JRPC Plan: Ridership Adjustments	difference, RTA vs. JRPC
Capital Costs					
LRT	$4,184M	$8,423M	$6,082M		($1,898M)
Comm. Rail	595M	318M	318M		276M
total	$4,779M	$8,741M	$6,401M		($1,622M)
Operating Costs					
LRT	$120M	$146M	$96M		$24M
Comm. Rail	26M	22M	22M		4M
total	$146M	$168M	$118M		$28M
Daily Boardings					
LRT	169,000	305,650	247,021	190,264	(21,264)
Comm. Rail	17,100	8,100	8,100	7,232	9,868
total	189,800	318,250	259,621	201,514	(11,714)
Performance					
Cost per Boarding	$4.66	$4.05	$3.57	$4.60	($0.06)
Revenue Speed LRT	25.0	30.0	30.0	30.0	(5.0)
Revenue Speed Comm. Rail	34.0	34.0	34.0	34.0	0

(for additional information, please refer to Appendix A)

Generally, the RTA plan accomplished its reduction in costs while maintaining comparable ridership productivity:

- For comparable segments, the RTA plan reduced capital costs by $1.6 billion (25%) though operating cost estimates are slightly higher.
- Daily boardings decreased by about 12,000 (6%), owing mainly to the lower operating speed of the RTA plan (about 25 mph versus 30 mph+ in the JRPC plan).
- Cost per boarding was practically the same in both plans.

It is important to note, however, that the RTA ridership estimates assume a tunnel alignment through the University District. A surface alignment, which is still under consideration, is generally acknowledged to have a lower operating speed and would probably carry less riders. With this caveat, the changes made to the JRPC plan appear to be cost effective.

2.2 Comparison to Other Rail Systems

Another perspective on the plan's performance can be achieved by its comparison to other multimodal systems developed in the United States since the beginning of the resuscitation of urban transit in the mid 1960's. This comparison is first placed in a historical perspective, then viewed from a statistical perspective for light rail transit and commuter rail services.

Rail System Development in the U.S.

Most of the major intermodal transit systems in the country were developed through various strategies by private and public agencies over a period of many decades. The primary examples of these kinds of older, more established, systems are in the Boston region, Metropolitan New York City, Philadelphia, Chicago, and Cleveland. Over the recent two or three decades, the preexisting rail transit, commuter rail, light rail, bus, and trolley bus systems operating in these metropolitan areas have been improved through various strategies which have resulted in rehabilitation, and often expansion of these systems.

Since 1965 or so, three major new regional rail rapid transit systems have been developed in San Francisco, Atlanta, and Washington, D.C. These single mode rail rapid transit systems have been developed based on an original regional system plan. In the case of Atlanta and San Francisco, full original build out was initiated at the outset and carried out over a period of several years. Since the completion of these original system plans of 60 to 70 miles, newly planned extensions have been developed and implemented - in both cases to the respective airports.

In the case of Washington D.C., the system that has been under construction for the past three decades has been based on an original plan with staging based on a combination of financial and service considerations.

In San Francisco. the rail rapid transit system of BARTD has been complemented by the light rail system owned and operated by the City of San Francisco, and a commuter rail line connecting San Francisco with the suburbs and commercial areas to the South which is sponsored by the State.

In Baltimore, the State of Maryland has developed three new rail modes since 1970. The first stage of a 60 mile regional rail rapid transit system has been completed and has been in operation for several years. The second stage is under construction. At the same time, the state rehabilitated commuter rail lines between Baltimore and Washington, D.C., and between Washington and the northwestern Maryland suburbs, as well as a light rail line between Baltimore and its north central suburbs. Further extensions of the light rail line are planned to the airport and its neighboring commercial and residential areas. Both the commuter rail and light rail lines were developed and implemented in parallel to the rail rapid system, over a relatively brief implementation period.

The other light rail systems that have been developed over the past two decades have taken a more incremental approach. These systems are in Buffalo, San Diego, San Jose, Sacramento, Portland, Los Angeles, Denver, and St. Louis. In these cases, new light rail lines have been

developed incrementally in segments generally in the 10 to 20 mile range. In some cases, these lines are the first phase in longer term plans for a multi corridor or a full regional system.

With the exception of Los Angeles and San Jose, none of these regions has a companion commuter rail or rail rapid transit operation. San Jose is at the southern end of the commuter rail service on the Peninsula to San Francisco. In Los Angeles, the County MTA is developing other light rail and rail rapid transit lines in addition to the existing light rail line to Long Beach, and the County is a partner in a multi-county agency that has developed and implemented a regional commuter rail system.

Statistical Comparison: LRT Systems

A summary of the major financial and operating characteristics of the RTA plan and that of a selection of other existing systems is provided on Exhibit 2-2. In this table, we have compared the RTA light rail plan to the average of four groups of other systems:

- the three new rail rapid systems in San Francisco, Atlanta, and Washington
- the seven new light rail systems in San Diego, San Jose, Sacramento, Buffalo, Portland, Los Angeles, and Baltimore
- the seven "old" light rail systems in Boston, Philadelphia, Cleveland, Pittsburgh, San Francisco, Newark and New Orleans (even though the latter two are very small and quite different otherwise)
- the average of the all three groups.

(the detailed data for each of these systems is presented in Appendix B)

The new systems that have recently begun operation in Denver and St. Louis are not included in this comparison, because the data from these systems are not yet available. In general, both of these lines are being developed incrementally in the style of the other new light rail systems.

Exhibit 2-2: LRT Systems Comparison

System Group	Directional Route Miles	Operating Costs	Vehicle Hours	Cost per Hour	Passengers per Hour	Farebox Recovery
Rail Rapid Systems	124	$211M	1,207,000	$162	91.2	NA
Newer LRT Systems	33	$20M	124,868	$167	71.1	36.4%
Older LRT Systems	47	$30M	187,229	$167	105.8	40.0%
Group Average	68	$87M	506,499	$165	89.4	38.2%
RTA (projected)	138	$120M	674,550	$178	75.2	40.0%
RTA % of group average	203%	137%	133%	108%	84%	105%

The general conclusions that can be reached from this comparison include:

- the operating and financial characteristics of the RTA light rail plan are more comparable to the three large rail rapid systems (BART, WMATA, MARTA) that were built under the concept of achieving full regional service as soon as possible
- the scale of the RTA light rail system is significantly larger than those of either the seven new or the seven old light rail systems
- the level of service provided, measured in vehicle hours, is greater than both the other new systems and the old light rail systems - in part because of the length of the system
- the operating costs of the RTA system, measured in cost per car hour, are comparable to the average of the other systems
- the 40% "operating ratio" assumed by the RTA is very close to the average of the other systems
- the ridership productivity (riders per vehicle hour) is lower than that for the rail rapid systems and the older LRT systems, but slightly above the newer LRT systems.

Statistical Comparison: Commuter Rail

The comparison of the proposed commuter rail element of the plan calls for some similarly judgmental considerations. The current set of commuter rail programs that are in operation in the United States vary significantly in nature and extent, operating and financial characteristics, and underlying costs factors. Some are owned by public agencies, and operate passenger services only. Some are publicly owned and operated by private carriers. Some are owned by private companies and subsidized by public agencies.

For the purpose of this comparison, we selected a sample of five commuter rail lines: one in Boston, two in Chicago, the new system in southern Florida serving the three counties en route to Miami, and the system operated by CalTrans serving San Francisco. The results of this comparison are presented in Exhibit 2-3 (top of following page).

The general conclusions that can be drawn from the commuter rail system comparison are as follows:

- The estimated cost per hour of the RTA commuter rail system is less than the average cost per hour of the other systems.
- The average passengers per hour of the RTA system is about 60% that of the other systems.
- The speed of the RTA system is comparable to that of the other systems.
- The level of service provided, measured in revenue hours, falls within the range of the other systems and is about the same as the services provided by BN in Chicago.
- The estimate of total annual passengers is lower than the average of the other systems, and exceeds only that of the Tri-Rail service in south Florida.

The overall scale of the planned commuter rail system is partly a function of the indirect alignment of the existing right of way, a partly of a desire to serve Tacoma on one end of the route and Everett on the other. The aspect of the plan helps the overall equity of the redistribution of the tax revenues, but diminishes the cost effectiveness of the overall scheme.

Exhibit 2-3:
Commuter Rail
Systems Comparison

System	Operating Cost per Revenue Hour	Riders per Revenue Hour	Operating Speed	Annual Statistics (000s)			
				Operating Expenses	Vehicle Miles	Vehicle Hours	Riders
Boston (MBTA)	$199	39.8	29.7	$99,954	15,177	511	19,949
Chicago (C&NW)	$262	64.2	32.9	$95,565	12,342	370	23,299
Chicago (BN)	$279	92.7	34.5	$34,234	4,886	142	11,359
Florida Tri-Rail	$367	51.2	40.6	$16,249	1,892	56	2,267
CalTrans	$327	68.8	33.5	$28,774	2,951	88	6,058
1992 Average	$287	63.3	34.2	$54,955	7,450	233	12,606
1995 Value @ 4%/year	$323	63.3	34.2	$61,817	7,450	233	12,606
RTA (projected)	$256	34.9	32.9	$32,000	4,110	125	4,361
RTA % of peer group	79.3%	55.1%	96.1%	51.8%	55.2%	55.7%	34.6%

3. Operating Issues

The operation of the services proposed in the plan carries with it a set of assumptions which are common to such plans. The nature of several of these assumptions is that they require the acceptance and cooperation by a number of other agencies and organizations to be carried out effectively and within the cost and service quality parameters of the plan.

It would not necessarily be the case that all of these issues would be resolved at this stage of the planning. However, the ability of the RTA eventually to deliver the services it proposes at that costs it estimates will depend to at least some extent on its ability to work with each of the relevant agencies to reach an acceptable resolution. For the short term, agreements in principle would be useful to support the financial and operating feasibility of the plan.

The operating issues and assumptions can are unique to each of the three major modes of the plan: commuter rail, lights rail, and "feeder bus" and "trunk bus" services.

3.1 Commuter Rail

The commuter rail operating plan calls for operating passenger service on the same tracks that the railroad currently operates freight services. This is a practice that is common to many existing commuter rail operations in this country and elsewhere, and is generally a very feasible scheme. The volume of freight service on this line is extensive, and greater than is found on many joint passenger and freight operations.

The difficulties of such operation are known to the RTA, and have not been ignored. They include:

- using rolling stock that is safe to operate in common with freight operations
- coordinating schedules so that passenger service can achieve on time performance
- avoiding passenger service delays caused by freight operations on a railroad owned and managed by the freight railroad
- allocating to costs of right of way maintenance in such a way that reflects the generally higher standards required for high speed passenger service, while the extent of wear and tear is largely a function of the weight and volume of freight traffic.

The resolution of these issues can be dealt with in the eventual contract for services, but should be spelled out in a memorandum of understanding with the railroad before the commitment is made to make the capital improvements on the railroad that are a part of the plan and will be necessary to provide the levels of service contemplated by the plan.

The eventual agreement with the railroad will also be subject to the federal procurement regulations to which agencies that receive FTA funding are bound. These include the requirement that service contracts be competitively procured initially, and then recompeted every three to five years. The application of this principle to an operating contract with an owning railroad may require an exemption from the FTA.

A competitive procurement involving both private and public bus companies could achieve a lower cost of these services. Among the factors that suggest this strategy are:

- the current physical plant of METRO is reportedly at capacity
- the time that it takes a public agency to acquire new rolling stock and provide an operating base is substantially longer than can be done by the private sector
- the operating costs of Community Transit's express operations are substantially lower than those of METRO.

The ridership of the light rail system includes a substantial diversion of riders from existing bus services, and depends on the three bus operations to adopt operating strategies that create this diversion. In general, this means that the "competing" bus services needs to be curtailed, and complementary feeder and distribution bus services must be developed to provide access to the light rail system.

The RTA has adopted a "hold harmless" scheme for reimbursing the local carriers for ridership and revenues lost to the light rail system. It has not yet reached agreements with the three agencies with respect to reduction of "competitive" service nor to the service plan for providing feeder and distribution services.

The are several years before these actual feeder and distribution service decisions need to be made. Nevertheless, the feasibility of achieving ridership - as well as creating service revision opportunities for the carriers - would be enhanced by agreements in principle on these issues with the three major public carriers.

4. Bus/Rail Integration

We examined the impact of bus/rail integration through a review of current bus routes that RTA assumed would be changed when the rail system became operational. The RTA planners were conservative in their forecasts and did not make any assumptions about how the METRO bus system as a whole might be restructured and reoriented to provide feeder service to the rail system. They only assumed changes to existing METRO routes that now serve proposed rail stations or that provide competing line haul service.

The RTA planners provided a list of 107 bus routes that they assumed would be affected. The routes could be grouped into three categories:

- 20 routes were marked for elimination because they provided competing line haul service.
- 27 routes were targeted for reduced service because it was assumed that these routes would lose long-distance travelers to the rail system and would only retain their existing short-distance riders.
- 60 routes would be cutback at the rail stations and converted to feeder bus services.

We obtained recent (1993) route level statistics from King County METRO to assess the potential impact of the proposed changes on the current bus system. We found that the proposed changes would affect about 37 percent of METRO's existing ridership and about 40 percent of current service provided as measured by platform hours (see Exhibit 4-1).

Exhibit 4-1:
Bus Service Changes Associated with Rail System Implementation

Type of Change	Number of Routes	Platform Hours	Passengers	Revenues
Eliminated Service	20	252,523	5,248,137	$3,422,950
Reduced Service	27	357,929	9,871,547	$5,378,549
Truncated Service	60	556,148	13,617,128	$8,901,053
Total	107	1,166,600	28,736,813	$17,702,553
Total Bus System	234	2,804,614	76,870,301	$44,221,051
Percent of System	45.7%	41.6%	37.4%	40.0%

(for detailed data supporting the above table, please refer to Appendix C)

One of the benefits of the proposed rail system is the potential to redeploy bus service that is replaced by rail service to meet unserved bus needs. We estimated that approximately 759,000 annual platform hours of bus service --- 27 percent of the total system --- would be available to meet unserved needs if the bus route changes assumed by the RTA planners were implemented (see Exhibit 4-2).

Exhibit 4-2:
Potential for Bus Service Redeployment

Type of Change	Platform Hours	Percent Redeployed	Redeployed Platform Hours
Eliminated Service	252,523	100%	252,523
Reduced Service	357,929	25%	89,482
Truncated Service	556,148	75%	417,111
Total	1,166,600		759,116
Total Bus System	2,804,614		2,804,614
Percent of System	41.6%		27.1%

Although the operating costs for the redeployed service would not change, there may be a reduction in passenger revenues because the service may be redeployed to areas with lower passenger productivity. We estimated the loss in passenger revenue based on three key assumptions:

- *The passenger productivity of the redeployed services would be 20 passengers per platform hour.* This rate compares to an average system productivity of 27 passengers per platform. We feel that the rate of 20 passengers per platform hour is reasonable because the redeployed service probably would be assigned to some areas such as the City of Seattle where productivities may be near or above the system average and to other suburban areas where the productivities may be as low as half the system average.

- *The average fare per passenger on the redeployed services would be $0.50.* This farebox return appears reasonable from a review of current experience of local METRO bus routes.

- *METRO would continue to receive the same passenger fares on the routes where service is reduce or the route is truncated.* This assumes that an equitable revenue sharing scheme can be negotiated between the RTA and METRO.

Based on these assumptions, it is estimated that METRO would lose approximately $3.8 million in annual passenger revenues if the RTA bus route changes were implemented. This estimate represents 8.7 percent of METRO's total passenger revenues and 1.9 of METRO's total bus operating costs, and is calculated as follows:

	Lost Revenues
Eliminated Service	($897,720)
Reduced Service	($449,817)
Truncated Service	($2,504,680)
Total - affected service	($3,852,217)
System Passenger Revenues	$44,221,051
Percent of System Revenues	***8.7%***

The estimate of lost revenues is based on 1993 passenger statistics. The RTA forecasts that transit ridership will grow 27 percent between now and 2010 due primarily to population and employment growth. If this growth occurs, the loss in annual passenger revenues would be $4.9 million.

The RTA Master Plan anticipated the potential loss of passenger revenues by local bus operators. It has proposed a regional fare integration budget of $15 million a year in 2010 to provide full reimbursement of all operators. This budget appears sufficient to meet the needs of METRO and other local operators. still ?

While the RTA policy on fare integration is good conceptually, many details must be negotiated. These issues include:

- The design of a single regional fare structure that would be applicable to and accepted by all operators.
- The method for allocating revenues to transit operating agencies.
- The basis for determining what full reimbursement of operators means as the rail system is implemented and population, employment, and ridership increases. Some important issues include:
  - What is the base year for reimbursement (e.g., 1995, 2010)?
  - What provisions for natural growth in ridership (e.g., none, partial, or actual growth)?
  - What, if any, guidelines should be applied to redeployed bus service resources and resulting revenues?
  - Will the funds for regional fare integration be a permanent part of RTA's budget or will it have a limited life to provide for a smooth transition for the region's operators?

