

TRANSIT SYSTEM PERFORMANCE

EVALUATION METHODOLOGY

An Interim Draft Report

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TABLE OF CONTENTS

	Page
CHAPTER ONE: INTRODUCTION	1
Problem Assessment	1
"State-of-the-Art" Overview	4
"Major Gaps" in Transit Performance Evaluation	5
CHAPTER TWO: CONCEPTUAL EVALUATION FRAMEWORK	8
Measurement Criteria	8
Goals and Objectives	10
Establishing Goals and Objectives	12
Transit Performance Measures	13
Transit Performance Standards	14
Process for Developing Transit Performance Measures and Standards	15
Factors Considered in Previous Research	15
Experience in Developing Service Standards	19
Recommended Selection Process for WSDOT Study	19
Selection of Service Standards	22
CHAPTER THREE: MONITORING AND EVALUATION PROCESS FOR WASHINGTON STATE	26
State and Local Evaluation Experience to Date	26
Purpose	28
Participants	28
Primary	28
Secondary	29
Audience for Evaluation Results	29
Appropriate Level of Detail for Analysis	30
Frequency of Evaluation	30
Resources	32
Suggested Evaluation Procedure for Washington	32
Internal Evaluation Process	32
External Evaluation Process	36
Diagnostic Review (Phase I)	38
Detailed Evaluation (Phase II)	39
Conclusion	42
REFERENCES	43
APPENDIX A: SELECTED LISTING AND EXPLANATION OF PERFORMANCE MEASURES	A-1
APPENDIX B: SUGGESTED ANNUAL REPORT FORM FOR WASHINGTON STATE	B-1

LIST OF FIGURES

FIGURE 1: Transit Performance Evaluation Framework	Page 9
FIGURE 2: Comprehensive Set of TMP's Proposed by Fielding, et al	17
FIGURE 3: Reduced Set of TMP's Proposed by Fielding, et al	18
FIGURE 4: Suggested Transit Performance Measures for Use in Washington	21
FIGURE 5: Transit Data Summary Report Form	31
FIGURE 6: Internal (Local) Evaluation Process	33
FIGURE 7: External Evaluation Process	37

LIST OF TABLES

TABLE 1: Performance Comparison of Small Community Transit With State and National Peer Groups	24
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INTRODUCTION

Throughout the 1981-82 fiscal year, Washington State Transportation Center (TRAC) has been conducting research in order to develop a suggested evaluation methodology and to identify appropriate performance monitoring procedures for public transit systems throughout the state. Specific objectives of the study were to:

1. Prepare a "state of the art" literature review
2. Develop a suggested classification scheme for grouping transit systems relative to size and scale of operation
3. Develop a suggested framework for evaluation from state and local perspective
4. Develop suggested guidelines for identifying performance measures and standards to be used in evaluation.

A literature review and bibliography (150 citations) on the development and application of transit performance evaluation was prepared and submitted to State DOT as a preliminary draft in March 1982. Research leading to a classification system for appropriate transit "peer groups" (objective #2) will be completed in September 1982. The purpose of this report is to present major concepts of performance evaluation and suggest procedures and guidelines for internal and external performance monitoring (objectives #3 and #4). The report begins with a brief assessment of the problem, followed by a conceptual framework for evaluation, and a suggested procedure for Washington State.

Problem Assessment

Today, throughout Washington State as well as the country, escalating costs of providing public transit are increasing more rapidly than operating revenues leading to growing deficits that must be financed by government dollars.

Transit officials are being "squeezed" between public opposition to tax increases for underwriting deficits and patron opposition to fare increases that would help reduce deficit levels.

Additionally, many systems have received new demands for service stemming from concerns relating to energy conservation and air quality. Frequently, these demands originate 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 increasing disparities between costs and revenues. Transit management needs a rational and consistent procedure for assessing existing or planned services in areas of marginal demand.

It is presumed the 1980's will present even greater challenges for transit officials to manage existing resources more efficiently and effectively. The "age of austerity" mood throughout the nation will constrain public support for all services, including transit. Performance monitoring and evaluation is seen as an essential process in meeting the objective of maintaining and improving transit service within acceptable limits of public support.

The interest in effectiveness of transit reflects a concern of how well transit is meeting the goals and objectives set by government policy. Typical effectiveness measures include:

- total ridership
- ridership per vehicle mile or hour
- ridership per capita
- safety indicators (accidents per 100,000 miles)
- schedule reliability (percent of on time arrivals)
- percent employment served
- revenue generation (passenger revenue per mile/hour)
- cost effectiveness (operating ratio).

Concern with efficiency reflects an interest in assuring the proper use of resources. How much capital and labor inputs are required to produce a certain level of outputs as measured in miles and hours of service? Efficiency measures are expressed as a ratio of output per unit of input and additional distinction is made between produced and consumed output. Typical efficiency measures include:

- vehicle miles,or hours per employee
- vehicle miles or hours per vehicle
- vehicle miles per roadcall
- vehicle miles or hours per operational cost.

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 performance is viewed as a means of insuring that the public is well served.

State-of-the-Art Overview

During the past seven years, numerous research studies relating to transit performance evaluation have been conducted. Tomazinis (37), Meyer and Gomez (28), Dajani and Gilbert (18), Fielding, Glauthier and Lave (13), Drostat (12), and Sinha with Judkins, Dobry and Bhandari (34) made significant contributions in identifying major issues, conceptualizing the general framework, validating performance criteria and indicators suggested, and testing methods against data sets from individual transit properties. The work of these researchers, and others not identified above (see references), have greatly improved the transit industry's understanding of performance evaluation methodology and utility. State-of-the-art theory and application have progressed to the point where:

1. A conceptual framework of evaluation that distinguishes major concepts of efficiency and effectiveness and including appropriate indicators for each criteria, have been developed and tested for inter- and intrasystem evaluation. A synthesis of that evaluation framework is presented in the next section.
2. Earlier problems with data inconsistency and nonuniformity have been addressed by UMTA's Section 15 reporting procedures (UMTA, Project FARE, July 1976). The first annual report (1978-79 data) has recently been released (UMTA, 1981), and while some problems remain (Holec and Schwagger, 1981), this information does provide the first opportunity for researchers and policy makers to review uniform and comprehensive information regarding transit operations throughout the United States.
3. Recent studies reviewed indicate that most systems are improving their data collection efforts and many of the larger properties are adopting formal procedures for monitoring and evaluating system, functional area, and route performance. Smaller systems, however, are still restrained in their implementation of performance evaluation due to cost and perceived complexities of data collection and analysis.

4. Several states have developed procedures for linking subvention of funding allocation to local recipients with specific performance levels. California and New York use performance measures to determine eligibility for funding. Transit Performance Measures in Pennsylvania have been used to provide incentive payments for superior performance.

State DOT's in Wisconsin, Michigan, Iowa, Indiana, and Florida currently provide (or are developing) managerial and technical assistance to local operators based on evaluation of performance. State evaluation models such as these that stress the State's managerial assistance role (as opposed to funding allocation) are more applicable in considering a proposed methodology for Washington State. These evaluation models have been reviewed and appropriate procedures have been integrated into the guidelines suggested for Washington State Department of Transportation (WSDOT) and presented in Chapter Three.

