
Portland: Tri-Met Adds Service, Gains Passengers, Demonstrates Rail “Economy of Scale”

publictransit.us Special Report 13

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A web-based publication of
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Abstract

Portland's Tri-Met increased transit service levels between 1997 and 2001, coinciding with opening of its new "Westside MAX" light rail (LRT) line. Annual revenue service hours (RSH) were increased by 41 percent systemwide (adjusting for relative vehicle size). This generated a 28 percent increase in annual boardings and a 27 percent increase in annual passenger-miles. Inflation-adjusted total operating cost did increase, but not out of proportion to the ridership increase. Therefore, inflation-adjusted unit operating costs remained stable. LRT unit operating costs (per RSH) fell sharply, reflecting economies of scale provided by a significant increase in service intensity (annual vehicle-miles per route-mile). Bus unit operating costs (per RSH) increased by an annual rate about two percent greater than the economy-wide increase in consumer prices.

Introduction

The Tri-County Metropolitan Transportation District of Oregon (Tri-Met), Portland’s principal transit operator, significantly increased overall transit service levels between 1997 and 2001, coinciding with the opening of the “Westside MAX” light rail line. Adjusting for inflation and relative vehicle sizes, a 41 percent increase in revenue service hours generated a 28 percent increase in annual boardings and a 27 percent increase in annual travel (passenger-miles). Total operating cost did increase, but not out of proportion to the overall increase in ridership. However, unit operating costs remained stable.

This service increase also provided a demonstration of rail “economy of scale.” This permitted overall “consumption-side” unit operating costs to remain stable in spite of the large increase in service supplied and service consumed. Tri-Met expanded light rail service significantly in September 1998, shortly before opening of Westside MAX, using newly-delivered rolling stock. In response, inflation-adjusted LRT “production-side” unit operating costs plummeted. No such economy of scale was apparent for bus operations. Tri-Met was not able to hold the rate of increase in bus production-side unit operation costs below the economy-wide consumer price inflation rate. The following comparisons use data for 1997 and 2001 from the National Transit Database (NTD).

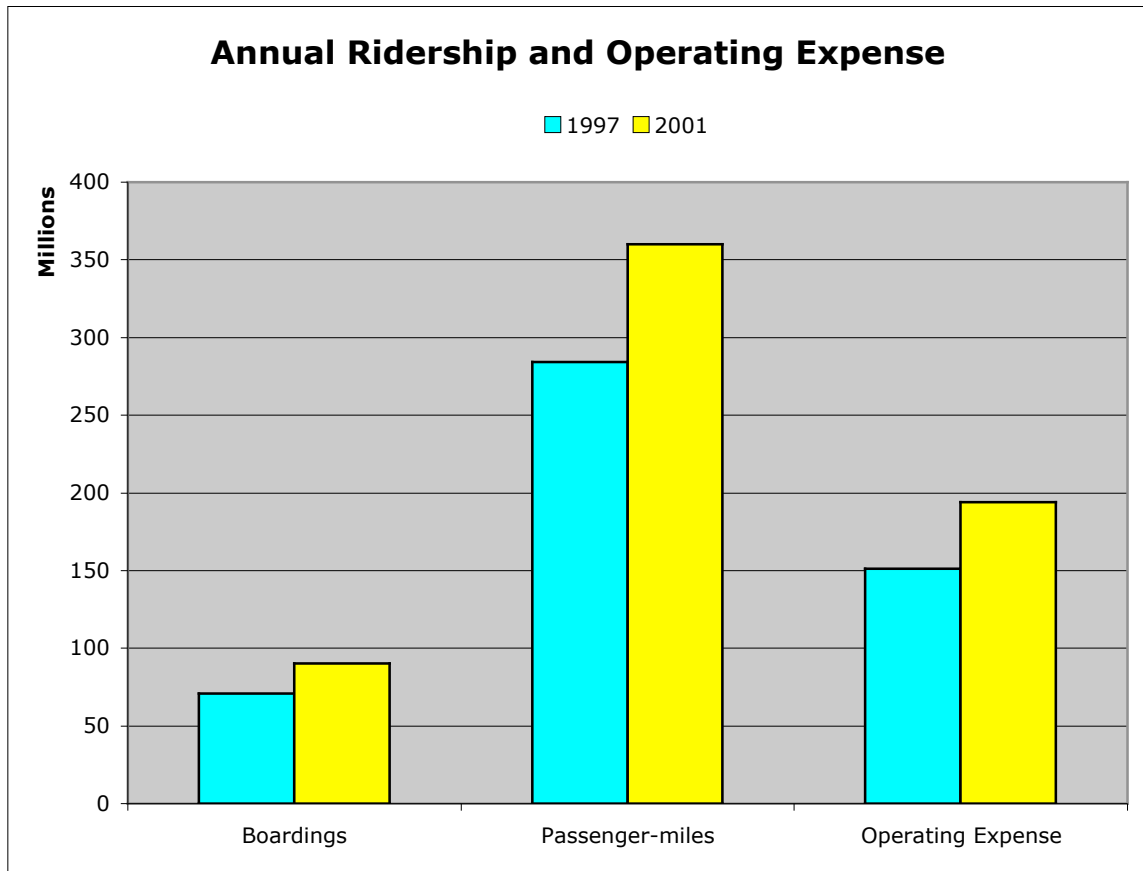
1) Data and Statistics, Tri-Met (NTD, FY1997 and FY2001)