It is important to recognize that the estimate of 760,000 annual platform hours represents the maximum amount of service that would be available for redeployment. It is likely that METRO, like other transit systems that have built new rail systems, will be unable to make all of these changes because:

- For selected trips, some bus routes may be faster than rail service.
- Some riders are reluctant to change long established travel habits and will always ride the existing bus routes and lobby for their continuation.
- Some riders are unwilling to give up a one-seat ride and transfer to the rail system.
- Transit boards often are unwilling to eliminate service when there any level of vocal and public rider opposition.

For these reasons, we do not believe that METRO will be able to redeploy 760,000 annual platform hours of service. We think a more reasonable estimate might be between 300,000 and 400,000 annual platform hours.

5. Capital Costs

The purpose of the capital cost review was to determine the reasonableness of the RTA estimates, based on comparisons with similar projects in the United States and Canada. This review was conducted by Toronto Transit Consultants Limited (TTCL). TTCL reviewed the current Phase I RTA engineering reports and cost estimates, and public documents describing the RTA Master Plan. TTCL also reviewed various alignment drawings for rail alternative plans and capital cost data prepared by the Parsons Brinckerhoff/ICF Kaiser Engineers Team.

The RTA Master Plan proposes a regional rail and bus system which would cost $6.7 billion to construct and operate through the year 2010. The plan includes light rail transit (69 route miles), commuter rail (74 route miles), and regional trunk bus services. The review conducted by TTCL focused on the light rail transit (or LRT) component of the plan. Construction of the LRT system accounts for approximately 60% of the plan's total costs.

The remainder of this section presents a breakdown of the LRT system capital costs, provides an overview of the cost estimating methods, and presents an analysis of the capital cost estimates relative to other rail projects. Generally, the cost estimates are within the range of costs experienced elsewhere. Given the conceptual nature of the plan and the lack of site-specific information, however, it would be prudent for cost contingencies to be higher than now included in the plan.

5.1 LRT System Capital Costs

The LRT system is comprised of three lines *(please refer to Appendix A for a system map)*. The length, cost, and unit cost of each line are as follows:

Line	Length (miles)	Cost ($M)	Cost per Mile ($M)
North	19.3	$1,700	$88
South	34.3	1,525	44
East	15.0	620	41
total	68.7	$3,845	$59

The costs for each of the line segments include a share of the following system costs:

Vehicle cost, 300 at $2.3M each		$690M
DSTT conversion to LRT operation		26M
RTA Headquarters		31M
Main Maintenance Facility		
300 vehicles at $0.5M/vehicle	150	
Central Control Facility		$ 33M
		$930M

5.2 Estimating Methods

The rigor of the estimating methods employed by the RTA is limited by the level of engineering data currently available for the plan. The Phase I Plan for the LRT system is only in the conceptual stage. Cost estimates, based on alignment option drawings, at 1 inch = 200 feet scale exist for only part of the proposed alignment. Accordingly, one cannot expect a great deal of precision in the cost estimates.

A variety of techniques have been used to estimate system costs.

- A Unit Cost Library was prepared for common unit costs.
- A Construction "Kit" was prepared for rapid identification of total costs for various system elements.
- Costs per foot for a variety of construction sections were estimated.
- A number of alignment options were estimated in a more complete format.
- Finally a check of comparable system costs per mile from similar US system were escalated to 1995 dollars and compared with the final results of the Seattle estimate.

(samples of these documents are presented in Appendix D)

These techniques appear reasonable for the purpose for which they were developed – "quick turnaround" capital cost estimates to aid in developing consensus on the scope of the plan. Cost estimates are typically the product of unit costs and quantities. Although considerable care seems to have been exercised in developing the unit costs, a good deal of work remains to be done in estimating quantities before the cost estimates can be considered solid.

5.3 Capital Cost Analysis

The capital cost estimates in the RTA plan are generally consistent with capital cost associated with similar projects in the US and Canada, as shown in the table below:

Item	Project	Unit Cost
Tunneling ($ per lineal foot of twin tunnels)	RTA North Line	$10,900
	Downtown Seattle Transit Tunnel	$10,700
	BART Airport Extension	$15,000 to $24,000
	Toronto (various projects)	$9,100 to $11,900
Subway Stations ($ per station)	RTA	$34M to $54M
	Toronto	$30M
Rail cars	RTA	$2.3M
	Toronto	$2.0M

Although the RTA's unit cost estimates fall within a reasonable range of those experienced elsewhere, it still would be prudent to increase the project's contingency funds. The RTA assigned line-by-line item contingencies ranging from 15 to 30 percent, depending on the level of uncertainty. At this stage of the project, with only a conceptual design and no alignment-specific geotechnical data, a more appropriate contingency range might be 30 to 40 percent. The upper end of this range should be applied to subway sections of the alignment. As noted above, tunneling costs can be substantially higher than planned for by the RTA. The cost risk will remain unknown until complete geotechnical data are available.

Project contingency funds are important because they allow for the inevitable additions and changes during design development and for changes and claims during construction. Contingency allowance should be highest at the conceptual stage of the project, and decrease contract by contract as final design is completed and construction starts. Among the kinds of changes that could produce unexpected increased costs are:

- betterments and mitigations adopted during the EIS stage;
- more elaborate stations to accommodate local interests;
- increased right of way protections for safety and traffic conditions; and
- unanticipated difficulties during the actual construction of the project.

Some additional observations about major components of the RTA's capital cost estimates are provided below.

Tunneling Costs

The Downtown Seattle Transit Tunnel (DSTT), which was constructed in the late 1980's and opened in September, 1990, provides some insight into tunneling costs to be anticipated in the Seattle area. The DSTT involved twin tunnels, 18 feet in diameter and about 5,000 feet in length. The tunneling portion of this project's cost is approximately $44M. The cost per foot of twin tunnels escalates to about $10,700 in 1995 dollars. The tunnels were driven in soft ground and it is assumed that this condition will prevail for all future tunneling. Bedrock is said to be very deep and beyond any practical tunneling application.

Aerial Structures

Aerial guideway cost estimates appear reasonable when compared with costs from Toronto and Los Angeles' Blue Line (LRT). Consider the following costs per lineal foot of double-track structure:

RTA Seattle	$3,000 to $5,000
Los Angeles	$3,400
Toronto	$4,600

Similarly, the costs of aerial station can be compared with those in Los Angeles.

RTA Seattle (300 foot platform)	$6 to 7M each
Los Angeles (400 foot platform)	$3M

Surface Structures

Surface guideway, including trackwork, can be compared with Toronto and Los Angeles costs as follows:

RTA Seattle ($'s per foot, double track)	$ 740
Los Angeles (T&B construction)	$ 726
Toronto (T&B construction)	$ 900
Toronto (In-street construction)	$1,200 to $1,500

(note T&B refers to ties & ballast construction, whereas "in-street construction" refers to direct fixation of rail to the roadway pavement surface)

As with tunneling, surface construction costs are quite variable. Mitigation of traffic flows and business disruption (due to roadway reconstruction) are among the sources of cost risk.

Trackwork Costs

Cost per foot of single track compared with Toronto and Los Angeles shows that the RTA estimates are relatively conservative for both Ties and Ballast (T&B) and Direct Fixations (DF) type of construction:

RTA Seattle (T&B)	$370
RTA Seattle (DF)	220 to 460
Los Angles (T&B)	250
Toronto (T&B)	230
Toronto (DF)	$365

Yard and Shops

The RTA's estimates for yards and shops are very general. While the estimate compares favorably to recent experience in Los Angeles, site conditions and facility design will influence the costs of construction.

RTA Seattle	$500,000 per car
Los Angeles	$600,000 per car

6. Financing Plan

Our review of the financing plan focused on the methodology and assumptions used to determine the RTA's financial capacity to implement the Master Plan by 2010. As part of this review, we also analyzed the procedures for developing the subregional revenue estimates which have been a focus of attention for evaluating the equity of the plan's services and facilities. Findings from both these analyses are presented below.

6.1 Reasonableness of Methods and Assumptions

Financial Methodology

The methodology is expressed by the cash flow model used to calculate the RTA's prospective cash position for each year between 1995 and 2020. Tables produced from this model were included in the ***Regional Transit System Master Plan Technical Appendix***, dated November 23, 1994. These tables include: (1) an annual cash flow summary; (2) annual operating and capital expenditures; (3) bond financing and debt service; (4) annual revenues; (5) federal funding assumptions; and (6) tax revenue assumptions and calculations. These tables provide a complete and relatively transparent picture of how the RTA's year-end cash position is projected.

We reviewed the calculations of the model and determined that the resulting projections present a reasonable basis for evaluating the financial feasibility of the plan, given the assumptions on which the projections are founded.

Several modifications should be made to the model, however, which would improve the precision of the results:

- The debt service coverage ratio should be calculated net of local tax revenues committed to other purposes, such as operating costs. The debt service coverage ratio currently included in the model assumes that all local taxes would be pledged to debt service, which tends to overstate the RTA's ability to issue additional bonds. In 2011, the year in which the minimum debt service coverage is reached, the model identifies a coverage ratio of 3.09. If revenues needed for operating subsidies are subtracted from the calculation, however, the coverage ratio drops to 1.9. This is a more realistic measure of the RTA's remaining debt capacity at 2011.

- First-year interest payments are currently excluded from the annual cash flow. This is immaterial from the standpoint of determining financial feasibility, but does understate the outlays required for debt service.

- Annual reserves should be differentiated according to operating and construction programs. The operating reserves now included in the model are excessive, while construction program reserves are not identified. These two situations may net to zero additional reserves compared to what is now included in the model, but should be explicitly identified.

Financial Assumptions

The financial plan indicates that revenues are balanced against costs on an annual basis, after accounting for proceeds from bonds and the debt service costs associated with the bonds. The viability of the financial plan depends on the reasonableness of cost and revenue estimates. The reasonableness of the cost estimates is addressed elsewhere in this report. The most important assumptions with respect to the revenue estimates, in order, are as follows:

- **Local tax revenue** – Local tax revenue, from a 0.4% sales and use tax and a 0.3% motor vehicle excise tax (MVET), is the single-largest source of funding for the RTA Master Plan. A total of $3.3 billion (constant 1995$) is projected for the period 1995-2010. We verified the calculation used to establish the beginning tax base, and evaluated the reasonableness of assumed growth rates for the revenue projections.

  The tax base for both retail sales and for MVET was estimated by the RTA from the percentage of retail employment (92%) and population (85%), respectively, lying within the RTA boundary in 1990. The tax base presented in the RTA's cash flow is an accurate representation of these percentages. The sales tax base, however, may be understated because the tax is applied to more taxable events than taxable retail sales alone. We did not verify the degree of understatement but believe it to be approximately 5%, based on a comparison of retail sales and use tax collections to taxable retail sales in King County for 1993.

  The annual growth rates applied to this beginning revenue base are consistent with recent regional tax base projections prepared for the Puget Sound Regional Council (PSRC) by Dick Conway & Associates. These growth rates, in turn, are linked to projected personal income for the region and other variables which affect retail purchases, building activity, and motor vehicle purchases.

  In summary, the tax revenue projections are based on reasonable assumptions that are drawn from the best available data.

- **Federal grants** – Federal grants form the second-largest source of funds for the Master Plan. The RTA assumes that approximately $1.12 billion (constant 1995$) will be available to fund rail capital costs. This is about $70 million per year for the period 1996 through 2010. Federal grants would account for approximately 24% of the rail capital program.

  The RTA's request for Federal funds would be at the high end of the experience of other metropolitan areas that have received "new start" rail funds. Atlanta ($1.6 billion), Los Angeles ($1.3 billion), and Miami ($0.9 billion) are the only areas to-date which have received funds in the neighborhood of the RTA's proposal. Also, the RTA's request would need to be sustained over a 16-year period. The $70 million annual funding request equates to about 18% of the federal fiscal year 1995 projected funding for new rail starts. In comparison, Los Angeles sustained an average of 35% of rail funds for 9 years, and Atlanta sustained a 26% share over 6 years. This suggests that out-year funding is risky, even if support for Federal funds is attained for the early segments of the rail system.

One factor that is in the RTA's favor is the relatively low Federal match being requested. The RTA's request for 24% federal funding compares to an average of 64% being requested by other rail projects that are now in alternatives analysis.

In summary, the RTA's outlook for federal funds is aggressive and potentially attainable, but is risky over the long run.

- **State funds** – State funds are the third-largest revenue source for the RTA Master Plan, and are projected to total $880 million (1995$) between 1995 and 2010. This is approximately 20% of rail capital costs.

  Currently, the state's only source for supporting the rail program is the Transportation Fund. This fund derives from a statewide 0.2% MVET surcharge, and is authorized to be used for a wide variety of transportation uses. In contrast, all other material sources of state funding are restricted to highway purposes. Because the state has limited financial capacity for highways, including use of the Transportation Fund, it appears unlikely that the RTA plan would be funded absent an increase in state transportation taxes.

  The Transportation Commission recently announced a new transportation revenue package, which would include a refinery tax which would be used to fund the state's contribution to high capacity transit (HCT) projects. The Commission has indicated that substantial public support exists for supporting HCT projects with state funding.

  In summary, state funding for the project, in the amounts anticipated by the RTA Master Plan, depends on the ability to enact a new transportation funding package. Although the RTA could proceed with the implementing the plan before these state funds are available, completion of the plan depends on the state funds eventually being available.

- **Farebox revenues** Fare revenues are anticipated to total $360 million between 1995 and 2010, and form the fourth-largest source of funds in the financial plan. This assumption is based on the ridership forecasts, and translates to approximately $0.90 per rider on the LRT and commuter rail systems. This fare is reasonable, and is higher than the average fare now paid by bus riders in King County.

The financial plan is feasible within the constraints of the assumptions identified above. Additional bonding capacity of approximately $330 million (constant 1995$) would exist at 2011, at the close of Phase I construction, after meeting all other obligations. This can be viewed as untapped financial capacity for meeting shortfalls which may occur in the capital program funding sources.

6.2 Subregional Revenue Allocations

The local taxes to be collected by the RTA have been used as a criterion in determining the equity of the overall plan. Collection of these taxes, and estimates for these tax revenues on a subregional basis requires some judgment because precise source data does not currently exist for

either sales tax collections or MVET collections that conform to the RTA plan "subareas" within each county.

Sales tax collections are currently reported for each city, and for the unincorporated area of each county. MVET collections are reported on a county-wide basis only. To assess the RTA's estimates of sales tax and MVET revenues for each subarea, we reviewed the RTA's definition of the subareas and the methodology used to allocate revenues to each subarea.

The RTA uses different methods for allocating sales tax revenue and MVET revenue to each subarea, which is appropriate given the differences in the source data. Sales tax revenues are allocated to each subarea based on retail employment. The retail employment estimates were obtained from the Puget Sound Regional Council, which maintains a detailed database of population and employment for various geographic breakdowns within each county. The RTA decided on this approach based on a statewide, county-by-county analysis of the relationship between sales tax revenues and various explanatory variables. MVET revenues were allocated to each subarea based on population.

The sales tax allocation method carries some potential error because the value of sales tax collections per employee may not be constant across all subareas. To validate the RTA's estimate, we used actual sales tax revenue reported by city, and used the RTA allocation method only for the unincorporated areas. This involved a four-step process: (1) identifying the forecast analysis zones lying within each subarea; (2) assigning each zone to either a city or to the unincorporated area; (3) calculating 1990 population and retail employment for incorporated and unincorporated areas within each subarea; and (4) computing each subarea's share of sales tax revenue based on actual city collections and allocated collections for the unincorporated areas. The findings from this analysis are presented in Appendix E.

Our findings virtually replicated those reported by the RTA. Our estimates of population by subarea were exactly the same as those presented by the RTA. Although some differences emerged for sales tax revenues in each subarea for 1990, our estimates of the sales tax distributions were within 1% of the RTA's by subarea for 1993. We believe that the 1990 data may contain some error because of annexations and incorporations that occurred that year, and that the 1993 data are more reliable. Accordingly, we believe that the numbers used by the RTA for subregional sales tax revenue allocations are reasonable.

With regard to the per capita distribution of MVET revenues, we believe the RTA used the best available approach. There are no sub-county data for MVET. While differences may exist within the county as to the residential component of MVET (i.e., because higher-income families may own more vehicles or higher-cost vehicles), the location of commercially-owned vehicles would tend to offset the income-based error in per capita distributions of MVET. Thus, we believe the RTA's approach to allocating MVET revenue was reasonable.