Major "Gaps" in Transit Performance Evaluation

As identified earlier, key concepts, criteria, and measures for transit performance have been proposed and tested successfully during the past few years. However, there are at least three important issues that warrant additional study:

1. Because appropriate "peer group" classes have not been developed and tested, transit performance relative to alternative size and scale of operations has not been thoroughly analyzed. A "peer group" classification scheme that would identify and assess major differences and/or similarities in performance between different classes of systems needs to be developed. While final definitions and descriptions for individual "peer groups" can only come after detailed study, a cursory review of the range of public transit

operations in Washington (see reference 39) would reveal at least 7 classes of fixed route systems including:

- a. Metropolitan Regional Transit Systems: Seattle Metro is the only system to occupy this peer group characterized by extensive service operations within a large metropolitan city (>500,000 population) and region (>1,000,000 population). Significant population, higher densities, and major activity centers would contribute to intensive transit demand.
- b. Large Urban Area Regional Systems: These are regional Public Transportation Benefit Area (PTBA) systems serving urbanized areas (e.g., Tacoma or Spokane) and their surrounding regions. Transit demand in these systems would be exceeded only in the metropolitan system.
- c. Midsize Urban Area Regional Systems: These systems serve urbanized areas (> 50,000 population) and operate outside municipal boundaries.
- d. Midsize Urban Municipal Systems: These systems serve urbanized areas (>50,000 population) within municipal boundaries.
- e. Small Community Regional Systems: These systems serve small cities (< 50,000 population) and surrounding areas.
- f. Small Community Municipal Systems: These systems serve small cities (< 50,000 population) within municipal boundaries.
- g. Rural Regional Transit Systems; These systems serve multiple smaller cities and communities throughout a rural region.

Again, the classes identified above are not proposed as definitive but do serve to suggest probable differences in operational performance. For example, if one were examining the transit performance measure passengers per vehicle mile and compared the TPM value of a rural regional system as found in Pacific County against the value of the Seattle Metro System, it is anticipated there would be significant differences. Operating in low density travel corridors, the rural system has to provide considerably more vehicles miles of service to meet its transit demand.

Each transit system in the state is unique and operates in an environment unlike any other. From that perspective, strict comparisons of performance should be avoided. But it is proposed that each system can be classified into approximate "peer groups" which would be similar in size and scale of operations. Once such a classification scheme is

developed, managers and decision makers can benefit by relative comparison of their system's performance with its associated "peer group's" performance.

2. The evaluation literature reviewed recommends standards and service levels be developed locally. While local operating standards must reflect local needs, resources, and constraints, suggested guidelines based on the operating experience of each peer group would aid managers and decision makers in their determinations. This is particularly true for midsize and smaller properties. The literature that exists is instructive, but primarily oriented 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 that beneficial distinctions can be identified and more relevant service planning and evaluation guidelines can be prescribed for each group.
3. Thirdly, the impacts of intrasystem evaluation are not widely known. Several of the larger operators have formalized and documented their monitoring and evaluation procedures, but the net results have not been widely reported. It is anticipated that during the continuation of this research, mini case examples illustrating procedures, utility, results, and cost of performance monitoring and evaluation for each class can be collected and reported.

Research relative to the "gaps" identified above will be completed in September 1982 and a report will be prepared documenting the analysis and findings.

CONCEPTUAL EVALUATION FRAMEWORK

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

1. The establishment of transit system goals and objectives
2. Development of measures that relate to the stated goals and objectives, and reflect criteria of effectiveness and efficiency
3. Development and application of performance measures that quantify measurement
4. Development and application of standards that can serve as benchmarks against which measures can be compared
5. Continuous monitoring and evaluation over time (2).

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

Measurement Criteria

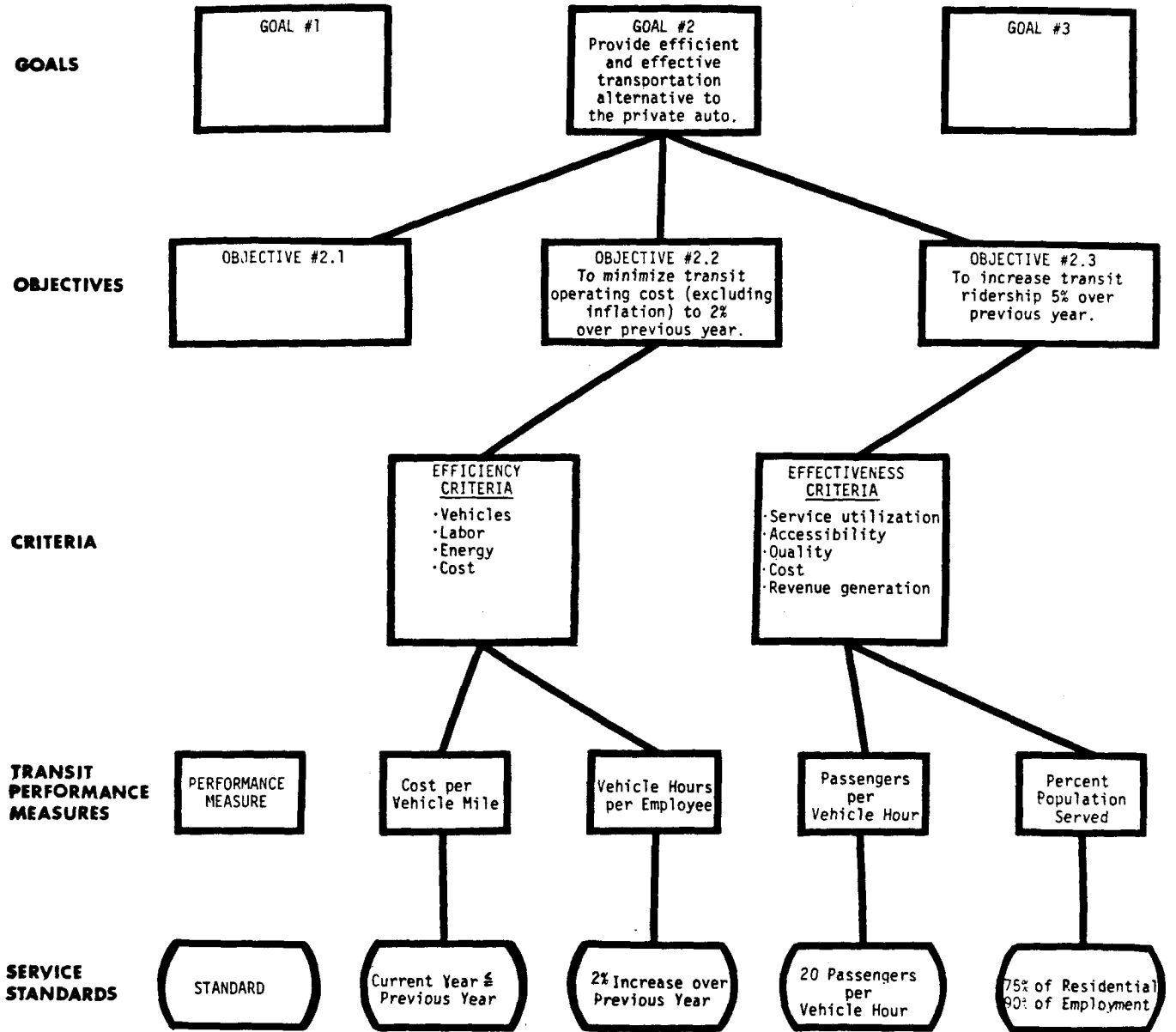
The two primary criteria for measuring transit performance are efficiency and effectiveness (3, 13, 18, 34, 37).

