Transit System Performance Evaluation Methodology

WA-RD 57.1

Final Report
April 1,1983

Washington State Department of Transportation
Public Transportation and Planning
In Cooperation with
United States Department of Transportation
Federal Highway Administration

TRANSIT SYSTEM PERFORMANCE EVALUATION METHODOLOGY FOR WASHINGTON STATE

FINAL REPORT

WA-RD 57.1

Prepared for

Washington State Transportation Commission

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16. Abstract

This report examines major issues, concepts and methods of bus transit performance evaluation and suggests procedures and guidelines for internal and external monitoring in Washington State. In support of suggested procedures, data analysis on six years of operational and financial characteristics of Washington State systems, 1979-80 Section 15 data, and collected samples of small community/rural systems from other states was conducted. The major objective of the analysis was to test methodologies for developing and assessing transit "peer groups" relative to size and scale of operations, and prior to comparative within-group evaluation. The methodology entailed employing cluster analysis using up to 10 variables depicting service design and distribution. Two key variables were population and line miles. Problems were encountered in using Section 15 data. Due to its use of urban area, as opposed to service area population, clear distinctions of operating environments could not be determined. Thus, cluster groupings using Section 15 data were inconclusive. Cluster groupings using sample data for rural/small community systems (1980) and Washington State systems (1980) were satisfactory and following additional verification, a suggested "peer group" classification for Washington State was recommended. The seven group types ranged in size from a rural regional (<40,000 population) to metropolitan (>1,000,000 population). Values for 8 efficiency and effectiveness indicators were used to assess "peer group" trends in performance in Washington over a five-year period (1976-80). Comparative evaluations of individual systems were not made. Despite only partial success in determining "peer groups," the study does identify methods and procedures for assisting in external and internal performance evaluation.

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EXECUTIVE SUMMARY

The purpose of this study was to examine major issues, concepts and methods of transit evaluation and to suggest procedures for internal and external performance monitoring in Washington State. The following highlights key elements of the report.

There was extensive growth in transit through Washington State during the 1970s and early 1980s. That growth necessitated greater public expenditures. Increased expenditures have generated concern for more public accountability.

The major issue regarding transit evaluation is fiscal. How do we continue to provide good transit service while controlling the costs of delivering that service? How should we evaluate service requests from low density areas where demand is minimal? Performance monitoring and evaluation in and of itself cannot provide direct answers to these hard policy questions, but it can provide a rational framework for problem identification and point to means of improvement. The key premise is, "that which gets measured is improved."

The two major evaluation concepts identified are efficiency and effectiveness. The interest in effectiveness reflects a concern of transit's meeting the goals and objectives set by government policy. Typical transit performance measures (TPM's) used in evaluating transit effectiveness include:

- passengers per vehicle hour or mile;
- passengers per service area population;
- operational reliability (roadcalls per 100,000 miles);
- schedule reliability (per cent on-time arrival); and
- operating ratio (passenger revenue ÷ operating expenditures).

The concern with efficiency reflects an interest in assuring the proper use of resources. Efficiency measures are expressed as a ratio of output per unit of input; that is, how much capital (dollars) is required to produce a unit of output (miles or hours of service)? Typical efficiency measures include:

- vehicle miles or hours per employee hour;
- vehicles miles or hours per vehicle; and
- operational cost per vehicle hour or mile.

Appropriate performance evaluation requires equal concern with both efficiency and effectiveness.

Specific criteria for selecting measures are identified in the full report but primarily include economy, availability of data, meaningfulness to users, and the ability to measure all important elements of cost, supply, distribution and consumption of service.

Transit evaluation should take place within a predetermined framework or process that involves:

- developing transit goals and objectives;
- specifying efficiency and effectiveness criteria;
- developing performance measures and targets related to the criteria; and
- instituting an ongoing program of performance monitoring and evaluation.

Procedures for developing this process at the local and state levels are identified within the context of key questions to consider:

- What is the intended purpose?
- Who is involved and who is the audience for reporting?
- What level of detail and frequency is required?
- What resources are available to collect the information and conduct the analysis?

Major purposes for transit evaluation include:

- public accountability;
- allocation of resources; and
- improved planning and management.

The two major audiences for evaluation include:

- decisionmakers; and
- managers.

Guidelines for determining the necessary level of detail and reporting frequency are suggested.

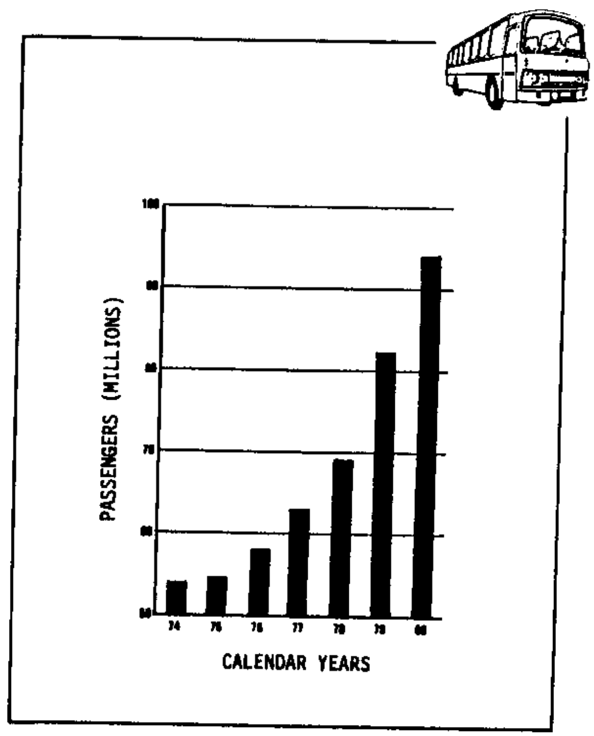
A major constraint to developing a statewide evaluation program has been the issue of comparability between individual systems being examined. Transit operators are concerned that evaluation programs have not sufficiently accounted for differences in size and scale of operation or environmental conditions. Acknowledging this problem, research was conducted to develop and test a peer group classification scheme. Using statistical methods, three alternative data sets were examined. Results from the analysis of one data set (Section 15 report) were not satisfactory due to extreme variability on certain measures. Distinct groupings were derived, however, using the other sets of data. Preliminary results were tested using alternative verification techniques. Seven "peer group" classes were defined for use in Washington State. Characteristics and comparative performance trends of those peer groups are presented in Chapter VI and Appendix E. No comparisons of individual systems are made.

BACKGROUND

During the last eight years there has been a significant growth in transit operations throughout Washington State. Figure 1-1 illustrates that statewide ridership has almost doubled over the last seven years. While Seattle Metro accounts for 65% of total ridership, interest and participation in public transit extends beyond the metropolitan region. In 1974 there were only 12 public transit systems operating in the state, but by 1981 there were 20 systems. Former city-only systems have expanded into regional systems. In several small cities and rural areas of the state, citizens have come to expect and depend on fixed route bus service that did not exist in their communities two or three years ago. This dramatic change can be observed by comparing the 1975 service areas shown in Figure 1-2 with the existing and potential transit service areas in Figure 1-3.

With the growth in service have come substantial increases in public expenditures for transit. Greater public expenditures have created greater concern for public accountability. A major focus of that concern is the growing "gap" between passenger revenues and operational expenditures. Figure 1-4 illustrates that "gap" in constant dollars (1980 = 100). Before highlighting major dimensions of the problem, a brief overview of Washington's public policy for transit as identified in the statutes is instructive in outlining the context of accountability.

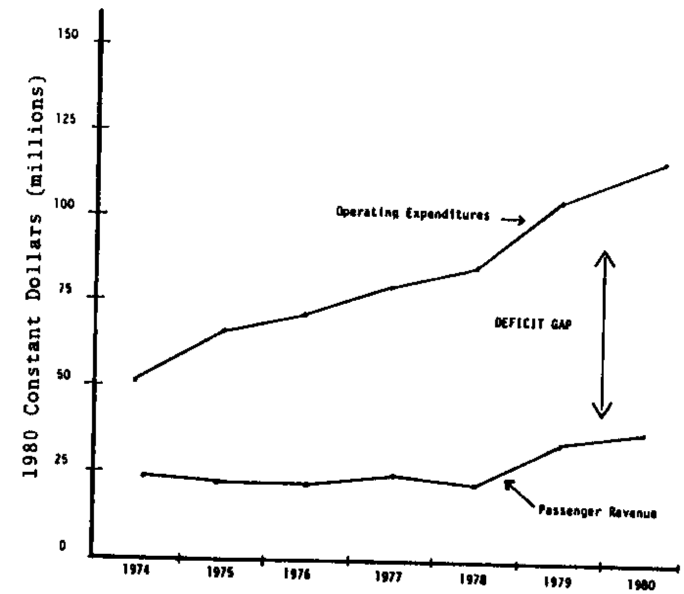
Major state legislation authorizing several alternative institutional and funding arrangements for local transit service was adopted or amended during 1974 and 1975 (see Appendix D). The legislation provides for flexibility in governance and a dedicated source for funding. One of the more preferred institutional arrangements is to establish a Public Transit Benefit Area, or PTBA (11 of the 20 systems are instituted under this mechanism). The PTBA provides an opportunity for city and county officials to jointly govern a regional transit authority. While alternative tax revenue mechanisms are authorized, it has been customary for PTBA boards to choose a sales tax option that can capture up to 0.03% of local sales. This local tax option must be approved by area voters. When implemented, the option also provides for what is in effect a return or rebate of one-half of the 2% Motor Vehicle Excise Tax (MVET) levied and collected by the state. The combination of



Source: Transportation Trends, Washington State Department of Transportation, 1981.

Figure I-1

Statewide Public Transit Ridership (1974-1980)



Note: Passenger revenues did not decline in actual dollars, only constant 1980 $

Source: Adapted from Public Transportation in Washington State, WSDOT, 1978-80 editions

Figure I-4

Gap Between Operating Revenue and Operating Cost for Washington State Transit Systems (1974-1980)

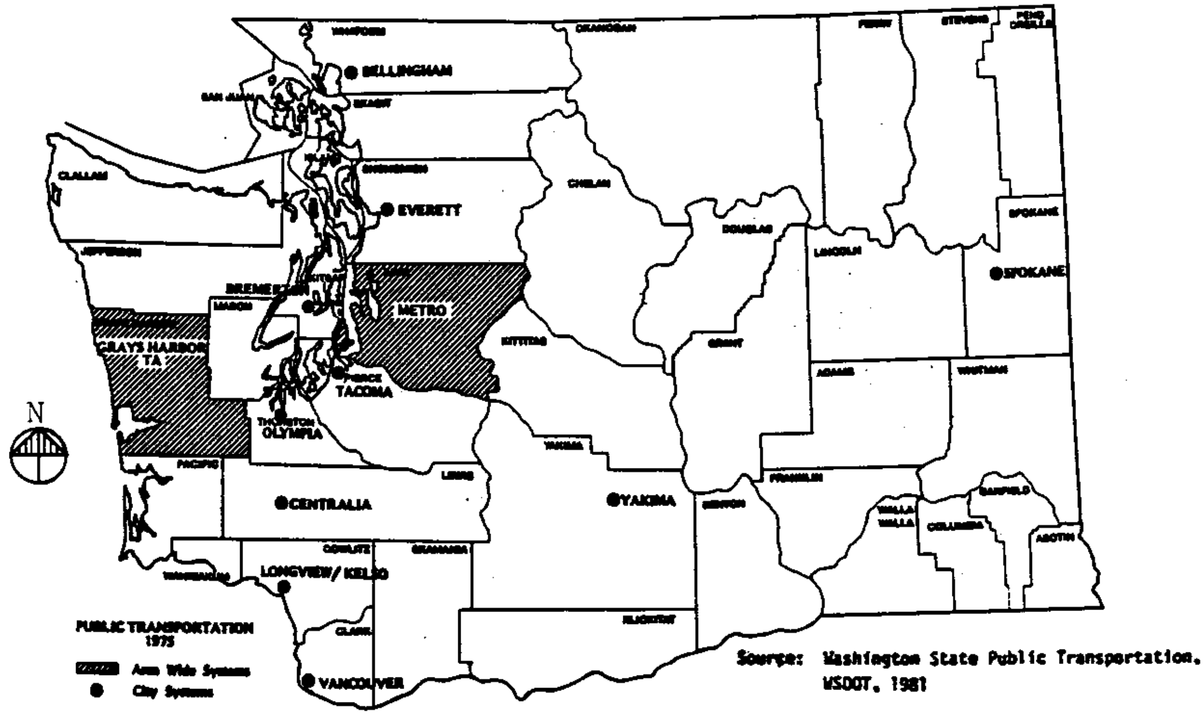


Figure 1-2

1975 Transit Service Areas in Washington State

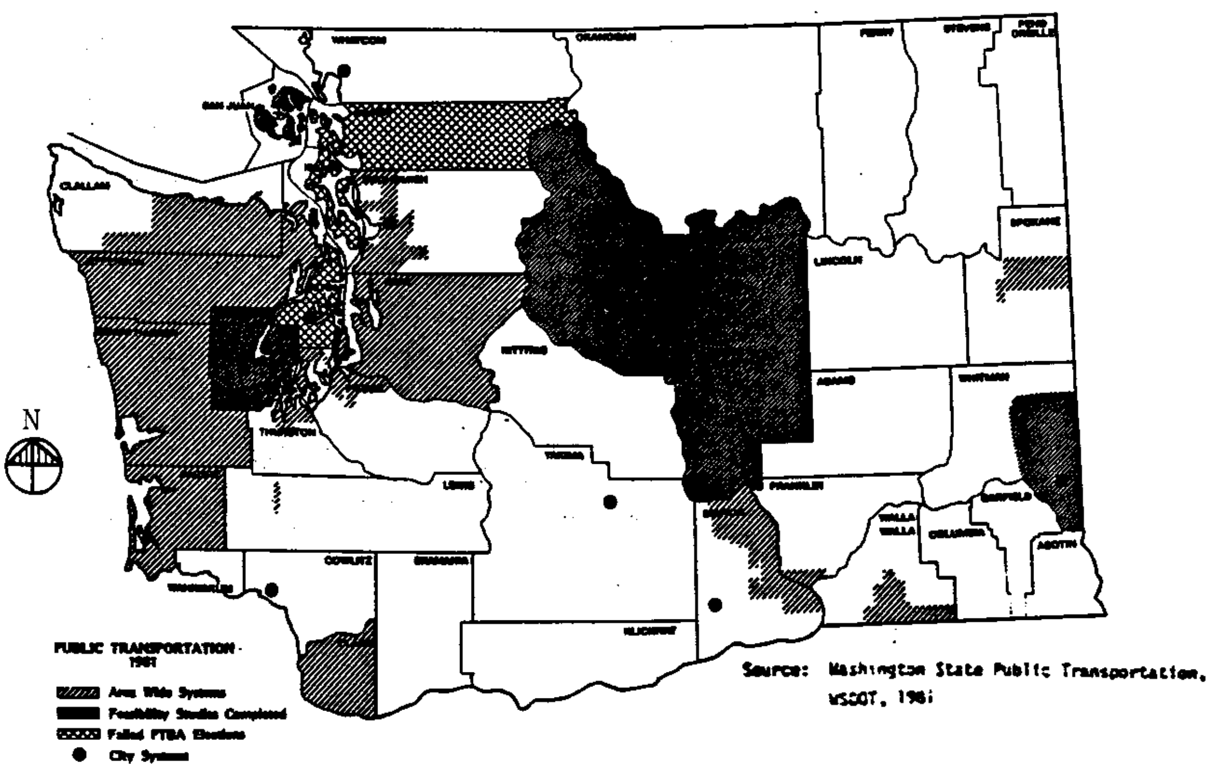


Figure 1-3

Existing and Potential Transit Service Areas (1980) these two dedicated revenue mechanisms have proven to be reasonably stable (in terms of inflation impacts) source of transit funding for local areas. Seattle Metro's authorization is somewhat different from the PTBA, but the local/state partnership as to funding is similar with the exception that Metro is authorized to levy up to 0.06% sales. In 1981, dedicated local and state financial assistance provided 63% of total public transit revenue.

The state collects both the sales and MVET tax revenue but is not directly involved in the subvention of funds to local transit. That process must be initiated by local elected officials and approved by area citizen vote. And while transit authority boards must operate within the legal sanctions governing municipalities in the state, the administrative and system accountability procedures are determined by local policy.

Oversight and review of these statutes is the responsibility of the Legislative Transportation Committee. They are assisted by committee staff and the Washington State Department of Transportation (WSDOT). With the above policy as backdrop, the discussion that follows presents the dimensions (real or perceived) of the problem in Washington State.

DIMENSIONS OF THE PROBLEM

The major dimension relates to the fiscal aspect of transit. Nationally, substantial increases in operational costs and local and state financial constraints have severely impacted transit operation (particularly in locales without stable and dedicated revenue sources). In many cases, draconian steps of major fare increases or major service reductions or both were required to keep systems operational.

In Washington, with few exceptions, drastic measures have not been necessary. Costs have increased but with minor adjustments in fares and improved internal fiscal management, Washington properties continue to survive the storm. In several cases former city-only systems have instituted PTBA's, received voter approval of increased taxes, and collected sufficient revenue to expand service areas and levels, thereby increasing ridership while fulfilling the explicit promise of improved service to the region. More expressive are the paraphrased comments of a local board member: "This is the only board I sit on where it's not a bloody hatchet battle among competing agencies for a few crumbs of the discretionary budget. Furthermore, it's most pleasant to be providing improved public service rather than cutting it off." This relative stability in the present may not be indicative of the future. A recent (1982) needs assessment conducted by members of the Washington State Transit Association (WSTA) projected a six-year (1983-1988) shortfall of $79 million in "maintaining" current services. When considering additional "essential improvements," the six-year shortfall increases by $317 million, for a total difference between anticipated funds and projected expenditures in 1988 of $396 million (assumes 7-9% inflation). If this substantial shortfall does occur unabated, transit decisionmakers in Washington may find themselves in the position of their counterparts in other states. Those counterpart officials are being "squeezed" between public opposition to additional tax increases for underwriting deficits and patron opposition to service reductions or fare increases that would reduce deficit levels. There are in most cases alternatives to major fare increases or service reductions but assessment of these alternatives and their impacts requires advanced monitoring and analysis within a predetermined framework for service evaluation.

The second dimension of the problem is actually a corollary of the first. Several systems in Washington continue to receive demands for new service, primarily from low-density suburban areas where ridership is low and/or occurs only in the peak hours. Supplying service to these areas often leads to increased disparities between costs and revenues. Often the decision to supply service is predicated on "good politics" that are currently "affordable." It is cautioned that in the future transit decision makers will need a more rational and uniform procedure for assessing existing and planned services, particularly in areas of marginal demand.

The third dimension is more difficult to delineate. Public support for transit remains high, particularly by today's standard of tempered public service times. This is evidenced by continued voter approval in local option tax measures to fund transit. However, Washington governments, local and state, are well into an extraordinarily bleak fiscal cycle. Unemployment is high, tax revenues are down and no public service, however exemplary, is immune from scrutiny by legislators seeking to reduce expenditures or "borrow" revenues. Again, it is suggested that a comprehensive program of performance evaluation that documents and assesses public accountability and provides a credible assessment of the positive benefits of transit would thwart any attempt to constrain or reduce transit service.

Lastly, a fourth dimension can be identified as relating not to a problem, but an opportunity. The opportunity is that the relatively stable fiscal climate for transit in Washington provides a unique environment to become more proactive rather than reactive in developing strategic plans for Washington's future transportation needs. A major component of such planning would be a cooperative performance monitoring and evaluation program at the state and local level.

In light of the above, this report will present transit evaluation not as a reaction to critical suboptimal performance, but as an opportunity to enhance performance of a valued public service and to ensure citizens their public resource is being well managed.

PROBLEM STATEMENT

During the past seven years of substantial growth in service, there have been major improvements in transit effectiveness as measured by increased ridership and distribution of service. However, the efficiency of transit has declined as measured by a forty percent (constant dollar) increase in operating cost per vehicle mile. The increase in costs of service and local policies of maintaining minimum fares have necessitated greater public support. It is perceived that the continuation of adequate public support for transit in the future will require a more rigorous process of accountability. Such a process must include an integrated (local and state) system of performance monitoring and evaluation.

STUDY PURPOSE

The purpose of the study was to examine major concepts of transit performance evaluation and suggest procedures and guidelines for internal and external performance monitoring in Washington State. Specific objectives included:

- Conduct a "state-of-the-art" review to identify the scope of the problem, conceptual framework for transit evaluation, and relevant applied experience in state and local performance assessment.
- Develop guidelines for identifying performance measures and standards appropriate for use in Washington State.
- Develop a suggested model for internal (local) and external (statewide) performance monitoring and evaluation.
- Develop a suggested classification scheme for grouping transit systems in Washington into "peer groups" of similar size and scale of service so that differences in operation and performance relative to each group can be determined.

ORGANIZATION OF THE REPORT

The report is organized into six additional chapters and five appendicies. Chapters II, III, and IV provide tutorial background on the nature and scope of the problem, major concepts of performance evaluation, and the applied experience to date in performance monitoring and analysis. Chapters V and VI are specific to Washington State. The former suggests procedures for statewide monitoring and evaluation and the latter identifies relative "peer group" classes of transit systems based on size and scale of operation. Chapter VII presents conclusions and suggestions for future research. The appendices identify an extensive bibliography, definition of major terms, specification of data elements comprising selected performance measures, state funding and institutional arrangements, and disaggregate (by system) trends in transit performance over the five-year period of 1976-1980.

OVERVIEW

During the past few years throughout the United States, there has been a growing interest in public transit productivity and performance evaluation. This interest has grown largely as a result of the widening gap between transit's operational cost and passenger revenues, with the difference having to be absorbed by public support. Greater need for subsidies has prompted decision-makers to place more emphasis on critical evaluation of continued and proposed service based on performance criteria using efficiency and effectiveness measures.

The interest in effectiveness of transit reflects a concern for transit's meeting the goals and objectives set by government policy. Typical effectiveness measures include:

- ridership per mile or hour;
- ridership per capita;
- operational reliability (roadcalls per 100,000 miles);
- safety indicators (accidents per 100,000 miles);
- schedule reliability (per cent on-time arrivals);
- per cent employment served; and
- operating ratio (passenger revenue ÷ operating expenditures).

The concern with efficiency reflects an interest in assuring the proper use of resources. How much capital and labor input is required to produce a certain level of output as measured in miles and hours of services? Efficiency measures are expressed as a ratio of output per unit of input. Typical efficiency measures include:

- vehicle miles or hours per employee;
- operational cost per vehicle hour or vehicle mile;
- vehicle miles per gallon of fuel consumed; and
- vehicle miles or hours per vehicle per year.

The concern with efficiency is heightened now because limited public funds must be allocated among a variety of important public services. As a result, evaluation of transit performace is viewed as a means of insuring that the public is well served.

Potential conflicts can occur when one tries to assess the relative importance of these two criteria in relation to transit goals and objectives of the community. This is particularly true when performance comparisons are made between systems without consideration of local transit policy. Consider a hypothetical scenario in which Systems A and B initially have equal operating revenue and equal expenditures of $1 million, total ridership of one million passengers, and total vehicle miles of 500,000. A regional transit authority is approved by the voters in System A's service area, which authorizes a local sales tax (transit dedicated), generating an additional $500,000 of revenue. These monies are expended to provide extended service to the region. System A's annual ridership increases to 1,250,000 and vehicle miles increase to 650,000. System B remains the same. In evaluating the two systems after the change, System A could be judged as being more effective because it attracted a 25% increase in ridership, but System B could be viewed as more cost efficient by maintaining a cost per vehicle mile of $2.00, compared to System A's increased cost per vehicle mile of $2.30. Which system is performing better? There are no simple or absolute answers. Neither can performance monitoring and evaluation provide direct answers, but the process can provide a more appropriate frame of reference.

SCOPE

The scope of the problem can best be illustrated by examining state and national operating and financial characteristics. The reader should be cautioned that while aggregate values provide a summary overview of conditions and trends, they also may obscure unique differences that may exist within individual systems or within particularly sized groups (large vs. small) of operations.

TRENDS IN U.S. AND WASHINGTON STATE TRANSIT SERVICE (ADJUSTED FOR INFLATION)

As shown in Table 2-1, general inflation had a major impact (63%) on rising costs of transit service. Due to such dramatic effects, comparison of actual dollar revenues and expenditures from one year to the next is difficult to assess. Table 2-2 identifies Washington operations, converting expenditures and revenues to constant dollars (1980 = 100). Table 2-3 makes the same conversion for the U.S. transit industry. The conversion was calculated using the Department of Labor CPI index for each year and further distinction was

Table 2-1

Major Factors Affecting U.S. Transit Service Cost

FACTOR	% OF 1973-1979 COST INCREASE ATTRIBUTABLE TO:
General Inflation	63.8
Wage and Fringe Benefits (exceeding inflation)	13.3
Service Expansion	12.3
Additional Employees	6.2
Diesel Fuel Cost (exceeding Inflation)	4.3
	99.9

Source: "An Evaluation of the Section 5 Program," Urban Mass Transit Administration, U.S. Department of Transportation, Washington, D.C., December 1979.

Table 2-3

Selected U.S. Transit Industry Operating and Financial Characteristics, 1974-1980

Revenues and Expenditures Converted to Constant Dollars (1980=100.)

Data Items [1,2]	1974	1975	1976	1977	1978	1979	1980	% Δ 1974-1980
Unlinked Passenger Trips	6,935	6,972	7,081	7,286	7,616	8,479	8,577	23.67
Operating Revenue	3,196.6	2,989.6	3,014.7	2,989.1	2,840.6	2,873.6	2,568.2	-19.65
Passenger Revenue	2,974.9	2,777.7	2,825.7	2,827.9	2,709.3	2,772.5	2,462.3	-17.23
Local Operating Assistance	NA	1,044.2	1,196.1	1,102.7	1,166.5	1,612.4	1,703.8	63.16
State Operating Assistance	NA	607	512.1	627.2	673.2	725.7	820.4	35.15
Federal Operating Assistance	NA	212.7	574.4	749.6	817.5	973.8	1,093.8	414.24
Average Fare	53.06	49.22	49.81	49.41	42.45	43.5	38.4	-27.62
Total Operating Expense	5,338.3	5,532.9	5,609.1	5,643.6	5,621.5	6,385.7	6,514.2	22.02
Total Vehicles (exact values)	58,889	62,226	63,787	63,287	64,013	65,696	70,983	20.53
Total Vehicle Miles	1,907.4	1,989.7	2,026.3	2,021.3	2,028.3	2,045.3	2,095	9.83
Total Employees (exact values) [3]	153,100	159,800	162,950	162,510	165,400	177,000	184,700	20.64
Payrolls	3,241.7	3,338.5	3,353.2	3,338.7	3,269.4	3,442.5	3,141.7	-3.08

[1] Refers to all modes (bus, rail, trolley)

[2] Values are in millions unless otherwise noted

[3] Does not include parttime employees

Source: Transit Fact Book, American Public Transit Association, 1974-1980 series.
See Appendix B for discussion of conversion to constant dollar

Table 2–2

Selected Washington State Public Transit Operating and Financial Characteristics

Revenues and Expenditures Converted to Constant Dollars (1980 = 100)

Data Items	1974	1975	1976	1977	1978	1979	1980	% Δ 1974-1980
Passengers	54,038,000	54,536,000	58,113,000	62,562,000	71,463,000	84,695,000	98,724,000	82.69
Miles Traveled	29,035,000	31,657,000	32,965,000	32,214,000	36,244,000	39,797,000	46,177,000	59.03
Vehicles	886	910	1,023	1,026	1,244	1,451	1,627	83.63
Miles of Route	1,596	1,994	2,077	2,070	2,485	4,186	5,185	224.87
Revenue - Total	(75,077,000)	(72,780,000)	(113,030,000)	(123,298,000)	(156,650,000)	(174,818,000)	(175,235,000)	133.40
Farebox	24,775,000	21,834,000	20,345,000	24,661,000	21,932,000	29,719,000	31,360,000	26.57
Local Tax	30,031,000	30,568,000	32,779,000	38,222,000	46,995,000	45,453,000	47,904,000	59.51
M/V Excise Tax	10,511,000	10,189,000	23,736,000	28,358,000	26,630,000	33,215,000	33,344,000	217.22
Federal Grants	3,754,000	5,095,000	30,518,000	29,591,000	54,827,000	57,690,000	49,065,000	1207.00
Other[1]	6,006,000	5,094,000	5,652,000	2,466,000	6,266,000	8,741,000	13,562,000	125.80
Expenditures - Total	(69,970,000)	(82,214,000)	(114,171,000)	(117,487,000)	(144,979,000)	(182,361,000)	(177,050,000)	153.03
Capital	4,199,000	11,510,000	39,960,000	25,847,000	55,092,000	65,650,000	47,803,000	1038.43
Operations	52,477,000	66,593,000	71,928,000	79,891,000	85,538,000	105,769,000	118,624,000	126.05
Other[2]	13,294,000	4,111,000	2,283,000	11,749,000	4,349,000	10,942,000	10,623,000	-20.09

[1] Includes interest and State grant assistance.

[2] Includes cost of promotion advertising, marketing, salaries of staff personnel, special planning studies, employee fringe benefits, bond retirement.

Source: Transit data adapted from Public Transportation in Washington State, Division of Public Transportation and Planning, State DOT, 1978, 1979, 1980 editions. CPI conversion factors for Washington State taken from annual reports of the U.S. Department of Labor, 1974-1980 (see Appendix B for discussion).

made by using the Seattle-Everett CPI for converting Washington dollars. The following discussion highlights comparisons between the two tables.

- Passenger growth rates in Washington (83%) far exceeded growth of the U.S. industry as a whole (24%). The U.S. figures are dominated by the large, densely populated cities in the North-east Corridor which, while highly dependent upon transit, have stabilized in terms of ridership growth. Similar contrast can be noted relative to fleet size growth (84% in Washington vs. 21% for the U.S.) and increases in vehicle miles traveled (59% in Washington vs. 10% in the U.S.).
- Passenger revenue (farebox) in Washington increased modestly (27%), while the U.S. industry average declined 17%. Federal operating assistance (capital assistance not shown) increased significantly (415%) for the U.S. industry. Washington State properties receive relatively little in federal operating assistance but the significant increase in federal grants (1200%) for capital assistance, primarily for Seattle Metro, reflects the national government's support of growth in Washington transit during this time period.
- While capital expenditures for the U.S. are not shown, the 1000% + increase in expenditure for capital in Washington reflects an expanding growth of service. At the national level, operating expenditures increased very little (22%) but in Washington State they increased 126%, again characterizing the expansion cost of improved transit in the state. Interesting to note is the decline (4%) of U.S. transit payrolls when measured in constant dollars. Expenditures for administration staff, planning studies, etc. in Washington State, while erratic, declined 20% over the time period.
- Figure 2-1 illustrates the larger number of passengers per vehicle mile for the U.S. industry. This is typical of high-density cities in the Northeast. Figure 2-2 depicts how more cost-effective passenger transport becomes in the higher-density cities reflected by the U.S. averages. Figure 2-3 demonstrates that even in constant dollars, operating cost per vehicle mile for the U.S. and Washington has increased, although Washington showed a slight decline in 1980. Figure 2-4 illustrates that in constant dollars, both Washington and U.S. passenger revenue per trip has declined.

TRENDS IN WASHINGTON STATE TRANSIT SERVICE OVER TIME

Washington State experienced dramatic growth in public transit throughout the decade of the seventies. There was a 60% (from 12 to 20) increase in the number of systems operating. Additionally, many of the original city systems converted to regional systems, thereby greatly extending service coverage (see Figures 1-3, 1-4, and Appendix E). Ridership increased 81% and operating cost increased 120% in constant 1980 dollars.

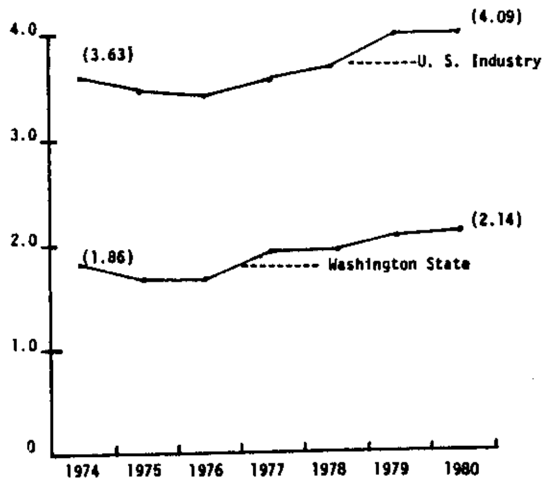


Figure 2-1

Average Passengers per Vehicle Mile

Comparison of U.S. and Washington State

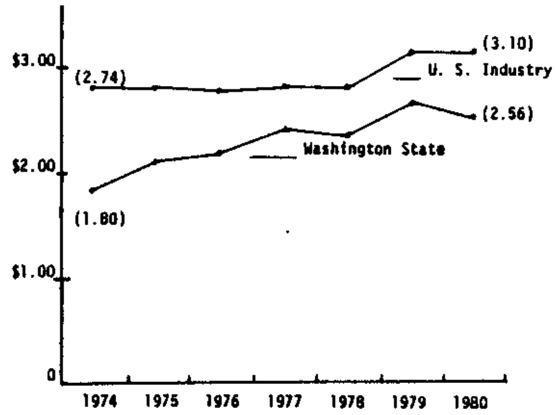


Figure 2-3

Operating Cost per Vehicle Mile

U.S. Average vs. Washington State Average

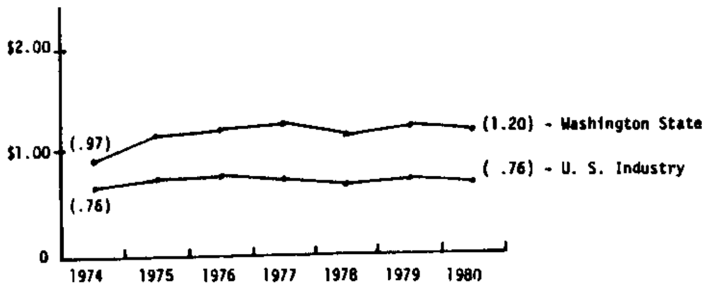


Figure 2-2

Operating Cost per Passenger

Comparison of U.S. and Washington State

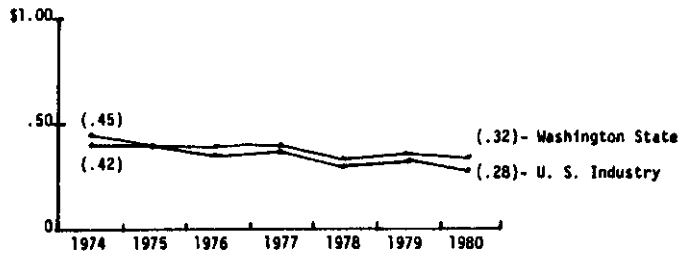


Figure 2-4

Passenger Revenue per Trip

Comparison of U.S. and Washington State

In terms of service effectiveness criteria, Washington State transit operations excelled by:

- increasing total ridership
- increasing per capita ridership (see Table 2-4)
- increasing ridership per mile (see Table 2-4 and Figure 2-1)

However, in terms of cost effectiveness, revenue generation declined as measured by passenger revenue per trip (Figure 2-4). It should be noted that this indicator reflects a local policy of maintaining low fares in order to encourage greater ridership. Moreover, the majority of transit systems in the state initated 20% - 50% fare increases in 1981-82.

Relative to efficiency criteria, operating cost per vehicle mile increased over 40% (see Figure 2-2) in constant 1980 dollars. Statewide aggregates of vehicle-miles per vehicle remained stable. However, Seattle Metro's vehicle-miles per vehicle declined 25% between 1976 and 1980 [40]. This measure also reflects the need for having additional vehicle fleet capacity to serve expanded peak hour demand.

Based on the brief overview of financial and operating data examined for Washington State transit systems from 1974 to 1980, operations throughout the state have made improvements in performance as measured by service effectiveness criteria (e.g., ridership), but showed declines in cost effectiveness (e.g., operating ratio) and some efficiency criteria (e.g., cost per vehicle mile). These measures will be discussed more thoroughly in Chapter III. It can be argued that improvements in effectiveness (greater ridership) were achieved in part through declines in efficiency (cost per unit of service). The goal of Washington transit in the 1970's was to improve service and attract greater ridership. The challenge for transit in the 1980's is to continue improvements in effectiveness without reductions in cost efficiency.

VARIABLES INFLUENCING TRANSIT PERFORMANCE

As presented in Table 2-1, general inflation had the major impact on rising costs of transit service. The American Public Transit Association estimates that when the effects of inflation are eliminated, constant dollar increases are minimal. For example, from 1973 to 1978, the cost per vehicle mile for the U.S. industry in 1972 constant dollars grew from $1.31 to $1.53 (3.4%

Table 2-4

Selected Washington State Public Transit Performance Indicators

Measures[1]	1974	1975	1976	1977	1978	1979	1980	% Change 1974-1980
Pass/vehicle mile	1.86	1.72	1.76	1.82	1.97	2.12	2.13	14.51
Farebox rev/pass	0.46	0.40	0.35	0.39	0.31	0.35	0.32	-30.43
Total rev/pass[2]	1.39	1.33	1.95	1.97	2.19	2.06	1.77	27.34
Operations exp/pass	0.97	1.22	1.23	1.28	1.20	1.25	1.20	23.71
Total exp/pass[2]	1.29	1.51	1.96	1.88	2.03	2.15	1.79	38.76
Passengers/capita	NA	28.83	28.86	32.02	34.17	38.79	38.91	34.96
Operating ratio[3]	0.47	0.33	0.28	0.31	0.26	0.28	0.26	-44.68
Operating exp/ vehicle mile	1.81	2.10	2.18	2.48	2.36	2.65	2.57	41.99

[1] Constant dollar values (1980=100).

[2] Will vary with capital expenditures and/or grants.

[3] Farebox revenue/operating expenditures.

Source: Adapted from, Public Transportation in Washington State, Division of Public Transportation, Washington State Department of Transportation, 1978, 1979, and 1980 editions.

annually) and the costs per passenger increased from \$0.45 to \$0.52 (3.1% annually). However, inflation is not the only factor affecting transit costs and performance.

Transit has difficulty in using its labor most efficiently. Sixty per cent of the weekday passengers are carried in four peak hours. The systems must have sufficient employees to handle these rush hour loads but the eight-hour spread between the AM and PM peaks presents problems for labor utilization. Union work rules often restrict part-time employment and split shifts. As an example, one of the larger systems in the Northeast does not allow part-time drivers but does allow split shifts with compensation. To meet peak demand, an operator may start work at 6:30 AM and complete work at 7:00 PM with a 4.5 hour midday break -- a 12½ hour day. For the first 10 hours, the driver is compensated only for the 8 hours of labor, since there is a 2-hour unpaid break. After 10 hours employees receive time-and-a-half, and after 11 hours they receive double time. In the spring of 1980, management estimated that 50% of the drivers' schedules exceeded 10 hours and 28% exceeded 11 hours [46].

Expansion of service areas and levels has provided improved transit accessibility, but at significant cost. Between 1950 and 1980, the average home-to-work trip increased from two to more than six miles [3, 1980]. In addition to longer distances, service in new expansion areas often has fewer passengers per mile and more deadheading of vehicles (from central city to suburb).

Limited vehicle capacity during peak hours is frequently a constraint along high ridership commuting corridors. Standard buses have seating capacities of 45-55. Articulated buses, introduced only recently in the U.S., have seating capacities of 65-75. The 30% increase becomes a critical factor when one considers that 70-80% of operating costs are labor-related. Seattle Metro and other large bus transit operators are investing in these higher-capacity vehicles in anticipation of reduced labor costs relative to service (seat miles) produced.

Although dramatic fuel efficiency improvements have been made in the automobile industry, new buses are generally less fuel-efficient than older models. Older model buses (pre-1970) achieve 5-6 mpg, while newer models (post-1975) often get less than 4 mpg. Diesel fuel has risen in price by over 400% (actual dollars) since 1972 [3, 1980]. Modest improvements in fuel efficiency could have significant cost benefits.

Street capacity and traffic congestion limit the speed of buses, thus decreasing passengers transported per labor hour input, as well as decreasing fuel efficiency with stop-and-go travel. It has been estimated that a one mile per hour speed increase would result in 10-20% improved productivity [42].

The changing social and political context of public transit has generated increases in management and administrative personnel levels. Environmental impact statements, equal employment and contractual provisions, specialized elderly and handicapped services, Section 13 labor protection review, and public hearings requirements have necessitated more non-driver personnel to perform these services. This results in a need for additional administrative personnel.

Problems with hiring and training qualified mechanics have had impacts on vehicle maintenance. UMTA estimates that over 35% of vehicle repairs are improperly done [46]. As an example, on an average day one large southwest region system had over 25% of its fleet down due to mechanical failures.

Improper inventorying and stock control prevent timely repairs. When mechanics are free to get their own parts and when items secured from stock are not recorded, the resulting shortages lead to unnecessary delays in bus repairs.

Requests for new service often originate in lower density areas where the potential for ridership and passenger revenue per hour or mile is limited. There is little consensus on how to evaluate this service request objectively. Increased ridership and reduced automobile travel are primary goals of transit, yet meeting these goals frequently requires greater subsidy per passenger mile or hour.

On the revenue side, many believe transit must adopt more realistic, efficient, and equitable fare policies. The transit industry tries to keep fares as low and as simple as possible. Recent research [11] demonstrated that shorter distance, non-peak, inner city riders are frequently paying more per mile of service than longer distance, peak-hour, suburban riders. The authors suggested that graduated fares based on distance would be more equitable and would generate additional revenue needed. Some studies [46] have insinuated that the availability of government subsidy has encouraged transit systems to deemphasize fares as revenue sources. Other authors [6] argue that subsidies have not had a negative impact on efficiency but have had favorable impacts on transit effectiveness (greater ridership). What is incontestable is that passenger revenues declined in constant dollar value throughout the 1970's by more than 10% [42]. If it is a public objective to reduce the growing gap between costs and revenues, then greater attention must be given to developing a market approach to transit fares that will produce cost-effective and equitable "user charges" for service.

Transit performance evaluation alone cannot eliminate these problem areas but it can help identify them and point to means of improvement.

ALTERNATIVE PERSPECTIVES

Problems between individuals or institutions usually result when there is a lack of common purpose and differences in perceived objectives. Various groups affecting and affected by public transit tend to perceive performance evaluation differently [34, Vol. I, 42]. Five varying perspectives can be identified -- those of government, transit operators, labor, users, and the general public.

GOVERNMENT

All levels of government are involved in providing operating assistance to supplement farebox revenue. Transit provides a public good; thus the public shares in the cost of service. However, there are perceived limits to government's underwriting of increasing deficits. Questions posed are:

- What should be the funding priorities for transit in relation to other public services?
- What are appropriate funding levels?
- What are sufficient service levels?
- What percentage of the operating cost should be borne by the user?
- What percentages of cost should be paid with local, state and federal taxes?
- What percentage should be borned by the private sector?

Initially, federal policy was one of offering assistance to state and local governments as an incentive for providing public transit, which in turn would help achieve national transportation goals. The 1964 UMTA Act (as amended) provides both operating and capital assistance through Sections 5 and 3, respectively. The transportation improvement program regulations (1974) require regional metropolitan planning organizations (MPO's) to coordinate local planning and programming priorities. Transportation system management (TSM) (Federal Register, September 17, 1975) guidelines stress improved utilization of existing resources as opposed to capital-intensive programs. Thus, transit is an important TSM strategy. Currently, operating assistance is based largely on a per capita basis. Local systems desire federal support without interference in operating policies. The federal agencies have responded by maintaining a "hands-off" posture. They encourage performance improvements by distributing research findings, conducting conferences and seminars, and requiring grant recipients to monitor and submit performance data (through Section 15). The current Administration, however, is considering immediate reductions and eventual (1985) elimination of Section 5 assistance. By contrast, the previous Administration proposed increased federal support financed through the windfall profits tax. Such dramatic changes in federal support, and the absence of a clear and integrated national transportation policy, make it difficult to formulate an appropriate context for transit evaluation from the federal perspective.

State governments are supportive of transit objectives but are concerned with "where to draw the line." Several states, including New York, California and Pennsylvania, link funding allocations to performance monitoring and evaluation. In this attempt to develop a more rational process of allocating funds, some states have encountered problems in developing a procedure that is objective and equitable [12, 14, 17, 25]. These problems will be discussed in detail in Chapter IV. Similar to the federal government, during the 1960's and 1970's many states adopted legislation offering financial support to local governments. Other states developed matching procedures, whereby if cities would generate monies through local tax initiatives, then the state would match that amount through state revenue sources. The latter situation required a greater commitment from local areas and presumably led to a greater concern for operational efficiency.

There are also regional differences within states that have dedicated financial mechanisms for supporting transit. Urban regions tend to support state tax measures that provide continued assistance, whereas rural regions without transit operations often oppose tax increases for that purpose. While most local governments provide some operating support and are concerned with efficiency, they are also more sensitive to fare increases or service reductions that would be necessary to reduce deficits. Frequently, differences in perspectives depend on the state and local transit financial mechanisms. When funding for transit is an exclusive dedicated source and does not compete with other public service needs, then local official support for transit improvements is more politically feasible. Other local areas do not have dedicated revenue sources and have come to depend on state and federal assistance to help them achieve increased ridership levels without substantial increases in local general revenue support. As federal and state assistance is reduced in the future, many local governments will for the first time be faced with difficult choices in allocating funds and will need appropriate evaluation tools.

TRANSIT OPERATORS

Managers are certainly aware of the concerns regarding transit performance, and many have initiated studies and monitoring procedures in an effort to improve productivity. Management is apprehensive of state and national activities in performance monitoring which attempt to compare systems without giving careful attention to differences in operating environments. Operators try to give equal attention to efficiency and effectiveness criteria but are concerned when too much emphasis is placed on mere financial efficiency. Stokes [37], speaking for the industry, stressed the need for performance evaluation but cautioned that no one indicator would reveal the relative or absolute performance of a system. He noted that emphasis should be placed on measuring system effectiveness (e.g., ridership per vehicle mile) as opposed to cost effectiveness (e.g., farebox revenue per passenger). Smaller system operators frequently do not have sufficient resources for the extensive data collection and analysis required by evaluation studies. There are also different operating perspectives among managers. One manager may view transit as a public utility only, with the role of management seen as merely keeping the bus operating. Another manager may view public transit as a service which must be promoted in a competitive market. From this perspective, management would tend to stress planning and marketing as essential elements of operations [35, Vol. I].

TRANSIT LABOR

Labor unions are essentially concerned with wages and working conditions, but are certainly not immune to issues regarding industry performance and productivity. Labor costs represent 70-80% of total operating expenditures. As deficits have grown, some unions have become more sensitive to the need for restraint in wage and benefit negotiations as well as the need to work more closely with management to improve productivity. For example, during New York City's financial crisis in 1976, transit workers agreed to tie future wage increases to improved productivity [42]. Unfortunately, implementation of this agreement was stymied by the failure to agree on definitions of productivity and performance criteria. In 1978, Seattle Metro became the first property to overcome union resistance to using part-time bus drivers during peak periods [42]. Innovations such as part-time drivers, improved scheduling, and modified work rules will of necessity become more prevalent as labor is faced with either becoming equal partners in improving productivity or losing jobs due to service cutbacks [19].

TRANSIT USERS

Patrons can be divided into captive and choice riders. Within limits, the captive rider must use transit regardless of the level of service offered. This group is concerned with quality and effectiveness measures such as walking distance, frequency of service, area of service, and fares. The choice rider is interested in being provided service that is competitive with the auto. Schedule adherence, minimum walk, wait and ride times, and route connectivity are indicators that appeal to the rider who has other options [35, Vol. 1].

GENERAL PUBLIC

Non-users are most interested in financial efficiency. Many do not understand the "external social benefits" of transit and feel that the user should be paying a greater share of the costs. While most taxpayers support provision of service for the transportation-disadvantaged (low-income, elderly, etc.), many are unwilling to subsidize middle-class commuter trips from the suburbs. There are also regional concerns where rural residents, without benefit of alternative transportation, resent their tax dollars' use for strictly urbanized services.

All these groups, with their complex and competing viewpoints, contribute through the political process to transit policy formulation. Achieving a balance that addresses these divergent viewpoints is the major challenge faced in performance evaluation.

OPPORTUNITIES FOR IMPROVEMENT

Assessment of the problem would not be complete without identifying a number of actions being taken by transit operators throughout the country which have resulted in improved performance. Figure 2-5 identifies a list of improvement opportunities that can be initiated at the internal management level. In addition, UMTA, in cooperation with Public Technologies, Inc., distributes a compilation of improvement strategies (with periodic updates) entitled Transit Actions. A summary of reported actions and specific results (where provided) are presented in Figure 2-6. Many of the actions identified in the figure require modest time and resources to implement, but presumably result in demonstrable improvements in performance and productivity. Other actions are small scale incremental adjustments that when assessed singularly are not dramatic, but when considered collectively, do result in measurable improvements. Implicit in each of these actions is the need for an ongoing monitoring and evalution program that will provide necessary information for designing the improvement and measuring the results.

SUMMARY OF KEY ISSUES

At the surface, the concerns are about costs and revenues. Beneath the surface, the concerns are more complex and politically sensitive because they beg questions regarding who pays for what costs and who receives which benefits.

The principal determinants of cost are the quantity and quality of service distribution in time and space [19]. Service expenditures are budgeted within the framework of local goals, objectives, and available resources. To a great extent, service cost can expand or contract drastically based on the adopted policies determining service levels.

- Life-cycle costing of transit vehicles, in terms of the trade-off between maintenance costs and capital outlays for replacement vehicles.
- Spare vehicle ratios, in terms of the trade-offs among maintenance resources, service reliability, and the costs of retaining additional vehicles in the fleet.
- Preventative maintenance programs, in terms of the trade-off between preventative maintenance and breakdown maintenance.
- Use of diagnostic instruments in vehicle maintenance.
- Inventory levels, in terms of the trade-off between vehicle availability and investment in inventory.
- Advantages and disadvantages of purchasing spare parts from the original maker rather than from the unit manufacturer.
- A practical basis for make or buy decisions on parts.
- Criteria for facility location and design.
- Fare-handling procedures.
- Use of part-time employees.
- Retraining needs of operators, mechanics, and supervisors.
- Driver incentives related to courtesy and safety.
- Cash flow analysis and financial management techniques for small and medium size transit systems.
- Insurance programs, including self-insurance, and claims-handling techniques.
- Performance audit techniques.
- Improvements in internal security techniques and methods of reducing the incidence and cost of vandalism.

Source: Proceedings of First National Conference on Transit Performance, USDOT and Public Technology, Inc., US DOT, Washington, D.C., Jan, 1978.

Figure 2-5

Selected "Opportunities" for Improvements in Internal Management

Service Level Improvements

- a midsize system reduced vehicle miles and hours by 10% and identified only a 2% losss in ridership and passenger revenue.
- several systems noted that by using UMTA's RUCUS model (an algorithim to reduce # of runs), 2-5% of runs were eliminated with no measurable loss in ridership.
- development of transit sponsored ridesharing for low density areas can reduce fixed route demand/costs.
- several systems reported reducing frequency on low demand routes. (specific impacts were not reported)
- Seattle's agreement with Bellevue to improve transit service in relation to reduced parking in CBD is expected to improve ridership.

Improved Financing Policies

- Seattle Metro's success in employer sponsored passes (Seattle First) is a national leader in the "action".
- many large systems are converting to differential fares in the peak hour with reported gains in revenue and only minor losses in ridership.
- greater emphasis on transit marketing in general and for off-peak periods in particular (Spokane's Midday Rider Program) is resulting in improved ridership/revenue with only marginal costs.

Internal Management Improvements

- systems report using extraboard drivers in non driving function when between scheduled runs.
- systems report using handicapped personnel for cleaning vehicles
- many systems are instituting computer assisted maintenance management and inventory control systems with measurable reductions in cost and improved productivity.
- automated passenger counters in many systems are reducing personnel (checkers) requirements.
- internal manufacturing of small parts (Spokane) can reduce costs.

Labor Management/Relations

- Seattle was first system nationally to negotiate use of part-time drivers. Many systems have repeated the success.
- systems report linking cost of living (COLA) increases to improvements in productivity.
- systems report cost savings and productivity gains from negotiation of improved work rule.
- explicit standards/procedures for disciplinary codes result in improved productivity and employee morale.

Performance Evaluation/Productivity

- systems report success in using management by objectives (MBO) programs. Some systems link MBO with incentive payment for senior staff.
- some systems are developing "bonus" payments for measurable productivity gains from employees.
- many systems have conducted management performance audits and major evaluations/inventories proceeding new service policy development.
- systems report establishing comparative evaluations among operating divisions/bases.
- continuous performance monitoring and evaluation programs are being implemented in every state.

Figure 2-6

Transit Improvement Activities

The revenue issue focuses on sources of finance. What segment of the public should bear the cost-users, residents of service areas, state taxpayers or federal taxpayers? If all of these groups are to pay a portion of the cost, what are the appropriate shares for each group?

Incremental improvements in transit performance can be made over time, but they require an agreed-upon context of evaluation based on national, state, and local community and transportation goals and objectives. At the 1977 Conference on Transit Performance [42], the participants developed an extensive listing of specific issues. The following summarizes key concerns.

Transit Goals and Objectives

What are they nationally?

What should they be locally?

Do explicit goals and objectives improve performance?

How consistent are they with other transportation and community goals?

How are they best developed?

If meeting local transit and community goals leads to reduced financial performance, should it be done?

What are the impacts of of not doing it?

Balancing Efficiency, Effectiveness and Equity Criteria

What are the relationships?

How are each to be measured?

What are the impacts of emphasizing one over the other?

Appropriate Context for Evaluation

What is the prevailing context--funding allocation, improved planning, and management, or policy development?

How do alternative state and local institutional/funding arrangements shape the context?

What is the private sector role?

What is relationship of transit and transportation system (all mode) evaluation?

Appropriate Content for Evaluation Programs

What are the relevant criteria, measures, and standards of transit performance?

What is the optimal level of detail and frequency for monitoring program?

What is the cost effectiveness of self evaluation?

What is the appropriate balance of information needed to satisfy local, state, and national policy concerns?

Uncertain Future

What are the new realities and trends in economics, energy, environment, and government intervention?

What are the impacts of expanded or reduced transit service?

How should performance monitoring and evaluation be integrated with strategic planning to reduce uncertainty and identify contingency alternatives?

The transit industry needs answers to these questions if performance problems are to be resolved and opportunities for improvements identified. However, before solutions can be prescribed, the problem must be partitioned and described. The next two chapters review major contributions in assessing the problem and pointing to possible solutions.

INTRODUCTION

The authors of early literature on transit evaluation struggled with concepts and definitions of measurement criteria. While researchers could borrow in part from the science of business economics and management, not all of the private sector evaluation methods and concepts translated to public sector productivity concerns. Private industry's major evaluation criterion is efficiency and the most important measure is profit. Public sector evaluation of social goods and services is more complex and requires multiple criteria and measures.

In an economic sense, efficiency can be defined as a ratio of inputs to outputs. Using efficiency as a criterion implies measuring the utilization of resources expended in producing a particular good or service. In theory, the rate of change in outputs with respect to inputs measures the marginal production value of the input. Productivity then can be identified as the marginal product of various inputs. The primary inputs for transit are labor and the major outputs are miles and hours of service. Efficiency in transit then reflects the amount of resources required to produce those miles and hours of service [1, 14, 28].

As a public service, transit also attempts to achieve social and environmental goals set by society. In that respect, transit must be evaluated on the effectiveness of goal achievement. Unfortunately, financial efficiency criteria are often in conflict with social effectiveness criteria. Additionally, some aspects of transit performance relate more to the quality or adequacy of service. Driver courtesy and schedule reliability are two examples of "quality"-based indicators.

The development of transit evaluation criteria and measures has taken place over several years with a great deal of debate over definitions and applications. The following literature review highlights major contributions and refinements that occurred.

MAJOR CONTRIBUTIONS IN THE DEVELOPMENT OF TRANSIT PERFORMANCE EVALUATION

One of the first conceptual studies was conducted by Tomazinis [38] in the mid-1970's in which he described the need for transit evaluation and developed a preliminary framework oriented toward monitoring and improving transit efficiency. He defined efficiency as the rate of success a specific process has either in recovering expended resources, or in achieving a given objective. Tomazinis also argued that not just transit, but the total transportation system, should be evaluated as interrelated parts of the whole.

Gilbert and Dajani [18] are credited with expanding the work by Tomazinis in distinguishing between efficiency and effectiveness criteria. Efficiency was defined as the ratio of inputs to outputs and effectiveness as achieving system objectives. Examples of performance measures were proposed and tested using small sample sizes from properties in North Carolina. Additionally, their study examined possible perspectives (federal, state, local user and operator) which an evaluation procedure might address and assessment was made that the interrelated nature of these perspectives required a more expanded conceptual framework than originally assumed. In addition to impacts, the authors also pointed out the need to consider environmental constraints on transit operations in evaluating performance.

Fielding, Glauthier, and Lave [13] conducted extensive research on transit performance. They refined earlier concepts, developed and tested numerous performance indicators, and actually applied indicators against a large data set drawn from operations in California and Washington. Specific findings of their study will be addressed in Chapter IV. Their scholarly approach and comprehensive data analysis continues to serve as one of the seminal studies in transit evaluation literature.

Drosdat [12] examined transit performance evaluation in relationship to state funding allocations to local operators. After a thorough review of the literature and practice, he concluded there were significant constraints to using performance measures to allocate funds. He found that problems associated with data inconsistencies and issues of comparability precluded their use for this purpose. His research design evaluated 40 different transit performance measures (TPM's) relative to their utility in allocating funds. Of the six measures meeting Drosdat's criteria, all but one (gallons of fuel per passenger) are commonly used by transit systems today. Drosdat also reviewed three special studies associated with state agency efforts in linking transit performance to funding allocations. Major findings at that time were:

- state efforts tended to oversimplify complex aspects of transit performance;
- the studies assumed that TPM's could be easily identified and applied;
- TPM's proposed by state agencies ignored multimodal aspects of transportation; and
- TPM's identified had limited meaning and questionable utility.

Fuller et al. [17] undertook a comprehensive study for California's DOT that sought to not only resolve conceptual problems of criteria, but to prescribe specific measures and standards that were to be used in assessing system performance. The procedure was intended to be a determining factor in allocation of operating support to local operators. After months of study, the analysts concluded that evaluation was more complex than initially assumed and recommended that performance measures not be used in awarding state assistance until problems could be resolved.

The debate on the efficacy of transit performance evaluation continued at the 1977 National Conference on Transit Performance sponsored by the Urban Consortium and U.S. DOT [42]. The conference brought together researchers, government officials, and transit operators to address concerns and try to achieve consensus on concepts and definitions. Relative agreement was reached on key concepts but disagreement continued on exactly how performance evaluation was to be applied. The conference proceedings provide one of the more insightful overviews of the issues.

In the six years since that conference, innumerable studies have been funded at the federal, state and local levels which have contributed to improved understanding and a more commonly accepted language of performance evaluation. The first volume in the comprehensive study by Sinha and others [35] presents an overview of the many viewpoints and the eventual convergence of terms since that conference. The framework suggested below is drawn from the composite of research identified, and it is suggested that the process, criteria, and measures presented below would be accepted with few qualms by industry or academe.

EVALUATION PROCESS

As an overview, transit performance evaluation can be viewed as a continuing process involving the following activities:

- the establishment of transit system goals and objectives;
- development of measures that relate to the stated goals and objectives, and reflect criteria of effectiveness and efficiency;
- development and application of performance measures that quantify measurement;
- development and application of standards that can serve as benchmarks against which measures can be compared; and
- continuous monitoring and evaluation over time [2].

Figure 3-1 graphically illustrates the relationship between key elements of that process, and the following discussion highlights relevant aspects of each activity.

MEASUREMENT CRITERIA

The two primary criteria for measuring transit performance are efficiency and effectiveness [3, 13, 18, 34, 37].

Efficiency criteria measure the relationship of input resources (labor, capital, fuel) used to produce outputs (miles and hours of service). Major categories of interest relative to efficiency include:

- vehicle utilization;
- labor productivity;
- energy utilization; and
- cost efficiency (expense per produced unit).

Effectiveness criteria measure the consumption and quality of transit service as well as impacts on societal goals (reducing traffic congestion and conserving energy). Categories of interest relative to effectiveness criteria include:

- service utilization;
- accessibility of service;
- quality of service;
- cost-effectiveness (expense per consumed unit); and
- revenue generation

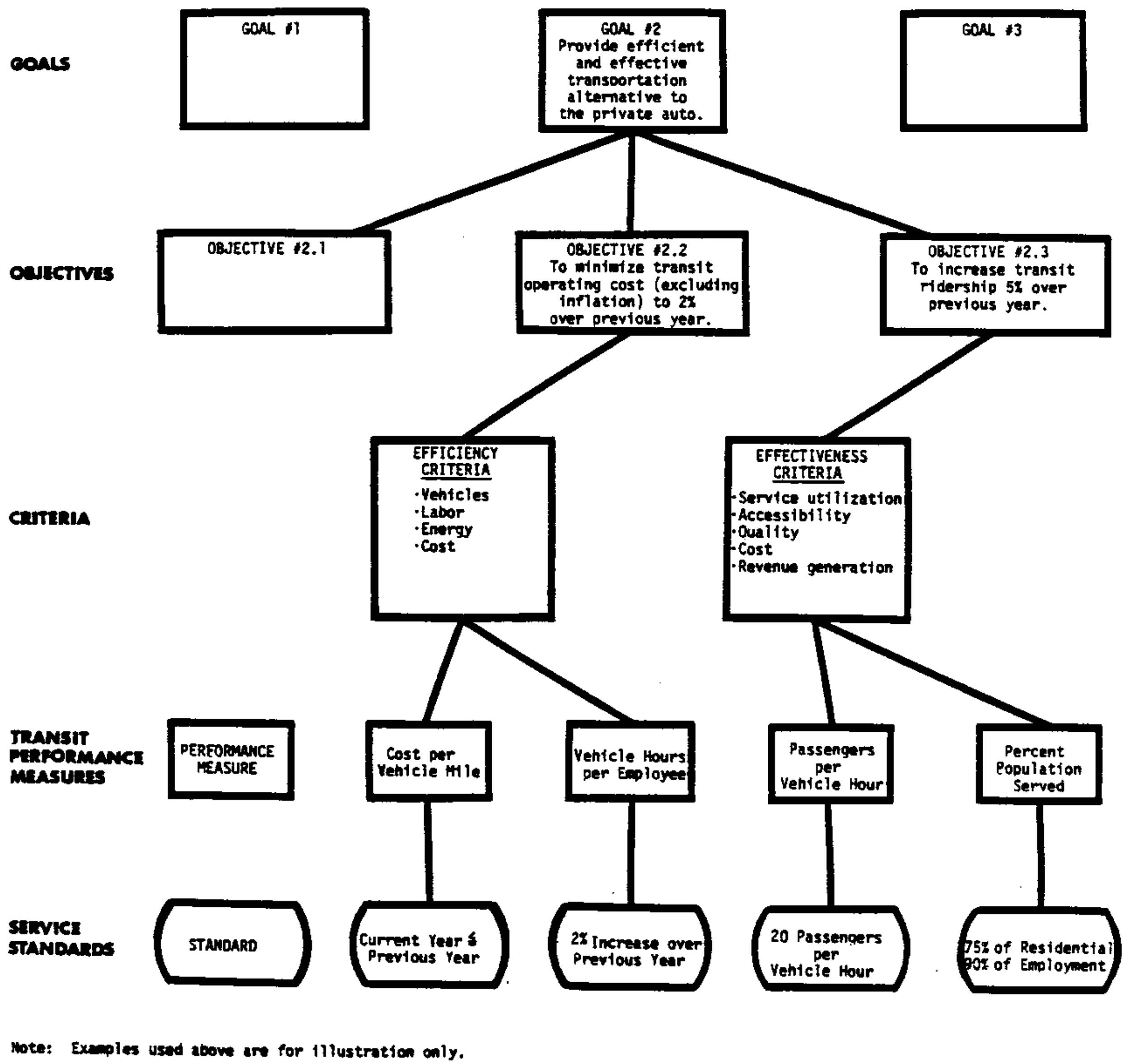


Figure 3-1
Transit Performance Evaluation Framework

No single criterion can appropriately evaluate performance. For example, a low unit cost figure (as a measure of efficiency) indicates only that the service was produced with a minimum of waste. It does not indicate how well it was provided, what the quality of service was, or whether it produced the desired results. Conversely, a high unit cost could mean the service was produced inefficiently or that a high quality of service was provided. This suggests the need for seeking an optimal balance between efficiency and effectiveness criteria. That balance is best achieved through establishing priorities or goals and objectives.

GOALS AND OBJECTIVES

Transit goals and objectives provide the policy context for evaluating performance. All studies reviewed have emphasized the need for relating performance measures to specific statements of transit policy.

> "Performance evaluation requires the establishment of clear goals and objectives for transit and the specification of indicators appropriate to those goals. Performance evaluation is a systematic process for comparing operational results against the goals of a particular system or program. Goals are the basis for developing an evaluation scheme and the fundamental reference point by which judgments are made." [13]

Goals are broad, general statements that describe a preferred alternative for the future. The primary purpose of goals is to provide a sense of direction. Typical transit goals include:

- provide alternative transportation to auto;
- provide mobility for handicapped and disadvantaged;
- reduce auto congestion;
- conserve energy;
- reduce air pollution;
- enhance economic growth; and
- assist in orderly urban development.

Objectives are more specific and describe precisely how individual goals will be achieved. The following guidelines help to insure precise objectives.

"An objective statement should be:

- clear, concise, unambiguous;
- measurable and attainable in a reasonable period of time and with reasonable effort;

- consistent with goals and priorities; and
- assigned to an individual or group who will be responsible for its accomplishment." [32, Vol. 1]

Frequently, multiple objectives are established for each major goal. Some objectives will reflect a concern for efficiency while others will reflect interest in effectiveness criteria. The previous examples used in Figure 3-1 illustrate the concept.

Deciding on appropriate goals and objectives is not an easy task. While most systems have the implicit goal of providing the best possible service for the least cost, such a goal is ineffectual without definition of "best service" and "least cost."

Other major considerations in setting goals and objectives are recognizing the need for establishing priorities and understanding that some objective statements may be in conflict with each other.

