Transit System Performance Evaluation Methodology
For Washington State

WA·RD 57.2
TRANSIT SYSTEM PERFORMANCE EVALUATION METHODOLOGY FOR WASHINGTON STATE

SUMMARY

WA-RD 57.2

Prepared for
Washington State Transportation Commission
Department of Transportation
and in cooperation with
U.S. Department of Transportation
Federal Highway Administration

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Study Purpose

During the past eight years of substantial growth in the transit service throughout Washington State, there have been major improvements in transit effectiveness as measured by increased ridership and breadth of service. However, transit efficiency has declined as measured by a 40% (constant dollar) increase in operating cost per vehicle mile. Increases in costs of service, supplying service in areas of marginal demand, and local policies of maintaining minimum fares have necessitated greater public expenditures.

The purpose of this study was to identify major concepts of transit performance evaluation and suggest procedures and guidelines for local and external evaluation in Washington State. Study objectives were:

- Identify performance measures
- Develop local and external evaluation methods
- Develop peer groups

Efficiency = Inputs + Outputs
Effectiveness = Achieving System Objectives
Statewide Public Transit Use

Gap Between Revenue and Cost (Statewide)
Transit Performance Measures

Transit performance measures are values representing production, consumption and quality variables associated with the operation and financial characteristics of transit service. The measures are generally quantifiable and can be expressed as whole numbers, percentages, or ratios.

Most often these performance measures are expressed as ratios. As an example, the measure "passengers per vehicle hour" expressed in ratio form captures the relationship between service output (vehicle hours) and units of consumption (passengers).

Performance measures are a major instrument of evaluation and are used to assess whether or not transit service is achieving intended objectives.

The major purposes for using performance measurement are to allow transit management to make more rational choices regarding resource allocations and to provide a means of communicating service policies to the general public.

Information Needs

- Financial Characteristics
- Operational Characteristics
- Passenger Profiles
- Route Analysis
- Service Consumption
- Functional Area Productivity
- User Satisfaction
EXAMPLE

Transit Performance Measures

- Passengers per Vehicle Mile or Hour
- Operating Cost per Vehicle Mile or Hour
- Revenue per Passenger
- Operating Ratio (Passenger Revenue ÷ Operating Costs)
- Peak Load Factor (# of Seats ÷ # of Passengers)
- Road Calls per 100,000 Miles
- Passengers per Service Area Population
Local Evaluation Process

The suggested local process can be applied in assessing system-wide performance, individual route analysis or functional area (operations, maintenance, planning and marketing, and general administration) evaluation.

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

Phase I - conduct baseline inventory

Phase II - develop evaluation plan

Phase III - institute continuous monitoring and evaluation program

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

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

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

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

Phase III - The performance monitoring program should aid the transit system in meeting established objectives. The program should identify activities proposed, personnel and equipment required, and state as explicitly as possible how the program will be implemented.

A budget should be prepared estimating the cost for achieving the objectives and assessing whether resources are available to carry out the program. Information required for performance monitoring should be carefully defined and collected on a routine and systematic basis.

Throughout the year (minimally on a quarterly basis), actual performance objectives should be compared to planned objectives to determine if performance is on target. If it appears objectives are being met, no action is required. However, if objectives are not met, action should be initiated.
CONDUCT BASELINE INVENTORY
INTERNAL MANAGEMENT
SERVICE/ROUTE ANALYSIS

DEVELOP GOALS
AND OBJECTIVES

SELECT PERFORMANCE
MEASURES AND IDENTIFY
INFORMATION NEEDS

ESTABLISH PERFORMANCE
TARGETS AND STANDARDS

PLAN MONITORING AND
IMPROVEMENT PROGRAM

IMPLEMENT MONITORING
PROGRAM:
COLLECT DATA
ANALYZE RESULTS

COMPARE ACTUAL (TPM)
VS PLANNED PERFORMANCE
TARGET STANDARDS

MEET OBJECTIVES

Implementation Steps
The purpose of the external evaluation is to assist WSDOT, or others, in providing appropriate managerial and technical assistance to local systems and to assure state decision makers, e.g., the legislature, that public transportation service is being provided efficiently and effectively.

The external process is divided into two phases. Phase I consists of assessing statewide and peer group performance, while Phase II entails a more detailed analysis of individual systems.

**Phase I - Diagnostic Review**
The objectives of the diagnostic review are to:

- Determine what basic information (transit area, socio-economics, population) is most relevant in assessing characteristics that influence transit performance

- Develop selected set of performance measures for external evaluation

- Develop a methodology for classifying transit systems in the state into appropriate peer groups of similar size and scale of operation

- Using current data, analyze performance of each peer group to include the average values of selected performance measures, the range and standard deviation of values for each measure, and an analysis of variables affecting performance

- Compare performance of each individual system to itself over time (3-4 year period)

- Compare performance of individual system with respective peer group

- Identify performance measures within each system that appear to be outliers (greater or less than one standard deviation from the peer group mean)

- Document assessment of peer group performance in a summary report comparing each individual system to itself over time and to its relative peer group.