Efficiency criteria measures 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
- cost efficiency (expense per produced unit).

FIGURE 1

TRANSIT PERFORMANCE EVALUATION FRAMEWORK



Note: Examples used above are for illustration only.

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)
- revenue generation

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. The illustration also suggests the need for seeking an optimal balance between efficiency and effectiveness criteria. That balance is best achieved through establishing priorities of 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. 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
- assist in orderly urban development

The primary purpose for goals is to provide a sense of direction.

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:

1. clear, concise, unambiguous
2. measureable and attainable in a reasonable period of time and with reasonable effort
3. consistent with goals and priorities
4. 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 1 illustrate the concept.

Establishing Goals and Objectives

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 clarification of what is "best service" and "least cost".

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

As an example of how transit objectives can potentially be in conflict, Figure 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.

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 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 necessarily undesirable, but do require decision makers and their staff to carefully weigh the trade offs of each and establish priorities accordingly.

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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 a whole number, a percentage, or as a ratio. 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 instruments of performance evaluation and are used to assess whether or not transit service is achieving intended objectives.

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 (e.g., operations, maintenance, administration, and planning) of systems.

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

1. Related to stated system objectives
2. Easily understandable and defineable
3. Unbiased and objective
4. Measureable from available data
5. Methodologically correct (e.g., properly separating input from output measures)
6. Acceptable to parties involved (3).

Transit 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; thirty percent of the operating costs should be captured by revenue from passengers.

One of the earliest studies of transit performance was initiated in 1958 by the National Committee on Urban Transportation (29) in which standards and warrants for service were evaluated and the recommendations made. While the study remains generally applicable, different environmental and socioeconomic conditions encountered today justify the need for an updated version.

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

- historically accepted industry values
- guidelines or average values derived from other transit systems
- professional judgements by transit managers and planners
- "dynamic" standards that systems adapt to over time due to changing conditions (8).

While the performance evaluation literature has grown increasingly self-assured regarding performance indicators, there was notable reluctance on the part of most authors in suggesting specific values or ranges of values for service standards. Moreover, while the National Committee study remains somewhat relevant, the orientation is largely toward metropolitan transit authorities. Little information exists on service standards for medium size properties and absolutely no information exists for small size properties.

Selection Process for Developing Transit Performance Measures

Development of appropriate criteria for selecting transit performance measures and standards (not to be confused with evaluation criteria of efficiency and effectiveness) may vary with respect to scope of evaluation, level of analysis required, data availability, and perceived needs of the user. Before identifying the criteria applied in this study, a review of criteria used in previous research is presented.

Factors Considered in Previous Research

In a doctoral dissertation at the University of Washington, Drosdat (12) examined forty alternative transit performance measures relative to their utility in allocating funds to transit properties. His selection process included three screening criteria; aggregate significance, ease of definability, and utility.

The first criteria of aggregate significance assessed whether the TPM had meaning at the aggregate or system wide level of analysis rather than some measure designed for internal evaluation. Ease of definability implied that necessary data was available. The utility criteria involved evaluating the consistency of data availability and application from property to property. Only six of the TPM's examined by Drosdat passed the criterion test relative to potential for funding allocation use. Those measures were:

1. Energy Efficiency: Consumption (expressed as BTU's or gallons)/passenger
2. Fiscal Operating Efficiency: Operating ratio of fare revenues/operating expenditures
3. Vehicle Use Efficiency: Revenue hour/vehicle
4. Vehicle Use Efficiency: Revenue miles/vehicle

5. Service Consumption Efficiency: Passengers/vehicle mile or hour
6. Labor Efficiency: Vehicle miles or hours/employee

Fielding, Glauthier, and Lave (13) identified 21 potential performance measures (see Figure 2). Using the criteria of data availability, theoretical validity, appropriateness for management, and minimal environmental (external) effects, the potential set was reduced to 9 TPM's (see Figure 3).

A recent study (1980) by the Tidewater Transportation Commission in Norfolk, Virginia (38) describes the development and testing of a midsize transit system's evaluation procedure from an operator's perspective. Fifteen performance measures were developed and tested. The criterion used in selecting measures included:

- indicators must be at least partially under the control of the operator
- should reflect previous success in service evaluation by other transit systems
- operator must have the ability and resources to collect the data
- indicators should be understandable to those involved in service evaluation

The study called attention to two important aspects of service evaluation relative to midsize and smaller properties. Eighty one thousand dollars and fifteen thousand man hours were expended in collecting and analyzing the 15 transit performance measures. Costs such as these could represent severe constraints to medium and small size operators. Secondly, the study identified that very few of these indicators were used extensively by staff or decision makers. The one or two exceptions were financial measures such as deficit per passenger and operating ratio which suggest the need for education and information sharing relative to the utility of multiple performance measures.

FIGURE 2

COMPREHENSIVE SET OF TPM'S PROPOSED BY FIELDING, ET AL

EFFICIENCY:

As Measures of:

Revenue Vehicle Miles Per Employee
Total Vehicle Miles Per Employee
Revenue Vehicle Hours Per Employee

Labor Productivity

Revenue Vehicle Miles Per Vehicle
Total Vehicle Miles Per Vehicle
Revenue Vehicle Hours Per Vehicle

Vehicle Utilization

Operating Expense Per Seat Mile
Operating Expense Per Revenue Vehicle Mile
Operating Expense Per Total Vehicle Mile
Operating Expense Per Revenue Vehicle Hour

Expense Per Produced
Output Unit

Energy Consumption Per Revenue Vehicle Mile
Energy Consumption Per Total Vehicle Mile
Energy Consumption Per Revenue Vehicle Hour

Energy Efficiency

EFFECTIVENESS:

Percent Population Served
Revenue Passengers Per Service Area
Population
Total Passengers Per Vehicle
Revenue Passengers Per Revenue Vehicle Mile
Revenue Passengers Per Revenue Vehicle Hour

Accessibility

Utilization of Service

Operating Expense Per Total Passenger
Operating Expense Per Revenue Passenger
Operating Expense Per Passenger Mile

Expense Per Consumed
Output Unit

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

FIGURE 3

REDUCED SET OF TPM'S PROPOSED BY FIELDING, ET AL

EFFICIENCY:

Revenue Vehicle Hours Per Employee
Revenue Vehicle Hours Per Vehicle
Operating Expense Per Revenue Vehicle Hour

As Measures of:

Labor Productivity
Vehicle Utilization
Expense Per Produced
Output Unit

EFFECTIVENESS:

Revenue Passengers Per Service Area
Population
Total Passengers Per Vehicle
Revenue Passengers Per Revenue Vehicle Hour
Operating Expense Per Total Passenger
Operating Expense Per Revenue Passenger
Percent Population Served

Utilization of Service

} Expense Per Consumed
Output Unit

} Quality of Service
Accessibility

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

Experience in Developing Service Standards

The literature addresses the topic only by calling attention to the need for service standards and recommending the development of standards be left to local management and decision makers. While this recommendation is sound, it can also be argued that in order to appropriately select service standards, local managers and decision makers need an opportunity to review and compare "ranges" of performance levels from other similar size and scale operations. This opportunity is available for the metropolitan systems, but very few "peer group" examples are available for midsize and small systems.