Appendices:

A. RTA & JRPC Plan Data

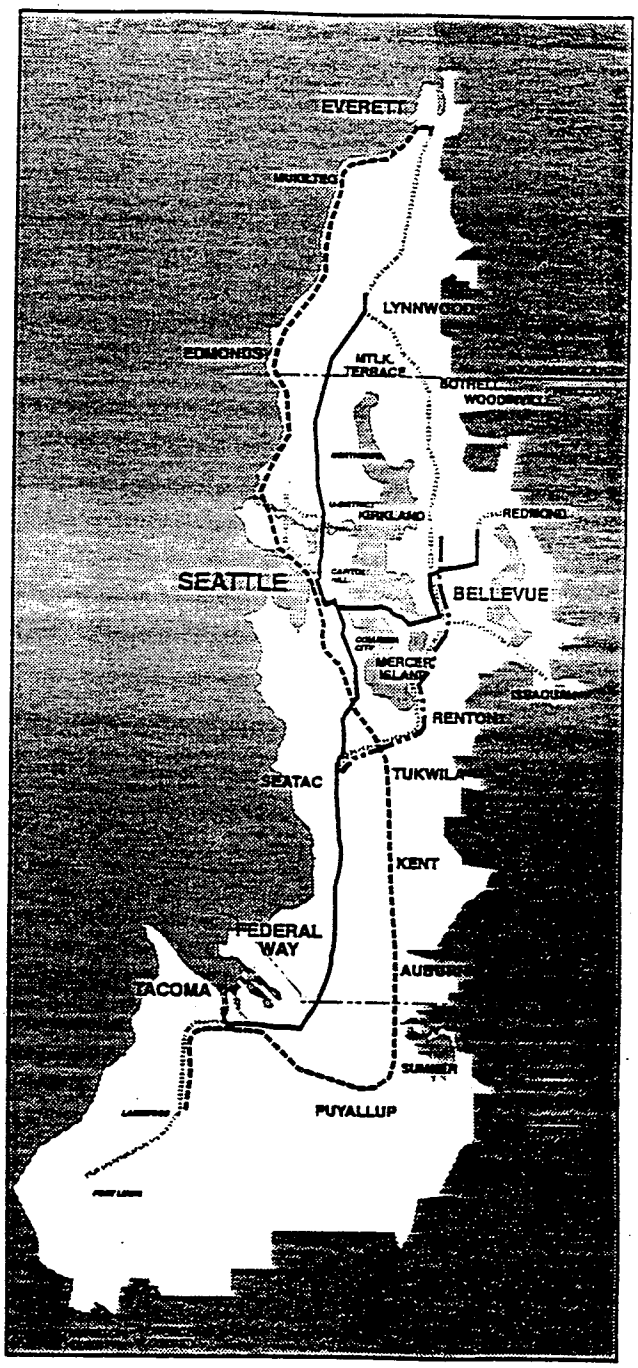
B. Comparative LRT System Data

C. Disposition of Metro Bus Routes with Rail

D. Sample Source Documents – Capital Costs

E. Subregional Revenue Allocations

A. RTA & JRPC Plan Data



LEGEND

N

0 1 2 3 Miles

Phase I

- Light rail
- Commuter rail
- Subject to study

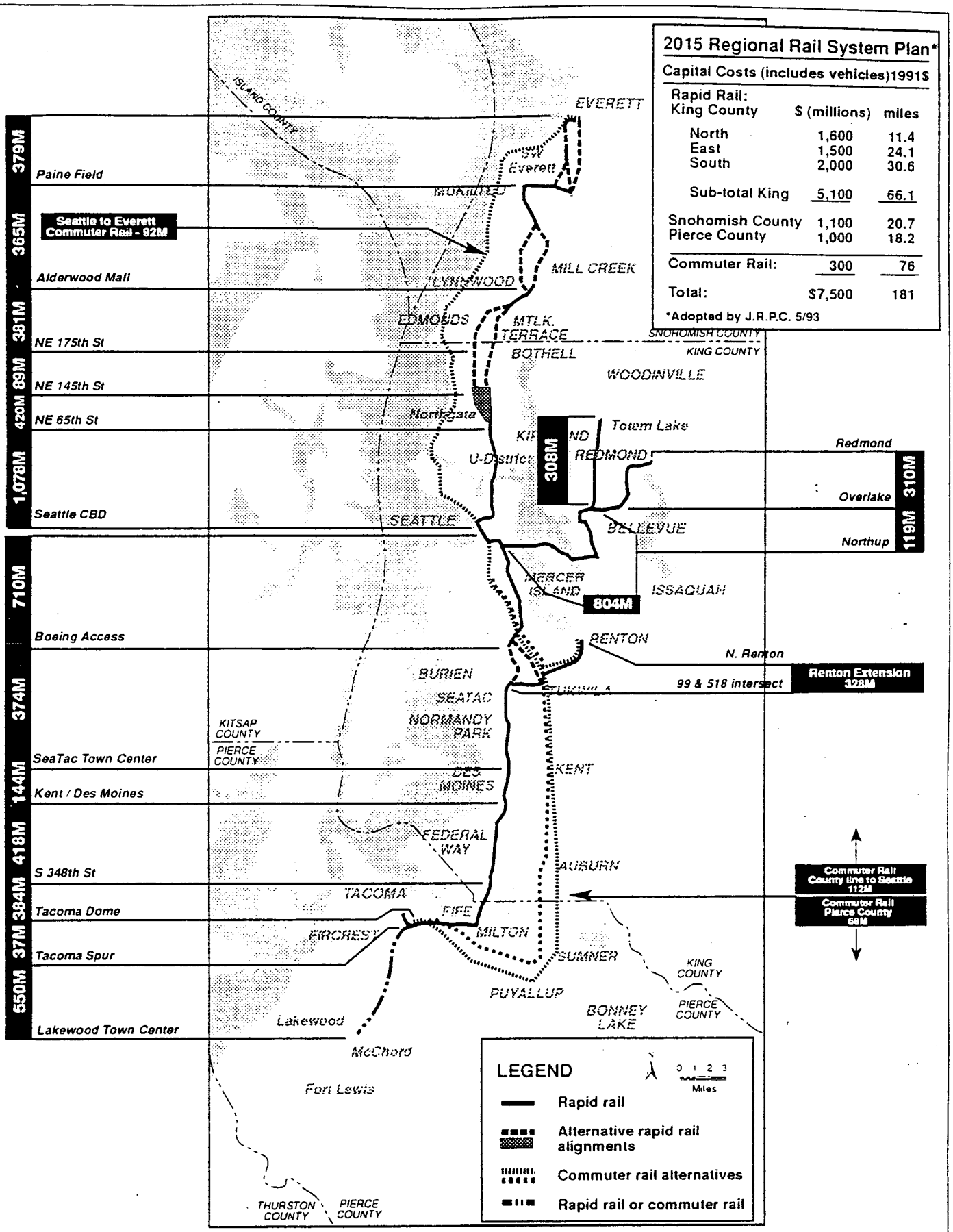
Future Phases

- Possible extensions
- Regional Transit District

Central Puget Sound Regional Transit Authority

RTA94M2003.2

MAP C
Regional Transit System
Adopted October 29, 1994



Regional Transit Project

KING COUNTY • PIERCE COUNTY • SNOHOMISH COUNTY

RTP93C0125.2

2015 Rail Segment Capital Costs

October 16, 1993

Comparison of RTA Master Plan to JRPC Plan

	(1) RTA Master Plan 2010	JRPC Plan (2) Adopted Plan 2020	(3) Segments Similar to RTA Plan 2020	(4) Ridership Adjustments	(5) RTA Net Change Relative to JRPC Plan
CAPITAL COSTS (1995$ mil)					
LRT Capital Costs	*69 miles*	*105 miles*	*69 miles*		
North King (incl. IDS to Boeing Access)	1,933	2,702	2,702		(769)
South King	800	1,509	1,125		(325)
East King	644	1,755	1,175		(531)
King total	3,377	5,966	5,002		(1,625)
Snohomish	480	1,287	585		(105)
Pierce	327	1,170	495		(168)
total LRT capital	4,184	8,423	6,082		(1,898)
Commuter Rail Capital Costs	*74 miles*	*76 miles*	*76 miles*		
North King	116	62	62		54
South King	141	131	131		10
East King	0	0	0		0
King total	257	193	193		64
Snohomish	87	46	46		41
Pierce	251	80	80		171
total CR capital	595	318	319		276
total capital costs	4,779	8,741	6,401		(1,622)
ANNUAL O&M COST (1995$ mil.)					
LRT	120	146	96		24
Commuter Rail	26	22	22		4
total O&M costs	146	168	118		28
DAILY BOARDINGS					
LRT					
North King					
CPS to C/L	56,700	69,800	69,800	52,973	3,727
Downtown Tunnel	63,800	112,500	90,921	69,003	(5,203)
IDS to Boeing Access	9,900	28,200	28,200	21,402	(11,502)
North King total	130,400	210,500	188,921	143,378	(12,978)
South King	9,800	25,000	20,350	15,444	(5,644)
East King	17,200	24,900	16,900	12,826	4,374
King total	157,400	260,400	226,171	171,648	(14,248)
Snohomish	7,900	40,750	16,350	14,598	(6,698)
Pierce	3,700	4,500	4,500	4,018	(318)
total LRT boardings	169,000	305,650	247,021	190,264	(21,264)
Commuter Rail	17,100	8,100	8,100	7,232	9,868
total boardings	189,800	318,250	259,621	201,514	(11,714)
PERFORMANCE					
All use 40-yr facility life, 300-day annualization factor					
Cost per Boarding @7% cost of capital	$8.86	$8.63	$7.68	$9.89	($1.03)
Cost per Boarding @0% cost of capital	$4.66	$4.05	$3.57	$4.60	$0.06
Revenue Speed - LRT	25.0	30.0	30.0		(5.0)
Revenue Speed - Commuter Rail	34.0	34.0	34.0		0

Notes:

(1) Drawn from RTA Master Plan (10/29/94) and Technical Appendix (11/23/94). Capital costs include proportional allocation of "Mitigation Betterment" costs.

(2) JRPC Plan as adpoted in May, 1993. Capital and operating costs inflated from 91$ @4% per year. Capital costs are based on final estimates; O&M costs are allocated based on route miles and costs included in the FEIS.

(3) Based on capital costs and allocated operating costs of those segments of the JRPC plan that closely match the RTA rail alignments.

(4) Boardings in the JRPC plan were reduced by 15% in King County to reflect a change in the RTA forecasting methodology. All boardings were reduced by 12% to adjust for growth in ridership between 2010 and 2020.

(5) Calculated as RTA values (col. 1) less JRPC values (col. 4 if ridership-related, col. 3 otherwise).

prepared by Porter & Associates, Inc.

B. Comparative LRT System Data

Comparative Financial & Operating Data: LRT Systems

	Vehicles	Directional Route Miles	Track Miles	Stations	Operating Expense	Passenger Fares	Annual VehMiles	Annual VehHrs	Unlinked Trips	Passenger miles
Rail Rapid Systems										
MARTA	136	67	87.4	29	62,573,700		16,316,900	650,300	64,078,000	334,399,800
BARTD	415	142	196.5	34	207,212,200		42,235,900	1,428,800	77,247,000	911,843,400
WMATA	534	162.1	175.9	70	295,138,500		39,563,900	1,543,100	186,781,900	1,027,089,600
Average, 1992 data	362	124	153.3	44	188,308,133		32,705,567	1,207,400	109,368,967	757,777,600
Average 1995$					211,821,040					
"Newer" light rail systems										
Baltimore	30	26	21.4	15	12,462,864	1,528,227	1,260,144	78,473	3,457,361	24,561,984
Buffalo	23	12.4	14.1	14	12,202,100	4,231,179	919,700	75,600	8,570,300	19,375,100
Los Angeles	36	43.2	46.7	22	41,187,500		2,964,800	163,500	11,306,900	101,830,400
Portland	22	30.2	29.1	30	11,441,000		1,461,100	96,500	7,702,500	41,292,200
Sacramento	32	36.2	32.6	28	11,354,900	3,419,963	1,701,200	94,700	6,781,200	33,325,800
San Diego	59	41.5	41.5	24	18,922,700	12,999,123	4,553,500	231,700	17,162,500	116,190,500
San Jose	36	39	41.1	33	19,229,100		2,109,700	133,600	6,134,800	44,154,400
Average, 1992 data	34	32.6	32.4	24	18,114,309	5,544,623	2,138,592	124,868	8,730,794	54,390,055
Average 1995$					20,376,134	6,236,947				
"Older" light rail systems										
Boston	201	52	77.5	77	25,298,900	12,754,193	1,538,600	92,600	24,937,000	34,911,800
Cleveland	26	26.7	28.9	29	10,909,600	3,610,496	1,175,600	67,800	5,043,500	31,185,100
New Orleans	21	16.9	12.7		5,301,300		718,600	86,900	6,911,900	14,919,200
Newark	16	8.3	8.3	11	4,298,000		644,600	45,600	3,057,200	10,073,000
Philadelphia	147	126.7	171.5	64	56,960,400	20,826,251	4,375,900	505,700	41,577,800	95,615,900
Pittsburgh	59	45.2	52.9	14	23,487,200		2,049,300	136,700	8,727,800	49,487,500
San Francisco	101	49.7	54.2	9	62,263,600		3,888,000	375,300	39,033,900	105,810,300
Average, 1992 data	82	46.5	58.0	34	26,931,286	12,396,980	2,055,800	187,229	18,469,871	48,857,543
Average 1995$					30,294,034	13,944,917				
Group Average (1995$)	159	68	81	34	87,497,069	10,090,932	12,299,986	506,499	45,523,211	287,008,399
RTA Plan	300	137.56		47	120,000,000	48,000,000	15,738,300	674,550	50,700,000	
RTA/Average 3RT	83%	111%		106%	57%	#DIV/0!	48%	56%	46%	
RTA/New Average	882%	421%		198%	589%	770%	736%	540%	581%	
RTA/Old Average	368%	296%		138%	396%	344%	766%	360%	275%	
RTA/Group Average	189%	203%		138%	137%	476%	128%	133%	111%	

Comparative Financial & Operating Data: LRT Systems

	Cost/ VehMile	Cost/ Vehhour	Cost/ Rider	Miles/ Hour	Riders/ VehMi	Riders/ VehHr	Trip Length	Station Spacing	Operating Ratio	Average Fare	Miles/ Vehicle	VehHrs RtMile	VehMi/ Rtmil
Rail Rapid Systems													
MARTA	3.83	96.22	0.98	25.09	3.93	98.54	5.22	1.16			119,977	9,706	243,536
BARTD	4.91	145.03	0.81	29.56	1.83	54.06	11.80	2.09			101,773	10,062	297,436
WMATA	7.46	191.26	1.11	25.64	4.72	121.04	5.50	1.16			74,090	9,519	244,071
Average, 1992 data	5.40	144.17	0.97	26.76	3.49	91.21	7.51	1.47	#DIV/0!	#DIV/0!	98,613	9,762	261,681
Average 1995$	6.07	162.17	1.09										
"Newer" light rail systems													
Baltimore	9.89	158.82	3.60	16.06	2.74	44.06	7.10	0.87	12.3%	0.44	42,005	3,018	48,467
Buffalo	13.27	161.40	1.42	12.17	9.32	113.36	2.26	0.44	34.7%	0.49	39,987	6,097	74,169
Los Angeles	13.89	251.91	3.64	18.13	3.81	69.16	9.01	0.98			82,356	3,785	68,630
Portland	7.83	118.56	1.49	15.14	5.27	79.82	5.36	0.50			66,414	3,195	48,381
Sacramento	6.67	119.90	1.67	17.96	3.99	71.61	4.91	0.65	30.1%	0.50	53,163	2,616	46,994
San Diego	4.16	81.67	1.10	19.65	3.77	74.07	6.77	0.86	68.7%	0.76	77,178	5,583	109,723
San Jose	9.11	143.93	3.13	15.79	2.91	45.92	7.20	0.59			58,603	3,426	54,095
Average, 1992 data	9.26	148.03	2.30	16.42	4.54	71.14	6.09	0.70	36.4%	0.55	59,958	3,960	64,351
Average 1995$	10.42	166.51	2.58										
"Older" light rail systems													
Boston	16.44	273.21	1.01	16.62	16.21	269.30	1.40	0.34	50.4%	0.51	7,655	1,781	29,588
Cleveland	9.28	160.91	2.16	17.34	4.29	74.39	6.18	0.46	33.1%	0.72	45,215	2,539	44,030
New Orleans	7.38	61.00	0.77	8.27	9.62	79.54	2.16				34,219	5,142	42,521
Newark	6.67	94.25	1.41	14.14	4.74	67.04	3.29	0.38			40,288	5,494	77,663
Philadelphia	13.02	112.64	1.37	8.65	9.50	82.22	2.30	0.99	36.6%	0.50	29,768	3,991	34,537
Pittsburgh	11.46	171.82	2.69	14.99	4.26	63.85	5.67	1.61			34,734	3,024	45,338
San Francisco	16.01	165.90	1.60	10.36	10.04	104.01	2.71	2.76			38,495	7,551	78,229
Average, 1992 data	11.47	148.53	1.57	12.91	8.38	105.76	3.39	1.09	40.0%	0.58	32,911	4,218	50,272
Average 1995$	12.90	167.08	1.77										
Group Average (1995$)	9.80	165.25	1.81	18.70	5.47	89.37	5.66	1.09	38.2%	$0.56	63,827	5,980	125,435
RTA Plan	7.62	***177.90***	2.37	23.33	3.22	75.16		1.46	40.0%	0.95	52,461	4,904	114,410
RTA/Average 3RT	126%	110%	218%	87%	92%	82%		100%	#DIV/0!	#DIV/0!	53%	50%	44%
RTA/New Average	73%	107%	92%	142%	71%	106%		209%	110%	172%	87%	124%	178%
RTA/Old Average	59%	106%	134%	181%	38%	71%		134%	100%	164%	159%	116%	228%
RTA/Group Average	78%	108%	131%	125%	59%	84%		135%	105%	168%	82%	82%	91%