This baseline of trends and cross-sectional information should be maintained and updated annually by WSDOT.

**Phase II - Detailed Evaluation**
The purpose of Phase II is to provide an opportunity for more detailed evaluation of performance as identified in the diagnostic review. The initial step in Phase II would be to review and comment on the comparative analysis. It is envisioned that other participants (e.g., local managers and decision makers) would take part in the review.

Future steps in Phase II represent a continuing process involving local and state decision makers, transit managers, and WSDOT. There are two approaches that can be taken in implementing the detailed evaluation process: self-assessment and on-site visits by an evaluation team. The objectives of both approaches are the same:

- To identify specific areas of transit service that represent superior performance and/or areas warranting improvements
External Evaluation Process

PHASE 1

1. SELECT EVALUATION PROCEDURES

2. COLLECT AND ANALYZE PERFORMANCE DATA
   TIME SERIES ASSESSMENT
   PEER GROUP ANALYSIS
   FACTORS INFLUENCING PERFORMANCE

3. DOCUMENT FINDINGS

4. REVIEW WITH AFFECTED PARTIES

PHASE 2

1. COMMUNICATE FINDINGS

2. DEVELOP AND MAKE AVAILABLE SELF-ASSESSMENT MANUAL

3. ON REQUEST, CONDUCT ON-SITE VISITS
   IDENTIFY PROBLEM AREAS
   SUGGEST IMPROVEMENT STRATEGIES

4. REVIEW WITH TRANSIT MANAGEMENT
To assist local transit agencies in developing and improving services with a minimum of state interference

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

A 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 to that system alone.

A self-assessment manual (if the system did not have its own local evaluation program) that would provide background on performance evaluation, a general framework outlining procedures for conducting internal evaluation, a candidate list of transit performance measures (including definitions and explanations), and examples (mini case studies) of how transit performance evaluations can be used to improve service.

On-site Visits 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 and staff over a one- or two-day period and would be followed by an informal but structured discussion focusing on the review of data and the system's evaluation program.
Key Principles of Performance Evaluation

1. WHAT GETS MEASURED - GETS IMPROVED
2. MEASURES MUST BE BASED ON SYSTEM VALUE
3. PEOPLE, NOT PROCEDURES, IMPROVE PERFORMANCE OF A SERVICE
4. ALL PROBLEMS CAN NOT BE SOLVED AT THE SAME TIME
5. EVALUATION MUST BE POSITIVE, NOT PUNITIVE
Comparability

A major constraint to developing a statewide evaluation program has been the issue of comparability between individual systems being examined. Transit operators are concerned that evaluation programs have not sufficiently accounted for differences in size and scale of operation or environmental conditions. Acknowledging this problem, research directed at developing a peer group classification scheme was conducted.

Methods

Using statistical methods, three alternative data sets were examined. Results from the analysis of one data set (79-80 Section 15 Report) were not satisfactory due to extreme variability on certain measures. Distinct groupings were derived, however, using two of these sets of data. Preliminary results were tested using alternative verification techniques. Seven peer group classes for 16 systems (1980) were defined for use in Washington State. The figure depicts the cluster for these groups.

These groups in the figure are only for illustration. Proper peer groups would be developed using transit systems from several other states. Once peer groups were developed, performance measures would be developed for each group. Individual systems could then be compared to their peer groups such as discussed earlier.
Cluster Dendogram of 1980 WSDOT Data
<table>
<thead>
<tr>
<th>CONCEPT MEASURED</th>
<th>TRANSIT PERFORMANCE MEASURE</th>
</tr>
</thead>
<tbody>
<tr>
<td>Service Cost Efficiency</td>
<td>Operating Expense/Total Vehicle Hours</td>
</tr>
<tr>
<td></td>
<td>Operating Expense/total Vehicle Miles</td>
</tr>
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<td>Vehicle Efficiency</td>
<td>Total Vehicle Miles/Total vehicles</td>
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<td></td>
<td>Total Vehicle Hours/Total Vehicles</td>
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<td>Service Cost Effectiveness</td>
<td>Operating Expense/Miles of Line</td>
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<td>Operating Expense/Total Passengers</td>
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<tr>
<td></td>
<td>Total Revenue/Total Passengers</td>
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<td>Total Revenue/Operating Expense</td>
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<td>Passenger Revenue/Operating Expense</td>
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<td>Effectiveness of Service Consumption</td>
<td>Total Passengers/Miles of Line</td>
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<td>Total Passengers/Total Vehicle Miles</td>
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<td></td>
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<td>Total Passengers/Total Vehicles</td>
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<td>Effectiveness of Service Design and</td>
<td>Total Passengers/Service Area Population</td>
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<tr>
<td>Distribution</td>
<td>Total Vehicle Miles/Service Area Population</td>
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<td></td>
<td>Total Vehicle Hours/Service Area Population</td>
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<td></td>
<td>Total Vehicle Miles/Miles of Line</td>
</tr>
<tr>
<td></td>
<td>Total Vehicle Hours/Miles of Line</td>
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<td></td>
<td>Service Area Population/Miles of Line</td>
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<td>Effectiveness of Revenue Generation</td>
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<td>Passenger Revenue/Total Vehicle Hours</td>
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<td>Effectiveness of Public Assistance</td>
<td>Total Vehicle Miles/Local Tax Assistance</td>
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<td>Total Passengers/Local Tax Assistance</td>
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<td>Total Passengers/Total Operating Assistance</td>
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<tr>
<td></td>
<td>Service Area Population/Total Operating Assistance</td>
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# Peer Group Clusters Based on Service Distribution/Design Characteristics