Recommended Selection Process for WSDOT

The primary data base for deriving TMP's will be the Fiscal Year 1980 Section 15 (UMTA) reports for midsize (>50,000 population) and larger systems supplemented by selected State Department of Transportation reports for smaller systems.

Based on the review of representative studies identified previously, the following potential criteria could be used in selecting Transportation Performance Measures for use in Washington State.

1. Availability of data
2. Controllability of variables (e.g., within the control of the local operators)
3. Uniqueness of measure (not redundant)
4. Utility - represents a measure of a legitimate performance concept (e.g., efficiency and effectiveness)
5. Economy - data for developing measure should be within resources of local operators to collect and organize

6. Meaningful to local operator in the analysis of system, route, and functional area operations
7. Meaningful from research and policy analyst perspective
8. Ubiquitous use and success in monitoring and improving performance
9. Potential for multimodal application
10. Necessary level of variability (should not be static in nature).

The selection criteria identified above are qualified with the term potential for two reasons. First, until extensive analysis of the respective data sets has been conducted, it is not clear how many and what types of performance measures are most useful. Previous studies (3, 23) have identified as many as 60 performance measures that can be developed from Section 15 data. Secondly, monitoring and assessing some TPM's is not as relevant from every evaluation perspective (e.g., operational versus policy planning). For example, it may be appropriate to use only a small set of TPM's for analyzing performance of small systems, while an expanded set may be necessary for evaluating large properties.

While recommended performance measures can not be validated until after research on "peer groups" has been conducted, the previous experience of other researchers and operators does suggest a candidate list of performance indicators that meet the selection criteria identified above. Figure 4 identifies that candidate list of twenty-three measures. All major categories of efficiency and effectiveness criteria are represented. Data for developing these measures are available.

FIGURE 4

SUGGESTED TRANSIT PERFORMANCE MEASURES FOR USE IN WASHINGTON STATE

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

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The most important question is the utility of this many measures. While it is presumed State DOT analysts and planners employed by the larger properties would use this many measures (and perhaps more), it is not as clear that management or the decision makers of small and midsize systems would find monitoring of twenty-three measures a worthwhile endeavor. For a more exhaustive listing of potential TPM's and their definitions, see Appendix A. Perhaps no more than ten measures (similar to Figure 3 as proposed by Fielding) should be used by the smaller properties. This question will be posed to operators during field interviews to be conducted throughout the summer (1982) and the suggested consensus identified in final reports prepared in the fall.

Selection of Service Standards

Prior to analysis of TPM's or service standards, cluster analysis techniques will be applied to the estimated 350 transit systems in order to develop homogeneous groupings of transit operations. As implied earlier, service standards, as expressed by a mean average and "range" of values, will be developed for each TPM used and those expressed values will be disaggregated to the "peer group" level. For example, assuming there were seven "peer groups", there would be seven unique sets of "service standard ranges". As an illustration, one of the researchers was recently engaged in an evaluation study of a small city transit system in southeastern Washington (Pullman). In order to provide some relevant and relative context for a comparative evaluation, a sample data set (N=27) of 1980 operating and financial characteristics for similar size properties (10,000-49,000 service area population) throughout six states was assembled and analyzed. Table 1 depicts a summary form of the mean average

and value range for selected TPM's. For the first time, this small community system can compare its operational characteristics and performance with a representative "peer group" that is similar in size and scale.

Highlights of that comparison include:

1. The population versus ridership comparisons of the small system with the state and national "peer group" illustrate that in spite of 30% less population than the state or national average, the small system achieved greater than average values in ridership. This reflects the density (approximately 4,000 persons per square mile) of the community as well as the fact that it is a college town serving a higher number of "captive" riders (students).
2. The density and local environment identified above contribute to the system's better than average performance on effectiveness measures such as:
 - passengers per capita
 - passengers per hour
 - passengers per mile
3. However, on efficiency measures of operating expense per mile and hour of service, the small system's values are similar to the state peer group, but considerably higher than the national peer group average. This is probably indicative of the higher regional wage scale of the Northwest as compared to the Midwest and Southern states comprising the national peer group. This example illustrates the utility of having both a state and national peer group so regional distinctions such as the above can be identified.
4. Cost effectiveness measures of revenue per passenger and farebox (also known as operating) ratio for the small systems were slightly lower in 1980 than the state or national average. Recognizing this deficiency, the system instituted a fare increase of 25% in 1981.

TABLE 1

PERFORMANCE COMPARISON OF SMALL COMMUNITY TRANSIT
WITH STATE AND NATIONAL "PEER GROUPS"

Characteristics	Pullman	WA Peer Group Average	WA Range	US Peer Group Average	US Range
Population	23,579	35,792	23,579-42,181	34,567	11,300-49,678
Ridership	442,731	426,054	41,159-943,068	421,165	18,971-2,042,042
Vehicle miles	115,180	161,838	64,365-348,837	251,644	25,480-496,501
Vehicle hours	17,224	17,441	4,771-35,000	18,441	1,960-68,503
Operating expense	424,291	355,826	129,208-683,397	388,388	26,989-1,663,746
Farebox revenue	96,016	105,818	9,382-271,647	107,706	2,165-476,830
Ave. revenue/passenger	.217	.225	.167-.288	.267	.16-.50
Passengers/capita	18.79	11.54	1-26.88	11.457	1-59.2
Passengers/hour	25.70	20.75	8.53-26.94	15.96	5.12-29.62
Passengers/mile	2.05	1.74	.63-2.70	1.352	.37-2.70
Operating cost/passenger	1.13	2.02	.86-5.21	1.536	.84-5.21
Operating cost/hour	29.17	29.12	19.12-44.96	19.184	12.15-44.96
Subsidy/passenger	.70	1.15	.44-2.91	1.08	.44-2.34
Local subsidy/passenger	.40	.81	.19-2.17	.334	.067-2.17
Operating cost/vehicle mile	2.33	2.35	1.40-3.33	1.56	.88-3.33
Farebox ratio	.23	.235	.07-.40	.237	.07-.46
Expense/capita	17.99	11.10	3.13-18.87	10.91	2.39-48.23
Deficit/capita	13.91	7.75	2.97-13.91	7.99	1.50-35.21
Local subsidy/capita	7.59	7.18	3.23-13.05	2.947	.319-13.05

Source: Adapted from 1980 Annual Transit Reports of the following states; Washington, Iowa, North Carolina, Indiana, and Wisconsin.

Note: All data represents fixed route bus systems operating in service areas of less than 50,000 but more than 10,000 population.

Washington Peer Group, N=4.