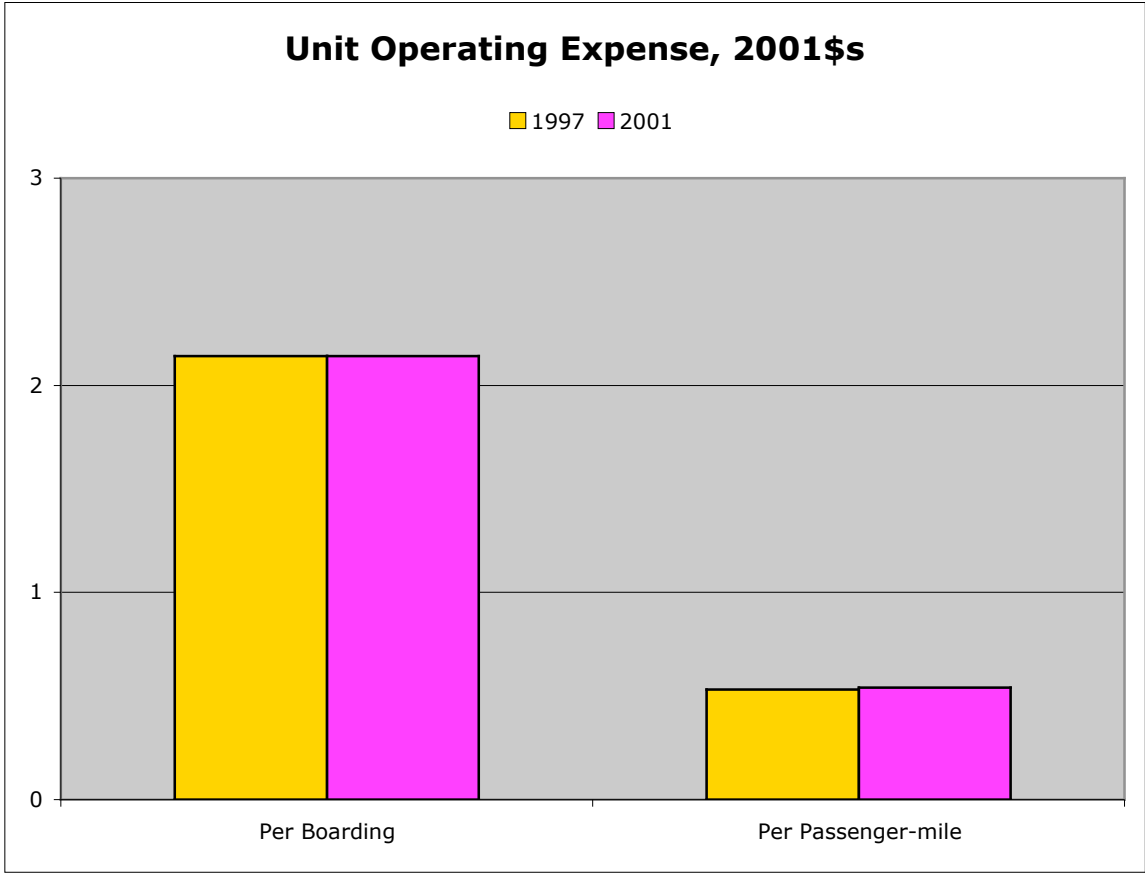
		1997	(2001\$)	2001	Change
Annual Operating Expense	Bus	\$118,527,989	\$129,195,508	\$153,860,651	19.1%
	LRT	\$20,021,800	\$21,823,714	\$40,035,484	83.4%
	Total	\$138,549,745	\$151,019,222	\$193,896,135	28.4%
Annual Boardings	Bus	60,260,000		65,427,872	8.6%
	LRT	10,432,400		24,976,610	139.4%
	Total	70,692,400		90,404,482	27.9%
Annual Passenger-miles	Bus	229,358,500		216,054,689	-5.8%
	LRT	54,727,700		144,023,605	139.4%
	Total	284,086,200		360,078,294	26.7%