As an example of how transit objectives can potentially be in conflict, Figure 3.1's objective #2.2 is stated as minimizing operating costs, while objective #2.3 is to increase patronage. If gains in patronage require increase in miles and hours of service, then costs must increase accordingly. Achieving both patronage gains and reduced costs is not impossible, but does require careful planning. One reasonable approach is to develop objectives that associate improved service consumption with costs. Examples of cost-effective objectives might be as follows:

- to increase ridership per dollar of additional operating costs;
- to decrease operating and capital cost per transit rider;
- to increase transit accessibility to employment per dollar additional cost;
- to increase per cent of population served per dollar additional cost; and
- to decrease transportation cost per passenger mile.

[Adapted from Evaluating Urban Transportation System Alternatives, System Design Concepts, for U.S. DOT, November 1978]

Another general example of how objectives can be in opposition is the case where a community seeks to minimize cost to the user (transit fare) as well as to the general public (tax subsidies). Maintaining minimal fares year after year despite increased operating cost leads to increased deficits that must be financed by additional tax revenues.

Conflicting objectives are not always avoidable, but the degree of conflict can be minimized when decisionmakers and their staffs carefully weigh the tradeoffs of each and establish priorities accordingly.

TRANSIT PERFORMANCE MEASURES

Transit performance measures (TPM's) are values representing production, consumption, quality, and impact variables associated with operating and financial characteristics of transit service. The measures are generally quantifiable and can be expressed as whole numbers, percentages, or as ratios. Most often TPM's are expressed as ratios. As an example, the TPM of "passengers per vehicle hour" expressed in ratio form captures the relationship between service output (vehicle hours) and units of consumption (passengers). Such measures are the <u>instruments</u> of performance evaluation and are used to assess whether or not transit service is achieving intended objectives. Table 3-1 depicts a representative set of transit performance measures being used throughout the United States [5, 13, 35, 39].

The specific TPM's used in evaluation are dependent in part on what aspect of performance is being measured and at what level analysis is being conducted. Transit performance can be evaluated in relation to the U.S. industry as a whole, state or regional assessments, "peer groups" of similar size and scale, individual systems, routes within systems, and functional areas of operation.

The primary purpose for performance measurement is to allow transit management to make more rational decisions regarding resource allocations and provide a means of communicating service policies to elected officials and the general public [8]. More specifically, performance indicators can be used for:

- Comparing functional units (operations vs. maintenance improvements) to assess performance and identify units needing attention;

Table 3-1

Selected Transit Performance Measures

Performance measure	Measurement of:
Operating cost per revenue vehicle mile Operating cost per revenue vehicle hour	Cost per output of unit produced
Revenue passengers per vehicle mile Revenue passengers per vehicle hour Revenue passengers per capita	Service utilization " " " "
Percent population served Percent employment served Percent E&H served	Accessability " "
Accidents per 100,000 bus miles	Safety effectiveness
Operating cost per passenger	Cost per consumed unit output
Roadcalls per 100,000 bus miles	Maintenance effeciency
Revenue vehicle miles per employee Revenue vehicle hours per employee	Labor productivity " "
Percent on-time arrivals of vehicles Percent transfers Load factor (passengers per seating capacity)	Service quality " " " "
Passenger revenue per vehicle hour Passenger revenue per passenger	Revenue Generation " "
Operating revenue per operating expense (Operating ratio)	Cost effectiveness
Vehicle hours per active vehicle Vehicle miles per active vehicle	Vehicle efficiency " "
Vehicle miles per gallon (BTU) of fuel consumed Vehicle hours per gallon (BTU) of fuel consumed	Energy efficiency " "

Table 3-2

Selected Data Items Maintained by Transit Systems

1. Operating expense	10. Service area population
2. Revenue	11. Revenue vehicle hours
3. Fare revenue	12. Total vehicle hours
4. Total passengers (unlinked)	13. Revenue vehicle miles
5. Transfer passengers	14. Total vehicle miles
6. Gallons of fuel consumed	15. Revenue seat miles
7. Number of accidents	16. Total vehicles
8. Number of road calls	17. Vehicles operated during period
9. Operating employee hours	18. Peak hour fleet

Note: See Appendix C for definition of terms.

- making system or subsystem comparisons over time to measure progress;
- assessing policy or program changes with quantitative descriptors of impacts; and
- making comparisons with other "peer group" systems.

From an operator or management perspective, generally accepted criteria for selection of TPM's are that they should be:

- related to stated system objectives;
- easily understandable and definable;
- unbiased and objective;
- measurable from available data;
- methodologically correct (e.g., properly separating input from output measures); and
- acceptable to parties involved [8].

SERVICE STANDARDS

Service standards are the "benchmarks" against which existing or proposed service may be evaluated. Performance measures are compared against the minimum or threshold values as expressed by service standards. For example, many public transit systems use the standard of 30% operating ratio; that is, 30% of the operating costs should be captured by revenue from passengers. Standards or threshold values are currently being used in route evaluation by many systems. Routes that fall below some minimum value on selected measures (e.g., 25 passengers per vehicle hour) are "flagged" for more detailed evaluation.

One of the earliest studies on transit performance was initiated in 1958 by the National Committee on Urban Transportation [29] in which standards and warrants for service were evaluated and recommendations made. While the study remains generally applicable, different environmental and socioeconomic conditions encountered today justify the need for a more comprehensive and current assessment.

Service standards are developed through a variety of means, including:

- historically accepted industry values;
- guidelines or average values derived from other transit systems;

- professional judgments by transit managers and planners; and
- "dynamic standards that systems adapt to over time due to changing conditions. [8]

While the performance evaluation literature has grown increasingly self-assured regarding appropriate performance measures, there was considerable reluctance on the part of most authors to identify specific values or ranges of values for use in developing service standards. In part this is understandable, because specific standards should be developed locally. But concern for local choice does not obviate the need for general guidelines. A need exists for identifying a range of values specific to major performance measures and related to different sizes and scales of operation. Such a list, based on current U.S. operating experience, would provide general guidelines to transit decisionmakers. The National Committee Study [29] remains somewhat relevant, and a more recent study [34] sponsored by the Pennsylvania DOT provides general performance guidelines by measure. However, both of these reports have a metropolitan transit authority orientation. Little information exists on service standards for medium-sized properties (e.g., 50,000 - 250,000 population) and even less information is available for small community systems (less than 50,000 population).

Finally, performance standards are generally an expression of the minimum accepted value for a given measure. A recent study [25] stressed the importance of having a performance target, that is, an optimal value (rather than minimal) for a given measure. The performance target then is a way of quantifying (in a positive way) the achievement of specified objectives. The two concepts, standards and targets, are not exclusive. Standards can be used to express threshold values for service quality and quantity, while targets can be used to denote preferred values.

EXTERNAL FACTORS AFFECTING PERFORMANCE

From a policy analysis perspective, transit performance measures may reflect much more than the quality or economy of system management. They may also reflect significant institutional and environmental constraints over which management has little or no control. Examples of these would include:

- low fares established and maintained by governing boards are policy decisions that affect collection of passenger revenues and thus revenue generation and cost-effectiveness measures;
- varying population densities of different service areas are reflected in measures such as ridership per mile and hour;
- auto traffic congestion and street capacity affect transit speeds and thus are reflected in operating efficiency per mile and hour of service;
- regional wage differentials affect performance measures that include cost of labor;
- disproportionate peak period ridership demand, perhaps affected by per cent of work trips to the CBD, creates need for additional vehicles and drivers underutilized during the off peaks;
- natural environments such as climate and topography can affect operations differently depending on the region;
- per cent of population which is transportation disadvantaged (captive rider) such as elderly, youth, and autoless can greatly affect ridership; and
- institutional and funding mechanisms are often established by state enabling legislation that can constrict or expand management's and local decisionmakers' control over planning and operations [13, 14, 18, 19, 35].

Sinha and Jukins [35, Vol. I] investigated the effects of various environmental and policy factors on performance and through a series of stratification schemes found that:

- system age is an influence in that younger systems generally have less ridership per mile and hour (effectiveness); and
- wage rates, vehicle speed, and area population accounted for major variance in certain efficiency measures.

Giuliano [19] organized her doctoral dissertation at the University of California, Irvine around the effects environmental and institutional factors have on transit performance. The study conceptualized performance as a function of two sets of factors -- those within the control of the operator and those outside of the operator's control. Further distinctions were made between environmental and institutional variables. Environmental factors included:

- service area size;
- service area density;

- road capacity/congestion;
- spatial structure; and
- transit dependency.

Institutional factors included:

- organizational size;
- form of ownership (municipal vs. regional transit authority);
- unionization; and
- age and growth of transit organization.

Using multiple regression analysis on data from 40 transit properties in California and Washington, the effects of those external factors were tested against selected efficiency and effectiveness performance measures. The following summarizes results:

- The efficiency indicator of revenue vehicle hours per employee was related (R^2 = .6485) to system size and urban area size;
- The cost efficiency measure of expense per revenue vehicle hour was affected (R^2 = .60) by wage rate and unionization; and
- Effectiveness measures such as ridership per service area population and ridership per vehicle hour were related to congestion, transit dependency, and compact spatial configurations.

One of the more interesting findings was that smaller firms (e.g., Long Beach, California) with compact service districts, but operating within metropolitan urban areas, tended to be more efficient and effective. This is counter to the widely held belief that "bigger is always better." Federal and state policy often encourage transit to be organized on a regional basis with service to be provided by a single operator. For example, RCW 36.57 stipulates that there can be only one PTBA within a given county.

Fielding and Lyons [15] looked at organizational size and structure in relationship to transit performance and found that organizational size, span of control, centralization, and managerial tenure were all correlated with higher levels of performance. Specialization and formalization were associated with lower levels of performance on certain efficiency and effectiveness indicators.

The results of these studies indicate that the performance of transit systems cannot be compared without taking into consideration the characteristics of the operating environment.

INFORMATION NEEDS

From the discussion above, it is clear that transit performance evaluation requires a modest degree of data collection and analysis. Table 3-2 identifies the major categorical information maintained by transit systems. However, until very recently the absence and/or non-uniformity of data collected and maintained by transit operators all but precluded evaluation. Much of the literature reviewed identified this as the major problem. Only a few state DOT's have historically collected and maintained operational and financial data on systems under their purview. Not until 1978 did UMTA begin to require uniform and consistent data from all operators receiving Section 5 operating assistance. Section 15 consists of multiple levels of reporting detail reflecting differences in transit agency size (differentiated by the number of revenue vehicles). However, Section 15 does not include information from operators serving less than 50,000 population. The first two annual reports [44, 45] have been released, and while some problems remain [4, 24], the information does provide the first opportunity to review uniform and comprehensive information regarding transit operations throughout the United States.

INTRODUCTION

From an applied perspective, the purpose and utility of transit performance evaluation can be grouped into three categories -- funding, management and planning. Many of the early studies explored the feasibility of developing external evaluation procedures for basing allocation of operating assistance to local transit authorities on their relative performance over time. In some respects, the earlier preoccupation with funding overshadowed the utility of internal performance evaluation in system management and short-range planning. Only recently have transit managers and planners recognized that evaluation information can assist them with allocating internal resources and assessing service improvements. This chapter will examine applications of evaluation methodology with respect to the major categories identified and the three government levels that support evaluation research and development.

FEDERAL ACTIVITIES IN PERFORMANCE EVALUATION

The U.S. DOT and UMTA have been the primary funding agencies for the majority of studies identified in the literature. From that perspective, their role in transit evaluation has been one of supporting research that would identify the problems and propose improvements. Additionally, UMTA proposed and supported the development of Section 15 Uniform Transit System Accounts and Records, identified as Project Fare [43] and the recent comparative analysis of that data [4].

The first major study to develop and analyze performance measures for a large number of transit operators was by Fielding, Glauthier, and Lave [13]. The study suggested that performance measure values achieved by individual properties could be analyzed and compared against "average" values for all properties, or against that same property's values in preceding years. The performance measure set was tested using operating and financial data collected from 52 public transit systems in California and Washington. The major constraint identified was that operating data were often unavailable or were not comparable due to differences in definitions or the manner in which the data were generated.

Initially the researchers proposed the use of 21 transit performance measures (TPM's) as presented in Table 4-1, but due to missing and noncomparable data,

Table 4-1

Comprehensive Set of TPM's Proposed by Fielding, *et al.*

PERFORMANCE MEASURE	MEASUREMENT OF
EFFICIENCY	
Revenue Vehicle Miles per Employee	Labor Productivity
Total Vehicle Miles per Employee	" "
Revenue Vehicle Hours per Employee	" "
Revenue Vehicle Miles per Vehicle	Vehicle Utilization
Total Vehicle Miles per Vehicle	" "
Revenue Vehicle Hours per Vehicle	" "
Operating Expense per Seat Mile	Expense per Produced Output Unit
Operating Expense per Revenue Vehicle Mile	" "
Operating Expense per Total Vehicle Mile	" "
OPerating Expense per Revenue Vehicle Hour	" "
Energy Consumption per Revenue Vehicle Mile	Energy Efficiency
Energy Consumption per Total Vehicle Mile	" "
Energy Consumption per Revenue Vehicle Hour	" "
EFFECTIVENESS	
Percent Population Served	Quality of Service Accessibility
Revenue Passengers per Service Area Population	Utilization of Service
Total Passengers per Vehicle	" " "
Revenue Passengers per Revenue Vehicle Mile	" " "
Revenue Passengers per Revenue Vehicle Hour	" " "
Operating Expense per Total Passenger	Expense per Consumed Output Unit
Operating Expense per Revenue Passenger	" "
Operating Expense per Passenger Mile	" "

Source: Fielding, *et al.*, Development of Performance Indicators for Transit: Final Report, NTIS, Springfield, VA, December 1977.

Table 4-2

Reduced Set of TPM's Proposed by Fielding, *et al.*

PERFORMANCE MEASURE	MEASUREMENT OF
EFFICIENCY:	
Revenue Vehicle Hours per Employee	Labor Productivity
Revenue Vehicle Hours per Vehicle	Vehicle Utilization
Operating Expense per Revenue Vehicle Hour	Expense per Produced Output Unit
EFFECTIVENESS	
Revenue Passengers per Service Area Population	Utilization of Service
Total Passengers per Vehicle	" " "
Revenue Passengers per Revenue Vehicle Hour	" " "
Operating Expense per Total Passenger	Expense per Consumed Output Unit
Operating Expense per Revenue Passenger	" "
Percent Population Served	Quality of Service Accessibility

Source: Fielding, *et al.*, Development of Performance Indicators for Transit: Final Report, NTIS, Springfield, VA, December 1977.

the set was reduced to the nine measures identified in Table 4-2. They found that different types of transit organizations and properties with different population densities were generally comparable but that different modal operations (demand response vs. fixed route) were not comparable. The mean TPM values were determined for the data set and each property's values were compared against the average with the following results:

- Properties that were new or beginning major new services were found to have much lower values than the mean.
- Properties with populations of less than 500 persons per square mile rarely achieved mean values.
- Systems with well-established routes and moderate-to-high densities scored above the mean values.
- Properties serving significant segments of transit-dependent populations scored favorably.
- Properties operated by municipalities (as opposed to regional authorities) scored favorably on efficiency indicators (municipal effect may understate manpower and cost figures).
- Properties operated as transit authorities scored more favorably on effectiveness measures and total ridership.

While Fielding's study considered system-wide evaluation, many researchers have focused on subsystem route or functional area performance. Glauthier and Feren [21] were two of the first authors to suggest performance measures in the use of internal route evaluation. The study discussed inherent problems as well as procedures and methods being used by systems on the West Coast. They concluded that route monitoring and evaluation could be instrumental in identifying less productive routes.

Stone et al. [36] later conducted extensive research in route evaluation applying a type of statistical analysis used in quality control. Using the TPM's of passengers per mile and hour, they developed a relatively simple but useful statistical model for examining route productivity.

Attanuci et al. [5] surveyed 240 transit systems to determine their use of performance measures and found that generally only the larger systems had developed rigorous procedures for evaluation. Smaller systems relied only on a few measures that addressed financial efficiency at the system or route level. The study also identified specific criteria and standards being utilized by properties of various sizes.

Sinha and Bhandari [35, Vol. 3] developed a methodology for relating route performance to proposed service changes. The procedure considered bus speed, stop spacing, and fares as key variables. They developed a computer software package that has general applicability for evaluating small and medium-sized systems. The model's accuracy was observed to be within 10% based on before-and-after evaluations. The major limitation was the model's extreme sensitivity to demand elasticities.

In the process of developing the model, the researchers analyzed 19 separate transit systems in the Midwest. Important findings included:

- There was significant variation among systems relative to goals and objectives. Only a few systems had adopted a complete set of goals and objectives with related evaluation criteria. Most systems utilized the implicit goal of providing the most service possible within budget constraints.
- Most systems did not have formal performance monitoring programs but all engaged in periodic evaluation of limited aspects of performance.
- The most common performance measures used were:

  operating cost per vehicle mile and hour; and
  passengers per vehicle mile and hour.
- Data collection activities were increasing in quality and quantity, with many managers expressing interest in automatic counters and data analysis techniques.
- In reviewing the relative performance of systems operating in different states, there was strong positive correlation between favorable values on effectiveness indicators and support (financial and technical) received from state DOT's. Those systems that did not have strong relations with state DOT's seemed to perform less favorably.

Sinha and Jukins [35, Vol. I] investigated major exogenous variables that affect transit performance. Recognizing that non-judicious application of performance indicators in direct comparison of systems can be misleading, the authors sought to adopt an approach that would identify the influence of such variables. Using the statistical technique of analysis of variance, the authors tested independent variables (wage rates, operating speeds, and selected demographic characteristics) against dependent variables of specified performance measures (operating cost per mile, revenue passengers per vehicle hour, and driver cost per vehicle hour). The found that the technique could explain:

- 49% of the variation in vehicle utilization;
- 50% of the variation in labor productivity; and
- 57% of the variation in labor utilization.

Their work serves to document the extent of influence such variables have on transit performance.

Smerk and others [32] at Indiana University investigated the evaluation of performance through management performance audits. This procedure entails a comprehensive examination and evaluation of a transit system's goals and objectives, methods of operations and control, and human and physical resources. The stated purpose of the audit is to help management achieve the most efficient administration possible and to provide a means for the public to evaluate the use of tax dollars.

In 1980, the Institute of Transportation Studies at the University of California, Irvine was contracted by UMTA to statistically analyze data collected by Section 15 reports. In examining the inaugural year (1978-79) data, Anderson and Fielding's report [4] essentially develops and tests a suggested methodology for comparative analysis of performance among approximately 300 U.S. transit systems submitting Section 15 reports that year. Using factor analysis, 48 performance measures were reduced to nine performance "dimensions." Standardized values for each indicator and for each transit property were calculated so that transit systems could be rank-ordered according to the sum of each of the nine indicators. Cluster analysis was used in assigning transit systems into peer groups. Clusters of eight peer groups were defined using four variables of: (1) number of active revenue vehicles, (2) annual vehicle miles, (3) average speed, and (4) peak to base ratios. Due to missing values and data inconsistencies, the authors urged caution in drawing conclusions from the analysis of the inaugural year data. However, they remained confident that as data error problems are resolved over time, the availability of national data collected on a standard format will prove extremely useful to researchers, administrators and managers in analyzing and developing improvement strategies for transit performance.

STATE ACTIVITIES IN PERFORMANCE EVALUATION

Several state DOT's have developed alternative approaches to monitoring and evaluating the performance of local transit systems under their purview. California and New York use performance indicators to determine eligibility for funding. Transit performance measures in Pennsylvania have been used to provide incentive payments for superior performance. Florida, Indiana, North Carolina, Iowa, Wisconsin and Michigan all currently provide managerial assistance to local operators based on analysis of transit performance.

One of the first state transportation departments to formally adopt service evaluation in the allocation of operating assistance was Pennsylvania's DOT in 1973 [47]. Their operating guidelines and standards program was designed to assist in the allocation of funds to various local transit properties. Each eligible system is evaluated on an objective scale and assigned a grade based on its performance, generally on an annual basis. The method allocates discretionary funds as a reward for relatively good or improving service. A method was also developed to assist those systems that are not performing well in order to help them meet the standards. The literature does not identify the relative impact this procedure has had on transit performance.

More recently, the Pennsylvania DOT sponsored (with UMTA) a study [34] leading to the development of a service evaluation manual to assist their local transit managers and governing boards in formulating performance objectives and designing appropriate strategies to achieve those objectives. To facilitate explanation and use of the methology, a case study evaluating service changes for a hypothetical transit system was conducted. The major contribution of the manual is its excellent illustration of the relationships between establishing system objectives and performance. A second important contribution is a chapter devoted to identifying suggested standards drawn from current operating statistics in Pennsylvania and throughout the U.S.

In 1975, the California legislature linked service evaluation to operating assistance when approving the state transportation act. Several studies [12, 13, 17] were conducted in an effort to develop an appropriate evaluation procedure; however, most concluded that comparison of systems was not possible at the time given the lack of data and insufficient methods of assessing differences in operating environments. The literature does not provide a description of administrative procedure adopted or impacts incurred.

In 1979, California enacted legislation making state funding conditional on transit operators having in their present or future union contracts a provision for part-time employees. The intent of the legislation was restrained in subsequent labor negotiations as unions restricted the amount of part-time labor to a maximum of 10% of the work force [45].

The New York State DOT utilizes a set of 15 multimodal measures that examine efficiency, economy, and effectiveness criteria of the transit operators participating in the state's operating assistance program [48]. The program compares operator performance against previous years and/or mean averages of similar size operators. As additional data become available, the department will reassess "desirable" and "acceptable" threshold levels initially selected. The report does not provide a discussion of specific use of the indicators in evaluation relative to distribution of operating assistance.

The State of Michigan, in developing its performance evaluation methodology for mid-sized transit systems, chose Section 15 as a primary data base [23, 25]. The study describes the procedure that has been developed and discusses many of the constraints relative to evaluation. The authors feel the process has general applicability to other states but caution that entities considering development of their own evaluation program should consider:

- What is the purpose or use of the evaluation?
- Who is the audience for the evaluation results?
- What is the appropriate level of detail for analysis?
- What should be the frequency of evaluation? and
- What resources are available to conduct the evaluation?

In the first phase of the program, the procedure does not prescribe specific standards. Instead it reviews selected performance measures applied against each individual system in a time series of itself. The primary objective is to identify measures that merit additional attention. On the issue of comparability of systems, the authors state that comparisons need not be avoided but should be conducted carefully. The report implies that in spite of the caution used, many operators were apprehensive of the comparison element.

LOCAL ACTIVITIES IN PERFORMANCE EVALUATION

At the local level, numerous municipalities and regional transit authorities have developed performance monitoring programs [5, 8, 9, 10, 16, 26, 30, 31, 39]. Table 4-3 identifies selected municipal and regional transit systems that have developed transit service evaluation procedures.

Most evaluation plans reviewed provided discussion of policy framework including goals, objectives, performance measures and standards. Many of the systems have developed functional area measures. In evaluating routes and service levels some systems examined social and environmental factors, but economic performance was frequently the determining factor. Typical performance indicators were:

- passengers per bus hour and mile;
- operating or farebox ratios;
- peak load factors;
- accidents per 100,000 bus miles;
- cost per passenger; and
- subsidy per passenger.

Typical operating standards identified included:

- 33% of operating cost to be covered with farebox;
- peak load factors of 1.25 to 1.50;
- 1.5 to 2.0 passengers per mile of service per route (off-peak minimums); and
- 25 to 30 revenue passengers per hour of service per route (off-peak minimums).

One of the more explicit service evaluation systems is that of Portland's Tri-Met Metropolitan Transportation District [26]. System operations are based on an established set of goals for transportation including:

- increasing ridership;
- doubling downtown travelers;
- farebox ratio of 40%; and
- increase of elderly and handicapped passengers.

Service criteria were described generally by the planners as follows:

Table 4-4

Performance Measures Used by Tidewater Transportation District

FINANCIAL	SERVICE	DEMOGRAPHIC
Total cost per employee Total cost per bus hour Total cost per bus mile Total cost per passenger Deficit per passenger Ratio of platform to pay hours Revenue per bus mile Operating ratio: Revenue/ expenses	Safety: Accidents per 100,000 miles Reliability: % on-time arrivals Loading: Passengers/ capacity Directness of service: % transfers	Percent population served Percent employment served

Table 4-3

Selected Local and Regional Transit Authorities with Developed Performance Evaluation Procedures

SYSTEM	LOCATION
Alameda-Contra Costa Transit	Oakland, CA
Santa Clara Transit	San Jose, CA
Delaware Area Regional Transit	Wilmington, DE
Denver Regional Transit	Denver, CO
Kansas City Area Transportation Authority	Kansas City, MO
Massachusetts Bay Transportation Authority	Boston, MA
Memphis Transit Authority	Memphis, TN
Metro Transit	Seattle, WA
MARTA	Atlanta, GA
San Diego Transit	San Diego, CA
SCRTD	Los Angeles, CA
Tidewater Regional Transit	Norfolk, VA
Tri-Met	Portland, OR

> "The criteria will spell out where bus lines ought to go, what hours and how often they ought to run, how fast they should reach a given destination and how much is an acceptable level of costs." [26, p. 24]

The transit development board for San Diego in preparing its five-year plan [30] outlined six major objectives and identified specific criteria for evaluating service. The following indicators for route evaluation were selected:

- revenue hours per total hours;
- operating ratio (fare revenue/total expense);
- passengers per bus hour; and
- peak load factor.

Successful goal achievement in transit is exemplified by Seattle Metro's 1980 Public Transportation Plan, adopted in 1972 [31]. The major goal was to double the 1971 ridership from 28 to 54 million annual riders. By 1980, Metro's ridership had increased to over 66 million annually. The 1990 update adopted in February, 1981, seeks to accommodate 138 million passenger trips by the target year. Thirty-four specific service, capital and financial objectives are identified. Transit routes and services are periodically evaluated based on productivity standards that vary according to time of day, day of week, and population/employment density.

The Barton-Aschman study for the Delaware Authority [8] provides a thorough overview of the procedure that should be followed in developing a local evaluation program. This preliminary report does not identify the specific measures adopted nor describe relationships between service options and the use of performance evaluation in selecting alternatives.

The Tidewater Transportation District in Norfolk, Virginia recently completed a prototype bus service evaluation procedure study for UMTA [39] which describes performance measures utilized, reporting frequency, data collected, and most importantly, analyzes the cost of generating and maintaining these performance measures. The study separated the measures as shown in Table 4-4.

Eighty-one thousand dollars and 15,000 man-hours were expended in identifying these measures. For large systems with multimillion dollar budgets, such costs are minor. But for small to medium-sized properties these costs could be constraints to conducting an evaluation. The other candid point made in the evaluation study was that only a few of the measures were extensively used by staff and decisionmakers. The single measure considered most important was deficit per passenger.

A recent paper by Fielding, Mundle and Misner [16] describes the efforts of the Los Angeles County Transportation Commission in developing performance-based guidelines for allocating transit subsidies for all fixed route operators in the county, including the large Southern California Rapid Transit District. The program, designed in cooperating with local operators, classifies service into local and express categories. Then it identifies standards relative to those categories and three selected performance indicators that must be achieved by all operators in order to be eligible for discretionary funds. Additionally, the paper describes the method used in quantifying the loss of such funds should the operator fall below the standard.

Suggested procedures for data collection and analysis relative to route evaluation have been comprehensively documented in an UMTA-sponsored study done by Multisystem [5]. The study advocates a two-phase approach:

- Phase I consists of developing a detailed profile of each route; and
- Phase II is a less intensive monitoring schedule for updating the baseline phase.

The manual(s) include a step-by-step approach that specifies:

- type of data;
- frequency of collection;
- collection techniques; and
- sampling procedures.

The procedures were successfully tested and used in the design of the data collection program in Chicago. As importantly, the manual identifies a method for estimating (within a range) the cost of data collection for the ongoing monitoring phase. The costs assumed that a full-time traffic checker would monitor every route in the system four times annually. The number of traffic checkers required ranged from one or less for small systems (25 peak hour buses) up to 40 checkers for large properties (2000+ peak hour buses). Cost estimates for data processing and analysis are not identified due to the wide range of possibilities.

While not specific research studies, UMTA (with Public Technology, Inc.) issues periodic information briefs (Transit Actions) that describe innovations by systems (primarily internal management and marketing approaches) that result in improved performance. Similarly, the American Public Transit Association (APTA) provides mini-case study examples of performance/productivity improvements in its weekly newsletter to members.

All of the studies identified have made valuable contributions to improved understanding of transit performance evaluation. However, additional issues regarding transit performance measurement need to be addressed or expanded through continued field research.

SUMMARY OF MAJOR POINTS

This chapter has presented a review of the application and utility of existing transit performance monitoring and evaluation approaches throughout the United States. A synthesis of that review is presented below.

RATIONALE FOR TRANSIT EVALUATION

Assessment of the rationale for transit evaluation is in part situationally dependent and may differ with respect to whether the evaluation is being conducted for internal or external reasons. However, common objectives generally include [13, 25, 35]:

- to provide information on how public funds for transit are being expended;
- to assess the efficiency and effectiveness of transit service;
- to identify areas where transit may be deficient; and
- to identify opportunities for improving performance.

MAJOR COMPONENTS OF EVALUATION

The major evaluation elements being used in applied studies correspond to the conceptual model identified in Chapter III and include:

- development of transit goals and objectives;
- specifications of efficiency and effectiveness criteria as expressed by transit performance measures and service standards;

- initial inventory and periodic monitoring of necessary data for evaluation; and
- alternative procedures for assessing performance, diagnosing problems and suggesting corrective actions.

While only a few systems were identified as having explicit goals and objectives and an integrated set of performance measures, recent evidence suggests systems are devoting more resources to developing such programs and policies.

ATTRIBUTES INFLUENCING PERFORMANCE EVALUATION

The primary focus for transit evaluation is at the local system and subsystem level. Major differences in scope and design of performance assessment at the local level are often related to one or more of the following:

- size and scale of the system operation;
- extent of system's fiscal constraint;
- external (e.g., State DOT) performance reporting requirements relative to public accountability or funding allocation;
- demonstrated utility of objectives, measures, and standards proposed;
- availability of resources to conduct evaluation;
- current phase of overall system development (e.g., declining, stable or growing service demand);
- recognition by decision makers and management that <u>explicit</u> evaluation program is necessary and useful; and
- availability of technical assistance in design and implementation of monitoring and evaluation program.

Recent surveys documenting the extent and type of self evaluation being used throughout the industry indicate that large urban and metropolitan transit agencies are more likely to have developed and implemented formal data monitoring and evaluation programs. Their service distribution and delivery is more complex and thus requires more formal and systematic procedures for management. However, many large systems have yet to develop and use comprehensive or complete sets of measures to evaluate efficiency and effectiveness of their service. Rather, the major items of interest have been limited to schedule adherence, loading factors, headways, subsidy per passenger, passengers per vehicle mile, operating ratio, and operating cost per vehicle mile or hour.

Midsize and smaller systems are constrained in the development and application of performance evaluation due to perceived complexities and limited resources to conduct evaluation. Minimally, smaller systems monitor changes in aggregate trends relating to ridership, revenues, and expenditures. However, they seldom have the resources to analyze system characteristics at the disaggregate level according to route, route segment or functional area.

Any system undergoing major changes relative to funding constraints or service demand may place added emphasis on evaluation as a means of justifying assistance or having a more rational decision framework for assessing service delivery. However, when problems become critical, planning and evaluation are characterized by the reactive mode and are more subject to influence from immediate political consideration. The experience identified above will be used as a basis for proposing procedures for Washington.

This chapter outlines a general process and selected procedures for internal and external performance evaluation. Both the process and procedures are based on experience from other states and local areas, but adapted, where applicable, to the unique institutional and service environment of transit in Washington State.

CATEGORIES OF INTEREST

In developing a performance evaluation program, there are six general categories of interest that shape both the context and content [23]:

- purpose of the evaluation;
- evaluation participants and their roles;
- audience for evaluation results;
- appropriate level of detail for analysis;
- evaluation frequency; and
- available resources to conduct evaluation.

These will be used as an introductory framework for discussing procedures appropriate for Washington. While the discussion is from the perspective of this study's principal client, Public Transportation and Planning Division of WSDOT, the needs and concerns of the other major actors are identified. Additionally, this report explicitly recognizes that detailed prescription for internal evaluation procedures is not within its scope. The guidelines suggested are general but do satisfy basic requirements for internal and external performance evaluation of public transit in Washington.

PURPOSE

Purposes for transit performance evaluation can be divided into a number of areas; resource or funding allocations, public accountablity, improved planning and management, and policy development [8,25]. Additional distinction in purpose can be made when considering whether the evaluation is for internal or external use.

Externally, from a state perspective, the only purpose that does not apply in Washington is the use of evaluation for funding allocation. Unlike several states identified previously, neither WSDOT nor any other Washington state agency is directly involved in the subvention of funds to local transit authorities. Yet, WSDOT is concerned with the judicious development of performance evaluation relative to statewide public accountability, technical assistance in diagnosing problem areas (particularly for small limited staff systems), and as a vehicle for improving statewide transit policy and program planning.

Internally, from a local perspective, each of the purposes identified are relevant for transit decision makers and their staff. Transit officials are concerned with local public accountablity and ensuring the most efficient use of resources. Transit managers use evaluation for diagnosing performance within functional areas (transportation, maintenance, planning, marketing, and administration), and conducting route analysis. In terms of resource allocation, many transit systems throughout the United States reward measurable improvements in employee productivity with bonus or incentive payments. Seattle Metro has utilized this incentive mechanism in conjunction with a management by objective (MBO) program for senior staff. Those individuals consistently meeting or exceeding monthly division performance targets were substantially rewarded.

PARTICIPANTS

Within the context of an integrated evaluation process there are primary and secondary participants at the local and state level.

Primary participants at the local level include board members and managers. Local transit decision makers in Washington are given the primary responsibility for establishing transit policy that will ensure efficient and effective service delivery. Management's role with assistance from staff is to implement that policy through transit planning and programming.

Primary participants at the state level include the Legislative Transportation Committee, the Transportation Commission, and State DOT officials and their staff. Specific to transit, the Public Transportation and Planning Division of WSDOT is responsible on a day to day basis for ensuring that state policy is implemented.

Secondary participants include other government agencies, professional associations, and research/consulting groups. At the federal level, the U.S. Department of Transportation and Urban Mass Transportation Administration (UMTA) are engaged in developing and implementing national transit policy and programs, and thus, are equally concerned with state and local efforts in improving performance. At the local level, Councils of Governments (COGs) in urban regions are often the designated Metropolitan Planning Organizations (MPOs) and are responsible for coordinating transit improvements with regional transportation plans. Professional and institutional organizations such as Washington State Transit Association (WSTA) play an important supporting role by sponsoring conferences, seminars and committee reports relative to improvements in transit management and planning. WSTA has a standing committee on transit evaluation. That committee has previously developed internal evaluation guidelines for use by its members and has served as an information review panel for this study. Finally, Washington State Transportation Center (TRAC) as well as other research and planning consulting groups in the state, play a supporting role in the development and application of evaluation procedures and methods.

AUDIENCE AND INFORMATION NEEDS

The audience for evaluation results is a critical category in that the need and use for information influences the frequency and level of detail for performance monitoring and analysis. In a general sense, all primary participants identified above represent the major audience for performance evaluation.

Local transit management has the greatest need for continuous performance monitoring and analysis at system-wide, route, and functional area levels. Their internal planning and management control systems should be designed to provide this information at requisite levels of detail on a weekly, monthly or quarterly basis. Managers use this information for purposes of internal accounting and control, problem diagnosis, planning improvements, and providing their board members with essential and timely information for making effective decisions on short and long range policy. This report cannot generalize, beyond the above, the extensive type, detail, and frequency of information needed by managers. The management issue is not one of failing to know what information is needed, but rather one of having the resources to design and implement an appropriate Management Information System (MIS). Many of the citations speak to this issue, but references 5, 32, and 34 are most relevant, particularly for small and mid-sized system managers who may not have established an internal management or service monitoring system.

Local transit decision makers have a need for monthly summary reports on major revenue/expenditure items and system wide performance measures, supplemented with periodic reports on route and functional area evaluation. This information is used by them to assess system and management performance and to assure the general public that resources are being used efficiently and effectively. In addition to the more common budget and ridership status reports, local decision makers should be provided (monthly) with minimally the following performance measures:

- passengers per vehicle hour;
- operating cost per vehicle hour;
- operating cost per passenger;
- subsidy per passenger; and
- operating ratio.

These measures (TPMs) should be presented in a manner so that trends over time can be compared. Finally, it is important that board members be presented (monthly) with brief status reports that identify achievement to date on prescribed service and functional area objectives. It is recommended that each system develop a service evaluation plan (as opposed to a Transit Development Plan) for this purpose.

State decision makers have a need for annual assessments (aggregate level) of financial and operating characteristics and selected performance measures for all systems. In order to provide that information, WSDOT annually collects necessary data (see Figure 5-1 and 5-2) from each system in the state, and produces a summary statistical report on statewide transit system characteristics. Appendix E, while modified and specific to this report, identifies the type of summary information prepared by WSDOT. The annual external reporting requirements recommended later in this chapter are not substantially different from what is currently being collected. Additionally, it is recommened that WSDOT have on file a current service evaluation plan for each system and receive annual reports on progress achieved. The intended use of this information by state officials and their staff is to increase the understanding of transit operation in the state, to monitor the use of public funds as part of the legislative oversight function, and to identify opportunities for state assistance in improving performance. It should be emphasized that the need for and use

Figure 5-1
WSDOT Transit Questionaire: System Characteristics

DEPARTMENT OF TRANSPORTATION
HIGHWAY ADMINISTRATION BUILDING
OLYMPIA, WASHINGTON 98504

MUNICIPAL TRANSIT QUESTIONNAIRE

Calendar Year ____________

Name of Public Agency ____________
Name of Manager ____________
Mailing Address of Public Agency ____________
Street Address of Public Agency ____________
Prepared By and Phone Number ____________

CAPITAL PLANT DATA

NUMBER OF VEHICLES
Seating Capacity of Vehicles

AGE OF VEHICLES (in years)	Less than 13	13 - 15	16 - 24	25 - 33	34 - 45	45 or More
Less than 5 years						
5 - 7 years						
8 - 12 years						
13 - 16 years						
17 - 20 years						
21 or more years						

Number of vehicles in peak hour revenue service . . . . ____
Number of vehicles in normal hour revenue service . . . . ____
Does your agency provide maintenance in its own shops? . . . . ____
Number of vehicles accessible to wheelchair handicapped persons . . . . ____
Number of vehicles modified for use by ambulatory, handicapped and elderly persons . . . . ____
Number of vehicles by type of energy consumption:
- A. Diesel . . . . ____
- B. Gasoline . . . . ____
- C. Other (Specify) . . . . ____

OPERATING STATISTICS

- A. Days of operation (Example: Monday thru Friday): . . . . . . ____
- B. Hours of operation (Example: 6:30 A.M. – 6:30 P.M.): . . . . ____
- C. Total Annual Vehicle Miles Travelled: . . . . . . ____
- D. Miles of routes (All lines, one way): . . . . . . ____
- E. Total Annual Revenue Vehicle Hours: . . . . . . ____
- F. Annual number of passengers carried: . . . . . . ____
- G. Individual Adult Fare: . . . . . . ____
- H. Individual Youth Fare: . . . . . . ____
- I. Individual Special/Other (Specify) Fare . . . . . . ____
- J. Zone/Transfer/Pass (Specify) Charge . . . . . . ____
- K. Household Tax Rate: . . . . . . ____
- L. Employee Tax Rate: . . . . . . ____
- M. Utility Tax Rate. . . . . . . ____
- N. Sales Tax Rate (Check one) ☐ 0.1% ☐ 0.2% ☐ 0.3% . . . . ____
- O. Other (Specify) Tax Rate: . . . . . . ____

WORKSHEET FOR PR 535 (Rev. 1/80)
GPO 1974 OL-564-301

Figure 5-2
WSDOT Transit Questionaire: System Revenues and Expenditures

REVENUES AND EXPENSES FOR MASS TRANSPORTATION*

ITEM	AMOUNT
A. REVENUES	
1 Local	
a. General Fund (446.11)	
b. Dedicated Tax (446.12 & 13) (446.15 - if dedicated)	
c. Farebox (441.00)	
d. Operating Contracts (442.10 & 20)	
e. Charters (442.30)	
f. M V E T (446.14)	
g. Other (443.00, 446.16 & 20, 448.32) (446.15 - if not dedicated)	
h. Sub-Total	
2. State	
a. Highway-User	
b. General (447.20 & 30, 448.20)	
c. Sub-Total	
3 Federal	
a. FHWA (447.10, 448.10)	
b. UMTA Grants	
(1) Planning (447.10, UMTA Sec. 8)	
(2) Capital (448.10, UMTA Sec. 3 & 5)	
(3) Operating (447.10, UMTA Sec. 5)	
c. Revenue Sharing (447.10, 448.10)	
d. Other (Specify) (UMTA Sec. 6 & 16)	
e. Sub-Total	
4 Bonds and Notes (449.20)	
5 Transit Agencies (448.30 & 40)	
6. Other Governmental (448.31 & 32)	
7 Other Revenues (444.00, 448.40, 449.10 & 90)	
8 Total Revenues	

ITEM	AMOUNT
B. EXPENSES	
1. Capital Outlay	
a. Maint. & Operating Facilities (Garages, Bldgs., Electrical O/H)	
b. Vehicles	
c. Traffic Management (Signs, Striping, Park & Ride, etc.)	
d. Other Facilities (Communications, Computers, Shelters, etc.)	
e. Sub-Total	
2. Operating Expense	
a. Operations (641.00)	
b. Maintenance (642.00)	
c. General Administration (643.00)	
(1) Administration	
(2) Marketing	
(3) Planning	
d. Sub-Total	
3 Interest Expense (644.91)	
4 Depreciation (644.10)	
5. Interfund Loans (645.10)	
6. Redemption of Bonds, etc. (645.20)	
7 Other (identify in remarks)	
8 Total Expenses	

REMARKS

NOTE: Please return one copy in the enclosed self addressed envelope. If questions arise concerning completion of this form, you may contact the Dept. of Transportation (Olympia) 753-6143 or SCAN 234-6043.

*Numbers in parenthesis refer to Account Numbers in the Budgeting, Accounting, Reporting System for Transit Systems of this information by state officials does not represent any major change from present procedures.

LEVEL OF DETAIL AND FREQUENCY OF EVALUATION

For internal evaluation purposes, frequency and level of detail for performance monitoring and analysis will vary widely and is dependent on the needs of management and local boards.

Seattle Metro has a very extensive and frequent monitoring program. For example, in route analysis, Metro uses electronic passenger counters, calibrated to time and space along the route. Recordings are machine analyzed and statistical and graphic summaries are produced.

Other large properties (e.g., Spokane and Pierce PTBAs) have developed ongoing monitoring and evaluation programs for functional areas and route analysis. For route analysis, both of these operators use "checkers" (person physically on board and observing) to identify passenger loads as they continually rotate through all routes of the system. Micro computers are then used to tabulate and analyze results.

At the other end of the scale, small city and rural systems, some of which are new services, have limited staff and resources to engage in detailed analysis. Passenger counts by route, when conducted, are collected by drivers and analyzed when the manager is not preoccupied with administrative and operational concerns.

This above discussion is merely to emphasize that no uniform and tailored program for internal evaluation can be suggested, given the differences in size and scale of operators throughout the state. What is suggested is an internal evaluation process that identifies minimal information needs and general procedures. The internal evaluation process suggested is designed to meet minimum needs, but not exceed resources of the smaller systems. Many of the midsize and larger systems presently have an ongoing process.

Transit managers and policy boards will establish the specific evaluation program and procedure and thus the extent of detail and frequency for system, route, and functional area analysis will be left to their discretion. This report only recommends a process and identifies areas of interest. It is recommended that WSDOT develop a prototype program model that is flexible and can be adapted to meet divergent needs of the smaller systems.

At the state level, basic financial and operating characteristics would continue to be provided by local operators. It is recommended that employment and safety information be added to the current list of data elements. Figure 5-3 provides a summary of the data elements needed by WSDOT. Appendix F provides a more comprehensive overview of information to be collected annually. These values would then be converted to transit performance measures and a summary report tracking progress over time would be prepared annually.

In terms of reporting frequency, at the local level most boards meet monthly and management and staff prepare operational reports for those meetings. Many systems then aggregate those monthly reports on an annual base to highlight major trends. Minimally, an internal performance monitoring report should be prepared on a quarterly basis. At the state level, summary reports will continue to be produced annually.

RESOURCES

At the local level, management and decision makers will make a determination as to the amount of resources to be allocated to performance monitoring and evaluation. Two major expenses are conducting a comprehensive inventory for route analysis and conducting an internal management audit. Many of the smaller systems may be severely constrained in this respect and request assistance from WSDOT. A definitive cost assessment model for conducting these two basic inventories could not be established. Recent experience of larger operators (100-150 bus fleet) have been in the range of $50-75,000 for a baseline service inventory and route analysis. Internal management audit costs for similar size systems have ranged from $40-50,000. It would be safe to assume that minimal threshold costs for small system audits or route inventories would be $15,000 each. Service monitoring costs are just as difficult to estimate. Reference 5 identifies a general range of manpower costs for data collection based on number of operating vehicles.

Service Inputs

- operating cost (expenditures for operations, maintenance, administration, and total)
- employee hours (full time equivalent, e.g., FTE=2,000 hours, operations, maintenance, administration, and total)
- capital investment (number of vehicles, percent opperating) at peak, age, capacity, active)
- energy consumption (fuel cost and volume)

Service Outputs

- vehicle hours (total and revenue)
- vehicle miles (total and revenue)
- capacity miles (total and revenue)
- service reliability (number of roadcalls)
- service safety (number of accidents)

Service Consumption

- passengers (revenue, special, total)
- operating revenue (passenger, other, total)

Service Area

- population
- square miles

Service Design/Distribution

- modes (motor bus, trolley, vans)
- operation (fixed route, demand/response, special)
- route miles
- schedule (hours, days)
- fares (by user groups)

Public Assistance

- local (type, amount, assignment to capital and operating)
- MVET (amount and assignment to capital and operating)
- State direct (amount and assignment)
- Federal (amount and source e.g., Section 3, 5 or other)

Note: See Appendix B for definition of terms.

Source: Condensed from reports identifying information needs for effective performance monitoring and evaluation [4, 5, 8, 25, 32, 34, 40, 43].

Figure 5-3

Suggested Transit Data to be Collected by WSDOT: A Summary by Evaluation Concept

The range was .5-1 FTE (checkers) for systems with 25 peak hour buses and up to 20-38 for systems with 2,000 peak hour buses.

For external evaluation purposes, it is assumed that WSDOT will continue to devote a portion of its staff resources to statewide performance evaluation at the aggregate level. Continued research and technical assistance support at the disaggregate level is presumed also.

SUGGESTED EVALUATION PROCESS FOR WASHINGTON

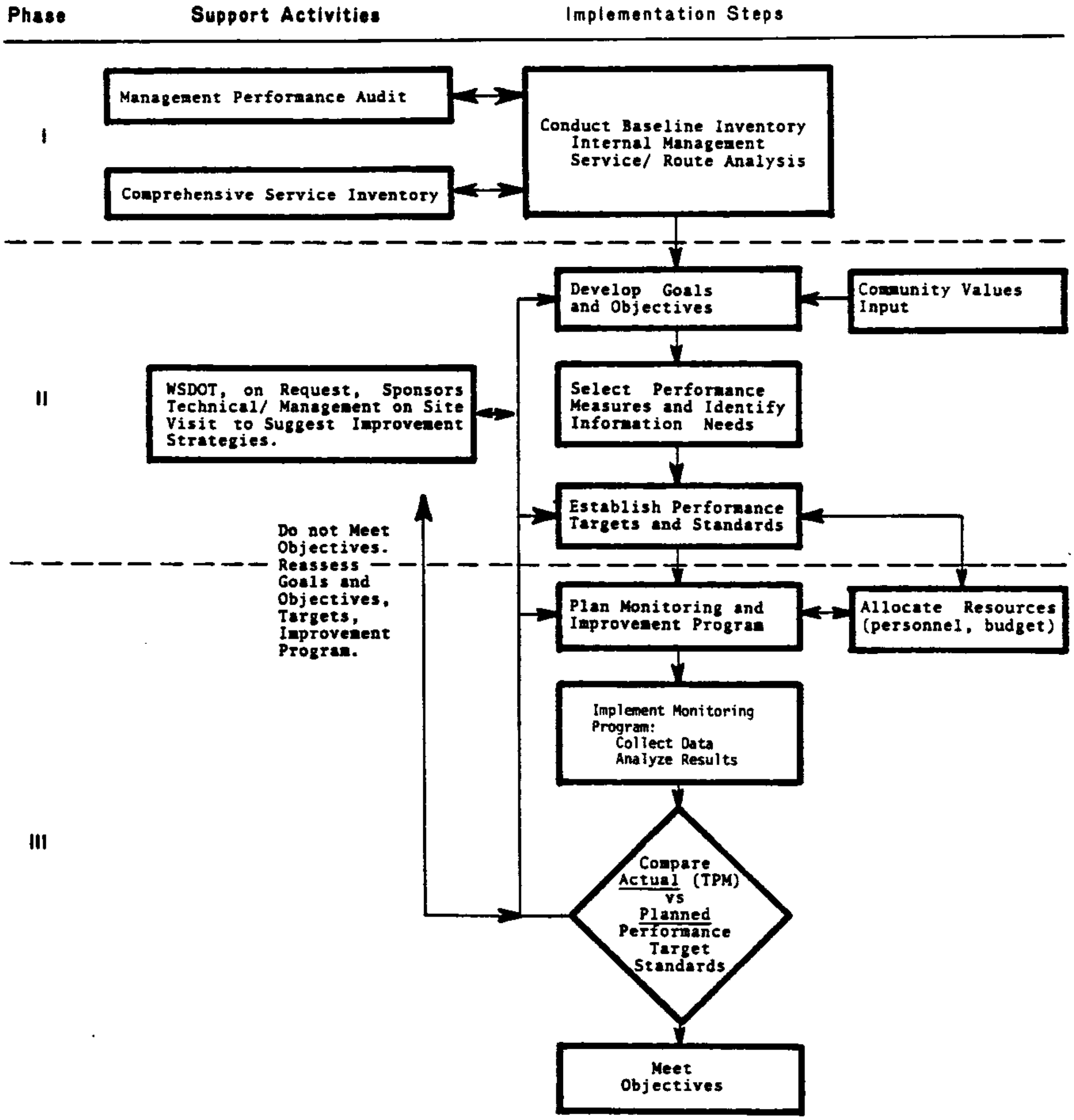
The public transportation evaluation process suggested for Washington is adapted in part from the methodology and experience gained in other states and in particular takes advantage of the work accomplished in developing a statewide evaluation program for Michigan [25]. The model consists of two major elements; one outlining an internal evaluation process to be conducted by local management and the other focusing on external evaluation conducted by the WSDOT.

INTERNAL EVALUATION PROCESS

The suggested local process incorporates key evaluation concepts identified previously in Chapter Three into a general framework for internal management and self-evaluation of a transit system. Figure 5-4 diagrams major elements and their relationship. The process can be applied in assessing system wide performance, individual route analysis or functional area (operations, maintenance, planning and marketing, and general administration) evaluation.

Purposes for the internal evaluation include:

- means of assuring accountability to public officials and citizens of the community served;
- assist in internal allocation of resources and management control;
- helps clarify and prioritize system objectives;
- with continuous monitoring and evaluation ensures early diagnosis and resolution of potential problems; and
- aids in assessing impacts of expansion or reduction in service levels.



Source: Adapted from Management and Self-Evaluation Manual for Public Transit Systems in Michigan. Peat, Marwick, Mitchell, & Co., April, 1982.

Figure 5-4

Internal Evaluation Process

There are three basic elements or phases for internal performance evaluation:

- Phase I - conduct baseline inventory;
- Phase II - develop evaluation plan; and
- Phase III - institute continuous monitoring and evaluation program.

Within each phase, there are two major areas of concern, the service system and internal management system.

Phase I

For service, a basic inventory of activities by time of day for all routes is necessary. The data collected would include passenger loadings, running times, revenues, origin/destination, and passenger characteristics [5].

For inventorying internal management, a comprehensive audit of functional tasks, procedures, and productivity of all operational and support divisions is conducted. Items of interest include governance, management and organization, planning and marketing, transportation and safety, maintenance, purchasing and inventorying, finance and accounting, and personnel and labor relations [32].

While there are manuals available to assist internal staff in conducting either the service inventory or management performance audit, it is recommended that professional groups be used if at all possible. This will not only ensure a comprehensive and objective assessment, but the findings and recommendations should clearly identify key elements for the continuous monitoring program that will require staff resources.

Phase II

Developing a service and management performance evaluation plan requires analyzing the results of the inventory/audit, identifying problem areas, and developing strategies for improvement. Specifically it requires establishing goals and objectives, identifying activities to accomplish objectives, defining performance measures to monitor achievement, and allocating resources to monitor and evaluate programs. Activities of this phase deserve elaboration.

Key steps would include the following:

- Establish Goals and Objectives. Development of goals and objectives serves as a means of communicating direction for the system, establishing priorities, and encouraging careful consideration by policy makers, management, and supervisory staff on what can and should be accomplished by the transit system (see Chapter III for additional discussion). The information supplied by the inventories will provide the essential resources in making these policy determinations. Local citizens and transit patrons should be given an opportunity to participate in this important phase.
- Identify and Define Performance Measures and Data Needs. The cost of collecting and analyzing data provides an incentive for selecting only a limited set of performance measures that provide the most useful and meaningful measurement relative to each objective. Appendix C identifies a candidate list of 24 performance measures, their utility, and factors that influence respective values.
- Establish Service Standards. Service standard represent the minimal or threshold values indicating acceptable levels of performance. The standards established should be reasonable and achievable. In conjunction, transit systems may establish performance targets--that is, the preferred level of performance. Sources for information for developing performance standards or targets include an evaluation of current and past performance of the transit system and an examination of past and current performance of other transit systems, particularly those "peer group" systems of similar size and scale of operations (Chapter VI identifies such ranges of values).

Phase III

The performance monitoring and improvement program should be designed to aid the transit system in meeting established objectives. The program should identify activities proposed, personnel and equipment required, and state as explicitly as possible how the program will be implemented. A budget should be prepared estimating the cost for achieving the objectives and assessing whether resources are available to carry out the program. Information required for performance monitoring should be carefully defined and collected on a routine and systematic basis.

Throughout the year (minimally on a quarterly basis), actual performance objectives should be compared to planned objectives to determine if performance is on target. If it appears objectives are being met, no action is required. However, if objectives are not met, then transit management should:

- reconsider the target objective (is it too high to be achieved?)
- reconsider the improvement program (is the program effective; is staff motivated?)

- or reconsider the budget (are there sufficient funds for carrying out the improvement?). [25, 32]

This process is clearly dynamic and interactive over time. It is important to note that if targets established at the first of the year are to be achieved, progress review must be conducted frequently.

Finally, it is suggested there be an on going opportunity for local management and decision makers to request external assistance in evaluating internal performance and developing improvement strategies. In the following section this concept is illustrated with a possible scenario of how a 2-3 member team sponsored by WSDOT might assist the manager of a small system in identifying solutions.

The internal evaluation process as outlined above can be viewed as an aid to management in seeking to improve the efficiency and effectiveness of their systems. It is assumed that during the first few years of implementation not all objectives will be acheived. However, as experience is gained over time, more realistic expectations regarding performance improvements will be afforded.

EXTERNAL EVALUATION PROCESS

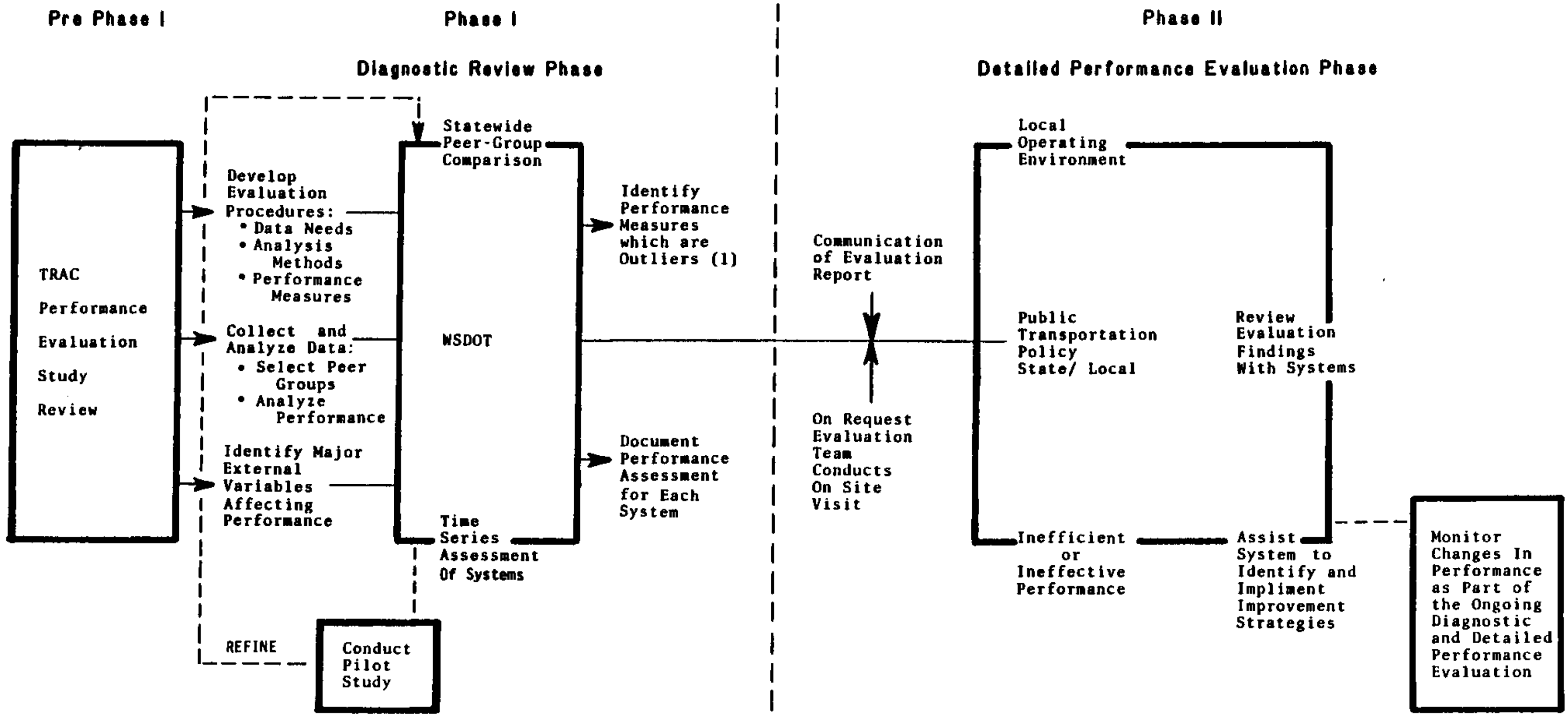
The external evaluation process can be viewed as an aggregate assessment of transit performance for all systems in the state. The purpose of the external evaluation is to assist WSDOT in providing appropriate managerial and technical assistance to local systems and to assure state decision makers (e.g., the Legislature) that public transportation service is being provided efficiently and effectively.

The external process is divided into two phases. Phase I consists of assessing statewide and "peer group" performance, while Phase II entails a more detailed analysis of individual systems. Figure 5-5 outlines the major activities. It should be noted that these Phase I activities were assessed in this study and are discussed in Chapter VI.

Diagnostic Review (Phase I)

The objectives of the diagnostic review are to:

- determine what basic information (transit area, socioeconomics, population) is most relevant in assessing charateristics that influence transit performance;



(1) "Outlier" is the term used to describe performance measures values that are significantly higher or lower than those in other systems or that are changing significantly over time.

Source: Adapted from Evaluation Methodology for Mid-Size Transit Systems in Michigan. Peat, Marwick, Mitchell, & Co., April, 1982.

Figure 5-5

External Evaluation Process

NEED FOR "PEER GROUP" DEVELOPMENT

The integrated evaluation framework presented previously is more than a conceptual model as evidenced by similar internal and external procedures being implemented in other states and local areas. And yet the model as applied elsewhere must be modified and adapted to meet the specific needs of transit monitoring and evaluation in Washington. The overall process as outlined is sound and implementable, but it should be noted that there are unresolved issues. Three important and related issues are identified below:

- Because appropriate "peer group" classes for transit systems have not been developed, performance relative to an alternative size and scale of operations has not been carefully studied. Major differences and/or similarities between different classes need to be identified and assessed. Without such a classification scheme, external evaluation is severely restricted and elements of internal evaluation are hampered (e.g., developing appropriate standards).
- There is a substantially large number of transit performance measures (TPM's) that can be used to evaluate alternative aspects of transit service. One study [24] identified over 100 TPM's that could be developed from Section 15 data. In contrast, a national survey [5] concluded that most large operators are actually using fewer than 10 TPM's, and smaller operators, fewer than five TPM's. What guidelines or criteria should be used in selecting appropriate sets of performance measures for internal evaluation? Similarly, given major differences in operation by the 20 systems in the state, what uniform set of measures should be used in external evaluation? What performance concepts should the measures evaluate?
- The evaluation literature reviewed recommends that standards and service levels be developed locally. While local operating standards or performance targets must reflect local needs, resources and constraints; suggested guidelines, based on the operating experience of distinct peer groups, would aid managers and decisionmakers in their determinations. This is especially true for mid-sized and smaller properties. The literature that exists is instructive but oriented primarily toward the larger metropolitan systems and their service environments. It is proposed that by examining operational characteristics and performance within each class of peer groups, some beneficial distinctions can be made and more relevant service planning and evaluation guidelines can be identified for each group. From an external evaluation perspective, some range of values (e.g., standard deviation from the mean) for each measure and relative to each peer group needs to be predetermined before "outliers" can be assessed.

Recognizing these needs, the latter portion of the study's work program was devoted primarily to these issues.

In initial testing for relationships between transit systems in Washington, analysis of variance was used. While more commonly used to test and refine relationships after groups are formed, in this instance it was used to test preliminary hypotheses for group assignments using 1980 operational and financial characteristics for 17 Washington systems (see Appendix G). In using analysis of variance, one is testing the hypothesis that no differences exist in the central tendencies of a population group. A critical determinant in validation is the size of the F ratio. In this particular analysis, less than a 2.5 F ratio indicated data were subject to random error and any value over 4 indicated significant differences existed within the group. Seattle Metro data (due to unique values) were excluded and assigned a separate group. Five other groups were hypothesized for Washington State that ranged in size from small rural specialized service to large regional fixed-route service.

The 17 transit systems were first assigned to groups based on general observation of central tendencies across a multiple of variables. Nineteen variables (absolute values of operational and financial characteristics) were used as data input and pooled (summed) standard deviations served as the unit of measure for each system. Relatively stable population group (multiples of systems) measures were found. All of the groups tested satisfied the F ratio criterion for minimum within-group variance. The procedure was then reversed to test for between-group variance and significant differences (F ratio greater than 12) were found for each pairwise test (e.g., mid-sized vs. regional). This resulted in an initial classification as follows:

- Group 1 (2 cases) - small rural systems operating flexible service (E&H)
- Group 2 (2 cases) - rural fixed-route service
- Group 3 (4 cases) - small city (<50,000 service area population) transit
- Group 4 (5 cases) - medium city (>50,000 service area population) transit
- Group 5 (3 cases) - large regional (>200,000 service area population) transit
- Group 6 (1 case) - metropolitan (>1,000,000 service area population) transit

Due to the limited method of analysis, and the small number of cases assigned to each group, no firm conclusions were drawn. When performance was analyzed within each group, some groups (rural, small city) showed little deviation, while other groups (medium city and regional) showed substantial deviation among the 6 measures. There was, as anticipated, measurable difference in performance between the groups. Analysis of variance was then conducted on system groupings based on similar central tendencies among the 6 TPM's of:

- passengers per service area population;
- passengers per vehicle hour;
- operational cost per passenger;
- operational cost per vehicle mile;
- operational cost per vehicle hour; and
- operating ratio.

These subsequent tests resulted in systems being assigned to different groups. This raised an important issue regarding "peer group" development. How should "peer groups" be defined -- by relative performance or by similarities in size, scale, area of operation? For purposes of this research, it was assumed that classification of "peer groups" should be made on the basis of operational and service area characteristics, and then performance within each group could be compared relative to some common system environment. In summary, these early experiments identified two needs:

- In order to identify representative "peer groups," additional data sets and methodological approaches would be needed to verify the group assignment and to insure that each group was represented by a sufficient number of cases.

- When alternative sets of measures were used (e.g., operational characteristics vs. performance measures), these values influence the assignment of a system to a particular group. If the intention of performance evaluation is to have groups assigned according to operational and service area environment and then to analyze performance within each group, that initial assignment must be made with neutral (relative to performance) values.

RESEARCH DESIGN

It was proposed that by employing a variety of statistical techniques on an expanded data base using Section 15 data for small urban and larger systems and selected small system data characteristics for non-urban systems, a set of defensible "peer groups" could be determined.

DATA SOURCES

Information from UMTA's Section 15 program (FY 79-80) was requested to expand the data base for small urban and larger properties (i.e., those systems serving areas of 50,000 or more population and receiving Section 5 support). However, many of the systems in Washington are rural and small city operations (less than 50,000 population). Comparable data for those groups were collected separately from selected State DOT's (North Carolina, Wisconsin, New York, Pennsylvania, Michigan, Iowa, Florida and Indiana).

STATISTICAL METHODS

A variety of statistical techniques and programs were selected for use in classification. A summary of these methods is provided below:

- Analysis of Variance - Tests variation within and between groups for significance. Used after preliminary classification is completed to test how well properties are grouped.
- Factor Analysis - Groups variables into factors which represent major dimensions of variables. Can be useful to identify how transit property characteristics or TPM's might be aggregated and which are correlated.
- Clustan - This numerical taxonomy program includes major "grouping" algorithms used in cluster analysis to search for homogeneous classes of objects or variables.
- Discriminant Analysis - This technique is used once classes are determined to describe a functionwhich separates each one. The discriminant score helps place observations into their most likely group.

Cluster Analysis

Cluster analysis, due to its primary role in the research, warrants additional explanation. The major objective of cluster analysis is to identify groupings or "clusters" of objects that best represent certain impirical measures of similarity. Objects assigned to a group represent maximum similarity to that group and maximum dissimilarity to objects outside the group. The algorithm identifies whether there is any natural (inherent in the data) structure which will partition objects into optimally homogeneous groups. There are a variety of algorithms used to identify clusters but essentially they represent three alternative procedures:

- hierarchical classification -- object classes are subdivided into groups of subclasses that can be graphically represented as a tree (dendogram);
- partitioning -- groups are mutually exclusive; and
- clumping -- classes and groups can overlap.