C. Disposition of Metro Bus Routes with Rail

Disposition of Metro Bus Routes at Phase I Rail Build-Out

Route	Eliminate	Reduce	Truncate	Expand	Plat. Hours	Riders	O&M Cost	Fare Revenue	Plat. Miles	Rev. Hours	Rev. Miles	Revenue/ Cost	Passengers/ Rev Hour	Platform/ Rev Hours	Rev Miles/ Rev Hour	Revenue per Rider	Cost per Rider	Subsidy per Rider
6Ex		X			18,972	768,986	$1,386,386.00	$444,485.00	224,067	12,504	195,396	32.1%	61.5	1.52	15.6	$0.58	$1.80	$1.22
7Ex	X				7,637	228,092	$537,024.00	$143,073.00	98,372	4,923	52,873	26.6%	46.3	1.55	10.7	$0.63	$2.35	$1.72
9				X	16,569	834,390	$1,370,633.95	$433,151.61	146,368	13,843	146,368	31.6%	60.3	1.20	10.6	$0.52	$1.64	$1.12
16		X			30,459	1,063,559	$2,066,811.00	$521,085.00	309,772	22,886	281,620	25.2%	46.5	1.33	12.3	$0.49	$1.94	$1.45
16Ex			X		6,346	134,366	$422,314.00	$80,177.00	81,625	3,924	53,482	19.0%	34.2	1.62	13.6	$0.60	$3.14	$2.54
21		X			30,941	785,177	$2,265,280.57	$413,704.27	485,836	21,321	356,713	18.3%	36.8	1.45	16.7	$0.53	$2.89	$2.36
22		X			22,141	596,346	$1,518,658.68	$296,631.34	279,148	17,757	253,973	19.5%	33.6	1.25	14.3	$0.50	$2.55	$2.05
25		X			21,307	515,964	$1,470,229.56	$273,515.41	288,320	16,109	223,203	18.6%	32.0	1.32	13.9	$0.53	$2.85	$2.32
26				X	23,983	646,633	$1,552,730.96	$358,379.67	248,245	16,847	212,256	23.1%	38.4	1.42	12.6	$0.55	$2.40	$1.85
32			X		724	10,160	$45,719.42	$6,149.02	9,174	351	4,059	13.4%	28.9	2.06	11.6	$0.61	$4.50	$3.89
36		X			50,490	2,007,619	$4,005,221.57	$1,036,063.89	483,665	34,770	434,235	25.9%	57.7	1.45	12.5	$0.52	$2.00	$1.48
41	X				16,620	550,606	$1,331,557.03	$379,042.24	295,681	9,047	180,332	28.5%	60.9	1.84	19.9	$0.69	$2.42	$1.73
42			X		24,506	786,897	$1,778,525.00	$410,159.00	334,168	19,982	305,594	23.1%	39.4	1.23	15.3	$0.52	$2.26	$1.74
42Ex			X		3,124	97,790	$218,210.00	$62,042.00	38,250	2,049	27,102	28.4%	47.7	1.52	13.2	$0.63	$2.23	$1.60
54		X			28,980	855,442	$2,104,609.63	$420,190.89	414,868	20,444	365,924	20.0%	41.8	1.42	17.9	$0.49	$2.46	$1.97
55		X			18,230	658,679	$1,331,098.06	$339,633.56	234,869	12,743	204,628	25.5%	51.7	1.43	16.1	$0.52	$2.02	$1.50
62		X			8,744	185,014	$592,386.99	$85,983.55	118,623	5,592	83,341	14.5%	33.1	1.56	14.9	$0.46	$3.20	$2.74
65		X			5,859	151,638	$399,092.33	$65,890.42	73,795	2,866	37,567	16.5%	52.9	2.04	13.1	$0.43	$2.63	$2.20
67		X			8,081	311,404	$593,144.92	$147,120.46	101,026	5,601	71,618	24.8%	55.6	1.44	12.8	$0.47	$1.90	$1.43
68		X			4,589	116,332	$296,037.26	$56,731.64	48,735	3,488	41,209	19.2%	33.3	1.32	11.8	$0.49	$2.54	$2.05
71			X		31,904	1,254,119	$2,254,062.75	$590,452.82	341,409	22,455	310,600	26.2%	55.9	1.42	13.8	$0.47	$1.80	$1.33
72			X		25,766	1,153,392	$1,918,921.52	$558,412.42	297,994	18,722	268,448	29.1%	61.6	1.38	14.3	$0.48	$1.66	$1.18
73			X		27,516	1,230,396	$2,056,835.56	$566,238.61	322,987	19,945	280,765	27.5%	61.7	1.38	14.1	$0.46	$1.67	$1.21
74Ex			X		4,051	86,614	$277,690.00	$51,211.00	56,624	2,371	29,370	18.4%	36.5	1.71	12.4	$0.59	$3.21	$2.62
75Ex			X		3,374	104,648	$253,919.00	$59,483.00	52,230	2,684	38,699	23.4%	39.0	1.26	14.4	$0.57	$2.43	$1.86
76			X		6,917	156,464	$484,265.06	$101,279.50	100,449	3,954	54,780	20.9%	39.6	1.75	13.9	$0.65	$3.10	$2.45
77			X		5,207	143,764	$381,647.12	$94,161.35	79,088	3,213	49,108	24.7%	44.7	1.62	15.3	$0.65	$2.65	$2.00
78			X		3,150	74,930	$221,442.00	$28,265.98	45,362	1,528	18,943	12.8%	49.0	2.06	12.4	$0.38	$2.96	$2.58
79			X		3,590	70,866	$249,265.96	$45,629.51	53,528	2,256	31,687	18.3%	31.4	1.59	14.0	$0.64	$3.52	$2.88
106			X		23,571	627,532	$1,669,485.02	$339,451.08	329,862	17,728	284,328	20.3%	35.4	1.33	16.0	$0.54	$2.66	$2.12
107			X		25,046	617,959	$1,794,134.11	$368,729.30	374,572	17,767	308,745	20.6%	34.8	1.41	17.4	$0.60	$2.90	$2.30
108	X				2,760	36,322	$206,144.66	$23,215.37	54,199	1,854	33,386	11.3%	19.6	1.49	18.0	$0.64	$5.68	$5.04
109	X				1,160	14,732	$88,812.25	$11,435.27	24,186	703	18,329	12.9%	21.0	1.65	26.1	$0.78	$6.03	$5.25
111			X		5,652	99,568	$480,769.96	$92,246.03	138,953	3,120	71,110	19.2%	31.9	1.81	22.8	$0.93	$4.83	$3.90
114			X		4,881	85,598	$380,361.66	$88,390.95	99,720	2,705	49,695	23.2%	31.6	1.80	18.4	$1.03	$4.44	$3.41
124	X				3,505	14,729	$222,128.12	$7,934.47	53,540	2,830	50,828	3.6%	5.2	1.24	18.0	$0.54	$15.08	$14.54
130Ex			X		8,086	185,928	$640,198.00	$124,790.00	160,007	5,461	111,940	19.5%	34.0	1.48	20.5	$0.67	$3.44	$2.77
132Ex			X		7,988	187,604	$633,207.00	$130,646.00	157,516	5,207	110,802	20.6%	36.0	1.53	21.3	$0.70	$3.38	$2.68
133			X		2,675	54,864	$225,505.97	$25,135.57	62,614	1,346	30,691	11.1%	40.8	1.99	22.8	$0.46	$4.11	$3.65
135		X			14,455	381,290	$1,010,474.73	$196,320.07	195,382	9,500	176,305	19.4%	40.1	1.52	18.6	$0.51	$2.65	$2.14
138		X			4,357	95,528	$295,754.01	$45,802.63	58,609	3,165	57,596	15.5%	30.2	1.38	18.2	$0.48	$3.10	$2.62
145			X		6,210	112,674	$488,389.85	$102,611.14	128,529	3,353	63,241	21.0%	33.6	1.85	18.9	$0.91	$4.33	$3.42
147			X		13,246	222,250	$961,946.08	$159,378.04	232,049	9,415	175,133	16.6%	23.6	1.41	18.6	$0.72	$4.33	$3.61
148			X		5,287	138,684	$437,896.57	$138,065.55	111,592	3,052	56,799	31.5%	45.4	1.73	18.6	$1.00	$3.16	$2.16
150			X		64,567	1,507,465	$4,968,571.02	$952,334.32	1,187,989	45,884	948,900	19.2%	32.9	1.41	20.7	$0.63	$3.30	$2.67
152			X		12,730	202,756	$1,119,892.64	$199,537.34	340,025	7,345	196,639	17.8%	27.6	1.73	26.8	$0.98	$5.52	$4.54
154		X			6,689	79,756	$553,642.45	$55,073.12	165,049	4,119	83,053	9.9%	19.4	1.62	20.2	$0.69	$6.94	$6.25
158			X		7,226	144,018	$616,995.49	$145,239.12	174,793	3,941	93,238	23.5%	36.5	1.83	23.7	$1.01	$4.28	$3.27
159			X		6,236	70,781	$526,750.17	$65,744.73	160,970	3,382	80,978	12.5%	20.9	1.84	23.9	$0.93	$7.44	$6.51
160			X		3,607	38,608	$277,474.78	$36,165.65	77,785	1,892	37,191	13.0%	20.4	1.91	19.7	$0.94	$7.19	$6.25
162			X		4,250	37,084	$335,098.56	$38,472.24	98,527	2,193	48,148	11.5%	16.9	1.94	22.0	$1.04	$9.04	$8.00
163			X		4,483	68,580	$364,744.30	$67,227.00	103,116	2,201	44,348	18.4%	31.2	2.04	20.1	$0.98	$5.32	$4.34
167		X			7,015	112,522	$610,320.94	$53,235.84	183,198	4,322	97,069	8.7%	26.0	1.62	22.5	$0.47	$5.42	$4.95
173			X		2,891	45,720	$249,246.43	$32,204.45	74,320	1,791	42,258	12.9%	25.5	1.61	23.6	$0.70	$5.45	$4.75
175			X		4,784	83,122	$426,688.95	$89,199.49	129,454	2,468	66,403	20.9%	33.7	1.94	26.9	$1.07	$5.13	$4.06
176			X		8,416	187,898	$570,873.10	$154,141.00	195,769	6,201	136,364	27.0%	30.3	1.36	22.0	$0.82	$3.04	$2.22
177			X		7,319	161,036	$686,116.06	$164,872.84	209,004	3,264	99,850	24.0%	49.3	2.24	30.6	$1.02	$4.26	$3.24
178			X		4,987	90,869	$444,629.10	$84,813.47	133,784	2,756	69,662	19.1%	33.0	1.81	25.3	$0.93	$4.89	$3.96
179			X		5,791	72,644	$481,950.09	$68,978.26	143,518	3,217	74,353	14.3%	22.6	1.80	23.1	$0.95	$6.63	$5.68
181		X			7,162	146,489	$248,712.99	$87,838.37	108,961	6,296	108,961	35.3%	23.3	1.14	17.3	$0.60	$1.70	$1.10
184		X			1,023	11,938	$79,005.48	$4,211.13	21,996	791	19,528	5.3%	15.1	1.29	24.7	$0.35	$6.62	$6.27