		1997	(2001\$)	2001	Change
Annual Operating Expense per Boarding	Bus	\$1.97	\$2.14	\$2.35	9.8%
	LRT	\$1.92	\$2.09	\$1.60	-23.4%
	Total	\$1.96	\$2.14	\$2.14	nil
Annual Operating Expense per Passenger-mile	Bus	\$0.52	\$0.56	\$0.71	26.8%
	LRT	\$0.37	\$0.40	\$0.28	-30.0%
	Total	\$0.49	\$0.53	\$0.54	1.9%
Annual Revenue Vehicle-hours	Bus	1,665,120		1,856,166	11.5%
	<i>Adjusted - 40' Equivalents</i>	<i>1,581,864</i>		<i>1,924,730</i>	21.7%
	LRT	105,536		286,115	171.1%
	<i>Adjusted - 40' Equivalents</i>	<i>229,321</i>		<i>621,704</i>	"
	<i>Adjusted - 40' Equivalents</i> Total	<i>1,811,185</i>		<i>2,546,434</i>	40.6%
Annual Revenue Vehicle-miles	Bus	21,239,993		22,957,607	8.1%
	<i>Adjusted - 40' Equivalents</i>	<i>20,177,933</i>		<i>23,805,625</i>	18.0%
	LRT	1,578,182		5,051,406	220.1%
	<i>Adjusted - 40' Equivalents</i>	<i>3,429,258</i>		<i>10,976,284</i>	"
	<i>Adjusted - 40' Equivalents</i> Total	<i>23,607,251</i>		<i>34,781,909</i>	47.3%
Directional Route miles	Bus	1,384		1,454	
(annual average)	LRT	30.2		64.9	
Vehicles in p.m. Peak Service	Bus	515		568	
(annual average)	LRT	25		58	
Annual Operating Expense per Revenue Vehicle-hour	Bus	\$71.18	\$77.59	\$82.89	6.8%
	LRT	\$189.71	\$206.78	\$139.93	-32.3%
Annual Operating Expense per Revenue Vehicle-mile	Bus	\$5.58	\$6.08	\$6.70	10.2%
	LRT	\$12.68	\$13.82	\$7.93	-42.6%

