Bus Service Evaluation Procedures: A Review

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16. Abstract

The report presents the results of a literature review and survey of 71 transit properties in the U.S. and Canada regarding bus service evaluation procedures currently in use. The focus of the study was to identify service performance indicators and criteria used to evaluate bus service on a route by route basis. Three types of evaluation indicators (service design measures, operating performance measures, and economic or productivity measures) were identified, and a range of standards which have been developed for each indicator are reported. The results are presented separately for transit properties owning less than and greater than 400 buses. Detailed appendices provide more complete information on the survey response. These appendices also provide the transit operator and regional transit planner with a compendium of a wide range of performance measures, descriptions of how they are used and how the needed data is collected, and a listing of contact persons in each property. The analysis of the results provides several insights and suggestions regarding the development of a systematic bus service evaluation program.

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BUS SERVICE EVALUATION PROCEDURES:

A REVIEW

Prepared By

Massachusetts Bay Transportation Authority
Tidewater Transportation District Commission

Prepared For

U. S. Department of Transportation
Urban Mass Transportation Administration
Office of Planning Assistance

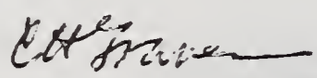
March, 1979

FORWARD

Many transit operators have a critical need for a service evaluation system which can measure existing service performance. To assist these operators, UMTA's Office of Planning Assistance, through its Special Studies Program, has initiated operator prototype studies in Boston and Norfolk. The purpose of these studies is to develop and test systems for bus service evaluation. The emphasis of these studies is on how local operators can use existing planning techniques to meet their evaluation needs.

This document represents the first interim report from these studies. It summarizes a survey of evaluation techniques used by transit operators in the United States and Canada. We believe this "State-of-the-Art" review will be of great value to transit operators who are interested in improving their evaluation systems.

Additional copies of this report are available from the National Technical Information Service (NTIS), Springfield, Virginia 22161. Please reference UMTA-MA-09-7001-79-1 on the request.



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1.0 INTRODUCTION

Over the past few years, rising costs and limited budgets have encouraged transit authorities to evaluate the "cost-effectiveness" of the services they provide. In many cases, budget constraints have forced public transit properties to reduce service provided, either across the board or in selected areas. In almost all urban areas, new bus or service proposals have been critically examined, and evaluated in some way related to their potential effectiveness. While, to date, existing services have not been scrutinized as carefully, there is growing emphasis in this area. Recent UMTA Section 15 reporting requirements have further encouraged properties to collect the data necessary to assess transit services.

The Massachusetts Bay Transportation Authority (MBTA), Boston, Massachusetts, and the Tidewater Transportation District Commission (TTDC), Norfolk, Virginia, are among many properties interested in updating and improving bus service evaluation programs. The MBTA and TTDC have received funding for the development of prototypical bus service evaluation programs from the Planning Research and Evaluation Division of the Urban Mass Transportation Administration, U. S. Department of Transportation. These otherwise independent projects include a joint review of the state-of-the-art in bus service evaluation techniques across the country. This information will be used to develop bus service evaluation programs for both TTDC and the MBTA. To identify current evaluation procedures, the review included a literature search as well as a survey of transit properties in the United States and Canada.

TTDC, an authority with 175 buses, contacted properties with less than 400 buses; the MBTA, which operates 954 buses, concentrated on the larger authorities. Of the 230 U. S. and 10 Canadian properties that were contacted, 32 percent provided information on their evaluation techniques. Information was gathered on service policy standards, evaluation criteria, data requirements and collection techniques, and management procedures.

This report analyzes the results of this survey, presents the findings of the literature search, and provides a compendium of the specific data gathered from each authority. Section 2 discusses the results of the literature search; Section 3 presents the results of the survey of transit operators; and Section 4 includes a number of conclusions regarding the current state-of-the-art in service evaluation methods. The five appendices provide more detailed information on the available literature on the subject and more specific information on the

various evaluation procedures currently used by transit properties responding to the survey.

2.0 LITERATURE REVIEW

An initial review of the literature related to evaluating bus transit service indicated that several well-documented bibliographies have recently been compiled. The comprehensive literature review included in "Development of Performance Indicators for Transit" (Fielding), University of California, Irvine, December, 1977, concentrated on reviewing that literature which is most directly related to this present study. This recent, well-referenced review is presented in its entirety in Appendix A.

2.1 General Literature

The largest portion of the literature reviewed in the Irving study directly addressed the issues surrounding transit service evaluation. The authors found that evaluating transportation alternatives in particular cities and regions has received the most attention in the literature. In these cases, the effectiveness of different modes or various types of transit service was compared rather than the differences in effectiveness between similar services of the same mode.

The Irvine review (see Appendix A) also includes a discussion and bibliography of topics including service standards, alternative analysis, government assistance, as well as evaluation research theory and other bibliographies. Reports on service standards include literature reviews, listings and discussions of possible transit performance criteria, weighting of performance criteria, and development of evaluation strategies. Studies on governmental assistance include discussions of the effect which government subsidies currently have on promoting transit industry efficiency.

A number of other sources reviewed for this study discuss evaluating system performance in general and include possible evaluation schemes for comparing similar services. Several additional sources on this latter area of study are included in the bibliography compiled as part of this current study (see Appendix B). Fielding's work for the Irvine study, a thorough study on transit service evaluation, adds to this literature by discussing the importance of developing transit performance indicators and by analyzing the usefulness of specific indicators. These indicators are later used to compare transit properties in California and Washington.

Several key findings in this review of the general literature are particularly relevant to this current study:

- A variety of literature exists which details different transit service evaluation methods and performance indicators;

- Although some of the literature provides guidance on the usefulness of various service indicators, it is important for individual transit properties to develop their own conceptual framework for using these indicators and other performance criteria;

- A distinction should be made by management in monitoring so-called "effectiveness" indicators (which have a direct impact on ridership) as opposed to "efficiency" indicators (which relate more to internal productivity);

- Attention should be focused on developing indicators and evaluation techniques which are sufficiently detailed to reveal differences in the performance of similar bus routes and the impacts on various user groups.

2.2 Operator Literature

A limited amount of literature on current service standards and policies was also reviewed by the Irvine study team. These sources emphasize the measures, such as passengers per bus mile or subsidy per passenger, used to analyze and compare existing and proposed bus services. They also often describe the development of a rational basis for making service reductions brought on by budget constraints.

The bibliography compiled as part of this present study (see Appendix B) expands on this aspect of transit service evaluation, and provides a list of publications and working papers which describe on-going bus service evaluation programs at U. S. and Canadian transit authorities.