based on RTA modeling assumptions

Disposition of Metro Bus Routes at Phase I Rail Build-Out

Route	Eliminate	Reduce	Truncate	Expand	Plat. Hours	Riders	O&M Cost	Fare Revenue	Plat. Miles	Rev. Hours	Rev. Miles	Revenue/ Cost	Passengers/ Rev Hour	Platform/ Rev Hours	Rev Miles/ Rev Hour	Revenue per Rider	Cost per Rider	Subsidy per Rider
190	X				4,818	114,554	$438,126.23	$123,917.07	127,536	2,011	61,036	28.3%	57.0	2.40	30.4	$1.08	$3.82	$2.74
191	X				4,945	71,374	$402,109.44	$62,536.97	114,699	2,862	55,494	15.6%	24.9	1.73	19.4	$0.88	$5.63	$4.75
192			X		5,283	71,628	$448,472.10	$75,141.05	134,727	3,040	70,373	16.8%	23.6	1.74	23.2	$1.05	$6.26	$5.21
194	X				27,702	626,008	$2,273,254.30	$377,553.24	597,674	18,705	504,778	16.6%	33.5	1.48	27.0	$0.60	$3.63	$3.03
195	X				3,421	73,406	$319,022.69	$70,757.60	97,193	1,609	46,721	22.2%	45.6	2.13	29.0	$0.96	$4.35	$3.39
196	X				7,391	165,608	$714,448.10	$175,976.72	222,931	3,476	111,603	24.6%	47.6	2.13	32.1	$1.06	$4.31	$3.25
197	X				4,923	73,660	$432,658.99	$36,979.35	132,428	2,519	69,720	8.5%	29.2	1.95	27.7	$0.50	$5.87	$5.37
202			X		9,878	114,214	$635,912.89	$100,608.58	149,791	5,214	94,157	15.8%	21.9	1.89	18.1	$0.88	$5.57	$4.69
205Ex			X		2,705	31,242	$197,574.71	$18,180.58	51,605	1,516	27,841	9.2%	20.6	1.78	18.4	$0.58	$6.32	$5.74
210		X			18,331	226,458	$1,387,102.86	$174,693.91	374,203	11,693	284,632	12.6%	19.4	1.57	24.3	$0.77	$6.13	$5.36
211		X			7,152	96,590	$573,399.52	$68,829.64	162,763	5,108	145,791	12.0%	18.9	1.40	28.5	$0.71	$5.94	$5.23
212		X			2,053	61,976	$174,353.74	$67,364.10	43,812	830	21,854	38.6%	74.7	2.47	26.3	$1.09	$2.81	$1.72
213		X			9,076	231,902	$834,871.98	$244,420.78	241,755	5,249	141,844	29.3%	44.2	1.73	27.0	$1.05	$3.60	$2.55
220			X		3,260	64,008	$247,758.91	$65,791.34	61,217	2,049	38,567	26.6%	31.2	1.59	18.8	$1.03	$3.87	$2.84
225			X		2,735	76,708	$222,002.13	$79,942.54	53,843	1,659	36,048	36.0%	46.2	1.65	21.7	$1.04	$2.89	$1.85
226	X				14,770	268,885	$1,029,342.22	$185,785.75	228,144	9,912	208,174	18.0%	27.1	1.49	21.0	$0.69	$3.83	$3.14
227			X		3,471	76,200	$274,612.41	$81,854.48	69,466	1,681	34,836	29.8%	45.3	2.07	20.7	$1.07	$3.60	$2.53
228			X		2,460	9,398	$164,132.40	$5,619.28	42,631	1,414	28,717	3.4%	6.6	1.74	20.3	$0.60	$17.46	$16.86
229			X		4,576	110,744	$363,638.50	$115,593.83	89,936	2,455	50,841	31.8%	45.1	1.86	20.7	$1.04	$3.28	$2.24
235			X		13,410	240,568	$926,958.99	$175,957.37	203,586	8,667	179,514	19.0%	27.8	1.55	20.7	$0.73	$3.85	$3.12
240		X			19,309	249,142	$1,296,722.02	$122,816.80	295,380	13,920	257,611	9.5%	17.9	1.39	18.5	$0.49	$5.20	$4.71
247	X				7,049	54,356	$570,174.60	$35,318.18	173,645	4,487	82,057	6.2%	12.1	1.57	18.3	$0.65	$10.49	$9.84
250			X		7,620	111,816	$593,064.77	$109,468.11	160,734	4,369	89,218	18.5%	25.6	1.74	20.4	$0.98	$5.30	$4.32
252			X		6,583	136,071	$538,012.63	$127,741.38	143,942	3,802	77,970	23.7%	35.8	1.73	20.5	$0.94	$3.95	$3.01
253			X		36,929	1,021,427	$2,681,646.45	$616,092.27	545,785	27,891	453,105	23.0%	36.6	1.32	16.2	$0.60	$2.63	$2.03
253Ex	X				9,584	154,432	$738,621.00	$142,004.00	194,417	5,232	109,586	19.2%	29.5	1.83	20.9	$0.92	$4.78	$3.86
256	X				5,313	88,646	$378,858.94	$75,408.58	89,124	3,302	67,097	19.9%	26.8	1.61	20.3	$0.85	$4.27	$3.42
257			X		5,300	89,256	$421,192.74	$85,044.76	113,990	3,120	65,166	20.2%	28.6	1.70	20.9	$0.95	$4.72	$3.77
258		X			2,993	54,610	$240,387.45	$53,309.78	64,798	1,736	35,286	22.2%	31.5	1.72	20.3	$0.98	$4.40	$3.42
259		X			2,599	29,972	$204,183.10	$28,298.81	57,983	1,418	30,617	13.9%	21.1	1.83	21.6	$0.94	$6.81	$5.87
260		X			3,353	36,322	$265,958.62	$34,837.64	76,891	1,897	35,364	13.1%	19.2	1.77	18.6	$0.96	$7.32	$6.36
262		X			3,569	40,894	$273,345.73	$40,461.28	75,585	2,134	41,118	14.8%	19.2	1.67	19.3	$0.99	$6.68	$5.69
263			X		5,165	40,894	$362,146.44	$35,035.38	94,430	3,467	72,311	9.7%	11.8	1.49	20.9	$0.86	$8.86	$8.00
266			X		9,584	154,432	$738,620.54	$142,004.21	194,417	5,232	109,586	19.2%	29.5	1.83	20.9	$0.92	$4.78	$3.86
267			X		4,339	74,168	$346,625.64	$68,747.23	94,099	2,502	55,029	19.8%	29.6	1.73	22.0	$0.93	$4.67	$3.74
268			X		3,734	48,514	$291,891.62	$46,004.60	81,092	1,935	43,114	15.8%	25.1	1.93	22.3	$0.95	$6.02	$5.07
306			X		4,132	147,574	$344,120.45	$149,848.95	78,476	2,688	56,375	43.5%	54.9	1.54	21.0	$1.02	$2.33	$1.31
307	X				42,129	984,160	$3,022,255.84	$569,724.10	646,537	29,037	547,163	18.9%	33.9	1.45	18.8	$0.58	$3.07	$2.49
308			X		2,972	46,228	$213,004.12	$38,291.85	51,331	2,070	36,919	18.0%	22.3	1.44	17.8	$0.83	$4.61	$3.78
309			X		5,474	70,612	$427,116.65	$55,529.70	118,544	3,213	55,232	13.0%	22.0	1.70	17.2	$0.79	$6.05	$5.26
311			X		8,564	120,650	$743,322.73	$115,952.44	226,812	4,911	120,228	15.6%	24.6	1.74	24.5	$0.96	$6.16	$5.20
317	X				17,679	283,869	$1,143,995.11	$164,052.86	231,116	11,594	187,811	14.3%	24.5	1.52	16.2	$0.58	$4.03	$3.45
340	X				50,103	1,074,263	$3,945,292.99	$627,096.70	998,358	39,884	836,137	15.9%	26.9	1.26	21.0	$0.58	$3.67	$3.09
355			X		9,775	255,270	$742,694.06	$157,266.99	167,493	6,536	98,494	21.2%	39.1	1.50	15.1	$0.62	$2.91	$2.29
360			X		4,204	99,822	$300,707.70	$76,227.71	63,604	2,307	37,264	25.3%	43.3	1.82	16.2	$0.76	$3.01	$2.25
377	X				17,518	341,099	$1,191,992.47	$193,746.57	248,137	12,623	207,846	16.3%	27.0	1.39	16.5	$0.57	$3.49	$2.92
915	X				3,497	29,337	$109,619.63	$17,392.09	67,112	2,921	67,112	15.9%	10.0	1.20	23.0	$0.59	$3.74	$3.15
921			X		7,892	58,037	$245,105.79	$37,073.77	100,975	5,950	96,824	15.1%	9.8	1.33	16.3	$0.64	$4.22	$3.58
Eliminated Service					**252,523**	**5,248,137**	**$19,095,439**	**$3,422,950**	**4,695,026**	**169,528**	**3,498,082**	**17.9%**	**31.0**	1.49	20.6	$0.65	$3.64	$2.99
Reduced Service					**357,929**	**9,871,547**	**$26,077,192**	**$5,378,549**	**5,189,088**	**248,257**	**4,086,054**	**20.6%**	**39.8**	1.44	16.5	$0.54	$2.64	$2.10
Truncated Service					**556,148**	**13,617,128**	**$41,814,078**	**$8,901,053**	**9,729,882**	**366,810**	**6,701,185**	**21.3%**	**37.1**	1.52	18.3	$0.65	$3.07	$2.42
Expanded Service					**40,552**	**1,481,023**	**$2,923,365**	**$791,531**	**394,612**	**30,690**	**358,624**	**27.1%**	**48.3**	1.32	11.7	$0.53	$1.97	$1.44

based on RTA modeling assumptions

D. Sample Source Documents – Capital Costs

02-Jun-94

REGIONAL TRANSIT PROJECT
UNIT COST LIBRARY

CODE	DESCRIPTION	UNIT	COST
AF101	Architectural Finish, Underground Stations (floor area)	SF	$65
AF102	Arch. Finish, Aerial & At-grade stations (floor area)	SF	$20
AF111	Safety Handrail	LF	$20
AF112	Stairs w/Handrail	LF	$150
AF113	Stairs w/Handrail 25' High	VLF	$350
AF115	Handrail at Steps and Ramps	LF	$35
AF116	Acoustical Barrier, 4' High	LF	$55
CN101	Box Beams for Busway	LF	$400
CN102	Box Beams for Guideway, 14'-6" wide	LF	$720
CN103	Box Beams for Platform, 12' wide	LF	$650
CN104	CIP, Column Capital, Girder	CY	$766
CN105	CIP, Columns	CY	$888
CN106	CIP, Concrete Columns	CY	$888
CN107	CIP, Concrete Mezzanine Slab	CY	$641
CN109	CIP, Concrete Pier Cap	CY	$568
CN110	CIP, Concrete Roof Slab	CY	$440
CN111	CIP, Concrete Slab @ Misc Areas	CY	$295
CN112	CIP, Concrete Walk, Outside	CY	$222
CN113	CIP, Concrete Walk, Inside	CY	$250
CN114	CIP, Concrete Walls & Ancl. Spaces	CY	$443
CN116	CIP, Footing, Pile Cap or Spread	CY	$267
CN117	CIP, Invert Slab	CY	$440
CN118	CIP, Parapet Wall	CY	$581
CN119	CIP, Retaining Wall	CY	$501
CN120	CIP, Retaining Wall Foundation	CY	$256
CN121	CIP, Roof Including Beams	CY	$540
CN122	CIP, Slab on Grade	CY	$212
CN123	CIP, Steps & Ramps	CY	$801
CN124	CIP, Suspended Slab	CY	$855
CN126	CIP, Wall – Exterior, formed 1 side	CY	$440
CN127	CIP, Wall – Interior, formed 2 sides	CY	$533
CN128	Concrete Pavement	CY	$210
CN129	CIP, Highway Jersey Barrier	LF	$50
CN131	CIP, Concrete Deck Slab	CY	$650
CN132	CIP, Second Pass Lining, 10" Thick	CY	$400
CN136	Formwork Liner/Finish Columns	SF	$2
CN138	Platform Canopy Support Columns	CY	$800
CN139	Platform Slab	CY	$754
CN140	Precast Concrete Barrier, Permanent	LF	$44
CN141	Second Pour Concrete	SF	$5
CN142	Second & Third Pour Concrete	SF	$7
CN143	Sound Wall, 8' High (Incl Rebar, ftgs, etc.)	LF	$125
CN144	Waterproofing w/ Bentonite Panel, At sides	SF	$1.90
CN145	Waterproofing Membrane, at top & bottom	SF	$2.50
CN146	Rigidboard Protection, at top	SF	$1.60
CN147	Post Tensioning (2 Lbs per Surface SF)	LBS	$1.50
CN149	Precast Concrete Pile, 12" I.D.	LF	$20
CN150	Misc. Metal Allowance, Underground Stations	LS	$300,000
CN151	Misc. Metal Allowance, Underground Vent Shaft	LS	$125,000
EE101	Elevator(s) w/Support (Approx 25' High)	EA	$100,000
EE102	Elevator, High Speed	EA	$300,000
EE103	Escalator(s) w/Support (Approx 25' High)	EA	$220,000
EE104	Electrical Power, Stations	SF	$10
EE105	Lighting, Stations	SF	$10

toronto transit
consultants limited

02-Jun-94

REGIONAL TRANSIT PROJECT
UNIT COST LIBRARY

CODE	DESCRIPTION	UNIT	COST
EE106	Lighting, Guideway	TF	$75
EE107	Modify Existing Signal Allowance	LS	$25,000
EE108	New Signal Allowance	INT	$100,000
EE109	Signal Pre-Emption for LRV	EA	$110,000
EE110	Corrosion Control	RF	$15
EE111	Modify Street Lighting - Urban	RF	$150
EE112	Modify Street Lighting - Suburban	RF	$15
EE113	Traffic Signal w/ Pre-Emption for LRV	EA	$210,000
FR101	Furnishings, Stations - Side Platform	LS	$50,000
FR102	Furnishings, Stations - Center Platform	LS	$40,000
LN101	Landscaping, Guideway	RF	$20
LN102	Landscaping, Stations	SF	$4
LN103	Landscaping - Urban	LS	$20,000
LN104	Landscaping - Suburban	LS	$10,000
ME100	Vent Shaft Equipment (per Shaft)	EA	$300,000
ME101	Fire Protection, Stations	SF	$2
ME102	Fire Protection, Guideway	TF	$100
ME103	Ventilation & Heating, Stations	SF	$4
ME104	Pump Station, Drainage @ Stations	EA	$50,000
ME105	Drainage, Tunnel Guideway incl pump station	RF	$100
ME107	Aerial Guideway Drainage, 100'/col	LF	$50
ME108	Retain Cut/Fill Guideway Drainage	LF	$50
ME109	At-Grade Drainage Ditch	LF	$25
ME110	Highway Drainage for HOV Lanes	LF	$50
ME111	Modify Street Drainage - Urban	RF	$80
ME112	Modify Street Drainage - Suburban	RF	$80
ME113	Modify Street Utilities - Urban	RF	$350
ME114	Modify Street Utilities - Suburban	RF	$100
ME115	At-Grade Guideway Drainage	LF	$40
ST101	Bus Stops w/ Shelters per Metro	EA	$13,500
ST102	Canopy @ Stations	SF	$50
ST103	Service Walkway, Aerial, At-Grade, U/G	LF	$60
ST105	Elastomeric Bearing Pads	EA	$1,200
ST106	Expansion Joints	LF	$30
ST108	Head House, @ Station Access Points	SF	$100
ST109	Head House, @ Emergency Access Points	EA	$75,000
ST110	Pedestrian Bridge, 12'W conc, uncovered, fenced	LF	$750
ST111	Pedestrian Bridge, @ Stations, Covered, Glazing	LF	$1,500
ST112	Stairs & Escalator Support Beams	CY	$500
ST113	Transit Center per Metro - see std	EA	$2,000,000
ST114	Construct Bus Bulb	EA	$16,000
SW100	Clear & Grubbing, Moderate	RF	$1
SW101	3" Asphalt Treated Base	SY	$5
SW102	Aggregate Base	CY	$20
SW103	Street Modification	EA	$3,000
SW104	8" Asphalt Paving	SY	$17
SW105	Backfill, Native Material	CY	$15
SW107	Backfill, Structural, Imported	CY	$22
SW108	Base Course - 12"	CY	$20
SW109	Compact Site	SF	$0.65
SW110	Curb & Gutter	LF	$12
SW111	Demolition (incl. saw cutting, hauling, etc.)	SF	$1
SW112	Dewatering	RF	$150
SW113	Disposal of Excavated Material	CY	$12

02-Jun-94

REGIONAL TRANSIT PROJECT
UNIT COST LIBRARY

CODE	DESCRIPTION	UNIT	COST
SW115	Excavation	CY	$30
SW116	Erosion Control	RF	$15
SW117	Excavate, Mass	CY	$10
SW118	Excavate Station, Mining & Roof Support	CY	$180
SW119	Excavation, Deep Trench	CY	$20
SW120	Excavation for Access Shaft	CY	$120
SW121	Excavation Support System (Soldier Beam & Lagging)	SF	$30
SW122	Excavation Wall Footing	CY	$15
SW123	Excavation, Cut & Cover	CY	$20
SW124	Excavation, Pier Footing	CY	$20
SW125	Excavation, Tunnel (EPBM) 18.5' I.D.	LF	$1,860
SW125B	Excavation, Tunnel (EPBM) 20.33' I.D.	LF	$2,000
SW126	Excavation, Tunnel (TBM Normal or Shield)	LF	$1,020
SW127	Moderate Grading	SY	$5
SW128	Grouting, Tunnel Lining 18.5' I.D.	LF	$150
SW128B	Grouting, Tunnel Lining, 20.33' I.D.	LF	$167
SW129	Embankment Imported Fill incl Compaction	CY	$15
SW130	Instrumentation, Tunnel Construction by TBM	RF	$100
SW131	Instrumentation, C & C Construction	RF	$200
SW132	Parking, Multistory	SPACE	$10,000
SW133	Parking Area, Surface Type (300 Cars @ 400 sf each)	SF	$7.50
SW134	AC Paving incl Base	SY	$27
SW135	Remove AC Paving, (Assume 30' Wide)	SF	$0.50
SW136	Remove Bus Stop & Dispose	EA	$1,000
SW137	Remove Curb	LF	$1.50
SW138	Remove Sidewalks, (Assume 5' Wide)	SF	$1
SW139	Remove Structure & Obstructions	RF	$3
SW140	Rough, Fine Grade & Compact Site	SF	$0.55
SW141	Saw Cut	LF	$2.50
SW142	Security Fence & Gates @ Stations (Ironwork)	LS	$60,000
SW143	Shoring, Shallow Excavation	SF	$15
SW144	Sidewalk Demolition	SF	$1
SW145	Site Work & Surface Drainage	RF	$30
SW146	Security Chain Link Fence	LF	$12
SW147	Sidewalk, 5'W	SF	$2.50
SW149	Sidewalk	SF	$2.50
SW151	Rumble Strip	LF	$40
SW152	Belgian Blocks	SF	$12
SW153	Interchange Modifications	EA	Input $$
TC101	Traffic Control, City Street cut & cover	RF	$500
TC102	Traffic Control, Freeway (Cones, Signs, Barriers)	RF	$25
TC103	Traffic Control for "Guideway", City Street, Median	RF	$150
TC104	Traffic Control for "Trackwork", City Street, Median	TF	$20
TC105	Traffic Control in Intersection – Urban	LS	$60,000
TC106	Traffic Control in Intersection – Suburban	LS	$25,000
TC110	Street Decking	SY	$350
TN101	Precast Tunnel Lining, Bolted, Gasketed, 18.5' I.D.	LF	$1,900
TN101B	Precast Tunnel Lining, Bolted, Gasketed for 20.33' I.D.	LF	$2,110
TN102	Precast Tunnel Lining, Expanded Segmented	LF	$1,100
TN180	CIP, Cross Passages, 800' o.c., Standard	EA	$130,000
TN181	CIP, Cross Passages, 800' o.c., Compressed Air	EA	$320,000
TR101	Reflectors (2 per 10')	EA	$4
TR102	Striping	LF	$1
TR103	Striping (2 sides, painted)	LF	$1

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The New and Improved (Simplified) Construction Kit (1995 $'s)

For any option, to add or subtract a **Route Mile** of:

- Tunnel, use $125 million
- Aerial structure, use $60 million
- Surface alignment, use $35 million*

*could be $10 million less on pre-existing reserved right-of-way, or as much as $15 million more in dense urbanized areas

To add or subtract a **Station** in the case of:

- Tunnel, use $65 million
- Aerial, use $15 million
- Surface, use $2.5 million

To add or subtract a 500 stall **Park & Ride**:

- Surface, use $5 million
- Structure, use $10 million

For **Mitigation/Betterment**:

- Tunnel, use 2.5%
- Aerial, use 5%
- Surface, use 5%

For **Operating & Maintenance** costs per mile per year:

- Tunnel, use $2.0 million
- Aerial, use $1.9 million
- Surface, use $1.5 million