The hierarchical procedure is one of the more developed approaches and was selected for clustering transit systems in this research. The method used in computing similarity is based on Euclidean distance of points (of data) from every point and is mathematically expressed as:

$$\Delta_{jk} = \left[\sum_{i=1}^{N} (X_{ij} - X_{ik})^2 \right]^{\frac{1}{2}}$$

There are a number of subroutines and alternative procedures for assisting the analyst with defining the clusters but the researcher (based on observation and experience) must decide:

- What measures are appropriate for defining the characteristics of each group? and
- What "test" is appropriate for inferring if the groups are actually unique and different from one another?

These questions relative to transit peer groups are addressed in the section on data analysis.

As an example of the procedure Clustan follows, seven TPM's for 16 systems were used in a clustering routine that employed the following steps:

- read a data matrix of 16 cases by 7 variables;
- standardized variables (zero mean, and unit standard deviation);
- computed distance matrix for all points;
- ran hierarchical clustering routine based on within-group variance;
- developed groups based on iterations that give the least increase in sum of squared error;
- summarized all N-1 fusions in a dendogram table; and
- plotted dendogram based on that information.

Figure 6-1 illustrates the plot (solid lines). The dashed line to the left provides preliminary and general interpretations as to peer group.

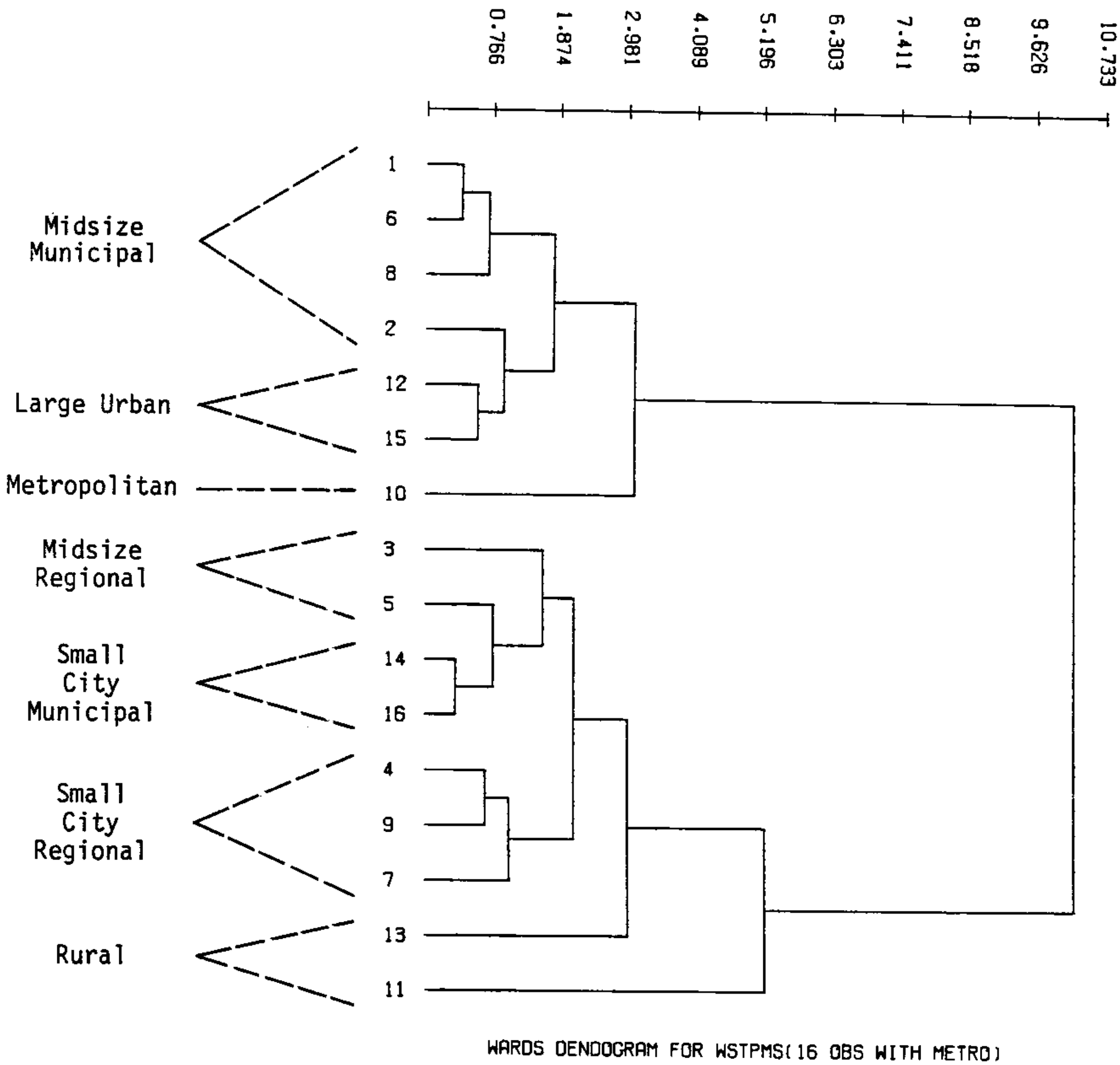


Figure 6-1

Cluster Dendogram on 1980 WSDOT Data

PRE-CLASSIFICATION ANALYSIS

Based on the results and interpretation of numerous runs on 1980 WSDOT data, the earlier hypothesis on the number of "peer groups" in Washington changed and increased to include the following:

• Metropolitan Regional Transit (>1,000,000 service area population) Serves large region.	Seattle Metro
• Large Urban Regional System (200,000 - 500,000 service area population) Operates in region.	Pierce, Spokane
• Midsize Urban Regional Systems (>50,000 service area population) Service to region.	Intercity, Community, Clark
• Midsize Urban Municipal System (>50,000 service area population) Operates within municipal boundary.	Bellingham, Everett, Bremerton
• Small City/Regional System (>50,000 total service area population, multiple cities served) Extensive line miles/vehicle miles for size.	Grays Harbor, Twin, Community Urban
• Small Community Transit (<50,000 service area population, small cities served) Limited miles of route.	Pullman, Yakima
• Rural Transit (10,000 - 40,000 service area population) Serves small towns/cities in rural region, extensive route/vehicle miles.	Pacific, Prosser

Those changes were based on multiple cluster analysis, alternately using three or more of the following TPM's as variables in each computer run:

- service area population/line mile;
- passengers/line mile;
- vehicle miles/line mile;
- vehicle hours/line mile;
- vehicle hours/service area population;
- vehicle miles/service area population; and
- passengers/service area population.

As can be seen, these values are "neutral"; that is, they are not measuring traditional aspects of performance or productivity but rather were selected as being useful in measuring differences in community density and service, design and distribution. Analysis of the values within each cluster provided a clearer distinction between the above "peer groups." It was particularly beneficial in providing more clarification between mid-sized and smaller systems. For example, in 1980 there were six systems in Washington with very similar service area populations ranging between 40,000 and 50,000. But those same systems had very dissimilar spatial distributions of service ranging from 26 miles of line to 85 miles of line. Some means of distinguishing the effects between whether a system was operating within a small municipal area (fewer line miles) or an expanded regional area (greater line miles) was necessary. Again, the purpose was to develop tentative "peer group" classes that would satisfy objective criteria for depicting the relative size and scale of operation <u>prior</u> to attempting to analyze performance between or within each peer group.

SELECTION OF TPM's FOR PEER GROUP ANALYSIS

Previous chapters have identified alternative TPM's and their relationship to major concepts of performance being measured. This section identifies the evaluation process used in choosing the set of TPM's for assessing "peer groups" and performance within and between the groups. The need was unique (research) and all TPM's selected are not necessarily recommended for general evaluation purposes.

Based on a review of the evaluation literature (in particular references 8, 12, 13 and 35), a number of criteria for selecting performance measures were identified. They are:

- availability of data;
- controllability of variables (e.g., within the control of the operator);
- uniqueness of measure (not redundant);
- utility in representing a legitimate performance concept (efficiency, effectiveness);
- economy (data for developing measure should be within resources of operator to collect and analyze);
- meaningful to operator;
- meaningful from research and policy analyst perspective;
- ubiquitous and demonstrated use;
- potential for multi-modal application; and
- sufficient level of variability (values should not be static in nature).

While all of the above criteria are valid, their utility is primarily from the perspective of the local operator. Application of these criteria would tend to minimize the number of TPM's selected. It was determined that for initial research purposes, a more comprehensive set of TPM's were needed to thoroughly investigate differences in peer groups. It was anticipated that eventually a smaller set could be identified after classification analysis. The criteria used included:

- balanced set of measures for each performance concept;
- sufficient level of variability;
- utility in distinguishing variance between alternative size and scale of systems; and
- capability of determining measure with existing WSDOT data.

Table 6-1 presents the 30 TPM's that were selected for pre-classification use in peer group assessment. The major concepts included multiple aspects of service efficiency and effectiveness. Some important aspects (e.g., fuel, labor, maintenance efficiency) were not included because information on these items was not available for all systems in the state.

ANALYSIS SEQUENCE

The research design process included the following steps:

- Prepare and edit data (79-80 Section 15 and sample data on nonurbanized systems).
- Using selected TPM's, factor analyze (R type) major dimensions of performance for evaluating variables influencing performance and refinement of evaluation measures.
- Using cluster analysis based on service design and distribution variables, position all cases into homogeneous "peer groups." Alternative samples of data set would be used to verify cluster groups. Using analysis of variance (MANOVA), further tests the validity of groupings. Cluster analysis of systems based on alternative concepts of efficiency and effectiveness would be used to determine ranges of performance. Use of discriminant analysis would be used to further test validity of classification scheme and to assign Washington systems to U.S. peer groups.
- Once satisfied on validity of groups, factor and discriminant analysis would be used to evaluate major dimensions of efficiency and effectiveness of performance within each group. Particular attention would be given to determining ranges of performance within each group.

Table 6-1

TRAC TPM's Used in Peer Group Assessment

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE
Service Cost Efficiency	Operating expense/total vehicle hours Operating expense/total vehicle miles
Vehicle Efficiency	Total vehicle miles/total vehicles Total vehicle hours/total vehicles
Service Cost Effectiveness	Operating expense/miles of line Operating expense/total passengers Total revenue/total passengers Total revenue/operating expense Passenger revenue/operating expense
Effectiveness of Service Consumption	Total passengers/miles of line Total passengers/total vehicle miles Total passengers/total vheicle hours Total passengers/total vehicles
Effectiveness of Service Design and Distribution	Total passengers/service area population Total vehicle miles/service area population Total vehicle hours/service area population Total vehicle miles/miles of line Total vehicle hours/miles of line Service area population/miles of line
Effectiveness of Revenue Generation	Passenger revenue/total passengers Passenger revenue/total vehicle miles Passenger revenue/total vehicle hours
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance Total passengers /local tax assistance Total vehicle miles/Motor Vehicle Excise Tax Total passengers /Motor Vehicle Excise Tax Total vehicle miles/operating assistance Total vehicle hours/operating assistance Total passengers/total operating assistance Service area population/total operating assistance

While the process, as identified, involves the use of multiple statistical tools to analyze the data, those tools do not substitute for sound judgment.

COMPARATIVE ANALYSIS

This section reviews adaptive procedures and results of the research design, including problems encountered, analysis of clustered groups, and suggested improvements in methodology for analyzing Section 15 data. In addition to discussion of the 1979-80 Section 15 data used in the TRAC study, highlights of Anderson and Fielding's [4] analysis of the inaugural (1978-79) Section 15 report are also presented.

DATA PREPARATION

The 1979-80 Section 15 tape was obtained from Transportation Systems Center (TSC). In addition to the routine problems associated with transferring taped data developed on one system (IBM) to another system (CDC), extreme difficulty was encountered relative to the file structure and variable format of the Section 15 tape.

Considerable effort was expended in restructuring data from the tape version that was formatted by variable to a disc version formatted by case. Cross-sectional analysis of the data required that the files be listed by transit systems. A lengthy FORTRAN program had to be developed to reformat the data before it was suitable for use.

Once the data were correctly formatted, values on the tape were checked against values identified in TSC's written report [45]. Numerous discrepancies were noted between the tape and printed report. Additional discrepancies were noted when comparing Section 15 data values for Washington properties with WSDOT annual reports. Verifications were solicited where possible (e.g., Washington Systems) and corrections made for major differences.

Further complications occurred relative to missing values. In the data, important characteristics for many systems were not reported. Both missing values and zero values were coded "0.0." It is customary to code unreported values with a negative number such as 9.0 or 99.0 to distinguish from actual zero values. The difficult choice of deleting the variable is magnified when considering that the final TPM ratio requires whole values in the numerator and denominator. Consequently, the number of omissions increases dramatically.

Data content problems were also noted. Commonly maintained transit characteristics such as revenue passengers, total passengers and service area population were not collected. Urban area population can be a suitable proxy for large regional systems but its use severely complicates service area analysis for smaller systems operating within some larger regional population group.

Relative to the non-urbanized transit system data collected from other State DOT reports, there were problems but they were not as severe. Responses were received from eight states with a total of 65 candidate systems. However, data requirements essential for matching the sample to Washington properties eliminated 20 of the systems and the inability to verify definitions of terms in some cases, and values in others, eliminated another 15 candidates. The data for the remaining 31 rural-small community systems representing four states (North Carolina, Indiana, Iowa and Wisconsin) were coded and actual values converted to TPM ratios. A reduced set of TPM's (13) was used in analyzing peer groups for the non-urbanized sample.

Three major data files from Section 15 were developed. One file contained 113 absolute values for all operational and financial characteristics of the 320 transit properties reporting. The other two files contained alternative sets of TPM's -- one set containing the 30 TPM's selected for this study and an alternative set of 48 TPM's to be used in comparison with findings from analysis of the inaugural year (1978-79) data [4]. The variable lists with central tendencies are described in Appendix G and discussed in the next section.

STATISTICAL ANALYSIS OF DATA SETS

The primary purposes for analysis were to develop a peer group classification system for use in assessing transit performance within and between distinct classes of operators in Washington State and to identify "relative" performance value ranges on selected TPM's for each peer group. Direct comparisons between individual systems or "scoring" of overall performance were not objectives. Before presenting the analysis of the 1979-80 Section 15 data, highlights on recent and related research of the 1978-79 Section 15 data set by Anderson and Fielding [4] at the University of California, Irvine, are presented. The methodology was similar to the research design of the TRAC study. Major similarities and differences are noted in the following two sections on data analysis.

University of California, Irvine Study

The three objectives for the Irvine study were:

- to assist UMTA in assessing the reliability of Section 15 data;
- to develop a small set of TPM's; and
- to produce a classification of bus transit systems.

Data reliability was tested by attempting to replicate previous research findings with demand, supply, and cost equations. The regression analysis was inconclusive and the authors urged that Section 15 data be used with caution. Similar problems with data files and coding as noted in this report were identified and specific recommendations for improvements were made to UMTA.

The major effort of the study was directed at testing the hypothesis that 48 performance measures could be reduced to a smaller set of nine measures that adequately represented major dimensions of efficiency and effectiveness. Using factor analysis, the larger set of specific measures (48) were statistically reduced to 12 major dimensions or "factors" of performance. It was found that nine dimensions accounted for 90% of the covariance, and measures that were found to load highest on each factor dimension were selected. The original 48 measures and the two sets of reduced measures are shown in Tables 6-2 and 6-3, respectively. Factor scores are identified in Appendix G. This procedure was beneficial from the perspective that local operators can more easily evaluate major concepts of performance by using a small set of measures that minimize data collection and analysis requirements.

Values for the nine measures (as well as an alternative set of nine) were determined for approximately 75% of the 311 reporting systems. A performance ranking process using the sum of the standardized (z score) value on each of the measures was then used to position all properties into six major groups (groups based on ± 0.5 deviation from sample mean) and then rank score performance within each group was calculated. Descriptions of the ranking for both sets of nine measures are identified in Appendix H.

Lastly, the Irvine study used cluster analysis in an effort to partition transit systems into data-inherent classes. Clusters based on demographic (e.g., urban area population, mean January temperature, regional wage rate) variables did not identify homogeneous groups. In defense of the use of demographic type variables,

Table 6–2

Comprehensive Set of TPM's Used in Section 15 Study

COST EFFICIENCY MEASURES

Variable Number	
	Labor Efficiency
* 1	TVH/EMP
* 2	RVH/OEMP
3	TVM/EMP
* 4	PVEH/ADM
5	PVEH/OP
6	PVEH/MNT
	Vehicle Efficiency
7	TVH/AVEH
8	TVH/PVEH
* 9	TVM/AVEH
10	TVM/PVEH
*11	RVM/TVM
	Fuel Efficiency
12	RVM/FUEL
13	TVM/FUEL
	Maintenance Efficiency
14	TVEH/MEXP
15	TVM/MNT
*16	TVM/RCAL
	Output per Dollar Cost
17	RVH/OEXP
*18	TVM/OEXP
19	RVH/TWG
20	RVH/OWAG
*21	RVH/VMWG
*22	RVH/ADWG

SERVICE EFFECTIVENESS MEASURES

Variable Number	
	Utilization of Service
23	TPAS/RVH
24	TPAS/RVM
25	TPAS/PVH
	Social Effectiveness
26	RVH/POP
27	TPAS/POP
28	TPAS/ELD
*29	TPAS/AUT
	Operating Safety
30	TVM/ACC
31	RVH/ACC
	Revenue Generation
32	REV/PVEH
33	REV/RVH
34	TREV/RVH
*35	REV/TPAS
	Public Assistance
*36	RVH/TSUB
*37	POP/TSUB
*38	PAS/TSUB
*39	REV/TSUB
40	PAS/OSUB
*41	POP/OSUB
42	RVH/OSUB
43	REV/OSUB

COST EFFECTIVENESS MEASURES

	Service Consumption per Expense
44	PAS/OEXP
45	PAS/TWAG
46	PAS/FUEL
	Revenue Generation per Expense
47	REV/OEXP
48	TREV/TEX

*Deleted from initial set in order to form the balanced set of 32 indicator measures.

Source: Anderson and Fielding, Comparative Analysis of Transit Performance, UC Irvine, January, 1982.

Table 6-3

Two "Factor" Reduced Sets of TPM's

Set of Standard Indicators

1. Revenue vehicle hours per operating expense (RVH/OEXP)
2. Total passengers per revenue vehicle mile (TPAS/RVM)
3. Total vehicle miles per peak vehicle (TVM/PVEH)
4. Total vehicle miles per gallons of fuel consumed (TVM/FUEL)
5. Passenger revenue per operating assistance (REV/OSUB)
6. Revenue vehicle hours per urban population (RVH/POP)
7. Total vehicle miles per maintenance employee (TVM/MNT)
8. Passenger revenue per operating expense (REV/OEXP)
9. Revenue vehicle hours per accident (RVH/ACC)

Alternate Standard Set

1. Revenue vehicle hours per total wage and fringe expense (RVH/TWG)
2. Total passengers per revenue vehicle hour (TPAS/RVH)
3. Total vehicle hours per peak vehicle (TVH/PVEH)
4. Total vehicle miles per gallon of fuel consumed (TVM/FUEL)
5. Passenger revenue per operating assistance (REV/OSUB)
6. Revenue vehicle hours per urban population (RVH/POP)
7. Peak vehicles per maintenance expense (TVEH/MEXP)
8. Passenger revenue per operating expense (REV/OEXP)
9. Total vehicle miles per accident (TVM/ACC)

Source: Anderson and Fielding, Comparative analysis of Transit Performance, 4c. Irvine, January, 1982.

it should be noted that the urban area population values, as opposed to transit service area population values, tend to obscure unique differences in size and scale of systems. A more satisfying cluster, according to the Irvine team, was achieved by the use of four operational variables: number of active vehicles, average speed, peak to base ratio, and total vehicle miles. The cluster analysis of these variables produced eight distinct groupings. The following provides a summary description of the cluster groups:

- The four large groups partitioned (6, 3, 8, 5) were described as smaller systems in terms of vehicles and vehicle miles from the sample mean.
- Cluster 6 tended to represent mid-sized systems with a high peak to base commuter orientation and slower speeds than average.
- Cluster 3 represented another cluster of mid-sized properties.
- Cluster 8 was described as below average in number of vehicles and the lowest speed of any group.
- Cluster 5 was similar to cluster 8 but had higher than average speed.
- Cluster 1 contained large systems in metropolitan areas and was more than two standard deviations above the mean on vehicles and vehicle miles.
- Cluster 2 was the second largest system size group and was one standard deviation above the mean. It differed from cluster 1 in having lower operating cost per revenue vehicle hour.
- Cluster 4 had the highest peak to base ratio and a slow speed, and similar patterns to cluster 6 suggest tradeoffs between speed and peak hour service.
- Cluster 7 was the smaller of the transit systems and characterized by average speed and low peak to base.
- The properties (11) not fitting into distinct groups were generally the very large transit systems, some with values as much as 6 standard deviations from the sample mean.

Again, because population and area characteristics were not used, it was not possible to associate the cluster groupings with distinct areas or size.

Appendix H contains the systems by cluster as developed by the Irvine study research. The authors noted that missing data and funding constraints precluded statistical analysis of the cluster groupings, but strongly recommended continued research on improving the taxonomical procedures as well as analyzing performance within clusters.

TRAC STUDY CLUSTER ANALYSIS

The analytical methods employed by the Irvine study demonstrated the utility and alternative approaches to comparative evaluation of transit systems. Recognizing this successful demonstration, and similarly constrained by resources, the TRAC project research design was modified to focus more immediately on the primary objective of the study's analysis element -- that of identifying homogeneous peer groups. The specific approach and findings follow.

The hypothesis of the earlier experimental investigations regarding development of transit peer groups was that such groups could be optimally defined by selected absolute or ratio values depicting service area design and distribution characteristics. Specifically, the ratio characteristics should include the use of line mile as a denominator. The rationale for emphasizing line mile was threefold:

- First, when used in relation to population, it serves as a suitable proxy for an important but hard-to-obtain variable: population density.
- Second, when used in relation to hours or miles of service or passengers, it magnifies service area indication of supply and demand.
- Third, and perhaps most important, it is a characteristic that is highly variable between systems and thus potentially capable of being a key determinant in defining peer groups.

For example, when analyzing line miles for each system in Washington State (and excluding the value for Metro), the standard deviation (129) is higher than the mean (117). At the national level, examination of the Section 15 printed report column showing line miles per revenue vehicle class reveals major variation of line mile values between and within these vehicle groups.

Based on these observations, it was decided to continue testing the hypothesis by insuring the variables used in the TRAC study cluster analysis included an array of ratios using line mile as a denominator. The testing was constrained by two factors:

One constraint was funds. Large data files such as the Section 15 tape are expensive to manipulate, particularly through complex algorithms employed in cluster analysis, and unforeseen data editing problems consumed much of the available budget.

Secondly, and perhaps most importantly, data omissions within important categories, and the use of urban area population as opposed to service area population, greatly constrained the use of key TPM's for testing hypotheses regarding service design and distribution. For example, 87 of the 310 systems were identified as urban area populations in excess of 2 million; there were 25 systems listed in the New York City region alone.

ALTERNATIVE CLUSTER PROCEDURES AND RESULTS

One set of TPM's for clustering was constructed around identical measures used in the Irvine study. The 48 measures are identified in Appendix G as the Anderson/Fielding TPM set. The purpose for this set was to have some basis of comparison to the previous work mentioned. Since the report [4] provided extensive discussion of the utility of these measures (as reduced by factor analysis), less time was devoted to testing cluster alternatives or performance evaluation with this set. Clustering results identified seven major clusters ranging in size from 9 cases to 202 cases. The large cluster (202) was comprised of medium and large properties transporting an average of 30 passengers per vehicle hour and having slightly higher than average revenue vehicle hours per population. The smaller clusters identified either small to mid-sized systems operating below the sample mean on passengers per vehicle hour, or identified very small clusters (1-4) of extremely large systems with ridership per hour 3-4 standard deviations above the mean. F ratios for most of the cluster variables were quite low (<0.5) and in many instances the standard deviations for variables were much larger than the mean, implying an unstable population group and thus not representative of homogeneous clusters.

The other set of TPM's used in clustering were those identified previously in Table 6-1. Those concepts and representative measures were selected based on previously identified criteria, including the availability of data for developing similar ratios for Washington systems. This set is identified in Appendix G as the TRAC study TPM set. This complete set, or major elements, were used with 1980 WSDOT data, Section 15, and the non-urbanized transit data sample.

Section 15 Cluster (TRAC TPM's)

Several runs were made using alternative sets of variable TPM's. The most satisfying cluster arrangement in terms of distinct groups was made using 10 effectiveness measures relating to service distribution and consumption.

Table 6-4 highlights central tendencies for seven of the clusters and Appendix H contains the full cluster groups.

The following comments highlight each group:

- Group 1 comprises large urban and metropolitan regional systems serving extensive population and transporting significant ridership. It has the highest level of service (vehicle hours and miles of population or line mile) of all the groups.
- Group 2 is the largest cluster and contains mid-sized and large urban area systems with above-average ridership.
- Groups 3 and 4 represent mid-sized and smaller systems, many of which are located in industrial areas with stable or declining populations.
- Group 5 depicts large metropolitan systems with slightly lower service levels but greater ridership. Population density is double that of Group 1.
- Group 6 is made up of the smaller systems with lower levels of service and ridership.
- Group 7 is indicative of several peak-hour commuter-oriented properties operating primarily in the New York City region.

In examining the clusters in Table 6-4, there is measurable distinction when comparing the mean average ($\overline{x}$) between each group but examining the standard deviation (σ) shows a large variation within each cluster and precludes "peer group" definition.

Another clustering routine was attempted using the full set of TRAC TPM's. The initial output identified eight major groups similar to those identified above, but again with large variation within group values for most of the variables. An adaptive procedure was used to remove cases from a grouping if 10 of its TPM values were above or below one standard deviation from the group mean. After two iterations this resulted in substantially fewer cases per group and somewhat reduced the extreme variation within the groups without altering distinction between the groups. The results of this procedure are presented in Table 6-5. This table depicts performance on all TRAC TPM's with the exception of public assistance effectiveness. Due to extreme cases of missing data, this concept could not effectively be measured for all groups. The importance of this table is that it provides a "relative" range of performance values within a fairly stable group. Were it not for the spurious population values, these clusters would approximate relative peer groups.

Table 6-4

Seven Cluster Groupings Using TRAC Study TPM's

Variable #/ Name		1 N=28	2 N=94	3 N=39	4 N=33	5 N=18	6 N=17	7 N=5
1. PASS/LM:	$\bar{x}$	46451.43	15760.49	7620.84	6135.54	64547.18	17191.39	36383.95
	σ	19782	6398	3536	8704	19653	7967	
2. PASS/VM:	$\bar{x}$	2.70	2.23	1.56	.7503	4.22	3.32	4.59
	σ	0.55	0.43	0.47	0.28	0.72	0.70	
3. PASS/VH:	$\bar{x}$	35.46	29.07	19.49	10.12	52.49	41.78	73.19
	σ	6.44	4.98	4.17	4.48	7.33	7.18	
4. PASS/VL:	$\bar{x}$	84684.22	67301.92	45061.98	26643.67	122938.39	99503.36	171277.17
	σ	19409	12294.06	9583	16937	20499	210002	
5. PASS/POP:	$\bar{x}$	43.75	18.70	8.79	6.03	46.43	22.56	39.21
	σ	74.04	13.60	9.9	9.84	40.95	9.23	
6. VM/POP:	$\bar{x}$	18.12	8.55	5.94	5.13	11.15	7.20	8.64
	σ	37.44	6.59	6.8	4.76	9.49	3.10	
7. VH/POP:	$\bar{x}$	1.30	0.65	0.4579	0.38	0.86	0.5712	0.53
	σ	2.38	0.47	0.48	0.39	0.67	0.25	
8. VM/LM:	$\bar{x}$	17281.91	7248.04	5086.52	5622.40	15320.50	5375.01	8266.22
	σ	5774	2896	1963	4147	3625	2239	
9. VH/LM:	$\bar{x}$	1323.52	554.35	412.74	388.37	1229.51	433.21	537.94
	σ	479	226.75	230	331.53	309	198	
10. POP/LM:	$\bar{x}$	11775.36	2510.48	11130.74	5915.78	21423.05	802.51	80703.05
	σ	34903	5708	27748	12970	42187	493	

Note: Eight small clusters are not shown on this table but are presented in Appendix H.

Table 6-5

Refined Central Tendencies for Section 15 Cluster Groups

CONCEPT MEASURED	TPM	1 (N=13) $\bar{x}$	1 (N=13) σ	2 (N=28) $\bar{x}$	2 (N=28) σ	3 (N=24) $\bar{x}$	3 (N=24) σ	4 (N=15) $\bar{x}$	4 (N=15) σ	5 (N=11) $\bar{x}$	5 (N=11) σ	6 (N=10) $\bar{x}$	6 (N=10) σ	7 (N=9) $\bar{x}$	7 (N=9) σ
Cost Efficiency	OEX/VH	34.00	3.46	21.61	14.24	27.26	8.58	25.45	7.53	21.52	4.42	22.63	2.66	22.90	9.69
	OEX/VM	2.57	0.35	1.83	1.25	2.34	0.87	1.68	0.46	1.87	0.33	1.57	0.20	2.23	0.74
Vehicle Efficiency	VM/V	29218	4993	30453	12958	23853	6341	36654	16764	28788	5368	34765	7023	29063	8610
	VH/V	2237	223.6	2520	1038	2011	338	2590	552	2557	684	2417	487	2002	971
Cost Effectiveness	OEX/LM	54715	30207	38752	27377	24624	19694	13527	6981	19343	7273	11425	4324	28679	37453
	OEX/PASS	0.74	0.16	0.42	0.35	1.30	0.64	0.94	0.36	0.68	0.21	1.18	1.29	0.75	0.61
	TREV/PASS	1.63	2.23	0.69	0.47	1.51	0.79	1.15	0.49	0.70	0.23	1.18	1.19	0.80	0.64
	TREV/OEX	43.66	15.06	32.52	20.57	35.50	31.98	30.56	10.85	22.19	4.50	23.29	3.07	32.3	846
	PREV/OEX	0.40	0.20	0.39	0.17	0.41	0.22	0.37	0.20	0.37	0.09	0.29	0.13	0.45	0.26
Effectiveness of Service Consumption	PASS/VM	3.71	1.05	3.71	3.39	2.24	1.15	1.91	0.50	2.99	0.91	1.96	0.80	1.83	1.72
	PASS/VH	47.3	8.67	42.57	34.66	26.68	14.82	28.88	8.49	34.58	12.62	27.98	10.38	20.86	19.78
	PASS/V	105657	21946	135810	89581	53241	31481	73685	22936	84493	24442	32248	31710	58116	55575
Effectiveness of Service Design/ Distribution	PASS/LM	77146	43522	85789	85798	23966	19749	15977	10141	32549	17008	14432	7240	13043	17139
	PASS/POP	56.7	15.80	69.24	49.39	19.91	18.31	12.73	10.59	24.75	15.83	16.02	13.26	13.67	6.27
	VM/POP	15.90	5.01	15.49	13.15	8.86	6.64	6.67	5.09	7.86	4.19	8.10	7.06	1.89	2.97
	VH/POP	1.22	0.37	1.2	0.90	0.77	0.55	0.43	0.31	0.70	0.42	0.55	0.46	0.14	0.23
	VM/LM	20543	10182	14843	9269	9982	6456	7965	3436	10447	4088	7256	2563	10645	9354
	VH/LM	1619	866	1288	924	850	468	529	232	926	388	502	166	931	1221
	POP/LM	1327	550	2987	4759	8050	18925	2499	2814	20155	55019	2781	4407	161997	305889
	PREV/PASS	0.28	0.11	0.21	0.10	0.47	0.32	0.29	0.13	0.25	0.10	0.24	0.16	0.30	0.34
	PREV/VM	1.08	0.63	0.89	0.59	0.94	0.67	0.55	0.23	0.71	0.29	0.38	0.24	1.1	0.98
	PREV/VH	13.40	6.19	10.38	5.78	12.28	10.64	7.04	3.10	8.11	3.36	5.12	3.44	9.76	8.25

Note: Each of the values presented should be viewed with caution due to potential coding measurement error.

In summary, efforts to identify national transit peer groups using 1979-80 Section 15 data were not successful. However, with refinement of the methodology and improved data collection of distinct service area variables, it is possible such peer groups can be defined.

Small Community/Rural Area Cluster

Cluster analysis and interpretation of the small community data presented few problems. Table 6-6 identifies central tendencies of each cluster group. Appendix H contains the full analysis.

The two major classes are identified as cluster groupings. One, with much higher values in passengers per hour mile and service area population, represents a small city (15-40,000) transit group. The other, with low values of passengers per mile and hour, represents a rural transit group with large service areas, more vehicle miles, and fewer passengers. There were three systems reported in this sample that were not assigned to a cluster.

Washington State Transit Peer Groups

Previous discussion identified cluster analysis being used to partition Washington transit systems into relatively distinct groups. Specification of those group characteristics were withheld pending confirmation by a larger number of cases to represent each group. Attempts to develop those groupings using Section 15 data were not successful. In view of this, additional attention was given to verifying previous cluster analysis by using alternative procedures.

The procedure involved selecting seven "neutral" service distribution and design TPM's, standardizing the value for each TPM by system and summing the standardized value for all TPM's by system. This procedure produces a representative single number (z score) classification of "peer groups" based on 0.5, 1.0, 1.5 standard deviations above and below the mean. The z score for each transit system identifies within which of the six groups it will be placed. The placement of each system using this procedure matched the results of the cluster analysis.

Table 6-7 identifies the central tendency characteristics for each group. Since Seattle Metro is a unique class in Washington, Section 15 data for similarly sized systems nationally were used to develop the Metro ranges. The distinctions made between regional and municipal in the mid-sized and small city

Table 6-6

Small Community/ Rural Transit Cluster Groups

TPM's	N=12 $\bar{x}$	N=12 σ	N=17 $\bar{x}$	N=17 σ
1. Passenger Revenue/Passengers	.26	.13	.37	.21
2. Passengers/Service Population	15.52	10.29	5.32	3.33
3. Passengers/Vehicle Hours	22.07	4.40	6.01	3.99
4. Passengers/Vehicle Miles	1.82	.42	.76	.46
5. Operating Expense/Passengers	.97	.20	1.96	.73
6. Operating Expense/Vehicle Hours	19.93	4.44	11.93	7.26
7. Total Subsity/Passengers	.68	.19	1.54	.78
8. Local Subsidy/Passengers	.23	.10	.36	.48
9. Operating Expense/Vehicle Miles	1.68	.37	1.19	.29
10. Passenger Revenue/Operating Expense	.27	.07	.29	.33
11. Total Expenditures per Capita	13.15	6.29	9.19	6.81
12. Total Subsidy per Capita	9.34	4.14	7.38	5.95
13. Local Subsidy per Capita	2.97	1.69	1.73	1.63

Table 6-7
Service Distribution/ Design Characteristics for Washington State

TPM/ Central Tendency Category	PEER GROUPS* (1980) Metro	Large Urban	Midsize Regional	Midsize Municipal	Small City Regional	Small City Municipal	Rural Transit
System	Seattle Metro	City of Spokane, City of Tacoma	Intercity Transit, Community Transit Vancouver	Bellingham, Everett	Grays Harbor, Twin, Community Urban	Pullman, Yakima	Pacific, Prosser
POP/LM							
range	1200-2500	700-1200	500-1000	400-600	300-900	500-600	50-300
mean	2142	991	738	498	611	561	172
SD	519	285	242	57	376	17	108
PASS/LM							
range	50-75,000	30-50,000	10-20,000	15-25,000	4-8000	10-15,000	200-2000
mean	72,368	40,235	11,735	18,139	4796	12,899	760
SD	18,238	11,893	6696	5852	2424	2642	843
VM/LM							
range	20-30,000	15-20,000	5-10,000	6-8000	4-7000	5-7000	500-2000
mean	25,874	15,766	7668	6844	5678	6662	2413
SD	7953	3559	1822	670	3080	715	2043
VH/LM							
range	1500-2000	900-1300	400-700	500-1000	250-500	500-700	50-250
mean	1889	1188	507	833	399	561	151
SD	766	221	160	447	203	18	128
VH/POP							
range	1.5-2.0	1.0-1.5	0.7-0.8	1.0-1.25	0.3-0.7	0.6-0.7	0.5-0.75
mean	1.74	1.21	0.72	1.09	0.49	0.715	0.75
SD	0.34	0.13	0.03	0.12	0.26	0.02	0.32
VM/POP							
range	15-25	15-20	10-15	10-15	5-10	8-10	10-15
mean	23.17	16.05	10.74	12.38	6.9	8.5	12.4
SD	7.39	1.0	2.67	2.38	3.89	.86	3.88
PASS/POP							
range	40-60	30-40	10-20	25-35	5-10	15-20	5-10
mean	56.70	40.55	15.15	32.67	7.43	16.48	6.46
SD	15.79	0.34	3.6	7.85	1.22	3.27	4.76

*Metropolitan characteristics developed based on metropolitan transit data from Section 15.

Note: One transit system in Washington could not be assigned to a peer group due to uniqueness of operational and service area characteristics.

categories are not always evident in all TPM's but do serve a useful function in differentiating regional PTBA's and municipal-only service.

Two additional points regarding Washington peer groups are warranted. First, they are not static. 1980 data were used in this assessment and since that time four additional transit systems have been initiated and could be assigned to one of the representative groups. Second, many of Washington's transit systems are less than three or four years old and operational characteristics will change over time as routes and service improvements are established.

Illustrations of how the Washington "peer groups" have changed over time in comparison to statewide averages are provided in Appendix E.

In summary, the preceding discussion addressed the need for development of transit "peer groups." A methodology was outlined and implemented, but with only partial success. A recent study [4] was successful in using Section 15 data to develop transit "classes" based on performance "scores" and on operational characteristics. This study's attempt to develop U.S. "peer groups" based on service design and distribution characteristics using Section 15 data was not successful. However, suggested "peer group" classification based on data from Washington State was developed and tested using alternative methods which confirmed the classification as outlined.

This study presented problems and potentials relative to improving the efficiency and effectiveness of public transit service. An overview of issues, concepts, applied experience, and continuing research was identified. A summary of major points and recommendations for future study are highlighted below.

Sponsored research and technical studies have provided a demonstration of the utilities associated with transit performance. The conceptual framework, including appropriate criteria and measures, has been developed and tested for inter- and intrasystem evaluation. The seminal work done by Fielding et al. [4, 13, 14, 15, 16] has consistently provided leadership and direction. The operational studies by Smerk [32] and others [8, 34] relative to internal performance assessment provide useful guidelines for managers. Recent work by Attanucci, Wilson and others [5, Vols. 1-2] gives useful instructions and procedures for route analysis. There is a need for additional research in functional area and peer group evaluation.

Must urban systems were identified as having improved their data collection efforts and many of the larger systems have adopted formal procedures for system and route evaluation. More studies are needed that will document man-hour and dollar costs of data collection and analysis, and will specifically illustrate how data were used and with what results.

Several states have developed evaluation procedures for local grant recipients that link funding allocation to transit performance. What the studies do not indicate is the relative impacts experienced in each state. Have these guidelines resulted in improved transit performance? What changes in efficiency and effectiveness measured have occurred?

Performance monitoring and evaluation require modest resources to implement effectively. Many smaller properties do not have such resources and therefore have restrained evaluation programs. How can guidelines for small system evaluation be improved? What minimum data collection and performance measure analysis will yield the optimal results in terms of measurable improvements?

While a substantially large number of performance measures have been identified, most systems have restricted their analysis to only a few measures on which data are collected and the meaning is clear. Effective evaluation requires the use of a comprehensive "set" of measures that captures major elements of both efficiency and effectiveness. It was assumed previously that such a comprehensive set of measures would number in the dozens and require considerable data collection and analysis. Recent research [4] suggests otherwise, and identifies two alternative sets of nine measures each that can serve to evaluate all aspects of systemwide performance in an objective manner. Supporting research and case studies are needed to document the utility of these small sets of measures.

Although the literature provides detailed guidance on the development and application of performance measures, most studies stop short of suggesting standards or performance targets relative to alternative size and scale of operations. While transit system policymakers should select their own individual and localized objectives and performance targets, it is proposed that by having "ranges" of performance values associated with specific "peer groups," the decisionmakers would have a more objective framework for making their selection. This was attempted in this study but the range of performance values developed cannot clearly be associated with a specific size and scale of operation. Additional research is needed in this area.

There are three major variables that substantially affect transit performance: costs, revenues and ridership. When shifts in any of these variables are unanticipated, major impacts can occur. It is proposed that continuous performance monitoring and evaluation could improve forecasts and aid in anticipating changes in those major variables.

A corollary need is that of improved impact assessment relating to service expansion or reduction. Again, current data provided by a continuous monitoring and evaluation program can supply major information needed for assessing impacts.

Relative to Washington State, the study identified suggested guidelines for both internal and external evaluation. It is anticipated that as these guidelines are implemented, and "baseline" data collection is improved, specific procedures and programs necessary to facilitate improvements in performance will become more evident. A major step will have been made when local transit authorities are prepared to develop very specific goals and objectives for service in their communities.

Chapter VI reviewed methodology and analysis associated with comparative evaluation, and in particular the development of transit "peer groups." Substantially more research is needed in this area. One study [4] was successful in using Section 15 data for "scoring" performance of transit systems and then classifying those systems based on performance scores. The TRAC study's approach was somewhat different in that the methodology sought to develop "peer groups" based on "neutral" service area and distribution characteristics before undertaking comparative evaluation within groups. Service area population was a key variable. The substitute, urban area population, used in Section 15 reporting was not adequate for making clear distinctions between systems and thus, "peer group" development using Section 15 data was not successful. However, using WSDOT data, and two alternative statistical methods, relative "peer groups" for Washington were defined and a comparative assessment of peer group performance was presented. No comparative assessment of individual systems was made.

To support and expedite performance improvements in Washington State, there are a number of research and technical studies that should be considered:

- An important technical study would be to improve on previous work by Smerk and others in designing a small system internal evaluation guide, specific to the needs and issues in Washington.
- A technical study directed at improving route analysis procedures for mid-sized and small systems would be beneficial.
- Research and applied studies are needed in improving forecasting models for revenues, costs and ridership.
- Research is needed in assessing the cost-effectiveness of transit and determining impacts associated with service reductions.
- Research and technical studies are needed in the area of transit agency sponsorship of and integration with ridesharing programs in low-density areas.
- A feasibility/technical study is needed to assess cost, benefits, and impacts associated with having several small systems integrate their computer assisted analysis programs.

- Finally, continued research in the development of transit "peer groups" and their performance is warranted. Problems encountered in using Section 15 data can be overcome and by experimenting with alternative approaches to classification, it is proposed that defensible "peer groups" can be defined.

In closing, it can be said that beginning in the 1970's Washington State clearly recognized a need and supported public transit in becoming a viable element of the transportation system. Washington State in the 1980's is recognizing another need -- that is, to continue improvements in transit service will require that more careful attention be given to performance evaluation which will encourage greater efficiency and effectiveness of service delivery.

1. Allen, Bruce W., The Productivity and Efficiency of Inputs in the Provision of Transportation Service, Wharton School, prepared for UMTA, U.S. DOT, May 1979 (PB 298 161).

2. Allen, W.G. and F. DiCesare, "Transit Service Evaluation: Preliminary Identification of Variables Characterizing Level of Service," Transportation Research Record 606, Transportation Research Board, 1976.

3. American Public Transit Association, Transit Fact Book, Chicago, IL, Annual Series 1971-80.

4. Anderson, Shirley C. and G.J. Fielding, Comparative Analysis of Transit Performance, Institute of Transportation Studies, University of California, Irvine, Final Report (prepared for UMTA), January 1982.

5. Attanucci, John P. et al., Bus Service Evaluation Study (3 volumes): (with L. Jaeger and J. Becker) Bus Service Evaluation Procedures: A Review, UMTA, April 1979 (PB 79 296314); (with I. Burns and N. Wilson) Bus Transit Monitoring Manual: Vol. I - Data Collection Design, UMTA, August 1981 (PB 82 122227); (with I. Burns and N. Wilson) Bus Transit Monitoring Manual: Vol. II - Sample Size Tables, UMTA, August 1981 (PB 82 122235).

6. Barnum, Darold T. and John M. Gleason, "Measuring the Influence of Subsidies on Transit Efficiency and Effectiveness," U.S. DOT, 1979.

7. Barnum, Darold T. and John M. Gleason, "Drawbacks Inherent in Currently Used Measures of Mass Transit Performance," U.S. DOT, 1980.

8. Barton-Aschman and Associates, The Development of Service Standards and Operating Guidelines for the Delaware Authority for Regional Transit (DART), UMTA, U.S. DOT, 1979 (PB 80 196322).

9. Booz-Allen and Hamilton, New York MTA Management Study, Vol. 1, Summary Report, prepared for UMTA, U.S. DOT, January 1980 (PB 81 199416).

10. Booz-Allen and Hamilton and ATE, SEPTA Management Study, prepared for U.S. DOT, May 1978 (PB 285 010).

11. Cervero, Robert B. et al., Efficiency and Equity Implications of Alternative Transit Fare Policies, University of California, Los Angeles, prepared for U.S. DOT, September 1980 (PB 80 224710).

12. Drosdat, Herbert A., "Transit Performance Measures: Their Significance in Local Funding Allocation," Ph.D. Dissertation, University of Washington, Seattle, 1977.

13. Fielding, Gordon J., R.E. Glauthier and C.A. Lave, Development of Performance Indicators for Transit: Final Report, December, 1977 (PB 278 678).

14. Fielding, Gordon J. et al., The Effect of Organization Size and Structure on Transit Performance and Employee Satisfaction, University of California, Irvine, UMTA-CA-11-0016-71-1, December 1978.

15. Fielding, Gordon J. and William M. Lyons, "Performance Evaluation for Discretionary Grant Programs," Transportation Research Record 797, Transportation Research Board, 1981, PB 299 369.

16. Fielding, Gordon J., S.R. Mundle and J. Misner, "Performance Based Funding Allocation Guidelines for Transit Operators in Los Angeles County," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

17. Fuller, Ernest, Performance Measures for Public Transit Service, California State Department Department of Transportation, prepared for U.S. DOT, October 1978 (PB 291 032).

18. Gilbert, Gorman and J.S. Dajani, "Measuring the Performance of Transit Service," Center for Policy Analysis, Duke University, 1975.

19. Giuliano, Genevieve M., "Transit Performance: The Effect of Environmental Factors on theEfficiency of Public Transit Service," Transportation Research Record 797, Transportation Research Board, 1981.

20. Glauthier, R. and G. Fielding, "Distribution and Allocation of Transit Subsidies in California," Institute of Transportation Studies, University of California, Irvine, September 1976.

21. Glauthier, R. and J.N. Feren, "Evaluating Individual Transit Route Performance," Transit Journal, Vol. 5, American Public Transit Association, 1979.

22. Goldberg, Joel A. et al., Transit Productivity: Improvement Through Management Training and Development, prepared for UMTA, U.S. DOT, June 1979 (PB 299 369).

23. Holec, James M., Dianne S. Schwager and Angel Fandialan, "Use of Federal Section 15 Data in Transit Performance Evaluation: Michigan Program," Transportation Research Record 746, Transportation Research Board, 1980.

24. Holec, James M. and Dianne S. Schwager, "Improving the Usefulness of Section 15 Data for Public Transit," Peat, Marwick, Mitchell & Co., prepared for the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1981.

25. Holec, James M. and Dianne S. Schwager, Draft Evaluation Manual for Mid-Size Transit Systems in the State of Michigan, Peat, Marwick, Mitchell & Co., prepared for Michigan DOT, August 1978.

26. King, T.J., "A Rational Approach to Planning: Tri-Met's Criteria for Service," Transit Journal, Vol. 1, No. 1, February 1975.

27. Loudon, William R. et al., "The Development of Regional, Multimodal Transportation Performance Measures for the Twin Cities," presented at the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1981.

28. Meyer, John R. and Jose A. Gomez-Ibanez, "Improving Urban Analysis of Productivity in Transportation Industries," Department of City Planning, Harvard University, Cambridge, MA, 1975.

29. National Committee on Urban Transportation, Recommended Standards, Warrants, and Objectives for Transit Service and Facilities, Public Administration Service, Chicago, IL, 1958.

30. San Diego Metropolitan Transit Development Board, "Service Concept Element of Five Year Plan," San Diego, CA, August 1979.

31. Seattle Metro, Comprehensive Plan for Public Transportation, 1972-1990, as amended in 1981, Seattle, WA.

32. Smerk, George et al., Handbook for Management Performance Audits: Vols. 1-4, U.S. DOT, October 1979.

33. Smerk, George M., Urban Mass Transportation: A Dozen Years of Federal Policy, Indiana University Press, Bloomington, IN, 1974.

34. Simpson and Curtin with the University of Pennsylvania, Transit System Performance Evaluation and Service Change Manual, prepared for Pennsylvania DOT and UMTA, U.S. DOT, February 1981.

35. Sinha, K.C. et al., A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity (3 volumes): Vol. 1 (with Jukins) - Definition and Measurement; Vol. 2 (with Dobry) - Labor Aspects; Vol. 3 (with Bhandari) - Analysis of Options to Improve Performance. Purdue University, prepared for UMTA, U.S. DOT, 1978 (PB 295 220-223).

36. Stone, Thomas J. et al., Application of Transit Performance Indicators, University of Utah, UMTA-UT-11-0001-79-1, September 1979.

37. Stokes, B.R., "The Need for and Use of Performance Indicators in Urban Transit," Transit Journal, American Public Transit Association, Winter 1979.

38. Tomazinis, Anthony R., Productivity, Efficiency and Quality in Urban Transportation Systems, Lexington Books, Lexington, MA, 1975.

39. Tidewater Transportation District Commission, "Prototype Bus Service Evaluation System," prepared for UMTA, U.S. DOT, April 1981.

40. Washington State Department of Transportation, Public Transportation in Washington: A Summary Report, Public Transportation and Planning Division, WSDOT, Olympia, 1981.

41. Wilbur Smith and Associates, Measures of Effectiveness of Transportation System Management, UMTA, U.S. DOT, April 1981 (PB 81 233884).

42. Urban Consortium and Urban Mass Transportation Administration, Proceedings of the First National Conference on Transit Performance, U.S. DOT, Norfolk, VA, September 1977.

43. Urban Mass Transportation Administration, Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System, Project FARE -- Task V, Volume 1 -- General Description, U.S. DOT, July 1976.

44. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: First Annual Report on Section 15 Reporting System, U.S. DOT, November 1981.

45. Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: Second Annual Report on Section 15 Reporting System, U.S. DOT, June 1982.

46. United States General Accounting Office, Soaring Transit Subsidies Must be Controlled, Report to Congress, Washington, D.C., February 1981 (PB 81 237144).

47. Vuchic, Vukan R. et al., Transit Operating Manual, Pennsylvania DOT, Pub. No. 150, 1975.

48. Zerrillo, Robert J., "Use of Service Evaluation Plans to Analyze New York State Transit Systems," Transportation Research Record 797, Transportation Research Board, 1981.

Abkowitz, Mark, Transit Service Reliability, Transportation Systems Center, Cambridge, MA, December 1978 (PB 265-744).

Abrams, E.M. and H.J. McLaughlin, Jr., "Incentive Program for Bus Carriers," Transportation Research Record 663, Transportation Research Board, 1978.

Allen, Bruce W., The Productivity and Efficiency of Inputs in the Provision of Transportation Services, Wharton School, prepared for UMTA, U.S. DOT, May 1979 (PB 298 161).

Allen, W.G. and F. DiCesare, "Transit Service Evaluation: Preliminary Identification of Variables Characterizing Level of Service," Transportation Research Record 606, Transportation Research Board, 1976.

Altschuler, Alan et al., The Urban Transportation System: Politics and Policy Innovation, MIT Press, February 1980.

American Public Transit Association (APTA), Transit Fact Book, Chicago, IL, Annual Series 1971-1980.

American Public Transit Association (APTA), "Indicators: Measuring Productivity," Passenger Transport, Vol. 35, No. 44, November 4, 1977.

Anderson, Shirley C. and G.J. Fielding, Comparative Analysis of Transit Performance, Institute of Transportation Studies, University of California, Irvine, Final Report (prepared for UMTA), January 1982.

Attanucci, John P., Leora Jaeger and Jeff Becker, Bus Service Evaluation Procedures: A Review, Report No. UMTA-MA-09-7001-79-1, Massachusetts Bay Transportation Authority, March 1979.

Attanucci, J.P., Nigel Wilson, B. McCollom and I. Burns, "Design of Bus Transit Monitoring Programs," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Baker, M.M. et al., "Role and Effectiveness of Contract Management in the Transit Industry," Urban Transportation Program, Marquette University, Milwaukee, WI, 1975.

Barbour, L.C. and R.J. Zerrillo, "Transit Performance in New York State," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Barnum, Darold T. and John M. Gleason, "Measuring the Influence of Subsidies on Transit Efficiency and Effectiveness, U.S. DOT, 1979.

Barnum, Darold T. and John M. Gleason, "Drawbacks Inherent in Currently Used Measures of Mass Transit Performance," U.S. DOT, 1980.

Barton-Aschman and Associates, The Development of Service Standards and Operating Guidelines for the Delaware Authority for Regional Transit (DART), prepared UMTA, U.S. DOT, 1979 (PB 80 196322).

Berkshire Regional Planning Commission, "Transit Service Evaluation," Berkshire Regional Transit Authority, prepared for UMTA, U.S. DOT, 1979.

Berry, Brian J. (ed.), City Classification Handbook: Methods and Applications, Wiley Interscience, New York, NY, 1972.

Bhandari, Anil S., "Analysis of Options to Improve Transit Performance," Ph.D. Dissertation, Purdue University, 1979.

Bhandari, A.S. and K.C. Sinha, "Impact of Short-Term Service Changes on Urban Bus Transit Performance," Transportation Research Record 718, Transportation Research Board, 1979.

Billheimer, John W. et al., Evaluation Handbook for Transportation Impact Assessment, Systan, Inc., Los Altos, CA, December 1980 (PB 81 192155).

Booz-Allen and Hamilton, New York MTA Management Study, Vol. I, Summary Report, prepared for UMTA, January 1980 (PB 81 199416).

Booz-Allen and Hamilton and ATE, SEPTA Management Study, prepared for U.S. Department of Transportation, May 1978 (PB 285 010).

Cervero, Robert B. et al., Efficiency and Equity Implications of Alternative Transit Fare Policies, University of California, Los Angeles, prepared for U.S. Department of Transportation, September 1980 (PB 80 224710).

Cervero, R.B., "A Multi-Stage Approach for Refining Transit Cost Allocations," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Cherwony, W, L. Polin and S. Mundle, "Transit Performance in the I-35W Urban Corridor Demonstration Project," Transportation Research Record 626, Transportation Research Board, 1977.

Cherwony, W. and S.R. Mundle, "Transit Cost Allocation Model Development," Transportation Engineering Journal, American Society of Civil Engineers, January 1980.

Cherwony, Walter and M.G. Ferreri, "Strategic Planning as a Transit Management Tool," paper presented at the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1981.

Cox, Wendell, "The Distribution of Public Transit Subsidies in Los Angeles County," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Dajani, J.S. and G. Gilbert, "Measuring the Performance of Transit Systems," Transportation Planning and Technology, Vol. 4, No. 2, January 1978.

Drosdat, Herbert A., "Transit Performance Measures: Their Significance in Local Funding Allocation," Ph.D. Dissertation, University of Washington, 1977.

Dueker, Kenneth J. et al., Public Transportation Planning Effectiveness: Case Studies, University of Iowa, Iowa City, IA, December 1977 (PB 300 148).

Duiker, Tracy E., "Partnership in Funding Public Transit: Seattle Metro," paper prepared for the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1981.

Emerson, N.H., Current Trends and Issues in Public Transportation, Department of Civil Engineering, Hawaii University, Report No. CETP-TS-78-1, March 1978.

Fielding, Gordon J., R.E. Glauthier and C.A. Lave, Development of Performance Indicators for Transit: Final Report, December 1977 (PB 278 678).

Fielding, Gordon J. and R.E. Glauthier, "Obstacles to Comparative Evaluation of Transit Performance," Institute of Transportation Studies, University of California, Irvine, April 1977.

Fielding, Gordon J. et al., The Effect of Organization Size and Structure on on Transit Performance and Employee Satisfaction, Institute of Transportation Studies, University of California, Irvine, UMTA-CA-11-0016-79-1, December 1978.

Fielding, Gordon J. and William M. Lyons,"Performance Evaluation for Discretionary Grant Transit Programs," Transportation Research Record 797, Transportation Research Board, 1981, PB 299 369.

Fielding, G.S., S.R. Mundle and J. Misner, "Performance-Based Funding Allocation Guidelines for Transit Operators in Los Angeles County," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Forkenbrock, David J., "Transit Performance Measures and Local Objectives: State-Level Policy Considerations," Transportation Research Record 813, Transportation Research Board, 1981.

Fuller, Ernest, Performance Measures for Public Transit Service, California State Department of Transportation, prepared for U.S. Department of Transportation, October 1978 (PB 291 032).

Gallagher, J.S., "What Is Holding Back the Development of New Transit Systems?", Metropolitan, Vol. 65, September 1969.

Gilbert, Gorman and J.S. Dajani, "Measuring the Performance of Transit Service," Center for Policy Analysis, Duke University, 1975.

Giuliano, Genevieve M., "Transit Performance: The Effect of Environmental Factors on the Efficiency of Public Transit Service," Transportation Research Record 797, Transportation Research Board, 1981.

Glauthier, R. and J.N. Feren, "Evaluating Individual Transit Route Performance," Transit Journal, Vol. 5, American Public Transit Association, 1979.

Glauthier, R. and G. Fielding, "Distribution and Allocation of Transit Subsidies in California," Institute of Transportation Studies, University of California, Irvine, September 1976.

Gobb, T.F., E.T. Canty and R.L. Gustafson, Classification of Metropolitan Areas for the Study of New Systems of Arterial Transportation, Research Publication GMR-1225, General Motors Research Laboratories, Transportation Research Department, Warren, MI, August 1972.

Goldberg, Joel A. et al., Transit Productivity: Improvement Through Management Training and Development, prepared for UMTA, U.S. DOT, June 1979 (PB 299 369).

Gray, George E. and Lester A. Hoel (eds.), Public Transportation Planning, Operations and Management, Prentice-Hall, 1979.

Griener, J.M. et al., "Monitoring the Effectiveness of State Transportation Services," U.S. DOT, Washington, D.C., 1977.

Guenther, R.P. and K.C. Sinha, "Maintenance, Schedule Reliability, and Transit Performance," paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Guseman, P.K. and K.N. Womack, "Evaluation of Service Improvements: Measures of System Effectiveness," Texas Transportation Institute, Texas A&M University, November 1978.

Heathington, Kenneth W., "Evaluation of Urban Public Transportation," University of Tennessee, Knoxville, 1975.

Heaton, C., "Designing a Transit Performance Measurement System," Transit Journal, Vol. 6, American Public Transit Association, 1980.

Holec, James M., Dianne S. Schwager and Angel Fandialan, "Use of Federal Section 15 Data in Transit Performance Evaluation: Michigan Program," Transportation Research Record 746, Transportation Research Board, 1980.

Holec, J.M. and D.S. Schwager, "Improving the Usefulness of Section 15 Data for Public Transit," paper prepared for the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1981.

Holec, James M. and Dianne S. Schwager, "Statewide Transit Evaluation in Michigan," prepared for U.S. DOT, July 1981.

Hollinden, A., R. Blair and D.J. McKelvey, Comparisons of Productivity of Four Modes of Service in Orange County, California, Special Report No. 184, Transportation Research Board, 1979.

Horn, Kevin H., Transit Authority Boards of Directors: Membership, Organization, Functions and Performance, Pennsylvania Transportation Institute, University Park, PA, October 1976 (PB 292 152).

Jukin, D.P. and K.C. Sinha, Bibliography on Project Evaluation and Priority Programming Criteria, Circular No. 213, Transportation Research Board, Washington, D.C., January 1980.

King, R.L. and N.S. Erlbaum, "Factors Influencing Transit Productivity," New York State DOT, Albany, NY, August 1977.

King, T.J., "A Rational Approach to Planning: Tri-Met's Criteria for Service," Transit Journal, Vol. 1, No. 1, February 1975.

Knautz, D.D., A Vital Phase of Transit Evolution: Management Information Systems, Special Report 187, Transportation Research Board, 1980.

Lago, Armando M. et al., Patronage Impacts of Change in Transit Fares and Services, Ecosometrics, Inc., Bethesda, MD, prepared for U.S. DOT, September 1980 (PB 81 167652).

Lave, Charles A. and Randall J. Pozdena, Jr., "Statistical Analysis of Transit Performance," Institute of Transportation Studies, University of California, Irvine, December 1977.

Lave, Charles A. and Kenneth M. Chawitz, "Part-Time Labor, Work Rules and Transit Cost," Institute of Transportation Studies, University of California, Irvine, 1981.

Lee, Douglas, Impacts of Subsidies on Transit Efficiency, University of Iowa, Iowa City, IA, October 1978 (PB 300 416).

Levinson, Herbert S., Bus Route and Schedule Planning Guidelines, NCHRP Report No. 69, Transportation Research Board, Washington, D.C., May 1980.

Lieb, Robert C., "Labor in the Transportation Industries," College of Business Administration, Northeastern University, Boston, MA, February 1973.

Loudon, William R. et al., "The Development of Regional, Multimodal Transportation Performance Measures for the Twin Cities," presented at the 60th Annual Meeting of the Transportation Research Board, Washington, D.C., 1981.

McCrossen, Dennis F., "Choosing Performance Indicators for Small Transit Systems," Transportation Engineering, Vol. 48, No. 3 (March, 1978).

McShane, W.P. et al., "Transit Ridership in an Intense Transit Environment," Transportation Research Record 746, Transportation Research Board, 1980.

Meyer, John R. and Jose A. Gomez-Ibanez, "Improving Urban Analysis of Productivity in Transportation Industries," Department of City Planning, Harvard University, Cambridge, MA, 1975.

Miller, David R., "Cost Functions in Urban Transportation," Ph.D. Dissertation, Northwestern University, Evanston, IL, August 1967.

Miller, D.R.,"Measuring the Efficiency of Public Enterprises," Transportation (Netherlands), Vol. 8, March 1979.

Miller, J.H., "The Use of Performance-Based Methodologies for the Allocation of Transit Operating Funds," Traffic Quarterly, Vol. 34, 1980.

Multisystems, Inc. with ATE Management and Service Co., Inc., Bus Transit Monitoring Manuals (2 volumes), UMTA, U.S. DOT, Washington, D.C., August 1981.

Mundle, S.R. and W. Cherwony, "Diagnostic Tools in Transit Management, Transportation Research Record 746, Transportation Research Board, 1980.

National Committee on Urban Transportation, Recommended Standards, Warrants, and Objectives for Transit Service and Facilities, Public Administration Service, Chicago, IL, 1958.

Nelson, K.E. and W.C. Nevel, "Cost Effectiveness Analysis of Public Transit Systems," Traffic Quarterly, Vol. 33, April 1979.

New York DOT, Public Transportation Operating Assistance: Evaluation and Options: Summary Report, Albany, NY, January 1975.

Perry, James L. and Harold L. Angle, "The Impact of Labor Management Relations on Productivity and Efficiency in Urban Mass Transit," University of California, Irvine, March 1980.

Phifer, Susan P., Use of Sampling in Bus Line Data Collection, paper presented at the 61st Annual Meeting of the Transportation Research Board, Washington, D.C., January 1982.

Prosperi, D.C., "Portfolio Model of Resource Allocation for the Transit Firm," Transportation Research Record 746, Transportation Research Board, 1980.

Public Technology, Inc., "Transit Actions: Techniques for Improving Productivity and Performance," Washington, D.C., 1981.

Pushkarev, B.S. and J.M. Zupan, Public Transportation and Land Use Policy, Indiana University Press, Bloomington, IN, 1977.

Reichert, J.P., "Wanted: National Policy on Suburban Transit," Transit Journal, Vol. 5, American Public Transit Association, 1979.

Saito, Doyle S., "Seattle Metro Transit: A Case Study of Operational Efficiency 1973-80, with Comments on 1990 Projections," unpublished Master's Thesis, Department of Civil Engineering, University of Washington, Seattle, 1981.

San Diego Metropolitan Transit Development Board, "Service Concepts of Five Year Plan," San Diego, CA, August 1979.

Scheppach, Raymond C. and L.C. Woehlekes, Transportation Productivity, Lexington Books, D.C. Heath and Co., Lexington, MA, 1975.

Schofer, Joseph L., "Evaluating Transportation Alternatives," paper presented at Seminar on Emerging Transportation Planning Methods, U.S. DOT, Daytona Beach, FL, December 1976.

Seattle Metro, Comprehensive Plan for Public Transportation, 1972-1990, Seattle, WA, as amended, 1981.

Simpson and Curtin, Standards for Bus Service Contract Payments and a System of Incentives, Philadelphia, PA, December, 1976 (PB 269 054).

Simpson and Curtin (with University of Pennsylvania), Transit System Performance Evaluation and Service Change Manual, prepared for Pennsylvania DOT and UMTA, U.S. DOT, February 1981.

Sinha, K.C. and Richard P. Guenther, Field Applications and Evaluations of Bus Transit Performance Indicators, Purdue University, Report No. CE-TRA-81-1, March 1981.

Sinha, K.C. et al., A Comprehensive Analysis of Urban Bus Transit Efficiency and Productivity (3 volumes): Vol. 1 (with Jukins) - Definition and Measurement; Vol. 2 (with Dobry) - Labor Aspects; Vol. 3 (with Bhandari) - Analysis of Options to Improve Performance. Purdue University, prepared for UMTA, U.S. DOT, 1978 (PB 295 220-223).

Sloan, Anthony R., Managing SEPTA (Southeastern Pennsylvania Transportation Authority) Strategically, SEPTA, Philadelphia, PA, September 1979 (PB 80 123649).

Smerk, George et al., Handbook for Management Performance Audits: Vols 1-4, U.S. DOT, October 1979.

Smerk, George M., Urban Mass Transportation: A Dozen Years of Federal Policy, Indiana University Press, Bloomington, IN, 1974.

Smith, I.P. and N. Einstein, Barriers to the Diffusion of Innovation in the Transit Industry, prepared for U.S. DOT, Washington, D.C., 1980 (PB 80 161508).

Stephandes, Torgos J. et al., Techniques for Analyzing the Performance of Rural Transit Systems (2 volumes), Dartmouth College, Hanover, NH, prepared for UMTA, U.S. DOT, October 1980.

Stokes, B.R., "The Need for and Use of Performance Indicators in Urban Transit," Transit Journal, American Public Transit Association, Winter 1979.

Stone, Thomas J. et al., Application of Transit Performance Indicators, University of Utah, UMTA-UT-11-0001-79, September 1979.