U.S. Peer Group, N=27

5. Examining subsidy per passenger, the system compares favorably (lower value) with the state and national average due to its large ridership. But comparing expense or deficit per capita, the system has a greater than average value relative to the peer groups due to its smaller than average service area population.
6. Finally, a comment should be made regarding local subsidy per capita comparisons. The individual system's value is similar to the Washington State average, yet both are three times larger than the national peer group average. It does not mean the national peer group required less subsidy, but rather reflects the fact that most of the states comprising the national peer group do not have dedicated transit funding mechanisms at the local level. Instead they must depend on state and national assistance. This dependency on external funding sources could be harmful to those systems in the future, particularly when the federal government is proposing drastic reductions in operational assistance. Local systems in Washington State are fortunate in having authorized funding mechanisms to support transit at the local level.

Being able to make comparisons such as the above should aid the manager and decision makers of that local system in assessing performance and suggesting "performance targets" (service standards) for future improvement strategies. For example, the system farebox ratio was .23 in 1980 and lower than the state and national average. In order to improve revenue generation and cost effectiveness, it would have been reasonable for the system to adopt a .25 farebox ratio as a performance target or system standard for 1981. Modest adjustments in increasing revenues and/or reducing operational cost in 1981 would have helped achieve that objective. Without such a basis of "peer group" comparisons however, it is more difficult for systems to choose reasonable and achievable performance objectives. Once statewide "peer group classification has been completed, other size and scale operations will be afforded similar comparisons. ,

MONITORING AND EVALUATION PROCESS FOR WASHINGTON STATE

In developing an evaluation program, there are several key questions which should be considered (25):

1. What is the purpose of evaluation?
2. Who are the participants in the process and what are their respective roles?
3. Who is the audience for evaluation results?
4. What is the appropriate level of detail for analysis?
5. What should be the frequency of evaluation?
6. What resources are available to conduct the evaluation?

Before addressing each of those questions relative to Washington State, an overview of experience in other states and local areas is presented.

Evaluation Experience to Date

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. Michigan is currently providing managerial assistance to local operators based on detailed analysis of transit performance of midsize systems. The latter example more closely compares to the needs of Washington State, yet the model does not address monitoring and evaluation from the perspective of small city and rural systems (i.e., those areas of less than 50,000 population). This omission will be addressed in the proposed model for Washington State.

At the local level, numerous municipalities and regional transit authorities have begun to develop performance monitoring programs to assist in local planning and decision making over time (3, 8, 9, 10, 27, 38).

Most evaluation plans reviewed provided discussion of policy framework, including goals, objectives, performance measures and standards. Many of the systems have developed functional area (maintenance, procurement, etc.) 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
- Road calls per 100,000 bus miles
- Cost per passenger
- Subsidy per passenger.

Typical operating standards were:

- .33-.40% of operating expenditures to be covered by passenger revenues
- Peak load factors of 1.25-1.50
- 1.5-2.0 passengers per mile of service per route (off peak minimum).
- 25-30 revenue passengers per hour of service per route (off peak minimums).

DOT engages in technical and managerial assistance, particularly for the smaller systems.

At the Federal level, the Department of Transportation and its Urban Mass Transit Administration (UMTA) are engaged in developing and implementing national policy and from that perspective are equally concerned with efficient and effective transit services.

Secondary Participants

The Washington State Transit Association (WSTA) plays an important supporting role by sponsoring conferences, seminars, and committee reports relative to transit performance. At a recent WSTA meeting it was suggested that the membership begin a process of "peer group" review through which a team of managers from one property would visit (by request) another property for the purpose of diagnostic evaluation of performance. This approach is still at the conceptual level, but when developed and implemented, could provide an important service.

Finally, Washington State Transportation Center (TRAC) as well as other research and consulting groups play a supporting role in the development and assessment of the evaluation methods.

Audience for Evaluation Results

All of the actors identified previously represent the general audience for evaluation results. It should be emphasized however, that local transit policy boards in this state have the primary responsibility for governing transit systems, and thus could be viewed as the primary audience.

Appropriate Level of Detail for Analysis

Local transit managers and policy boards will establish their own internal evaluation procedure and thus the extent of system, route, and functional area analysis will be left to their discretion. Suggestions by WSDOT and WSTA as to a prototype model will be developed.

At the State level, basic financial and operating characteristics would continue to be provided by the local operators. It is recommended that employment and safety information be added to that list of data elements. Figure 5 provides a summary example of the type of data to be reported. Appendix B provides a more comprehensive overview of data to be collected annually. These values would then be converted to transit performance measures and an annual report tracking progress over time would be prepared. The State may want to consider adopting a format similar to UMTA's Section 15 report (required for systems serving more than 50,000 population and receiving Section 5 operating assistance) for midsize and larger properties and a scaled down version for the small rural systems.

Frequency of Evaluation

For local internal evaluation, most boards meet monthly and management prepares operational reports for those meetings. Many systems then aggregate those monthly reports on an annual base to highlight major trends. At a minimum, an internal monitoring report should be prepared on a quarterly basis.

At the State level, reports are submitted annually. The State may want to consider adopting a fiscal year as opposed to calendar year reporting period to coincide with UMTA's Section 15 Report.

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FIGURE 5

TRANSIT DATA SUMMARY REPORT FORM

Name of system _____ Period covered _____ to _____

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 hours _____
14. Total vehicle miles _____
15. Revenue seat miles _____
16. Total vehicles _____
17. Vehicles operated during period _____
18. Peak hour fleet _____

Note: See Appendix B for more comprehensive list of data items and definition of terms.

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Resources

At the local level, management and its decision makers, will make a determination as to the amount of resources to be allocated to performance evaluation. Many of the smaller systems may be severely constrained in this respect and request assistance from WSDOT or WSTA.

State DOT will continue to devote a portion of its staff resources to performance evaluation at the aggregate level. Continued research and technical assistance support is presumed.