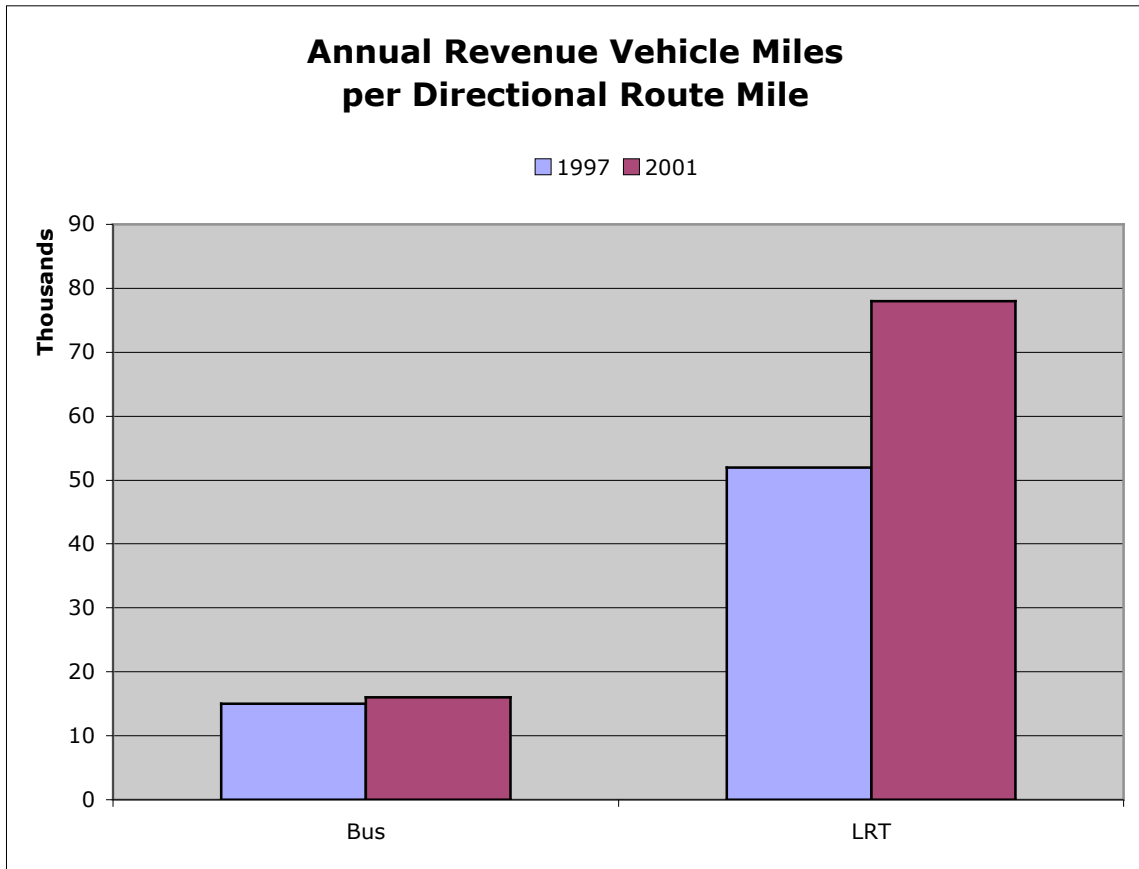
Note: Adjustment to 40-foot equivalents based on weighted average of gross vehicle length. See Appendix 1 for metric equivalents.