Tidewater Transportation District Commission, "Prototype Bus Service Evaluation System," prepared for UMTA, U.S. DOT, April 1981.

Tomazinis, Anthony R., Productivity, Efficiency and Quality in Urban Transportation Systems, Lexington Books, Lexington, MA, 1975.

Transportation Research Board, Transit Boards -- Composition, Roles and Procedures, NCHRP Synthesis No. 75, Washington, D.C., 1981.

Transportation Research Board, State Transit Management Assistance to Local Communities, NCHRP Synthesis No. 74, Washington, D.C., 1980.

Underwood, W.C., "Performance Indicators: A Necessary Tool?", Transit Journal, American Public Transit Association, Winter 1979.

Underwood William C. et al., "Procedures for the Financial Analysis of Transit Operations in Assistance Grant Requests," Pennsylvania DOT, January 1976.

United States Department of Transportation, Public Transportation Planning Manual, Draft Report, prepared by COMIS Corp., 1978.

United States Department of Transportation, Transportation System Management: State of the Art, Washington, D.C., February 1977.

United States General Accounting Office, Soaring Transit Subsidies Must Be Controlled, Report to Congress, Washington, D.C., February 1981 (PB 81 237144).

Urban Consortium for Technology Initiatives, "Transit System Productivity," U.S. DOT, Washington, D.C., March 1977.

Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. DOT, June 1982.

Urban Mass Transportation Administration, National Urban Mass Transportation Statistics: First Annual Report, Section 15 Reporting System, U.S. DOT, November 1981.

Urban Mass Transportation Administration, Proceedings of the First National Conference on Transit Performance, U.S. DOT, Norfolk, VA, September 1977.

Urban Mass Transportation Administration, A Transit Operating Performance and the Impact of Section 5 Programs, U.S. DOT, Washington, D.C., November 1976.

Urban Mass Transportation Administration, Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System, Project FARE -- Task V, Volume 1 -- General Description, U.S. DOT, Washington, D.C., July 1976.

Urban Mass Transportation Administration with Public Technology, Inc., Transit Actions, periodic information briefs on transit management, U.S. DOT, Washington, D.C.

Vuchic, Vukan R. et al., Transit Operating Manual, Pennsylvania DOT, Pub. No. 150, 1975.

Washington State Department of Transportation, Public Transportation Financing Alternatives, A Legislative Report, January 1979.

Washington State Transit Association, "A Case Study of the Possibility of Consensus on Performance Indicators by Transit Managers," Olympia, WA, July 1979.

Weiss, D.L., "Citizen Options of Public Transportation Roles, Services, and Financing, Transportation Research Record 590, Transportation Research Board, 1976.

Wilbur Smith and Associates, Measures of Effectiveness of Transportation System Management, UMTA, U.S. DOT, April 1981 (PB 81 233884).

Winnie, Richard E. and H.P. Hatry, "Measuring the Effectiveness of Local Government Services: Transportation," The Urban Institute, Washington, D.C., 1972.

Yunich, David, "Efficiency and Productivity in Public Transportation," Transit Journal, Vol. 2, No. 4, 1976.

Zerrillo, Robert J., "Use of Service Evaluation Plans to Analyze New York State Transit Systems," Transportation Research Record 797, Transportation Research Board, 1981.

Zerrillo, R.J. and L.C. Barbour, "The Use of Service Quality Measures to Evaluate Transit Performance," Transit Program and Evaluation Bureau, New York DOT, August 1981.

DEFINITIONS

Amortization

The act of fully depreciating a capital cost or debt over a period of time.

Auxiliary transportation revenues

Revenue earned that is closely associated with the transportation of passengers, but not related to fares (e.g., advertising, station and vehicle concessions).

Charter service

Transprotation service provided on an exclusive basis by a vehicle that is available for the trip or a certain period of time, depending on contractual arrangements.

Deadhead

To move a revenue vehicle without passengers or cargo on board (e.g., on a regular route to and from a garage or from the end of one revenue route to the beginning of another).

Depreciation

A decrease in value of property through wear, deterioration, or obsolescence.

Fare revenue

Revenues paid from fare-paying passengers along regularly scheduled routes or from demand-responsive service.

Gallons of fuel consumed

The gallons of fuel consumed by all vehicles during the reporting period.

Layover time

The time a vehicle is out of service, usually at the end of a route, to provide a recovery period in case the bus is behind schedule, or as a rest period for the operator.

Missed runs

Any part of a run in which scheduled revenue service is not provided for any reason. The usual reasons are breakdowns, accidents, or excessive traffic delays.

Nonfare paying passengers

Passengers who (1) do not pay a fare, (2) do not purchase tokens or passes, or (3) are not covered by a service contract. This includes passengers who transfer at no cost.

Nonservice mileage

All the miles accumulated by the transit system except revenue miles (e.g., deadhead miles, training miles, etc.)

Number of accidents

The number of occurrences of any accident that results in any amount of property damage, or personal injury to any individual or individuals.

Number of road calls

The total number of interruptions of revenue service caused by a maintenance-related vehicle failure, either a mechanical failure or "other" failure (tire failure, farebox failure, air conditioning, etc.) as defined in the Uniform System of Accounts and Records and Reporting System, Volume II, page 8.5-1. These interruptions require assistance from someone other than the revenue vehicle operator or crew to put the vehicle back in service.

Operating employee hours

The sum of the hours worked by all operating employees (e.g., drivers, dispatcher, etc.) during the reporting period. Excludes maintenance employees.

Operating expense

The total of all expenses to operate the transit system during the reporting period, except capital.

Peak hour fleet

The largest number of revenue vehicles in scheduled operation at any one time during a normal day of operation.

Property

Synonymous with transit system or authority. Commonly used term in the transit industry that originated when transit was a private utility.

Retired vehicles awaiting disposal

Vehicles that are no longer used for service, even if they are still operable. Frequently, these are kept for spare parts.

Revenue

The total revenue earned from the transit system operation during the reporting period. Includes fares, charter service, contract service, and auxiliary transportation revenues. (Defined and identified by Revenue Object Classes 401-410 for Section 15 reporting requirements.)

Revenue passengers

All passengers who pay a fare to use the service. Includes passengers who pay with cash, use passes or tokens, and passengers whose trips are paid for by contract. Excludes nonfare paying passengers and transfer passengers even if they pay a transfer fee.

<u>Revenue seat miles</u>

For systems with 35 buses or fewer: the sum of the products of revenue vehicle miles times the number of seats on each bus of every bus in the fleet.

For systems with more than 35 buses: revenue vehicle miles times the average number of seats on the revenue vehicles in the fleet operated during the period.

<u>Revenue vehicle</u>

A vehicle that is used to carry passengers. Excludes maintenance or supervisory vehicles that may be necessary, but to not bring in revenue.

<u>Revenue vehicle hours</u>

The sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period. Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

<u>Revenue vehicle miles</u>

The total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period. Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus mileage, and mileage lost due to missed runs.

<u>Service area population</u>

The entire population residing within the legal operating limits of the transit operator.

<u>Spare vehicles</u>

Vehicles that are available for service, but are not used during the peak demand period. Spare vehicles equals total available vehicles minus peak hour fleet.

<u>Total passengers</u> (unlinked)

The total of all passengers during the reporting period. Includes regular passengers, transfer passengers, and nonfare paying passengers. This is defined as unlinked passenger trips when identified for Section 15 reporting requirements.

<u>Total vehicle hours</u>

The total hours of operation by revenue vehicles during the reporting period. Includes nonservice hours (travel to and from storage facilities and deadhead travel), and charter service hours.

<u>Total vehicle miles</u>

The total mileage incurred by all revenue vehicles during the reporting period.

Total vehicles

The total number of vehicles available for revenue service during the recording period. Excludes retired vehicles awaiting disposal, vehicles in extended maintenance or rebuilding, vehicles used early in the reporting period and disposed of at the end of the period, etc. It shall be considered available if it is capable of being used, even if not used.

Unlinked passengers (same as total passengers)

The total of all passengers during the reporting period. Includes regular passengers, transfer passengers, and nonfare paying passengers. This is defined as unlinked passenger trips when identified for Section 15 reporting requirements.

Vehicles operating during period

The number of vehicles actually used for revenue service during the recording period. Excludes retired vehicles awaiting disposal, vehicles in extended maintenance or rebuilding, vehicles used early in the reporting period and disposed of at the end of the period, etc.

Table of Contents

Operating Expense/Revenue Vehicle Hours

Definitions

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Revenue vehicle hours--the sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period.

Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

Use

This measure shows how efficiently the operator is providing basic service. A low ratio is preferable.

Influencing Factors

** Cost
** Frequency of service
** Hours of operation
** Inflation
** Operating speed
** Total route miles

Operating Expense/Revenue Vehicle Miles

Definitions

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Revenue vehicle miles--the total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period.

Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus mileage, and mileage lost due to missed runs.

Use

This measure shows how efficiently the operator is providing basic service. A low ratio is preferable.

Influencing Factors

** Cost
** Frequency of service
** Hours of operation
** Inflation
** Operating speed
** Total route miles

Operating Expense/Total Vehicle Hours

Definitions

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Total vehicle hours--the total hours of operation by revenue vehicles during the reporting period.

Includes nonservice hours (travel to and from storage facilities and deadhead travel), and charter service hours.

Use

This measure indicates how efficiently the operator is providing basic service. A low ratio is preferable.

Influencing Factors

** Cost
** Deadhead mileage
** Frequency of service
** Inflation
** Nonservice mileage
** Total route miles

Operating Expense/Total Vehicle Miles

Definitions

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Total vehicle miles--the total mileage incurred by all revenue vehicles during the reporting period.

Includes nonservice mileage (travel to and from storage facilities and deadhead travel), and charter service mileage.

Use

This measure indicates how efficiently the operator is providing basic service. A low ratio is preferable.

Influencing Factors

** Cost
** Deadhead mileage
** Frequency of service
** Inflation
** Nonservice mileage
** Total route miles

Operating Expense/Revenue Seat Miles

Definitions

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Revenue seat miles--for systems with 35 buses or fewer: the sum of the products of revenue vehicle miles times the number of seats on each bus for every bus in the fleet.

For systems with more than 35 buses: the average revenue vehicle miles per bus times the average number of seats on the revenue vehicles in the fleet operated during the period.

Use

This measure shows how efficiently the operator is providing basic service without being influenced by vehicle size, which may differ significantly between large and small properties. A low ratio is preferable.

Influencing Factors

** Cost
** Inflation
** Frequency of service
** Total route miles
** Vehicle capacity

Revenue/Total Passengers

Definitions

Revenue--the total revenue earned from the transit system operation during the reporting period.

Includes fares, charter service, contract service, and auxiliary transportation revenues (defined and identified by Revenue Object Classes 401-410 for section 15 reporting requirements).

Total passengers--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Use

This measure shows the average revenue the transit system receives for providing the basic unit of consumed service.

A higher ratio is preferable for this measure.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Marketing program
** Quality of service
** Total route miles
** Transit demand

Revenue/Operating Expense

Definitions

Revenue--total revenue earned from the transit system operation during the reporting period.

Includes fares, charter service, contract service, and auxilliary transportation revenues (defined and identified by Revenue Object Classes 401, 402, 404-406 for section 15 reporting requirements).

Operating expense--the total of all expenses to operate the transit system during the reporting period, except capital.

Excludes depreciation and amortization.

Use

This measure shows the transit system's overall level of revenue production. A ratio of 1.0 indicates that the system is breaking even. Transit systems do not expect to go over 1.0, but would like to come as close as possible.

Influencing Factors

** Auxilliary transit services
** Charter and contract service
** Cost
** Fare collection procedures
** Fares
** Inflation
** Total passengers

Fare Revenue/Operating Expense

Definitions

Fare revenue--revenues paid from fare-paying passengers along regularly scheduled routes or from demand-responsive service.

Includes base fares, zone fares, transfer fares, prepaid fares, park-and-ride charges, and any special fares during the reporting period.

Operating expense--the total of all expenses to operate the transit system during the reporting period.

Excludes depreciation and amortization.

Use

This measure shows how much the basic service financially supports the total operation. This is often referred to as "the operating ratio." A high (operating) ratio is preferable.

Influencing Factors

** Cost
** Fare collection procedures
** Fares
** Inflation
** Total passengers

Passengers (Unlinked)/Transfer Passengers

Definitions

Passengers (unlinked)--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Transfer passengers--the total of all passengers who transfer to a line or route after riding another line or route as part of their same trip.

Includes passengers who pay a transfer fee, or those who transfer for free.

Use

This measure indicates convenience to passengers. A high percentage indicates that many passengers require more than one ride to get from their origin to their destination. This may happen because routes are not designed to directly connect important traffic generators. A low percentage is preferable.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Marketing program
** Quality of service
** Route design
** Total route miles
** Transit demand

Total Passengers/Revenue Vehicle Hours

Definitions

Total passengers--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Revenue vehicle hours--the sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period.

Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

Use

This measure indicates how many produced units of transit service that transit patrons have consumed. A high ratio is preferable.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Hours of operation
** Marketing program
** Quality of service
** Total route miles
** Transit demand

Total Passengers/Revenue Vehicle Miles

Definitions

Total passengers--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Revenue vehicle miles--the total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period.

Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus mileage, and mileage lost due to missed runs.

Use

This measure indicates how many produced units of transit service that transit patrons have consumed. A high ratio is preferable.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Marketing program
** Quality of service
** Total route miles
** Transit demand

Total Passengers/Vehicles Operated During Period

Definitions

Total passengers--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Vehicles operated during period--the number of vehicles actually used for revenue service during the recording period.

Excludes retired vehicles awaiting disposal, vehicles in extended maintenance or rebuilding, vehicles used early in the recording period and disposed of at the end of the period, etc. (You may not count a vehicle in extended maintenance because, even though you expect to use the vehicle again, it was not available for service during the period.)

Use

This measure shows how much patrons are using the existing equipment. A high ratio may indicate an efficient operation while a low ratio may indicate low ridership or an excess quantity of equipment.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Marketing program
** Quality of service
** Total route miles
** Transit demand

Total Passengers/Service Area Population

Definitions

Total passengers--the total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for section 15 reporting requirements.

Service area population--the entire population residing within the legal operating limits of the transit operator.

Use

This measure indicates the level of community support for the transit system. It does not distinguish between a large group of occasional users or a small group of regular users. A high ratio is preferable in this measure.

Influencing Factors

** Auto disincentives
** Density of service area population
** Fares
** Frequency of service
** Marketing program
** Quality of service
** Service area
** Total route miles
** Transit demand

Number of Accidents/1,000 Miles

Definitions

Number of accidents--the number of occurrences of any accident that results in any amount of property damage, or personal injury to any individual or individuals.

1,000 miles--the total mileage incurred by all vehicles during the reporting period, divided by 1,000.

Includes nonservice mileage.

Use

This measure shows the degree of operating ability of the transit system operators and the level of safety they have achieved. The smallest possible ratio is preferable.

Influencing Factors

** Operator's ability
** Operator's experience
** Operator's training
** Street condition
** Terrain
** Traffic congestion
** Vehicle maintenance
** Weather

Number of Road Calls/1,000 Miles

Definitions

Number of road calls--the total number of interruptions of revenue service caused by a maintenance - related vehicle failure - either a mechanical failure or an "other" failure (tire failure, farebox failure, air conditioning, etc.) as defined in the Uniform System of Accounts and Records and Reporting System, Volume II, page 8.5-1.

These interruptions require assistance from someone other than the revenue vehicle operator or crew to put the vehicle back in service.

1,000 miles--the total mileage incurred by all vehicles during the reporting period, divided by 1,000.

Includes nonservice mileage.

Use

This measure shows the efficiency of the system's maintenance program and the reliability of the transit service. The smallest possible ratio is preferable.

Influencing Factors

** Operator reporting criteria
** Operator techniques
** Operator understanding of mechanical systems
** Street condition
** Terrain
** Traffic congestion
** Vehicle age
** Vehicle inspection
** Vehicle maintenance

Total Vehicle Miles/Gallons of Fuel Consumed

Definitions

Total vehicle miles--the total mileage incurred by all vehicles during the reporting period.

Includes nonservice mileage and charter service mileage.

Gallons of fuel consumed--the gallons of fuel consumed by all vehicles during the reporting period.

Use

This measure indicates how efficiently the service vehicles are being maintained and operated. This measure also can be used along with route miles and storage capacity to determine the reserve supply of fuel in operating days.

Influencing Factors

** Air pollution devices
** Equipment age
** Equipment efficiency
** Equipment maintenance
** Operator practices
** System mileage
** Terrain
** Traffic congestion
** Type of equipment

Revenue Vehicle Miles/Service Area Population

Definitions

Revenue vehicle miles--the total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period.

Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus mileage, and mileage lost due to missed runs.

Service area population--the entire population residing within the legal operating limits of the transit operator.

Use

This measure indicates the accessibility of the service to the general public by comparing units of produced (or available) service to the size of the population in the service area. A higher ratio indicates more service is available for each individual.

Influencing Factors

** Frequency of service
** Service area population
** Total route miles

Revenue Vehicle Miles/Revenue Vehicle Hours

Definitions

Revenue vehicle miles--the total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period.

Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus mileage, and mileage lost due to missed runs.

Revenue vehicle hours--the sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period.

Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

Use

This measure shows the fleet's average miles per hour for scheduled service during the reporting period. The value of the ratio will vary widely depending on local conditions. A higher ratio may indicate a low density population with few passenger stops. A low ratio may indicate densely populated conditions, congested traffic, and frequent passenger stops.

Influencing Factors

** Density of service area population
** Operating speed
** Total passengers
** Traffic congestion
** Transit demand

Total Vehicles Minus Peak Hour Fleet/Peak Hour Fleet

Definitions

Total vehicles--the total number of vehicles available for revenue service during the recording period.

Excludes retired vehicles awaiting disposal, vehicles in extended maintenance or rebuilding, vehicles used early in the recording period and disposed of at the end of the period, etc. It shall be considered available if it is capable of being used, even if you do not.

Peak hour fleet--the largest number of revenue vehicles in scheduled operation at any one time during a normal day of operation.

Use

This measure indicates the availability of replacement vehicles for use in case of breakdowns or accidents. A low ratio indicates a need for more vehicles to guarantee reliability. A ratio that is too high indicates an excess quantity of vehicles.

Influencing Factors

** Drivers' assignments (work schedule)

Revenue Vehicle Hours/Total Vehicles

Definitions

Revenue vehicle hours--the sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period.

Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

Total vehicles--the total number of vehicles available for revenue service during the recording period.

Excludes retired vehicles awaiting disposal, vehicles in extended maintenance or rebuilding, vehicles used early in the recording period and disposed of at the end of the period, etc. It shall be considered available if it is capable of being used, even if you do not.

Use

This measure indicates the level of use of existing equipment. A high ratio may indicate efficient use of equipment, or it may indicate a lack of spare vehicles. A low ratio may indicate excess vehicle supply, or it may only indicate short operating hours.

Influencing Factors

** Frequency of service
** Hours of operation
** Operating speed

Revenue Vehicle Hours/Operating Employee Hours

Definitions

Revenue vehicle hours--the sum of the number of hours each vehicle is scheduled to be in revenue service during the reporting period.

Excludes nonservice hours (deadhead, training, etc.), charter hours, school bus hours, and time lost due to missed runs.

Operating employee hours--the sum of the hours worked by all operating employees (e.g., drivers, dispatcher, etc.) during the reporting period.

Excludes maintenance employees.

Use

This measure shows the relationship between the actual units of service provided and the number of operating employee hours required to provide that service. A ratio of greater than 1.0 is impossible in a conventional transit system that requires one operator per vehicle. A ratio slightly less than 1.0 is considered normal. A lower ratio may indicate that operating employees are spending too much time in deadheading, missed runs, or sitting idle at the garage.

Influencing Factors

** Frequency of service
** Hours of operation
** Number of missed runs
** Number of operating employees
** Number of vehicles

Revenue Vehicle miles/Revenue Vehicles

Definitions

Revenue vehicle miles--total mileage incurred in scheduled service (miles in each route times the number of times each route is run) during the reporting period.

Excludes nonservice mileage (deadhead, training, etc.), charter mileage, school bus runs, and mileage lost due to missed runs.

Revenue Vehicles--the number of active vehicles in the fleet used in revenue service during the reporting period.

Use

This measure indicates the level of revenue vehicle utilization. A high score is preferable for this measure.

Influencing Factors

** Peak/Off peak ratio
** Bus speed (e.g., congestion)
** Trip length
** System mileage
** Headways

Total Passengers/Total Employees

Definitions

Total passengers--total of all passengers during the reporting period.

Includes regular passengers, transfer passengers, and non-fare paying passengers. This is defined as unlinked passenger trips when identified for Section 15 reporting requirements.

Total employees--the average number of operating, maintenance, and general administative employees of the transit system during the reporting period. Part time and contract employeement is calculated to the nearest one-half employee (employee equivalent is 2000 hours per year).

Use

This measure indicates labor force requirements for providing service consumed by transit patrons.

Influencing Factors

** Service characteristics (routes, miles, hours, etc.)
** Marketing program
** Service population
** System seze
** Transit demand
** Travel generation

INTRODUCTION

The purpose of this appendix is to review several alternatives for governing and financing public transportation in the State of Washington. During the 1970's there was a tremendous increase in the number of transit systems in the state and many of the former city-only systems made transitions to regional transit authorities in order to provide service outside of incorporated areas. In 1970 there were only six public transit systems, but by 1981 there were 20 municipal, county and regional systems. [1] This growth and expansion of public transit in Washington was greatly aided by the enabling legislation passed during the early part of the previous decade which provided flexible alternatives for organizing and funding public transit.

During the early part of 1970, state law was adopted recognizing the importance of public transportation to the state. Revised Code of Washington (RCW) 35.95.010 states that:

> "... the maintenance and operation of an adequate public transportation system is an absolute necessity to the economic, industrial and cultural growth, development and prosperity of a municipality and of the state and nation, and to protect the health and welfare of the residents of such municipality and public in general."

In response to this policy statement, state law offers several flexible alternatives by which local governments may organize and fund public transportation. Attachment D-1 provides Revised Code of Washington citations for enabling legislation relative to public transit in general. Table D-1 provides an overview of those organizational alternatives, and the following discussion highlights major differences [2]. Table D-1 lists organization for each system in the state.

METROPOLITAN MUNICIPAL CORPORATIONS

Metros are separate legal entities which are governed by an extensive set of state laws outlining the establishment and performance of metro functions. The proposed metro area may be greater or less than countywide, except in King, Snohomish and Pierce Counties, and must include at least two cities, one of which must be either a first class or optional municipal code city. There are statutory dictates regarding the composition of the metro governing council. The establishment of a metro is subject to a majority voters' approval, as is each function added as a metro responsibility. Seattle Metro is currently providing service under this type of organization.

Table D-1

Overview of Organizational and Management Alternatives

Transit Operating Authority	Manner of Establishment	Governing Body Composition	Possible Service Area Types[a]	Voter Approval Required: Before Conduct of Business	Voter Approval Required For Local Funding: Household and B&O Taxes	OR Sales Tax (.1%, .2%, or .3%)	Local Funding Available for Motor Vehicle Excise Taxes Match (Up to 1%): Household and B&O Taxes	OR Sales Tax (.1%, .2%, or .3%)	Remarks
METROPOLITAN MUNICIPAL CORPORATION (METRO)	Citizen petition or county commissioner resolution places question on ballot for voter approval	County commissioners, mayors, and city councilmen as apportioned by state statute	County-Wide — Transit Service District	YES	NO	YES[b]	YES	YES[b]	Must include at least 2 cities, one being either a 1st class (>20,000 pop.) or optional municipal code city
COUNTY TRANSPORTATION AUTHORITY (CTA)	Resolution by board of county commissioners	3 county commissioners and 3 mayors	County-Wide	NO	YES	YES	YES	YES	Only function a CTA may carry out is that of public transportation
PUBLIC TRANSPORTATION BENEFIT AREA (PTBA)	PTBA conference called by county commissioners, any 2 cities, or public petition; approval by conference members (including city officials)	9 county and local elected officials	County-Wide — Transit Service District	NO	YES	YES	YES	YES	Only one PTBA per county
CITY(S)/ TOWN(S)	Ordinance by city/town council(s)	City/town council(s)	County-Wide[c] — Transit Service District — Local Service Areas	NO	NO	YES	YES	NO	Service may extend 15 miles outside city limits--need agreement with any existing common carriers
COUNTY UNINCORPORATED TRANSIT AUTHORITY (CUTA)	Resolution by board of county commissioners	Board of county commissioners	County-Wide[c] — Transit Service District[c] — Local Service Areas	NO	NO	YES	YES	NO	Operating authority limited to unincorporated areas

[a] These are broad definitions for illustrative purposes only.

[b] Only AA Counties (population of 500,000 or more) may impose sales tax for transit.

[c] On a co-operative basis with other authorities

SOURCES: Public Transportation Financing Alternatives, WSDOT, 1979; The Consortium; and Spokane County Engineer's Office

COUNTY TRANSPORTATION AUTHORITIES

CTA's are separate legal entities for which enabling legislation was enacted in 1974; they must be countywide. A CTA is established by resolution of the county board of commissioners and the governing body is statutorily composed of three county commissioners and three mayors. Public transportation is the only function which may be undertaken by a CTA. A CTA may not promulgate any local taxes without a majority voters' approval. A CTA must adopt a public transportation plan. The only CTA is the Grays Harbor Transportation Authority, organized in 1974.

PUBLIC TRANSPORTATION BENEFIT AREAS

PTBA's are separate legal entities for which enabling legislation was enacted in 1975 and may be either less than countywide, or multi-county, provided there is only one PTBA per county. A PTBA is established as a result of a public transportation conference initially convened by the county board of commissioners. The boundaries of the area are determined and adopted by the public transportation conference. The governing body is comprised of up to nine elected officials from among component city mayors and/or city council persons or commissioners and among county commissioners for a single-county PTBA or 15 elected officials for a multi-county PTBA, as collectively agreed at the conference. Public transportation is the only function which may be undertaken by a PTBA. A PTBA may not promulgate any local taxes without a majority voters' approval; a PTBA must adopt a public transportation plan which is subject to review and approval by the State Department of Transportation. Ten of the state's 20 public transportation systems are organized under this authority.

CITIES AND TOWNS

Cities and towns may operate public transportation systems within corporate limits and extend this service up to 15 miles beyond these limits, provided no certified common carrier operates in the area to which service is extended. Seven of the state's 20 public transportation systems are organized under this authority.

COUNTIES (UNINCORPORATED AREAS ONLY)

The county board of commissioners may operate public transportation systems only in the unincorporated areas of a county. There are no public transportation operations functioning under this authority at the present time.

STATE FINANCIAL SUPPORT

The state imposes and collects a Motor Vehicle Excise Tax (MVET) at the rate of 2.2% of the fair market value of motor vehicles (2.0% "basic" tax plus a 0.2% surcharge to finance capital improvements of the state ferry system). Revenues from this tax are used for a number of state and local government programs, including distribution to municipalities for local public transportation as noted below. Figure D-1 depicts the MVET revenue collection and distribution in 1980.

LOCAL FINANCIAL SUPPORT

State statute authorizes a number of local option taxes which may be levied by municipalities.

1% Motor Vehicle Excise Tax

Municipalities that operate public transportation systems are authorized to impose a local 1% MVET, which is a credit against the "basic" 2% MVET imposed and collected by the state. This tax must be matched by locally generated tax funds budgeted in a calendar year for public transportation purposes.

Household and Business & Occupation Taxes

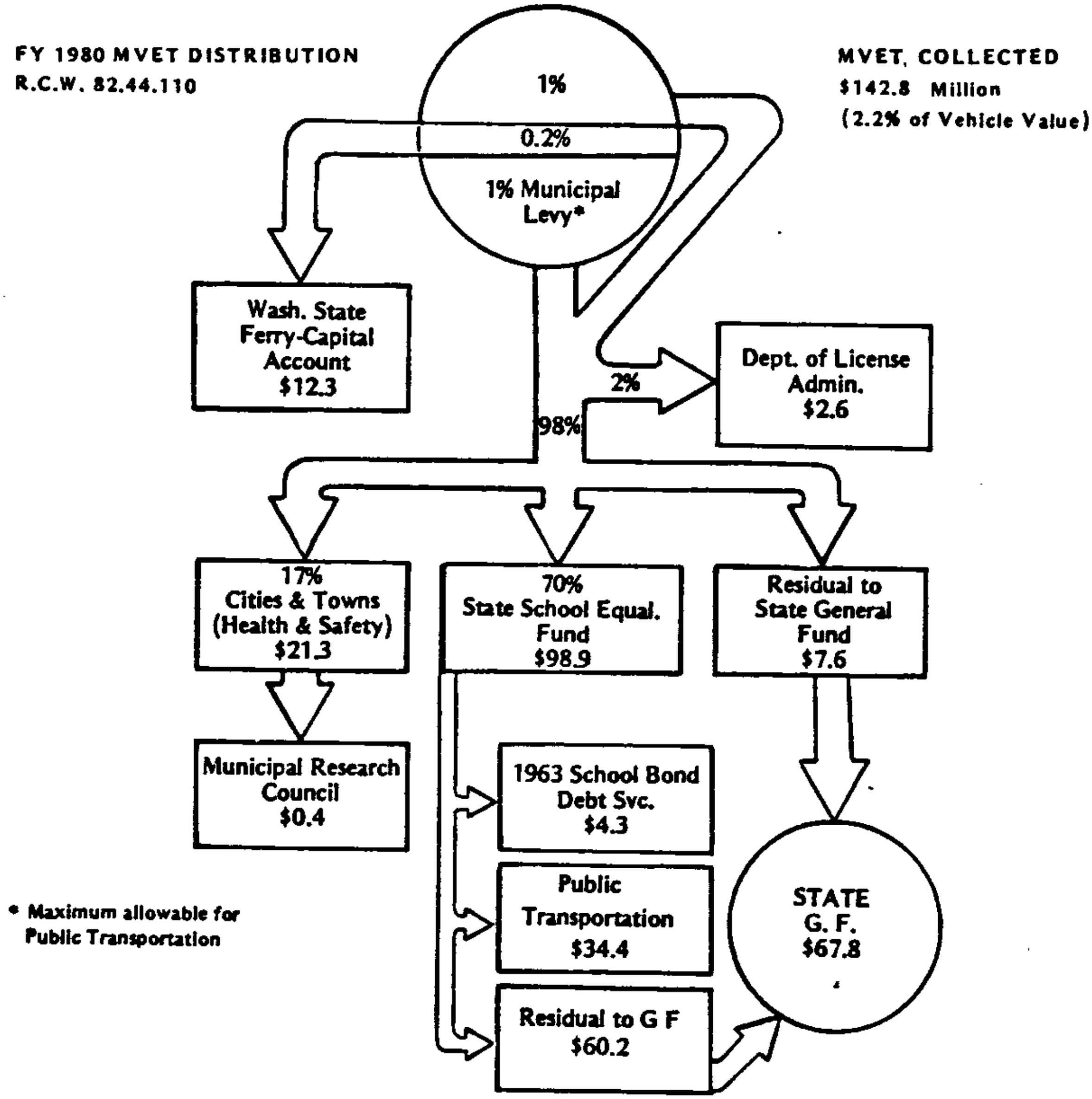
Municipalities may levy an excise tax and/or business and occupation tax to support public transportation. The excise tax permitted is commonly called the household tax, and is limited to a maximum of $1 per month. This tax may be levied on all households served and billed for any public utility services operated by the municipality. The business and occupation tax authorized may be applied against the value of products, gross proceeds of sales, or gross income of businesses within a municipality. These taxes may be levied by a county transportation authority or a public transportation benefit area only with a majority popular vote.

Sales and Use Tax

A 0.1, 0.2 or 0.3% sales and use tax may be levied by municipalities to support public transportation if approved by popular vote. This tax may not be imposed in addition to the household or B&O taxes described above. In 1980, legislation was adopted authorizing Metro only to levy up to 0.6% sale and use tax within its service area.

General Tax Revenues

In addition to the special local option taxes described above, municipalities may use other general, local tax revenues to support public transportation.



Source: Washington State Transit Association Newsletter, January 1981.

Figure D-1

1980 Motor Vehicle Excise Tax Collection and Distribution

MATCHING REQUIREMENTS

Generally, the state (using funds from the local 1% MVET credit discussed above) is required to match all locally imposed general and special taxes that are budgeted for public transportation support in a calendar year. An exception to this requirement is that sales and use taxes (0.1, 0.2 or 0.3%) are not eligible for matching when imposed by cities and counties (unincorporated areas).

The amount of matching requirement is the lower of the following two amounts:

- one-half of the "basic" 2% MVET collected from vehicle owners residing in the municipality (i.e., the local 1% MVET); or
- the amount of locally imposed taxes (other than the local 1% MVET) budgeted for public transportation in a calendar year.

Table D-2 provides a summary of the manner in which the 20 public transit systems in Washington are organized and the type of local funding instituted.

FARES

Over the past five years, farebox revenue for systems in Washington have only generated 25-30% of the operating cost, with governmental assistance providing the balance. Since 1981, most of the systems have increased fares 20-50%.

FEDERAL REVENUE SOURCES

Current federal assistance programs for public transit include direct funding grants, funds that require local matching money and funds for both urban and non-urban areas. The major federal aid programs are directed toward urbanized areas. Table D-3 provides a summary of the Urban Mass Transportation Act (1964 and as amended) programs. Section 3 (capital assistance) and Section 5 (capital and operating assistance) represent the major funding sources. The present Administration has recommended immediate reduction and eventual elimination of the Section 5 program. This is not projected to have a major impact on transit operations in Washington.

Figure D-2 illustrates sources and distribution of transit funds in 1980.

Table D-2

Public Transportation Organization in Washington State (1981)

Transportation System	Transit Operating Authority	Governing Body Composition	Management	Service Area	Local Funding	MVET Match Available
Bellingham Munic. Transit	City	City Council	Transit Man.	Inc. Area	0.3% Sales	No
Benton-Franklin Transit	PTBA	PTBA Board- Local Elected	Transit Man.	Urbanized Area	0.3% Sales	Yes
Bremerton Municipal Trans.	City	City Council	Contract	Inc. Area	$.80 House Tax	Yes
Clallam Transit System	PTBA	PTBA Board- Local Elected	Transit Man.	Eastern County	0.3% Sales	Yes
Community Transit	PTBA	" " "	" "	Urban Area	"	Yes
Community Urban Bus Service	City	Intergovernmental City/ County	Public Works Director	Urban Area	0.1% Utility	Yes
Everett Transit System	City	City Council	Transit Man	Urban Area	0.3% Sales	No
Gray's Harbor Tran. Author.	CTA	CTA Board-Local Elected	Transit Man.	County Wide	0.2% Sales	Yes
Intercity Transit	PTBA	PTBA Board-Local Elected	Transit Man.	Urban Areas	0.3% Sales	Yes
Jefferson Transit	"	" " " "	" "	County Wide	" "	"
Metro	Metro	Metro Council(37 members) Elected/Appointed	EX Director	County Wide	0.6% Sales	Yes
Pacific Transit System	PTBA	PTBA Board	Transit Man.	County Wide	0.3% Sales	Yes
Pierce Transit	"	" "	" "	Tacoma Urban	" "	"
Prosser Rural Transp.	City	City Council	Transit Man.	Inc. Area	B&O Tax	Yes
Pullman Transit System	City	Mayor/City Council Transit Commission	Transit Man.	Inc. Area	2% Utility Tax	Yes
Spokane Trans. Authority	PTBA	PTBA Board	Transit Dir.	County	0.3% Sales	Yes
Twin Transit	PTBA	PTBA Board	Transit Man.	Urban Area (Centr./Cheha.)	$1/mo. household tax	Yes
Valley Transit	"	" "	" "	Urban Area Walla^2	0.3% sales	Yes
Vancover Transit System	"	" "	Transit Dir.	County	0.3% Sales	Yes
Yakima Transit System	City	Mayor/City Council	Transit Man.	Inc. Area	0.3% Sales	No

Source: Adapted from Public Transportation in Washington State: A Summary, WSDOT, 1982.

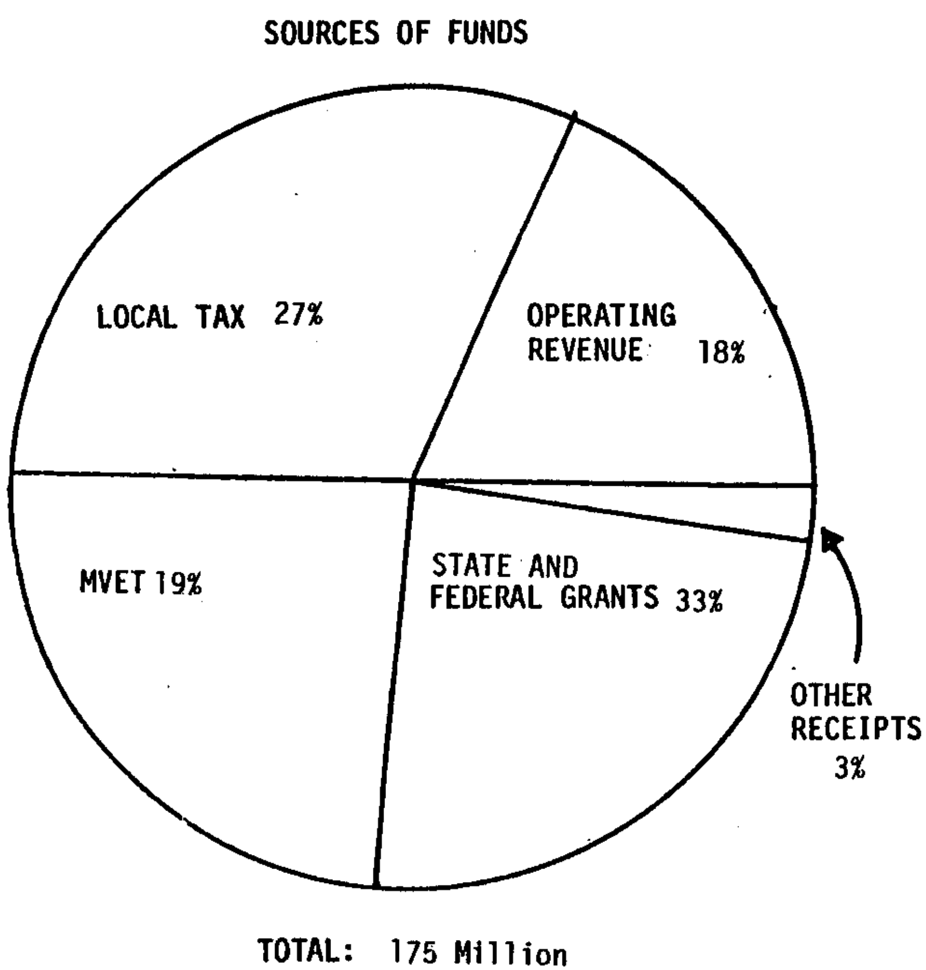
Table D-3

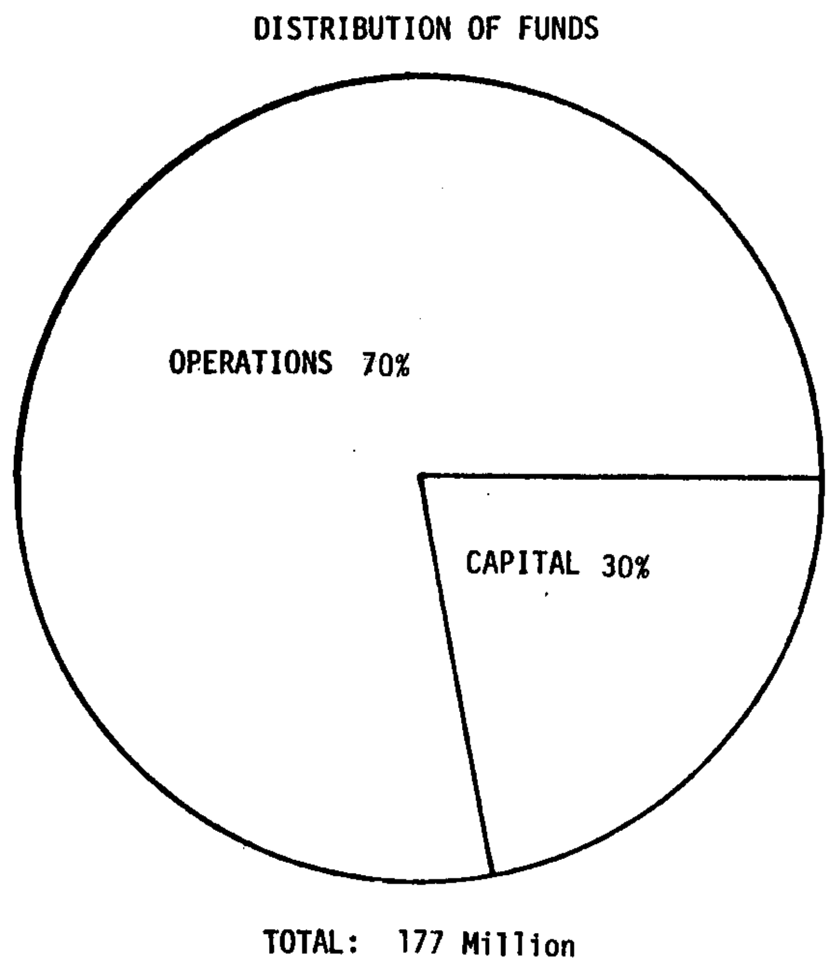
Summary of Federal Mass Transportation Aid Programs

Urban Mass Transportation Act	Program Purpose	Matching Requirements Type	Matching Requirements Percentage	Type of Program	Application
Section 3	Capital improvements	Federal Nonfederal	80 20	Discretionary	Any area
Section 5	Operating assistance and capital improvements	Operating Federal Nonfederal Capital Federal Nonfederal	 50 50 80 20	Formula	Urbanized areas
Section 6	Research, development, and demonstration	Federal	100 max.	Discretionary	
Section 8	Technical studies	Federal Nonfederal	80 20	Discretionary	Any area
Section 10	Management training	Federal Nonfederal	75 25	Discretionary	Any area
Section 11	University research and training	Federal Nonfederal	50 50	Discretionary	Any area
Section 16(b)(2)	Capital aid to private, nonprofit corporations and associations	Federal Nonfederal	80 20	Discretionary	Any area
Section 18	Capital and operating aid to nonurbanized areas	Capital Federal Nonfederal Operating Federal Nonfederal	 80 20 50 50*	Formula to states	Nonurbanized areas

*Up to one-half of the local share may come from other federal funds.

Source: Reference 5.





Source: Washington State Department of Transportation, 1980 Public Transit Statistics

Figure D-2
Washington State Transit Systems
Sources and Distribution of Funds (1980)

CONCLUSION

All transit systems throughout the country are faced with increasing deficits that require governmental support. Many states do not have dedicated and stable sources of funding for support of transit. Washington is fortunate in having enabling legislation that authorizes a multitude of organizational and funding alternatives. In particular, the Public Transportation Benefit Area (PTBA) concept insures a relatively stable source of funds, fosters regional transportation, and provides an opportunity for improved intergovernmental cooperation between cities and counties within the service area.

REFERENCES

1. Public Transportation in Washington State: A Summary, Public Transportation and Planning Division, Washington State Department of Transportation, 1981.

2. Public Transportation, Public Transportation and Planning Division, Washington State Department of Transportation, Olympia, WA, 1981.

3. Public Transportation Financing Alternatives: A Legislative Study, prepared for the Legislative Transportation Committee, Washington State Department of Transportation, January 1979.

4. Enabling Legislation as Codified in the Revised Code of Washington, Municipality of Metropolitan Seattle (Metro), September 1980.

Attachment D-1

Revised Code of Washington (RCW) Citations Relative to Public Transportation in Washington State

Source: Public Transportation, Public Transportation and Planning Division, Washington State Department of Transportation, Olympia, Washington, 1979.

State Laws Pertaining to Public Transportation

(RCW* Citations Inclusive of 1979 Legislation)

35.43 LOCAL IMPROVEMENTS

35.43.200 *Street railways at expense of property benefitted.* Empowers cities and towns owning and operating a municipal street railway to finance the purchase or construction of facilities by levying special assessments against benefitting properties.

35.58 METROPOLITAN MUNICIPAL CORPORATIONS

35.58.240 *Powers relative to transportation.* Specifies powers of a metropolitan municipal corporation regarding metropolitan transportation.

35.58.245 *Public transportation function – Authorization by election required –* Procedure requires voter approval before a metropolitan municipal corporation may perform the functions of metropolitan public transportation.

35.58.250 *Other local public passenger transportation service prohibited – Agreements – Purchase – Condemnation.* Prohibits private corporations from operating public transportation systems if such a system is operated by a metropolitan municipal corporation.

35.58.260 *Transportation function – Acquisition of city system.* Authorizes a metropolitan municipal corporation which acquires a city public transportation system to assume the duties and responsibilities of the city system. Requires the consent of the city council for a metropolitan corporation to acquire the system.

35.58.265 *Acquisition of existing transportation system – Assumption of labor contracts – Transfer of employees – Preservation of employee benefits – Collective bargaining.* Describes rights of employees of existing systems acquired by a metropolitan municipal corporation.

35.58.270 *Metropolitan transit commission.* Establishes the composition of the Metropolitan transit commission and gives it certain powers and responsibilities.

35.58.2712 *Public transportation feasibility study* - Advanced financial support payments. Entitles a municipality to receive a one-time advanced financial support payment to perform a feasibility study to determine the need for public transportation to serve its residents. Sets conditions of payment.

35.58.272 *Public transportation systems – Definitions.* Defines various meanings of the term "municipality" as it relates to public transportation, and certain other terms.

35.58.2721 *Public transportation systems – Authority of municipalities to acquire, operate, etc. - Indebtedness – Bond issues.* Authorizes municipalities to acquire, construct, operate and maintain public transportation systems, and to issue general obligation bonds for such purpose. Prescribes limits of indebtedness. Identifies tax sources that may be obligated for repayment of bonds, and preclude legislature from withdrawing taxing authority.

35.58.273 *Public transportation systems – Motor vehicle excise tax authorized – Credits – Public hearing on Route and Design.* Authorizes municipalities to levy an excise tax of one percent of the fair market value of motor vehicles registered in the municipality. Both corridor and design public hearings must be held before excise tax can be spent for right of way or construction of transit facilities.

35.58.274 *Public transportation systems – Motor vehicles exempt from tax.* Exempts dealers from one percent motor vehicle excise tax levied in RCW 35.58.273.

35.58.275 *Public transportation systems – Provisions of motor vehicle excise tax chapter applicable.* Provides references to sections of chapter 82.44 RCW prescribing schedules, penalties, etc. relating to motor vehicle excise tax.

35.58.276 *Public transportation systems - When tax due and payable - Collections.* Directs county auditors to collect one percent excise tax and remit to the state as per chapter 82.44 RCW.

35.58.277 *Public transportation systems – Remittance of tax by county auditors.* Prescribes procedures used bv county auditors to remit one percent excise tax to the state.

35.58.278 *Public transportation systems – Distribution of tax.* Directs that distribution of one percent excise tax be made in accordance with RCW 82.44.150.

* Revised Code of Washington.

35.58.279 *Public transportation systems – Crediting and use of tax revenues.* Limits use of revenues from one percent excise tax to specified public transportation purposes. Precludes legislature from withdrawing authority for municipality to levy the tax if it has been pledged for bond payback.

35.58.2791 *Public transportation systems* -- Internal combustion equipment to comply with pollution control standards. Requires that new internal combustion equipment meet the standards for pollution control set by the state air pollution control board in order to be purchased with excise tax revenue.

35.58.2792 *Public transportation systems – Parking facilities to be in conjunction with system stations or transfer stations.* Requires parking facilities financed with revenues from one percent excise tax to be in conjunction with and adjacent to public transportation stations.

35.58.2794 *Public transportation systems – Research, testing, development, etc., of systems – Powers to comply with federal laws.* Grants any public agency operating a public transportation system the right to engage in research and testing of transportation systems and equipment, and grants all powers necessary for agencies to comply with standards of federal Urban Mass Transportation Act.

35.84 UTILITY AND OTHER SERVICES BEYOND CITY LIMITS

35.84.060 *Street railway extensions.* Provides that municipal corporations may operate urban public transportation systems to within fifteen miles outside their corporate limits as long as that territory is not served by a privately operated transportation company authorized by the utilities and transportation commission.

35.85 VIADUCTS, ELEVATED ROADWAYS, TUNNELS AND SUBWAYS

35.85.010 *Authority to construct viaducts, bridges, elevated roadways, etc.* Empowers first class cities to construct and maintain bridges, subways, elevated roadways, etc., and to assess property benefitted by the improvement.

35.92 MUNICIPAL UTILITIES

35.92.060 *Authority to acquire and operate transportation facilities.* Cities and towns granted authority to purchase, construct, maintain or operate railways, buses, cars and trucks for the purpose of moving freight or passengers within the city limits. Fare-setting authority granted.

35.95 PUBLIC TRANSPORTATION SYSTEMS IN CITIES AND METROPOLITAN MUNICIPAL CORPORATIONS -- FINANCING

35.95.010 *Declaration of intent and purpose.* States that municipally owned transit companies are unable to cover their expenses with revenues from fares. Consequently municipalities are forced to subsidize public transit to the detriment of other public services. Since public transportation is considered a necessary service the appropriation of general funds and the leveying and collecting of taxes by municipalities for the funding of public transportation is justified.

35.95.020 *Definitions.* Defines various meanings of the term "municipality" as it relates to public transportation, and certain other terms.

35.95.030 *Appropriation of funds for transportation systems authorized – Referendum.* Authorizes municipalities to appropriate general funds for the operation, maintenance and capital needs of municipally owned and operated public transportation systems.

35.95.040 *Levy and collection of excise taxes authorized – Business and Occupation tax – Excise tax on residents – appropriation and use of proceeds – Voter approval.* Authorizes corporate authorities to levy a business and occupation tax and a household tax for the sole purpose of funding public transportation. These taxes must be approved by the voters who would be affected by them.

35.95.050 *Collection of tax – Billing.* Provides that taxes levied by municipalities for the operation, maintenance and capital needs of municipal owned and operated public transit systems can be used solely for the purpose. The taxes can be billed and collected in a manner determined by the corporate authorities. It further provides that municipalities can contract out the operations and maintenance of their public transit systems.

35.90.060 *Funds derived from taxes – Restrictions on classification, etc.* Restricts funds derived from taxes collected to fund public transportation from being classified as revenue of the public transportation system.

35.95.070 *Purchase of leased public transportation system – Purchase price.* Provides that the purchase price of a public transportation system being leased by a municipality shall be no greater than the fair market value of the system at the commencement of the lease.

35.95.080 *Referendum rights not impaired.* Precludes provisions of Chapter 35.95 RCW or any city ordinance form preventing a referendum on any municipal ordinance adopted as a result of this chapter.

35.95.090 *Corporate authorities may refer ordinance levying tax to voters.* Allows a municipality to refer an ordinance for the levy and collection of an excise tax to a vote of the people before adopting the ordinance.

35A.81 PUBLIC TRANSPORTATION

35A.81.010 *Application of general law.* Exempts urban passenger transportation systems from payment of special (diesel) fuel taxes, and allows refund for gasoline taxes paid.

36.57 COUNTY PUBLIC TRANSPORTATION AUTHORITY

36.57.010 *Definitions.* Defines terms "authority", "population", and "public transportation function" as used in this chapter.

36.57.020 *Public transportation authority authorized.* Authorizes counties to create county transportation authorities except in counties where a metropolitan municipal corporation is already performing the functions of public transportation.

36.57.030 *Membership – Compensation.* Establishes the composition of a county transportation authority.

36.57.040 *Powers and duties.* Specifies the powers and duties of a county transportation authority.

36.57.050 *Chairman – General manager.* Provides for election of a chairman and appointment of general manager by Authority, and function of each.

36.57.060 *Transportation fund – Contributions.* Establishes and describes management of "transportation fund" to be set up by each Authority.

36.57.070 *Public transportation plan.* Requires a transportation authority to develop a comprehensive transportation plan.

36.57.080 *Transfer of transportation powers and rights to authority – Funds – Contract indebtedness.* Describes rights of Authority when taking over passenger transportation system previously owned by a county or city.

36.57.090 *Acquisition of existing transportation system – Assumption of labor contracts – Transfer of employees – Preservation of benefits – Collective bargaining.* Prescribes obligations of Authority when acquiring an existing transportation system.

36.57.100 *Counties authorized to perform public transportation function in unincorporated areas – Exceptions.* Authorizes counties to perform public transportation functions except where a metropolitan municipal corporation within the county is performing those functions or where a public transportation benefit area exists.

36.57.110 *Boundaries of unincorporated transportation benefit areas.* Authorizes counties to create and define the boundaries of unincorporated transportation benefit areas following school district or election precint lines as far as practicable.

36.57A PUBLIC TRANSPORTATION BENEFIT AREAS

36.57A.010 *Definitions.* Defines "public transportation benefit area","public transportation service", "public transportation improvement conference", and other terms used in this chapter.

36.57.020 *Public transportation improvement conference -- Convening – Purpose – Multi-county conferences.* Authorizes county legislative authorities to hold conferences to evaluate the need for public transportation benefit areas to provide public transportation service. Authorizes multi-county conference.

36.57A.030 *Establishment or change in boundaries of public transportation benefit area – Hearings – Notice – Procedure – Authority of county to terminate public transportation benefit area.* Gives conferences the authority to change the boundaries of a PTBA. Requires public hearings.

36.57A.040 *Cities to be wholly included or excluded – Boundaries – Only benefited areas to be included. – One area per county.* Describes certain criteria for establishing boundaries of public transportation benefit areas.

36.57A.050 *Governing body – Selection, qualification, number and compensation of members.* Provides for selection of a benefit area Authority by elected officials within 60 days of establishment of boundaries. Allows any city to withdraw within the 60 days.

36.57A.060 *Comprehensive plan – Development – Elements.* Lists required elements of comprehensive plan.

36.57A.070 *Comprehensive plan – Review – Approval or disapproval – Resubmission.* Requires review and approval by the state transportation commission or the planning and community affairs agency.

36.57A.080 *General Powers.* Grants PTBA's the power of contract. Requires competitive bids. Allows PTBA's to sue and be sued in a corporate capacity.

36.57A.090 *Additional Powers – Acquisition of existing system.* Grants power to prepare, adopt and carry out a general comprehensive plan. Also grants power to acquire and operate transportation facilities, and to fix fares. Requires consent of city council to assume a city transportation facility.

36.57A.100 *Agreements with operators of local public transportation services – Operation without agreement prohibited – Purchase or condemnation of assets –* Prohibits private corporations from operating local public passenger transportation services within the PTBA without an agreement with the PTBA.

35.57A.110 *Powers of component city concerning passenger transportation transferred to benefit area – Operation of system by city until acquired by benefit area - Consent.* Provides that any city operating a public transportation system on July 1, 1975 may continue to operate the system until it is acquired by the benefit area.

36.57A.120 *Acquisition of existing system – Labor contracts, employee rights preserved – Collective bargaining.* Outlines rights of employees of an existing system being acquired by a benefit area.

36.57.130 *Transportation fund – establishment – Use – Custodian – Contribution of sums for expenses.* Describes establishment, use and management of transportation fund to be set up by each benefit area Authority.

36.57A.140 *Annexation of additional area.* Establishes procedure for annexation of a contigious area to a PTBA.

36.57A.150 *Advanced financial support payments.* Permits counties to receive advanced financial support from the state to assist in the development of a comprehensive transit plan. Sets conditions.

36.57A.160 *Dissolution and liquidation.* Provides that a PTBA may be dissolved by voter approval. Establishes procedure for the election.

39.33 INTERGOVERNMENTAL DISPOSITION OF PROPERTY

39.33.050 *Public mass transportation system – Contracts for services or use.* Authorizes the legislative body governing a public transportation system to contract with other legislative bodies, persons or firms for public transportation services.

39.34 INTERLOCAL COOPERATION

39.34.085 *Agreements for operation of bus services.* Authorizes cities, towns or a county or a combination of these to enter into agreements with each other or with a public transportation agency of a contiguous state or contigious Canadian province, to allow a city or transportation agency to operate public bus service within their boundaries. Bus service may extend beyond their boundaries if it does not conflict with existing bus service authorized by the Washington Utilities and Transportation Commission.

43.21C.030 *Guidelines for State Agencies, Local Governments – Statements – Reports – Advice – Information.* Sets forth the guidelines that must be followed before any statement, report, advice or information is given out by any branch of state government, including state agencies, municipal and public coorporations and counties.

43.41.130 *Passenger motor vehicles owned or operated by State Agencies – Duty to establish policies as to acquisition, operation, authorized use, etc.* The director of financial management shall establish policies as to governing the acquisition, operation, management, maintenance, repair and disposal of all passenger motor vehicles owned and operated by any state agency.

46.04 MOTOR VEHICLES – DEFINITIONS

46.04.190 *For Hire Vehicle.* Any motor vehicle used for the transportation of persons for compensation, except auto stages and ride-sharing vehicles.

46.04.355 *Municipal Transit Vehicle.* Defines ownership and use characteristics of such vehicles.

46.61 RULES OF THE ROAD

46.61.165 *Reservation of portion of highway for use by public transportation vehicles, etc.* Gives state and local authorities the right to reserve all or any portion of any highway.

46.61.560 *Stopping, standing, or parking outside of business or residence districts.* Permits public transportation vehicles to stop on the roadway to receive or discharge passengers.

46.72 TRANSPORTATION OF PASSENGERS IN FOR HIRE VEHICLES

47.04 GENERAL PROVISIONS

47.04.081 *Urban public transportation systems – Participation of highway commission in planning, development and establishment of system.* Empowers highway commission to join financially or otherwise with any state, federal or local agency in planning for urban public transportation system in conjunction with new or existing highway facilities.

47.04.082 *Urban public transportation systems – Defined.* Defines this term with respect to types of vehicles operated and areas in which the vehicles operate.

47.04.083 *Urban public transportation systems – Declaration of public policy – Use of motor vehicle funds, city street or county road funds.* Declares policy of joint planning, construction and maintenance of public highways and urban public transportation system serving common geographical areas wherever feasible. Allows the motor vehicle funds, city street or county road funds to pay the full cost of streets to be used jointly with an urban public transportation system.

47.08 HIGHWAY FUNDS

47.08.070 *Cooperation in public works projects, urban public transportation systems.* Authorizes the state highway commission to cooperate financially with any public agency in construction of public works projects, including urban public transportation systems.

47.12 ACQUISITION AND DISPOSITION OF STATE HIGHWAY PROPERTY

47.12.010 *Acquisition of property authorized – Condemnation actions – Cost.* Empowers the Highway Commission to acquire by gift, purchase or condemnation, property for transportation purposes, including urban public transportation systems.

47.12.270 *Acquisition of property for parking facilities for motorists using urban public transportation facilities or private car pool vehicles.* Empowers Highway Commission to exercise this function.

47.28 CONSTRUCTION AND MAINTENANCE OF HIGHWAYS

47.28.140 *Agreements to benefit or improve highways, roads or streets, establish urban public transportation system – Labor or contract – Costs.* Authorizes state highway department and any public agency to jointly establish an urban public transportation system on or near a public highway.

47.44 FRANCHISES ON STATE HIGHWAYS

47.44.010 *Wire and pipe line and tram and railway franchises – Application – Notice – Posting and Publication.* Empowers highway commission to grant franchises to use state highways for construction and maintenance of urban public transportation system.

47.44.040 *Franchises across joint bridges.* Grants authority to Highway Commission to join with cities, counties and other states to grant franchises across joint bridges for transportation purposes including urban public transportation systems.

47.48 CLOSING HIGHWAYS AND RESTRICTING TRAFFIC

47.48.010 *Closure authorized – Restricting use of portion of highway to urban public transportation system use.* Authorizes highway commission to restrict use of any public highway to use by an urban public transportation system.

47.52 LIMITED ACCESS FACILITIES

47.52.025 *Additional Powers – May control use of limited access facilities – Reservation of facility, lanes or ramps for public transportation vehicles, etc.* Empowers state, counties or cities to reserve a limited access facility, or designated lanes or ramps, for exclusive use of public transportation vehicles.

47.52.090 *Cooperative agreements – Provision for urban public transportation systems – Title to facility – Traffic regulations – Underground utilities and overcrossings – Passenger transportation – Storm sewers – City street crossings.* Authorizes state, counties, cities owning or operating an urban public transportation system to enter into agreements regarding financing, planning, establishment, etc. of limited access facilities to further purposes of this chapter.

47.56 STATE TOLL BRIDGES, TUNNELS AND FERRIES

47.45.256 *Highway Commission may grant franchises for utility, railway, urban public transportation purposes.* Authorizes Commission to grant franchises to use property of toll bridges, tunnels and ferries for purposes including urban public transportation systems.

54.04.160 *Any Municipal Corporation is authorixed to assume the obligations of a private pension plan when an Urban Transportation System is acquired.*

81.75 TRANSPORTATION CENTERS

81.75.010 *Authorization to own and operate – Purpose.* It is proper that cities, towns, counties, public transportation benefit area authorities, and municiple corporations of this state be authorized to own and operate transportation centers.

81.75.020 *Method of Acquisition and operation prescribed – Grants – Consolidation of Activities.*

82.14 COUNTIES, CITIES AND METROPOLITAN MUNICIPAL CORPORATIONS - RETAIL SALES AND USE TAXES

82.14.045 *Sales and use taxes for public transportation systems.* Authorizes public transportation authorities to levy a sales and use tax of one-tenth, two-tenths or three-tenths of one percent subject to voter approval. Revenue generated is exclusively for the support of public transportation – Sets conditions and requirements of the tax.

82.36 MOTOR VEHICLE FUEL TAX

82.36.275 *Refunds for urban transportation systems.* Grants refunds for use of motor vehicle fuel by urban transportation systems.

82.38 SPECIAL FUEL TAX ACT

82.38.080 *Exemptions.* Exempts urban public transportation systems from payment of special (diesel) fuel taxes, except on trips more than 25 miles from the corporate limits of the county in which the trip originated.

82.44 MOTOR VEHICLE EXCISE

82.44.150 *Apportionment and distribution of motor vehicle excise taxes generally.* Prescribes method of distribution of two percent motor vehicle excise tax, including the one percent portion to eligible municipality for public transportation purposes.

NOTE:

This appendix provides an overview of transit operations in Washington State between 1976 and 1980. The discussion is presented as follows:

Part 1 - Statewide Averages

Part 2 - Comparative Trends by Transit Peer Groups

Part 3 - Trends in Characteristics and Performance of Individual Systems

Constant Dollar Conversion

Tables referenced in this appendix present transit expenditures and revenues that were corrected to 1980 constant dollars using the CPI and a conversion factor for the respective years prior to 1980.

The Consumer Price Index (CPI) compares the cost of a market basket of goods and services this month with its cost a month ago, or a year ago. The point in time to which the prices are compared is called the base period (currently 1967). For example, in 1967 the prescribed market basket could have been purchased for $100.00. In June 1977 the CPI was 181.8, thus what was $100.00 in 1967 is $181.80 in June 1977.

In order to convert actual dollars to constant dollars and account for the rampant inflation during the 1970's, Department of Labor reports on CPI over seven years were examined for both the U.S. as a whole and the area adjusted CPI for Seattle/Everett, Washington.

Year	U.S. Average CPI[1] (all areas)	U.S. Data Conversion Multiplier	Seattle/Everett CPI[1] (specific to WA)	WA Data Conversion Multiplier
1980	233.2	1.000	236.0	1.000
1979	204.7	1.138	199.6	1.182
1978	195.4	1.193	190.1	1.241
1977	177.8	1.311	171.3	1.377
1976	167.1	1.396	161.7	1.459
1975	156.1	1.493	152.5	1.547
1974	141.5	1.648	135.8	1.737

[1] 1967=100.00

Source: CPI Detailed Report, U.S. Department of Labor, 1974-1980.

PART 1

STATEWIDE AVERAGES

Statewide Transit Overview
(As of October 1981)

There has been a tremendous growth in public transit since 1975. In 1975, there were 12 transit systems in Washington State, 10 city systems and two regional systems. By 1981, there are 20 systems, including 7 city systems and 13 regional systems. (Please refer to the accompanying maps). In the future, as many as 26 regional systems may be operating.

In 1980, transit systems in Washington State hauled 98,724,000 passengers over 46,177,000 miles. Total cost for the service in 1980 was $177,000,000, and total revenue was $175,000,000. This represents an 81 percent increase in ridership, a 46 percent increase in miles, a 334 percent increase in cost, and a 372 percent increase in revenue since 1975. These increases are due to the development of new systems, and the growth of existing operations. (The accompanying charts show the changes in revenues and expenditures since 1975.)