<table>
<thead>
<tr>
<th>TPM/Central Tendency Category</th>
<th>Metro</th>
<th>Large Urban</th>
<th>Midsize Regional</th>
<th>Midsize Municipal</th>
<th>Small City Regional</th>
<th>Small City Municipal</th>
<th>Rural Transit</th>
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<tbody>
<tr>
<td>System</td>
<td>Seattle Metro</td>
<td>City of Spokane, City of Tacoma</td>
<td>Intercity Transit, Community Transit, Vancouver</td>
<td>Bellingham</td>
<td>Everett</td>
<td>Grays Harbor, Twin, Community Urban</td>
<td>Pullman, Yakima, Prosser</td>
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<tr>
<td>POP/LM range</td>
<td>1200-2500</td>
<td>700-1200</td>
<td>500-1000</td>
<td>400-600</td>
<td>300-900</td>
<td>500-600</td>
<td>50-300</td>
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<tr>
<td>mean</td>
<td>2142</td>
<td>991</td>
<td>738</td>
<td>498</td>
<td>611</td>
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<tr>
<td>SD</td>
<td>519</td>
<td>285</td>
<td>242</td>
<td>57</td>
<td>376</td>
<td>17</td>
<td>172</td>
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<td>PASS/LM range</td>
<td>50-75,000</td>
<td>30-50,000</td>
<td>10-20,000</td>
<td>15-25,000</td>
<td>4-8,000</td>
<td>10-15,000</td>
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<td>18,139</td>
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<td>760</td>
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<tr>
<td>SD</td>
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<td>11,893</td>
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<td>5,652</td>
<td>2,424</td>
<td>2,642</td>
<td>843</td>
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<tr>
<td>VM/LM range</td>
<td>20-30,000</td>
<td>15-20,000</td>
<td>5-10,000</td>
<td>6-8,000</td>
<td>4-7,000</td>
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<td>500-2,000</td>
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<tr>
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<tr>
<td>SD</td>
<td>7,953</td>
<td>3,559</td>
<td>1,822</td>
<td>670</td>
<td>3,080</td>
<td>715</td>
<td>2,043</td>
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<tr>
<td>VH/LM range</td>
<td>1500-2000</td>
<td>900-1300</td>
<td>400-700</td>
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<td>250-500</td>
<td>500-700</td>
<td>50-250</td>
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<tr>
<td>mean</td>
<td>1889</td>
<td>1188</td>
<td>537</td>
<td>833</td>
<td>399</td>
<td>561</td>
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<tr>
<td>SD</td>
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<td>160</td>
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<td>203</td>
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<td>VH/POP range</td>
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<td>1.0-1.5</td>
<td>0.7-0.8</td>
<td>1.0-1.25</td>
<td>0.3-0.7</td>
<td>0.6-0.7</td>
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<tr>
<td>VM/POP range</td>
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<td>10-15</td>
<td>10-15</td>
<td>5-10</td>
<td>8-10</td>
<td>10-15</td>
</tr>
<tr>
<td>mean</td>
<td>23.17</td>
<td>16.05</td>
<td>10.74</td>
<td>12.38</td>
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<td>8.5</td>
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<td>30-40</td>
<td>10-20</td>
<td>25-35</td>
<td>5-10</td>
<td>15-20</td>
<td>5-10</td>
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<tr>
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<tr>
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<td>3.6</td>
<td>7.85</td>
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<td>3.27</td>
<td>4.76</td>
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</table>

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

Note: Bremerton could not be assigned to a peer group due to uniqueness of operational and service area characteristics.