2) Ridership and Expenses - Trends



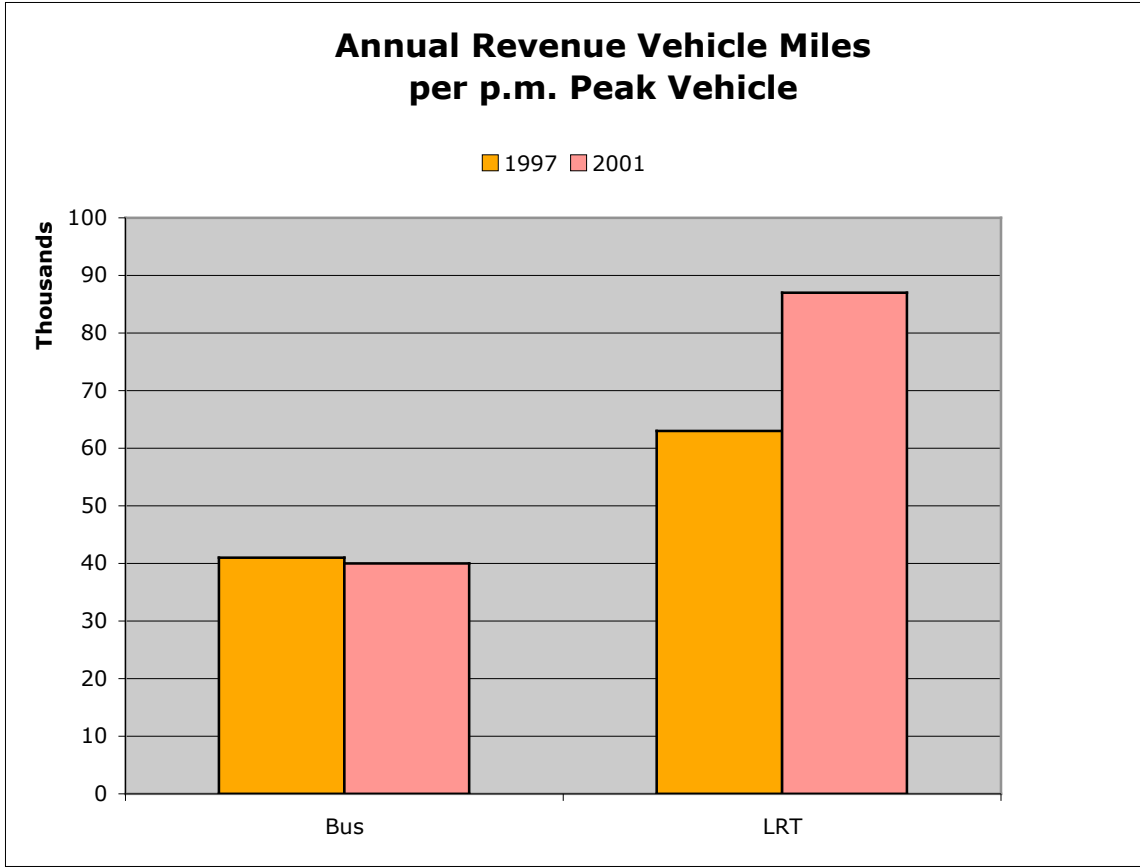


3) Service Levels and Unit Operating Costs - Trends

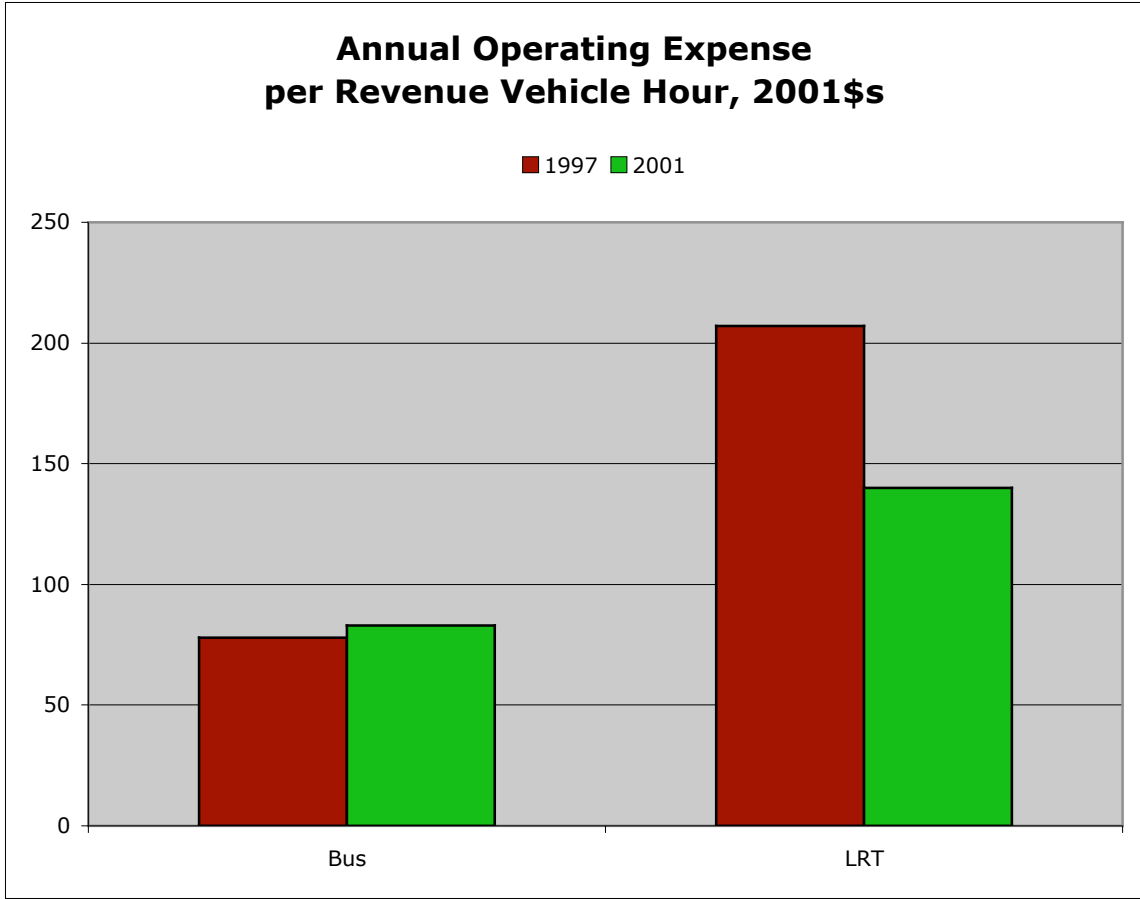


Annual Revenue Vehicle-miles per Directional Route-mile (rounded to nearest thousand)				
	1997	2001	Change	
			Absolute	Percentage
Bus	15,000	16,000	+1,000	+3
LRT	52,000	78,000	+26,000	+50

(**Note:** Conversion to metric units does not change the value of the statistics above.)