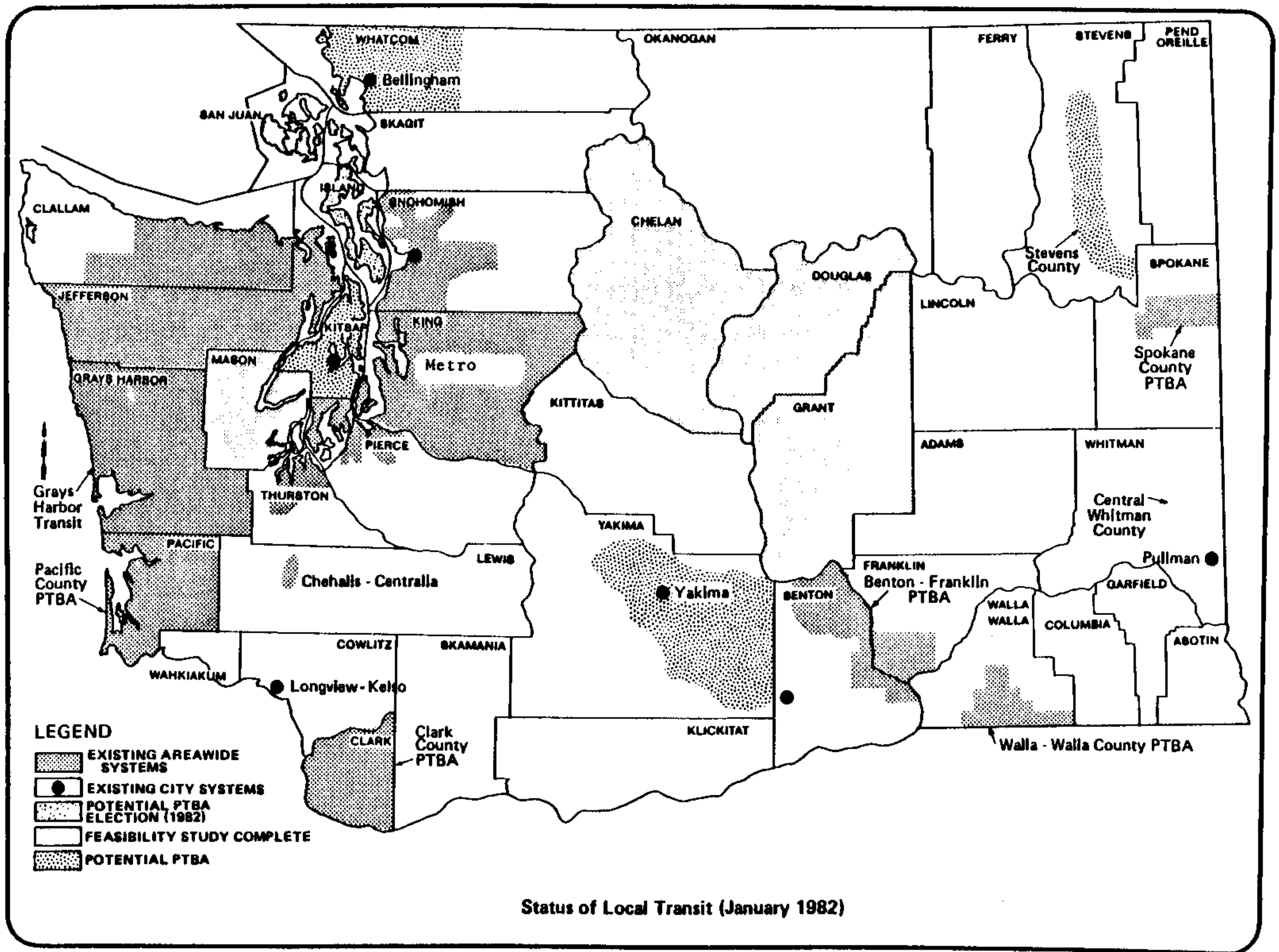
The growth of transit also reflects the decline of city transit systems. The trend appears to be toward regional systems, generally because of the ability to match local sales tax revenues with Motor Vehicle Excise Tax (MVET) funds. The estimated MVET distribution for calendar year 1981 is $43,568,000. It is estimated this will increase to $75,045,000 by calendar year 1985. The exact distribution will depend upon the success or failure of local elections granting taxing authority to transit boards.

Adequate revenue sources are crucial to the well being of transit, particularly since many systems are planning to expand services and upgrade equipment and facilities over the next few years. Anticipated reductions in federal programs make funding a critical issue, and makes locally generated revenues very important. A loss of revenues could result in higher fares, loss of ridership, delays in upgrading equipment, and disruptions to the local community. Other concerns of transit include the availability of appropriate equipment, training and upgrading the knowledge of transit personnel, and the development of a comprehensive federal and state transportation policy.

Trends in Transit Financial and Operating Characteristics Statewide (1976-80)

SYSTEM Statewide Totals

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	2,537,146
	Total Passengers	58,003,000	62,562,000	68,488,000	82,637,000	96,950,000
	Total Vehicle Miles	32,920,000	34,237,000	36,244,000	39,797,000	46,177,000
	Total Vehicle Hours	NA	NA	NA	NA	2,772,000
	Miles of Line	2,224	2,028	2,776	4,283	5,184
	Total Vehicles	1,006	1,024	1,085	1,483	1,625
	Total Employees	NA	NA	NA	NA	NA
Actual Dollars	Revenue Total	(77,471,000)	(89,541,000)	(126,229,000)	(147,386,000)	(174,733,000)
	Farebox	14,245,000	16,390,000	17,466,000	24,171,000	30,857,000
	Local Tax	22,451,000	28,275,000	38,205,000	38,921,000	47,905,000
	MVET	15,955,000	20,769,000	21,306,000	28,209,000	33,344,000
	Other	24,820,000	24,107,000	49,251,000	56,085,000	62,627,000
	Expenditure Total	(78,253,000)	(85,321,000)	(116,824,000)	(154,282,000)	(176,608,000)
	Capital	27,609,000	19,032,000	43,970,000	56,293,000	48,625,000
	Operations	49,094,000	57,645,000	68,758,000	88,188,000	117,873,000
	Other	1,552,000	8,644,000	4,096,000	9,801,000	10,110,000
	Total Operating Assistance	NA	NA	NA	NA	(82,285,000)
Constant 1980 Dollars	Revenue Total	(113,030,000)	(123,298,000)	(156,650,000)	(174,210,000)	(174,733,000)
	Farebox	20,783,000	22,569,000	21,675,000	28,570,000	30,857,000
	Local Tax	32,756,000	38,935,000	42,412,000	46,005,000	47,905,000
	MVET	23,278,000	28,599,000	26,441,000	33,343,000	33,344,000
	Other	36,212,000	33,195,000	61,122,000	66,292,000	62,627,000
	Expenditure Total	(114,171,000)	(117,487,000)	(144,979,000)	(182,361,000)	(176,608,000)
	Capital	40,281,000	26,207,000	54,567,000	66,538,000	48,625,000
	Operations	71,628,000	79,377,000	85,329,000	104,238,000	117,873,000
	Other	2,264,000	11,903,000	5,083,000	11,585,000	10,110,000
	Total Operating Assistance	NA	NA	NA	NA	(82,285,000)



SOURCE: Washington Department of Transportation

Transit System Service Areas (1982)

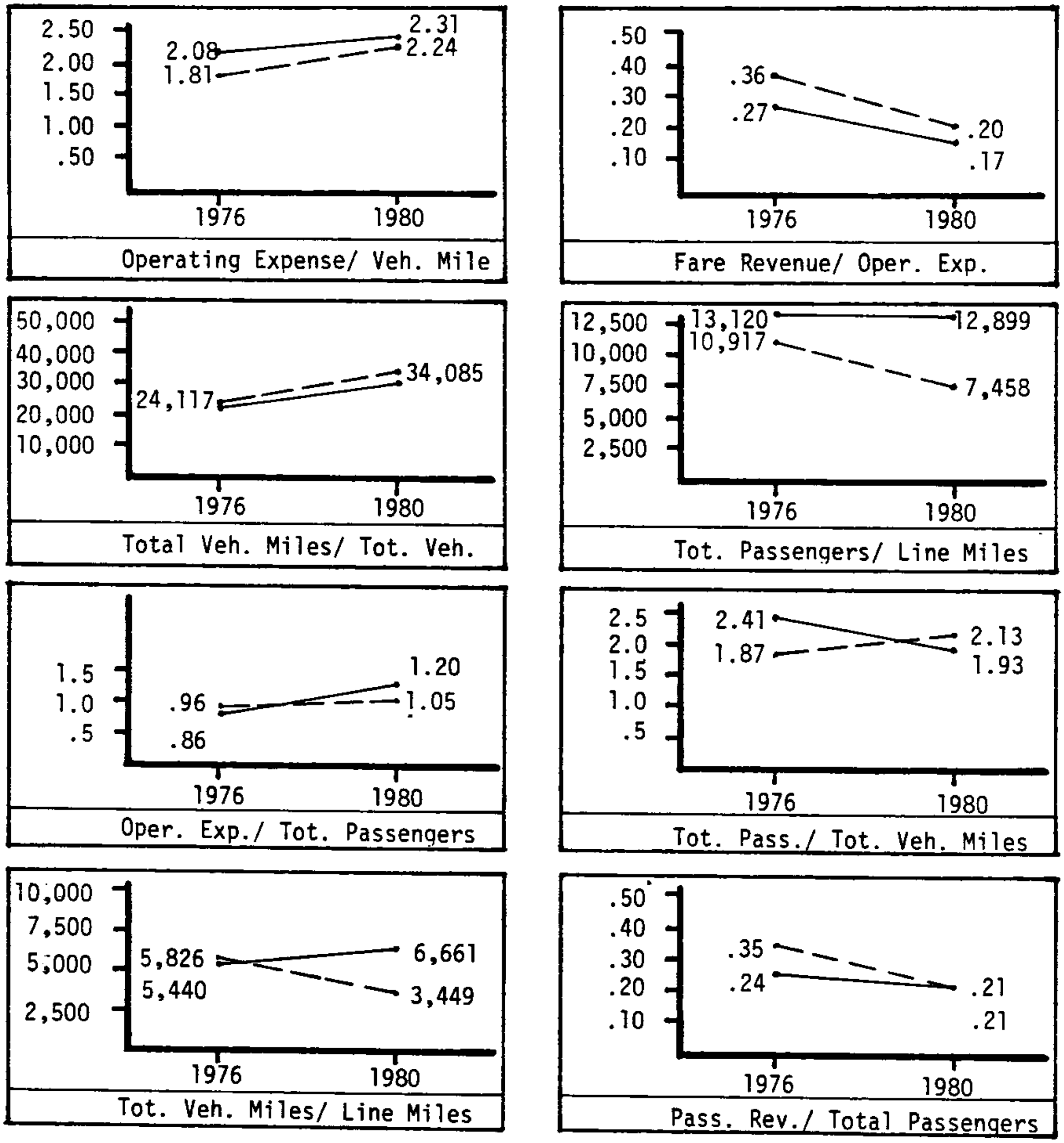
Trends in Transit Performance for Statewide Transit
(all dollar values in constant 1980 dollars)

		STATEWIDE TOTALS				
CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	42.51
	Operating expense/total vehicle mile	2.18	2.32	2.35	2.62	2.55
Vehicle Efficiency	Total vehicle miles/total vehicles	32,724	34,435	33,405	26,835	28,417
	Total vehicle hours/total vehicles	NA	NA	NA	NA	1,706
Cost Effectiveness	Operating expense/total passengers	1.23	1.26	1.25	1.26	1.22
	Total revenue/total passengers	1.95	1.97	2.28	2.11	1.80
	Total revenue/operating expense	1.57	1.55	1.83	1.67	1.48
	Passenger revenue/operating expense	0.29	0.28	0.25	0.27	0.26
Effectiveness of Service Consumption	Total passengers/total vehicle miles	1.76	1.83	1.89	2.08	2.10
	Total passengers/total vehicle hours	NA	NA	NA	NA	34.96
	Total passengers/total vehicles	57,657	61,096	63,123	55,723	59,662
Effectiveness of Service Distribution	Total passengers/line mile	26,080	30,849	24,671	19,294	18,702
	Total passengers/service area population	NA	NA	NA	NA	38.21
	Total vehicle miles/service area population	NA	NA	NA	NA	18.20
	Total vehicle hours/service area population	NA	NA	NA	NA	1.09
	Total vehicle miles/miles of line	14,802	16,882	13,056	9,292	8,908
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.36	0.36	0.32	0.35	0.32
	Passenger revenue/total vehicle miles	0.63	0.66	0.60	0.72	0.67
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.01	0.88	0.85	0.87	0.96
	Total passengers/local tax assistance	1.77	1.61	1.45	1.80	2.02
	Total vehicle miles/MVET assistance	1.41	1.20	1.37	1.19	1.39
	Total passengers/MVET assistance	2.49	2.19	2.59	2.48	2.91
	Total vehicle miles/total operating assistance	NA	NA	NA	NA	0.53
	Total passengers/total operating assistance	NA	NA	NA	NA	1.11

PART 2

COMPARATIVE TRENDS BY TRANSIT PEER GROUPS

Small City/ Municipal



LEGEND

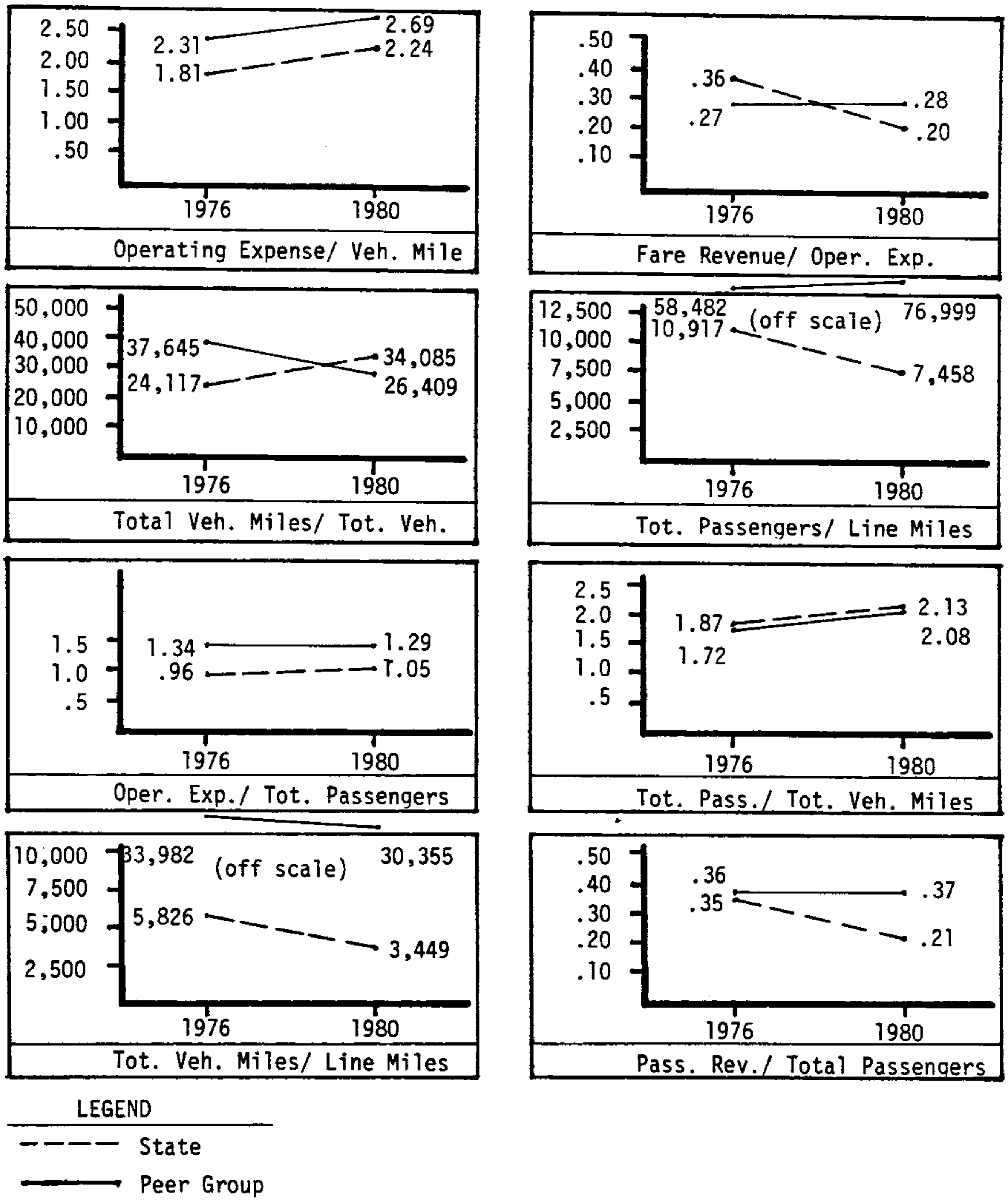
- - - - State

——— Peer Group

NOTES: 1976 is represented by only one system.

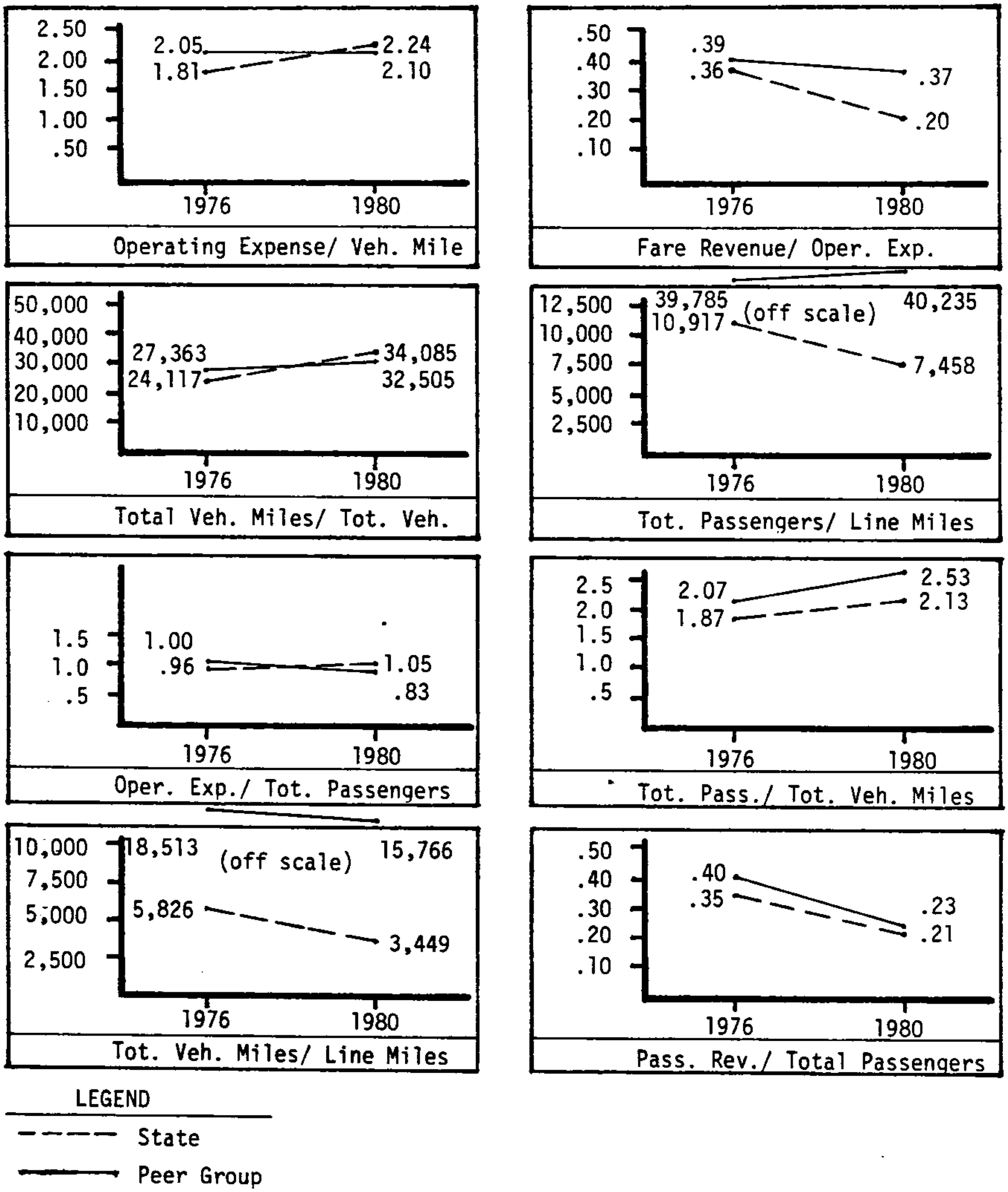
Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

Metro



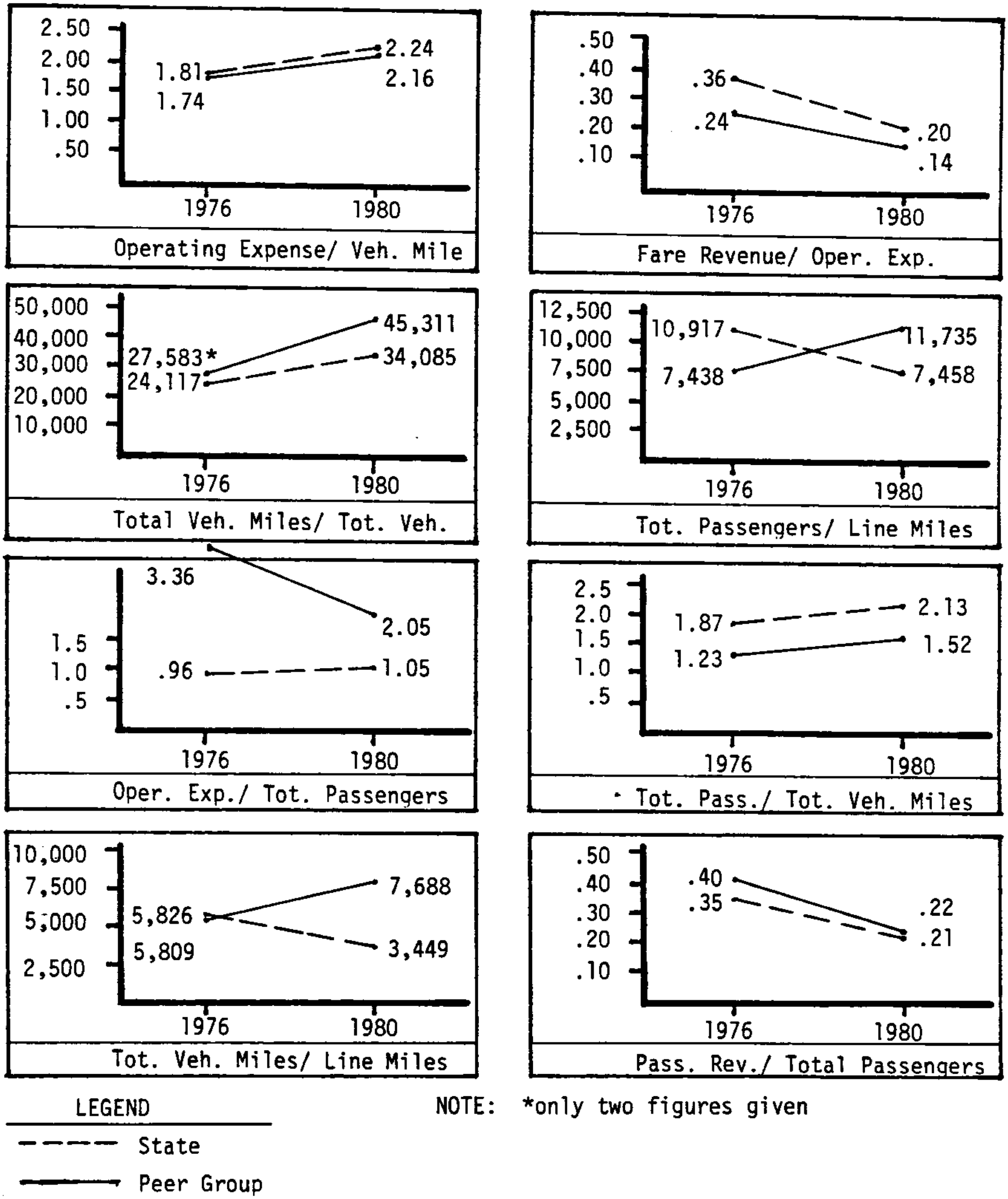
Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

Large Urban



Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

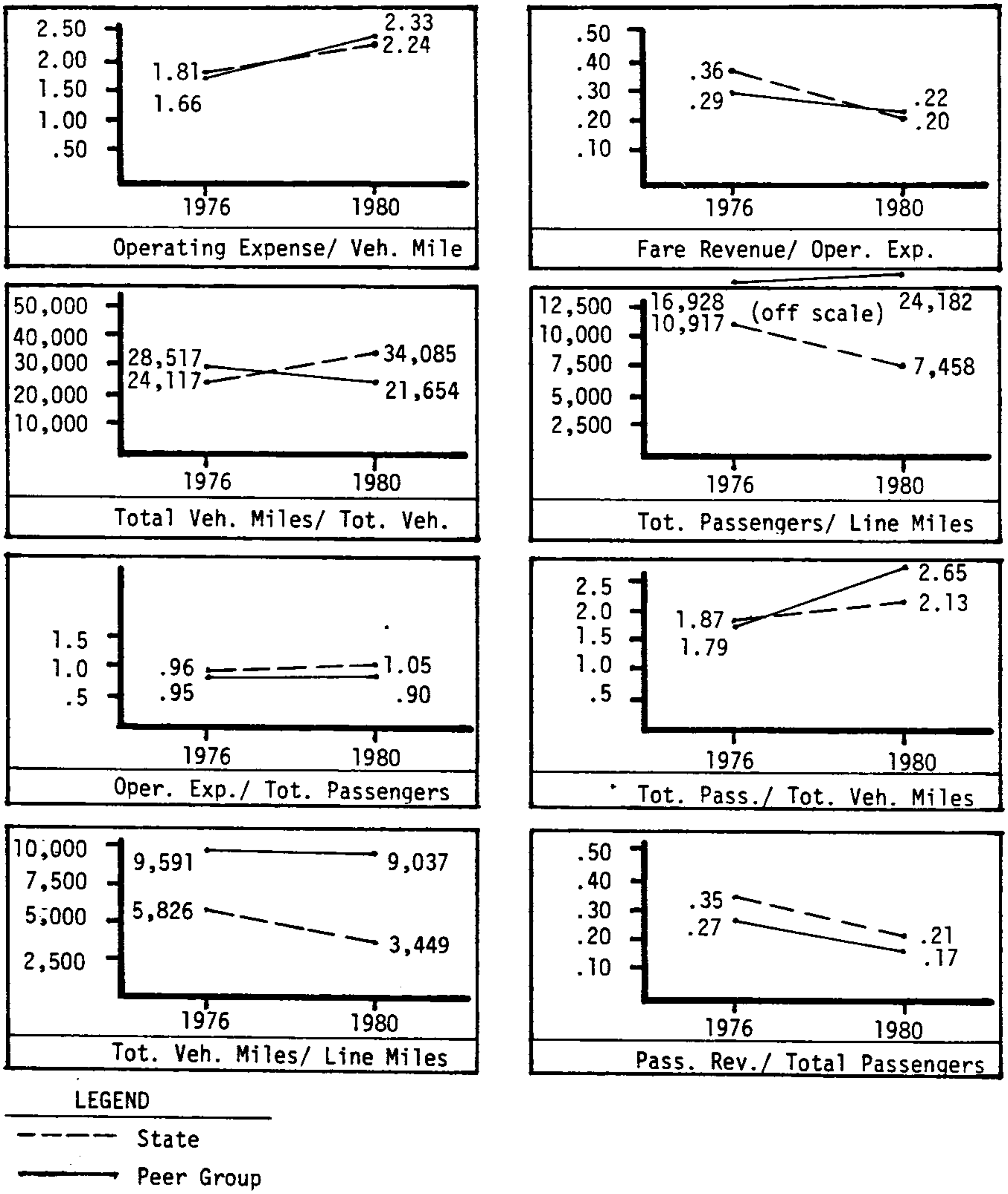
Midsize Regional



NOTE: *only two figures given

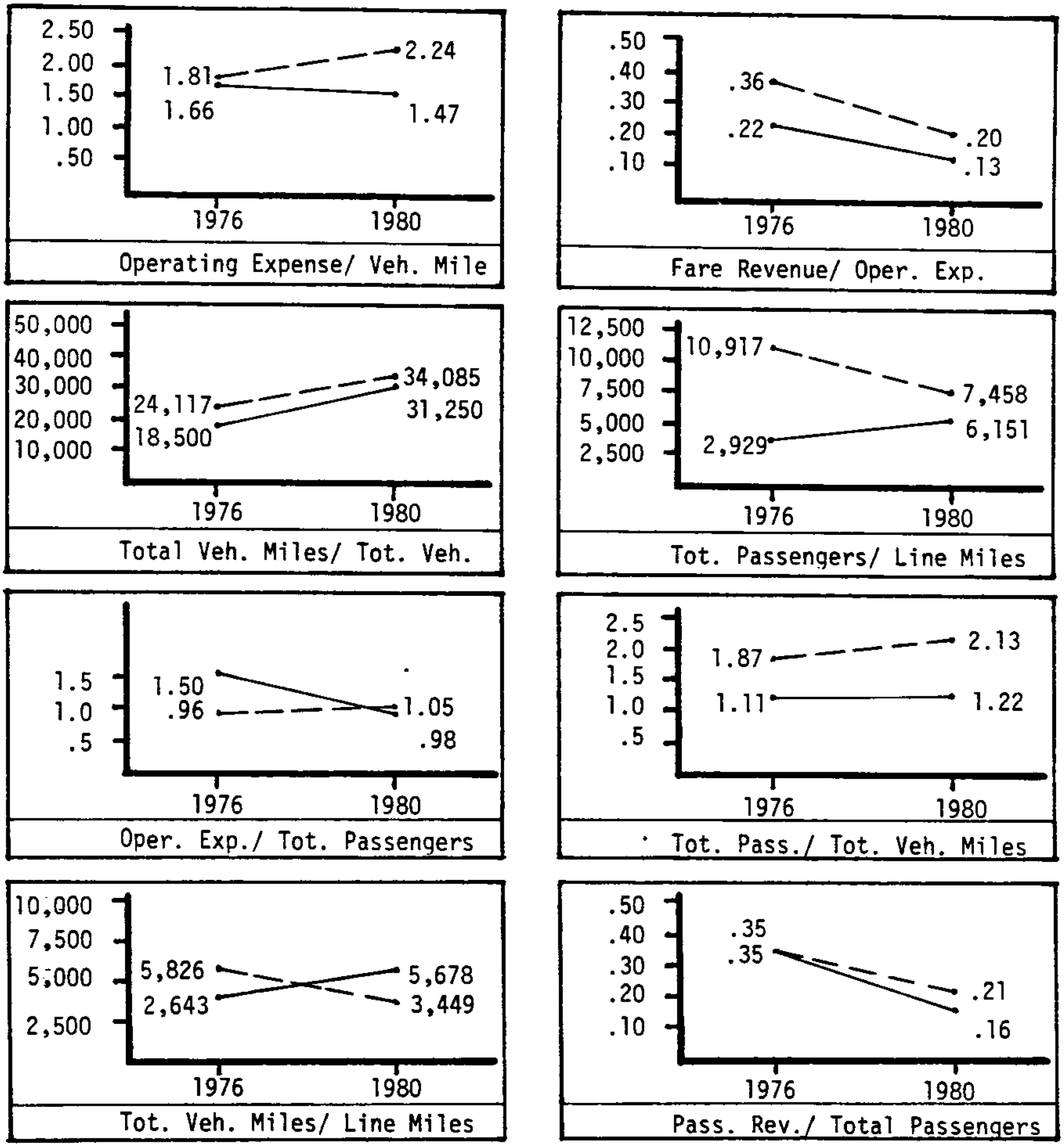
Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

Midsize Municipal



Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

Small City/ Regional



LEGEND

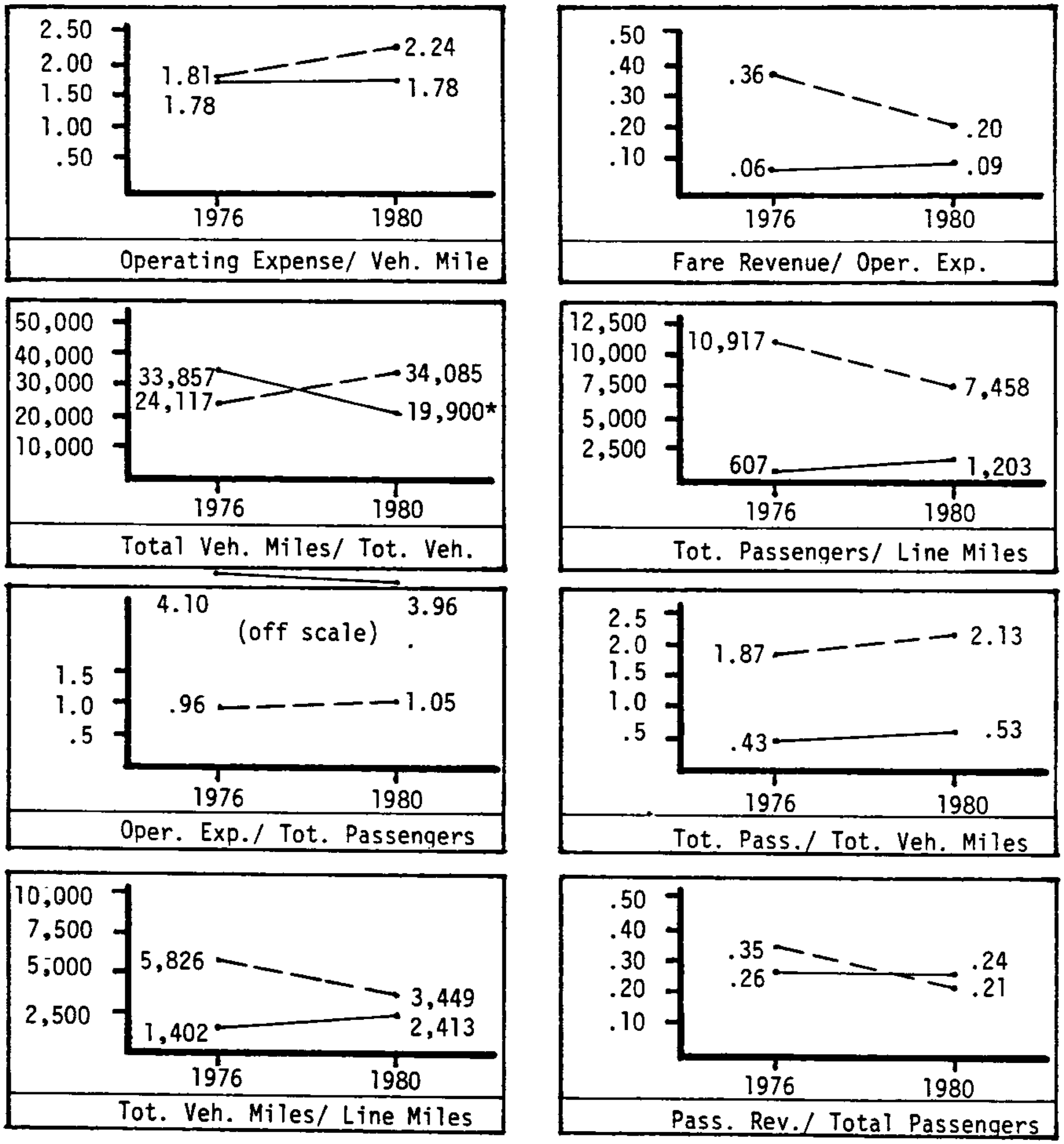
- - - - - State

——— Peer Group

NOTE: 1976 is represented by only one system.

Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

Rural



LEGEND

- - - - State

——— Peer Group

NOTES: 1976 is represented by only one system.
*only two systems

Comparison of "Peer Group" Trends in Relation to Statewide Average (excluding Metro)

PART 3

TRENDS IN CHARACTERISTICS AND PERFORMANCE OF INDIVIDUAL SYSTEMS

Bellingham Municipal Transit
(As of October 1981)

The city of Bellingham took over operation of transit in 1971, and initially funded it with a household tax. In 1975, the voters elected to increase the sales tax by 0.3 percent to pay for transit. Transit is now funded by the sales tax, the farebox, and other sources.

Bellingham Transit operates nine routes throughout the incorporated area. Service is provided Monday through Friday with eight routes operating on Saturday. The accompanying table provides recent service statistics.

Service is provided with a fleet of 24 full service coaches. Bellingham Transit employs an administrative staff of three, and a maintenance/service crew of seven. The system employs 30 drivers. Policy is determined by the Mayor and City Council, while the transit director is responsible for day-to-day operations.

A recent highlight was the completion of the downtown transfer facility which will serve to further improve the capabilities of the transit system, while at the same time upgrading an area at the city's core.

Finances have become a significant concern, and Bellingham Transit is investigating several options to secure additional funding, including legislative relief and the possibility of a PTBA.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Bellingham Municipal Transit

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	45,794
	Total Passengers	971,000	1,100,000	1,252,000	1,572,000	1,893,000
	Total Vehicle Miles	487,000	490,000	491,000	547,000	622,000
	Total Vehicle Hours	NA	NA	NA	NA	52,980
	Miles of Line	85	61	61	82	85
	Total Vehicles	15	15	26	20	25
Actual Dollars	Revenue Total	($850,000)	($1,152,600)	($1,396,000)	($1,993,500)	($2,119,700)
	Farebox	123,000	119,700	114,600	137,200	212,700
	Local Tax	695,000	1,002,600	1,182,600	1,155,400	1,180,600
	MVET	20,000	0	0	0	0
	Other	12,000	30,300	98,800	700,900	726,400
	Expenditure Total	($491,000)	($743,200)	($1,036,200)	($2,262,300)	($3,228,100)
	Capital	0	44,000	268,700	1,127,600	1,721,300
	Operations	491,000	699,200	723,000	1,069,400	1,381,000
	Other	0	0	45,500	65,300	125,800
	Total Operating Assistance	NA	NA	NA	NA	($1,167,400)
Constant 1980 Dollars	Revenue Total	($1,240,600)	($1,587,100)	($1,732,400)	($2,356,300)	
	Farebox	179,600	164,800	142,200	162,200	
	Local Tax	1,104,000	1,380,600	1,466,900	1,365,700	
	MVET	29,200	0	0	0	
	Other	17,500	41,700	122,600	828,500	
	Expenditure Total	($716,400)	($1,023,400)	($1,285,900)	($2,674,000)	
	Capital	0	60,600	333,500	1,332,800	
	Operations	716,400	962,800	897,200	1,264,000	
	Other	0	0	56,500	77,200	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Bellingham Municipal Transit (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	26.07
	Operating expense/total vehicle miles	1.47	1.96	1.83	2.31	2.22
Vehicle Efficiency	Total vehicle miles/total vehicles	32,467	32,667	18,885	27,350	24,886
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,119
Service Cost Effectiveness	Operating expense/miles of line	8,428	15,784	14,708	15,415	16,247
	Operating expense/total passengers	0.74	0.88	0.72	0.80	0.73
	Total revenue/total passengers	1.28	1.44	1.38	1.50	1.12
	Total revenue/operating expense	1.73	1.65	1.93	1.86	1.54
	Passenger revenue/operating expense	0.25	0.17	0.16	0.13	0.15
Effectiveness of Service Consumption	Total passengers/miles of line	11,424	18,033	20,525	19,171	22,271
	Total passengers/total vehicle miles	1.99	2.24	2.55	2.87	3.04
	Total passengers/total vheicle hours	NA	NA	NA	NA	35.73
	Total passengers/total vehicles	64,733	73,333	48,154	78,600	75,720
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	41.34
	Total vehicle miles/service area population	NA	NA	NA	NA	13.58
	Total vehicle hours/service area population	NA	NA	NA	NA	1.16
	Total vehicle miles/miles of line	5,729	8,033	8,041	6,671	7,318
	Total vehicle hours/miles of line	NA	NA	NA	NA	623
	Service area population/miles of line	NA	NA	NA	NA	539
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.18	0.15	0.11	0.10	0.11
	Passenger revenue/total vehicle miles	0.37	0.37	0.29	0.30	0.34
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	4.01
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	0.44	0.35	0.34	0.40	0.53
	Total passengers /local tax assistance	0.88	0.80	0.85	1.15	1.60
	Total vehicle miles/Motor Vehicle Excise Tax	16.68	0.00	0.00	0.00	0.00
	Total passengers /Motor Vehicle Excise Tax	33.25	0.00	0.00	0.00	0.00
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.53
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.05
	Total passengers/total operating assistance	NA	NA	NA	NA	1.62
	Service area population/total operating assistance	NA	NA	NA	NA	0.04

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Ben Franklin Transit

(As of October 1981)

The newest transit operation in the state, Ben Franklin Transit serves the Tri-Cities urbanized area, and the Hanford Reservation. Voters in the service area approved a 0.3 percent sales tax in 1981. Buses are expected to be on the road sometime in 1982.

The system currently is planned to have 18 fixed routes operating on a time transfer program. Service will be available throughout the urbanized area, with contracts planned with private operators for taking commuters to Hanford. Early in 1982, the system will begin financing an elderly and handicapped van program. Service will initially be provided Monday through Friday with a 10 - 12 hour day.

The system currently owns no buses, but will be ordering vehicles soon, after decisions about headways and service levels are made. Policy is determined by the PTBA Board, comprised of local elected officials. The Transit Manager is responsible for the day-to-day operations of the system.

The system will be built from scratch. The current staff consists of a manager and a secretary. Routes and schedules must be planned, equipment acquired, personnel hired and trained, and a maintenance facility identified.

Bremerton Municipal Transit
(As of October 1981)

Bremerton Municipal Transit was formed in 1971, and has contracted with the Bremerton-Charleston Transportation Company for operations. Kitsap County voters rejected a sales tax measure to support a regional transportation system proposed in 1979. The system currently receives income from an $.80/month household tax.

The system operates five routes Monday through Saturday, and two routes on Sunday within the city. This represents 24 miles of route. The system also operates 13 commuter runs to serve the Puget Sound Naval Shipyard. The accompanying table provides recent service statistics.

Service is provided with a fleet of 25 vehicles owned by Bremerton Municipal Transit, and two leased vehicles. The system employs 3 administrative staff, 3 maintenance personnel, and 23 drivers. Policy is determined by the Mayor and the City Commission.

The establishment of a regional PTBA is still being investigated, and a new tax proposal may go to the voters in 1982. The system currently is planning to acquire six new buses and to design and acquire a new maintenance facility. No plans exist for changing routes or schedules in the near future.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Bremerton Municipal Transit

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	36,208
	Total Passengers	839,000	850,000	827,000	937,000	943,000
	Total Vehicle Miles	402,000	375,000	343,000	373,000	349,000
	Total Vehicle Hours	NA	NA	NA	NA	35,000
	Miles of Line	33	24	24	24	26
	Total Vehicles	29	25	23	25	25
Actual Dollars	Revenue Total	($558,000)	($573,000)	($626,500)	($751,600)	($893,000)
	Farebox	244,000	252,900	245,000	279,800	271,600
	Local Tax	106,000	126,500	90,000	135,700	175,300
	MVET	115,000	155,000	200,000	210,000	267,600
	Other	93,000	38,900	91,500	126,100	179,300
	Expenditure Total	($566,000)	($573,100)	($651,000)	($785,700)	($848,000)
	Capital	0	0	0	0	700
	Operations	566,000	573,100	651,000	785,700	847,300
	Other	0	0	0	0	0
	Total Operating Assistance	NA	NA	NA	NA	($384,417)
Constant 1980 Dollars	Revenue Total	($814,100)	($789,000)	($777,500)	($888,400)	
	Farebox	356,000	348,200	304,000	330,700	
	Local Tax	154,700	174,200	111,700	160,400	
	MVET	167,800	213,400	248,200	248,000	
	Other	135,700	53,600	113,600	149,100	
	Expenditure Total	($825,800)	($789,200)	($807,900)	($928,700)	
	Capital	0	0	0	0	
	Operations	825,800	789,200	807,900	928,700	
	Other	0	0	0	0	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Bremerton Municipal Transit (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	24.21
	Operating expense/total vehicle miles	2.05	2.10	2.36	2.49	2.43
Vehicle Efficiency	Total vehicle miles/total vehicles	13,862	15,000	14,913	14,920	13,960
	Total vehicle hours/total vehicles	NA	NA	NA	NA	1,400
Service Cost Effectiveness	Operating expense/miles of line	17,151	23,879	27,125	28,571	32,588
	Operating expense/total passengers	0.98	0.93	0.98	0.99	0.90
	Total revenue/total passengers	0.97	0.93	0.94	0.95	0.95
	Total revenue/operating expense	0.99	1.00	0.96	0.96	1.05
	Passenger revenue/operating expense	0.43	0.44	0.38	0.36	0.32
Effectiveness of Service Consumption	Total passengers/miles of line	25,424	35,417	34,458	39,042	36,269
	Total passengers/total vehicle miles	2.09	2.27	2.41	2.51	2.70
	Total passengers/total vheicle hours	NA	NA	NA	NA	26.94
	Total passengers/total vehicles	28,931	34,000	35,957	37,480	37,720
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	26.04
	Total vehicle miles/service area population	NA	NA	NA	NA	9.64
	Total vehicle hours/service area population	NA	NA	NA	NA	0.96
	Total vehicle miles/miles of line	12,182	15,625	14,292	15,542	13,423
	Total vehicle hours/miles of line	NA	NA	NA	NA	1,346
	Service area population/miles of line	NA	NA	NA	NA	1,393
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.42	0.41	0.37	0.35	0.29
	Passenger revenue/total vehicle miles	0.89	0.93	0.89	0.89	0.78
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	25.51
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	2.60	2.15	3.07	2.33	1.99
	Total passengers /local tax assistance	5.42	4.88	7.40	5.84	5.38
	Total vehicle miles/Motor Vehicle Excise Tax	2.40	1.76	1.38	1.50	1.30
	Total passengers /Motor Vehicle Excise Tax	5.00	3.98	3.33	3.38	3.52
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.91
	Total vehicle hours/operating assistance	NA	NA	NA	NA	2.45
	Total passengers/total operating assistance	NA	NA	NA	NA	2.53
	Service area population/total operating assistance	NA	NA	NA	NA	0.09

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

C–Tran (Vancouver)
(As of October 1981)

Vancouver Transit began operations in 1969. In 1980, Clark County created a PTBA that was endorsed by the voters. The PTBA went operational in 1981, and adoptd the name C-TRAN.

C-TRAN operates 22 routes throughout the county, a free shuttle service in downtown Vancouver, and express bus service between Camas/Washougal and Portland, and Hazeldell and Portland. C-TRAN also contracts with Tri-Met in Portland to provide express bus service between Portland and the transit terminal in downtown Vancouver. (See table for ridership statistics).

Service is provided with a 25 bus fleet. C-TRAN employs 15 persons in administrative positions, 7 persons in maintenance, and 51 full and part-time drivers. Overall policy is determined by an eight-member board consisting of local elected officials, with a general manager responsible for operations.

The system is funded by 0.3 percent local sales tax, motor vehicle excise tax, and other sources.

C-TRAN is currently implementing their comprehensive plan, and immediate goals include acquiring 34 new buses, identifying a new administrative/operations/maintenance facility, and developing a park-n-ride lot program with the WSDOT.

Trends in Transit Financial and Operating Characteristics (1976–80)

SYSTEM C-Tran (Vancouver)		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	42,834
	Total Passengers	353,000	341,000	431,000	487,000	575,000
	Total Vehicle Miles	320,000	321,000	425,000	441,000	450,000
	Total Vehicle Hours	NA	NA	NA	NA	31,834
	Miles of Line	38	38	42	45	80
	Total Vehicles	12	12	12	10	15
Actual Dollars	Revenue Total	($1,120,000)	($693,000)	($977,400)	($1,317,700)	($1,148,100)
	Farebox	86,000	71,000	68,600	80,900	99,800
	Local Tax	218,000	222,900	228,900	232,500	238,200
	MVET	255,000	236,000	225,000	225,000	235,000
	Other	561,000	162,500	454,900	779,300	575,100
	Expenditure Total	($1,033,000)	($761,800)	($1,046,600)	($1,015,300)	($1,391,200)
	Capital	622,000	22,300	24,000	0	36,500
	Operations	411,000	658,900	947,800	1,015,300	1,354,700
	Other	0	80,000	75,800	0	0
	Total Operating Assistance	NA	NA	NA	NA	($1,254,068)
Constant 1980 Dollars	Revenue Total	($1,634,100)	($954,300)	($1,213,000)	($1,557,500)	
	Farebox	125,500	97,900	85,100	95,600	
	Local Tax	318,100	306,900	294,100	274,800	
	MVET	372,000	325,000	279,200	266,000	
	Other	818,500	224,400	364,500	921,100	
	Expenditure Total	($1,463,900)	($1,049,000)	($1,298,800)	($1,200,100)	
	Capital	907,500	30,700	29,800	0	
	Operations	[illegible]	907,300	1,176,200	1,200,100	
	Other	0	111,000	94,100	0	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for C-Tran (Vancouver) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	42.55
	Operating expense/total vehicle miles	1.87	2.83	2.77	2.72	3.01
Vehicle Efficiency	Total vehicle miles/total vehicles	26,667	26,750	35,417	44,100	30,000
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,122
Service Cost Effectiveness	Operating expense/miles of line	15,779	23,876	28,005	21,495	16,934
	Operating expense/total passengers	1.70	2.66	2.73	. 2.46	2.35
	Total revenue/total passengers	4.63	2.80	2.81	3.20	1.99
	Total revenue/operating expense	0.27	1.05	1.03	1.30	0.84
	Passenger revenue/operating expense	0.21	0.11	0.07	0.08	0.07
Effectiveness of Service Consumption	Total passengers/miles of line	9,289	8,974	10,262	10,822	7,187
	Total passengers/total vehicle miles	1.10	1.06	1.01	1.10	1.27
	Total passengers/total vheicle hours	NA	NA	NA	NA	18.06
	Total passengers/total vehicles	29,417	28,417	35,917	48,700	38,333
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	13.42
	Total vehicle miles/service area population	NA	NA	NA	NA	10.50
	Total vehicle hours/service area population	NA	NA	NA	NA	0.74
	Total vehicle miles/miles of line	8,421	8,447	10,119	10,500	5,625
	Total vehicle hours/miles of line	NA	NA	NA	NA	398
	Service area population/miles of line	NA	NA	NA	NA	535
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.36	0.29	0.20	0.20	0.17
	Passenger revenue/total vehicle miles	0.39	0.30	0.20	0.22	0.22
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.14
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.01	1.05	1.50	1.60	1.89
	Total passengers /local tax assistance	1.11	1.11	1.52	1.77	2.41
	Total vehicle miles/Motor Vehicle Excise Tax	0.86	0.99	1.62	1.66	1.91
	Total passengers /Motor Vehicle Excise Tax	0.95	1.05	1.54	1.83	2.45
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.35
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.03
	Total passengers/total operating assistance	NA	NA	NA	NA	0.46
	Service area population/total operating assistance	NA	NA	NA	NA	0.03

Source: Public Transportation in Washington State, 1981. Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Clallam Transit
(As of October 1981)

Clallam County voters approved a 0.3 percent sales tax increase to fund a PTBA in 1979 in eastern Clallam County. Service was begun in October of 1980.

Clallam Transit operates eight regular fixed-routes and five commuter routes over a distance of 128 miles within the service area. Service is provided Monday through Friday. The accompanying table provides recent service statistics for the system.

The service operates 13 buses and 4 vans. It is the only system to operate propane-powered vehicles. The system employs 6 administrative staff, 2 maintenance people, and 24 drivers. Clallam Transit contracts with Port Angeles for maintenance work. Policy is determined by the PTBA Board, comprised of local elected officials. The Transit Manager is responsible for the day-to-day operations of the system.

Clallam Transit will soon be contracting for an evaluation study to determine the effectiveness of the program. Current plans include acquiring eight new buses, a new washrack, a fueling facility, and developing an areawide dial-a-ride program.

Community Urban Bus Service (Kelso-Longview)
(As of October 1981)

The Community Urban Bus Service (CUBS) came into existence in 1975 when the city of Longview bought out the existing private operator. A 0.1 percent utility tax was levied, and matched against MVET funds to support the system. The city of Kelso entered into an agreement with Longview to support the system.

CUBS operates four routes over 48 miles within the Kelso/Longview area. Service is available Monday through Saturday. The accompanying table provides recent service statistics.

The system operates a 5 bus fleet, employs 3 administrative staff, and 11 drivers. Maintenance is provided by the city of Longview shops. Policy is determined by the Transit Operating Board, an inter-governmental organization comprised of three members each from Kelso and Longview, and a representative from Cowlitz County. The Public Works Director is the Transit Manager and day-to-day activities are handled by the Operations Supervisor.

CUBS plans no immediate service changes, but efforts are underway to acquire two new buses, 75 benches, and an expanded maintenance capacity at the city shops. The staff also is working with the new shopping mall to design a small bus mall to facilitate service by the bus system.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Community Urban Bus Service (Kelso-Longview)

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	42,181
	Total Passengers	41,000	89,000	169,000	231,000	277,000
	Total Vehicle Miles	37,000	139,000	200,000	180,000	175,000
	Total Vehicle Hours	NA	NA	NA	NA	12,768
	Miles of Line	14	50	50	50	50
	Total Vehicles	2	6	6	6	5
Actual Dollars	Revenue Total	($233,000)	($555,000)	($344,900)	($459,900)	($502,300)
	Farebox	10,000	20,300	19,600	25,000	46,200
	Local Tax	85,000	121,100	123,400	163,400	136,400
	MVET	85,000	121,100	148,400	193,400	200,000
	Other	53,000	292,500	53,500	77,900	119,700
	Expenditure Total	($42,000)	($577,300)	($287,800)	($341,400)	($357,400)
	Capital	0	373,600	5,200	23,800	5,600
	Operations	42,000	176,800	282,600	290,400	324,100
	Other	0	26,900	0	27,200	27,700
	Total Operating Assistance	NA	NA	NA	NA	($277,173)
Constant 1980 Dollars	Revenue Total	($339,900)	($764,200)	($428,000)	($543,600)	
	Farebox	13,400	28,000	24,300	29,800	
	Local Tax	124,000	166,800	169,900	193,100	
	MVET	124,000	166,800	179,700	228,600	
	Other	77,300	402,800	66,400	92,100	
	Expenditure Total	($61,300)	($794,900)	($357,200)	($403,500)	
	Capital	0	514,400	6,500	28,100	
	Operations	61,300	231,100	350,700	343,300	
	Other	0	37,000	0	32,200	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Community Urban Bus Service (Kelso-Longview) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	25.38
	Operating expense/total vehicle miles	1.66	1.66	1.75	1.91	1.85
Vehicle Efficiency	Total vehicle miles/total vehicles	18,500	23,167	33,333	30,000	35,000
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,554
Service Cost Effectiveness	Operating expense/miles of line	4,379	4,622	7,014	6,866	6,482
	Operating expense/total passengers	1.50	2.60	2.08	1.49	1.17
	Total revenue/total passengers	8.29	8.59	2.53	2.35	1.81
	Total revenue/operating expense	5.54	3.31	1.22	1.58	1.55
	Passenger revenue/operating expense	0.22	0.12	0.07	0.09	0.14
Effectiveness of Service Consumption	Total passengers/miles of line	2,929	1,780	3,380	4,620	5,540
	Total passengers/total vehicle miles	1.11	0.64	0.85	1.28	1.58
	Total passengers/total vneicle hours	NA	NA	NA	NA	21.69
	Total passengers/total vehicles	20,500	14,833	28,167	38,500	55,400
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	6.57
	Total vehicle miles/service area population	NA	NA	NA	NA	4.15
	Total vehicle hours/service area population	NA	NA	NA	NA	0.30
	Total vehicle miles/miles of line	2,643	2,780	4,000	3,600	3,500
	Total vehicle hours/miles of line	NA	NA	NA	NA	255
	Service area population/miles of line	NA	NA	NA	NA	844
Effectiveness of Revenue Generation	Passenger revenue/total passengers	[illegible]	0.31	0.14	0.13	0.16
	Passenger revenue/total vehicle miles	0.36	0.20	0.12	0.17	0.26
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.62
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	0.30	0.83	1.18	0.93	1.28
	Total passengers /local tax assistance	0.33	0.53	0.99	1.20	2.03
	Total vehicle miles/Motor Vehicle Excise Tax	0.30	0.83	1.11	0.79	0.87
	Total passengers /Motor Vehicle Excise Tax	0.33	0.53	0.94	1.01	1.38
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.63
	Total vehicle hours/operating assistance	NA	NA	NA	NA	1.00
	Total passengers/total operating assistance	NA	NA	NA	NA	0.17
	Service area population/total operating assistance	NA	NA	NA	NA	0.15

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Community Transit (Snohomish)
(As of October 1981)

In 1976, voters in Snohomish County approved a 0.3 percent tax increase to support a PTBA. The original service area was in the southwest corner, but several annexations have expanded the service area to include Stanwood, Arlington, Marysville, Snohomish, Monroe, Edmonds, Mountlake Terrace, and Lynnwood.

The system operates 14 routes within its service areas. In addition, the Community Transit operates two express routes to Seattle, and contracts with METRO for 10 more express routes. Local service is provided seven days a week. The accompanying table provides recent service statistics.

The program operates a 73-bus fleet, and employs 20 persons in administrative positions and 96 drivers. Maintenance is provided under contract with the Edmonds School District. Policy is determined by a nine-member board of elected officials, and the Transit Director is responsible for the day-to-day operations of the system.

Community Transit recently had two successful annexations, and four additional areas have expressed an interest. The staff is working with the WSDOT to plan and develop new park-and-ride lots; has plans for building new passenger shelters; is developing a replacement schedule for the buses; and is currently involved in the planning, design, and acquisition of a new maintenance facility.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Community Transit (Snohomish)

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	194,200
	Total Passengers	380,000	915,000	1,216,000	1,684,000	2,475,000
	Total Vehicle Miles	458,000	1,162,000	1,434,000	1,833,000	2,628,000
	Total Vehicle Hours	NA	NA	NA	NA	142,977
	Miles of Line	150	150	169	210	288
	Total Vehicles	0	18	21	31	36
Actual Dollars	Revenue Total	($953,000)	($3,232,800)	($3,773,400)	($6,901,500)	($7,579,000)
	Farebox	172,000	296,800	98,600	646,600	868,200
	Local Tax	187,000	1,129,900	2,395,200	2,568,000	2,956,600
	MVET	50,000	1,259,600	1,121,000	3,289,000	3,000,000
	Other	544,000	46,500	158,600	397,900	754,900
	Expenditure Total	($596,000)	($1,828,800)	($1,684,600)	($5,362,700)	($5,402,700)
	Capital	21,000	4,600	0	1,998,300	242,900
	Operations	575,000	1,824,200	1,664,900	3,216,700	4,980,100
	Other	0	0	19,700	157,700	179,700
	Total Operating Assistance	NA	NA	NA	NA	($4,096,850)
Constant 1980 Dollars	Revenue Total	($1,390,000)	($4,451,600)	($4,687,800)	($8,157,600)	
	Farebox	251,000	371,500	122,400	764,300	
	Local Tax	273,900	2,244,400	2,972,400	3,035,400	
	MVET	72,900	1,734,500	1,391,200	3,887,600	
	Other	793,700	64,000	196,800	470,300	
	Expenditure Total	(869,600)	($2,518,300)	($2,090,600)	($6,338,700)	
	Capital	30,600	63,300	0	2,350,200	
	Operations	838,900	2,518,300	2,090,600	3,862,100	
	Other	0	0	244,500	186,400	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Community Transit (Snohomish) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	34.83
	Operating expense/total vehicle miles	1.83	2.17	1.46	2.11	1.89
Vehicle Efficiency	Total vehicle miles/total vehicles	0.00	64,556	68,286	59.129	73,000
	Total vehicle hours/total vehicles	NA	NA	NA	NA	3,972
Service Cost Effectiveness	Operating expense/miles of line	5,593	16,789	12,370	18,391	17,292
	Operating expense/total passengers	2.21	2.75	1.72	2.29	2.01
	Total revenue/total passengers	3.66	4.68	3.86	4.84	3.06
	Total revenue/operating expense	1.66	1.77	2.24	2.11	1.35
	Passenger revenue/operating expense	0.30	0.15	0.06	0.20	0.17
Effectiveness of Service Consumption	Total passengers/miles of line	2,533	6,340	7,195	8,019	8,594
	Total passengers/total vehicle miles	0.83	0.82	0.85	0.92	0.94
	Total passengers/total vheicle hours	NA	NA	NA	NA	17.31
	Total passengers/total vehicles	0.00	52,833	57,905	59,129	68,750
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	12.74
	Total vehicle miles/service area population	NA	NA	NA	NA	13.53
	Total vehicle hours/service area population	NA	NA	NA	NA	0.74
	Total vehicle miles/miles of line	3,053	7,747	8,484	8,729	9,125
	Total vehicle hours/miles of line	NA	NA	NA	NA	469
	Service area population/miles of line	NA	NA	NA	NA	674
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.66	0.39	0.10	0.45	0.35
	Passenger revenue/total vehicle miles	0.55	0.32	0.09	0.42	0.33
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	5.78
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.67	0.52	0.48	0.60	0.88
	Total passengers /local tax assistance	1.39	0.42	0.41	0.55	0.84
	Total vehicle miles/Motor Vehicle Excise Tax	6.28	0.67	1.03	0.47	0.88
	Total passengers /Motor Vehicle Excise Tax	5.21	0.54	0.87	0.43	0.82
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.64
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.05
	Total passengers/total operating assistance	NA	NA	NA	NA	0.60
	Service area population/total operating assistance	NA	NA	NA	NA	0.05

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Everett Transit System
(As of October 1981)

The city of Everett has been in the transit business since 1970. Originally funded by a household and employee tax, the voters approved a 0.3 percent sales tax for transit in late 1978.

The system has 15 routes running over 82 miles within the city limits, and includes service to Mukilteo and Silver Lake. The system also finances a van program for the elderly and the handicapped that is operated by the Everett Senior Center. Service is provided seven days a week. The accompanying table provides recent service statistics.

Everett Transit operates a 32 bus fleet, and provides funding for three lift-equipped vans operated by the senior center. The system employs 6 administrative staff, 7 maintenance people, and 50 drivers. Maintenance is performed in the city shops. Policy is determined by the City Council, and the Transit Manager, who reports to the Transit/Traffic Director, is responsible for day-to-day operations.

The system is involved with several major projects. The city has been annexing land, and the system has plans to expand service. Express service will be provided to the Boeing Plant, and a ridesharing program is being developed. Plans exist to acquire five new buses through 1986, and efforts are underway to design and develop a new maintenance facility.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Everett Transit System

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	54,413
	Total Passengers	906,000	910,000	1,012,000	1,359,000	1,667,000
	Total Vehicle Miles	706,000	695,000	696,000	705,000	758,000
	Total Vehicle Hours	NA	NA	NA	NA	63,108
	Miles of Line	65	65	65	65	119
	Total Vehicles	18	18	19	22	29
Actual Dollars	Revenue Total	($638,000)	($691,400)	($961,600)	($2,115,000)	($2,475,200)
	Farebox	130,000	129,300	131,400	144,800	186,300
	Local Tax	240,000	243,900	292,600	1,547,900	2,202,900
	MVET	264,000	234,500	294,500	0	0
	Other	4,000	83,700	243,100	422,300	86,000
	Expenditure Total	($705,000)	($858,100)	($961,600)	($1,191,900)	($1,987,100)
	Capital	0	40,900	900	3,000	206,600
	Operations	705,000	813,600	960,700	1,182,100	1,780,500
	Other	0	3,600	0	6,800	0
	Total Operating Assistance	NA	NA	NA	NA	($1,592,353)
Constant 1980 Dollars	Revenue Total	($930,800)	($952,100)	($1,193,300)	($2,499,900)	
	Farebox	189,700	178,000	163,100	171,200	
	Local Tax	350,200	335,900	363,100	1,829,600	
	MVET	385,200	322,900	365,500	0	
	Other	5,800	115,300	301,700	499,200	
	Expenditure Total	($1,028,600)	($1,181,600)	($1,193,300)	1,408,800	
	Capital	0	56,300	1,100	3,500	
	Operations	1,028,600	1,120,300	1,192,200	1,397,200	
	Other	0	5,000	0	8,000	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Everett Transit System (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	28.21
	Operating expense/total vehicle miles	1.46	1.61	1.71	1.98	2.35
Vehicle Efficiency	Total vehicle miles/total vehicles	39,222	38,611	36,632	32,045	26,138
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,176
Service Cost Effectiveness	Operating expense/miles of line	15,825	17,235	18,342	21,495	14,962
	Operating expense/total passengers	1.14	1.23	1.18	1.03	1.07
	Total revenue/total passengers	1.03	1.05	1.18	1.84	1.48
	Total revenue/operating expense	0.90	0.85	1.00	1.79	1.39
	Passenger revenue/operating expense	0.18	0.16	0.14	0.12	0.10
Effectiveness of Service Consumption	Total passengers/miles of line	13,938	14,000	15,569	20,906	14,008
	Total passengers/total vehicle miles	1.28	1.31	1.45	1.93	2.20
	Total passengers/total vheicle hours	NA	NA	NA	NA	26.41
	Total passengers/total vehicles	50,333	50,556	53,263	61,773	57,483
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	30.64
	Total vehicle miles/service area population	NA	NA	NA	NA	13.93
	Total vehicle hours/service area population	NA	NA	NA	NA	1.16
	Total vehicle miles/miles of line	10,862	10,692	10,708	10,846	6,370
	Total vehicle hours/miles of line	NA	NA	NA	NA	530
	Service area population/miles of line	NA	NA	NA	NA	475
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.21	0.20	0.16	0.13	0.11
	Passenger revenue/total vehicle miles	0.27	0.26	0.23	0.24	0.25
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	2.95
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	2.02	2.07	1.92	0.38	0.34
	Total passengers /local tax assistance	2.59	2.71	2.79	0.74	0.76
	Total vehicle miles/Motor Vehicle Excise Tax	1.83	2.15	1.91	0	0
	Total passengers /Motor Vehicle Excise Tax	2.35	2.82	2.77	0	0
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.48
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.04
	Total passengers/total operating assistance	NA	NA	NA	NA	1.05
	Service area population/total operating assistance	NA	NA	NA	NA	0.04

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Gray's Harbor Transportation Authority
(As of October 1981)

After several years of study, the Grays Harbor Transportation Authority (GHTA) was created in 1974. Grays Harbor voters approved a 0.3 percent sales tax increase for transit that same year, making GHTA the only operational county transportation authority in the state.

Service is provided with 10 fixed routes, 4 routes with route deviation, and 2 demand response runs. The routes cover a total of 757 miles throughout the county. Service is 7 days a week, and the accompanying table provides recent service statistics.

The GHTA operates 27 vehicles and contracts with Washington Coast Lines for the use of 3 more. The system employs 6 administrative staff, 7 maintenance people, and 33 drivers. Policy is determined by a board consisting of 3 county commissioners and the mayors of three communities within the county. The Transit Manager is responsible for the day-to-day operations of the system.