Suggested Evaluation Procedure for Washington

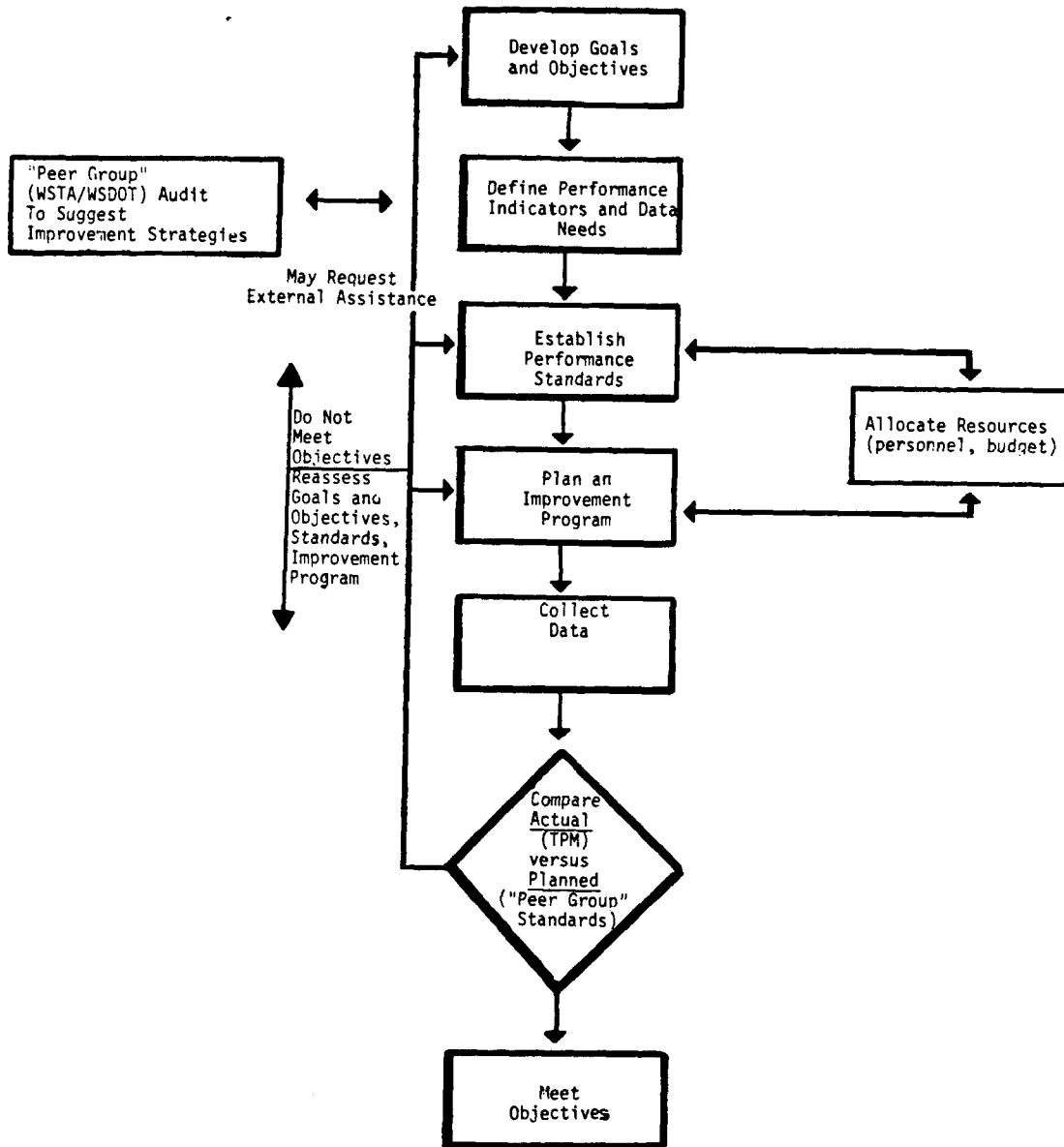
The public transit performance evaluation procedure suggested for Washington State is adapted from the methodology developed by Peat, Marwick, Mitchell & Co. for Michigan's State Department of Transportation (25) and consists of two major elements; one outlining an internal evaluation process to be conducted by local management and the other focusing on external evaluation of statewide "peer group" performance conducted by WSDOT and assisted by WSTA.

Internal (Local) Evaluation Process

The suggested local evaluation process incorporates key concepts of evaluation identified previously in Chapter Two into a general framework for internal management and self-evaluation of a transit system. Figure 6 diagrams major elements and their relationship. The process can be applied in assessing systemwide performance, individual route analysis or functional area (operations, maintenance, planning and marketing, and general administration) evaluation.

FIGURE 6

INTERNAL (LOCAL) EVALUATION PROCESS



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

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
- helps clarify and prioritize system objectives
- continuous monitoring and evaluation insures early diagnosis and resolution of potential problems
- helpful in assessing impacts of expanded or contracted service levels.

Key steps involved in implementing internal performance evaluation include the following:

1. **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 One for additional discussion).
2. **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. Two important sources of information for monitoring and evaluating transit performance are the UMTA Section 15 Report (for systems receiving Federal Operating Assistance) and WSDOT's annual operating report. Appendix A identifies a candidate list of 24 performance measures, their utility, and factors that influence respective values. Appendix B is a suggested reporting format for local managers to use in reporting annual operational and financial characteristics to WSDOT.
3. **Establish Performance Standards:** Performance Standards represent the minimal or threshold values indicating acceptable levels of performance. The standards established should be reasonable and achievable. In some cases, transit systems may prefer to establish performance targets,

implying more of a challenging objective, as opposed to standards that imply minimally acceptable values. Sources for information for developing developing performance standards or targets include:

- .evaluation of current and past performance of the transit system
 - .examining past and current performance of other transit systems, particularly those "peer group" systems of similar size and scale of operations.
4. Plan an Improvement Program: The improvement program is designed to aid the transit system in meeting established objectives. The plan should identify the activities proposed, personnel and equipment required, and state as explicitly as possible how the program will be accomplished. Additionally, a budget should be prepared estimating the cost for achieving the objectives and assessing whether resources are available for carrying out the program.
 5. Data Collection: Information required for performance monitoring should be carefully defined and collected on a routine and systematic basis.
 6. Compare Actual to Planned Performance: 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 achieved, 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; are staff motivated?)
 - .or reconsider the budget (Are there sufficient funds for carrying out the improvement?)

This process is clearly dynamic and interactive over time and if targets established at the first of the year are to be achieved, progress assessments can not be put off to the end of the year.

Finally, it is suggested there be an opportunity for local management 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 from WSTA 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 achieved. However, as experience is gained over time, more realistic expectations regarding performance improvements and their costs will be afforded.