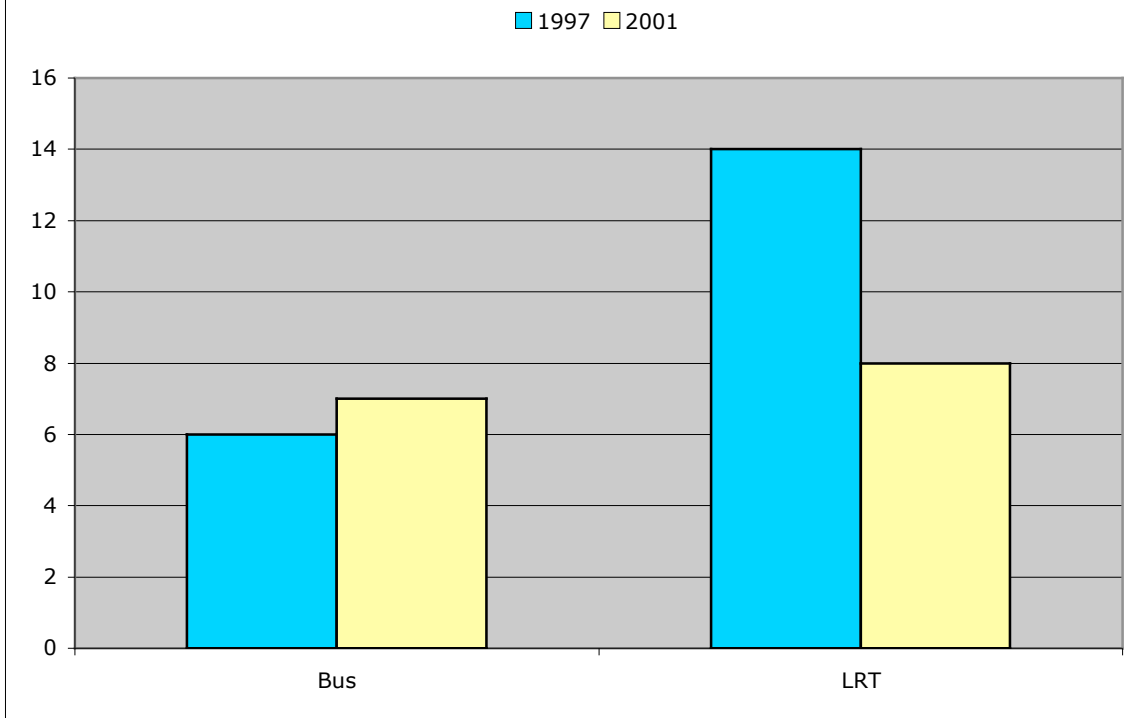


Annual Revenue Vehicle-miles (km) per p.m. Peak Vehicle (rounded to nearest thousand)				
	1997	2001	Change	
			Absolute	Percentage
Bus	41,000 (66,000)	40,000 (65,000)	-1,000	-2
LRT	63,000 (102,000)	87,000 (140,000)	+24,000	+38



Annual Operating Expense per Revenue Vehicle Hour, 2001\$s (rounded to nearest dollar)				
	1997	2001	Change	
			Absolute	Percentage
Bus	\$78	\$83	+\$5	+7
LRT	\$207	\$140	-\$67	-32

Annual Operating Expense per Revenue Vehicle Mile, 2001\$s

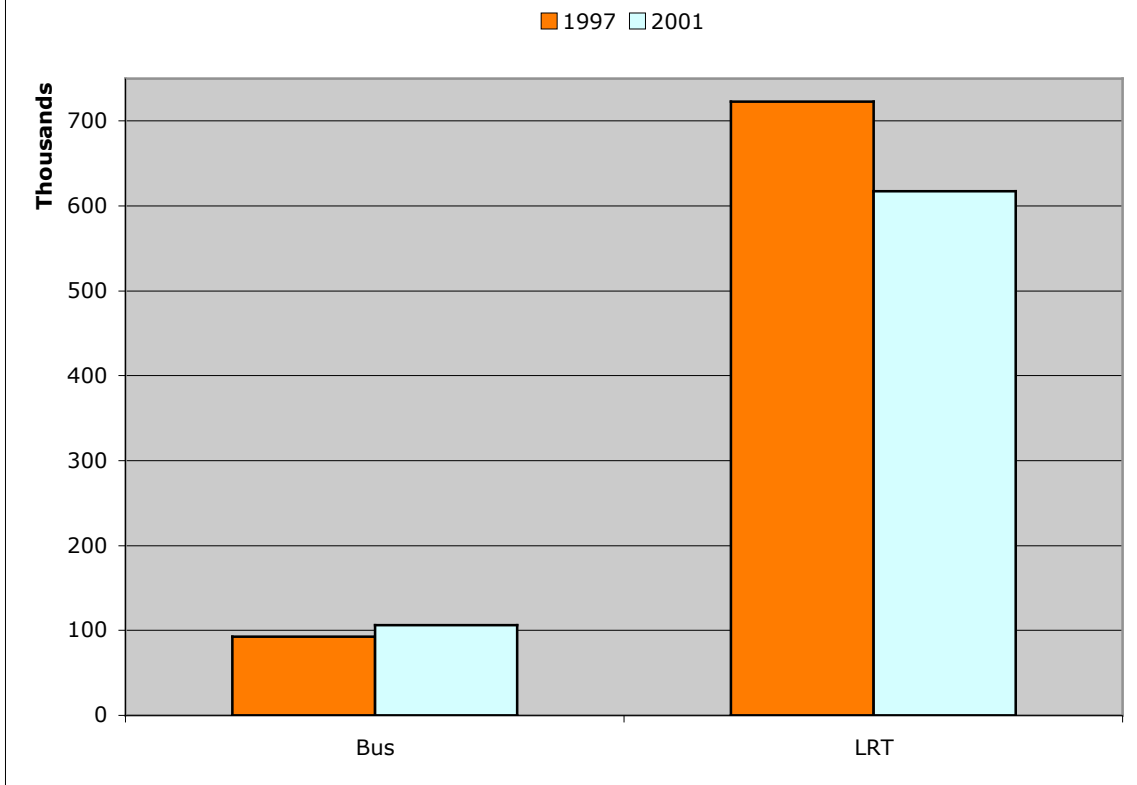


Annual Operating Expense per Revenue Vehicle Mile (km), 2001\$s

(rounded to nearest dollar)