A five year transportation plan was recently adopted that calls for continued system expansion and capital expenditures over those five years of about $928,000 for replacement and additional equipment.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Gray's Harbor Transportation Authority

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	66,314
	Total Passengers	205,000	281,000	383,000	552,000	783,000
	Total Vehicle Miles	474,000	569,000	636,000	972,000	810,000
	Total Vehicle Hours	NA	NA	NA	NA	56,761
	Miles of Line	338	341	323	375	375
	Total Vehicles	14	18	23	25	30
Actual Dollars	Revenue Total	($1,534,000)	($2,229,500)	($3,536,600)	($3,469,300)	($3,789,000)
	Farebox	37,000	79,200	77,300	130,000	172,800
	Local Tax	806,000	1,089,000	1,551,100	1,532,300	1,447,600
	MVET	636,000	864,900	540,300	1,000,000	1,437,500
	Other	1,000	196,400	1,367,900	807,000	731,100
	Expenditure Total	($708,000)	($999,900)	($2,920,000)	($1,533,400)	($2,326,900)
	Capital	131,000	6,800	1,787,300	249,800	434,700
	Operations	577,000	971,700	1,133,100	1,283,600	1,892,200
	Other	0	21,400	0	0	0
	Total Operating Assistance	NA	NA	NA	NA	
Constant 1980 Dollars	Revenue Total	($2,238,100)	($3,070,000)	($4,388,900)	($4,100,700)	
	Farebox	54,000	109,100	95,900	153,700	
	Local Tax	1,254,800	1,499,600	1,924,800	1,811,200	
	MVET	927,900	1,191,000	607,500	1,182,000	
	Other	1,500	270,400	1,697,600	953,900	
	Expenditure Total	($1,033,000)	($1,376,900)	($3,623,700)	($1,812,500)	
	Capital	191,100	9,400	2,218,600	295,300	
	Operations	841,900	1,338,000	1,406,200	1,517,200	
	Other	0	29,500	0	0	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Gray's Harbor Transportation Authority (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	33.34
	Operating expense/total vehicle miles	1.78	2.35	2.21	1.56	2.34
Vehicle Efficiency	Total vehicle miles/total vehicles	33,857	31,611	27,652	38,880	27,000
	Total vehicle hours/total vehicles	NA	NA	NA	NA	1,892
Service Cost Effectiveness	Operating expense/miles of line	2.491	3,924	4,354	4,406	5,046
	Operating expense/total passengers	4.10	4.76	3.67	2.75	2.42
	Total revenue/total passengers	10.92	10.93	11.46	7.43	4.84
	Total revenue/operating expense	2.66	2.29	3.12	2.70	2.00
	Passenger revenue/operating expense	0.06	0.08	0.07	0.10	0.09
Effectiveness of Service Consumption	Total passengers/miles of line	607	824	1.186	1,472	2,088
	Total passengers/total vehicle miles	0.43	0.49	0.60	0.57	0.96
	Total passengers/total vheicle hours	NA	NA	NA	NA	13.79
	Total passengers/total vehicles	14,643	15,611	16,652	22,080	26,100
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	11.81
	Total vehicle miles/service area population	NA	NA	NA	NA	12.21
	Total vehicle hours/service area population	NA	NA	NA	NA	0.86
	Total vehicle miles/miles of line	1,402	1,669	1,969	2,592	2,160
	Total vehicle hours/miles of line	NA	NA	NA	NA	151
	Service area population/miles of line	NA	NA	NA	NA	177
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.26	0.39	0.25	0.28	0.22
	Passenger revenue/total vehicle miles	0.11	0.19	0.15	0.16	0.21
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.04
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	0.38	0.37	0.33	0.30	0.60
	Total passengers /local tax assistance	0.16	0.19	0.20	0.54	0.54
	Total vehicle miles/Motor Vehicle Excise Tax	0.51	0.38	1.05	0.47	0.56
	Total passengers /Motor Vehicle Excise Tax	0.22	0.24	0.63	0.82	0.54
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.49
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.03
	Total passengers/total operating assistance	NA	NA	NA	NA	0.47
	Service area population/total operating assistance	NA	NA	NA	NA	0.04

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Intercity Transit (Olympia–Lacey–Tumwater) (As of October 1981)

Olympia, Lacey, and Tumwater created the Intercity Transit Commission in 1972. In 1980, Thurston County voters approved a 0.3 percent sales tax for the Thurston County PTBA. This expanded the service area for Intercity Transit around the original three cities.

The system operates 17 routes over 164 miles within the service area. Service is provided Monday through Saturday. The accompanying table provides recent service statistics.

Intercity Transit operates a 31 bus fleet, employs 8 administrative staff, 9 maintenance people, and 52 drivers. Policy is determined by the PTBA Board comprised of local elected officials. The Transit Director is responsible for day-to-day operations.

Several projects are planned or underway. Currently, the program is preparing to implement a computer system for records and accounting. Efforts are underway to identify and develop a new maintenance/operations facility. The system plans to acquire 23 new buses, and to begin a replacement program. Obtaining new bus shelters is an on-going effort.

Trends in Transit Financial and Operating Characteristics (1976–80)

SYSTEM Intercity Transit (Olympia-Lacey-Tumwater)

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	87,600
	Total Passengers	703,000	832,000	960,000	1,320,000	1,690,000
	Total Vehicle Miles	399,000	423,000	500,000	642,000	718,000
	Total Vehicle Hours	NA	NA	NA	NA	59,300
	Miles of Line	67	67	90	97	87
	Total Vehicles	14	14	18	22	30
Actual Dollars	Revenue Total	($871,000)	($591,000)	($1,108,300)	($1,158,500)	($1,848,000)
	Farebox	88,000	108,300	105,000	170,800	221,000
	Local Tax	211,000	221,300	784,300	938,800	1,319,100
	MVET	232,000	229,200	0	0	0
	Other	350,000	32,200	219,000	48,900	307,900
	Expenditure Total	($790,000)	($631,700)	($913,700)	($1,166,800)	($1,827,000)
	Capital	369,000	33,300	252,900	84,800	588,300
	Operations	421,000	541,900	660,800	1,004,700	1,142,100
	Other	0	56,500	0	77,300	96,600
	Total Operating Assistance	NA	NA	NA	NA	($894,172)
Constant 1980 Dollars	Revenue Total	($1,270,800)	($813,800)	($1,375,400)	($1,369,300)	
	Farebox	128,400	149,100	130,300	201,900	
	Local Tax	307,800	304,700	973,300	1,109,700	
	MVET	338,500	315,600	0	0	
	Other	510,700	44,300	271,800	57,800	
	Expenditure Total	($1,152,600)	($869,900)	($1,133,900)	($1,379,200)	
	Capital	538,400	45,900	313,800	1,002,300	
	Operations	614,200	746,200	820,100	1,187,600	
	Other	0	77,800	0	918,800	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Intercity Transit (Olympia—Lacey—Tumwater) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	19.26
	Operating expense/total vehicle miles	1.54	1.76	1.64	1.85	1.59
Vehicle Efficiency	Total vehicle miles/total vehicles	28,500	30,214	27,778	29,182	32,933
	Total vehicle hours/total vehicles	NA	NA	NA	NA	1,977
Service Cost Effectiveness	Operating expense/miles of line	9,167	11,137	9,112	12,243	13,128
	Operating expense/total passengers	0.87	0.90	0.85	0.90	0.68
	Total revenue/total passengers	1.81	0.98	1.43	1.04	1.09
	Total revenue/operating expense	2.07	1.09	1.68	1.15	1.62
	Passenger revenue/operating expense	0.21	0.20	0.16	0.17	0.19
Effectiveness of Service Consumption	Total passengers/miles of line	10,493	12,418	10,667	13,608	19,425
	Total passengers/total vehicle miles	1.76	1.97	1.92	2.06	2.35
	Total passengers/total vheicle hours	NA	NA	NA	NA	28.50
	Total passengers/total vehicles	50,214	59,429	53,333	60,000	56,334
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	19.29
	Total vehicle miles/service area population	NA	NA	NA	NA	8.20
	Total vehicle hours/service area population	NA	NA	NA	NA	0.68
	Total vehicle miles/miles of line	5,955	6,313	5,556	6,619	8,253
	Total vehicle hours/miles of line	NA	NA	NA	NA	682
	Service area population/miles of line	NA	NA	NA	NA	1,007
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.18	0.18	0.14	0.15	0.13
	Passenger revenue/total vehicle miles	0.32	0.35	0.36	0.31	0.31
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.73
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.30	1.42	0.51	0.58	0.54
	Total passengers /local tax assistance	2.28	2.73	0.99	1.19	1.28
	Total vehicle miles/Motor Vehicle Excise Tax	1.03	1.39	0	0	0
	Total passengers /Motor Vehicle Excise Tax	2.08	2.64	0	0	0
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.80
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.07
	Total passengers/total operating assistance	NA	NA	NA	NA	1.89
	Service area population/total operating assistance	NA	NA	NA	NA	0.10

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Jefferson Transit
(As of October 1981)

The voters of Jefferson County approved a 0.3 percent sales tax measure in 1980 to support a countywide PTBA. Service began in 1981.

Jefferson Transit operates five routes over 112 miles within the county. The system also contracts with the Grays Harbor Transit Authority for service in the west end of the county. Service is provided seven days a week. No statistics are available, except that 17,588 trips have been provided between January and May of 1981.

Service is provided with four buses owned by the system, and one that is leased. Jefferson Transit employs 5 administrative people and 8 drivers. Maintenance is contracted out to a private garage. Policy is determined by the PTBA Board comprised of local elected officials. The Transit Manager is responsible for the day-to-day operations of the system.

The system plans to acquire four new vehicles in 1982, and one new vehicle per year from 1983-87. The program will add two new routes early in 1982, and has begun efforts to obtain bus shelters. A new maintenance facility is planned for 1984-85.

Municipality of Metropolitan Seattle (Metro) (As of October 1981)

In 1972, the voters in King County authorized METRO to begin operating a unified transit system, supported by a 0.3 percent sales tax. After the Legislature authorized a tax increase to 0.6 percent, the voters approved an incremental increase in 1980. Currently, METRO collects a 0.4 percent sales tax, but this will be increased to 0.6 percent in 1982.

METRO operates 194 routes throughout King County. In 1980, METRO routes covered 975 miles and included a service area of 2128 square miles. METRO contracts with two private, nonprofit agencies in the county for elderly and handicapped van service. METRO also provides a taxi scrip program within Seattle for the elderly and the handicapped. Service is provided seven days a week. The accompanying table provides recent service statistics.

Service is provided with a fleet of 1196 buses, and the system employs 353 administrative staff, 518 maintenance people, and 1876 drivers. METRO Transit is one department of the Municipality of Metropolitan Seattle. METRO is governed by the Metropolitan Council, comprised of local elected officials.

METRO plans to acquire 202 articulated buses in the next few years, and has begun an extensive marketing and promotional campaign. The METRO Council is concerned about local revenue sources; and will approach the Legislature, and consider a fare increase to generate new funds.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Metro (Seattle)

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	1,269,749
	Total Passengers	41,464,000	44,905,000	49,461,000	58,259,000	66,072,000
	Total Vehicle Miles	24,093,000	24,301,000	25,573,000	27,679,000	31,691,000
	Total Vehicle Hours	NA	NA	NA	NA	1,645,535
	Miles of Line	709	827	800	960	1,044
	Total Vehicles	640	710	812	974	1,200
Actual Dollars	Revenue Total	($60,937,000)	($70,209,000)	($98,226,900)	($113,967,800)	($128,640,000)
	Farebox	10,300,000	12,315,000	13,082,000	18,658,000	24,296,000
	Local Tax	18,455,000	22,133,000	27,909,000	29,303,000	30,613,000
	MVET	12,044,000	15,570,000	16,621,900	20,490,800	22,707,000
	Other	20,138,000	20,191,000	40,614,000	45,516,000	51,024,000
	Expenditure Total	($63,249,000)	($70,651,000)	($95,370,000)	($115,566,000)	($134,797,000)
	Capital	25,080,000	27,579,000	44,040,000	50,303,000	40,939,000
	Operations	38,169,000	43,072,000	51,330,000	65,263,000	85,416,000
	Other	0	0	0	0	8,442,000
	Total Operating Assistance	NA	NA	NA	NA	($58,131,000)
Constant 1980 Dollars	Revenue Total	($88,907,100)	($96,677,800)	($121,944,300)	($134,709,900)	
	Farebox	15,027,800	16,957,800	16,234,800	22,053,800	
	Local Tax	26,925,800	30,477,100	34,635,100	34,636,100	
	MVET	17,572,200	21,439,900	20,627,800	24,220,100	
	Other	29,381,300	27,803,000	50,402,000	53,799,900	
	Expenditure Total	($92,280,300)	($97,286,400)	($118,354,200)	($136,599,000)	
	Capital	36,591,700	37,976,300	54,653,700	59,458,100	
	Operations	55,688,600	59,310,100	63,700,600	77,140,900	
	Other	0	0	0	0	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Municipality of Metropolitan Seattle (Metro) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	51.90
	Operating expense/total vehicle miles	2.31	2.44	2.49	2.79	2.69
Vehicle Efficiency	Total vehicle miles/total vehicles	37,645	34,227	31,494	28,418	26,409
	Total vehicle hours/total vehicles	NA	NA	NA	NA	1,371
Service Cost Effectiveness	Operating expense/miles of line	78,545	71,717	79,626	80,355	81,816
	Operating expense/total passengers	1.34	1.32	1.29	1.32	1.29
	Total revenue/total passengers	2.14	2.15	2.47	2.31	1.95
	Total revenue/operating expense	1.60	1.63	1.91	1.75	1.51
	Passenger revenue/operating expense	0.27	0.29	0.25	0.29	0.28
Effectiveness of Service Consumption	Total passengers/miles of line	58,482	54,299	61,826	60,686	63,287
	Total passengers/total vehicle miles	1.72	1.85	1.93	2.10	2.08
	Total passengers/total vheicle hours	NA	NA	NA	NA	40.15
	Total passengers/total vehicles	64,788	63,246	60,916	59,814	55,060
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	52.03
	Total vehicle miles/service area population	NA	NA	NA	NA	24.95
	Total vehicle hours/service area population	NA	NA	NA	NA	1.30
	Total vehicle miles/miles of line	33,982	29,385	31,966	28,832	30,355
	Total vehicle hours/miles of line	NA	NA	NA	NA	1,576
	Service area population/miles of line	NA	NA	NA	NA	1,476
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.36	0.38	0.33	0.36	0.37
	Passenger revenue/total vehicle miles	0.63	0.70	0.63	0.80	0.77
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	1.93
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	0.89	0.80	0.74	0.80	1.03
	Total passengers /local tax assistance	1.54	1.64	1.43	1.68	2.16
	Total vehicle miles/Motor Vehicle Excise Tax	1.37	1.13	1.24	1.14	1.39
	Total passengers /Motor Vehicle Excise Tax	2.36	2.09	2.40	2.41	2.90
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.54
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.03
	Total passengers/total operating assistance	NA	NA	NA	NA	1.13
	Service area population/total operating assistance	NA	NA	NA	NA	0.02

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Pacific Transit System

(As of October 1981)

Voters in Pacific County approved a 0.3 percent sales tax increase in 1979 to operate a PTBA. Contracts were signed with Grays Harbor Transportation Authority and Washington Coast Lines, enabling the system to provide service in January 1980. This service offered public transportation to residents of the county for the first time in 15 years.

Pacific Transit provides 6 routes in the county, 5 routes are contracted to other providers, and 1 route between Raymond and South Bend is operated by the system. The contracted routes connect residents with Aberdeen/Hoquiam and Astoria, Oregon besides connecting communities within the county. A Dial-a-Ride service is provided once a week. The accompanying table provides recent service statistics.

The system now operates one bus, and employs two administrative staff and three drivers. Policy is determined by the PTBA board comprised of local elected officials. The Transit Manager is responsible for day-to-day operations.

A comprehensive transportation plan was approved in 1980 that recommends 12 routes within the county. The system will be opening bids for five new buses with an option for three more. Efforts are underway to acquire a maintenance facility for the new equipment.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Pacific Transit System

		76	77	78	79	80
	Service Area Population					17,237
	Total Passengers					46,121
	Total Vehicle Miles					142,682
	Total Vehicle Hours					6,734
	Miles of Line					281
	Total Vehicles					0
Actual Dollars	Revenue Total					($405,528)
	Farebox					6,466
	Local Tax					182,106
	MVET					130,011
	Other					16,945
	Expenditure Total					($333,343)
	Capital					1,940
	Operations					331,403
	Other					0
	Total Operating Assistance					($326,742)
Constant 1980 Dollars	Revenue Total					
	Farebox					
	Local Tax					
	MVET					
	Other					
	Expenditure Total					
	Capital					
	Operations					
	Other					
	Total Operating Assistance					

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Pacific Transit System (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976[1]	1977[1]	1978[1]	1979[1]	1980
Service Cost Efficiency	Operating expense/total vehicle hours					42.21
	Operating expense/total vehicle miles					2.32
Vehicle Efficiency	Total vehicle miles/total vehicles					0(2)
	Total vehicle hours/total vehicles					0(2)
Service Cost Effectiveness	Operating expense/miles of line					1,179
	Operating expense/total passengers					7.19
	Total revenue/total passengers					8.79
	Total revenue/operating expense					1.22
	Passenger revenue/operating expense					0.02
Effectiveness of Service Consumption	Total passengers/miles of line					164
	Total passengers/total vehicle miles					0.32
	Total passengers/total vheicle hours					6.85
	Total passengers/total vehicles					0(2)
Effectiveness of Service Design and Distribution	Total passengers/service area population					2.68
	Total vehicle miles/service area population					8.28
	Total vehicle hours/service area population					0.39
	Total vehicle miles/miles of line					508
	Total vehicle hours/miles of line					23.96
	Service area population/miles of line					61.34
Effectiveness of Revenue Generation	Passenger revenue/total passengers					0.14
	Passenger revenue/total vehicle miles					0.05
	Passenger revenue/total vehicle hours					0.05
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance					0.78
	Total passengers /local tax assistance					0.25
	Total vehicle miles/Motor Vehicle Excise Tax					1.10
	Total passengers /Motor Vehicle Excise Tax					0.35
	Total vehicle miles/operating assistance					0.44
	Total vehicle hours/operating assistance					0.44
	Total passengers/total operating assistance					0.14
	Service area population/total operating assistance					0.05

Soure: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Pierce Transit
(As of October 1981)

The city of Tacoma purchased existing rights to public transit in 1961 and began operations that year. In November 1979, voters in the Tacoma urbanized area approved a 0.3 percent tax to support the operation of a PTBA. The new PTBA began operations in 1980.

Pierce Transit operates 40 routes over 325 miles within the service area. A shuttle service focused principally in Tacoma is also provided for mobility-disadvantaged persons. Service is provided seven days a week. The accompanying table provides recent service statistics.

The system operates 160 buses for fixed-route service, and 14 vans for dial-a-ride shuttle service. Pierce Transit employs 61 administrative staff, 78 maintenance people, and 278 drivers. Policy is determined by the PTBA Board, comprised of local elected officials. The Executive Director is responsible for the day-to-day operations of the system.

Pierce Transit plans to acquire 60 new buses and two new vans over the next five years. Plans are being developed for rehabilitating the existing maintenance facility and designing a new satellite base. Transit centers are being developed to serve as transfer points, and an extensive park-and-ride program is anticipated. An in-house computer system will be developed, and an aggressive marketing program has begun.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Pierce Transit

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	328,000
	Total Passengers	7,592,000	7,559,000	7,238,000	8,643,000	13,380,000
	Total Vehicle Miles	3,200,000	3,229,000	3,172,000	3,198,000	5,028,000
	Total Vehicle Hours	NA	NA	NA	NA	369,499
	Miles of Line	127	184	162	161	275
	Total Vehicles	116	116	116	184	170
Actual Dollars	Revenue Total	($4,889,000)	($4,753,700)	($5,560,000)	($7,604,900)	($16,089,000)
	Farebox	1,681,000	1,666,300	1,646,900	2,068,000	2,247,100
	Local Tax	484,000	464,600	668,500	505,200	4,727,700
	MVET	1,228,000	1,121,500	1,065,400	1,564,400	3,541,000
	Other	1,496,000	1,501,300	2,179,200	3,467,300	5,573,200
	Expenditure Total	($4,627,000)	($5,244,000)	($6,095,500)	($7,728,200)	($15,611,100)
	Capital	7,000	28,800	20,500	366,000	4,877,500
	Operations	4,620,000	5,043,600	5,898,600	7,162,000	10,591,400
	Other	0	171,600	176,400	200,200	142,200
	Total Operating Assistance	NA	NA	NA	NA	($7,675,500)
Constant 1980 Dollars	Revenue Total	($7,133,100)	($6,545,800)	($6,900,000)	($8,989,000)	
	Farebox	2,452,600	2,294,500	2,043,800	2,444,400	
	Local Tax	706,200	639,800	829,600	597,100	
	MVET	1,791,700	1,544,300	1,322,200	1,849,100	
	Other	2,182,700	2,067,300	2,704,400	4,098,300	
	Expenditure Total	($6,750,800)	($7,221,000)	($7,564,500)	($9,134,700)	
	Capital	10,200	39,700	25,400	432,600	
	Operations	6,749,100	6,945,000	7,320,200	8,465,500	
	Other	0	236,300	218,900	236,600	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Pierce Transit
(all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	28.66
	Operating expense/total vehicle miles	2.11	2.15	2.31	2.65	2.11
Vehicle Efficiency	Total vehicle miles/total vehicles	27,586	27,836	27,345	17,380	29,516
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,173
Service Cost Effectiveness	Operating expense/miles of line	53,143	37,745	45,186	52,581	38,514
	Operating expense/total passengers	0.89	0.91	1.01	0.98	0.79
	Total revenue/total passengers	0.94	0.86	0.95	1.04	1.20
	Total revenue/operating expense	1.06	0.94	0.94	1.06	1.52
	Passenger revenue/operating expense	0.36	0.33	0.28	0.29	0.21
Effectiveness of Service Consumption	Total passengers/miles of line	59,780	41,299	44,679	53,683	48,645
	Total passengers/total vehicle miles	2.37	2.35	2.28	2.70	2.66
	Total passengers/total vneicle hours	NA	NA	NA	NA	36.21
	Total passengers/total vehicles	65,448	65,509	62,397	46,973	78,705
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	40.79
	Total vehicle miles/service area population	NA	NA	NA	NA	15.32
	Total vehicle hours/service area population	NA	NA	NA	NA	1.12
	Total vehicle miles/miles of line	25,917	17,549	19,580	19,863	18,283
	Total vehicle hours/miles of line	NA	NA	NA	NA	1,344
	Service area population/miles of line	NA	NA	NA	NA	1,193
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.32	0.30	0.28	0.28	0.17
	Passenger revenue/total vehicle miles	0.77	0.71	0.64	0.76	0.45
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	6.08
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	4.53	5.05	3.82	5.36	1.06
	Total passengers /local tax assistance	10.75	11.88	8.72	14.47	2.83
	Total vehicle miles/Motor Vehicle Excise Tax	1.79	2.09	2.40	1.73	1.42
	Total passengers /Motor Vehicle Excise Tax	4.24	4.92	5.47	4.67	3.79
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.65
	Total vehicle-hours/operating assistance	NA	NA	NA	NA	0.05
	Total passengers/total operating assistance	NA	NA	NA	NA	1.74
	Service area population/total operating assistance	NA	NA	NA	NA	0.04

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Prosser Rural Transportation Program (As of October 1981)

The Prosser Rural Transportation Program (PRTP) began operations in 1977 as a demonstration program funded through Section 147 of the Federal Aid Highway Act of 1973. The city of Prosser collects a B&O tax to help fund the system.

The system operates two fixed-routes covering seven miles within the Prosser city limits. The system also provides an areawide dial-a-ride service, and provides a charter service when the vehicles are not otherwise being used. Service is provided Monday through Friday. The accompanying table provides recent service statistics.

The service is provided with four buses. The PRTP employs 1 administrative staff, 1 maintenance person, and 11 drivers, 9 of whom are volunteers. Policy is determined by the City Council which has a transportation committee. The Transit Manager reports to the City Superintendent and is responsible for the day-to-day operations of the system.

The system plans no immediate service expansion, but efforts have begun to secure one new bus next year.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Prosser Rural Transportation

		76	77	78	79	80
	Service Area Population			NA	NA	3,896
	Total Passengers			14,000	21,000	19,000
	Total Vehicle Miles			62,000	61,000	64,000
	Total Vehicle Hours			NA	NA	3,901
	Miles of Line			35	35	14
	Total Vehicles			5	5	5
Actual Dollars	Revenue Total			($29,800)	($67,700)	($42,800)
	Farebox			4,200	5,400	6,900
	Local Tax			0	7,000	8,900
	MVET			0	7,000	8,900
	Other			25,600	47,600	18,100
	Expenditure Total			($37,600)	($68,200)	($42,900)
	Capital			1,500	13,800	0
	Operations			36,100	54,400	42,900
	Other			0	0	0
	Total Operating Assistance			NA	NA	($27,529)
Constant 1980 Dollars	Revenue Total			($37,000)	($80,000)	
	Farebox			5,200	6,400	
	Local Tax			0	8,300	
	MVET			0	8,300	
	Other			31,800	56,300	
	Expenditure Total			($46,700)	($80,600)	
	Capital			1,900	16,300	
	Operations			44,800	64,300	
	Other			0	0	
	Total Operating Assistance			NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Prosser Rural Rural Transportation Program (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976[1]	1977[1]	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours			NA	NA	11.00
	Operating expense/total vehicle miles			0.72	1.05	0.67
Vehicle Efficiency	Total vehicle miles/total vehicles			12,400	12,200	12,800
	Total vehicle hours/total vehicles			NA	NA	780
Service Cost Effectiveness	Operating expense/miles of line			1,280	1,837	3,064
	Operating expense/total passengers			3.20	2.06	2.26
	Total revenue/total passengers			2.64	3.81	2.25
	Total revenue/operating expense			0.83	1.24	1.00
	Passenger revenue/operating expense			0.12	0.10	0.16
Effectiveness of Service Consumption	Total passengers/miles of line			400	600	1,357
	Total passengers/total vehicle miles			0.23	0.34	0.30
	Total passengers/total vheicle hours			NA	NA	5.00
	Total passengers/total vehicles			2,800	4,200	3,800
Effectiveness of Service Design and Distribution	Total passengers/service area population			NA	NA	4.88
	Total vehicle miles/service area population			NA	NA	16.43
	Total vehicle hours/service area population			NA	NA	1.00
	Total vehicle miles/miles of line			1,771	1,743	4,571
	Total vehicle hours/miles of line			NA	NA	279
	Service area population/miles of line			NA	NA	278
Effectiveness of Revenue Generation	Passenger revenue/total passengers			0.37	0.30	0.36
	Passenger revenue/total vehicle miles			0.08	0.10	0.11
	Passenger revenue/total vehicle hours			NA	NA	1.77
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance			0	0.73	7.19
	Total passengers /local tax assistance			0	2.53	2.13
	Total vehicle miles/Motor Vehicle Excise Tax			0	0.73	7.19
	Total passengers /Motor Vehicle Excise Tax			0	2.53	2.13
	Total vehicle miles/operating assistance			NA	NA	2.32
	Total vehicle hours/operating assistance			NA	NA	0.04
	Total passengers/total operating assistance			NA	NA	0.69
	Service area population/total operating assistance			NA	NA	0.06

Source: Public Transportation in Washington State, 1981,Washington State Department of Transportation, Public Transportation and Planning Division, May .1982.

Pullman Transit
(As of October 1981)

The city of Pullman voters approved a 2 percent utilities tax for transit in 1978. Buses began running in 1979.

Pullman Transit operates three routes over 200 miles within the city. The system also operates a Dial-a-Ride service. Both operations are available seven days a week. The accompanying table provides recent service statistics.

Service is provided with a fleet of 7 buses. The system employs 4 administrative staff, 2 maintenance people, and 14 drivers. Policy is determined by the City Council. A seven-member advisory council is appointed by the Mayor. The Transit Manager reports to the Public Works Director and the City Manager, and is responsible for day-to-day system activities.

There are no plans for immediate program expansion, but the system is planning to acquire one new bus and is currently involved with developing a new maintenance facility. Efforts to establish a PTBA have been set aside due to a lack of support.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Pullman

		76	77	78	79	80
	Service Area Population					23,579
	Total Passengers					443,000
	Total Vehicle Miles					215,000
	Total Vehicle Hours					17,224
	Miles of Line					30
	Total Vehicles					8
Actual Dollars	Revenue Total					($501,500)
	Farebox					96,000
	Local Tax					179,000
	MVET					178,400
	Other					48,000
	Expenditure Total					($521,000)
	Capital					
	Operations					502,500
	Other					18,500
	Total Operating Assistance					($387,975)
Constant 1980 Dollars	Revenue Total					
	Farebox					
	Local Tax					
	MVET					
	Other					
	Expenditure Total					
	Capital					
	Operations					
	Other					
	Total Operating Assistance					

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for

Pullman Transit

(all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours					29.17
	Operating expense/total vehicle miles					2.34
Vehicle Efficiency	Total vehicle miles/total vehicles					26,875
	Total vehicle hours/total vehicles					2,153
Service Cost Effectiveness	Operating expense/miles of line					16,750
	Operating expense/total passengers					1.13
	Total revenue/total passengers					1.13
	Total revenue/operating expense					1.00
	Passenger revenue/operating expense					0.19
Effectiveness of Service Consumption	Total passengers/miles of line					14,767
	Total passengers/total vehicle miles					2.06
	Total passengers/total vheicle hours					25.72
	Total passengers/total vehicles					55,375
Effectiveness of Service Design and Distribution	Total passengers/service area population					18.79
	Total vehicle miles/service area population					9.12
	Total vehicle hours/service area population					0.73
	Total vehicle miles/miles of line					7,167
	Total vehicle hours/miles of line					574
	Service area population/miles of line					786
Effectiveness of Revenue Generation	Passenger revenue/total passengers					0.22
	Passenger revenue/total vehicle miles					0.45
	Passenger revenue/total vehicle hours					5.57
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance					1.20
	Total passengers /local tax assistance					2.47
	Total vehicle miles/Motor Vehicle Excise Tax					1.21
	Total passengers /Motor Vehicle Excise Tax					2.48
	Total vehicle miles/operating assistance					0.55
	Total vehicle hours/operating assistance					0.04
	Total passengers/total operating assistance					1.14
	Service area population/total operating assistance					0.06

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Spokane Transit Authority for Regional Transportation (As of October 1981)

In 1968, the city of Spokane purchased the then existing transportation system, and began operations supported by a household tax. In 1981, voters in part of Spokane County approved a 0.3 percent sales tax to subsidize a PTBA. Spokane Transit Authority for Regional Transportation (START) began operations by collecting a 0.2 percent sales tax.

Service is provided on 22 routes covering 425 miles within the service area. The START also purchased 16 vans from the YMCA to lease to the Spokane Area Special Transportation Agency for dial-a-ride service for the elderly and the handicapped. Bus service is provided seven days a week. The accompanying table provides recent service statistics.

The START operates 79 buses, and employs 30 administrative staff, 35 maintenance people, and 131 drivers. Policy is determined by the PTBA Board, comprised of local elected officials. An Executive Director reports to the board and is responsible for day-to-day activities. Currently, the system contracts with National City Lines who operate the system.

With the recent election, the START is involved with many service expansion activities. The system will soon receive 20 new buses, and expects to order 10 others next year. Efforts are underway to set up an in-house computer system, develop a new maintenance facility, and develop community transit centers. The START is also involved with a new marketing program involving local businesses.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Spokane Transit

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	171,300
	Total Passengers	3,821,000	4,019,000	4,741,000	6,271,000	6,906,000
	Total Vehicle Miles	2,144,000	2,177,000	2,461,000	2,619,000	2,875,000
	Total Vehicle Hours	NA	NA	NA	NA	223,911
	Miles of Line	193	198	207	197	217
	Total Vehicles	79	68	68	85	81
Actual Dollars	Revenue Total	($3,161,000)	($3,438,300)	($4,202,500)	($6,417,300)	($5,830,300)
	Farebox	1,221,000	1,220,700	1,381,800	1,621,300	1,939,300
	Local Tax	816,000	826,300	845,200	864,100	881,300
	MVET	935,000	816,700	827,500	835,700	864,000
	Other	189,000	574,600	1,148,000	3,096,200	2,145,700
	Expenditure Total	($2,950,000)	($3,430,100)	($4,072,100)	($7,241,700)	($6,649,300)
	Capital	28,000	17,700	102,100	2,180,500	297,300
	Operations	2,922,000	3,171,500	3,750,700	4,679,600	5,966,400
	Other	0	240,900	219,300	381,600	385,500
	Total Operating Assistance	NA	NA	NA	NA	($4,182,200)
Constant 1980 Dollars	Revenue Total	($4,611,900)	($4,734,500)	($5,215,300)	($7,585,200)	
	Farebox	1,781,400	1,680,900	1,714,800	1,916,400	
	Local Tax	1,190,500	1,137,800	1,048,900	1,021,400	
	MVET	1,364,200	1,124,600	1,026,900	988,000	
	Other	275,800	791,200	1,424,700	3,659,700	
	Expenditure Total	($4,304,500)	($4,723,200)	($5,053,500)	($8,559,700)	
	Capital	40,900	24,400	126,900	2,577,400	
	Operations	4,263,200	4,637,200	4,654,600	5,531,300	
	Other	0	331,700	272,200	451,100	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Spokane Transit Authority for Regional Transportation (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	26.65
	Operating expense/total vehicle miles	1.99	2.13	1.89	2.11	2.08
Vehicle Efficiency	Total vehicle miles/total vehicles	27,139	32,015	36,191	30,812	35,494
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,164
Service Cost Effectiveness	Operating expense/miles of line	22,089	23,420	22,486	28,078	27,495
	Operating expense/total passengers	1.12	1.15	0.98	0.88	0.86
	Total revenue/total passengers	1.21	1.18	1.10	1.21	0.84
	Total revenue/operating expense	1.08	1.02	1.12	1.37	0.98
	Passenger revenue/operating expense	0.42	0.36	0.37	0.35	0.33
Effectiveness of Service Consumption	Total passengers/miles of line	19,789	20,298	22,903	31,832	31,825
	Total passengers/total vehicle miles	1.78	1.85	1.93	2.39	2.40
	Total passengers/total vheicle hours	NA	NA	NA	NA	30.84
	Total passengers/total vehicles	48,367	59,103	69,721	73,776	85,259
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	40.31
	Total vehicle miles/service area population	NA	NA	NA	NA	16.78
	Total vehicle hours/service area population	NA	NA	NA	NA	1.31
	Total vehicle miles/miles of line	11,109	10,995	11,889	13,294	13,249
	Total vehicle hours/miles of line	NA	NA	NA	NA	1,032
	Service area population/miles of line	NA	NA	NA	NA	789
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.47	0.42	0.36	0.31	0.28
	Passenger revenue/total vehicle miles	0.83	0.77	0.70	0.73	0.67
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.87
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.80	1.91	2.35	2.56	3.26
	Total passengers /local tax assistance	3.21	3.53	4.52	6.14	7.84
	Total vehicle miles/Motor Vehicle Excise Tax	1.57	1.94	2.40	2.65	3.33
	Total passengers /Motor Vehicle Excise Tax	2.80	3.57	4.62	6.35	7.99
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.69
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.05
	Total passengers/total operating assistance	NA	NA	NA	NA	1.65
	Service area population/total operating assistance	NA	NA	NA	NA	0.07

Source: Public Transportation in Wahsington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Twin Transit (Centralia-Chehalis)

(As of October 1981)

In 1976, voters in the cities of Centralia and Chehalis approved a $1.00 per month household tax to support the operations of a PTBA.

Twin Transit operates two routes covering 21 miles within the Centralia/Chehalis area. Service is provided Monday through Saturday. The accompanying table provides recent service statistics.

Service is provided with 6 buses, and the system employs 2 administrative staff, 1 maintenance person, and 7 drivers. Policy is determined by the PTBA Board, comprised of local elected officials. The Transit Manager is responsible for the day-to-day activities of the system.

The PTBA plans to approach the voters next year to change the local tax to either a 0.3 percent sales tax or a B&O tax to permit service improvements and expansion. Improvements include acquiring new vehicles and refining routes and schedules. Expansion includes adding more routes, and adding a dial-a-ride service for the elderly and the handicapped.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Twin Transit (Centralia-Chehalis)

		76	77	78	79	80
	Service Area Population			NA	NA	17,100
	Total Passengers			106,200	132,000	142,000
	Total Vehicle Miles			141,000	165,000	165,000
	Total Vehicle Hours			NA	NA	11,389
	Miles of Line			21	21	21
	Total Vehicles			6	6	6
Actual Dollars	Revenue Total			($215,100)	($214,200)	($317,900)
	Farebox			12,400	14,400	22,000
	Local Tax			81,800	85,100	83,400
	MVET			118,600	87,300	85,000
	Other			2,300	27,400	127,500
	Expenditure Total			($204,100)	($174,200)	($200,200)
	Capital			2,100	23,600	21,200
	Operations			165,000	150,600	179,100
	Other			2,300	27,400	127,500
	Total Operating Assistance			NA	NA	($172,935)
Constant 1980 Dollars	Revenue Total			($267,000)	($253,200)	
	Farebox			15,400	17,000	
	Local Tax			101,500	100,600	
	MVET			147,200	103,200	
	Other			2,900	32,400	
	Expenditure Total			($253,300)	($205,900)	
	Capital			2,600	27,900	
	Operations			204,800	178,000	
	Other			2,900	32,400	
	Total Operating Assistance			NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Twin Transit (Centralia-Chehalis) (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976 [1]	1977 [1]	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	15.76
	Operating expense/total vehicle miles			1.45	1.08	1.09
Vehicle Efficiency	Total vehicle miles/total vehicles			23,500	27,500	27,500
	Total vehicle hours/total vehicles			NA	NA	1,898
Service Cost Effectiveness	Operating expense/miles of line			9,752	8,476	8,529
	Operating expense/total passengers			1.93	1.35	0.79
	Total revenue/total passengers			2.51	1.92	2.24
	Total revenue/operating expense			1.30	1.42	1.77
	Passenger revenue/operating expense			0.06	0.10	0.12
Effectiveness of Service Consumption	Total passengers/miles of line			5,057	6,286	6,762
	Total passengers/total vehicle miles			0.75	0.80	0.86
	Total passengers/total vheicle hours			NA	NA	12.47
	Total passengers/total vehicles			17,700	22,000	23,667
Effectiveness of Service Design and Distribution	Total passengers/service area population			NA	NA	8.30
	Total vehicle miles/service area population			NA	NA	9.65
	Total vehicle hours/service area population			NA	NA	0.67
	Total vehicle miles/miles of line			6,714	7,857	7,857
	Total vehicle hours/miles of line			NA	NA	542
	Service area population/miles of line			NA	NA	814
Effectiveness of Revenue Generation	Passenger revenue/total passengers			0.15	0.13	0.15
	Passenger revenue/total vehicle miles			0.11	0.10	0.13
	Passenger revenue/total vehicle hours			NA	NA	14.76
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance			1.39	1.64	1.98
	Total passengers /local tax assistance			1.05	1.31	1.70
	Total vehicle miles/Motor Vehicle Excise Tax			0.96	1.60	1.94
	Total passengers /Motor Vehicle Excise Tax			0.72	1.28	1.67
	Total vehicle miles/operating assistance			NA	NA	0.95
	Total vehicle hours/operating assistance			NA	NA	0.07
	Total passengers/total operating assistance			NA	NA	0.82
	Service area population/total operating assistance			NA	NA	0.10

Source: Public Transportation in Washington State, 1981, Washington State Department Transportation, Public Transportation and Planning Division, May 1982.

Valley Transit
(As of October 1981)

In 1980, the voters of Walla Walla and College Place approved a 0.3 percent tax to support a PTBA. Service began in 1981.

The system operates five routes over 37 miles within the greater Walla Walla/College Place area. The system contracts with the Walla Walla Senior Center for elderly and handicapped transportation. Service is provided Monday through Saturday. Complete statistics are not available, but the system has carried 166,788 rides from January to May of 1981.

Valley Transit operates 12 buses, and employs an administrative staff of 7, 4 maintenance people, and 24 drivers. Policy is determined by the PTBA Board comprised of local elected officials. The Transit Manager is responsible for the day-to-day operations of the system.

Future projects include identifying a maintenance facility, and acquiring bus shelters and bus stop signs.

Yakima Transit
(As of October 1981)

Yakima Transit began operations as a city-owned and operated system in 1970. Funded initially with a household tax, it became necessary to ask the voters to change to the 0.3 percent sales tax. The voters approved this change in 1980.

The system operates eight loops over 64 miles of route throughout the Yakima incorporated area. Service is provided seven days a week. The accompanying table provides recent service statistics.

Service is provided with a fleet of 12 vehicles. Yakima Transit employs 3 administrative staff and 36 drivers. Maintenance is performed by the city shop. Policy is determined by the Mayor and the City Council. The Transit Manager reports to the Public Works Director and the City Manager, and is responsible for day-to-day operations.

The system is attempting to implement recommended service and facility improvements identified in a 1977 consultant study. Priority projects include extending hours of service, modifying the route structure, upgrading the maintenance facility, acquiring six new buses, constructing 25 bus shelters, and making traffic operations improvements.

Trends in Transit Financial and Operating Characteristics (1976-80)

SYSTEM Yakima Transit

		76	77	78	79	80
	Service Area Population	NA	NA	NA	NA	49,826
	Total Passengers	656,000	668,000	679,000	667,000	706,000
	Total Vehicle Miles	272,000	288,000	292,000	343,000	394,000
	Total Vehicle Hours	NA	NA	NA	NA	35,126
	Miles of Line	50	50	61	61	64
	Total Vehicles	12	12	12	12	12
Actual Dollars	Revenue Total	($434,000)	($449,500)	($718,600)	($440,900)	($1,129,500)
	Farebox	106,000	106,200	108,700	118,600	135,900
	Local Tax	139,000	142,900	144,700	148,300	151,300
	MVET	170,000	142,700	143,100	147,800	151,000
	Other	19,000	57,700	321,900	26,200	691,300
	Expenditure Total	($389,000)	($460,500)	($670,800)	($705,400)	($897,300)
	Capital	2,000	1,000	100	0	0
	Operations	387,000	459,500	670,700	705,400	897,300
	Other	0	0	0	0	0
	Total Operating Assistance	NA	NA	NA	NA	($715,404)
Constant 1980 Dollars	Revenue Total	($633,200)	($675,400)	($891,800)	($521,100)	
	Farebox	154,700	196,800	134,900	140,200	
	Local Tax	202,800	196,600	179,800	175,300	
	MVET	248,000	208,200	177,600	174,700	
	Other	27,700	79,500	399,500	31,000	
	Expenditure Total	($567,600)	($634,100)	($832,500)	($833,800)	
	Capital	2,900	1,400	100	0	
	Operations	564,600	632,700	832,400	833,800	
	Other	0	0	0	0	
	Total Operating Assistance	NA	NA	NA	NA	

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

Trends in Transit Performance for Yakima Transit (all dollar values in constant 1980 dollars)

CONCEPT MEASURED	TRANSIT PERFORMANCE MEASURE	1976	1977	1978	1979	1980
Service Cost Efficiency	Operating expense/total vehicle hours	NA	NA	NA	NA	25.55
	Operating expense/total vehicle miles	2.08	2.20	2.85	2.43	2.28
Vehicle Efficiency	Total vehicle miles/total vehicles	22,667	24,000	24,333	28,583	32,833
	Total vehicle hours/total vehicles	NA	NA	NA	NA	2,947
Service Cost Effectiveness	Operating expense/miles of line	11,292	12,654	13,648	13,669	14,020
	Operating expense/total passengers	0.86	0.95	1.23	1.25	1.27
	Total revenue/total passengers	0.97	1.01	1.31	0.78	1.60
	Total revenue/operating expense	1.12	1.07	1.07	0.62	1.26
	Passenger revenue/operating expense	0.27	0.31	0.16	0.14	0.15
Effectiveness of Service Consumption	Total passengers/miles of line	13,120	13,360	11,131	10,934	11,031
	Total passengers/total vehicle miles	2.41	2.32	2.33	1.94	1.79
	Total passengers/total vheicle hours	NA	NA	NA	NA	20.10
	Total passengers/total vehicles	54,667	55,667	56,583	55,583	58,833
Effectiveness of Service Design and Distribution	Total passengers/service area population	NA	NA	NA	NA	14.17
	Total vehicle miles/service area population	NA	NA	NA	NA	7.91
	Total vehicle hours/service area population	NA	NA	NA	NA	0.70
	Total vehicle miles/miles of line	5,440	5,760	4,787	5,623	6,156
	Total vehicle hours/miles of line	NA	NA	NA	NA	549
	Service area population/miles of line	NA	NA	NA	NA	779
Effectiveness of Revenue Generation	Passenger revenue/total passengers	0.24	0.29	0.20	0.21	0.19
	Passenger revenue/total vehicle miles	0.57	0.68	0.46	0.41	0.34
	Passenger revenue/total vehicle hours	NA	NA	NA	NA	3.87
Effectiveness of Public Assistance	Total vehicle miles/local tax assistance	1.34	1.46	1.62	1.96	2.60
	Total passengers /local tax assistance	3.23	3.39	3.78	3.80	4.67
	Total vehicle miles/Motor Vehicle Excise Tax	1.10	1.38	1.64	1.96	2.61
	Total passengers /Motor Vehicle Excise Tax	2.65	3.21	3.82	3.82	4.68
	Total vehicle miles/operating assistance	NA	NA	NA	NA	0.55
	Total vehicle hours/operating assistance	NA	NA	NA	NA	0.05
	Total passengers/total operating assistance	NA	NA	NA	NA	0.99
	Service area population/total operating assistance	NA	NA	NA	NA	0.07

Source: Public Transportation in Washington State, 1981, Washington State Department of Transportation, Public Transportation and Planning Division, May 1982.

NOTE

This suggested annual report form represents a prototype model similar to that of Iowa, Indiana, Florida and Wisconsin. The format is general and would have to be adapted to specific needs of WSDOT, but it does outline what the TRAC study team feel are essential modifications to existing data collection, and these include:

- Separating major financial and operational characteristics of dual mode (e.g., fixed route-demand response) systems.
- Collecting specific information on service area population and square miles.
- Collecting information on transit employment by functional classification. Part-time employees can be converted to fractional units by using a standard annual FTE (e.g., 1800 hours).
- Collecting information on fuel (energy) consumption.
- Collecting information on maintenance effectiveness (e.g., number of vehicle miles/number of roadcalls).
- Collecting information on transit safety (e.g., number of vehicle miles/number of collision-noncollision accidents).
- Collecting information that distinguishes number of vehicles operated in peak vs. number of vehicles in base.
- Assigning local, state, federal public support to specific categories under capital and operating revenues and expenditures.

Suggested

Annual Report Form for Public Transportation Systems in Washington State

CONTENTS

Name of system ________________________________

Address ________________________________

____

Phone number ______________ Contact person ________________

Part A: Description of Service

1. Type Of Service (check all that apply)

   __ Fixed route
   __ Demand responsive
   __ Other (describe) ______________
   ____

2. Service Hours (fill in hours for each operating day)

   Monday ______________
   Tuesday ______________
   Wednesday ______________
   Thursday ______________
   Friday ______________
   Saturday ______________
   Sunday ______________
   Holidays ______________

3. Fares

   Regular ______________
   Elderly ______________
   Handicapped ______________
   Youth ______________
   Transfer ______________
   Zone (describe) ______________

   Passes or Tokens (for each type of pass and token, complete the following)

Type Pass/Token	Eligibility	User Cost	Time Period	Number Rides	Restrictions

4. Service Area (describe)

5. Number Of Transit Employees

	FT	PT
Operators	______	______
Maintenance	______	______
General Administration	______	______
TOTAL	______	______

6. Capital Grant Information (list total amounts of funds awarded for capital improvement in last fiscal year)

Section 3 $ ____________ State $ ____________
Section 5 $ ____________ Local $ ____________
Section 18 $ ____________
Other (describe) ____

7. Energy Contingency Information

Fuel reserve capacity ______________________________ gallons
Average daily consumption ___________________________ gallons/day
Number of days service can be provided,
based on reserve capacity ___________________________ days

List the names of companies that supply your fuel:

8. Marketing Activities (describe special promotions during last fiscal year, such as shop-and-ride, free fare day, nickel day, radio ads, etc.)

9. Service Area Population

10. Square Miles in Service Area

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System ______________________________ Year 19____

Part B: Basic Information

Fill in the blanks that follow. See definitions.

Line

1. Operating expense ______________________________
2. Revenue ______________________________
3. Fare revenue ______________________________
4. Total passengers (unlinked) ______________________________
5. Transfer passengers ______________________________
6. Gallons of fuel consumed ______________________________
7. Number of accidents ______________________________
8. Number of road calls ______________________________
9. Operating employee hours ______________________________
10. Service area population ______________________________
11. Revenue vehicle hours ______________________________
12. Total vehicle hours ______________________________
13. Revenue vehicle miles ______________________________
14. Total vehicle miles ______________________________
15. Revenue seat miles ______________________________
16. Total vehicles ______________________________
17. Vehicles operated during period ______________________________
18. Peak hour fleet ______________________________

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System ____________________ Year 19____

Part C: Performance Measures

Fill in the blanks that follow with the information from Part B. Do indicated calculations.

Operating expense / Revenue vehicle hours	=	\$______	(line 1) / (line 11)	=	\$______ /hour
Operating expense / Revenue vehicle miles	=	\$______	(line 1) / (line 13)	=	\$______ /mile
Operating expense / Total vehicle hours	=	\$______	(line 1) / (line 12)	=	\$______ /hour
Operating expense / Total vehicle miles	=	\$______	(line 1) / (line 14)	=	\$______ /mile
Operating expense / Revenue seat miles	=	\$______	(line 1) / (line 15)	=	\$______ /seat mile
Operating expense / Total passengers	=	\$______	(line 1) / (line 4)	=	\$______ /passenger
Revenue / Total passengers	=	\$______	(line 2) / (line 4)	=	\$______ /passenger
Revenue / Operating expense	=	\$______ / \$	(line 2) / (line 1)	=	______ %
Fare revenue / Operating expense	=	\$______ / \$	(line 3) / (line 1)	=	______ %
Passengers (unlinked) / Transfer passengers	=	\$______	(line 4) / (line 5)	=	______ %
Total passengers / Revenue vehicle hours	=	\$______	(line 4) / (line 11)	=	______ passengers/hour
Total passengers / Revenue vehicle miles	=	\$______	(line 4) / (line 13)	=	______ passengers/mile
Total passengers / Vehicles operated during period	=	\$______	(line 4) / (line 17)	=	______ passengers/vehicle

continued

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System ______________________________ Year 19____

Part C: Performance Measures

$\frac{\text{Total passengers}}{\text{Service area population}}$	=	________ $\frac{\text{(line 4)}}{\text{(line 10)}}$	=	________ passengers/capita
$\frac{\text{Number of accidents}}{\text{1000 miles}}$	=	________ $\frac{\text{(line 7)}}{\text{(line 14/1000)}}$	=	________ accidents/1000 miles
$\frac{\text{Number of road calls}}{\text{1000 miles}}$	=	________ $\frac{\text{(line 8)}}{\text{(line 14/1000)}}$	=	________ road calls/1000 miles
$\frac{\text{Total vehicle miles}}{\text{Gallons of fuel consumed}}$	=	________ $\frac{\text{(line 14)}}{\text{(line 6)}}$	=	________ miles/gallon
$\frac{\text{Revenue vehicle miles}}{\text{Service area population}}$	=	________ $\frac{\text{(line 13)}}{\text{(line 10)}}$	=	________ miles/capita
$\frac{\text{Revenue vehicle miles}}{\text{Revenue vehicle hours}}$	=	________ $\frac{\text{(line 13)}}{\text{(line 11)}}$	=	________ miles/hour
$\frac{\text{Total vehicles minus peak hour fleet}}{\text{Peak hour fleet}}$	=	________ $\frac{\text{(lines 16–18)}}{\text{(line 18)}}$	=	________ %
$\frac{\text{Revenue vehicle hours}}{\text{Total vehicles}}$	=	________ $\frac{\text{(line 11)}}{\text{(line 16)}}$	=	________ hours/vehicle
$\frac{\text{Revenue vehicle hours}}{\text{Operating employee hours}}$	=	________ $\frac{\text{(line 11)}}{\text{(line 9)}}$	=	________ %

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Name of System ____ Year 19 ____

Part D: Demand-Responsive Service

Instructions:

— Use this form only if you provide both demand-responsive and fixed-route service.

— Fill out the regular quarterly report based on all services (both fixed-route and demand-responsive).

— Fill in the six blanks on this form based only on the demand-responsive service.

Fare revenue ____

Total passengers ____

Revenue vehicle hours ____

Total vehicle hours ____

Revenue vehicle miles ____

Total vehicle miles ____

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Name of System ______________________________ Year 19 ____

Part E: Annual Revenue Summary

Revenue Object Class Code	Revenue Description	Total for Year
401	Passenger Fares for Transit Service	
402	Special Transit Fares	
	SUBTOTAL FARE REVENUE	
403	School Bus Service Revenues	
405	Charter Service Revenues	
406	Auxiliary Transit Revenues	
407	Nontransportation Revenues	
	All Other Revenue*	
	GRAND TOTAL	

* Excludes taxes levied by transit systems (408) and cash grants and reimbursements (408-413).

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Name of System ____________________ Year 19 ____

Part F: Annual Expense Summary

Section 15 Function Code	Expense Description	Total for Year
501.01	Operator's Salaries/Wages	
501.02	General Administrative Salaries/Wages	
501.02	Other Salaries/Wages	
502	Fringe Benefits	
503	Services (Contractual)	
504.01	Fuel and Lubricants	
504.02	Tires and Tubes	
504.99	Other Equipment/Supplies	
505	Utilities	
506	Casualty/Liability Costs	
507	Taxes	
508	Purchased Transportation	
509.01 - .07 and 509.09 - .99	Miscellaneous Expenses	
509.08	Advertising/Promotion Media	
511 - 516	Total Reconciling Items	
	Equipment**	
	Indirect Expense**	
	TOTAL EXPENSE	

* Other Salaries/Wages includes all maintenance employees.
** These lines only apply to section 18 contracts with an approved line item for Equipment or Indirect Expense in their project budget.

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Name of System ______________________________ Year 19 ____

Part G: Annual Vehicle Inventory

Total Available Vehicles	Vehicles Operated During Period	Type	Year	Manufacturer	Engine Type (Gas, Diesel, etc.)	Seating Capacity	Standing Capacity	Lift Equipped
TOTAL	TOTAL							

NOTE

This appendix provides data tables prepared in analysis of 1980 WSDOT statistics, 1978-79 Section 15, 1979-80 Section 15 reports, and selected samples of small city/rural area systems.

1980 WSDOT Data Set Central Tendencies

-- DESCRIBE C1-C25

POP	N =	17	MEAN =	72723.	ST.DEV. =	83914.
VEH	N =	17	MEAN =	28.882	ST.DEV. =	41.1
VEH HRS	N =	17	MEAN =	66311.	ST.DEV. =	96834.
LINMILES	N =	17	MEAN =	121.12	ST.DEV. =	118.
PASSENG	N =	17	MEAN =	1881580.	ST.DEV. =	3395913.
VEHMILS	N =	17	MEAN =	912768.	ST.DEV. =	1359816.
LOCAL$	N =	17	MEAN =	965169.	ST.DEV. =	1289514.
MVET	N =	17	MEAN =	616657.	ST.DEV. =	1068904.
FARE$	N =	17	MEAN =	384829.	ST.DEV. =	676367.
OTHER$	N =	17	MEAN =	33914.	ST.DEV. =	55461.
FED$	N =	17	MEAN =	539067.	ST.DEV. =	1253023.
STATE$	N =	17	MEAN =	166151.	ST.DEV. =	219612.
TOTAL$	N =	17	MEAN =	2705493.	ST.DEV. =	4031219.
CAPCOST	N =	17	MEAN =	519228.	ST.DEV. =	1199382.
OPCOST	N =	17	MEAN =	1606936.	ST.DEV. =	2347668.
ADMIN	N =	17	MEAN =	261192.	ST.DEV. =	357756.
DEPREC	N =	17	MEAN =	56332.	ST.DEV. =	104029.
OTHCOST	N =	17	MEAN =	41208.	ST.DEV. =	127807.
TOTCOST	N =	17	MEAN =	2484874.	ST.DEV. =	3869684.
PASS/CAP	N =	17	MEAN =	17.222	ST.DEV. =	14.0
PASS/VHR	N =	17	MEAN =	19.653	ST.DEV. =	10.8
OPC/PASS	N =	17	MEAN =	2.4582	ST.DEV. =	2.79
OPC/VM	N =	17	MEAN =	2.0676	ST.DEV. =	0.639
OPC/VHR	N =	17	MEAN =	26.756	ST.DEV. =	12.3
FARE/OPC	N =	17	MEAN =	15.235	ST.DEV. =	9.02

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Note: Data Set includes Seattle Metro

1980 WSDOT Data Set Correlation Matrix

	POP	VEH	VEH HRS	LINMILES	PASSENG	VEHMILS	LOCAL$	MVET	FARE$
VEH	0.932								
VEH HRS	0.970	0.976							
LINMILES	0.596	0.495	0.562						
PASSENG	0.927	0.990	0.981	0.465					
VEHMILS	0.987	0.951	0.991	0.601	0.954				
LOCAL$	0.884	0.827	0.836	0.617	0.794	0.864			
MVET	0.896	0.767	0.814	0.696	0.738	0.875	0.851		
FARE$	0.925	0.932	0.974	0.512	0.952	0.959	0.710	0.744	
OTHER$	0.586	0.704	0.675	0.311	0.677	0.625	0.365	0.451	0.732
FED$	0.842	0.950	0.910	0.371	0.962	0.872	0.694	0.662	0.871
STATE$	0.581	0.380	0.437	0.732	0.314	0.521	0.665	0.802	0.354
TOTAL$	0.977	0.950	0.963	0.627	0.935	0.977	0.921	0.918	0.892
CAPCOST	0.772	0.874	0.799	0.359	0.864	0.777	0.792	0.662	0.691
OPCOST	0.978	0.947	0.990	0.627	0.949	0.997	0.857	0.870	0.961
ADMIN	0.953	0.966	0.974	0.495	0.968	0.964	0.822	0.794	0.930
DEPREC	0.668	0.588	0.706	0.403	0.640	0.699	0.419	0.445	0.803
OTHCOST	0.757	0.853	0.774	0.285	0.845	0.755	0.705	0.678	0.681
TOTCOST	0.964	0.979	0.983	0.557	0.978	0.978	0.876	0.841	0.928
PASS/CAP	0.579	0.686	0.685	0.229	0.698	0.625	0.549	0.303	0.673
PASS/VHR	0.547	0.595	0.589	0.146	0.601	0.537	0.501	0.268	0.554
OPC/PASS	-0.333	-0.325	-0.337	-0.046	-0.310	-0.311	-0.296	-0.177	-0.303
OPC/VM	0.016	0.024	-0.006	0.162	-0.013	-0.016	0.047	0.026	-0.016
OPC/VHR	0.149	0.056	0.083	0.508	0.033	0.110	0.169	0.216	0.057
FARE/OPC	0.432	0.454	0.482	-0.016	0.465	0.444	0.191	0.233	0.561

	OTHER$	FED$	STATE$	TOTAL$	CAPCOST	OPCOST	ADMIN	DEPREC	OTHCOST
FED$	0.608								
STATE$	0.141	0.200							
TOTAL$	0.570	0.874	0.603						
CAPCOST	0.434	0.898	0.318	0.847					
OPCOST	0.637	0.865	0.524	0.973	0.763				
ADMIN	0.620	0.936	0.381	0.950	0.811	0.959			
DEPREC	0.513	0.496	0.249	0.561	0.315	0.710	0.592		
OTHCOST	0.489	0.902	0.247	0.820	0.908	0.731	0.825	0.180	
TOTCOST	0.608	0.933	0.466	0.983	0.886	0.975	0.969	0.616	0.839
PASS/CAP	0.588	0.616	-0.002	0.568	0.586	0.644	0.634	0.619	0.413
PASS/VHR	0.481	0.529	0.007	0.496	0.532	0.541	0.566	0.513	0.419
OPC/PASS	-0.289	-0.243	-0.076	-0.276	-0.223	-0.308	-0.326	-0.296	-0.201
OPC/VM	0.018	0.026	0.117	0.034	0.019	0.025	0.074	-0.076	-0.058
OPC/VHR	-0.058	0.030	0.343	0.148	0.030	0.140	0.139	0.022	-0.019
FARE/OPC	0.746	0.355	-0.056	0.334	0.200	0.439	0.409	0.571	0.254

	TOTCOST	PASS/CAP	PASS/VHR	OPC/PASS	OPC/VM	OPC/VHR
PASS/CAP	0.661					
PASS/VHR	0.573	0.910				
OPC/PASS	-0.301	-0.608	-0.761			
OPC/VM	.024	0.076	0.071	0.249		
OPC/VHR	.107	0.021	0.086	-0.052	0.675	
FARE/OPC	0.390	0.633	0.682	-0.682	-0.388	-0.233

Mean and Standard Deviation for TRAC Study TPM Set

VARIABLE NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION
*1	Operating Expenditures/Total Vehicle Hours	19.6019	10.6240
*2	Operating Expenditures/Total Vehicle Miles	1.4972	.8453
3	Vehicle Miles/Vehicles	28102.4389	14145.3682
4	Vehicle Hours/Vehicles	2139.0077	1100.6093
5	Operating Expenditures/Line Miles	18687.1725	36300.0211
6	Operating Expenditures/Passengers	.8045	.8612
7	Total Revenue/Passengers	.9705	1.1968
*8	Total Revenue/Operating Expense	25.9952	49.6504
9	Passenger Revenue/Operating Expense	.3757	.9739
10	Passenger/Line Mile	25012.2112	73408.0526
11	Passenger/Vehicle Mile	1.8742	1.5428
12	Passenger/Vehicle Hour	24.1099	18.2761
13	Passenger/Vehicle	57845.7445	45307.5584
*14	Passenger/Service Area Population	168.1716	2701.0750
*15	Vehicle Mile/Population	66.7581	1064.8805
*16	Vehicle Hours/Population	4.7913	75.9427
17	Vehicle Miles/Line Mile	8728.6862	9914.4104
18	Vehicle Hours/Line Mile	720.5868	1154.0375
*19	Population/Line Mile	33919.5026	133833.5025
20	Passenger Revenue/Passenger	.2638	.3019
21	Passenger Revenue/Vehicle Mile	.5788	.6050
22	Passenger Revenue/Vehicle Hour	7.4290	6.6028
*23	Vehicle Mile/Local Tax Assistance	38.1777	509.5194
*24	Vehicle Hour/Local Tax Assistance	2.8152	37.3243
*25	Vehicle Mile/State(or MVET)Tax Assistance	100.6459	1471.2544
*26	Vehicle Hour/State(or MVET)Tax Assistance	7.8259	116.1279
27	Vehicle Mile/Total Operating Subsidy	2.6736	5.1137
28	Vehicle Hour/Total Operating Subsidy	.1953	.2945
29	Passenger/Total Operating Subsidy	5.3240	10.5345
*30	Population/Total Operating Subsidy	14.2518	58.9845

Note: * indicates mean values should be disregarded entirely. Those values are judged to be invalid due to data recording, coding or measurement error. In support of judgment, values are in most cases more than 3 standard deviations above or below means of similar TPMs developed in other (e.g. Ref 4) research studies using Section 15 data.

Note: Each of the values presented should be viewed with caution due to potential data recording, coding or measurement error.

Mean and Standard Deviation for Anderson/ Fielding TPM Set

VAR NO.	VARIABLE NAME	MEAN	STANDARD DEVIATION
1	Vehicle Hours Per Employee	1123.7301	1238.8106
*2	Revenue Vehicle Hours Per Operating Employee Hour	.8214	.4143
3	Vehicle Miles Per Employee	14553.6817	15716.9916
4	Peak Vehicle Per Ex. Professional Supervisory Employ	2.2253	1.7423
5	Peak Vehicle Per Operating Employee	.4381	.2751
6	Peak Vehicle Per Maint, Support, Service Personnel	1.5706	1.4190
7	Vehicle Hours Per Active Vehicle	2878.5234	1394.5997
8	Vehicle Hours Per Peak Vehicle Requirement	2457.2828	1580.6868
9	Vehicle Miles Per Active Vehicle	38008.5729	19201.6517
10	Vehicle Miles Per Peak Vehicle Requirement	32481.2241	22241.3244
11	Revenue Vehicle Miles Per Vehicle Miles	.8348	.3055
12	Revenue Vehicle Miles Per Gallon Diesel	5.8192	21.6364
13	Vehicle Miles(Bus)per Gallon Diesel	6.2055	22.2771
14	Total Vehicle Miles Per Maintenance Expense	3.1114	3.7031
15	Vehicle Miles Per Maintenance Employee	72666.5843	71654.5311
16	Vehicle Miles Per Roadcall	5260.8844	9625.4132
17	Revenue Vehicle Hours Per Operating Expense	.0407	.0271
18	Vehicle Miles Per Operating Expense	.5690	.3920
19	Revenue Vehicle Hours Per Total Labor and Fringe Expenses	.0754	.1201
20	Revenue Vehicle Hours Per Operations Labor and Fringe Expenses	.0760	.1035
*21	Revenue Vehicle Hours Per Vehicle Maintenance Expense	.2223	.2180
*22	Revenue Vehicle Hours Per General Administration Expense	.2604	.2433
23	Passenger Trips Per Revenue Vehicle Hour	26.4414	20.2755
24	Passenger Trips Per Revenue Vehicle Mile	2.0607	1.7198
*25	Passenger Trips Per Peak Vehicle	240.7153	214.8949
*26	Revenue Vehicle Hours Per Service Area Population	4.1748	65.5778
*27	Passengers Per Service Area Population	168.1716	2701.0750
28	Vehicle Miles Per Accident	20110.4827	26003.8071
29	Revenue Vehicle Hours Per Accident	1471.9795	2325.7512
30	Passenger Revenue Per Peak Vehicle	21881.8413	23015.8154
31	Passenger Revenue Per Revenue Vehicle Hours	7.9755	7.6177
*32	Operating Revenue Per Revenue Vehicle Hour	8.7763	8.1727
33	Passenger Revenue Per Passenger	.2638	.3019
*34	Revenue Vehicle Hours Per Local Cap and Op Asst	2.7582	34.1271
*35	Revenue Vehicle Hours Per State Cap and Op Asst	10.8103	122.5783
36	Revenue Vehicle Hours Per Total Operating Asst	.1848	.2799
*37	Revenue Vehicle Hours Per Total Cap and Op Asst	.2105	1.2314
*38	Passengers Per Local Operating Assistance	157.3777	1878.4887
*39	Passengers Per Total Operating and Cap Asst	6.1323	37.8793
*40	Passenger Revenue Per Total Cap and Op Asst	2.3023	13.0486
*41	Urban Area Pop Per Total Op and Cap Asst	14.2518	58.9845
*42	Urban Area Pop Per Total Op and Cap Asst	15.7047	66.2608
*43	Passenger Revenue Per Total Operating Asst	1.9845	4.6396
44	Passengers Per Total Operating Assistance	5.3240	10.5345
45	Passengers Per Operating Expense	.9494	.7103
46	Passengers Per Total Labor and Fringe Benefits	1.8425	2.1566
47	Passengers Per Gallon Diesel Fuel	13.7452	80.3158
48	Ratio Passenger Revenue To Operating Expense	.3757	.9739
49	Ratio Total Revenue To Total Expense	1.0430	.2578

Note: * implies mean value should be disregarded. Those values are judged to be invalid due to data recording, coding or measurement errors and are considered out of range in comparison to other (e.g. Ref. 4) research studies using Section 15 data.

Note: Each of the values presented should be viewed with caution due to potential data recording, coding or measurement error.