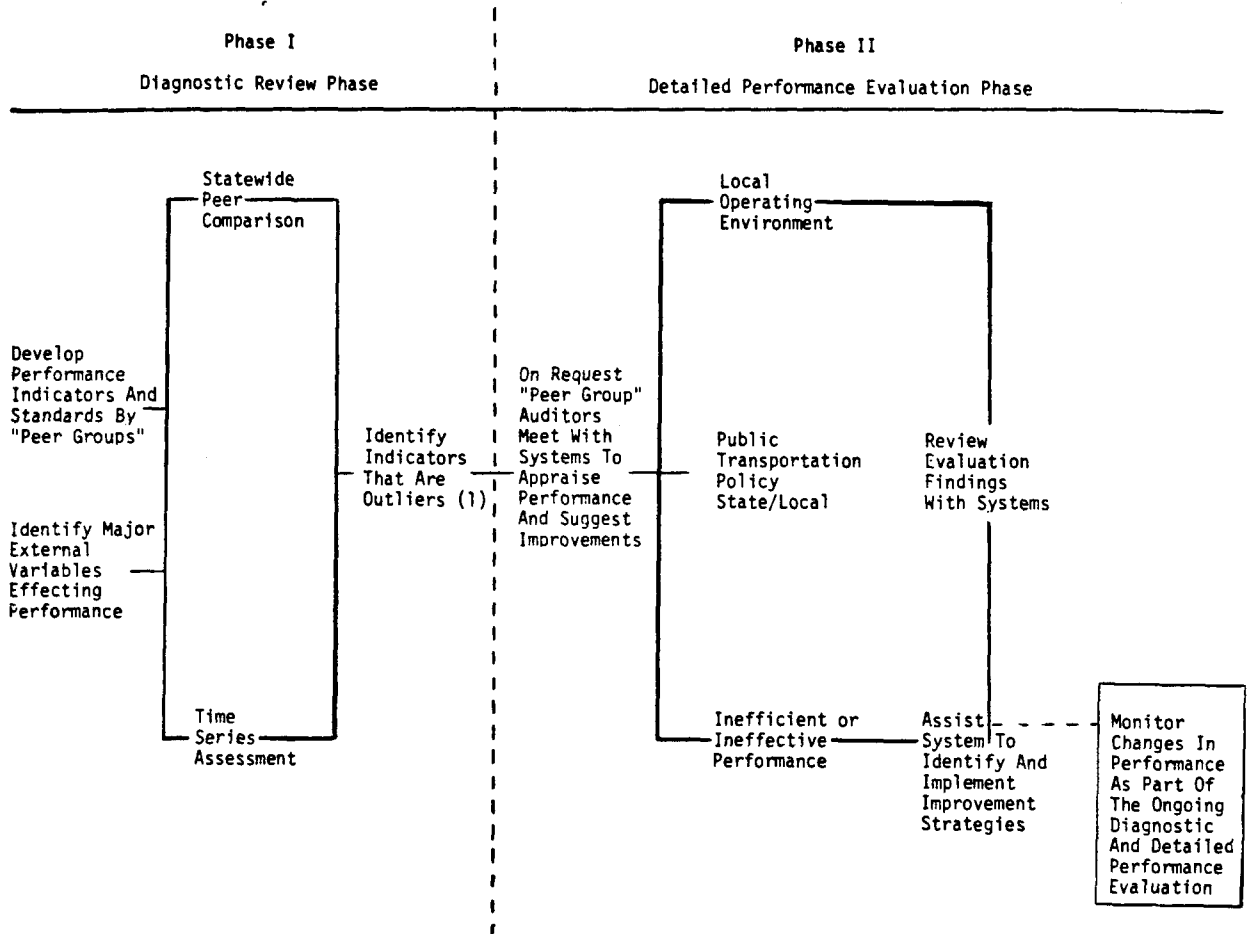
External Evaluation Process

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 2 phases; Phase I consists of assessing "peer group" performance, while Phase II entails a more detailed analysis of individual systems. Figure 7 outlines the major activities.

FIGURE 7

EXTERNAL EVALUATION PROCESS



(1) "Outlier" is the term used to describe performance indicator 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.

Diagnostic Review (Phase I)

The objectives of the diagnostic review phase are to:

1. Determine what information (demographic, financial, and operating characteristics) is most useful in assessing transit performance.
2. Identify recommended performance measures.
3. Develop a methodology for assigning transit systems in the state to appropriate "peer groups" of similar size and scale of operations.
4. Using 1980 data, analyze performance of each "peer group" to include:
 - .average values of selected performance measures
 - .range and standard deviation of values for each measure
 - .analysis of variables affecting performance.
5. Compare performance of individual systems with respective "peer groups".
6. Compare performance of each individual system to itself over time (3-4 year time period).
7. Identify performance measures within each system that appear to be outliers (greater or less than one standard deviation from the "peer group" mean).
8. Document assessment of "peer group" performance as described above to include a summary report comparing each individual system to respective group and to itself over time.

Currently, Washington State Transportation Center (TRAC) is engaged in performance evaluation research for Washington State Department of Transportation. The research will be completed in September and will contain the following products:

1. A transit classification system that will assign each transit system in the state to a logical "peer group".
2. A thorough analysis of transit performance within each "peer group" to include mean averages and value ranges of the salient characteristics.

3. A time series assessment of individual systems with comparative evaluation of the system to itself over time.
4. Based on the information from the above, suggested performance guidelines for each "peer group" will be developed. The guidelines will contain recommended TPM's, a range of performance values which suggest appropriate service standards, discussion of variables that impact performance and how they might be mitigated, and lastly, a brief procedure manual for conducting internal evaluation.

The products described above will be prepared in report form for WSDOT and WSTA review and comment.

Essentially, the work performed under the TRAC research described above will serve as the inaugural diagnostic review (Phase I). This "baseline" of information on "peer group" and individual system performance will be maintained and updated annually by WSDOT.

Detailed Evaluation (Phase II)

The purpose of Phase II is to provide an opportunity for more detailed evaluation of performance characteristics as identified in the diagnostic review. The initial step in Phase II would be the review and comment of the TRAC study by WSDOT. It is envisioned that members of WSTA's performance evaluation committee would also take part in that review.

Future steps in Phase II would represent a continuing process involving local management, WSDOT, and WSTA. There are two approaches that can be taken in implementing the detailed evaluation process: self assessment and on site visits by an evaluation team.

Self assessment would entail distributing materials prepared in the diagnostic review phase to each system. The materials would include the following:

1. Summary report evaluating the efficiency and effectiveness of the system in comparison to its respective "peer group" and to itself over time. The comparative evaluation would be directed exclusively to that system alone.
2. A self assessment manual (following guidelines as outlined in the internal evaluation process) that would provide background on performance evaluation, a general framework outlining procedures for conducting internal evaluation, candidate list of transit performance measures (including definitions and explanations), and examples (mini case studies) of how transit performance measures can be used to improve service.

It is presumed that transit managers would use the analysis of the diagnostic review report for their system in conjunction with the self assessment manual (some systems would already have an evaluation procedure in place) to develop an improvement program.

WSDOT may or may not wish to request a written response to inquiries on performance from each system.

The on site visit approach is considered to be optional and by request only from an individual system. It is envisioned that the interview would take place with the General Manager over a four to five hour period and would follow an informal but structured discussion focusing on the review of data and the system evaluation program. A scenario for an on site visit might be as follows:

One of the smaller transit systems in the state continues to have difficulty achieving the performance targets (standards) they have

established. After conferring with local decision makers, the manager requests, through State DOT, to have a small team (2-3 members from WSTA) conduct an on site performance audit. Prior to the on site visit, the audit team will have had an opportunity to review a "Phase I" type diagnostic report on the transit system and to request and receive any additional information required.

If success is to be achieved, it is critical that the evaluation team be perceived not as "auditors" in that strict, judgmental sense, but as fellow "peers" that may or may not be able to assist local management in "brainstorming" improvement strategies. Following the visit, field notes from each team member would be collected and synthesized into a report noting problem areas and suggested solutions.

The report would be forwarded to management for review and action as deemed appropriate. Perhaps some recommendations would not be considered feasible, given local conditions. It is anticipated in some cases that recommendations by external reviewers could be used to lend credence in persuading personnel or local decision makers of the efficacy of some action that had been avoided in the past due to lack of support. In most cases, however, it is felt the productive results of external evaluation would be in reinforcing successful management strategies and suggesting incremental improvements (drawn from the experience of the individual team members in their own systems) that taken singularly, might appear minor, but taken collectively and applied over time would lead to measureable improvements.

In addition to the scenario outlined above, both WSTA and WSDOT would support continuing evaluation through their state conferences and seminars.

WSTA management meetings and conferences can play a crucial role in supporting the suggested evaluation process by helping to overcome skepticism of any managers that may perceive the procedures from the "judgmental auditor" role. Additionally, information sharing on cost effective data collection/analysis

techniques and route or functional area performance improvement programs would particularly aid the small and midsize systems that are constrained by small management and planning staff.