Not surprisingly, the majority of the literature cited here deals with large authorities. Eleven service policies from authorities are included. Two authorities, Seattle Metro and Toronto, provided the most interesting and comprehensive information. Both authorities produced follow-up publications documenting steps taken to implement their service policies. Using adopted evaluation procedures and standards, Toronto has produced a report which evaluates and ranks a number of proposed service improvements, and lists the least cost-effective existing bus routes. Seattle produced a report which summarizes the seat availability, productivity, and on-time performance of each route. A

discussion is presented of the results as well as of some of the limitations of the data.

A number of papers have been written which describe Southern California Rapid Transit District's service policy, adopted in 1975, and discuss steps which have been taken to implement and revise the standards. Six standards are currently being utilized. "Data Requirements for Transit Planning", written two years after the service guidelines were first adopted, describes the desirable properties of good information systems and then outlines specific data needs and methods of data collection and processing. "The SCRTD Service Evaluation Program" (1978), presents a brief history of the methods which have been used to evaluate service, provides a rationale for this line evaluation program, and assesses its results.

The Washington Metropolitan Area Transit Authority has compiled a list of 43 performance measures and 11 operational standards. In a report entitled, "Metrobus Performance Measures and Indicators", the authority compares 1978's actual results with the stated objectives for 1978, and establishes new objectives for 1979.

Edmonton has designed a study to evaluate its bus operation on a route by route basis. Rough estimates of the manpower needed to implement the evaluation recommendations are included. Proposed transit service improvements for San Diego were published in an "Action Plan" in February, 1974. The plan was based on an evaluation of existing routes using 7 performance measures. In addition, areas were identified which were being underserved and neighborhoods were ranked according to their ridership potential.

Some of the reports generated by the various transit properties briefly discuss the cost-effectiveness of implementing service standards. Positive results have been presented in various reports from Montreal, Seattle, Toronto and Los Angeles. This data is presented in Section 3.4.5, "Effectiveness of Service Evaluation in Larger Bus Systems." However, there has been virtually no empirical analysis of how cost-effective it has been for authorities to implement service policy guidelines and standards. This type of analysis would require a very thorough understanding of each authority in question. Since most authorities which have developed comprehensive performance guidelines have only begun to implement them, such a study in the United States would be limited to a few operators.

2.3 Conclusions

Much work has already been done on developing methods of evaluating transit service. Ample material has been written on evaluation schemes, measures and indicators which can be used to evaluate service, and appropriate standards to be applied to various types of service. Measures, such as passengers/vehicle hour, passengers/vehicle mile, peak vehicle loads and subsidy/passenger are cited as being typically useful evaluation indicators. Through consultation with the surveyed authorities (see Appendices D and E), any transit property or transportation planning organization can review and select from a wide range of alternative evaluation methods and measures.

Generally, the literature suggests that the same type of evaluation measures and standards can be and, usually, are applied to both newly proposed and existing services. The degree to which the evaluation techniques are applied does vary, though, depending on the performance of existing routes and the budgetary considerations which dictate the degree of expansion or reduction of service in any given year.

Unfortunately, there is still little known about the cost-effectiveness of implementing systematic evaluation of transit services. More emphasis needs to be placed on the testing of actual applications of transit service standards and systematic evaluation procedures. Reports and critical appraisals of such tests will serve to further the knowledge of those techniques which are most useful, and provide operators a surer choice of the least costly, yet effective, methods.

3.0 RESULTS OF SURVEY

The survey of transit properties throughout the United States and Canada produced a wealth of information about how transit operators currently undertake self-evaluation. The reports submitted by transit authorities have been systematically reviewed, and this section presents the distilled results of the survey. In addition, it was necessary, and hopefully enlightening to present several anecdotal cases. A description of the survey is followed by discussion of the survey response, reported results from small and medium sized properties, and results from the analysis of the larger properties. While an effort has been made to report the same type of information about both large and small operators, the complexity of the operating environments and current evaluation methods vary so dramatically that it is not practical to structure the analysis presented here in the same way for both system size categories. The results presented in this section are largely based on the more detailed, property-specific and criteria-specific information presented in Appendices D and E.

3.1 Description of Survey

In August, 1978, an informal mail-back survey was sent to 240 transit properties of all sizes in the United States and Canada. Basic bus system descriptive data was requested so that similar size and type of operations could be grouped. A copy of the survey questionnaire and the accompanying letter, which solicited any available information on current bus evaluation practices, is included in Appendix C.

Generally, the survey asked managers of the various transit authorities to describe their service evaluation procedures by listing the criteria or standards used to assess service delivery and performance, as well as those indicators used to rank or choose selected service improvements or reductions. Also requested were the methods used to collect data needed to determine the values of these criteria, the frequency of collecting these data, the department responsible for the data collection and analysis, and the cost associated with the use of the various evaluation measures. Finally, operators were asked to assess the impact or effectiveness of the evaluation procedures used, recognizing that this would require a somewhat subjective judgement.

For ease of analysis, the MBTA and TTDC, shared the review of the returned surveys. The TTDC analyzed small and medium sized bus operations (up to 400 buses) and the MBTA examined those larger systems with more than 400 buses. This division generally marks the system size which requires the operation of more than one bus division or garage and for which data collection procedures becomes more complex.

3.2 Survey Response

Of the 195 small and medium sized transit properties contacted by the TTDC, 48 responded to the survey. A response was received from 23 of the 45 properties with over 400 buses contacted by the MBTA.

Table 1 summarizes the general characteristics of the respondents by system size and basic operating characteristics.

The response sample appears to be representative of the industry in terms of system size, geographic location, and type of area served. As with any survey of this type, the response is probably biased towards those systems currently using an organized service evaluation procedure since these systems could most easily describe their ongoing efforts. An example of this bias is seen in the nearly 100 percent return rate for the Canadian systems which were solicited. For the most part, the Canadian systems have on-going, highly organized bus service evaluation policies and procedures.

One note on the type of evaluation information reported is in order. Many of the responses from operators contained information about how they evaluate their internal management performance (through the use of so-called "efficiency" measures) as well as the evaluation of actual service delivery performance (using so-called "effectiveness" measures). An example of an efficiency measure is "revenue bus miles per employee" while a typical effectiveness measure would be "passengers per bus mile". Since this study concerns the monitoring and evaluation of transit service and passenger response to this service, discussion of the results and data presented in the appendices relate only to the use of effectiveness measures. While it is clearly recognized that aggressive monitoring of the efficiency of internal functions such as scheduling and maintenance has a profound influence on resources available for service delivery in every property, these efficiency issues are left to other reviews.

3.3 Service Evaluation in Small and Medium-Sized Properties

From analyzing the forty-eight responses of small and medium sized properties (operating up to 400 buses), it is apparent that the use of a wide range of explicit, service evaluation techniques is not common practice. Three notable exceptions are San Diego Transit (San Diego, Ca.), Central New York Regional Transportation Authority (Syracuse, N.Y.) and the Transit Authority of River City (Louisville, Ky.). In addition, one third of the respondents do not use any explicit (or formal) service evaluation criteria.