REGIONAL TRANSIT PROJECT
SURFACE RUNNING LRT SYSTEM
ADDITIONAL COMPOSITE COST ITEMS

02-Jun-94
T. RATTO

CODE	DESCRIPTON	UNIT	UNIT COST	FIGURE	COMMENT
12131	MODERATE ROADWAY MODIFICATIONS				
12131A	Roadway Modifications, Urban, 1 lane, each way + sidewalk, lighting, & utility relocation	RF	$894	N/A	Pavement Demolition & Removal in Standard 12110
12131B	Roadway Modifications, Suburban, 1 lane, each way + sidewalk, minor lighting, & utility relocation	RF	$384	N/A	Pavement Demolition & Removal in Standard 12110
12131C	Roadway Modifications, Urban, 2 lane, each way + sidewalk, lighting, & utility relocation	RF	$968	N/A	Pavement Demolition & Removal in Standard 12110
12131D	Roadway Modifications, Suburban, 2 lane, each way + sidewalk, minor lighting, & utility relocation	RF	$458	N/A	Pavement Demolition & Removal in Standard 12110
12131M	Intersection Modifications, Urban, 4 lane, each way + sidewalk, signaling, & utility relocation	EA	$432,223	FAX	Pavement Demolition & Removal in Standard 12110
12131N	Intersection Modifications, Suburban, 4 lane, each way + sidewalk, signaling, & utility relocation	EA	$310,223	FAX	Pavement Demolition & Removal in Standard 12110
12131P	Intersection Modifications, Urban, 2 lane, each way + sidewalk, signaling, & utility relocation	EA	$398,913	FAX	Pavement Demolition & Removal in Standard 12110
12131Q	Intersection Modifications, Suburban, 2 lane, each way + sidewalk, signaling, & utility relocation	EA	$292,313	FAX	Pavement Demolition & Removal in Standard 12110
12131R	Intersection Modifications, Urban, 4 lane, T-Crossing way + sidewalk, signaling, & utility relocation	EA	$389,392	FAX	Pavement Demolition & Removal in Standard 12110
12131S	Intersection Modifications, Suburban, 4 lane, T-Crossing way + sidewalk, signaling, & utility relocation	EA	$294,342	FAX	Pavement Demolition & Removal in Standard 12110
15228	GUIDEWAY, AT GRADE				
15228A	Guideway, at grade, dual, in street for paved tracks with Belgian Blocks	RF	$457	YES	Without Trackwork
15228C	Guideway, at grade, dual, in street for concrete paved tracks	RF	$415	YES	Without Trackwork
15228D	Guideway, at grade, dual, adjacent to street	RF	$198	YES	Without Trackwork
15228E	Guideway, at grade, dual, in street for ballasted track	RF	$324	YES	Without Trackwork
15320	STATION AT GRADE				
15324	Station, at grade, bw, 300'L w/ 2-12'W side platforms w/50% canopy	EA	$780,844	YES	Canopy Covers only 50% of Platform
15325	Station, at grade, bw, 300'L w/ 2-12'W staggered side plat's w/50% canopy	EA	$923,901	N/A	Canopy Covers only 50% of Platform
15326	Station, at grade, bw, 300'L x 15'W center platform w/50% canopy	EA	$525,190	YES	Canopy Covers only 50% of Platform
16230	TRACKWORK, PAVED TRACK				
16231	Trackwork, on track slab with Belgian Blocks	TF	$146	YES	Track Slab with Guideway
16232	Trackwork, on track slab with concrete infill	TF	$128	YES	Track Slab with Guideway
16420	TRACTION POWER, DOUBLE TRACK COMPLETE				
16420A	Mixed Center and Side Poles	RF	$350	N/A	

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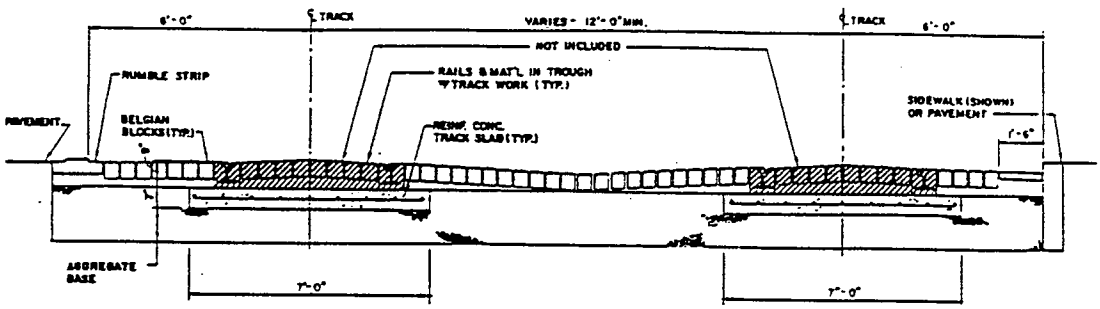

TYPICAL SECTION
AT-GRADE GUIDEWAY FOR PAVED (MALL) TRACK
15228A

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
15228A	Guideway, at grade, dual, in street for paved tracks with Belgian Blocks				
	Length			100	RF
	Width			25	FT
CN122	CIP, Slab on Grade	CY	$212.00	30	$6,360
LN101	Landscaping, Guideway	RF	$20.00	100	$2,000
SW102	Aggregate Base	CY	$20.00	55	$1,100
SW113	Disposal of Excavated Material	CY	$12.00	84	$1,008
SW115	Excavation	CY	$30.00	84	$2,520
SW151	Rumble Strip	LF	$40.00	100	$4,000
SW152	Belgian Blocks	SF	$12.00	1,140	$13,680
TC103	Traffic Control for "Guideway", City Street, Median	RF	$150.00	100	$15,000
	Note:				
	Demolition to be included w/ standard 12110				
	Roadway Modifications are included with the various 12131 standards				
	Total Cost			100	$45,668
	TOTAL COST PER ROUTE FOOT	RF			$457

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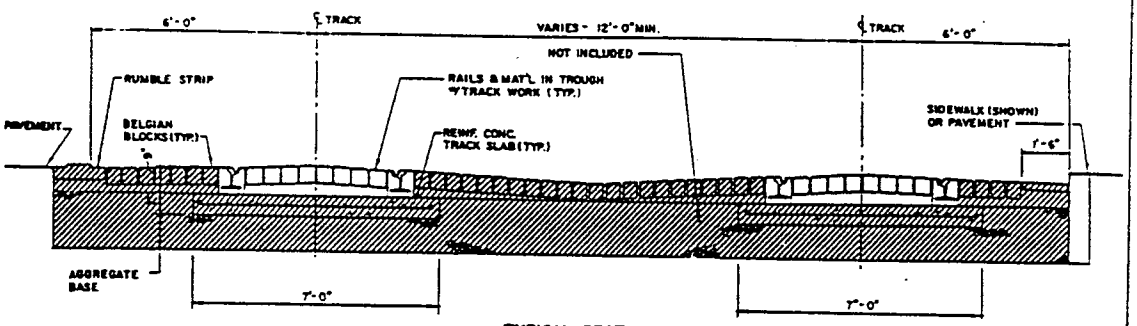
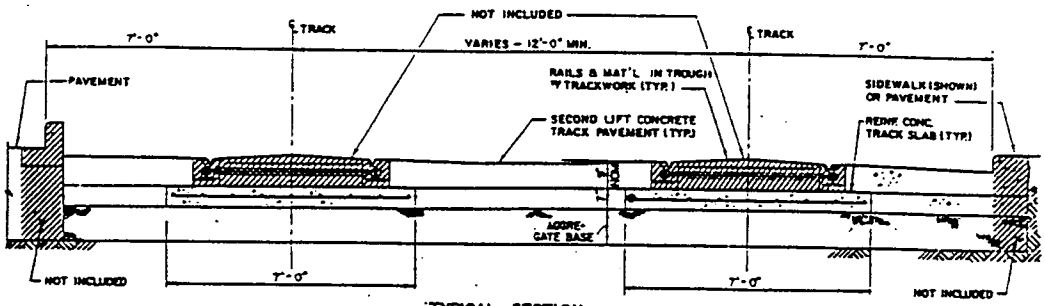


TYPICAL SECTION
AT-GRADE GUIDEWAY FOR PAVED (MALL) TRACK
16231

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
16231	Trackwork, on track slab with Belgian Blocks				
	Length			100	TF
	Width			5.5	FT
SW152	Belgian Blocks	SF	$12.00	400	$4,800
TC104	Traffic Control for "Trackwork", City Street, Median	TF	$20.00	100	$2,000
TW111	Girder Rail	LF	$25.00	200	$5,000
TW121	Rail Embedment Material	CF	$25.00	112	$2,800
	Note:				
	Demolition to be included w/ standard 12110				
	Roadway Modifications are included with the various 12131 standards				
	Total Cost			100	$14,600
	TOTAL COST PER TRACK FEET	TF			$146

02-Jun-94



TYPICAL SECTION
AT-GRADE GUIDEWAY FOR PAVED (CONC.) TRACK
15228 C

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
15228C	Guideway, at grade, dual, in street for concrete paved tracks				
	Length			100	RF
	Width			26	FT
CN122	CIP, Slab on Grade	CY	$212.00	76	$16,112
LN101	Landscaping, Guideway	RF	$20.00	100	$2,000
SW102	Aggregate Base	CY	$20.00	62	$1,240
SW113	Disposal of Excavated Material	CY	$12.00	169	$2,028
SW115	Excavation	CY	$30.00	169	$5,070
TC103	Traffic Control for "Guideway", City Street, Median	RF	$150.00	100	$15,000
	Note:				
	Demolition to be included w/ standard 12110				
	Roadway Modifications are included with the various 12131 standards				
	Total Cost			100	$41,450
	TOTAL COST PER ROUTE FOOT	RF			$415

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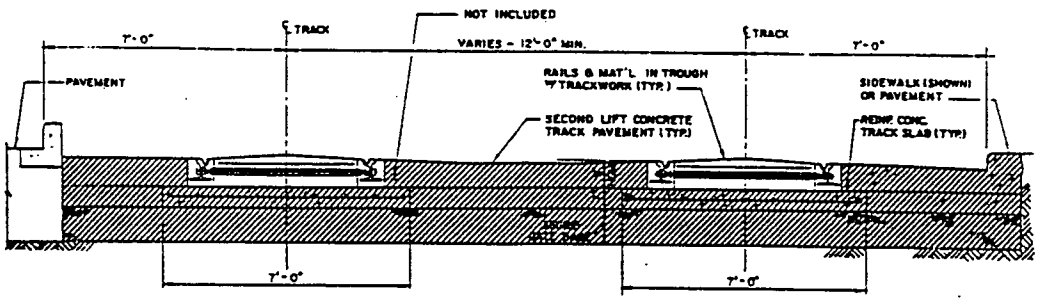

TYPICAL SECTION
AT-GRADE GUIDEWAY FOR PAVED (CONC.) TRACK
16232

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
16232	Trackwork, on track slab with concrete infill				
	Length			100	TF
	Width			5.5	FT
CN142	Second & Third Pour Concrete	SF	$7.00	400	$2,800
TC104	Traffic Control for "Trackwork", City Street, Median	TF	$20.00	100	$2,000
TW111	Girder Rail	LF	$25.00	200	$5,000
TW121	Rail Embedment Material	CF	$25.00	112	$2,800
	Note:				
	Demolition to be included w/ standard 12110				
	Roadway Modifications are included with the various 12131 standards				
	Total Cost			100	$12,600
	TOTAL COST PER TRACK FEET	TF			$126

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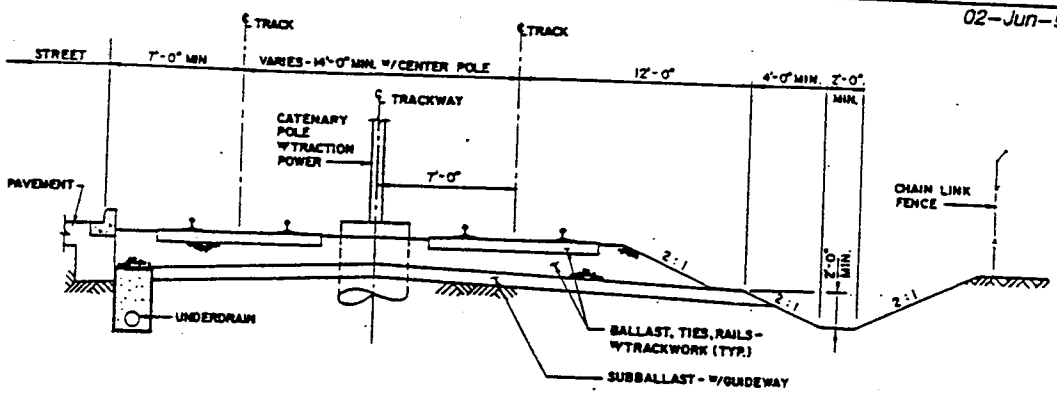

TYPICAL SECTION
AT GRADE GUIDEWAY – ADJACENT TO STREET
15228D

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
15228D	Guideway, at grade, dual, adjacent to street				
	Length			100	RF
	Width			40	FT
LN101	Landscaping, Guideway	RF	$20.00	100	$2,000
ME109	At–Grade Drainage Ditch	LF	$25.00	100	$2,500
SW100	Clear & Grubbing, Moderate	RF	$1.00	100	$100
SW140	Rough, Fine Grade & Compact Site	SF	$0.55	4,000	$2,200
TC102	Traffic Control, Freeway (Cones, Signs, Barriers)	RF	$25.00	100	$2,500
ME115	At–Grade Guideway Drainage	LF	$40.00	100	$4,000
TW101	Subballast	CY	$20.00	204	$4,082
SW110	Curb & Gutter	LF	$12.00	100	$1,200
SW146	Security Chain Link Fence	LF	$12.00	100	$1,200
	Note: Demolition to be included w/ standard 12110 Roadway Modifications are included with the various 12131 standards				
	Total Cost –				$19,782
	TOTAL COST PER ROUTE FOOT	RF		100	$198

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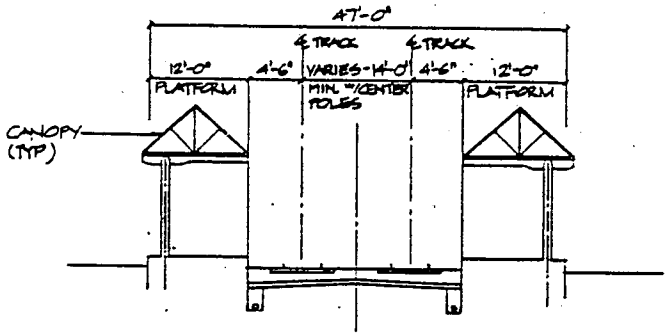
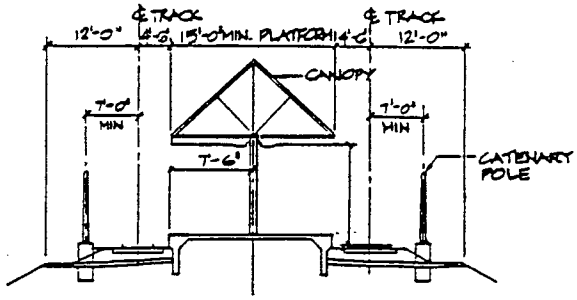


TYPICAL SECTION
AT-GRADE SIDE PLATFORM STATION
15324

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
15324	Station, at grade, low, 300'L w/ 2–12'W side platforms w/50% canopy				
	LENGTH OF STATION			300	LF
	TOTAL PLATFORM WIDTH			24	LF
	STATION WIDTH			47	LF
AF102	Arch. Finish, Aerial & At–grade stations (floor area)	SF	$20.00	7,200	$144,000
AF115	Handrail at Steps and Ramps	LF	$35.00	314	$10,990
CN111	CIP, Concrete Slab @ Misc Areas	CY	$295.00	66	$19,470
CN123	CIP, Steps & Ramps	CY	$801.00	36	$28,836
CN138	Platform Canopy Support Columns	CY	$800.00	29	$23,200
CN122	CIP, Slab on Grade	CY	$212.00	210	$44,520
EE104	Electrical Power, Stations	SF	$10.00	7,200	$72,000
EE105	Lighting, Stations	SF	$10.00	7,200	$72,000
FR101	Furnishings, Stations – Side Platform	LS	$50,000.00	1	$50,000
LN102	Landscaping, Stations	SF	$4.00	7,200	$28,800
ME101	Fire Protection, Stations	SF	$2.00	7,200	$14,400
ST102	Canopy @ Stations	SF	$50.00	3,600	$180,000
SW108	Base Course – 12"	CY	$20.00	100	$2,000
SW122	Excavation Wall Footing	CY	$15.00	46	$690
SW140	Rough, Fine Grade & Compact Site	SF	$0.55	14,100	$7,755
TC103	Traffic Control for "Guideway", City Street, Median	RF	$150.00	300	$45,000
	Subtotal				$743,661
	Art Work allowance				$37,183
	TOTAL COST PER STATION				$780,844