	1997	2001	Change	
			Absolute	Percentage
Bus	\$6	\$7	+\$1	+10
	(\$4)	(\$4)		
LRT	\$14	\$8	-\$6	-43
	(\$9)	(\$5)		

Annual Operating Expense per Directional Route Mile, 2001\$



Annual Operating Expense per Directional Route-mile (km), 2001\$

(rounded to nearest \$100,000)

	1997	2001	Change	
			Absolute	Percentage
Bus	\$93,000 (\$58,000)	\$106,000 (\$66,000)	+\$12,000	+13
LRT	\$723,000 (\$448,000)	\$617,000 (\$383,000)	-\$106,000	-15

4) Summary

During the four-year interval between FY1997 and FY2001, Tri-Met increased LRT service intensity (annual vehicle-miles per directional route-mile) by 50 percent, and increased vehicle utilization (annual revenue vehicle-miles per annual peak vehicle) by 38 percent. Inflation-adjusted unit operating costs fell: per vehicle revenue-hour by 32 percent, per vehicle revenue-mile by 43 percent, and per directional route mile by 15 percent. These changes came about as the result of "spreading" of fixed costs over a larger number of revenue service hours. The data provide strong evidence for economy of scale for rail transit operation.

No such economy of scale is apparent for Portland bus operations. During the four-year interval between FY 1997 and FY 2001, Tri-Met increased bus service by about 11 percent (revenue vehicle-hours). Bus fleet utilization (annual revenue vehicle-miles per annual peak vehicle) decreased slightly (-2 percent). Inflation-adjusted unit operating cost increased at an annual rate about two percent greater than the economy-wide rate of consumer price escalation from 1997 to 2001.

The service-intensity statistic was included for consistency between modes, but provides relatively little information, for directional route mileage has little influence on bus operating costs ("infrastructure" costs, e.g. roadway operation, maintenance and repair expenses, are seldom charged to transit operators). Tri-Met bus network service intensity (annual vehicle-miles per directional route-mile) was increased slightly (by 2 percent). Directional route miles were increased by 5 percent during this period.

The statistic giving annual operating expense per directional route-mile was also included for consistency between modes. As explained above, it provides relatively little information. The increase in annual operating expense per directional route mile reflects the increased cost of vehicle operation.

Despite network expansion, a large increase in LRT service levels per unit of route length resulted in a large reduction in LRT unit operating cost. A modest increase in bus service produced no reduction in unit operating cost.

Appendix I) Data and Statistics, Metric Units:

		1997	(2001\$)	2001	Change
Annual Passenger-km	Bus	369,933,100		348,475,305	-5.8%
	LRT	88,270,500		232,296,137	139.4%
	Total	458,203,500		580,771,442	26.7%
Annual Operating Expense per Passenger-km	Bus	\$0.32	\$0.35	\$0.44	26.8%
	LRT	\$0.23	\$0.25	\$0.17	-30.0%
	Total	\$0.30	\$0.33	\$0.33	1.9%
Annual Revenue Vehicle-km	Bus	34,258,053		37,028,398	8.1%
<i>Adjusted - 40' (12.19m) Equivalent</i>		32,545,053		38,396,169	18.0%
	LRT	2,545,455		8,147,429	220.1%
<i>Adjusted - 40' (12.19m) Equivalent</i>		5,531,061		17,703,684	"
<i>Adjusted - 40' (12.19m) Equivalent</i>	Total	38,076,211		56,099,853	47.3%
Directional Route km (annual average)	Bus	2,232		2,345	
	LRT	48.7		104.7	
Annual Operating Expense per Revenue Vehicle-km	Bus	\$3.46	\$3.77	\$6.70	10.2%
	LRT	\$7.86	\$8.57	\$7.93	-42.6%

Notes: Totals may vary from sum of data entries because of rounding. Adjustment to 40-foot (12.19-meter) equivalents based on weighted average of gross vehicle length.