The smaller number of buses and routes operated by small properties is conducive to frequent collection and analysis of ridership, operating and schedule adherence data. Also,

TABLE 1

CHARACTERISTICS OF RESPONDENTS

	Number of Buses	Population Served	Peak Buses Required	Annual Ridership	Number of Routes	Daily Bus Miles	Total Employees
SMALL PROPERTIES[1]							
Mean	40	149,450	32	2,420,484	15	4,107	85
Low	4	12,000	3	106,592	2	290	10
High	99	300,000	78	6,666,061	29	13,062	248
MEDIUM PROPERTIES[2]							
Mean	203	847,811	171	13,344,056	45	20,095	459
Low	102	118,000	76	5,237,745	15	4,176	180
High	350	3,850,000	285	36,000,000	105	43,000	882
LARGE PROPERTIES[3]							
Mean	955	1,976,693	787	83,529,412	110	31,291,667	2,895
Low	414	471,427	369	30,100,000	36	1,400,000	956
High	2,391	7,000,000	1,819	450,000,000	203	92,759,000	7,963

[1]Properties operating 0 to 100 buses: 29 respondents.

[2]Properties operating 101 to 400 buses: 17 respondents.

[3]Properties operating 400 or more buses: 23 respondents.

while labor agreements exist in most systems, flexibility in the assignment of extra duties (such as data collection) seems to be much greater for small and medium sized properties. However, comprehensive service evaluation is not common.

The reasons for the apparent lack of comprehensiveness in the use of service evaluation criteria and methods by small and medium sized properties are not entirely clear, but several reasons can be postulated:

(1) These operators generally do not feel that they have sufficient management, planning or administrative staffs with the capability and/or time to evaluate service in a comprehensive manner;

(2) For small properties in particular, basic route data (such as passengers per trip) is recorded and used by those responsible for service design or scheduling in their on-going evaluation of their systems. While systemwide data is available and adjustments are made as carefully and regularly as in larger systems, written reports or other documentation are simply not prepared.

(3) It appears that the use of evaluation methods is directly related to the aggressiveness of the authority in selecting new markets, expanding service or reducing operating deficits. Since many small authorities are stable, managers of such systems are likely to be more concerned with routine service delivery tasks then with evaluation analysis.

The next section describes the use of evaluation criteria by small and medium sized properties. Examples of particularly detailed and/or unique evaluation criteria are presented. A brief section on the effectiveness of the evaluation methods used by small and medium sized properties follows the description of the criteria currently used.

3.3.1 Evaluation Criteria Used

Table 2 presents the most commonly cited service criteria used by the small and medium sized respondents as well as responses with respect to standards used, how data are collected, how often data are collected, cost for collection and analysis of data, and the number of respondents using the criteria. Of the eight criteria, the two criteria used most often by the respondents are the ratio of revenue to cost and schedule adherence. The use of these two criteria indicate that the respondents are primarily concerned with the economic and the schedule performance of their systems. The range of acceptable revenue to cost ratios for those properties responding was 0.20 to 0.50. Of course, these standards depend to a large degree on the fare structure used by each property. In some cases, the revenue to cost ratio is an informal input into fare increase deliberations.

TABLE 2

CRITERIA USED FOR BUS SERVICE EVALUATION

IN SMALL AND MEDIUM-SIZED PROPERTIES (LESS THAN 400 BUSES)

CRITERION	DESCRIPTION OF CRITERION	HOW DATA ARE COLLECTED	HOW OFTEN DATA ARE COLLECTED	COST FOR COLLECTION AND ANALYSIS OF DATA	NO. OF RESPONDENTS USING THIS MEASURE
Ratio of Revenue to cost	Range: 20% to 50% acceptable	Revenue data, cost data, cost allocation formula, ridership counts.	Collected monthly by the majority of respondents	Range: Negligible to $3,000 per year	18 (38%)
Schedule Adherence	Range of on-time definition: 1.5 minutes early to 5 minutes late The definition by the majority of respondents is zero minutes early to five minutes late	Supervisors and/or traffic checkers	Range: Daily to Quarterly	Range: $640 to $45,000 per year.	18 (38%)
Accessibility To Routes	Range for bus stop spacing: 660 feet to 2,000 feet Range for route spacing: .25 mile to one mile	Maps are used	Range: Reviewed monthly to every three years	Negligible	14 (29%)
Passengers per Vehicle Mile	Standard varies among respondents. Range: 1.0 - 2.5	Passenger data obtained from on-board surveys and the ratio computed from accumulated statistics	Range: Daily to Annually	Range: Negligible to $30,000 per year	14 (29%)
Loading (Passengers as % of seated capacity)	Peak service range: 100% to 175% Non-peak service range: 75% to 175%	On-board surveys, peakload counts.	Range: Monthly to Annually	Range: Negligible to $1,000 for each boarding and alighting check	13 (27%)

TABLE 2 (Cont'd)

CRITERION	STANDARDS	HOW DATA ARE COLLECTED	HOW OFTEN DATA ARE COLLECTED	COST FOR COLLECTION AND ANALYSIS OF DATA	NO. OF RESPONDENTS USING THIS MEASURE
Policy Headways	Standard varies among respondents. Range: 10 minutes early - 10 minutes late.	Obtained from scheduling surveys on passenger waiting time, and boarding and alighting checks	Range: Monthly to Annually	Range: Negligible to $1,000 for each boarding and alighting check	11 (23%)
Transferring	Standard varies among respondents. For one respondent, the number of transfers for the system should not exceed 40% of the total boarding passengers; for another respondent, the percentage was 25%	Determined from transfer tickets collected and operator records	Range: Daily to Annually	Negligible	10 (21%)
Passengers Per Vehicle Hour	Two standards mentioned by several respondents are: The minimum number of passengers per hour for urban routes is 33 and for suburban routes is 20 The minimum route ridership per hour is 60% of the system average	Farebox revenues, ridership counts	Monthly	Negligible except for one transit company reporting a yearly cost of $15,000 to $20,000	9 (19%)

For schedule adherence, the majority of respondents defined a bus as being on time when it is zero minutes early to five minutes late. For those properties responding, Utah Transit Authority (Salt Lake, Utah) has the most explicit standard; schedule adherence standards vary by headways and the percent of trips required to be on-time is specified.

Bus stop spacing and route spacing are measures of the accessibility criterion. The range of acceptable bus stop spacing for the respondents is 660 feet to 2000 feet; for route spacing the range is one-fourth mile to one mile. Central New York Regional Transportation Authority (Syracuse, NY) has a particularly detailed standard which includes density as a variable.