02-Jun-94



TYPICAL SECTION
AT-GRADE CENTER PLATFORM STATION
15326

UNIT CODE	UNIT DESCRIPTION	UNIT	UNIT COST	QUANTITY	COST PER UNIT
15326	Station, at grade, low, 300'L x 15'W center platform w/50% canopy				
	LENGTH OF STATION			300	LF
	TOTAL PLATFORM WIDTH			15	LF
	STATION WIDTH			48	LF
AF102	Arch. Finish, Aerial & At-grade stations (floor area)	SF	$20.00	4,500	$90,000
AF115	Handrail at Steps and Ramps	LF	$35.00	240	$8,400
CN111	CIP, Concrete Slab @ Misc Areas	CY	$295.00	66	$19,470
CN123	CIP, Steps & Ramps	CY	$801.00	36	$28,836
CN138	Platform Canopy Support Columns	CY	$800.00	29	$23,200
CN122	CIP, Slab on Grade	CY	$212.00	122	$25,864
EE104	Electrical Power, Stations	SF	$10.00	4,500	$45,000
EE105	Lighting, Stations	SF	$10.00	4,500	$45,000
FR102	Furnishings, Stations – Center Platform	LS	$40,000.00	1	$40,000
LN102	Landscaping, Stations	SF	$4.00	4,500	$18,000
ME101	Fire Protection, Stations	SF	$2.00	4,500	$9,000
ST102	Canopy @ Stations	SF	$50.00	2,250	$112,500
SW108	Base Course – 12"	CY	$20.00	72	$1,440
SW122	Excavation Wall Footing	CY	$15.00	24	$360
SW140	Rough, Fine Grade & Compact Site	SF	$0.55	14,400	$7,920
TC103	Traffic Control for "Guideway", City Street, Median	RF	$150.00	300	$45,000
	Subtotal				$519,990
	Art Work allowance				$5,200
	TOTAL COST PER STATION				$525,190

toronto transit consultants limited

By Type Detail Pr/Very Detailed Pr

Codes	Description	Quantity Estimated	Unit Price	Units	Extension	Contingency (%)	ROW w/ 30% Contingency	Sub Total	Design/Mgmt	Total
11A54	Broadway Central to Vent Shaft,	I 539+50 to 620+50, RL=8,100'							Stationing: 430+70 to 592+10	
12110	Demolition (30'paving,2 curbs I 4' sidewalk, sawcut incl.) I Avg. $$/Route Foot I NI	300	33.00	RF	9,900	2,970 30	0	12,870		
12121	Moderate Utility Relocation I H20, SS, SD, elec, gas, etc. I Avg. $$/Route Foot I NI	300	1,656	RF	496,800	149,040 30	0	645,840		
12131	Moderate Roadway Modification I $$ ALLOWANCE (INCL. SIGNAL I MODIF.) I NI	300	296	RF	88,800	26,640 30	0	115,440		
15232	Tunnel, 2 - 18'6 I D., EPB I TBM, incl. liner, invert & walks I Bolted, Gasketed, Precast Liner I NI	8,290	10,869	RF	90,103,312	22,525,828 25	0	112,629,140		
15238	Tunnel, Cut&Cover, 34'W x22'H I Dual w/center wall, walkway I Downtown I NI	300	10,489	RF	3,146,700	786,675 25	0	3,933,375		
16240	Track, 115 RE, DirectFixation I pandrol clips I I NI	16,580	221	TF	3,664,180	549,627 15	0	4,213,807		
16252	Typical Double Crossover I 4-810 T.O. incl harden frog, switch, I panelized, #115 I NI	1.00	309,027	EA	309,027	46,354 15	0	355,381		
16422	Traction Power, Rail,no Poles I 2 track catenary for Tunnel, I Switching & Distrib. system I NI	8,290	309	RF	2,561,610	640,402 25	0	3,202,012		
16640	Command & Control I 2 tracks or guideway I I NI	8,290	304	RF	2,520,160	630,040 25	0	3,150,200		
16820	Communication, CCTV, Audio, I Telephone, Radio & Security I Systems for 2 tracks I NI	8,290	143	RF	1,185,470	296,367 25	0	1,481,837		
26682	R O W. COST I INCL. PROPERTY VALUE, I IMPROVEMENTS, & RELOCATION I NI	1.00	200,040	LS	0	0	1,003,392	1,003,392		
	TOTAL Broadway Central to Vent Shaft, ->	8,290 RF			104,085,959	25,653,944	1,003,392	130,743,295	40,369,879	179,668,833
11206	Vent Shaft,	I 602+00 to 603+00, RL=100'							Stationing: 592+10 to 610+00	
12120	Minor Utility Relocation I H20, SS, SD, elec, gas, etc. I Avg. $$/Route Foot I NI	100	55.00	RF	5,500	1,650 30	0	7,150		
12130	Minor Roadway Modifications I $$ Allowance I I NI	100	110	RF	11,000	3,300 30	0	14,300		
12158	Building Demo., incl Hauling I Debris (Allow 8% of the I improvement value) I NI	1.00	1.00	LS	4,525	1,357 30	0	5,882		
12160	Landscaping incl. planting, I seeding, irrigation, & fert. I Avg. $$/Square Foot I NI	10,000	3.00	SF	30,000	9,000 30	0	39,000		
15232	Tunnel, 2 - 18'6 I D., EPB I TBM, incl. liner, invert & walks I Bolted, Gasketed, Precast Liner I NI	100	10,869	RF	1,086,891	271,722 25	0	1,358,614		
15239	Vent Shaft, 30'Lx66'Tx47'Deep I incl. stairs, fans & head I house I NI	1.00	2,670,875	EA	2,670,875	667,718 25	0	3,338,593		
15357	Sound Wall, Approx 8'H I I I NI	400	88.00	LF	35,200	10,560 30	0	45,760		
16240	Track, 115 RE, DirectFixation I pandrol clips I I NI	200	221	TF	44,200	6,630 15	0	50,830		
16422	Traction Power, Rail,no Poles I 2 track catenary for Tunnel, I Switching & Distrib. system I NI	100	309	RF	30,900	7,725 25	0	38,625		
16640	Command & Control I 2 tracks or guideway I I NI	100	304	RF	30,400	7,600 25	0	38,000		
16820	Communication, CCTV, Audio, I Telephone, Radio & Security I Systems for 2 tracks I NI	100	143	RF	14,300	3,575 25	0	17,875		
26682	R O W COST I INCL. PROPERTY VALUE, I IMPROVEMENTS, & RELOCATION I NI	1.00	200,040	LS	0	0	574,704	574,704		
	TOTAL Vent Shaft, ->	100 RF			3,963,791	990,839	574,704	5,529,334	1,622,141	7,509,049

Regional Transit Authority

Design/Mgmt Costs @ 31% of Civil + 15% of ROW
Total includes 5% mitigation costs
Estimate in June 1994 Dollars

Prepared by RTA Engineering & Construction Division; Regional Transit Authority

North Option 3

toronto transit consultants limited

ByTypeDetailPr/VeryDetailed

Codes	Description	Quantity Estimated	Unit Price	Units	Extension	Contingency (%)	ROW w/ 30% Contingency	Sub Total	Design/Mgmt	Total
11308	15th Ave & Pacific St. Station	I, 653+00 to 659+00, Rt.=600'							Stationing: 629+50 to 635+50	
12110	Demolition (30'paving,2 curbs I 4' sidewalk, sawcut incl.) I Avg. $$/Route Foot I NI	600	33.00	RF	19,800	5,940 30	0	25,740		
12121	Moderate Utility Relocation I H20, SS, SD, elec, gas, etc. I Avg. $$/Route Foot I NI	600	1,656	RF	993,600	298,080 30	0	1,291,680		
12131	Moderate Roadway Modification I $$ ALLOWANCE (INCL. SIGNAL I MODIF.) I NI	600	296	RF	177,600	53,280 30	0	230,880		
12155	Underpinning, Type 5 I Steel/Conc, <5 Storys, I (Apprx 2000 sf loff area) I NI	2.00	92,708	EA	185,416	55,624 30	0	241,040		
15232	Tunnel, 2 - 18'6 I D., EPB I TBM, incl. liner, invert & walks I Bolted, Gasketed, Precast Liner I NI	600	10,869	RF	6,521,349	1,630,337 25	0	8,151,686		
15331	Station, Cut & Cover, Type A I 400'L x 24'W Center Platform w/Mezzanine I Total Length of Station - 600 LF I NI	1.00	8,549,667	EA	28,549,667	8,564,900 30	0	37,114,567		
15360	Plaza, Incl Paving, Lighting, I Signage, Furniture & Other I Hardscaping I NI	20,000	22.00	SF	440,000	132,000 30	0	572,000		
15362	Elevator - (Additional) I I I NI	2.00	110,367	EA	220,734	44,146 20	0	264,880		
16240	Track, 115 RE, DirectFixation I pandrol clips I I NI	1,200	221	TF	265,200	39,780 15	0	304,980		
16422	Traction Power, Rail,no Poles I 2 track catenary for Tunnel, I Switching & Distrib. system I NI	600	309	RF	185,400	46,350 25	0	231,750		
16640	Command & Control I 2 tracks or guideway I I NI	600	304	RF	182,400	45,600 25	0	228,000		
16820	Communication, CCTV, Audio, I Telephone, Radio & Security I Systems for 2 tracks I NI	600	143	RF	85,800	21,450 25	0	107,250		
16940	Fare Collection @ CBD Station I incl. typical 8 dispensers I @ avg. of 35K/dispenser I NI	1.00	309,027	LS	309,027	77,256 25	0	386,283		
	TOTAL 15th Ave & Pacific St. Station ->	600	RF		38,135,993	11,014,745	0	49,150,739	15,236,729	67,606,841

Regional Transit Authority

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Design/Mgmt Costs @ 31% of Civil + 15% of ROW
Total includes 5% mitigation costs
Estimate in June 1994 Dollars

Page: 4 Date: 8/31/94

North Option 3

toronto transit consultants limited

ByTypeDetail Pr/VeryDetailed Pr

Codes	Description	Quantity Estimated	Unit Price	Units	Extension	Contingency (%)	ROW w/ 30% Contingency	Sub Total	Design/Mgmt	Total
11A51	Madison Street Station	1, 503+00 to 509+00, RL=600'							Stationing: 391+50 to 397+50	
12110	Demolition (Mrpaving,2 curbs 1 4' sidewalk, sawcut incl.) 1 Avg. $$/Route Foot 1 N1	600	33.00	RF	19,800	5,940 30	0	25,740		
12121	Moderate Utility Relocation 1 1120, SS, SD, elec, gas, etc. 1 Avg. $$/Route Foot 1 N1	600	1,656	RF	993,600	298,080 30	0	1,291,680		
12131	Moderate Roadway Modification 1 $$ ALLOWANCE (INCL. SIGNAL 1 MODIF.) 1 N1	600	296	RF	177,600	53,280 30	0	230,880		
12153	Underpinning, Type 3 1 Steel/Conc, 5-10 Storys, 1 (Appx 2000 sf loff area) 1 N1	4.00	184,312	EA	737,248	221,174 30	0	958,422		
15232	Tunnel, 2 - 18'6 1 D., EPB 1 TBM, incl. liner, invert & walks 1 Bolted, Gasketed, Precast Liner 1 N1	600	10,869	RF	6,521,349	1,630,337 25	0	8,151,686		
15338	Station, Mined from EPB TBM 1 400'L x 24'W Center platform 1 w/Mezzanine 1 N1	1.00	4,146,693	EA	44,146,693	13,244,007 30	0	57,390,700		
15360	Plaza, Incl Paving, Lighting, 1 Signage, Furniture & Other 1 Hardscaping 1 N1	10,000	22.00	SF	220,000	66,000 30	0	286,000		
15362	Elevator - (Additional) 1 1 1 N1	4.00	110,367	EA	441,468	88,293 20	0	529,761		
16240	Track, 115 RE, DirectFixation 1 pandrol clips 1 1 N1	1,200	221	TF	265,200	39,780 15	0	304,980		
16422	Traction Power, Rail,no Poles 1 2 track catenary for Tunnel, 1 Switching & Distrib. system 1 N1	600	309	RF	185,400	46,350 25	0	231,750		
16640	Command & Control 1 2 tracks or guideway 1 1 N1	600	304	RF	182,400	45,600 25	0	228,000		
16820	Communication, CCTV, Audio, 1 Telephone, Radio & Security 1 Systems for 2 tracks 1 N1	600	143	RF	85,800	21,450 25	0	107,250		
16940	Fare Collection @ CBD Station 1 incl. typical 8 dispensers 1 @ avg. of 35K/dispenser 1 N1	1.00	309,027	LS	309,027	77,256 25	0	386,283		
26682	R O.W. COST 1 INCL. PROPERTY VALUE, 1 IMPROVEMENTS, & RELOCATION 1 N1	1.00	200,040	LS	0	0	2,779,920	2,779,920		
	TOTAL Madison Street Station ->	600 RF			54,285,585	15,837,550	2,779,920	72,903,055	22,155,160	99,811,126

Regional Transit Authority

Prepared by RTA Engineering & Construction Division; Regional Transit Authority

Design/Mgmt Costs @ 31% of Civil + 15% of ROW
Total includes 5% mitigation costs
Estimate in June 1994 Dollars

North Option 3

By Type Detail Pr/Very Detailed Pr

Codes	Description	Quantity Estimated	Unit Price	Units	Extension	Contingency (%)	ROW w/ 30% Contingency	Sub Total	Design/Mgmt	Total
11313	NE 65th St. to Northgate Sta,	| 741+00 to 844+00, Rl.=10,130'							Stationing: 739+00 to 839+60	
12120	Minor Utility Relocation | H20, SS, SD, elec, gas, etc. | Avg. $5/Route Foot | N2	1,550	55.00	RF	85,250	25,575 30	0	110,825		
12130	Minor Roadway Modifications | $5 Allowance | | N2	1,200	110	RF	132,000	39,600 30	0	171,600		
12157	Underpinning, Type 7 | Bridge Abutments | | N2	4.00	82,775	EA	331,100	99,330 30	0	430,430		
15211	Gdwy, Acr, 253ft x30'W w/piles | 2 Trk, incl cols & PC girder | walkways | N2	1,020	3,051	RF	3,112,020	622,404 20	0	3,734,424		
15213	Gdwy, Atypical Aerial, piles | +65% $5/RF to Standard 15211 | 15% of the Aerial Quantity | N2	180	5,033	RF	905,940	181,188 20	0	1,087,128		
15223	Gdwy, Retained Cut, 2-sides | 34'W, 20ft Walls, spré ftg | | N2	350	3,875	RF	1,356,250	339,062 25	0	1,695,312		
15232	Tunnel, 2 - 18'6 I.D., EPB | TBM, incl. liner, invert & walks | Bolted, Gasketed, Precast Liner | N2	8,580	10,869	RF	93,255,298	23,313,824 25	0	116,569,122		
16220	Track, Rail, ties, Ballast, | subballast, 115# RE, pandrol | rail clips | N2	700	149	TF	104,300	15,645 15	0	119,945		
16240	Track, 115 RE, DirectFixation | pandrol clips | | N2	19,560	221	TF	4,322,760	648,414 15	0	4,971,174		
16420	TRACTION POWER RAIL, 2 TR. | INCL. CAT, POLES, SUBSTA. | SWITCHING & DIST. SYSTEMS | N2	1,550	342	RF	530,100	132,525 25	0	662,625		
16422	Traction Power, Rail,no Poles | 2 track catenary for Tunnel, | Switching & Distrib. system | N2	8,580	309	RF	2,651,220	662,805 25	0	3,314,025		
16640	Command & Control | 2 tracks or guideway | | N2	10,130	304	RF	3,079,520	769,880 25	0	3,849,400		
16820	Communication, CCTV, Audio, | Telephone, Radio & Security | Systems for 2 tracks | N2	10,130	143	RF	1,448,590	362,147 25	0	1,810,737		
26682	R O W. COST | INCL. PROPERTY VALUE, | IMPROVEMENTS, & RELOCATION | N2	1.00	200,040	LS	0	0	1,649,232	1,649,232		
	TOTAL NE 65th St. to Northgate Sta, ->	10,130	RF		111,314,348	27,212,400	1,649,232	140,175,980	43,190,677	192,534,990

Regional Transit Authority

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Design/Mgmt Costs @ 31% of Civil + 15% of ROW
Total includes 5% mitigation costs
Estimate in June 1994 Dollars

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North Option 3

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ByTypeDetail Pr/VeryDetailed Pr