Factor Analysis of 32 Performance Variables

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4	FACTOR 5	FACTOR 6	FACTOR 7	FACTOR	FACTOR 9
RVH/OWAG	.935	.000	.000	.000	.000	.000	.000	.000	.000
RVH/OEXP	.927	.000	.000	.000	.000	.000	.000	.000	.000
RVH/TWG	.924	.000	.000	.000	.000	.000	.000	.000	.000
TREV/RVH	-.807	.000	.000	.000	.000	.000	.000	.000	.000
REV/RVH	-.705	.000	.000	.000	.000	.000	.000	.000	.000
TPAS/RVM	.000	.889	.000	.000	.000	.000	.000	.000	.000
PAS/OEXP	.000	.887	.000	.000	.000	.000	.000	.000	.000
TPAS/PVH	.000	.877	.000	.000	.000	.000	.000	.000	.000
PAS/TWAG	.000	.866	.000	.000	.000	.000	.000	.000	.000
TPAS/RVH	.000	.859	.000	.000	.000	.000	.000	.000	.000
REV/PVEH	-.489	.502	.000	.000	.000	.000	.000	.000	.000
TVM/PVEH	.000	.000	.885	.000	.000	.000	.000	.000	.000
TVH/PVEH	.000	.000	.877	.000	.000	.000	.000	.000	.000
PVEH/OP	.000	.000	-.802	.000	.000	.000	.000	.000	.000
TVH/AVEH	.000	.000	.633	.000	.000	.000	.000	.000	.000
TVM/FUEL	.000	.000	.000	.987	.000	.000	.000	.000	.000
RVM/FUEL	.000	.000	.000	.986	.000	.000	.000	.000	.000
PAS/FUEL	.000	.000	.000	.958	.000	.000	.000	.000	.000
REV/OSUB	.000	.000	.000	.000	.989	.000	.000	.000	.000
PAS/OSUB	.000	.000	.000	.000	.978	.000	.000	.000	.000
RVH/OSUB	.000	.000	.000	.000	.977	.000	.000	.000	.000
RVH/POP	.000	.000	.000	.000	.000	.926	.000	.000	.000
TPAS/POP	.000	.000	.000	.000	.000	.865	.000	.000	.000
TPAS/ELD	.000	.000	.000	.000	.000	.851	.000	.000	.000
TVM/MNT	.000	.000	.000	.000	.000	.000	.934	.000	.000
PVEH/MNT	.000	.000	-.483	.000	.000	.000	.784	.000	.000
TVM/MEXP	.540	.000	.000	.000	.000	.000	.643	.000	.000
TVM/EMP	.000	.000	.497	.000	.000	.000	.643	.000	.000
REV/OEXP	.000	.000	.000	.000	.000	.000	.000	.960	.000
REV/TEX	.000	.000	.000	.000	.000	.000	.000	.933	.000
RVH/ACC	.000	.000	.000	.000	.000	.000	.000	.000	.944
TVM/ACC	.000	.000	.000	.000	.000	.000	.000	.000	.923
VP	5.217	4.667	3.606	3.052	3.011	2.677	2.623	2.036	1.948

THE ABOVE FACTOR LOADING MATRIX HAS BEEN REARRANGED SO THAT THE COLUMNS APPEAR IN DECREASING ORDER OF VARIANCE EXPLAINED BY FACTORS. THE ROWS HAVE BEEN REARRANGED SO THAT FOR EACH SUCCESSIVE FACTOR, LOADINGS GREATER THAN .5000 APPEAR FIRST. LOADINGS LESS THAN .4500 HAVE BEEN REPLACED BY ZERO.

Source: Anderson and Fielding, Comparative Analysis of Transit Performance. UC Irvine, January, 1982.

Nonurbanized Sample Data Set

TPM Variables N:31

Variable #	Transit Performance Measure	Sample Mean	Standard Deviation
1	Passenger Revenue/Passenger	.32	.18
2	Passenger/Service Area Population	10.87	12.28
3	Passenger/Vehicle Hour	12.12	8.95
4	Passenger/Vehicle Mile	1.20	.69
5	Operating Cost/Passenger	1.68	.97
6	Operating Cost/Vehicle Hour	15.71	9.31
7	Total Operating Assistance/ Passenger	1.22	.79
8	Local Assistance/Passenger	.35	.50
9	Operating Cost/Vehicle Mile	1.48	.54
10	Passenger Revenue/Operating Cost	.28	.25
11	Operating Expenditure/Service Area Population	11.79	9.51
12	Total Subsidy/Capita	8.89	7.13
13	Local Subsidy/Capita	2.52	2.60

NOTE

This appendix contains the following tables relating to peer group analysis:

MB - motor bus
TB - trolley bus
DR - demand response

PART 1

U.C. IRVINE ANALYSIS OF 1978-79

SECTION 15 (ANDERSON AND FIELDING)

UNITS FOR CALCULATING PERFORMANCE MEASURES

TVH/EMP	Total Vehicle Hours/# of Employees (FTE)
RVH/OEMP*	Revenue Vehicle Hours/# of Operating Employees (FTE)
TVM/EMP	Total Vehicle Miles (millions)/# of Employees (FTE)
PVEH/ADM	# of Vehicles/# of Admin Employees in 1000's
PVEH/OP*	# of Vehicles/Operating Employees in Millions
PVEH/MNT	# of Vehicles/# of Maintenance Employees
TVH/AVEH	Hours/# of Active Vehicles
TVH/PVEH	Hours/# of Peak Vehicles
TVM/AVEH	Miles/# of Active Vehicles
TVM/PVEH	Miles/# of Peak Vehicles
RVM/TVM	Revenue Vehicle Miles/Total Vehicle Miles in 1000's
RVM/FUEL	Revenue Vehicle Miles/Gallon Diesel in 100's
TVM/FUEL	Total Vehicle Miles/Gallons of Diesel Fuel in 100's
TVM/MEXP*	Total Vehicle Miles/Maintenance Expense in $1000's
TVM/MNT	Total Vehicle Miles/# Maintenance Employees (FTE)
TVM/RCAL*	Total Vehicle Miles (millions)/# of Road Calls
RVH/OEXP	Revenue Vehicle Hours/Operating Expense in $10,000
TVM/OEXP*	Total Vehicle Miles /Operating Expense in $10,000
RVH/TWG	Revenue Vehicle Hours/Total Labor & Fringe Expense in $10,000
RVH/OWAG	Revenue Vehicle Hours/Operator Labor & Fringe Expense in $10,000
RVH/VMWG	Revenue Vehicle Hours/Vehicle Maintenance Labor & Fringe Expense in $10,000
RVH/ADWG	Revenue Vehicle Hours/Admin. Labor & Fringe Expense in $10,000
TPAS/RVH	Passengers/Revenue Vehicle Hours in 100's
TPAS/RVM	Passengers/Revenue Vehicle Miles in 100's
TPAS/PVH	Passengers/# of Peak Vehicles
RVH/POP	Revenue Vehicle Hours/Population of Service Area
TPAS/POP	Passengers/Population of Urbanized Area
TPAS/ELD	Passengers/Population Over 65 Years of Age

TPAS/AUT	Passengers/Population of Urbanized Area without Autos
TVM/ACC	Total Vehicle Miles/# of Accidents
RVH/ACC	Revenue Vehicle Hours/# of Accidents
REV/PVEH	Passenger Revenue in $/# of Peak Vehicles
REV/RVH	Passenger Revenue in $/Revenue Vehicle Hours in 100's
TREV/RVH	Operating Revenue in $/Revenue Vehicle Hours in 100's
REV/TPAS	Passenger Revenue in $/Passengers in 1000's
RVH/TSUB	Revenue Vehicle Hours/Total Gov't Subsidy in $100's
PAS/TSUB	Passengers/Total Gov't Subsidy in $100's
POP/OSUB	Urbanized Area Population/Total Government Operating Subsidy $1,000
RVH/OSUB	Revenue Vehicle Hours/Total Gov't Op. Subsidy in $100's
REV/TSUB	Passenger Revenue in $/Total Gov't Subsidy in $100
PAS/OSUB	Passengers/Total Gov't Op. Sub in $1,000
PAS/OEXP	# Passengers/Op Expense in $10,000
PAS/TWAG	# Passengers/Total Labor & Fringe Expense in $10,000
PAS/FUEL	# Passengers/Gallons of Diesel Fuel
REV/OEXP	Operating Revenue/Operating Expense in $10,000
TREV/TEX	Total Revenue in $/Operating Expense in $10,000
POP/TSUB	Urbanized Area Population/Total Govt. Subsidy in $100's
REV/OSUB	Passenger Revenue in $/Total Govt. Operating Subsidy in $1000's

*Denotes that the UCI calculations differ from the TSC method for calculating performance indicators in the <u>First Annual Report Section 15 Reporting System</u>, op. cit. pp. 1-11 and 1-66.

PART 1A

TRANSIT PROPERTIES GROUPED INTO CLASSES BY ASUM 1 Z-SCORES

Source: Anderson and Fielding, Comparative Evaluation of Transit, University of California, Irvine, January, 1982.

ABRVAR 1

	ID	ASUM1	RVH1TWG	TPASIRVH	TVH1PVEH	TVH1FUEL	REVIBSUB	RVH1POP	PVEH1NNT	TVH1ACC	REVIBEXP
	9004	6.893	745.380	3256.757	3664.762	396.995	254	436.888	4.773	37997.145	13768.277
	1008	5.312	643.923	3703.125	2351.895	5012.844	344	647.083	3.558	15957.387	10850.441
	5087	4.290	931.929	3448.236	2849.600	4833.555	-9	3.950	3.333	11709.285	10000.027
	9002	3.912	536.466	5621.941	3574.065	379.222	458	2707.529	1.538	11751.695	10101.289
	5008	3.255	618.331	5140.000	3383.948	534.076	1210	1245.551	2.699	17019.738	10002.433
	9013	3.140	376.507	3019.967	4181.297	-9.000	83	722.379	.684	18481.711	20804.809
	4007	3.070	977.657	2493.514	3080.316	376.115	546	770.079	3.455	27269.230	10042.148
	7	2.959	543.142	2365.326	4613.438	848.799	17801	1625.105	1.497	20458.465	9856.941
	3013	2.886	799.141	4103.473	2982.159	463.531	695	999.572	3.500	15170.707	10182.703
	4022	2.784	384.789	3773.890	2917.073	346.731	279	1698.190	1.284	31727.703	12299.199
	8	2.361	-9.000	3173.998	3301.401	411.045	1982	1553.457	2.431	14507.656	-9.000
	5028	2.280	960.416	2754.787	3131.143	504.432	97	793.100	-9.000	20137.422	11756.438
	4036	2.231	1066.480	2989.368	3575.000	403.789	775	697.332	1.455	29504.352	10196.441
	4023	2.200	1121.724	3964.525	3828.190	374.359	369	521.560	1.556	22373.000	9993.273
	2060	2.086	698.042	2258.613	5952.469	411.379	461	1022.936	1.197	14663.480	9864.070
	1	2.076	447.348	3597.095	3046.488	436.147	563	1480.401	2.143	11323.832	13151.023
	2025	2.060	677.877	4022.763	3516.377	352.325	2906	11.403	2.865	33402.359	10832.387
V	17	17	16	17	17	16	16	17	16	17	16
M	3903.06	3.16436	720.57201	3511.0223	3526.4482	1005.3341	1796.48	996.26557	2.37304	20791.480	11476.381
S	2997.39	1.30904	237.41269	909.14514	820.54691	1534.3740	4330.55	675.27345	1.13506	8295.2017	2779.5107
M	1	2.060	376.507	2258.613	2351.895	346.731	83	3.950	.684	11323.832	9856.941
M	9013	6.893	1121.724	5621.941	5952.469	5012.844	17801	2707.529	4.773	37997.145	20804.809

ABRVAR 2

	ID	ASUM1	RVH1TWG	TPASIRVH	TVH1PVEH	TVH1FUEL	REVIBSUB	RVH1POP	PVEH1NNT	TVH1ACC	REVIBEXP
	3006	2.050	1046.134	2353.674	4229.332	451.976	490	711.297	2.442	13623.324	9937.051
	2040	2.037	653.114	1678.464	7393.891	1032.354	8748	12.366	2.619	48052.586	12161.270
	4006	1.956	1060.330	2161.592	3013.333	388.988	539	793.824	1.333	29626.324	10000.000
	2	1.917	661.371	2490.989	3153.548	428.940	587	809.598	2.296	26684.664	12155.539
	9020	1.835	615.605	522.073	3339.064	524.704	339	1167.229	2.938	20085.641	12284.188
	6001	1.775	1465.847	1193.358	3137.333	894.627	231	437.664	-9.000	17500.262	10009.883
	3018	1.628	782.700	2752.005	2950.133	590.215	548	708.746	2.857	22443.871	10359.926
	3024	1.589	689.184	900.827	3770.000	388.277	618	897.982	2.532	31531.922	10027.707
	5022	1.565	782.377	752.639	2712.565	475.483	238	945.359	3.778	12159.531	12557.168
	4008	1.549	869.090	3069.808	3338.667	496.538	649	931.621	2.053	16276.672	10554.926
	9008	1.502	658.579	6600.266	3089.618	369.491	1225	32.266	3.560	8337.809	10797.969
	6002	1.470	886.993	3850.619	3640.000	356.832	320	794.256	2.210	12166.563	10076.605
	6034	1.464	-9.000	462.667	3900.000	2089.698	1404	512.256	1.600	25771.199	10000.000
	4024	1.445	1087.982	1992.529	3479.543	435.901	1000	553.860	1.522	27863.590	10635.320
	6003	1.425	770.723	2421.302	4012.000	491.213	267	371.638	.929	13417.445	14027.563
	3010	1.423	568.211	2633.333	3068.000	440.666	466	386.227	1.852	43973.934	10021.418
	6016	1.416	1094.473	3163.307	3532.000	341.890	418	394.637	1.625	7626.664	13765.066
	4034	1.407	585.563	3987.500	3980.861	339.281	699	1364.313	1.564	12064.898	10025.078
	3008	1.384	931.440	3004.744	4269.473	419.285	598	1145.082	1.357	7869.941	10136.938
	1006	1.372	-9.000	2969.253	2523.068	420.314	207	1335.188	2.704	14578.375	10828.980
	9035	1.350	668.227	904.445	3545.454	510.234	395	306.066	5.366	11723.637	10097.141
	3026	1.293	844.908	2547.431	4174.180	-9.000	345	690.857	1.571	19227.762	10181.848
	1041	1.269	553.366	2044.722	2728.000	1180.656	640	85.869	5.200	-9.000	9498.332
	3009	1.267	1312.442	2924.954	3464.500	715.454	5392	275.460	2.000	10972.000	10214.031
	4025	1.223	891.555	3221.000	3862.300	537.032	1876	917.406	1.481	13744.957	10019.543
	3007	1.216	946.426	1782.470	3837.241	455.137	545	666.679	1.933	22104.125	10223.504
	9030	1.193	751.875	1621.506	4425.590	646.134	231	321.636	1.691	30643.344	10269.434
	7015	1.159	-9.000	2657.564	3355.238	417.074	439	466.107	3.329	17799.629	-9.000
	5027	1.125	429.035	5565.711	2548.190	390.359	365	1046.484	2.356	7623.984	12365.121
	3001	1.079	737.735	2334.531	3510.454	490.603	628	1202.521	1.932	19705.473	9383.770
	9014	1.043	225.405	8035.742	2982.461	476.408	565	409.106	-9.000	15821.219	10815.180
	7012	1.010	677.873	2736.603	2350.833	459.235	418	558.283	4.000	18570.121	10527.637
	3012	.994	879.640	2274.879	3390.000	677.346	569	880.494	1.368	22242.270	10258.832
	3034	.981	380.654	5905.629	2737.437	366.710	1059	1218.679	2.429	11182.227	9907.141
V	34	34	31	34	34	33	34	34	32	33	33
M	4664.12	1.42382	790.67272	2779.9217	3389.5385	566.64037	978.99	686.79584	2.39461	19167.150	10791.639
S	2460.78	.29594	259.46412	1485.6886	566.16806	334.25063	1640.78	370.07944	1.07220	9740.4998	1375.5794
M	2	.981	225.405	462.667	2350.833	339.281	207	12.366	.929	7623.984	9383.770
M	9035	2.050	1465.847	8035.742	4425.590	2089.698	8748	1364.313	5.366	48052.586	14027.563

A B R V A R 3

ID	ASUM1	RVH1TWS	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV10SUB	RVH1POP	PVEH1ANT	TVH1ACC	REV10EXP
4012	.956	855.031	2270.417	3539.900	404.384	447	930.873	2.353	14019.199	10000.000
3015	.953	726.190	3029.359	3099.200	398.045	713	673.249	2.400	21138.301	10036.145
9005	.917	896.072	1576.941	3631.333	405.479	197	364.673	2.000	27499.340	10433.379
4004	.841	636.330	5423.543	2821.839	389.899	582	725.879	2.138	15549.020	10202.328
4003	.839	597.397	4548.188	3146.000	373.585	748	1064.002	2.044	10890.488	10444.887
9018	.824	666.235	3339.926	3299.111	502.411	461	594.786	2.250	16237.391	11361.766
9041	.688	651.104	4047.273	4758.000	437.293	416	10.959	1.818	20550.000	9862.043
4021	.650	242.350	8351.180	943.428	4028.469	-9	86.313	1.400	17636.207	8416.883
3014	.643	591.411	933.620	2404.492	395.704	686	576.911	2.542	48467.004	10000.004
4029	.569	682.378	2751.659	4413.848	487.635	290	612.685	1.530	18305.297	10000.000
7002	.528	707.972	2791.971	2953.532	415.715	526	858.602	2.401	8616.000	11712.063
8005	.519	850.056	1958.504	3821.037	519.991	376	482.248	2.250	15632.758	10504.918
7001	.398	954.506	2163.759	3191.314	510.026	505	827.564	2.555	8506.492	9871.840
5066	.383	216.288	7903.152	3256.983	329.787	1142	1005.990	1.435	9349.590	9794.801
5030	.356	-9.000	3389.953	3912.000	-9.000	226	564.564	1.857	11510.809	-9.000
6007	.351	731.975	3694.471	3013.636	372.797	569	300.117	3.088	15103.520	10196.688
3025	.318	683.297	4695.234	3516.933	374.497	587	502.417	1.531	17078.285	10213.086
3005	.274	526.003	3933.333	3590.476	429.956	665	583.606	2.000	19071.637	10040.309
4042	.238	570.570	3270.186	2283.974	421.374	1070	551.587	-9.000	35131.723	10000.000
5057	.183	717.350	2507.126	3533.920	616.871	181	323.584	-9.000	9089.984	12524.609
5025	.126	639.060	2457.603	2359.500	484.805	489	1273.013	3.077	8302.906	10025.211
3019	.004	257.887	6388.867	3702.829	321.275	644	872.385	1.232	8976.578	10763.539
6012	-.029	1010.392	2350.000	2228.571	620.702	344	262.531	1.750	22780.953	11903.891
5015	-.072	262.650	8032.828	2948.031	371.442	1506	703.106	1.512	6169.004	10820.602
9021	-.078	297.596	6942.160	3724.398	406.429	749	639.472	1.494	7261.027	10206.281
2018	-.079	558.213	3511.151	2523.972	378.407	613	917.332	2.700	14260.090	10094.965
9009	-.096	700.139	3368.536	2756.295	-9.000	298	150.613	3.034	-9.000	10199.914
V 27	27	26	27	27	25	26	27	25	26	26
M 5389.67	.41505	624.17125	3912.2571	3162.0946	583.88717	578.10	609.59485	2.11363	16428.215	10370.467
S 2236.99	.34804	218.36771	2024.5569	763.12935	722.49464	302.01	306.55566	.56450	9376.4063	797.95792
M 2018	-.096	216.288	933.620	943.428	321.275	181	10.959	1.232	6169.004	8416.883
M 9041	.956	1010.392	8351.180	4758.000	4028.469	1506	1273.013	3.088	48467.004	12524.609

A B R V A R 4

ID	ASUM1	RVH1TWS	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV10SUB	RVH1POP	PVEH1ANT	TVH1ACC	REV10EXP
3022	-.159	376.036	4073.062	3363.573	365.297	646	1397.517	1.788	6345.988	9996.859
3006	-.293	603.734	3201.941	2997.940	347.815	1846	1125.601	2.227	8170.441	10002.969
9039	-.304	752.907	3717.285	3264.857	422.776	699	5.367	2.333	20219.035	9962.492
4040	-.343	682.986	952.395	2885.161	364.157	741	844.435	1.802	31553.930	10020.129
9023	-.373	602.680	3434.145	3601.752	406.857	367	50.205	2.951	10096.160	10924.207
9036	-.453	-9.000	3068.568	4069.255	413.967	204	91.718	1.855	17135.656	-9.000
3030	-.477	241.049	5124.188	2741.438	350.471	811	1414.493	1.684	10002.586	9901.613
1016	-.513	717.771	3103.139	2635.454	469.146	549	1087.814	1.760	5814.172	11048.441
5059	-.516	472.705	4092.858	2577.059	411.005	353	626.786	2.429	12587.898	11142.453
6033	-.519	806.915	2450.897	2801.500	505.044	453	547.058	2.353	14096.797	10234.691
1055	-.531	645.531	1411.693	3070.476	426.118	933	925.530	2.482	15272.441	10008.223
12	-.569	377.423	2511.729	3550.857	805.951	153	860.392	1.657	22953.492	8813.605
4038	-.608	1049.924	684.099	4076.800	396.013	742	367.017	1.579	15661.121	10145.715
3002	-.613	711.204	1974.005	3369.052	574.585	451	381.972	1.727	24393.199	9912.129
2002	-.621	648.589	3050.476	2804.043	362.559	986	1043.900	2.115	11652.195	9534.594
6004	-.664	554.841	3087.875	2506.587	370.571	1310	638.131	2.752	9768.598	10558.641
5011	-.720	481.981	3137.127	2447.421	408.468	162	620.946	2.621	3242.353	12197.270
9019	-.784	425.581	3106.890	3141.163	458.604	260	773.027	2.043	19903.555	9420.535
2013	-.806	496.677	4369.039	3041.312	378.814	838	882.086	2.000	6939.168	9911.746
2007	-.870	450.475	3025.532	3612.544	425.735	840	46.873	1.426	32800.109	10367.500
5084	-.905	585.607	1837.099	2502.500	569.643	159	8.434	2.667	27370.086	11470.746
9032	-1.023	585.907	2789.046	2015.636	387.607	362	426.127	2.043	20529.418	10652.578
7014	-1.027	640.130	3071.721	2198.182	414.442	587	366.064	4.000	1313.755	10934.613
5031	-1.041	432.552	1713.850	4256.637	407.937	433	890.680	1.632	9871.688	10517.645
9026	-1.114	293.929	4872.207	4041.396	462.154	541	594.237	1.679	7389.984	9447.898
11	-1.167	845.451	1602.198	2783.529	516.623	189	555.484	2.656	10833.332	9601.977
V 26	26	25	26	26	24	26	26	26	26	25
M 4679.42	-.65429	587.31149	2933.1948	3121.4671	439.39832	600.45	637.38051	2.16382	14458.352	10269.118
S 3010.37	.27452	182.92030	1138.1322	564.88585	96.79558	390.10	408.22609	.56402	8406.9942	735.41786
M 11	-1.167	241.049	684.099	2198.182	347.815	153	5.367	1.426	1313.755	8813.605
M 9039	-.159	1049.924	5124.188	4256.637	805.951	1846	1414.493	4.088	32800.109	12197.270

ABRVARS	ID	ABUM1	RVM1TWS	TPASIRVM	TVM1PVEH	TVM1FUEL	REV1DSUB	RVM1POP	PVEHINHT	TVM1ACC	REV1DEXP
5											
	5074	-1.256	630.386	2147.471	3562.000	643.491	206	1.990	2.000	13052.000	11689.609
	7011	-1.312	673.711	2453.627	2631.200	418.286	548	776.628	2.222	10067.539	10224.894
	2029	-1.317	665.836	4022.222	3466.667	345.745	3369	5.775	2.061	7593.918	10970.389
	5052	-1.445	560.530	2750.000	3081.951	391.901	426	432.474	1.822	16183.176	10696.371
	4033	-1.476	664.843	774.074	3993.600	1017.594	158	118.427	1.064	21255.000	10554.862
	5036	-1.481	445.317	2688.865	3293.333	427.163	240	632.787	1.852	15376.637	10078.309
	5039	-1.591	-9.000	2109.224	2054.000	1236.652	298	194.887	3.043	8681.578	10047.715
	7006	-1.596	395.483	4221.555	2816.357	362.823	266	1019.180	1.653	6041.086	10082.609
	1001	-1.703	468.044	3963.439	2836.364	433.423	580	549.434	2.063	7672.941	10334.043
	5068	-1.718	872.889	2737.985	2772.250	429.892	451	6.606	-9.000	15710.934	9620.730
	7010	-1.737	585.190	1814.496	2535.000	394.887	719	675.855	2.963	9407.469	10000.000
	3031	-1.782	429.856	4330.582	2228.938	453.331	671	441.472	2.250	15359.809	9892.125
	5080	-1.785	698.557	1601.961	3596.752	422.673	481	40.271	2.525	12396.523	10014.242
	7009	-1.809	643.128	2538.224	3746.889	493.613	245	253.045	1.034	9313.332	11729.574
	4018	-1.941	513.511	3463.898	2920.891	416.431	341	724.304	1.723	7259.641	10031.262
	5056	-1.962	672.944	2178.245	2917.333	562.797	448	460.406	2.053	9779.422	10016.711
	2043	-1.964	474.003	5375.199	2815.313	283.287	2680	30.144	2.087	7781.020	10793.914
	5058	-1.999	544.377	2488.876	2851.875	443.124	291	421.886	2.177	13526.266	10139.098
	4001	-2.059	572.103	2594.231	2566.508	420.723	770	677.270	1.639	15800.879	10000.004
	2068	-2.066	374.387	3414.321	3180.504	480.099	1728	-9.000	1.459	14844.805	10114.973
	5061	-2.134	679.553	2404.733	3212.000	341.997	286	418.846	1.585	9481.016	10611.422
	5014	-2.158	-9.000	1014.392	2753.502	435.848	1275	759.182	2.160	8493.527	-9.000
	2008	-2.177	109.397	8663.258	4680.313	348.170	2174	786.088	1.025	11682.668	2236.234
	7005	-2.197	461.367	3574.186	2707.071	382.846	455	608.121	1.789	10776.840	10028.633
	1056	-2.257	597.014	672.750	2971.428	438.578	652	337.483	2.727	15600.000	10011.238
V	25	25	23	25	25	25	25	24	24	25	24
M	4434.76	-1.79688	553.58376	2963.1122	3047.6815	480.68296	791.11	431.85670	1.95740	11725.481	9996.3859
S	1889.12	.30306	152.99662	1643.2108	567.53199	209.68881	829.50	298.57649	.53619	3789.2580	1734.9086
M	1001	-2.257	109.397	672.750	2054.000	283.287	158	1.990	1.025	6041.086	2236.234
M	7011	-1.256	872.889	8663.258	4680.313	1236.652	3369	1019.180	3.043	21255.000	11729.574

ABRVAR	ID	ABUM1	RVM1TWS	TPASIRVM	TVM1PVEH	TVM1FUEL	REV1DSUB	RVM1POP	PVEHINHT	TVM1ACC	REV1DEXP
6											
	5012	-2.373	505.453	3709.615	2574.354	327.224	463	850.766	1.555	4993.359	10207.203
	5045	-2.379	523.113	3131.729	2595.326	411.383	1128	24.457	2.472	11695.352	10928.898
	5082	-2.382	564.627	3271.883	3795.342	395.552	-9	42.114	1.819	9139.422	10121.109
	2004	-2.457	453.870	4059.094	2430.667	361.676	1051	781.009	1.450	7970.043	10161.691
	2067	-2.524	602.665	3515.469	3130.833	374.053	1136	4.149	1.846	9235.551	10412.922
	2017	-3.099	969.032	364.318	2104.267	251.022	1282	82.112	2.500	9283.039	11525.387
	2044	-3.227	569.180	2102.857	2736.042	308.455	4104	11.230	2.310	5042.250	11859.930
	4002	-3.232	550.799	755.892	1961.143	338.824	692	648.560	3.150	7707.480	10023.410
	2041	-3.279	604.602	2150.000	1890.909	281.864	15197	3.850	3.235	5782.398	11285.836
	7016	-3.560	238.376	10364.965	884.000	164.207	248	6.466	-9.000	3576.627	9337.121
	9016	-3.720	198.419	3031.626	1737.357	500.015	1900	111.138	2.752	16017.281	10436.777
	6019	-4.353	710.051	1414.487	3456.762	508.730	396	496.303	2.250	12104.766	2526.267
	2042	-4.382	349.062	2759.138	1568.000	295.711	4188	5.583	2.241	14450.273	11294.828
	4019	-4.465	614.149	733.000	2665.000	417.164	869	163.888	1.975	7308.105	10115.547
	2059	-4.490	311.775	3006.345	1868.442	377.618	12111	18.558	1.836	17743.273	10252.871
	9012	-5.346	144.227	2681.395	2864.875	92.791	274	153.367	2.286	3450.965	9796.328
	6024	-7.571	194.405	3172.453	712.978	92.380	1456	134.565	1.800	5295.121	10051.934
	3027	-8.029	257.584	2929.714	760.000	69.187	304	73.920	1.368	6053.410	10016.289
V	18	18	18	18	18	18	17	18	17	18	18
M	4308.22	-3.93700	464.52168	2953.0096	2207.6164	309.33656	2752.06	211.77964	2.14981	8714.9287	10019.686
S	2388.59	1.65731	215.09777	2135.7445	880.77254	131.82136	4301.48	299.79688	.56041	4208.5942	1982.7992
M	2004	-8.029	144.227	364.310	712.978	69.187	248	3.850	1.368	3450.965	2526.267
M	9016	-2.373	969.032	10364.965	3795.342	508.730	15197	850.766	3.235	17743.273	11859.930
V	147	147	139	147	147	143	144	146	140	145	142
M	4629.49	-.13190	633.41772	3151.9095	3113.3101	540.18983	1104.04	599.28165	2.19443	15441.570	10467.456
S	2497.08	2.18390	237.21425	1683.2189	766.69754	638.20795	2304.61	442.24513	.78458	8701.2046	1622.7795
N	1	-8.029	109.397	364.310	712.978	69.187	83	1.990	.684	1313.755	2236.234
M	9041	6.893	1465.847	10364.965	5952.469	5012.844	17801	2707.529	5.366	48467.004	20804.809

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ID	ABUM1	RVN1TUB	TPAB1RVN	TVN1PVEN	TVN1FUEL	REV1OBUS	RVN1POP	PVEH1AMT	TVN1ACC	REV1OEXP
3	-999.000	529.529	3179.057	-9.000	534.867	410	726.546	-9.000	15474.684	10198.031
4	-999.000	743.043	1313.908	-9.000	448.276	101	42.360	-9.000	28253.340	7607.719
5	-999.000	731.164	-9.000	3376.533	775.663	428	39.228	5.357	-9.000	4861.699
6	-999.000	-9.000	-9.000	-9.000	-9.000	171	-9.000	-9.000	-9.000	12483.039
9	-999.000	785.481	-9.000	3102.667	871.478	163	752.913	2.913	20406.691	10078.953
10	-999.000	-9.000	-9.000	-9.000	-9.000	878	-9.000	5.000	-9.000	9552.551
1002	-999.000	-9.000	-9.000	-9.000	-9.000	653	-9.000	1.611	-9.000	10282.238
1003	-999.000	23.897	-9.000	543.182	89.181	278	146.262	.889	10017.301	11831.242
1004	-999.000	488.396	3022.894	-9.000	445.214	205	804.224	-9.000	11652.125	10714.102
1005	-999.000	679.686	3817.382	-9.000	4351.316	219	258.675	-9.000	18571.430	10995.313
1007	-999.000	-9.000	-9.000	-9.000	-9.000	511	-9.000	4.500	-9.000	10491.652
1013	-999.000	1020.792	-9.000	-9.000	538.980	312	193.170	-9.000	17143.469	10940.926
1014	-999.000	680.101	-9.000	3610.286	634.967	411	742.959	1.860	18120.215	10587.480
1015	-999.000	-9.000	-9.000	-9.000	-9.000	1051	-9.000	2.500	-9.000	10294.888
1042	-999.000	-9.000	-9.000	-9.000	-9.000	259	-9.000	-9.000	-9.000	10549.441
1043	-999.000	-9.000	-9.000	-9.000	-9.000	873	-9.000	2.182	-9.000	10570.570
1048	-999.000	991.110	-9.000	2338.786	393.785	990	1051.180	3.012	15612.715	10015.199
1062	-999.000	-9.000	-9.000	-9.000	-9.000	189	-9.000	2.300	-9.000	10015.203
2001	-999.000	-9.000	-9.000	-9.000	-9.000	507	-9.000	-9.000	-9.000	9875.840
2003	-999.000	-9.000	-9.000	-9.000	-9.000	811	-9.000	2.432	-9.000	10090.879
2004	-999.000	-9.000	-9.000	3544.667	168.357	217	1.312	1.200	33280.000	9999.988
2009	-999.000	1218.167	4125.805	-9.000	845.280	710	188.448	-9.000	40560.004	10491.723
2010	-999.000	-9.000	-9.000	3336.000	446.631	182	129.178	-9.000	28137.781	9983.316
2012	-999.000	-9.000	-9.000	-9.000	-9.000	4244	-9.000	-9.000	-9.000	10993.234
2015	-999.000	783.212	-9.000	3926.000	745.030	322	72.657	1.600	26200.574	8764.633
2016	-999.000	-9.000	997.087	-9.000	326.363	-9	42.715	-9.000	22571.715	10000.000
2019	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2020	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2021	-999.000	708.059	3087.276	-9.000	498.898	743	406.243	-9.000	16237.738	10000.941
2022	-999.000	-9.000	-9.000	-9.000	-9.000	885	-9.000	6.000	-9.000	-9.000
2024	-999.000	-9.000	-9.000	-9.000	-9.000	358	-9.000	3.125	-9.000	11441.148
2026	-999.000	-9.000	-9.000	-9.000	495.764	779	.279	-9.000	-9.000	9913.793
2027	-999.000	-9.000	-9.000	-9.000	-9.000	192	-9.000	3.333	-9.000	1623.422
2031	-999.000	1110.059	-9.000	-9.000	-9.000	473	.456	-9.000	-9.000	11604.301
2032	-999.000	-9.000	-9.000	-9.000	-9.000	32363320	-9.000	-9.000	-9.000	12325.070
2033	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2034	-999.000	-9.000	-9.000	-9.000	345.563	1876	-9.000	3.249	8600.633	10553.129
2035	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000

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ID	ABUM1	RVN1TUB	TPAB1RVN	TVN1PVEN	TVN1FUEL	REV1OBUS	RVN1POP	PVEH1AMT	TVN1ACC	REV1OEXP
2036	-999.000	1075.080	-9.000	3060.000	570.710	727	.560	-9.000	-9.000	30331.773
2037	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2038	-999.000	458.936	-9.000	3646.228	366.460	-9	36.866	1.305	14706.174	10707.684
2039	-999.000	343.889	-9.000	2658.500	303.450	3123	12.642	1.455	12361.676	10757.453
2045	-999.000	-9.000	-9.000	-9.000	327.316	1967	-9.000	1.944	7305.785	11273.117
2046	-999.000	432.906	-9.000	3702.206	269.907	3359	23.990	1.466	11141.852	10988.605
2047	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2048	-999.000	516.047	-9.000	3378.375	436.900	841	799.307	1.524	21636.063	10219.984
2049	-999.000	817.301	1600.801	-9.000	555.868	678	1.851	-9.000	23251.434	10749.047
2050	-999.000	840.891	-9.000	2741.143	173.611	978	2.368	2.800	54698.805	11083.164
2051	-999.000	853.638	-9.000	-9.000	497.320	372	2.483	-9.000	30723.336	10071.371
2052	-999.000	1758.996	1017.962	-9.000	1223.103	790	4.376	1.750	61347.035	10000.121
2055	-999.000	-9.000	-9.000	-9.000	424.037	1278	-9.000	2.250	21204.445	10246.283
2056	-999.000	-9.000	-9.000	-9.000	-9.000	2755	-9.000	.667	-9.000	9942.699
2058	-999.000	557.594	-9.000	4252.675	498.137	4570	11.669	1.381	52607.809	9776.766
2061	-999.000	-9.000	-9.000	-9.000	-9.000	566	-9.000	1.200	-9.000	10208.906
2063	-999.000	-9.000	-9.000	1716.000	-9.000	458	-9.000	1.600	-9.000	10675.730
2064	-999.000	703.703	2198.371	-9.000	-9.000	741	.985	-9.000	25532.008	9974.590
2065	-999.000	789.731	-9.000	4212.000	370.371	222	16.107	-9.000	-9.000	9999.914
2066	-999.000	-9.000	507.104	-9.000	658.632	1963	38.855	-9.000	34441.695	10307.359
2069	-999.000	-9.000	-9.000	-9.000	-9.000	259	-9.000	-9.000	-9.000	10238.908
2070	-999.000	-9.000	-9.000	-9.000	-9.000	338	-9.000	-9.000	-9.000	10315.793
2071	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
2074	-999.000	693.771	3527.273	-9.000	410.720	4492	3.529	-9.000	14604.254	10365.246
3003	-999.000	813.524	1762.939	-9.000	1019.001	671	250.361	-9.000	10348.570	10000.035
3004	-999.000	753.168	-9.000	2012.964	450.132	534	622.807	3.063	11960.250	9972.457
3011	-999.000	530.600	-9.000	1634.609	359.240	179	435.479	2.875	9530.835	10363.152
3016	-999.000	-9.000	400.000	-9.000	-9.000	263	14.002	-9.000	-9.000	11313.375
3017	-999.000	-9.000	3333.336	-9.000	-9.000	115	8.401	-9.000	-9.000	11502.734
3020	-999.000	-9.000	-9.000	3445.000	454.789	620	-9.000	1.333	23101.000	10577.027
3021	-999.000	-9.000	-9.000	-9.000	-9.000	1109	-9.000	1.500	-9.000	10105.238
3028	-999.000	-9.000	-9.000	-9.000	-9.000	823	-9.000	4.467	-9.000	9391.961
4005	-999.000	883.732	-9.000	2492.414	538.351	594	997.640	2.636	31913.441	10000.000
4009	-999.000	74.365	-9.000	228.222	38.978	410	25.457	1.385	1102.174	2944.296
4010	-999.000	-9.000	-9.000	-9.000	-9.000	386	-9.000	1.515	-9.000	10037.246
4011	-999.000	1117.855	-9.000	2847.000	428.462	327	365.101	4.000	34480.004	9179.324
4014	-999.000	1087.877	-9.000	-9.000	504.094	1914	176.198	-9.000	38952.730	8740.141
4015	-999.000	641.500	-9.000	2951.000	406.213	518	241.040	1.600	24984.000	10460.608
4017	-999.000	684.194	-9.000	3225.405	368.135	538	739.886	2.056	12997.563	10011.887
4026	-999.000	1202.078	-9.000	-9.000	1072.049	653	184.629	-9.000	41080.016	5177.395
4027	-999.000	-9.000	708.814	-9.000	596.965	687	327.394	2.727	21621.405	10057.984

ID	ASUM1	RVN1TWG	TPAS1RVN	TVN1PVEH	TVN1FUEL	REV1DSUB	RVN1POP	PVEH1ANT	TVN1ACC	REV1BEXP
4030	-999.000	759.297	-9.000	2189.032	331.775	427	927.888	2.583	7684.473	9999.727
4032	-999.000	1223.116	1923.529	-9.000	764.123	488	767.521	-9.000	18463.770	10183.484
4035	-999.000	-9.000	-9.000	-9.000	-9.000	984	-9.000	-9.000	-9.000	10049.863
4039	-999.000	973.603	-9.000	-9.000	354.146	704	398.434	-9.000	12580.645	10882.406
4043	-999.000	775.334	-9.000	3192.129	405.788	763	365.470	1.632	14344.000	10299.408
4044	-999.000	239.131	-9.000	679.852	83.861	1254	132.074	2.177	2326.614	10271.637
5001	-999.000	890.931	-9.000	2549.667	872.503	473	447.611	3.429	21437.688	10222.063
5002	-999.000	-9.000	-9.000	4493.410	531.963	816	891.673	2.429	23920.004	10377.348
5003	-999.000	997.587	-9.000	2746.370	530.351	234	802.260	4.909	13501.492	6338.094
5004	-999.000	-9.000	-9.000	-9.000	-9.000	394	-9.000	1.385	-9.000	10003.348
5005	-999.000	-9.000	-9.000	2558.317	381.112	668	1493.509	3.621	13777.824	-9.000
5007	-999.000	-9.000	-9.000	1593.750	806.441	239	170.637	2.667	10894.688	10000.000
5009	-999.000	-9.000	1175.781	-9.000	486.429	583	1199.711	3.265	52742.867	10392.461
5010	-999.000	137.275	-9.000	-9.000	89.027	871	92.068	-9.000	1760.934	10076.297
5013	-999.000	-9.000	-9.000	-9.000	-9.000	207	-9.000	.833	-9.000	10000.000
5017	-999.000	144.778	-9.000	2611.030	405.438	955	121.899	1.571	7549.027	12907.723
5018	-999.000	-9.000	-9.000	-9.000	-9.000	380	-9.000	3.667	-9.000	10518.270
5019	-999.000	1131.260	-9.000	-9.000	2700.621	345	32.749	-9.000	22609.605	10413.094
5020	-999.000	-9.000	-9.000	-9.000	-9.000	272	-9.000	2.500	-9.000	10438.648
5021	-999.000	513.496	-9.000	3354.000	544.162	655	144.154	1.333	20742.227	10168.547
5023	-999.000	-9.000	-9.000	-9.000	-9.000	486	-9.000	1.667	-9.000	9555.914
5024	-999.000	27.115	-9.000	184.281	27.145	136	17.353	2.036	994.563	11230.691
5026	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
5033	-999.000	393.308	-9.000	2158.490	454.359	268	325.000	2.377	14997.102	10047.813
5034	-999.000	-9.000	2314.263	-9.000	556.942	254	412.971	-9.000	15241.379	10209.469
5035	-999.000	796.080	-9.000	3090.286	452.951	212	702.643	2.941	9397.141	11662.289
5037	-999.000	-9.000	-9.000	-9.000	-9.000	152	-9.000	-9.000	-9.000	10787.242
5041	-999.000	813.701	-9.000	-9.000	-9.000	176	475.315	-9.000	15919.430	7784.914
5043	-999.000	1080.843	2411.368	-9.000	-9.000	877	427.019	-9.000	28662.410	10142.918
5044	-999.000	796.700	-9.000	3275.088	417.684	604	829.011	3.167	8128.734	10214.133
5047	-999.000	959.072	1460.596	-9.000	912.610	354	855.776	-9.000	15559.344	10040.695
5050	-999.000	-9.000	-9.000	-9.000	-9.000	1475	-9.000	-9.000	-9.000	10474.223
5051	-999.000	-9.000	-9.000	-9.000	-9.000	327	-9.000	-9.000	-9.000	10683.055
5053	-999.000	1234.330	-9.000	3731.428	831.984	340	616.997	1.750	24301.340	10000.000
5055	-999.000	570.857	-9.000	1785.333	524.299	329	19.681	2.500	12207.000	9999.918
5060	-999.000	684.060	-9.000	3627.765	440.745	374	1203.979	3.519	13650.219	11877.246
5063	-999.000	806.068	2700.000	-9.000	4919.363	339	267.906	-9.000	-9.000	10019.910
5065	-999.000	896.690	-9.000	-9.000	1665.680	146	25.895	-9.000	-9.000	11503.473
5073	-999.000	-9.000	-9.000	-9.000	-9.000	101497	-9.000	-9.000	-9.000	9936.117
5075	-999.000	-9.000	-9.000	-9.000	-9.000	181	-9.000	-9.000	-9.000	9986.340
5077	-999.000	-9.000	-9.000	-9.000	-9.000	387	-9.000	-9.000	-9.000	10512.945

ID	ASUM1	RVN1TWG	TPAS1RVN	TVN1PVEH	TVN1FUEL	REV1DSUB	RVN1POP	PVEH1ANT	TVN1ACC	REV1BEXP
5084	-999.000	146.922	-9.000	992.000	96.433	573	11.485	1.773	3158.949	10039.878
5090	-999.000	-9.000	819.149	-9.000	868.574	130	314.952	-9.000	21509.094	10484.355
5091	-999.000	-9.000	-9.000	-9.000	-9.000	857	-9.000	3.286	-9.000	10084.305
6005	-999.000	588.673	756.716	-9.000	483.236	58045	102.665	-9.000	39866.680	10457.922
6009	-999.000	267.481	-9.000	1101.750	138.771	1378	239.269	1.000	2167.616	10134.512
6010	-999.000	1363.656	-9.000	3144.000	3959.622	287	535.465	3.133	22954.609	10494.324
6011	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
6014	-999.000	149.807	-9.000	-9.000	-9.000	739	36.559	-9.000	3848.002	10358.531
6015	-999.000	95.081	-9.000	307.273	816.712	1212	54.685	1.467	21450.000	10409.809
6017	-999.000	-9.000	434.782	-9.000	403.409	373	969.527	1.827	14768.000	9916.500
6018	-999.000	-9.000	-9.000	-9.000	-9.000	310	-9.000	-9.000	-9.000	10045.668
6021	-999.000	845.751	-9.000	3443.304	433.565	8757	76.562	2.347	10163.199	11337.084
6022	-999.000	898.399	-9.000	3309.091	388.573	919	437.740	1.784	18051.430	10071.406
6023	-999.000	1429.791	2257.628	-9.000	-9.000	326	347.609	1.552	-9.000	12136.023
6026	-999.000	1134.328	-9.000	-9.000	1254.491	491	549.471	-9.000	28559.313	10000.000
6029	-999.000	680.613	-9.000	3475.333	395.339	414	65.045	1.286	8469.000	16464.633
6030	-999.000	-9.000	-9.000	-9.000	-9.000	700	-9.000	1.000	-9.000	12975.246
6032	-999.000	553.918	-9.000	3488.764	357.025	1275	1385.743	1.227	8705.566	10377.604
6035	-999.000	1151.483	-9.000	-9.000	1063.794	1118	203.600	-9.000	41050.301	7548.445
6037	-999.000	359.508	-9.000	863.200	196.263	329	67.560	-9.000	4501.711	10080.164
6038	-999.000	1594.323	-9.000	3908.667	326.050	472	585.251	3.000	-9.000	10000.000
7003	-999.000	708.977	-9.000	4714.664	1110.853	123	692.105	.692	20164.449	10658.918
7007	-999.000	421.228	-9.000	-9.000	-9.000	30	13.287	-9.000	17576.000	23181.402
7008	-999.000	-9.000	-9.000	-9.000	-9.000	548	-9.000	-9.000	-9.000	10193.598
7013	-999.000	-9.000	-9.000	-9.000	692.072	341	-9.000	3.333	-9.000	10101.469
8001	-999.000	641.715	2501.846	-9.000	-9.000	98	1556.283	1.408	-9.000	12596.426
8002	-999.000	1416.806	-9.000	1800.000	-9.000	547	302.398	4.483	-9.000	10076.668
8003	-999.000	-9.000	-9.000	-9.000	-9.000	416	212.894	-9.000	25456.371	6597.168
8004	-999.000	1010.692	1613.146	-9.000	837.685	155	468.000	-9.000	20567.371	9480.320
8006	-999.000	429.972	-9.000	3239.682	423.575	1745	1371.856	1.556	10723.641	12073.234
8007	-999.000	852.106	-9.000	3266.545	1196.846	486	342.304	2.200	12142.000	10000.000
9003	-999.000	-9.000	-9.000	-9.000	-9.000	2627	-9.000	-9.000	-9.000	9726.215
9006	-999.000	943.408	4121.211	-9.000	502.438	318	2326.527	-9.000	16250.000	13852.262
9007	-999.000	-9.000	-9.000	-9.000	-9.000	230	-9.000	2.250	-9.000	10000.000
9010	-999.000	582.979	-9.000	3810.444	550.962	303	8.845	-9.000	16284.449	10013.965
9015	-999.000	-9.000	-9.000	3705.095	329.384	456	507.326	.821	8169.852	-9.000
9017	-999.000	894.667	2251.553	-9.000	978.254	155	446.507	-9.000	35889.453	11407.113
9022	-999.000	-9.000	-9.000	-9.000	1771.089	115	-9.000	-9.000	26634.152	10320.234
9027	-999.000	630.368	-9.000	4217.621	381.194	230	1071.239	1.507	14107.305	11712.762
9028	-999.000	875.368	-9.000	3605.333	518.700	222	17.948	2.542	46879.746	10060.523
9029	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9.000	-9.000	-9.000
9033	-999.000	701.161	-9.000	3457.708	426.419	366	948.027	1.935	22557.406	10016.465
9042	-999.000	700.125	2721.338	-9.000	445.884	311	9.309	2.766	20477.828	10729.285
9043	-999.000	-9.000	-9.000	3276.000	1185.891	-9	1.961	1.000	-9.000	8237.332

	ID	ASUM1	RVN1TWG	TPAS1RVN	TVN1PVEH	TVN1FUEL	REV1DSUB	RVN1POP	PVEH1ANT	TVN1ACC	REV1BEXP
V	164	0	89	31	62	101	151	107	91	98	151
M	4144.09	M	748.29239	2066.4289	2825.4605	682.40963	216112.77	387.75069	2.31088	19943.561	10421.419
S	2414.81	M	349.40488	1114.2890	1105.4358	759.31212	2633560.9	435.13149	1.10402	12317.892	2495.3813
M	3	M	23.897	400.000	184.281	27.145	30	.279	.667	994.563	1623.422
M	9043	M	1758.996	4125.805	4714.664	4919.363	32343328	2326.527	6.000	61347.035	30331.773

	ID	ASUM1	RVN1TWG	TPAS1RVN	TVN1PVEH	TVN1FUEL	REV1DSUB	RVN1POP	PVEH1ANT	TVN1ACC	REV1BEXP
V	164	0	89	31	62	101	151	107	91	98	151
M	4144.09	M	748.29239	2066.4289	2825.4605	682.40963	216112.77	387.75069	2.31088	19943.561	10421.419
L	2414.81	M	349.40488	1114.2890	1105.4358	759.31212	2633560.9	435.13149	1.10402	12317.892	2495.3813
M	3	M	23.897	400.000	184.281	27.145	30	.279	.667	994.563	1623.422
M	9043	M	1758.996	4125.805	4714.664	4919.363	32343328	2326.527	6.000	61347.035	30331.773

PART 1B

TRANSIT PERFORMANCE BY CLUSTER GROUPS

Notes:

1. Groups listed by CLUSTER # left of ID column. At end of each group column is listed:

   V = valid cases
   M = mean
   S = standard deviation
   M = minimum value
   M = maximum value

2. Eight clusters are defined. CLUSTER 9 contains those that did not enter any group. Unnumbered CLUSTER lists properties with missing values which were not assigned a SUM 1 value.

CLUSTER 1

	ID	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1DSUB	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXP
	1	2.350	363.915	268.429	41861.199	426.147	563	1480.401	89723	771.096	13151.023
	5027	.912	323.817	408.537	34884.387	390.359	365	1046.484	82199	475.387	12365.121
	3034	.857	308.201	497.521	32493.469	366.710	1059	1218.679	78939	770.407	9907.141
	3019	.414	149.945	658.860	36056.219	321.275	644	872.385	44437	857.892	10763.539
	3022	.111	299.264	312.012	43908.941	365.297	646	1397.517	78504	486.127	9996.059
	3030	-.613	180.864	413.469	33963.004	350.471	811	1414.493	57199	657.190	9901.613
	5015	-1.056	180.274	540.279	35294.484	371.442	1506	703.104	53362	379.301	10820.602
	9014	-1.271	193.511	363.573	43659.402	476.408	565	409.106	-9	626.345	10815.180
	5031	-1.337	323.615	160.969	45787.609	407.937	433	890.680	74715	843.310	10517.645
	7006	-1.479	294.267	334.859	36809.020	362.823	264	1019.180	60844	401.729	10082.609
	2068	-1.814	290.370	216.341	50106.191	480.099	1728	-9.000	73120	808.347	10114.973
	11	11	11	11	11	11	11	10	10	11	11
	4115.18	-.26602	264.36758	379.53180	39529.448	393.54268	780.36	1045.2030	69304.15	643.37564	10766.864
	2463.45	1.29868	73.36292	146.05890	5743.4322	51.39926	468.20	342.55006	14510.95	180.89034	1062.1241
	1	-1.814	149.945	160.969	32493.469	321.275	264	409.106	44437	379.301	9901.613
	9014	2.350	363.915	658.860	50106.191	480.099	1728	1480.401	89723	857.892	13151.023

CLUSTER 2

	ID	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1DSUB	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXP
	9002	4.738	379.356	445.589	52729.020	379.222	458	2707.529	81081	871.615	10101.289
	5008	3.827	514.650	399.482	44893.707	534.076	1210	1245.551	121171	1282.895	10002.633
	8	2.385	-9.000	225.687	46330.910	411.045	1902	1553.457	112648	924.594	-9.000
	4034	2.144	441.092	340.267	53368.418	339.281	699	1364.313	83460	899.946	10025.078
	2007	-1.008	362.065	263.412	41852.926	425.735	840	46.873	59688	2381.406	10367.500
	6032	-999.000	379.426	-9.000	35872.512	357.025	1275	1385.743	44020	798.029	10377.684
	8006	-999.000	319.513	-9.000	45809.523	423.575	1745	1371.856	71259	667.329	12073.234
	9015	-999.000	-9.000	-9.000	37972.840	329.384	456	507.326	31187	797.151	-9.000
N	8	5	6	5	8	8	8	8	8	8	6
M	5389.00	2.41687	399.35018	334.88725	44853.732	399.91803	1073.07	1272.8310	75564.04	1077.8707	10491.236
S	3291.51	2.18991	68.69850	91.50082	6263.6258	65.75747	554.37	779.90362	31128.70	554.08188	792.34064
M	8	-1.008	319.513	225.687	35872.512	329.384	456	46.873	31187	667.329	10002.633
M	9015	4.738	514.650	445.589	53368.418	534.076	1902	2707.529	121171	2381.406	12073.234

CLUSTER 3

	ID	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1DSUB	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXP
	3013	2.506	561.320	398.410	32027.047	463.531	695	999.572	112095	1317.203	10102.703
	4003	1.114	464.970	331.922	43092.531	373.585	748	1064.002	88083	769.577	10446.887
	4004	.718	474.718	391.650	38370.965	389.899	582	725.879	82034	1063.791	10202.328
	7002	.590	532.534	209.942	39275.531	415.715	526	858.602	102169	601.481	11712.063
	4042	-.207	435.203	218.182	31958.527	421.374	1070	551.587	-9	2183.263	10000.000
	5025	-.270	503.973	195.291	29682.898	484.805	489	1273.013	91332	615.818	10025.211
	3006	-.323	463.797	299.436	32779.613	347.815	1846	1125.601	72989	699.827	10002.969
	4040	-.378	486.241	70.670	38882.578	364.157	741	844.435	70079	2341.362	10020.129
	2018	-.470	424.909	290.212	29601.984	378.407	613	917.332	79931	1146.419	10094.965
	5011	-.743	525.398	367.998	23933.684	408.468	162	620.946	62723	270.381	12197.270
	2013	-.750	379.151	368.866	36091.023	378.814	838	882.086	72182	539.625	9911.246
	6004	-.841	433.820	276.721	35197.164	370.571	1310	638.131	96855	611.056	10558.641
	2043	-1.239	351.996	655.844	22208.332	283.287	2680	30.144	46348	891.496	10793.914
	4018	-1.760	394.299	260.431	38818.402	414.931	361	724.304	66892	518.942	10031.262
	2004	-1.988	383.551	369.060	26816.590	361.674	1051	781.009	38895	718.577	10161.691
	7005	-2.086	350.521	253.700	38143.227	382.846	455	608.121	68228	745.295	10028.633
	4001	-2.165	367.143	170.282	39100.473	420.723	770	677.270	64081	1037.151	10000.004
	5012	-2.204	385.956	286.720	33307.203	327.226	463	850.766	51796	385.943	10207.203
	5080	-2.212	507.308	141.949	41976.355	422.673	481	40.271	105990	790.643	10014.242
	5016	-2.326	-9.000	78.644	35976.957	435.848	1275	759.182	77724	618.317	-9.000
	7010	-2.587	420.997	158.768	28340.000	394.087	719	675.855	83970	717.427	10000.000
	7016	-4.124	121.207	637.429	8175.141	164.207	248	6.466	-9	222.625	9337.121
	4019	-4.734	432.868	56.138	33800.000	417.164	849	163.888	64765	491.892	10115.547
	2059	-4.969	222.623	177.139	32311.430	377.618	12111	18.558	59316	869.271	10252.871
	1003	-999.000	17.217	-9.000	6896.145	89.181	278	146.262	6133	694.046	11831.262
	1048	-999.000	437.929	-9.000	30553.109	393.785	990	1051.180	92012	1195.110	10015.199
	2038	-999.000	353.786	-9.000	38218.441	366.460	-9	36.866	49863	1376.682	10707.684
	2039	-999.000	261.385	-9.000	25805.000	303.450	3123	12.642	37535	1226.826	10757.453
	3004	-999.000	498.415	-9.000	29684.480	450.132	534	622.807	90916	811.049	9972.457
	3011	-999.000	336.339	-9.000	20304.867	359.240	179	435.479	58377	726.939	10363.152
	5003	-999.000	733.999	-9.000	29503.258	530.351	234	802.260	144834	1145.763	6335.094
	5005	-999.000	-9.000	-9.000	31382.824	381.112	668	1493.509	113628	1069.171	-9.000
	5007	-999.000	532.855	-9.000	19750.250	806.441	239	170.637	52667	814.069	10000.000
	5017	-999.000	111.363	-9.000	32941.211	405.438	955	121.899	51765	580.667	12907.723
	5024	-999.000	21.476	-9.000	1797.193	27.145	136	17.353	3659	66.641	11230.691
	5055	-999.000	324.748	-9.000	32552.000	524.299	329	19.681	81380	507.000	9999.918
N	36	24	34	24	36	34	35	36	34	36	34
M	4047.72	-1.31038	389.82395	277.74189	30257.123	384.40161	1107.46	576.87761	71840.14	843.92625	10304.045
S	1694.02	1.78366	152.19812	151.83030	9469.7851	123.95519	2021.22	417.69047	28786.63	462.73466	1020.6549
M	1003	-4.969	17.217	56.138	1797.193	27.145	136	6.466	3659	66.641	6335.094
M	7016	2.506	733.999	655.844	43092.531	806.441	12111	1493.509	144834	2341.362	12907.723

CLUSTER 4

	ID	SUM1	RVH1OEXP	TPASIRVH	TVH1FVEH	TVH1FUEL	REV1OSUP	RVH1POF	TVH1MNT	RVH1ACC	REV1OEXP
	6034	5.887	1164.362	28.091	64428.000	2089.698	1404	512.256	103085	1560.000	10000.000
	1041	5.597	339.343	119.751	47080.000	1180.656	640	85.869	244816	4433.000	9498.332
	9013	2.958	220.117	203.493	61933.383	-9.000	83	722.379	42340	1175.613	20804.809
	9030	2.211	519.495	89.113	77102.563	646.134	231	321.636	130373	1647.112	10269.434
	9018	1.768	463.774	197.107	59537.109	502.611	461	594.786	133959	840.667	11361.766
	9036	.444	-9.000	204.696	65854.625	413.967	204	91.718	122131	976.990	-9.000
	12	.036	264.211	145.899	61482.570	805.951	153	860.392	101865	1270.686	8813.605
	9019	-.412	306.480	202.678	51726.090	458.604	260	773.027	105664	1095.955	9470.535
	4033	-.670	455.572	45.576	68016.000	1017.594	158	110.427	72357	1228.506	10554.863
	9009	-.706	313.570	220.467	43510.113	-9.000	298	150.613	132031	-9.000	10199.914
	9026	-1.012	253.150	295.690	57641.887	462.154	541	594.237	96756	388.482	9447.898
	7014	-1.307	427.319	182.374	37024.000	414.442	587	366.064	148096	78.000	10934.613
	2036	-999.000	518.325	-9.000	62521.332	570.710	727	.568	-9	3068.000	30331.773
	2065	-999.000	510.792	-9.000	75634.000	570.371	222	16.107	-9	2990.002	9995.914
	5033	-999.000	288.547	-9.000	39049.055	454.359	268	325.000	92807	828.985	10047.813
	6021	-999.000	559.980	-9.000	57444.172	433.565	8757	76.562	134818	566.400	11337.004
	9010	-999.000	357.217	-9.000	72375.313	550.962	303	8.045	-9	839.800	10013.965
V	17	12	16	12	17	15	17	17	14	16	16
M	6202.94	1.23289	435.14093	161.24472	58962.365	704.78517	899.83	329.98150	118649.77	1436.7741	12064.765
S	3257.19	2.49648	222.86767	78.02930	11959.943	445.70671	2049.30	293.45001	45922.49	1136.0967	5592.5607
M	12	-1.307	220.117	28.091	37024.000	413.967	83	.568	42340	78.000	8813.605
M	9036	5.887	1164.362	295.690	77102.563	2089.698	8757	860.392	244816	4433.000	30331.773

CLUSTER 5

	ID	SUM1	RVH1OEXP	TPASIRVH	TVH1FVEH	TVH1FUEL	REV1OSUP	RVH1POF	TVH1MNT	RVH1ACC	REV1OEXP
	1008	4.205	402.026	291.155	30350.324	5012.844	344	647.083	107991	1143.643	10850.441
	5087	3.788	665.964	298.726	32786.000	4833.555	-9	3.950	109287	947.143	10000.027
	4007	2.624	666.732	218.435	35142.945	374.115	546	770.079	121472	2388.817	10042.148
	2	1.981	491.681	220.760	38735.805	428.940	587	809.598	88949	2065.556	12155.539
	2025	1.962	448.973	332.023	42855.848	352.325	2906	11.403	122776	2717.766	10832.387
	6002	1.631	598.932	337.144	44748.203	356.832	320	794.256	98882	968.111	10076.605
	4008	1.629	569.358	211.702	48412.464	496.538	649	931.621	99373	1122.483	10554.926
	1004	1.164	516.422	288.076	26560.602	420.314	207	1335.188	71812	1335.188	10828.980
	3015	.868	549.640	249.606	36780.637	398.045	713	673.249	98873	1724.368	10036.145
	3014	.138	430.165	81.605	27808.918	395.704	686	576.911	70681	3968.345	10000.004
	7012	-.147	459.045	255.155	26307.664	459.235	418	558.283	105231	1575.294	10527.637
	2002	-.517	511.843	251.990	33753.367	362.559	986	1043.900	71386	952.878	9534.594
	1055	-.667	477.542	117.326	34944.762	426.118	933	925.530	91707	1269.291	10008.223
	5059	-.746	385.955	346.606	29618.586	411.005	353	626.786	71931	946.400	11142.453
	1001	-1.322	387.785	305.439	39015.754	433.423	580	549.434	80470	520.620	10334.043
	7011	-1.582	484.010	209.644	30706.000	418.286	548	776.628	68236	834.557	10224.094
	3031	-2.081	340.715	341.463	27875.207	453.331	671	441.472	62719	1114.993	9892.125
	2067	-3.009	370.202	314.938	34248.500	374.053	1136	4.149	63228	755.461	10412.922
	5045	-3.249	371.961	235.993	30880.988	411.383	1128	24.457	76345	698.792	10928.898
	2041	-4.106	385.190	241.121	21903.027	281.864	15197	3.850	70863	499.200	11285.836
	9	-999.000	582.511	-9.000	37412.266	871.478	163	952.913	108968	1612.000	10078.953
	4005	-999.000	659.713	-9.000	27511.586	538.351	594	997.640	72531	2891.200	10000.000
	5001	-999.000	640.972	-9.000	33943.000	572.503	473	447.611	116376	1525.790	10222.063
	5044	-999.000	594.685	-9.000	37221.051	417.684	684	829.011	117867	715.249	10214.133
	6007	-999.000	507.824	-9.000	34154.543	372.797	569	300.119	105460	1020.925	10196.688
	6029	-999.000	449.449	-9.000	48932.000	395.339	414	65.045	62913	601.500	16464.633
V	26	20	26	20	26	26	25	26	26	26	26
M	3404.35	.12827	498.04988	257.44537	34408.056	779.63925	1272.18	580.77560	89858.57	1381.3680	10647.865
S	2142.04	2.29594	100.69098	70.68504	6756.2362	1224.7415	2948.11	379.56702	20304.15	831.12698	1307.6025
M	2	-4.106	340.715	81.605	21903.027	281.864	163	3.850	62719	499.200	9534.594
M	7012	4.205	666.732	346.606	48932.000	5012.844	15197	1335.188	122776	3968.345	16464.633