The standard for passengers per vehicle mile varies among the respondents. However, several respondents state that 1.5 passengers per vehicle mile for a given route is acceptable and less than 1.5 requires re-evaluation.

The criterion frequency of service (often referred to as policy headway) is a measure of the maximum time between consecutive buses. The standard for the majority of respondents is that headways should not exceed 30 minutes for peak service and 60 minutes for off-peak service.

The criterion loading is a measure of the number of passengers as a percentage of seated capacity. The range of maximum loading standards for those responding is 100% to 175% for peak service and 75% to 175% for non-peak service.

The standard for transferring is expressed as a percentage of the total number of boarding passengers, by the majority of those properties responding. Utah Transit Authority has a particularly interesting standard; 90% of the persons transferring should be able to do so within an average of one-third of the connecting route's headway. If more than 30% of the route's riders require a specific transfer, new or through routes should be established or scheduled transfer times established with a five minute maximum waiting time.

The standard for the criterion passengers per vehicle hour varies among the respondents. The following Metropolitan Transit Authority (Nashville, Tenn.) standard is one of the more developed: continue the route if the route ridership per hour exceeds 90% of the system average; review route if the route ridership per hour falls between 70% and 90% of the system average; if the ridership per hour falls between 60% and 70% of system average, recommend possible actions for improvement or discontinue; and if the ridership per hour falls below 60% of system average, continue service in six month intervals or discontinue.

A review of the frequency of use of the eight criteria described above, shows that the use of explicit evaluation is not common for small and medium sized properties. Thirty-three percent of the respondents do not use any of the eight criteria. Furthermore, almost half (or 48%) of the respondents use no more than one of the criteria.

In most smaller systems, it appears that the costs of data collection is not a particular problem. Data are generally collected by on-board surveys and from accumulated statistics In many cases, accurate ridership and revenue information is recorded and collected routinely by drivers for each trip and often these data are summarized daily. It is noteworthy that most of the standards reported by the respondents did not require significant expenditures and, in most cases, were made a part of the routine accounting and scheduling tasks. It appears, therefore, that the major cost of implementing comprehensive evaluation programs in small and medium sized systems would not be in data collection, but rather in developing an evaluation program and analyzing available data. Since each management staff person in the small and medium sized properties has many different responsibilities, it appears that the effort required to develop and carry out a systematic evaluation program has yet to be identified in most cases.

3.3.2 Effectiveness of Small System Service Evaluation

Although very little was directly reported on the effectiveness of small and medium sized system evaluation, it is apparent that those properties currently carrying out service evaluation see a positive effect for their efforts. The very size and extent of these systems and their service areas allows both technical staff and policy boards to more easily understand the meaning of the various effectiveness measures for individual routes.

Comparisons between routes are more easily made throughout these systems for the same reasons. For example, San Diego Transit has produced a detailed evaluation report ranking the effectiveness of each of their routes. This evaluation was then used along with other data to develop a set of adjustments and expansions for the San Diego system.

What remains unclear is the ability of most smaller systems to find new resources, or more importantly, reallocate existing resources to adjust service so that it is most effective. Even the most minor service improvements usually require an increase in operating costs, and it is often difficult for a system that operates many routes at policy headway at far less than full capacity, to take from one route to improve another route. On the other hand, if a reduction in service and operating deficits are called for in a given area, the types of effectiveness measures reported here undoubtedly are used to identify the most appropriate candidate routes for service reductions. The economic performance of various routes, combined with information

relating to scheduling efficiencies which can be achieved, most often form the basis of specific service reduction decisions.

3.4 Service Evaluation in Large Properties

Table 3 lists the systems owning greater than 400 buses which responded to the MBTA request for information and indicates those which are currently using service criteria to evaluate the performance of their bus system. The range of procedures and analysis performed varies greatly among these systems, as well as the extent to which these procedures are applied to current routes and proposed changes.

Generally, the emphasis placed on service evaluation procedures is highly dependent on policy-dictated factors, such as a funding constraint. For example, the Minnesota Legislature has imposed a maximum allowed subsidy per passenger which, for the Minneapolis/St. Paul system, has been applied on a route by route basis. In Toronto, the subsidy policy requires that seventy (70) percent of the cost of transit service be paid out of the farebox. In many cases, service standards were adopted to provide a justifiable basis for significant reduction in services which were too costly and ineffective, while at the same time improving those services which have been most effective. In Boston, the adoption of the service policy standards allowed the elimination of a number of very poorly patronized bus routes and the subsequent reallocation of much of this manpower to provide headway improvements to other overloaded routes.

The evaluation of bus service in large systems is often performed using a variety of criteria or measures and by utilizing the inputs of a number of departments. The next section outlines which departments are generally responsible for specific aspects of service evaluation. Immediately following are several sections which describe the use of the three types of evaluation criteria or standards which were reported: service design measures, operating performance measures, and economic and productivity measures. A distinction has not been made as to whether each measure is applied to both existing and newly proposed services. Generally, the reported measures are almost always applied to proposed services, often applied to specific existing services where reductions or improvements to service in the same general geographic area are proposed, and only occasionally are applied systematically to all existing services. In many cases, different criteria or standards are used for different subgroups of the population (e.g., elderly and handicapped) and for different types of service (e.g., feeder vs. express bus service). A final section includes a discussion of the effectiveness of using these evaluation techniques in large properties.

Table 3

LARGE SYSTEM SURVEY RESPONSE

SYSTEM	NUMBER OF BUSES	UTILIZING ROUTE SPECIFIC SERVICE CRITERIA	DEVELOPING ROUTE SPECIFIC SERVICE CRITERIA
Atlanta	797	X	
Boston	954	X	
Buffalo	473	X	
Calgary	494	X	
Cleveland	1,064	X	
Denver	586		X
Detroit	864	X	
Edmonton	630	X	
Houston	470		X
Los Angeles	2,391	X	
Miami	550	X	X
Milwaukee	523	X	
Minneapolis/ St. Paul	1,019	X	
Montreal	2,075	X	
Philadelphia	1,660		X
Pittsburgh	955	X	
San Francisco	1,003	X	
Seattle	725	X	
St. Louis	1,140	X	
Toronto	1,219	X	
Vancouver	858	X	
Washington, D.C.	2,187		X
Winnipeg	543	X	X

3.4.1. Responsibility for Service Evaluation

Traditionally, the scheduling department has been the primary focus of service evaluation activities. At the current time, scheduling managers in large systems are still very much involved in these activities, although in most cases they do not have primary responsibility for producing evaluation reports or recommendations. Almost uniformly, the scheduling departments still determine appropriate headways and base needed headway adjustments on periodic maximum load counts on each route. They also often monitor route operating speed and schedule adherence and adjust schedules slightly to accommodate varying run times.