Codes	Description	Quantity Estimated	Unit Price	Units	Extension	Contingency (%)	ROW w/ 30% Contingency	Sub Total	Design/Mgmt	Total
11413	**Northgate Station**									
									Stationing: 00+00 to 00+00	
12110	Demolition (30'paving,2 curbs & 4' sidewalk, sawcut incl.) & Avg. $$/Route Foot & N2	400	33.00	RF	13,200	3,960 30	0	17,160		
12120	Minor Utility Relocations & H20, SS, SD, elec, gas, etc. & Avg. $$/Route Foot & N2	400	55.00	RF	22,000	6,600 30	0	28,600		
12158	Building Demo., incl Hauling & Debris (Allow 8% of the & improvement value) & N2	1.00	1.00	LS	35,869	10,760 30	0	46,629		
12165	Pedestrian Overpass, 12'W & incl. cols., beams, fencing & lighting, & drainage & N2	200	596	LF	119,200	35,760 30	0	154,960		
15311	Station, Aerial, Cu Platform & 400'L x 24'W w/Canopy, Guideway & 2 Columns for each Capital & N2	1.00	5,427,836	EA	5,427,836	1,085,567 20	0	6,513,403		
15356	Mezzanine, @ station (add'l) & structural & finishes & & N2	15,000	55.00	SF	825,000	247,500 30	0	1,072,500		
15360	Plaza, Incl Paving, Lighting, & Signage, Furniture & Other & Hardscaping & N2	6,000	22.00	SF	132,000	39,600 30	0	171,600		
15362	Elevator - (Additional) & & & N2	3.00	110,367	EA	331,101	66,220 20	0	397,321		
15363	Escalator (Additional) & & & N2	2.00	242,807	EA	485,614	97,122 20	0	582,736		
16240	Track, 115 RE, DirectFixation & pandrol clips & & N2	800	221	TF	176,800	26,520 15	0	203,320		
16420	TRACTION POWER RAIL, 2 TR. & INCL. CAT, POLES, SUBSTA. & SWITCHING & DIST. SYSTEMS & N2	400	342	RF	136,800	34,200 25	0	171,000		
16640	Command & Control & 2 tracks or guideway & & N2	400	304	RF	121,600	30,400 25	0	152,000		
16820	Communication, CCTV, Audio, & Telephone, Radio & Security & Systems for 2 tracks & N2	400	143	RF	57,200	14,300 25	0	71,500		
16942	Fare Coll @ NON - CBD Station & incl. typical 2 dispensers & @ avg. of 35K/dispenser & N2	1.00	77,257	LS	77,257	19,314 25	0	96,571		
26640	R O W, Cost, Central Business & incl. relocation, appraisal & legal & some mitigation & N2	121,166	22.00	SF	0	0	3,402,360	3,402,360		
	TOTAL Northgate Station ->	400 RF			7,961,477	1,717,825	3,402,360	13,081,662	3,510,938	17,422,230

Regional Transit Authority

Prepared by RTA Engineering & Construction Division; Regional Transit Authority

Design/Mgmt Costs @ 31% of Civil + 15% of ROW
Total includes 5% mitigation costs
Estimate in June 1994 Dollars

North Option 3

REGIONAL TRANSIT AUTHORITY

COMPARATIVE CAPITAL COSTS FOR NEW-START LIGHT RAIL SYSTEMS UPDATED TO 1995 DOLLARS

CITY	INITIAL SERVICE	MILES OF LINE	CAPITAL COSTS ($ mil)		1995 COST/MILE ($ mil)	ALIGNMENT NOTES
			ACTUAL	1995 (a)		
Lower Cost:						
- Sacramento	1987	18.3	$176	$241	$ 13	No tunnel, < 10% aerial, re-used structures, (d)
- San Diego	1981	41.9	(c)	$729	$ 17	No tunnel, few structures, (d)
- Baltimore	1992	22.5	$360	$406	$ 19	No tunnel, long viaduct, mostly r.r. r-o-w, (d)
- Denver (b)	1994	14.0	$263	$272	$ 19	No tunnel, few structures, (d)
- Portland, East	1986	15.2	$214	$305	$ 20	No tunnel, few structures, (d)
- St. Louis	1993	18.0	$351	$380	$ 21	Re-used r.r. tunnel & bridge, mostly r.r. r-o-w, (f)
Medium Cost:						
- Pittsburgh	1987	22.5	$539	$738	$ 33	24% tunnel, major river bridge renovation, (d) w/some (f)
- Santa Clara	1987	20.0	$537	$735	$ 37	No tunnel, CBD mall & street work, (d) w/some (e)
- Dallas	1996	20.0	$843	$811	$ 41	17% tunnel, new river bridge, CBD mall, mostly (e)
- Calgary	1981	18.2	(c)	$758	$ 42	Minor tunnels, 2 new river bridges & other structures (f)
Higher Cost:						
- Los Angeles, Blue	1991	21.6	$912	$1,067	$ 49	< 5% tunnel, extensive aerial & street work, (f)
- Edmonton	1978	8.6	$221	$430	$ 50	+/-33% tunnel, major new bridge, r.r. r-o-w, (f)
- Portland, West	1997	11.5	$688	$636	$ 55	30% tunnel, significant other structures, (d, e)
Highest Cost:						
- Buffalo	1985	6.4	$535	$792	$124	81% tunnel (f), 19% CBD mall, (d)

a - Inflation at 4% per year, compounded. b - Starter @ 5.3 miles ($116.5 mil) + Southwest Extension @ 8.7 miles ($146 mil). c - Various amounts in various years for several lines and extensions. d - Simple low platform stations. e - Multi-level low platform stations,. f - Multi-level high platform, stations.

LRTCOSTS:Rev.09/13/94

E. Subregional Revenue Allocations

Summary of Population and Retail Sales Tax Collections in RTA Subregions within King County

	Subregion	1990 Population			1990 Sales Tax Collections (000s)			1993 Population			1993 Sales Tax Collections (000s)		
		Cities	County	Total	Cities	County	Total	Cities	County	Total	Cities	County	Total
Reported Values	North	519,631	81,608	601,239	$37,816	$10,545	$48,361	531,105	81,353	612,458	$40,061	$9,907	$49,968
	South	247,052	173,481	420,533	22,646	9,527	32,173	294,710	172,939	467,649	28,437	8,950	37,387
	East	211,031	134,473	345,504	21,734	5,542	27,276	231,290	134,054	365,344	24,964	5,207	30,171
	sub-RTA	977,714	389,562	1,367,276	$82,196	$25,614	$107,810	1,057,105	388,346	1,445,451	$93,462	$24,065	$117,527
	Non-RTA	15,637	123,695	139,332	1,040	4,344	5,384	18,180	123,309	141,489	1,230	4,081	5,311
	total	993,351	513,257	1,506,608	$83,236	$29,958	$113,194	1,075,285	511,655	1,586,940	$94,692	$28,146	$122,838
Percent of County	North	34.5%	5.4%	39.9%	33.4%	9.3%	42.7%	33.5%	5.1%	38.6%	32.6%	8.1%	40.7%
	South	16.4%	11.5%	27.9%	20.0%	8.4%	28.4%	18.6%	10.9%	29.5%	23.2%	7.3%	30.4%
	East	14.0%	8.9%	22.9%	19.2%	4.9%	24.1%	14.6%	8.4%	23.0%	20.3%	4.2%	24.6%
	sub-RTA	64.9%	25.9%	90.8%	72.6%	22.6%	95.2%	66.6%	24.5%	91.1%	76.1%	19.6%	95.7%
	Non-RTA	1.0%	8.2%	9.2%	0.9%	3.8%	4.8%	1.1%	7.8%	8.9%	1.0%	3.3%	4.3%
	total	65.9%	34.1%	100.0%	73.5%	26.5%	100.0%	67.8%	32.2%	100.0%	77.1%	22.9%	100.0%
Percent of RTA/King	North	38.0%	6.0%	44.0%	35.1%	9.8%	44.9%	36.7%	5.6%	42.4%	34.1%	8.4%	42.5%
	South	18.1%	12.7%	30.8%	21.0%	8.8%	29.8%	20.4%	12.0%	32.4%	24.2%	7.6%	31.8%
	East	15.4%	9.8%	25.3%	20.2%	5.1%	25.3%	16.0%	9.3%	25.3%	21.2%	4.4%	25.7%
	total-RTA	71.5%	28.5%	100.0%	76.2%	23.8%	100.0%	73.1%	26.9%	100.0%	79.5%	20.5%	100.0%

compiled by Porter & Associates, Inc.

Allocation of Population and Retail Sales Tax Collections to RTA Subregions within King County

Jurisdiction	Corridor	1990	1993	Sales Tax Collections 1990 (000s)	Sales Tax Collections 1993 (000s)
Algona	S	1,694	1,895	$122	$75
Auburn	S	33,650	34,550	3,117	3,617
Beaux Arts	E	303	285	4	5
Bellevue	E	86,872	89,710	11,647	12,261
Black Diamond	S	1,422	1,575	48	44
Bothell	E	11,986	13,050	859	1,336
Burien	S	0	27,800	0	822
Carnation	X	1,243	1,360	44	59
Clyde Hill	E	2,957	2,990	23	39
Des Moines	S	17,283	19,460	363	418
Duvall	X	2,770	3,200	89	133
Enumclaw	X	7,227	9,205	534	603
Federal Way	S	67,449	75,320	1,955	3,677
Hunts Point	E	514	502	21	11
Issaquah	E	7,786	8,326	963	1,138
Kent	S	37,960	41,090	5,825	6,478
Kirkland	E	40,059	41,700	3,418	4,404
Lake Forest Park	N	3,372	3,405	91	126
Medina	E	2,981	3,000	96	142
Mercer Island	E	20,816	21,260	827	671
Normandy Park	S	6,709	6,890	92	95
North Bend	X	2,578	2,620	241	310
Pacific	S	4,622	5,160	58	75
Redmond	E	35,800	40,095	3,867	4,330
Renton	S	41,688	43,470	4,358	4,954
SeaTac	S	22,701	22,840	1,355	2,083
Seattle	N	516,259	527,700	37,725	39,935
Skykomish	X	273	250	12	17
Snoqualmie	X	1,546	1,545	120	108
Tukwila	S	11,874	14,660	5,353	6,099
Woodinville	E	0	9,407	0	608
Yarrow Point	E	957	965	9	19
subtotal - cities		993,351	1,075,285	$83,236	$94,692
Unincorporated					
North County	N	81,608	81,353	$10,545	$9,907
South County	S	173,481	172,939	9,527	8,950
East County	E	134,473	134,054	5,542	5,207
Non-RTA	X	123,695	123,309	4,344	4,081
subtotal - unincorporated		513,257	511,655	$29,958	$28,146
county total		993,351	1,075,285	$113,194	$122,838

Note:

Corridor designations are N(orth), S(outh), E(ast), and exurban (X). Exurban areas are outside the RTA boundary.

Values for unincorporated areas are based on percentage allocations derived from forecast analysis zone data maintained by the PSRC.

Population data are taken from reports on county population developed by the Washington State Office of Financial Management.

Sales tax collections are taken from the year-end report of local tax distributions prepared by the Washington State Department of Revenue.

Allocation of 1990 Population and Employment by RTA Subregion

	Population			Retail Employment		
	Cities	Unincorp.	Total	Cities	Unincorp.	Total
North	516,290	65,662	581,952	68,960	5,869	74,829
South	301,161	139,543	440,704	41,151	5,298	46,449
East	225,773	108,261	334,034	36,059	3,094	39,153
Sub-RTA	1,043,224	313,466	1,356,690	146,170	14,261	160,431
Non-RTA	51,010	99,620	150,630	4,120	2,428	6,548
Total	1,094,234	413,086	1,507,320	150,290	16,689	166,979
County %						
North	34.3%	4.4%	38.6%	41.3%	3.5%	44.8%
South	20.0%	9.3%	29.2%	24.6%	3.2%	27.8%
East	15.0%	7.2%	22.2%	21.6%	1.9%	23.4%
Sub-RTA	69.2%	20.8%	90.0%	87.5%	8.5%	96.1%
Non-RTA	3.4%	6.6%	10.0%	2.5%	1.5%	3.9%
Total	72.6%	27.4%	100.0%	90.0%	10.0%	100.0%
King RTA%						
North	38.1%	4.8%	42.9%	43.0%	3.7%	46.6%
South	22.2%	10.3%	32.5%	25.7%	3.3%	29.0%
East	16.6%	8.0%	24.6%	22.5%	1.9%	24.4%
Total RTA	76.9%	23.1%	100.0%	91.1%	8.9%	100.0%

prepared by Porter & Associates, Inc.

Source: PSRC Forecast Analysis Zone (FAZ) Data

Allocation of FAZ Data to RTA Subregions

FAZ	Population	Retail Employment	Corridor	Type	City/Cities
3010	31,103	787	S	C	Federal Way
3020	18,587	5,775	S	C	Federal Way
3030	24,288	212	S	U	
3045	22,676	799	S	C	Federal Way
3046	20,958	1,554	S	C	Des Moines
3110	5,595	62	S	C	Algona, Pacific
3120	18,491	624	S	C	Auburn
3130	14,510	3,171	S	C	Auburn
3200	15,106	1,124	X	C	Enumclaw
3310	9,083	243	X	C	Black Diamond
3320	16,302	200	X	U	
3330	11,039	187	X	U	
3413	5,456	624	X	U	
3414	18,151	524	S	U	
3415	15,345	699	S	U	
3416	20,036	874	S	U	
3425	11,162	0	X	U	
3426	10,343	524	S	U	
3427	13,220	468	S	U	
3505	26,863	2,497	S	C	Auburn
3600	12,337	2,197	S	C	Kent
3705	27,143	3,440	S	C	Burien, SeaTac
3706	14,734	868	S	C	Normandy Park
3815	17,740	2,410	S	C	Burien
3816	19,312	1,185	S	C	Burien
3825	15,153	880	S	U	
3900	4,130	8,528	S	C	Tukwila
3905	6,895	943	S	C	Tukwila
4005	10,333	156	S	U	
4110	14,987	1,448	S	C	Renton
4120	13,913	793	S	C	Renton
4130	11,187	4,070	S	C	Renton
4210	12,674	961	S	U	
4225	3,766	44	E	U	
4226	12,388	250	E	U	
4230	9,393	50	X	U	
4300	8,578	1,636	X	C	Issaquah
4400	20,816	886	E	C	Mercer Island
4505	14,120	12	E	U	
4506	15,682	2,684	E	C	Bellevue
4605	10,898	437	E	U	
4606	16,124	412	E	U	
4607	4,829	19	X	U	
4706	7,276	181	X	U	
4810	8,453	642	E	C	Bellevue
4820	6,836	462	E	C	Bellevue
4900	1,182	7,797	E	C	Bellevue
5010	16,140	2,609	E	C	Bellevue
5020	24,165	1,917	E	C	Bellevue
5100	7,436	94	E	C	Hunts Pt, Yarrow Pt, Medina, Clyde Hill
5205	11,181	4,670	E	C	Bellevue

Source: PSRC Forecast Analysis Zone (FAZ) Data

Allocation of FAZ Data to RTA Subregions

FAZ	Population	Retail Employment	Corridor	Type	City/Cities
5305	20,322	2,697	E	C	Kirkland
5306	20,197	2,759	E	C	Kirkland
5415	11,578	1,436	E	C	Bellevue, Redmond
5425	27,093	3,445	E	C	Redmond
5426	8,620	381	X	U	
5515	23,363	512	E	U	
5525	9,335	637	E	C	Bothell, Woodinville
5535	16,551	1,161	E	U	
5545	11,051	266	E	U	
5546	14,805	2,394	E	C	Woodinville
5600	10,552	930	E	C	Woodinville
5715	16,522	175	N	C	Seattle
5716	21,195	755	N	C	Seattle
5720	32,789	2,460	N	C	Seattle
5815	4,047	1,935	N	C	Seattle
5825	2,331	4,638	N	C	Seattle
5826	3,724	125	N	C	Seattle
5915	17,347	843	N	C	Seattle
5916	32,304	557	N	C	Seattle
5925	23,629	1,736	N	C	Seattle
6010	6,785	14,613	N	C	Seattle
6020	4,758	3,022	N	C	Seattle
6113	25,936	6,979	N	C	Seattle
6114	28,732	818	N	C	Seattle
6115	20,797	1,217	N	C	Seattle
6123	9,422	4,458	N	C	Seattle
6124	23,468	1,329	N	C	Seattle
6125	8,494	648	N	C	Seattle
6126	11,925	406	N	C	Seattle
6213	15,299	1,473	N	C	Seattle
6214	4,668	162	N	C	Seattle
6215	24,179	4,919	N	C	Seattle
6216	14,492	436	N	C	Seattle
6223	23,317	1,893	N	C	Seattle
6224	19,809	1,217	N	C	Seattle
6225	15,920	4,070	N	C	Seattle
6226	27,656	1,060	N	C	Seattle
6316	24,517	3,558	N	C	Seattle
6325	32,101	1,555	N	C	Seattle
6326	20,127	1,903	N	C	Seattle
6410	34,471	4,146	N	U	
6420	31,191	1,723	N	U	Includes Lake Forest Park
6505	3,888	206	X	U	
6506	11,285	1,086	X	C	Snoqualmie, North Bend
6605	6,958	31	X	C	Duvall, Carnation
6606	3,716	6	X	U	
6900	5,948	31	X	U	
6910	2,682	150	X	U	
6930	9,309	393	X	U	
	1,507,320	166,979			

Source: PSRC Forecast Analysis Zone (FAZ) Data