Similarly, WSDOT's annual conferences would serve as a forum for exchanging state-of-the-art improvements in performance monitoring and evaluation. The Decision Maker's Conference, in particular, provides an excellent opportunity to acquaint new transit board members with evaluation concepts and procedures.

Conclusion

It is suggested this evaluation framework as implemented over time will increase the understanding of transit operations and performance in Washington by all affected parties and interest groups. Additionally, it will serve to enhance and facilitate opportunities for improving performance. Critical to the eventual implementation and success of the procedure suggested is a thorough review of the draft by WSDOT. Following that review, a copy should be forwarded to WSTA's Performance Evaluation Committee for their comments.

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APPENDIX A

SELECTED LISTING
AND EXPLANATION OF
PERFORMANCE MEASURES

Table of Contents

Operating expense/revenue vehicle hours	A- 1
Operating expense/revenue vehicle miles	A- 2
Operating expense/total vehicle hours	A- 3
Operating expense/total vehicle miles	A- 4
Operating expense/revenue seat miles	A- 5
Operating expense/total passengers	A- 6
Revenue/total passengers	A- 7
Revenue/operating expense	A- 8
Fare revenue/operating expense	A- 9
Passengers (unlinked)/transfer passengers	A-10
Total passengers/revenue vehicle hours	A-11
Total passengers/revenue vehicle miles	A-12
Total passengers/vehicles operated during period	A-13
Total passengers/service area population	A-14
Number of accidents/1000 miles	A-15
Number of road calls/1000 miles	A-16
Total vehicle miles/gallons of fuel consumed	A-17
Revenue vehicle miles/service area population	A-18
Revenue vehicle miles/revenue vehicle hours	A-19
Total vehicles minus peak hour fleet/peak hour fleet	A- 20
Revenue vehicle hours/total vehicles	A- 21
Revenue vehicle hours/operating employee hours	A- 22
Revenue vehicle miles/revenue vehicles	A-23
Total passengers/total employees	A-24

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 administrative employees of the transit system during the reporting period. Part time and contract employment 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 size
- ** Transit demand
- ** Travel generation

APPENDIX B

Suggested

Annual Report Form
for Public Transportation Systems
in Washington State

CONTENTS

Part A: Description of Service	B-1
Part B: Basic Information	B-3
Part C: Performance Measures	B-4
Part D: Demand-Response Service	B-6
Part E: Annual Revenue Summary	B-7
Part F: Annual Expense Summary	B-8
Part G: Vehicle Inventory	B-9
Part H: Definitions	B-10

5. Number Of Transit Employees

	<u>FT</u>	<u>PT</u>
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.

$\frac{\text{Operating expense}}{\text{Revenue vehicle hours}}$	=	\$ _____ (line 1)	=	\$ _____ /hour
		(line 11)		
$\frac{\text{Operating expense}}{\text{Revenue vehicle miles}}$	=	\$ _____ (line 1)	=	\$ _____ /mile
		(line 13)		
$\frac{\text{Operating expense}}{\text{Total vehicle hours}}$	=	\$ _____ (line 1)	=	\$ _____ /hour
		(line 12)		
$\frac{\text{Operating expense}}{\text{Total vehicle miles}}$	=	\$ _____ (line 1)	=	\$ _____ /mile
		(line 14)		
$\frac{\text{Operating expense}}{\text{Revenue seat miles}}$	=	\$ _____ (line 1)	=	\$ _____ /seat mile
		(line 15)		
$\frac{\text{Operating expense}}{\text{Total passengers}}$	=	\$ _____ (line 1)	=	\$ _____ /passenger
		(line 4)		
$\frac{\text{Revenue}}{\text{Total passengers}}$	=	\$ _____ (line 2)	=	\$ _____ /passenger
		(line 4)		
$\frac{\text{Revenue}}{\text{Operating expense}}$	=	\$ _____ (line 2)	=	_____ %
		(line 1)		
$\frac{\text{Fare revenue}}{\text{Operating expense}}$	=	\$ _____ (line 3)	=	_____ %
		(line 1)		
$\frac{\text{Passengers (unlinked)}}{\text{Transfer passengers}}$	=	\$ _____ (line 4)	=	_____ %
		(line 5)		
$\frac{\text{Total passengers}}{\text{Revenue vehicle hours}}$	=	\$ _____ (line 4)	=	_____ passengers/hour
		(line 11)		
$\frac{\text{Total passengers}}{\text{Revenue vehicle miles}}$	=	\$ _____ (line 4)	=	_____ passengers/mile
		(line 13)		
$\frac{\text{Total passengers}}{\text{Vehicles operated during period}}$	=	\$ _____ (line 4)	=	_____ passengers/vehicle
		(line 17)		

continued

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System _____ Year 19 _____

Part C: Performance Measures

<u>Total passengers</u>	=	_____ (line 4)	=	
<u>Service area population</u>		_____ (line 10)		<u>passengers/capita</u>
<u>Number of accidents</u>	=	_____ (line 7)	=	
<u>1000 miles</u>		_____ (line 14/1000)		<u>accidents/1000 miles</u>
<u>Number of road calls</u>	=	_____ (line 8)	=	
<u>1000 miles</u>		_____ (line 14/1000)		<u>road calls/1000 miles</u>
<u>Total vehicle miles</u>	=	_____ (line 14)	=	
<u>Gallons of fuel consumed</u>		_____ (line 6)		<u>miles/gallon</u>
<u>Revenue vehicle miles</u>	=	_____ (line 13)	=	
<u>Service area population</u>		_____ (line 10)		<u>miles/capita</u>
<u>Revenue vehicle miles</u>	=	_____ (line 13)	=	
<u>Revenue vehicle hours</u>		_____ (line 11)		<u>miles/hour</u>
<u>Total vehicles minus</u>	=	_____ (lines 16-18)	=	
<u>peak hour fleet</u>		_____ (line 18)		<u>%</u>
<u>Revenue vehicle hours</u>	=	_____ (line 11)	=	
<u>Total vehicles</u>		_____ (line 16)		<u>hours/vehicle</u>
<u>Revenue vehicle hours</u>	=	_____ (line 11)	=	
<u>Operating employee hours</u>		_____ (line 9)		<u>%</u>

PUBLIC TRANSPORTATION ANNUAL REPORT

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 _____

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System _____ Year 19 _____

Part E: Annual Revenue Summary

<u>Revenue Object Class Code</u>	<u>Revenue Description</u>	<u>Total for Year</u>
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).

PUBLIC TRANSPORTATION ANNUAL REPORT

Name of System _____

Year 19 _____

Part F: Annual Expense Summary

<u>Section 15 Function Code</u>	<u>Expense Description</u>	<u>Total for Year</u>
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.

PUBLIC TRANSPORTATION ANNUAL REPORT

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							

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

Transportation 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 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.

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.

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 trip is paid for by contract. Excludes nonfare paying passengers and transfer passengers even if they pay a transfer fee.

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 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.

Revenue vehicle

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

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.

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.

Spare vehicles

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.

Total passengers (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.

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.

Total vehicle miles

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. (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.)