The traffic checkers in most systems, who collect most of the data ultimately used in service evaluation, are generally located in the scheduling department. For the survey respondents, the number of traffic checkers employed ranged from five to forty, with most of the systems currently using from ten to twenty checkers. There is not a strong relationship between the number of checkers used and the size of the system.

The revenue departments in large properties often provide basic data analysis used in evaluation of existing service. Such analysis is a useful by-product of the various audits which they must complete for revenue control reasons.

Large properties which indicated that they utilize rigorous evaluation procedures generally have a small analytical operations or service planning staff which ranged from two to ten persons. This is sometimes augmented by staff support from municipal or regional planning agencies which receive UMTA Section 9 planning funds. These planning staffs will usually produce written evaluation and short-term feasibility reports which recommend changes in route design, hours of service, or significant changes in frequency of service.

The operation planning staffs depend heavily on their ability to obtain current and relevant data on system performance, an ability which seems to vary widely from system to system depending on the size of the property, labor agreements, checkers available, and processing requirements. For example, the Pittsburgh and Minneapolis/St. Paul systems are able to obtain a virtually one hundred percent sample of revenue and ridership on each route because drivers have always been required to fill out a daily trip report. On the other hand, Los Angeles planners sometimes have to wait up to a year in some cases to obtain completed processing of relevent evaluation data.

The "data problem" is recognized by most large systems as a critical component of any evaluation scheme. The response to this study indicated that creative approaches to

this problem are being actively sought in many large properties. For example, the Toronto system uses field sheets for passenger characteristics (on-off) counts which can be optically "read" directly into a computer data bank. Other Canadian and U. S. systems are currently testing automatic passenger counting and vehicle monitoring systems. The UMTA Office of Planning Assistance is currently sponsoring a companion study to the MBTA and TTDC projects which will result in the production of a comprehensive guide to service evaluation data collection techniques. The final report of this study is expected in 1980.

3.4.2 Service Design Criteria

The surveyed properties use eight different criteria to evaluate the design of their bus services. Table 4 describes the various criteria, summarizes how and how often the necessary data is collected, and indicates how many authorities use each evaluation measure.

As can be seen from Table 4, 70% of all the reporting systems which utilize service criteria indicated that they use loading standards as an important measure to evaluate and adjust their services accordingly. Peak load point counts by time of day are usually used for determining these measures, although average occupancy is sometimes calculated from characteristic (on-off) counts along the entire route or some segment of a route. One system suggested that peak load point counts alone are not enough to adequately evaluate loading conditions since the duration of the peak load and the various loadings beneath it are critical to passenger satisfaction. Another system seems to have solved this problem by adopting a standard for the maximum amount of time (e.g., 10 minutes) that a bus passenger would have to stand, although such a standard is extremely difficult to systematically monitor.

The use of policy (or maximum) headways is probably underreported in this sample, since it is suspected that most systems use at least an informal guideline in setting minimum levels of services. Most large systems try to maintain at least 30 minute headways during peak hours and 60 minute headways during off-peak periods.

The service distribution criterion refers to where and how much service is maintained within a region. This variable can generally be measured given one of two philosophies of service distribution: 1) route spacing standards based on population density (a productivity emphasis), or 2) amount of service in a political jurisdiction based on funding provided by that jurisdiction (a funding emphasis). Each of the five authorities which indicated that they monitor service distribution place their emphasis on productivity. However, Los Angeles is currently in the process of redefining their policy to better reflect funding issues. Bus stop spacing standards

TABLE 4

CRITERIA USED FOR BUS SERVICE EVALUATION IN

LARGE PROPERTIES (MORE THAN 400 BUSES)

SERVICE DESIGN MEASURES

CRITERION	DESCRIPTION OF CRITERION	HOW DATA ARE COLLECTED	HOW OFTEN DATA ARE COLLECTED	NO. OF RESPONDENTS USING THIS MEASURE
Service Availability/ Route Spacing	Based on density, income, terrain, service type, distance from activity centers, and headways.	Generally non systmatic review of an area.	Range: Annually to as needed.	5 (22%)
Bus Stop Spacing	Varies by type of area and type of service. Range 400'-1250'.	Map.	As needed.	6 (26%)
Directness of Service	Based on number of transfers necessary and minimizing route deviations.	On board surveys, roadside counts, simulation model.	N.A.	3 (13%)
Loading Standard	Varies by time of day, service type, and standing time. Range: Peak 125%-180% Off-Peak 100%	Peak load counts, on-board counts.	Range: Daily to as needed.	16 (70%)
Policy Headways	Based on time of day, service type, maximum loadings, and runtime. Range: Peak 15-30 minutes Off- Peak 60 minutes	Peak load counts, general review.	Range: 5 times/year to rarely.	6 (20%)
Exclusive Bus Lane	Compared to number of automobiles which could be carried in lane.	Analysis using traffic data and ridership estimates.	Rarely	1 (4%)
Passenger Shelters	Locations based on geography of area, characteristics of people served, boarding counts, and frequency of service.	Roadside and in-house analysis.	Not regularly	3 (13%)
New Service Design	Based on estimated ridership, costs, access, comparisons with existing services.	Feasibility studies prepared of the cost-effectiveness of proposals.	Quarterly to as needed.	3 (13%)

are actually alternative, more frequently used measures of overall service distribution. Bus stop spacing usually varies with population density and character of the neighborhood.

Directness of service is evaluated in several ways: the number of transfers required to complete a trip, standards which define minimum transfer rates to determine suitability for through routing, and maximum route deviation standards which are applied to proposed improvements.

Passenger shelter standards are used to measure the equitable placement of passenger amenities throughout a large system. Shelter standards are generally based on a combination of boarding counts and frequency of service. These standards also may include some consideration of the user demographics and the characteristics (e.g., geography, weather exposure) of the area.

New service design measures involve the different criteria used to assess new service proposals. These often include the minimum service distribution, ridership and economic standards described elsewhere in this section, such as projected passengers per mile or revenue to cost ratios for the improvement. The obvious difference between the new service and existing service standards is that most of the new service measures must be estimated since no actual operating experience exists. Expansion proposals also are ranked on socio-economic characteristics of the neighborhood served, such as medium income, population density, auto ownership or percent elderly and youth population. More subjective criteria to assess the intergration of new proposals with the existing system are also used. Appendix E, "New Service Design", includes descriptions of the three authorities which provided specific evaluation programs. However, individual criteria which new services must meet are included in other portions of Appendix E which deal with productivity.