CLUSTER 6

ID	SUM1	RVH1OEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1OSUB	RVH1POP	TVH1ANT	RVH1ACC	REV1OEXP
3018	1.840	580.482	173.228	46384.000	590.215	548	708.746	132526	1338.581	10359.926
9008	1.506	450.455	529.304	40752.223	369.491	1225	32.266	145078	619.458	10797.969
8005	1.438	624.909	132.990	57899.109	519.991	374	482.248	130273	987.480	10504.918
3001	1.370	535.616	166.170	49782.242	490.683	628	1202.521	96189	1316.611	9383.770
6003	1.367	550.035	166.319	55734.000	491.213	267	371.638	51753	732.333	16027.563
5028	1.297	510.250	203.111	44590.000	504.432	97	793.100	-9	1331.871	11756.438
7015	1.234	-9.000	209.665	44484.762	417.074	439	466.107	157005	1304.815	-9.060
3010	1.141	441.061	271.745	40456.000	440.666	466	386.227	74919	3052.174	10071.418
7001	1.006	657.706	170.509	46421.141	510.026	505	827.564	118594	664.638	9871.840
6001	.280	727.562	85.600	44722.887	894.627	231	437.666	-9	1706.435	10009.883
3005	.241	374.107	250.850	52825.395	429.956	665	583.606	105651	1117.479	10040.309
5057	.078	515.284	180.757	49085.918	616.871	181	323.584	-9	637.867	12524.609
9023	-.116	439.272	262.509	47310.113	404.857	367	50.205	139623	739.464	10924.707
6012	-.767	588.867	153.261	34171.424	620.702	344	262.531	59800	1485.714	11903.891
6033	-.782	552.992	177.814	38178.832	505.044	453	547.058	89833	936.800	10234.691
9039	-.910	416.058	289.197	41882.285	422.776	699	5.367	97725	1545.656	9962.492
5039	-1.057	709.091	172.826	26664.855	1236.652	298	194.887	81154	668.744	10047.715
5074	-1.109	398.565	141.622	52208.000	643.491	206	1.990	104414	835.250	11689.609
5036	-1.233	342.298	197.362	45104.797	427.163	240	632.787	83527	1100.273	10078.309
5052	-1.296	406.748	204.969	42234.145	391.901	426	432.474	76960	1166.355	10696.371
9032	-1.484	358.017	189.495	40915.270	387.607	362	426.127	83584	1290.877	10652.570
5056	-1.798	469.586	151.750	41876.000	562.797	448	460.406	85956	681.293	10016.711
11	-1.806	479.442	116.640	38235.293	516.623	189	555.484	101563	788.667	9601.977
5082	-1.952	411.755	242.580	53101.215	395.552	-9	42.114	80673	616.070	10121.109
1056	-2.226	450.679	50.774	39371.426	430.578	652	337.483	107377	1177.358	10011.238
5068	-2.282	489.903	180.892	44187.000	429.892	451	6.606	-9	985.689	9620.730
4002	-3.648	403.260	50.488	29361.840	338.824	692	648.560	92490	514.800	10023.410
2017	-3.652	601.377	24.763	30943.465	251.022	1282	82.112	77359	617.760	11525.387
2042	-4.944	230.046	214.613	24232.000	295.711	4188	5.583	54313	830.092	11294.828
6024	-8.058	145.093	239.200	9648.887	92.380	1456	134.565	17368	384.927	10051.934
5	-999.000	514.253	-9.000	47985.598	775.663	428	39.228	257066	4415.270	4861.699
2050	-999.000	493.436	-9.000	39070.570	173.611	978	2.368	109398	3837.602	11083.164
4011	-999.000	527.033	-9.000	37353.332	428.462	527	365.101	149413	2628.000	9179.324
4015	-999.000	414.435	-9.000	40599.000	406.213	518	241.040	64958	1762.000	10460.688
4017	-999.000	467.861	-9.000	44964.539	368.135	538	739.886	92427	922.188	10011.887
4043	-999.000	529.388	-9.000	42106.578	405.788	763	365.470	68700	1035.428	10299.488
4044	-999.000	155.905	-9.000	8703.258	83.861	1254	132.074	18951	181.743	10271.637
8007	-999.000	621.360	-9.000	46360.363	1196.846	486	342.304	101993	841.905	10000.000
9027	-999.000	417.053	-9.000	60242.000	381.194	230	1071.239	90792	891.570	11712.762
9033	-999.000	444.206	-9.000	54746.066	426.419	366	948.027	105922	1290.370	10014.465
40	30	39	30	40	40	39	40	36	40	39
5077.55	-.87734	472.96016	186.70670	41872.396	481.92526	627.37	392.20873	97370.18	1212.0992	10452.637
2409.59	2.19961	126.56793	91.00018	10953.427	228.70124	667.04	312.08705	41872.70	863.17238	1481.5453
5	-8.058	145.093	24.763	8703.258	83.861	97	1.990	17368	161.743	4861.699
9039	1.840	727.562	529.304	60242.000	1236.652	4188	1202.521	257066	4415.270	16027.563

CLUSTER 7

ID	SUM1	RVH1OEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1OSUB	RVH1POP	TVH1ANT	RVH1ACC	REV1OEXP
2066	4.494	1224.656	75.874	90350.000	658.632	1963	38.855	-9	-9.000	10307.359
4027	4.241	-9.000	140.064	61261.199	596.965	687	527.394	147076	3072.284	10057.984
6017	2.442	-9.000	145.062	33563.633	403.409	373	969.527	61329	4496.957	9916.500
2029	-.960	461.714	485.906	31777.777	345.745	3369	5.775	65496	828.319	10970.289
9042	-.988	444.448	224.587	36230.000	445.884	311	9.309	100211	1690.000	10729.785
9012	-8.500	104.037	227.253	9166.625	92.791	274	153.367	20952	789.365	9796.328
2006	-999.000	245.161	-9.000	22186.664	168.357	217	1.312	26624	-9.000	9999.988
2046	-999.000	341.761	-9.000	30093.418	269.907	3359	23.990	44110	1345.343	10988.605
8	6	6	6	8	8	8	8	7	6	8
4036.63	.12152	470.29604	216.45773	39328.665	372.71127	1319.11	216.19122	69399.65	1953.7112	10345.792
3111.68	4.86233	392.72225	143.86256	25278.315	196.30481	1383.41	352.53079	50640.65	1561.7630	484.08462
2006	-8.500	104.037	75.874	9166.625	92.791	217	1.312	20952	789.365	9796.328
9042	4.494	1224.656	485.906	90350.000	658.632	3369	969.527	147076	4496.957	10988.605

CLUSTER 8

	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV1OBUF	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXF
9004	7.470	554.791	239.801	50642.855	396.995	254	436.888	241800	2748.571	13768.277
7	3.885	435.795	161.818	69149.563	848.799	17801	1625.105	103517	1339.077	9856.941
9020	2.686	464.893	33.516	52137.191	524.704	339	1167.229	153152	1241.607	12284.188
4036	1.979	670.935	266.334	42412.500	403.789	775	697.332	61691	2360.348	10196.441
5006	1.955	709.325	196.272	49952.188	451.976	450	711.297	121976	1084.572	9937.051
4006	1.919	712.848	175.723	46908.332	388.988	539	793.824	62544	2408.422	10000.060
4024	1.676	763.732	125.379	54134.969	435.901	1000	553.860	82379	1699.177	10635.320
9035	1.612	410.758	61.174	52756.363	510.234	395	306.066	283083	756.364	10097.141
3008	1.605	617.149	218.110	58817.473	419.285	598	1145.082	79824	571.268	10136.938
4025	1.555	654.649	273.255	47420.098	537.032	1876	917.406	70252	1088.609	10019.543
3026	1.429	556.163	175.389	59431.270	-9.000	345	690.857	93392	1280.118	10181.848
2060	1.370	514.657	222.560	57791.371	411.379	461	1022.936	69187	1395.204	9864.070
3024	1.315	465.378	91.663	37050.000	388.277	618	897.982	93797	3208.511	10027.707
3007	1.250	648.261	157.300	48019.309	455.137	545	666.679	92837	1657.397	10223.504
6016	1.238	705.758	253.927	44000.000	341.890	418	394.637	71500	612.213	13765.066
3009	1.067	885.391	263.879	38402.000	715.454	5392	275.460	76804	989.857	10214.031
4029	1.009	506.716	185.981	63182.793	487.635	290	612.685	96645	1171.539	10000.000
4012	.951	592.757	175.839	45562.398	404.384	447	930.873	107206	1016.800	10000.000
3012	.938	591.798	172.508	45340.000	677.346	569	880.494	62044	1597.283	10758.832
9005	.860	495.914	110.920	54998.664	605.479	197	364.673	109997	1898.000	10433.379
4023	.821	482.805	329.348	46876.762	374.359	369	521.560	72919	1765.636	9993.273
9041	.686	440.748	357.411	53430.000	437.293	416	10.959	97145	1760.000	9862.043
3025	.484	500.952	372.455	43834.266	374.497	587	502.417	67093	1332.416	10213.086
3020	-.021	-9.000	298.561	46202.000	454.789	620	-9.000	61603	-9.000	10527.027
5036	-.211	-9.000	278.870	41616.000	-9.000	226	564.564	77287	936.000	9.000
4038	-.381	649.719	46.863	59512.266	396.013	742	367.017	93967	1072.842	10145.715
3002	-.612	532.637	152.753	38517.578	576.585	451	381.972	66527	2133.734	9912.129
1016	-.629	487.667	243.662	33565.633	469.146	549	1087.814	59072	456.535	11048.441
7009	-1.708	479.352	240.190	40352.777	493.613	245	253.045	41749	863.343	11729.574
5058	-2.112	404.208	204.652	35083.750	443.124	291	421.886	76373	1047.518	10139.098
5061	-2.317	435.451	192.561	40112.000	341.997	286	418.846	63592	759.200	10611.422
6019	-4.088	492.436	104.517	48034.793	508.730	396	696.303	108078	828.464	2526.267
2044	-4.099	358.570	173.995	30173.684	308.655	4104	11.230	69702	401.766	11859.930
3027	-8.098	127.995	278.339	7916.000	69.187	304	73.920	10832	535.294	10016.289
1014	-999.000	448.080	-9.000	42388.355	634.967	411	742.959	78862	1403.206	10587.480
2010	-999.000	467.664	-9.000	50648.000	446.631	182	129.178	-9	1473.333	9983.316
2048	-999.000	391.461	-9.000	43272.125	436.900	841	799.307	65938	1673.750	10219.984
4009	-999.000	49.281	-9.000	2816.667	38.978	410	25.457	3900	89.304	2944.296
4030	-999.000	448.503	-9.000	34321.676	331.775	427	927.808	88664	462.762	9999.727
5002	-999.000	737.061	-9.000	63317.645	531.963	516	591.673	153771	1697.511	10377.348
5021	-999.000	402.548	-9.000	46670.000	544.162	655	144.154	62227	1369.333	10168.547
5035	-999.000	569.903	-9.000	37588.570	452.951	212	702.643	110555	763.286	11662.289
5053	-999.000	880.170	-9.000	46866.855	831.984	340	616.997	82017	1848.889	10000.000
5060	-999.000	477.557	-9.000	47775.762	440.745	374	1203.979	120324	1015.967	11877.246
5086	-999.000	112.900	-9.000	10003.332	96.433	573	11.485	17733	312.210	10039.078
6009	-999.000	160.801	-9.000	9889.750	138.771	1378	239.269	9890	230.082	10134.512
6010	-999.000	823.043	-9.000	40612.000	3959.622	287	535.465	127218	1747.652	10494.324
6022	-999.000	623.373	-9.000	38290.906	388.573	919	437.740	68303	1560.000	10071.406
6037	-999.000	230.647	-9.000	12604.797	196.263	329	67.560	-9	308.286	10080.164
6038	-999.000	919.842	-9.000	37665.332	326.050	482	585.251	112996	-9.000	10000.000
7003	-999.000	523.535	-9.000	60493.332	1110.853	123	692.105	41880	1555.186	10658.918
9028	-999.000	556.398	-9.000	46879.730	518.700	222	17.948	119186	3574.135	10060.523
52	34	50	34	52	50	52	51	50	50	51
4640.37	.45539	523.48752	201.04490	43374.282	521.57980	991.65	566.15437	87260.68	1302.0513	10193.995
2192.83	2.58487	187.51800	83.44689	14178.337	529.77562	2536.87	361.11643	48421.01	733.93341	1755.8281
2	-8.098	49.281	33.516	2816.667	38.978	123	10.959	3900	89.304	2526.267
9041	7.470	919.842	372.455	69149.563	3959.622	17801	1625.105	283083	3574.135	13768.277
198	142	188	142	198	194	195	196	185	193	191
4595.93	-.10591	456.97505	234.74936	40529.740	518.28278	972.45	553.08100	86985.82	1193.2333	10533.582
2440.58	2.49162	176.23920	119.76479	13850.848	559.36722	2013.67	435.55402	40219.16	816.64746	2110.8252
1	-8.500	17.217	24.763	1797.193	27.145	83	.568	3659	66.641	2526.267
9042	7.470	1224.656	658.860	90350.000	5012.844	17801	2707.529	283083	4496.557	30331.773

CLUSTER 9	ID	SUM1	RVHIDEXP	TPAS1RVH	TVM1PVEH	TVM1FUEL	REVIDSUB	RVH1POP	TVM1MNT	RVH1ACC	REVIDEXP
	8004	3.542	566.520	148.530	97695.000	837.685	155	460.000	-9	1748.843	9480.520
	2040	1.617	412.516	67.139	59847.270	1032.354	8748	12.366	156743	1462.832	12161.270
	5066	1.082	186.907	653.606	43625.594	329.787	1142	1005.990	62602	676.156	9794.801
	5084	-.431	392.777	89.520	52459.332	569.643	159	8.434	139892	1231.043	11470.746
	9021	-.564	233.467	427.075	51477.277	406.429	749	639.472	74940	394.387	10206.281
	4021	-1.085	166.315	177.983	47869.711	4028.469	-9	86.313	67018	347.579	8416.863
	9016	-4.116	147.484	137.127	37755.016	500.015	1900	111.138	103896	628.727	10436.777
	2068	-999.000	93.263	-9.000	31650.813	348.170	2174	786.088	32452	1415.556	2236.234
	2015	-999.000	598.108	-9.000	45851.000	745.030	322	72.657	73362	1872.000	8746.633
	2058	-999.000	311.413	-9.000	88060.813	498.137	4570	11.669	121646	2456.156	9776.766
	9043	-999.000	274.976	-9.000	108056.00	1185.891	-9	1.961	108056	2047.500	8237.332
	11	7	11	7	11	11	9	11	10	11	11
	5216.00	.00638	307.61332	242.99717	60395.257	952.87365	2213.23	291.28060	94060.51	1298.2527	9180.3856
	3056.18	2.41354	168.04077	216.53538	25611.481	1057.7146	2821.19	367.43078	38577.06	709.62766	2597.1210
m	2008	-4.116	93.263	67.139	31650.813	329.787	155	1.961	32452	347.579	2236.234
m	9043	3.542	598.108	653.606	108056.00	4028.469	8748	1005.990	156743	2456.156	12161.270
	11	7	11	7	11	11	9	11	10	11	11
	5216.00	.00638	307.61332	242.99717	60395.257	952.87365	2213.23	291.28060	94060.51	1298.2527	9180.3856
	3056.18	2.41354	168.04077	216.53538	25611.481	1057.7146	2821.19	367.43078	38577.06	709.62766	2597.1210
	2008	-4.116	93.263	67.139	31650.813	329.787	155	1.961	32452	347.579	2236.234
	9043	3.542	598.108	653.606	108056.00	4028.469	8748	1005.990	156743	2456.156	12161.270

CLUSTER 8	ID	SUM1	RVHIDEXP	TPAS1RVH	TVM1PVEH	TVM1FUEL	REVIDSUB	RVH1POP	TVM1MNT	RVH1ACC	REVIDEXP
	2052	13.638	1240.152	73.559	140221.69	1223.103	790	4.376	245308	4433.000	10000.121
	4022	3.064	370.743	280.715	40669.918	346.731	279	1698.190	52290	2105.286	12299.199
	5022	1.325	628.547	59.589	34261.270	475.483	238	945.359	129431	962.706	12557.160
	5009	-.299	-9.000	211.972	23075.000	486.429	583	1199.711	75347	-9.000	10392.461
	2034	-.624	-9.000	324.740	26302.910	345.563	1876	-9.000	85464	-9.000	10553.129
	6015	-5.811	56.792	104.899	46800.000	516.712	1212	54.685	68640	140.833	10409.809
	3	-999.000	426.065	236.311	-9.000	534.867	410	726.546	94206	1150.438	10178.031
	4	-999.000	508.782	108.985	-9.000	448.276	101	42.360	141267	2329.600	7607.719
	6	-999.000	-9.000	-9.000	-9.000	-9.000	171	-9.000	-9	-9.000	12483.039
	10	-999.000	-9.000	-9.000	-9.000	-9.000	870	-9.000	-9	-9.000	9552.551
	1002	-999.000	-9.000	-9.000	-9.000	-9.000	653	-9.000	-9	-9.000	10282.238
	1004	-999.000	359.912	248.525	-9.000	445.214	285	804.224	50978	950.032	10714.102
	1005	-999.000	267.934	336.893	-9.000	4351.316	219	258.675	108333	1350.514	10995.313
	1007	-999.000	-9.000	-9.000	-9.000	-9.000	511	-9.000	-9	-9.000	10691.452
	1013	-999.000	577.863	-9.000	-9.000	538.980	312	193.170	79216	1289.600	10940.926
	1015	-999.000	-9.000	-9.000	-9.000	-9.000	1051	-9.000	-9	-9.000	10294.008
	1042	-999.000	-9.000	-9.000	-9.000	-9.000	259	-9.000	-9	-9.000	10549.441
	1043	-999.000	-9.000	-9.000	-9.000	-9.000	873	-9.000	-9	-9.000	10570.570
	1062	-999.000	-9.000	-9.000	-9.000	-9.000	189	-9.000	-9	-9.000	10015.203
	2001	-999.000	-9.000	-9.000	-9.000	-9.000	507	-9.000	-9	-9.000	9875.840
	2003	-999.000	-9.000	-9.000	-9.000	-9.000	811	-9.000	-9	-9.000	10090.879
	2009	-999.000	572.662	332.208	-9.000	865.280	710	188.448	-9	3224.002	10491.723
	2012	-999.000	-9.000	-9.000	-9.000	-9.000	4244	-9.000	-9	-9.000	10993.234
	2016	-999.000	-9.000	51.256	-9.000	326.343	-9	42.715	79001	1147.714	10000.000
	2019	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2020	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2021	-999.000	575.242	263.015	-9.000	498.898	743	406.243	63748	1382.415	10000.941
	2022	-999.000	-9.000	-9.000	-9.000	-9.000	885	-9.000	-9	-9.000	-9.000
	2024	-999.000	-9.000	-9.000	-9.000	-9.000	358	-9.000	-9	-9.000	11441.148
	2026	-999.000	496.172	-9.000	-9.000	495.764	779	.279	-9	-9.000	9913.793
	2027	-999.000	-9.000	-9.000	-9.000	-9.000	192	-9.000	-9	-9.000	1623.42[illegible]
	2031	-999.000	523.495	-9.000	-9.000	-9.000	473	.456	143312	-9.000	11404.301
	2032	-999.000	-9.000	-9.000	-9.000	-9.000	32363328	-9.000	-9	-9.000	13335.070
	2033	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2035	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2037	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2045	-999.000	-9.000	-9.000	25257.141	327.316	1967	-9.000	49111	-9.000	11273.117

CLUSTER	ID	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV10SUB	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXP
	2047	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2049	-999.000	589.386	100.577	-9.000	555.868	678	1.851	81380	1428.762	10769.047
	2051	-999.000	528.355	-9.000	-9.000	497.320	372	2.483	92170	2236.000	10071.371
	2055	-999.000	-9.000	-9.000	42408.887	424.037	1278	-9.000	95420	-9.000	10246.203
	2056	-999.000	-9.000	-9.000	-9.000	-9.000	2755	-9.000	-9	-9.000	9942.699
	2061	-999.000	-9.000	-9.000	-9.000	-9.000	566	-9.000	-9	-9.000	10208.906
	2063	-999.000	-9.000	-9.000	-9.000	-9.000	458	-9.000	-9	-9.000	10675.730
	2064	-999.000	461.510	137.454	-9.000	-9.000	741	.985	42553	1596.400	9974.590
	2069	-999.000	-9.000	-9.000	-9.000	-9.000	259	-9.000	-9	-9.000	10238.988
	2070	-999.000	-9.000	-9.000	-9.000	-9.000	338	-9.000	-9	-9.000	10315.793
	2071	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	2074	-999.000	455.973	320.661	-9.000	410.720	4492	3.529	98057	1217.021	10365.246
	3003	-999.000	596.741	115.150	-9.000	1019.001	671	250.361	85627	1162.572	10000.035
	3016	-999.000	-9.000	41.667	-9.000	-9.000	263	14.002	-9	-9.000	11313.375
	3017	-999.000	1233.283	384.615	-9.000	-9.000	115	8.401	-9	-9.000	11502.734
	3021	-999.000	-9.000	-9.000	-9.000	-9.000	1109	-9.000	-9	-9.000	10105.238
	3028	-999.000	-9.000	-9.000	-9.000	-9.000	523	-9.000	-9	-9.000	9391.961
	4010	-999.000	-9.000	-9.000	-9.000	-9.000	386	-9.000	-9	-9.000	10037.246
	4014	-999.000	521.122	-9.000	-9.000	504.094	1914	176.198	82400	1938.182	8740.141
	4026	-999.000	732.447	-9.000	-9.000	1072.049	653	184.629	98592	2574.000	5177.395
	4032	-999.000	723.469	140.343	-9.000	744.123	488	767.521	110783	1281.159	10103.484
	4035	-999.000	-9.000	-9.000	-9.000	-9.000	954	-9.000	-9	-9.000	10049.863
	4039	-999.000	565.287	-9.000	-9.000	354.146	704	398.434	83571	1060.688	10882.406
	5004	-999.000	-9.000	-9.000	-9.000	-9.000	354	-9.000	-9	-9.000	10003.348
	5010	-999.000	101.749	-9.000	-9.000	89.027	571	92.068	28615	128.133	10076.297
	5013	-999.000	-9.000	-9.000	-9.000	-9.000	207	-9.000	-9	-9.000	10000.000
	5018	-999.000	-9.000	-9.000	-9.000	-9.000	300	-9.000	-9	-9.000	10518.270
	5019	-999.000	743.024	-9.000	-9.000	2700.421	365	32.749	282620	1497.600	10413.094
	5020	-999.000	-9.000	-9.000	-9.000	-9.000	272	-9.000	-9	-9.000	10438.648
	5023	-999.000	-9.000	-9.000	-9.000	-9.000	486	-9.000	-9	-9.000	9555.914
	5026	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	5034	-999.000	455.554	169.894	-9.000	554.942	254	412.971	94043	1118.896	10209.469
	5037	-999.000	-9.000	-9.000	-9.000	-9.000	152	-9.000	-9	-9.000	10707.242
	5041	-999.000	509.120	-9.000	-9.000	-9.000	176	475.515	60783	913.714	7786.914
	5043	-999.000	820.052	171.806	-9.000	-9.000	877	427.019	121109	2028.001	10162.918
	5047	-999.000	674.901	103.199	-9.000	912.610	354	855.776	131656	1079.709	10040.695
	5050	-999.000	-9.000	-9.000	-9.000	-9.000	1475	-9.000	-9	-9.000	10474.223
	5051	-999.000	-9.000	-9.000	-9.000	-9.000	327	-9.000	-9	-9.000	10683.055
	5063	-999.000	586.308	217.450	-9.000	4919.363	339	267.906	154960	-9.000	10019.910
	5065	-999.000	553.225	-9.000	-9.000	1665.680	146	25.895	49504	-9.000	11583.473

CLUSTER	ID	SUM1	RVH1DEXP	TPAS1RVH	TVH1PVEH	TVH1FUEL	REV10SUB	RVH1POP	TVH1MNT	RVH1ACC	REV1DEXP
	5073	-999.000	-9.000	-9.000	-9.000	-9.000	101497	-9.000	-9	-9.000	9936.117
	5075	-999.000	-9.000	-9.000	-9.000	-9.000	181	-9.000	-9	-9.000	9986.340
	5077	-999.000	-9.000	-9.000	-9.000	-9.000	387	-9.000	-9	-9.000	10512.945
	5090	-999.000	657.789	81.915	-9.000	868.576	130	314.952	33800	2221.819	10484.355
	5091	-999.000	-9.000	-9.000	-9.000	-9.000	857	-9.000	-9	-9.000	10084.305
	6005	-999.000	409.981	28.986	-9.000	483.234	58045	102.665	163091	1527.067	10457.922
	6011	-999.000	-9.000	-9.000	-9.000	-9.000	-9	-9.000	-9	-9.000	-9.000
	6014	-999.000	99.083	-9.000	-9.000	-9.000	739	36.559	7126	384.800	10358.531
	6018	-999.000	-9.000	-9.000	-9.000	-9.000	310	-9.000	-9	-9.000	10045.660
	6023	-999.000	1003.815	237.433	-9.000	-9.000	326	347.609	-9	3835.001	12136.023
	6026	-999.000	738.129	-9.000	-9.000	1254.491	491	549.471	65686	2163.653	10000.000
	6030	-999.000	-9.000	-9.000	-9.000	-9.000	700	-9.000	-9	-9.000	12975.246
	6035	-999.000	679.366	-9.000	-9.000	1063.794	1118	203.600	102626	2837.715	7548.445
	7007	-999.000	243.016	599.113	-9.000	-9.000	30	13.287	35152	884.000	23181.402
	7008	-999.000	-9.000	-9.000	-9.000	-9.000	548	-9.000	-9	-9.000	10193.598
	7013	-999.000	-9.000	-9.000	31200.000	692.072	341	-9.000	104000	9.000	10101.469
	8001	-999.000	458.921	128.773	-9.000	-9.000	98	1556.283	-9	1209.063	12596.426
	8002	-999.000	812.991	-9.000	-9.000	-9.000	547	302.398	-9	1748.000	10076.668
	8003	-999.000	571.938	-9.000	-9.000	-9.000	416	212.894	-9	1645.091	6597.168
	9003	-999.000	-9.000	-9.000	-9.000	-9.000	2627	-9.000	9	9.000	9726.219
	9006	-999.000	589.251	311.927	-9.000	502.638	318	2326.527	9	1191.467	13852.262
	9007	999.000	-9.000	9.000	-9.000	-9.000	230	-9.000	9	-9.000	10000.000
	901[illegible]	999.000	541.550	193.876	-9.000	970.254	155	446.507	9	3044.364	11407.113
	902[illegible]	999.000	-9.000	9.000	-9.000	1771.089	115	9.000	136500	9.000	10320.234
	9029	999.000	-9.000	-9.000	-9.000	9.000	-9	-9.000	9	9.000	-9.000
	102	6	43	31	9	39	91	46	41	39	91
	3843.18	1.88233	563.99309	197.33866	45577.424	930.41149	358049.05	377.74963	95306.24	1651.7748	10407.852
	2350.42	6.48264	241.28855	125.45652	36432.644	1000.8498	3392365.0	497.87483	52783.13	919.57172	2033.8130
	3	-5.811	56.792	28.986	23075.000	89.027	30	.279	7126	128.133	1623.422
	9029	13.638	1240.152	599.113	140221.69	4919.363	32363328	2326.527	282620	4433.000	23181.402

102	6	43	31	9	39	91	46	41	39	91
3843.18	1.88233	563.99309	197.33866	45577.424	930.41149	358049.05	377.74963	95306.24	1651.7748	10407.852
2350.42	6.48264	241.28855	125.45652	36432.644	1000.8498	3392365.0	497.87483	52783.13	919.57172	2033.8130
3	-5.811	56.792	28.986	23075.000	89.027	30	.279	7126	128.133	1623.422
9029	13.638	1240.152	599.113	140221.69	4919.363	32363328	2326.527	282620	4433.000	23181.402

PART 2

TRAC STUDY CLUSTER ANALYSIS OF SECTION 15 DATA (1979-80)

Cluster Analysis of Section 15

CLUSTER ANALYSIS OF SEC15 TPMS BASED ON LINE MILES(N=320,V=10)
WARDS METHOD GROUP 304 FUSE POINTS 218 256 AT COEF 2.448 16 CLUSTERS

CLASSIFICATION ARRAY

1	1	2	3	4	5	2	2	2	4	3	3	5	2	1	1	2	2	2	2	5	7	3	2	5	5	3	2	7	5
5	5	2	5	5	4	5	0	2	2	3	1	2	2	7	8	5	9	7	4	5	5	6	7	5	2	1	5	6	10
6	11	11	12	13	1	13	11	14	14	12	8	14	8	4	1	2	12	8	14	4	4	14	1	2	4	5	10	5	3
3	5	4	6	2	2	2	2	4	10	4	6	7	5	2	5	6	5	5	1	7	7	2	3	4	13	1	5	6	2
2	2	6	2	2	2	1	3	2	3	5	4	2	3	2	2	5	7	9	2	2	2	2	4	5	2	2	3	4	2
2	3	3	7	7	3	5	3	7	3	5	2	3	4	5	4	2	6	2	5	4	1	3	1	5	1	5	3	4	5
4	5	3	2	6	2	10	2	1	4	2	2	3	4	5	3	4	2	2	3	4	5	2	2	2	5	5	5	2	2
3	7	1	2	2	12	4	15	2	3	3	2	2	3	5	14	4	2	5	0	4	1	1	5	2	1	5	4	16	2
2	7	2	4	3	2	5	1	5	2	7	3	2	5	3	15	3	2	4	3	2	5	5	2	1	1	3	2	2	2
2	4	5	2	5	5	1	4	5	3	3	2	2	2	6	5	7	3	2	2	5	2	4	2	1	6	15	3	2	7
2	10	13	5	1	5	1	1	2	2	5	2	2	5	2	2	5	6	2	5										

CLUSTER 1 NUMBER OF CASES = 28

CASE NUMBERS -
1 2 15 36 42 57 66 76 84 110 117 127 172 174 176 189 213 232 233 236 248 265 266 277 295 305 307 308

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0008	-.0461	43.7464	74.0431	7	.0010	-.0460	1.2957	2.3805
6	.0012	-.0457	18.1243	37.4472	10	.0080	-.1655	11772.3629	34903.1000
1	.0726	.2921	46451.4318	19782.2933	3	.1243	.5213	35.4643	6.4425
2	.1306	.5350	2.6996	.5576	9	.1725	.5225	1323.5204	479.2495
4	.1835	.5924	84684.2204	19409.3606	8	.3392	.8627	17281.9089	5774.3989

(cont.)

CLUSTER 2 NUMBER OF CASES = 94

CASE NUMBERS
2 7 8 9 14 17 18 19 20 24 33 39 40 43 44 56 77 85 95 96 97 98 105 113 120 121 122 124 125 126
129 133 135 136 140 141 142 143 146 147 150 151 162 157 159 184 186 188 191 192 198 199 203 204 205 209 210 214 215 219
222 223 228 235 240 241 243 246 250 253 258 261 264 258 269 270 271 274 282 283 284 289 290 292 294 299 301 309 310 312
313 315 316 319

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0000	-.0553	18.6980	13.5052	6	.0000	-.0547	3.5494	6.5915
7	.0000	-.0545	.6504	.4757	10	.0018	-.2347	2510.4623	5708.7642
1	.0076	-.1260	15760.4871	6398.5358	9	.0386	-.1441	554.3477	226.7533
4	.0736	.2087	67301.9170	12294.0623	3	.0744	.2715	29.0713	4.9835
2	.0796	.2279	2.2259	.4353	8	.0854	-.1493	7243.0395	2896.7738

CLUSTER 3 NUMBER OF CASES = 39

CASE NUMBERS
4 11 12 23 27 41 90 91 114 128 130 134 148 152 153 156 158 160 163 173 178 183 193 196 200 211 220 221 224 245
252 255 257 260 267 280 281 288 298

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0000	-.0590	3.7897	9.9873	7	.0000	-.0571	.4579	.4001
6	.0000	-.0571	5.9413	6.8738	1	.0023	-.2369	7620.8372	3536.0410
8	.0392	-.3674	5086.5236	1963.3620	9	.0399	-.2668	412.7457	230.5525
10	.0430	-.1703	11130.7356	27748.8450	4	.0447	-.2822	45061.9769	9583.2619
3	.0521	-.2531	19.4849	4.1717	2	.0955	-.2015	1.5033	.4707

(cont.)

CLUSTER 4 NUMBER OF CASES = 33

CASE NUMBERS
9 10 36 50 75 81 82 86 93 99 101 115 132 144 149 164 166 171 179 181 190 194 197 201 217 227 231 238 244 259
272 278 293

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0000	-.0600	6.0345	9.9495	6	.0000	-.0579	5.1324	4.7645
7	.0000	-.0580	.3882	.3937	10	.0094	-.2092	5915.7794	12970.6480
1	.0141	-.2571	6135.5400	8704.9929	2	.0348	-.7285	.7203	.2878
3	.0603	-.7653	10.1236	4.4882	9	.0825	-.2879	388.3667	331.5318
4	.1316	-.6887	26643.6706	16437.3625	8	.1750	-.3133	5622.4036	4147.9995

CLUSTER 10 NUMBER OF CASES = 60

CASE NUMBERS
4 21 25 26 28 30 31 32 34 35 37 47 51 52 55 58 87 89 92 104 105 108 109 118 131 137 145 157 161 165
170 175 177 180 182 195 202 206 207 208 225 229 234 237 247 249 254 262 263 273 275 276 279 286 304 306 311 314 317 320

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0000	-.0621	.3225	1.2590	6	.0000	-.0607	2.0743	3.7684
7	.0000	-.0610	.1560	.2971	1	.0005	-.3338	511.0167	1562.5857
2	.0007	-1.2112	.0055	.0422	3	.0010	-1.3151	.0745	.5722
10	.0295	-.1943	7915.0055	22970.2945	4	.0366	-1.2147	2812.7668	8672.5341
9	.0634	-.4418	210.7503	290.4851	6	.1827	-.5863	2915.0932	4237.8261

(cont.)

USTER 6 NUMBER OF CASES = 18

SE NUMBERS
3 38 53 59 61 94 102 107 119 123 139 168 185 230 285 291 296 318

USTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
7	.0001	-.0317	.0622	.5750	6	.0001	-.0522	11.1517	9.4920
5	.0002	-.0451	46.4278	40.3596	1	.0717	.3386	64547.1817	19653.9786
9	.0718	.4410	1229.5072	309.2529	10	.0994	-.0934	21423.0517	42187.6303
8	.1337	.0649	15320.4989	3625.2503	3	.1011	1.2529	52.4900	7.3347
4	.2047	1.4367	122938.3656	20499.0529	2	.2195	1.0187	4.2172	.7228

CLUSTER 7 NUMBER OF CASES = 17

CASE NUMBERS
22 29 45 49 54 103 111 112 138 154 155 159 212 242 251 287 300

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	.0000	-.0559	7.2035	3.1042	7	.0000	-.0556	.5712	.2532
5	.0000	-.0539	22.5606	9.2310	10	.0000	-.2474	802.5071	493.4891
1	.0118	-.1065	17191.3688	7957.9732	9	.0296	-.2490	433.2106	198.6068
8	.0507	-.3383	5375.0082	2232.8517	3	.1545	.4670	41.7824	7.1426
2	.2060	.9364	3.3188	.7003	4	.2149	.9194	99503.3647	21002.0111

(cont.)

CLUSTER 6 NUMBER OF CASES = 4

CASE NUMBERS
46 72 74 79

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
7	0.0000	-.0631	.0000	0.0000	5	.0000	-.0623	.0150	.0150
6	.0000	-.0627	.0125	.0109	1	.0242	-.1171	16415.5872	17087.2958
9	.1130	.6081	1422.3700	387.8613	2	.2844	-.9069	.4750	.8227
4	.4426	-.6965	26287.6575	30141.3625	3	.7544	-.2440	14.1672	12.8737
10	.9444	7.5564	1045214.9500	133461.2559	8	1.0941	.5289	13972.0275	10370.4478

CLUSTER 9 NUMBER OF CASES = 1

CASE NUMBERS
46

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	0.0000	-.0563	6.7700	0.0000	6	0.0000	10.1700	109553.4400	0.0000
10	0.0000	-.1325	16190.6500	0.0000	2	0.0000	5.6039	15.5200	0.0000
7	0.0000	-.0494	1.0400	0.0000	3	0.0000	2.4157	63.2600	0.0000
9	0.0000	14.0052	16883.1200	0.0000	4	0.0000	4.3090	253075.0300	0.0000
1	0.0000	15.3573	1152363.6400	0.0000	5	0.0000	-.0359	71.1700	0.0000

(cont.)

CLUSTER 10 NUMBER OF CASES = 5

CASE NUMBERS
60 88 100 187 302

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
7	.0000	-.0561	.2250	.4870	6	.0001	-.0546	1.6360	7.7333
5	.0002	-.0477	39.2100	34.6953	1	.0280	.1549	36383.9500	12273.4323
9	.0518	-.1583	537.9300	262.7316	4	.0646	2.5035	171277.1600	13174.8746
8	.0985	-.0466	8266.2200	3111.3130	2	.2255	1.7590	4.5800	.7327
3	.5181	2.6653	73.1800	13.1556	10	.5699	.3496	80703.0480	101034.0519

CLUSTER 11 NUMBER OF CASES = 3

CASE NUMBERS
62 63 68

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	.0000	-.0625	.1867	.0419	5	.0000	-.0622	.0900	.1273
7	.0000	-.0629	.0167	.0047	4	.0947	-1.0592	9855.8900	13939.7475
1	.1334	-.0825	18955.5567	26807.2053	2	.1390	-.7512	.4067	.5751
3	.2211	-.9867	6.0767	8.5937	10	.3995	1.2188	237189.4800	84295.3278
9	.5663	2.6432	4001.7500	858.4571	8	.6056	3.2547	40997.1400	7715.4189

(cont.)

USTER 12 NUMBER OF CASES = 4

SE NUMBERS
4 64 71 78 216

USTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
7	0.0000	-.0631	.0000	0.0000	5	.0000	-.0622	.0400	.0339
6	.0000	-.0627	.0275	.0179	1	.0557	-.0684	19987.7025	17322.2525
3	.1055	-.4763	15.4050	5.9356	2	.1143	-.3057	1.4025	.5215
4	.2127	-.3238	43176.6425	20893.2260	10	.2206	3.1964	451709.5050	62885.1596
9	.3115	.3011	1068.1025	644.0754	8	.7563	.3767	12463.9350	8533.3665

STER 13 NUMBER OF CASES = 4

E NUMBERS
65 67 116 303

STER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	.0001	-.0545	6.7375	9.1487	7	.0001	-.0540	.5875	.7412
5	.0002	-.0498	33.7575	34.9767	3	.0266	1.5057	51.6275	3.0894
4	.2225	1.1691	110012.7325	21371.5199	8	.3006	3.1373	39832.9650	5437.5016
2	.3202	1.7894	4.0350	.8733	1	.3743	2.1709	184373.5200	44913.0036
10	.3939	.3906	86191.3425	83990.5437	9	.5453	2.4753	3577.2025	852.1594

(cont.)

TER 14 NUMBER OF CASES = 6

CASE NUMBERS
69 70 73 80 83 226

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
7	.0000	-.0631	.0000	.0000	6	.0000	-.0627	.0250	.0150
5	.0000	-.0622	.0817	.0534	1	.0135	-.1270	12687.1433	8214.7790
9	.0228	-.1705	523.8150	174.2336	8	.0910	-.3267	5487.8017	2991.5761
4	.1173	.2031	69765.1267	15519.1746	3	.2289	.2521	23.7167	8.7443
10	.2800	1.3287	211750.3150	70817.0356	2	.3234	-.1745	1.6050	.8774

CLUSTER 15 NUMBER OF CASES = 3

CASE NUMBERS
218 256 297

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	.0000	-.0526	10.7633	3.9808	7	.0000	-.0500	.9933	.3445
5	.0001	-.0325	80.3000	21.5142	10	.0001	-.2265	3603.4367	1158.2841
3	.1936	3.2551	83.6000	8.0413	2	.0201	3.0906	7.8767	1.2149
4	.6603	4.1061	243881.5567	36816.2315	9	.7154	2.2036	3263.5133	976.1164
1	1.1437	3.3491	270865.5933	78506.0344	8	2.0447	2.7451	33291.5233	14176.0288

(cont.)

CLUSTER 16 NUMBER OF CASES = 1

CASE NUMBERS
239

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
6	0.0000	17.6592	19084.6700	0.0000	8	0.0000	1.3605	22217.5500	0.0000
10	0.0000	-.2534	1.1600	0.0000	2	0.0000	.4316	2.5400	0.0000
7	0.0000	17.6594	1361.0800	0.0000	3	0.0000	.6271	35.5700	0.0000
9	0.0000	.7486	1584.5100	0.0000	4	0.0000	.7726	92851.6100	0.0000
1	0.0000	.4270	56354.2200	0.0000	5	0.0000	17.8594	48407.7600	0.0000

X X X X X

PART 3

TRAC STUDY CLUSTER ANALYSIS OF 1980 SMALL CITY/RURAL AREA DATA

Small City/ Rural Clusters

CLUSTER ANALYSIS OF U.S. SMALL SYST TPMS(1980)N=31,V=13
WARDS METHOD GROUP 27 FUSE POINTS 6 30 AT COEF 5.995 4 CLUSTERS

CLASSIFICATION ARRAY

1 2 1 1 3 4 4 4 4 4 4 4 4 4 4 1 1 1 1 4 4 1 1 1 1 4 1 4 4 4
4

CLUSTER 1 NUMBER OF CASES = 12

CASE NUMBERS
1 3 4 16 17 18 19 22 23 24 25 27

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
5	.0431	-.7277	.9717	.2028	8	.0477	-.2924	.2314	.1096
7	.0578	-.6826	.6808	.1908	10	.0960	-.0218	.2783	.0788
6	.2272	.4527	19.9300	4.4427	3	.2424	1.1112	22.0758	4.4091
12	.3370	.0621	9.3400	4.1429	4	.3640	.8581	1.8200	.4212
13	.4242	.1723	2.9750	1.6960	11	.4377	.1437	13.1583	6.2941
1	.4767	-.3060	.2675	.1308	9	.4791	.3607	1.6858	.3770
2	.7022	.3789	15.5250	10.2914					

CLUSTER 2 NUMBER OF CASES = 1

CASE NUMBERS
2

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
12	0.0000	-.8403	2.9000	0.0000	8	0.0000	3.6091	2.1700	0.0000
10	0.0000	-.4476	.1700	0.0000	2	0.0000	-.8039	1.0000	0.0000
1	0.0000	-.1873	.2900	0.0000	3	0.0000	-.3901	8.6300	0.0000
9	0.0000	3.3795	3.3300	0.0000	4	0.0000	-.8466	.6300	0.0000
11	0.0000	-.9104	3.1300	0.0000	5	0.0000	3.6126	5.2100	0.0000
13	0.0000	4.0413	13.0500	0.0000	6	0.0000	3.1384	44.9600	0.0000
7	0.0000	2.1279	2.9100	0.0000					

CLUSTER 3 NUMBER OF CASES = 1

CASE NUMBERS
5

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
12	0.0000	3.6870	35.2100	0.0000	8	0.0000	-.7134	.0000	0.0000
10	0.0000	-.0545	.2700	0.0000	2	0.0000	3.9352	59.7000	0.0000
1	0.0000	-.5567	.2200	0.0000	3	0.0000	-1.3537	0.0000	0.0000
9	0.0000	1.4884	2.3000	0.0000	4	0.0000	1.5457	2.3000	0.0000
11	0.0000	3.8301	48.2300	0.0000	5	0.0000	.1870	1.8600	0.0000
13	0.0000	-.9702	.0000	0.0000	6	0.0000	-1.6858	.0000	0.0000
7	0.0000	-.7972	.5900	0.0000					

CLUSTER 4 NUMBER OF CASES = 17

CASE NUMBERS
6 7 8 9 10 11 12 13 14 15 20 21 26 28 29 30 31

CLUSTER DIAGNOSIS OF MEANS, STANDARD DEVIATIONS AND F-RATIO

VAR	F-RATIO	T	MN-ORIG	STD-ORIG	VAR	F-RATIO	T	MN-ORIG	STD-ORIG
2	.0736	-.4516	5.3259	3.3315	3	.1992	-.6818	6.0176	3.9971
9	.2987	-.5410	1.1947	.2977	13	.3957	-.3022	1.7394	1.6381
4	.4457	-.6469	.7694	.4660	11	.5137	-.2732	9.1929	6.8186
5	.5653	.2905	1.9659	.7342	6	.6079	-.4050	11.9365	7.2663
12	.6971	-.2113	7.3888	5.9589	8	.9487	.0078	.3621	.4890
7	.9871	.4036	1.5424	.7880	1	1.3332	.2598	.3747	.2188
10	1.7415	.0449	.2953	.3357					

PART 4

PERFORMANCE OF FIVE WASHINGTON SYSTEMS IN RELATION TO SECTION 15 REVENUE VEHICLE CLASSES

FY 1979-80 Section 15 Transit Performance Indicators:

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLES	TOTAL ANNUAL VEHICLE REVENUE MILES				TOTAL ANNUAL VEHICLE REVENUE HOURS	
				PER VEHICLE PM PEAK	PER OPERATOR	PER VEHICLE REVENUE HOUR (MPH)	PER LINE MILE	PER VEHICLE PM PEAK	PER OPERATOR
	1000 & OVER REVENUE VEHICLES								
0001	Seattle Metro	MB	915	41833.8	17430.8	18.4	28000.4	2274.0	947.5
	Vehicle Group (1000+) Average	MB	---	35094.4	15916.3	11.1	22112.1	3164.3	1435.1
	Vehicle Group (500-999) Average	MB	---	41302.7	18556.9	13.0	13539.1	3171.0	1424.7
	100-249 REVENUE VEHICLES								
0003	Tacoma Transit System	MB	115	34789.2	20129.6	13.4	14581.4	2587.9	1497.4
		DR	12	0.0	19228.0	17.7	0.0	0.0	1084.3
	Vehicle Group (100-249) Average	MB	---	34983.8	20048.1	13.2	9460.9	2692.3	1549.9
	Vehicle Group (< 25) Average	DR	---	33222.5	21942.7	12.6	0.0	2544.7	1643.6
	50-99 REVENUE VEHICLES								
0002	City of Spokane TS	MB	80	30757.4	19325.4	8.2	11085.1	3750.6	2356.6
	Vehicle Group (50-99) Average	MB	--	37424.8	20980.6	12.7	5989.8	2923.7	1624.7
	UNDER 25 REVENUE VEHICLES								
0005	City of Everett Trans	MB	19	47930.4	22367.5	14.1	5185.7	3393.6	1583.7
0006	City of Yakima Trans	MB	12	34891.6	18151.7	15.2	5216.3	2293.0	1192.9
0004	Vancouver TS	MB	10	0.0	18745.0	16.8	6805.1	0.0	1118.9
	Vehicle Group (< 25) Average	MB	--	40632.3	22758.8	13.4	4128.2	2990.0	1704.9

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

FY 1979-80 Section 15 Transit Performance Indicators:

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLES	FUEL CONSUMPTION GALS PER VEHICLE MILE	FUEL CONSUMPTION GALS PER TEN PASSENGER MILES	FUEL CONSUMPTION GALS PER TEN CAPACITY MILES	FUEL CONSUMPTION KWHS PER VEHICLE MILE	FUEL CONSUMPTION KWHS PER TEN PASSENGER MILES	FUEL CONSUMPTION KWHS PER TEN CAPACITY MILES
	1000 & OVER REVENUE VEHICLES								
0001	Seattle Metro	MB	915	0.23	0.00	0.03	0.0	0.0	0.0
		TB*	168	0.00	0.00	0.00	1.94	0.0	0.0
	Vehicle Group (1000+) Average	MB	---	0.275	0.18	0.04	0.0	0.0	0.0
	Vehicle Group (500-999) Average	MB	---	0.266	0.22	0.04	0.0	0.0	0.0
	100-249 REVENUE VEHICLES								
0003	Tacoma Transit System	MB	115	0.21	0.28	0.03	0.0	0.0	0.0
	Vehicle Group (100-249) Average	MB	---	0.253	0.27	0.04	0.0	0.0	0.0
	50-99 REVENUE VEHICLES								
0002	City of Spokane TS	MB	80	0.28	0.21	0.07	0.0	0.0	0.0
	Vehicle Group (50-99) Average	MB	---	0.25	0.23	0.05	0.0	0.0	0.0
	UNDER 25 REVENUE VEHICLES								
0005	City of Everett Trans	MB	19	0.22	0.36	0.05	0.0	0.0	0.0
0006	City of Yakima Transit	MB	12	0.18	0.00	0.07	0.0	0.0	0.0
0004	Vancouver TS	MB	10	0.24	0.00	0.06	0.0	0.0	0.0
	Vehicle Group (<25) Average	MB	---	0.20	0.31	0.05	0.0	0.0	0.0

* Comparable data unavailable.

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

FY 1979-80 Section 15 Transit Performance Indicators

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLE	ADMINISTRATIVE EMPLOYEES (TOTAL)		TOTAL ANNUAL VEHICLE MILES		TOTAL REVENUE VEHICLES PER MAINTEN. EMPLOYEE	TOTAL NUMBER OF COLLISION ACCIDENTS		TOTAL NUMBER OF NON-COLLISION ACCIDENTS	
				PER VEHICLE (TOTAL)	PER VEHICLE PM PEAK	PER DOLLAR MAINTEN. EXPENSE	PER ROAD CALL		PER MILLION VEHICLE MILES	PER MILLION PASSENGER MILES	PER MILLION VEHICLE MILES	PER MILLION PASSENGER MILES
	1000 & OVER REVENUE VEHICLES											
0001	Seattle Metro	MB	915	0.27	0.38	3.48	2815.0	2.14	59.4	0.0	17.7	0.0
		TB	168	0.00	0.00	9.12	2296.8	6.72	41.1	0.0	12.8	0.0
	Vehicle Group (1000+) Average	MB	---	0.18	0.26	1.50	1281.0	1.60	67.5	4.5	37.8	0.0
	Vehicle Group (500-999) Average	MB	---	0.24	0.32	2.40	1361.8	1.80	58.1	4.1	25.7	2.5
	Vehicle Group (100-249) Average	TB	---	0.06	0.19	1.90	258.1	4.30	68.2	5.6	41.6	1.9
												3.8
	100-249 REVENUE VEHICLES											
0003	Tacoma Transit System	MB	115	0.09	0.11	3.04	2126.7	3.06	41.2	5.6	19.7	2.7
		DR	12	0.17	0.00	6.46	12481.3	12.00	73.4	56.9	20.0	15.5
	Vehicle Group (100-249) Average	MB	--	0.16	0.21	3.00	2203.8	2.60	48.1	5.1	19.3	1.9
	Vehicle Group (<25) Average	DR	--	0.24	0.41	5.10	3701.3	3.50	22.4	14.4	10.6	6.5
	50-99 REVENUE VEHICLES											
0002	City of Spokane TS	MB	80	0.20	0.23	2.96	2754.1	2.76	23.3	1.8	15.0	1.1
		DR	8	0.13	0.14	0.00	0.0	0.00	0.0	0.0	0.0	0.0
	Vehicle Group (50-99) Average	MB	--	0.14	0.19	2.90	2356.9	2.60	41.9	3.9	17.0	1.6
	Vehicle Group (<25) Average	DR	--	0.24	0.41	5.10	3701.3	3.50	22.4	14.4	10.6	6.5
	UNDER 25 REVENUE VEHICLES											
0005	City of Everett Tran	MB	19	0.01	0.01	0.00	20119.7	5.00	5.7	5.4	1.4	1.3
0006	City of Yakima Transit	MB	12	0.00	0.00	1.95	5883.3	12.00	35.8	0.0	29.8	0.0
0004	Vancouver TS	MB	10	0.00	0.00	2.37	0.0	3.33	14.4	0.0	0.0	0.0
	Vehicle Group (<25) Average	MB	--	0.16	0.22	3.40	2416.9	2.50	30.9	4.9	5.7	0.9

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

FY 1979-80 Section 15 Transit Performance Indicators

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLES: TOTAL REVENUE VEHICLES	TOTAL REVENUE VEHICLES: OPERATED PEAK PERIOD (PM)	TOTAL REVENUE VEHICLES: OPERATED BASE PERIOD	TOTAL REVENUE VEHICLES: PER LINE MILE	TOTAL ANNUAL VEHCILE MILES: PER VEHICLE PM PEAK	TOTAL ANNUAL VEHCILE MILES: PER OPERATOR	TOTAL ANNUAL VEHCILE MILES: PER VEHICLE HOUR (MPH)	TOTAL ANNUAL VEHCILE MILES: PER LINE MILE	TOTAL ANNUAL VEHICLES HOURS: PER VEHICLE PM PEAK	TOTAL ANNUAL VEHICLES HOURS: PER OPERATOR
	1000 & OVER REVENUE VEHICLES											
0001	Seattle Metro	MB TB	915 168	655 28	236 16	0.94 10.77	45951.2 25182.9	19146.3 30657.5	14.3 0.0	30756.2 45200.1	3221.5 0.0	1342.3 0.0
	Vehicle Group Average (Motor Bus; 1000+)	MB	---	---	---	.87	39752.7	18029.0	11.1	25047.1	3565.4	1617.0
	Vehicle Group Average (Motor Bus; 500-999)	MB	---	---	---	.43	45001.1	20218.6	13.1	14752.3	3430.7	1541.4
	Vehicle Group Average (Trolley Bus; 100-249)	TB	---	---	---	6.15	25900.7	15644.7	8.4	40399.7	3119.7	1535.1
	100-249 REVENUE VEHICLES											
0003	Tacoma Transit System	MB DR	115 12	92 0	41 0	0.52 0.00	34789.2 0.0	20129.6 21396.6	13.4 19.7	14581.4 0.0	2587.9 0.0	1497.4 1084.3
	Vehicle Group Average (Motor Bus; 100-249)	MB	---	---	---	0.36	34938.8	20048.1	13.2	9460.9	2917.8	1679.8
	Vehicle Group Average (Demand-Response; <25)	DR	---	---	---	0.00	38520.1	22002.3	12.4	0.0	2856.9	1832.7
	50-99 REVENUE VEHICLES											
0002	City of Spokane TS	MB DR	80 8	71 7	45 7	0.41 0.00	33825.5 0.0	21253.2 0.0	7.5 0.0	12190.9 0.0	4502.5 0.0	2829.0 0.0
	Vehicle Group Average (Motor Bus; 50-99)	MB	---	---	---	0.21	39871.5	22252.8	12.6	6358.6	3160.2	1751.8
	Vehicle Group Average (Demand-Response; <25)	DR	---	---	---	0.00	38520.1	22002.3	12.4	0.0	2856.9	1832.7
	UNDER 25 REVENUE VEHICLES											
0005	City of Everett Trans	MB	19	14	9	0.15	50299.3	23473.0	14.2	5442.0	3539.0	1651.5
0004	Vancouver TS	MB	10	0	0	0.17	0.0	18884.1	13.2	6855.6	0.0	1427.3
0006	City of Yakima Transit	MB	12	9	5	0.20	37260.9	19384.3	16.2	5570.6	2293.0	1192.9
	Vehicle Group Average (Motor Bus; <25)	MB	---	---	---	0.13	42492.9	23972.6	13.4	4362.1	3155.7	1798.3

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

FY 1979-80 Section 15 Transit Performance Indicators

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLE	TOTAL OPERATING EXPENSES PER VEHICLE PM PEAK	PER VEHICLE MILE	PER CAPACITY MILE	PER VEHICLE HOUR	PER VEHICLE REVENUE HOUR	PER PASSENGER	PER PASSENGER MILE	PER EMPLOYEE	PER OPERATOR HOUR
0001	Seattle Metro	MB	915	96639.8	2.10	0.03	30.00	42.50	0.86	0.00	26518.3	19.4
		TB	168	36588.8	1.45	0.00	0.00	0.00	2.65	0.00	20890.7	21.4
	Vehicle Group (1000+) Average	MB	---	123508.2	3.10	0.049	34.60	39.00	0.60	0.80	34315.1	26.9
	Vehicle Group (500-999) Average	MB	---	108019.7	2.40	0.037	31.60	34.20	0.688	0.20	30555.6	23.5
	Vehicle Group (100-249) Average	TB	---	76488.8	3.00	.0.06	30.30	30.30	0.47	0.30	26682.1	22.2
0003	Tacoma Transit System	MB	115	68467.4	1.97	0.03	26.50	26.50	0.84	0.27	28515.2	19.0
		DR	12	0.0	1.33	0.16	26.30	26.30	4.56	1.03	18144.0	13.7
	Vehicle Group (100-249) Average	MB	---	73178.3	1.90	0.032	25.00	27.10	0.76	0.20	27666.9	20.1
	Vehicle Group (< 25) Average	DR	---	67820.1	1.30	0.13	18.80	21.60	2.91	0.80	17035.8	13.4
0002	City of Spokane TS	MB	80	66983.5	1.98	0.05	14.90	17.90	0.65	0.15	28999.0	20.2
		DR	8	16768.9	0.00	0.00	0.00	0.00	1.47	0.48	6904.8	4.7
	Vehicle Group (50-99) Average	MB	---	72246.5	1.80	0.32	22.10	23.80	0.85	0.20	26628.7	19.2
	Vehicle Group (< 25) Average	DR	---	67820.1	1.30	0.13	18.80	21.60	2.91	0.80	17035.8	13.4
0005	City of Everett Trans	MB	19	83928.3	1.67	0.04	23.70	24.70	4.93	1.58	31929.2	18.8
0006	City of Yakima Transit	MB	12	76054.8	2.04	0.08	33.20	33.20	0.00	0.00	33718.9	19.0
0004	Vancouver TS	MB	10	0.0	2.01	0.05	26.60	34.0	1.62	0.00	27889.8	18.3
	Vehicle Group (< 25) Average	MB	---	61527.7	1.30	0.03	18.00	19.00	0.785	0.20	21216.5	15.5

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

FY 1979-80 Section 15 Transit Performance Indicators

COMPARISON OF WASHINGTON STATE TRANSIT SYSTEMS WITH VEHICLE GROUP AVERAGE (by mode)

ID CODE	TRANSIT SYSTEM	MODE	TOTAL REVENUE VEHICLES	TOTAL ANNUAL PASSENGER MILES				TOTAL PASSENGERS				TOTAL EMPLOYEES	
				PER LINE MILE (000)	PER VEH. PM PEAK (000)	PER CAPACITY MILE (000)	PER VEHICLE REV. HOUR	PER LINE MILE (000)	PER VEHICLE MILE	PER EMPLOYEE (000)	PER VEHICLE REV. HOUR	PER VEHICLE (TOTAL)	PER VEHICLE PM PEAK
	1000 & OVER REVENUE VEHICLES												
0001	Seattle Metro	MB	915	0.0	0.0	0.00	0.0	75.50	2.5	30.9	49.6	2.6	3.6
		TB	168	0.0	0.0	0.00	0.0	24.70	0.5	7.9	0.0	0.3	1.8
	Vehicle Group (1000+) Average	MB	----	374.2	429.2	0.20	187.7	129.37	5.2	57.1	64.9	2.6	3.6
	Vehicle Group (500-999) Average	MB	---	169.5	423.2	0.20	163.1	51.17	3.5	44.4	49.5	2.6	3.5
	Vehicle Group (100-249) Average	TB	---	0.0	0.0	0.00	0.0	251.62	6.2	56.3	73.1	0.7	2.9
	100-249 REVENUE VEHICLES												
0003	Tacoma Transit System	MB	115	107.4	265.3	0.12	99.0	34.30	2.4	34.1	31.6	1.9	2.4
		DR	12	0.0	0.0	0.16	25.5	0.00	0.3	4.0	5.8	0.9	0.0
	Vehicle Group (100-249) Average	MB	---	95.9	265.6	0.20	134.8	24.65	2.4	35.7	35.6	2.0	2.6
	Vehicle Group (<25) Average	DR	---	0.0	42.3	0.10	25.8	0.00	0.4	5.5	5.1	1.8	2.7
	50-99 REVENUE VEHICLES												
0002	City of Spokane TS	MB	80	161.2	447.3	0.32	119.8	37.00	3.0	44.5	27.4	2.1	2.3
		DR	8	0.0	35.3	0.00	0.0	0.00	0.0	4.7	0.0	2.1	2.4
	Vehicle Group (50-99) Average	MB	---	77.0	333.8	0.20	142.0	15.21	2.1	31.3	29.2	2.0	2.7
	Vehicle Group (<25) Average	DR	---	0.0	42.3	0.10	25.8	0.00	0.4	5.5	5.1	1.8	2.7
	UNDER 25 REVENUE VEHICLES												
0005	City of Everett TRANS	MB	19	33.8	291.8	0.13	92.2	110.70	2.0	37.3	29.1	1.9	2.6
0006	City of Yakima Transit	MB	12	0.0	0.0	0.00	0.0	0.00	0.0	0.0	0.0	1.7	2.3
0004	Vancouver TS	MB	10	0.0	0.0	0.00	0.0	8.50	1.2	17.2	21.0	3.0	0.0
	Vehicle Group (<25) Average	MB	---	29.1	211.0	0.10	95.5	7.70	1.8	28.1	25.1	2.0	2.8

Source: National Urban Mass Transportation Statistics: Second Annual Report, Section 15 Reporting System, U.S. Department of Transportation Systems Center, Cambridge, MA, June 1982.

Transit Performance Indicators: Details by Transit System Size

MOTOR BUS

Fiscal year ending between 7/01/79 and 6/30/80

PERFORMANCE INDICATORS	SIZE OF TRANSIT SYSTEM: NUMBER OF REVENUE VEHICLES							
	UNDER 25	25-49	50-99	100-249	250-499	500-999	1000 & OVER	ALL SYSTEMS
TOTAL REVENUE VEHICLES								
PER THOUSAND LINE MILES	136.6	191.8	212.2	383.6	366.5	438.9	871.9	429.5
TOTAL REVENUE VEHICLES (PM PEAK)								
PER THOUSAND LINE MILES	103.8	136.1	184.3	288.1	273.7	325.7	630.1	331.6
TOTAL REVENUE VEHICLES (BASE PERIOD)								
PER THOUSAND LINE MILES	81.7	96.0	112.8	138.6	148.2	188.5	318.4	177.1
TOTAL ANNUAL VEHICLE MILES								
PER VEHICLE (PM PEAK)	42482.9	42083.1	38871.5	38628.5	42452.5	46001.1	38752.7	40827.7
PER OPERATOR	23872.6	22767.1	22252.8	22238.3	21814.7	20218.6	18029.0	19880.0
PER VEHICLE HOUR (MILES PER HOUR)	13.4	13.5	12.6	13.2	13.3	13.1	11.1	12.2
PER LINE MILE	4382.1	5757.2	6358.6	10481.3	11820.9	14752.3	25047.1	12983.4
TOTAL ANNUAL VEHICLE HOURS								
PER VEHICLE (PM PEAK)	3155.7	3089.8	3180.2	2917.8	3185.4	3430.7	3508.4	3357.5
PER OPERATOR	1798.3	1678.9	1751.8	1679.6	1642.0	1541.4	1617.0	1632.2
TOTAL ANNUAL VEHICLE REVENUE MILES								
PER VEHICLE (PM PEAK)	40832.3	40231.3	37424.8	34883.8	38802.5	41302.7	35084.4	38855.3
PER OPERATOR	22758.8	21847.7	20980.6	20048.1	19836.3	18558.9	15918.3	17984.6
PER VEHICLE REVENUE HOUR (MILES PER HOUR)	13.4	13.5	12.7	13.2	12.9	13.0	11.1	12.1
PER LINE MILE	4128.2	5511.1	5808.8	9480.9	10667.1	13538.9	22112.1	11702.1
TOTAL ANNUAL VEHICLE REVENUE HOURS								
PER VEHICLE (PM PEAK)	2880.0	2974.8	2923.7	2682.3	2881.4	3171.0	3184.3	3051.3
PER OPERATOR	1704.9	1811.4	1624.7	1549.8	1532.0	1424.7	1435.1	1484.5
FUEL CONSUMPTION GALS								
PER HUNDRED VEHICLE MILES	20.3	23.7	25.1	25.3	26.3	28.8	27.5	26.4
PER HUNDRED PASSENGER MILES	3.1	2.9	2.3	2.7	2.0	2.2	1.8	2.1
PER HUNDRED CAPACITY MILES	0.5	0.4	0.5	0.4	0.4	0.4	0.4	0.4
TOTAL OPERATING EXPENSES $								
PER VEHICLE (PM PEAK)	61527.7	68333.8	72246.5	73178.3	87815.7	108019.7	123508.2	103031.4
PER VEHICLE MILE	1.3	1.6	1.8	1.8	2.1	2.4	3.1	2.5
PER HUNDRED CAPACITY MILES	3.0	3.0	3.2	3.2	3.3	3.7	4.9	4.1
PER VEHICLE HOUR	18.0	22.0	22.1	25.0	27.4	31.6	34.6	30.5
PER VEHICLE REVENUE HOUR	19.0	22.9	23.8	27.1	29.4	34.2	39.0	33.5
PER HUNDRED PASSENGERS	78.5	74.7	85.8	78.3	67.1	68.8	60.1	64.7
PER PASSENGER MILE	0.2	0.2	0.2	0.2	0.2	0.2	0.2	0.2
PER EMPLOYEE	21216.5	24488.2	26828.7	27808.9	28175.1	30551.8	34315.1	31182.0
PER OPERATOR HOUR	15.5	17.7	19.2	20.1	22.1	23.5	26.9	23.9
TOTAL ANNUAL PASSENGER MILES								
PER LINE MILE (THOUSANDS)	28.1	44.4	77.7	95.8	148.8	188.5	374.2	172.1
PER VEHICLE (THOUSANDS)	211.0	290.3	333.8	285.8	384.1	423.3	429.2	388.4
PER CAPACITY MILE	0.1	0.1	0.2	0.2	0.2	0.2	0.2	0.2
PER VEHICLE REVENUE HOUR	85.5	113.7	142.0	134.8	187.4	183.1	187.7	171.2
TOTAL PASSENGERS								
PER THOUSAND LINE MILES	7884.6	12325.4	15215.3	24852.1	35780.9	51173.9	128378.2	51854.9
PER THOUSAND VEHICLE MILES	1.8	2.2	2.1	2.4	3.0	3.5	5.2	3.8
PER EMPLOYEE (THOUSANDS)	28.1	33.1	31.3	35.7	40.9	44.4	57.1	48.2
PER VEHICLE REVENUE HOUR	25.1	30.8	29.2	35.6	43.5	49.5	64.8	52.2
TOTAL EMPLOYEES								
PER VEHICLE (TOTAL)	2.0	2.1	2.0	2.0	2.2	2.8	2.8	2.4
PER VEHICLE (PM PEAK)	2.8	2.8	2.7	2.8	3.2	3.5	3.6	3.3
TOTAL ADMINISTRATIVE EMPLOYEES								
PER TEN VEHICLES	1.6	1.7	1.4	1.8	1.7	2.4	1.9	1.8
PER TEN VEHICLES (PM PEAK)	2.2	2.3	1.9	2.1	2.4	3.2	2.6	2.5
TOTAL ANNUAL VEHICLE MILES								
PER DOLLAR VEHICLE MAINTENANCE EXPENSE	3.4	3.1	2.9	3.0	2.3	2.4	1.5	1.9
PER ROAD CALL	2418.9	2341.8	2356.9	2203.8	1442.6	1381.8	1281.0	1487.5
TOTAL REVENUE VEHICLES								
PER MAINTENANCE EMPLOYEE	2.5	2.5	2.6	2.6	1.9	1.9	1.6	1.8
NUMBER OF COLLISION ACCIDENTS								
PER MILLION VEHICLE MILES	30.9	43.7	41.9	48.1	52.5	58.1	67.5	57.7
PER MILLION PASSENGER MILES	4.9	5.2	3.9	5.1	3.8	4.1	4.5	4.4
TOTAL NUMBER OF NONCOLLISION ACCIDENTS								
PER MILLION VEHICLE MILES	5.7	15.7	17.0	19.3	26.9	25.7	37.8	28.9
PER MILLION PASSENGER MILES	0.9	1.9	1.6	1.9	2.2	1.9	2.5	2.3

Source: National Urban Mass Transportation Statistics: Second Annual Report - Section 15 Reporting System. USDOT, June, 1982.