3.4.3. Operating Performance Criteria

As can be seen from Table 5, the most widely used operational criterion is schedule adherence. The standards which are used to measure schedule adherence generally are comprised of two components which can be varied by type and frequency of service: 1) a definition of "on time" which includes an acceptable early and late range (e.g. one minute early and up to five minutes late), and 2) the percentage of trips on each route which are expected to be on-time (e.g. a range of 80-99 percent is considered acceptable by large properties). Schedule adherence data is generally collected by traffic checkers as they observe maximum load counts, although most properties also have starters and inspectors doing spot checks or assigned to specific routes

TABLE 5

CRITERIA USED FOR BUS SERVICE EVALUATION IN LARGE PROPERTIES (MORE THAN 400 BUSES)

OPERATING PERFORMANCE MEASURES

CRITERION	DESCRIPTION OF CRITERION	HOW DATA ARE COLLECTED	HOW OFTEN DATA ARE COLLECTED	NO. OF RESPONDENTS USING THIS MEASURE
Schedule Adherence	Based on time of day, headways, point along route. Range: On time=5 minutes early-5 minutes late. 80-90% of trips should meet standard.	Peak load checks, onboard checks, traffic inspector reports, time cards at terminal points.	Range: Monthly to as needed.	13 (56%)
Travel Speed	Based on route type.	Developed from on-board time checks.	Range: Monthly to 1/year.	2 (9%)
Accidents[1]	Compared to previous year, accidents/mile.	N.A.	Monthly	2 (9%)
Complaints	Compared to previous year, deviation from system average, complaints/operators, maintenance complaints/month.	Customer complaints, system checks.	Range: Monthly to as needed.	6 (26%)
Miles/Trouble Call[2]	10,000 miles/call 2,500 miles/call/month	Defect cards.	Monthly	2 (9%)
Lost Runs[2]	99.9% of runs must be completed. 5 runs lost/month, zero desired.	Garage reports.	Range: Daily to irregularly.	3 (13%)

[1]This "safety" measure is included because it is a measure of the reliability of service which passengers receive.

[2]This "maintenance" measure is included because it is a measure of the reliability of the service which passengers receive.

where problems have been identified. As most operators indicate that the scheduling department is responsible for analyzing these data, it is not clear whether many properties use this information for comparing the performance of different routes.

The remaining criteria listed in Table 5 are often used by transportation or operations department personnel as informal measures to identify specific corrective action, but are rarely used in overall system planning and evaluation. Operating speed standards are reported to be regularly used by only two respondents. Since transit operators do not have direct control over the traffic conditions which affect operating speed, these standards are often used in discussions with other governmental agencies to take action on improving particular traffic conditions. The transit operator may have the opportunity to initiate the implementation of priority traffic signals for buses or special preferential roadway lanes. In the extreme case, such standards are used to recommend rerouting around particularly troublesome spots.

The use of accident data is primarily confined to improvement in driver performance or vehicle safety, although a service related comparison between routes can be made to identify specific locations or turning movements which are especially dangerous. If so identified, service planners can identify alternative routings which would minimize the need to negotiate the more dangerous movements.

Complaint data are used in much the same way as accident data, that is, to spot troubled routes for some type of remedial action. The various standards used include a specified percent deviation from the system average and maximum thresholds by type of complaint which initiate special action. Again, a tie can be made to the service planning function if service type complaints are analyzed periodically for unsuspected problems or trends.

Data on miles per trouble call are used primarily for monitoring vehicle performance. If passenger delay is recorded on trouble call reports, routes can be monitored for the occurrence of undue delays and corrective action can be planned for recurring long delays.

The monitoring of lost runs is important from an operations planning perspective since, theoretically, a shortage of manpower or vehicles could be anticipated by preparing a plan for allocating such a shortage among routes which would impact the least number of people for the shortest period of time. In any case, the evaluation of lost run data can help identify any obvious biases in the allocation of the resources available systemwide.

3.4.4. Economic and Productivity Criteria

The economic and productivity criteria listed in Table 6 form the basis for the major portion of any transit service evaluation methodology. Service performance must ultimately be measured by the number of riders attracted and revenues generated by any system. The various measures used provide different biases towards different types of transit service (eg. express line-haul service, crosstown service, or feeder service) depending on the length of passengers' trips and the fare levels paid. Many large systems monitor several of these economic criteria to balance the specific bias inherent in each or, alternatively, attempt to develop some type of composite measure which combine two or more different measures.

Ridership trend data is monitored regularly by several properties and allows the quick identification of routes which deserve further analysis. A sudden increase or decrease in the ridership level of a route indicates that some change has taken place in either service delivery or trip generators in the area. More gradual ridership trends provide an opportunity to analyze specific subareas to plan for commensurate improvements for ridership increases and appropriate remedial action for a decreasing trend.

Passengers per vehicle hour and passengers per vehicle mile are alternative ways to measure productivity of specific routes or route segments. The per vehicle hour measure is biased against urban routes which are slowed by traffic congestion, while the per vehicle mile measure is biased against faster, express-type routes. Standards for individual routes often vary by time of day and type of passengers carried. For example, routes with high percentages of elderly or transit dependent passengers need to meet lower standards in the Boston region. It is interesting to note that none of the respondents reported that they currently use any measure of passenger miles, the specific performance measure required by UMTA regulations under the Project FARE, Section 15 reporting requirements. This is in spite of the fact that the passenger miles measure successfully avoids the biases discussed above with the "per mile" measure. It is known that London Transport uses this measure as its primary indicator of total benefit for service proposals.

Average fare per passenger measures the revenue generated by routes based on the type of passengers carried. It also may be used to identify routes which may have specific revenue control or fare evasion problems. The revenue per mile and cost per mile measures are straight-forward indicators of how routes compare on the basis of similar mileage, although they exhibit the same type of bias discussed above.

TABLE 6

CRITERIA USED FOR BUS SERVICE EVALUATION IN

LARGE PROPERTIES (MORE THAN 400 BUSES)

ECONOMIC AND PRODUCTIVITY MEASURES

CRITERION	DESCRIPTION OF CRITERION	HOW DATA ARE COLLECTED	HOW OFTEN DATA ARE COLLECTED	NO. OF RESPONDENTS USING THIS MEASURE
Ridership Trend	10% increase or decrease from previous month or from average trend	Onboard counts, revenue counts, peak load counts.	Daily, Quarterly	2 (8%)
Passengers/ Mile	Based on time of day, passenger characteristics, and service type.	Onboard counts, revenue data, peak load counts.	Range: Daily to as needed.	7 (30%)
Passengers/ Hour	Based on time of day, day of week, passenger characteristics, density	Onboard counts, peak load counts, revenue data.	Range: Daily to as needed.	8 (35%)
Revenue/Cost	Based on Route type and passenger characteristics. Range: .10-.50	Revenue data, ridership data, cost allocation formulas.	Range: Daily to annually.	5 (22%)
Subsidy/ Passenger	Range: $ .80-$1.25	Revenue data, cost allocation formulas, ridership data.	Range: Quarterly to as needed.	6 (27%)
Average Fare/ Passenger	Actual vs. budgeted	Revenue data.	Monthly	1 (13%)
Revenue/Mile and Cost/Mile	No values given.	Revenue data, onboard counts, cost allocation formulas, peak load counts.	Range: Monthly to annually	4 (17%)

The revenue to cost ratio is a well-formulated composite measure which can be used as a systemwide management goal as well as an indicator of individual route performance. The Toronto system must cover seventy percent of their yearly costs through legislative mandate. Using this measure as an overall screening tool, remedial action can be planned either in the direction of rerouting to serve larger trip generators or reducing the level and, therefore, the cost of providing the service. The precision of the revenue/cost ratio is, of course, dependent on the sophistication of the cost allocation model which is used. Factors such as operating speeds, administrative and maintenance overhead, and whether a trip is operated as a tripper or a regularly scheduled run, all affect the cost of operating a particular route.

Finally, subsidy per passenger is another measure which can be used in justifying funding levels; the Minnesota legislature has recently provided funding for the Minneapolis/ St. Paul system based on a specific subsidy per passenger figure. This provides an incentive to a system to attract new passengers and allows a reasonable increase in the amount of service provided to accommodate the new passengers. For policy-makers, a route by route comparison using this measure provides a bottom line analysis of the financial health of the system, even though it will be biased against those routes carrying a larger number of discount fare passengers.

3.4.5. Effectiveness of Service Evaluation in Larger Bus Systems

While most of the authorities surveyed have developed and are currently using some service criteria, data on the effectiveness of these evaluation efforts are limited. However, even where empirical cost-effectiveness data are not available, several authorities indicated that the presence of service standards has made it easier to gain support for management decisions.

The experiences of Montreal, Seattle, Toronto, and Los Angeles, indicate that efficiencies can be gained by carefully adhering to established standards. The Montreal Planning Director indicated that their data collection program has allowed the authority to slightly reduce the level of service provided without a ridership loss. While Seattle has not reduced the number of vehicles used, the established service standards have allowed management to systematically shift buses from less productive routes to those with higher demand.

As a result of work undertaken in Toronto since 1977, the consistent application of vehicle loading standards has resulted in systemwide net savings in peak hour vehicles. It is estimated

that 123 vehicles were saved during the two peak periods and 45 buses were added, leading to a net saving of 79 vehicles. By analyzing how the economic performance of routes in the bottom economic quartile could be improved, an additional 17 peak period vehicles were saved.

In Toronto, as in all other systems, the vehicle savings will be greatest during the first year of implementation. During this first year, the most blatant inefficiencies were identified and corrected. Adherence to loading standards in subsequent years will be useful in responding to minor shifts in ridership patterns.

Los Angeles appears to have made the greatest savings as a result of implementing established standards. From 1976 when formal standards were adopted, the peak bus requirement was reduced by over 100, and vehicle miles were reduced by 11 million. Without significant passenger loss the authority saved approximately $20 million. This savings compared quite favorably to the $1 million spent annually to collect the data necessary to implement the standards.

4.0 SUMMARY AND CONCLUSIONS

The analysis and discussion of bus transit service evaluation procedures presented here reveals that transit operators in the United States and Canada are aware that useful evaluation techniques are currently available. Most systems are beginning to recognize the importance of a systematic service evaluation procedure to ensure an efficient as well as a more effective delivery of service. Given this recognition, many properties have made commitments to move from sporadic use of evaluation measures toward the establishment of a systematic evaluation effort. Very few systems have achieved this goal fully at the current time. It appears important to note that most of those properties currently utilizing systematic service evaluation procedures have turned to these procedures in the face of severe legislative or policy-dictated funding constraints. The positive experience of these few properties has led other properties to consider the development of more rigorous procedures.

Several important points should be made regarding the development and use of any bus service evaluation program:

- The criteria and standards presented here are used in most cases to guide decisionmaking, but flexibility is reserved in most cases for consideration of more subjective factors; measures can often be used simply as screening tools to determine where to concentrate more rigorous analysis efforts.

- Data collection probably deserves the most intensive consideration when developing a service evaluation program; data collection procedures must ensure that the information obtained is truly valid and accurate; care must be taken to avoid collecting too much or inappropriate data; careful consideration must be given to how the data will be routinely processed in a timely fashion.

- The final products of the evaluation program must not be unduly complex; they must be understood and useful to policymakers; it may be best to develop and use a few reliable standards consistently, while relegating a number of secondary standards to occasional use in more technical reviews of problem-plagued routes.

- Given the variation in transit evaluation procedures, policy settings and funding conditions that have been observed in this study, it is apparent that each transit property should individually tailor the development

of an evaluation program to their own local operating environment.

From the review of service evaluation procedures now in use, it appears that an effective, systematic evaluation program is certainly achievable by every transit property at a reasonable, and often surprisingly low, additional cost. A short, but intensive staff effort is needed to examine existing data resources, new data requirements, and evaluation techniques in order to design a system which can effectively evaluate service performance. This study has shown that there is a relative abundance of information available from a wide range of transit properties on service evaluation techniques. Most properties contacted during the course of this study would welcome inquiries about their current methods.

In many ways, transit authorities are being held more accountable for their performance, and they can no longer afford to ignore the basic evaluation procedures outlined in this study. Effective management demands a continuing assessment of the service being delivered. Transit service evaluation need not be complex; it needs only to exist and be used by all levels of transit management.

APPENDIX A

BIBLIOGRAPHY I

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> Fielding, Gordon J., Roy E. Glauthier and Charles A. Lance, Development of Performance Indicators for Transit, Institute of Transportation Studies and School of Social Sciences, University of California, Irvine, California, December, 1977. NTIS-PB-278-678, prepared for UMTA.

INTRODUCTION TO LITERATURE REVIEW

The literature reviewed is best discussed and presented in two distinct categories: firstly, sources which directly relate to transit and the evaluation of transit performance, and secondly, sources dealing with theoretical subjects readily applicable to the research topic but with only peripheral importance to the present study.

Each section shall highlight the major areas of research, the outstanding sources, and then list the sources alphabetically by author or issuing agency.

This search has been conducted through the Information Resource Center of the Institute of Transportation Studies, University of California, Irvine. In compiling this bibliography use was made of on-line information retrieval databases including TRIS-ON-LINE, NTIS, Dissertation Abstracts, and Psychological Abstracts.

The sources included are available in the Information Resource Center of the Institute of Transportation Studies, and the University Library of the University of California, Irvine. Those documents available through the National Technical Information Service are so noted.

TRANSPORTATION AND TRANSIT EVALUATION:

The largest segment of literature reviewed relates to the evaluation of transit and transportation systems. The majority of this literature deals with the evaluation of alternative plans in particular cities and regions while a lesser number of sources address the problems inherent in evaluating system performance in general and advocate possible evaluation schemes.

Among those sources which discuss the problems and difficulties of evaluation, the study by Tomazinis stands out for the clarity with which it defines the conceptual and methodological aspects of evaluating productivity, efficiency, and quality of urban transportation systems. Tomazinis argues that the total transportation system of an area must be evaluated as an interrelated system. He also insists that measures of efficiency in the use of resources be separated from measures of effectiveness in achieving ridership.

Unquestionably the most comprehensive study is that done by the RAND Corporation (Pardee, et al) which developed a systematic, accounting-based methodology for evaluating the potential benefit of alternative transportation proposals. The major emphases of this study are the definition and measurement of transportation attributes and their aggregation into measures of benefit. The shortcoming of this volume is that it is comprised of loosely joined papers and is not cohesive.

Among the most applicable sources to the present study--and the most recent--are two studies which came out in 1975 and 1976. The first of these, by Allen and DiCesare, discusses the need for evaluation of transit service and provides an overview of the theory of evaluation methodology. Allen and DiCesare conclude that transit service can indeed be measured and that the effort to develop a comprehensive evaluation scheme--while being considerable--would be justified. The second paper, by Gilbert and Dajani, examines possible perspectives (federal, state, local, user and operator) which an evaluation system might take and determines that the interrelated nature of these perspectives necessitates a conceptual framework to assist in selecting appropriate performance indicators and combining their values into meaningful evaluations. Their conceptual framework emphasizes three levels of evaluation: efficiency, effectiveness, and impact. Gilbert and Dajani recommend that a basic leval of funding should be provided to systems with additional funding for

those which achieve increased effectiveness.

Several sources deal with the evaluation of particular aspects of transportation. Hoel discusses transportation requirements for dependent users and points out that traditional analysis techniques have not been sufficiently microscopic to isolate the needs or special problems of particular groups. The effects of geography on transit costs and evaluation are the subject of Miller's paper, and he finds that costs or urban bus operation vary across cities in ways which cannot be entirely accounted for by factor price of output differences. Miller further lists several "city descriptor" variables--such as congestion and density--which affect transit service but are outside the control of the operator.

Roess examines the evaluation of efficiency in rail transit, and argues that it is an extremely narrow subject and not capable of focusing on truly significant issues. Efficiency evaluation, he states, is limited to economic efficiency and labor utilization efficiency, yet the important questions are those relating to the public service aspects of transit.

SERVICE STANDARDS:

Specification of service standards are germane for this study of transit. Classics in this field are the reports published in 1958 by the National Committee on Urban Transportation. They still hold value as the origin of many of the evaluation techniques in use today. These reports were among the first to address the planning of transportation as a comprehensive urban system and to specify service standards, objectives, and measurement techniques for transit. More recently, Aronstein discusses the setting of performance standards, computation of achieved values, and the weighting and aggregation of factor scores into a single system score. Aronstein emphasizes the quality factors from the rider's point of view.

Research presently underway may resolve some of the problems posed in the above articles and establish an effective system of service standards. The California Department of Transportation's Level of Service research should be reviewed as indicative of the direction being pursued in current work. Although not yet completed, reports published to date have included the literature search, a listing of possible criteria, the evaluation and selection of an 11-criteria scheme of evaluation, and an explanation of the weighting of evaluation criteria.

ALTERNATIVES ANALYSIS:

Alternatives analysis, as mentioned above, received the attention of a major portion of literature sources, some of which have been cited above (see Pardee, et al). Other sources dealing with this topic were oriented toward the importance of transportation externalities and hard-to-quantify factors in the alternatives analysis (Klein and Irwin). Rea and Miller develop a method by which different modes of transportation may be evaluated as to their potential service and flexibility in a particular corridor or environment. Finally, the theory of transport pricing, demand forecasting, project evaluation, and systems planning is covered comprehensively in the two-volume Brookings Institute Study by Meyer and Straszheim.

GOVERNMENT ASSISTANCE:

Studies of governmental assistance to transit are also relevant to this project. The study by Jones, et al, is among the most valuable of these sources, and presents a detailed analysis of the sources and procedures of transit assistance. Jones finds that transit subsidies in general lack clear objectives, promote capital-oriented solutions, and fail to correspond to actual levels of need. Citing the failure of current subsidy systems to encourage efficiency and more effective service, three possible strategies are outlined for the allocation of additional funding: (1) a flat rate allocation per rider with a higher rate for senior citizen riders; (2) a lower, flat rate allocation per rider, higher flat rate per senior patron, and a flat rate allocation per coach mile; and (3) same allocation basis as strategy #1, yet insuring all operators a minimum allocation of 25 per cent of the shortfall between farebox revenues and operating costs. These three strategies are evaluated as to their potential effects in California, and found to require additional funding of $54, $59, and $62 million respectively.

Several other sources are worthy of note with respect to government assistance. The first, by Beshers, presents the arguments for federal operating subsidies, defines the subsidy options available, and concludes that a block-grant procedure combining operating and capital funds might be the most effective subsidy strategy. The second, by Tye, takes the position that the long-run trend of increasing deficits in the transit industry will result in escalating government subsidies, and that use should be made of potential inherent in subsidies to bring about improved financial conditions and efficiency. Lastly, Oi, analyzes the deficit situation of transit through the 1960's and into the 1970's and discusses the rationale for

transit subsidization. Assuming that subsidies are necessary for the continuance of the transit industry, Oi seeks the optimal allocation procedure for federal funds. Formulas based on urban population, transit revenue passengers, vehicle-miles of service, and potential transit riders are evaluated in terms of efficacy, economic efficiency, distribution costs, and equity; and the vehicle-miles and potential transit rider formulas are recommended over the others.

From the standpoint of justifying governmental transit subsidies, the paper by Elliott is an interesting attempt at isolating the "bottom line" cost to society of the automobile. Elliott computes costs of the hidden budgetary costs, smog, and congestion, and arrives at a hidden public cost of peak-hour driving of 6.3¢ per mile, or approximately $2 per drive per day during the summer and $1 per day during the winter.

EVALUATION SYSTEMS: APPLICABLE CASES

While most sources dealing with actual evaluations were limited to single areas, several have wider scopes and are particularly applicable to this study. The Council of Municipal Performance's report (Sagner) sets forth an evaluation scheme for an area's public transportation system and then proceeds to evaluate the systems of twenty-eight major U.S. cities. The report also reviews America's car-dependence, the need for public transportation to assist with problems of energy, pollution, and environmental quality, and sets forth low-cost ways of improving public transit. The Council's report is designed to raise public awareness of the problems and potentials of transit and provide directions for seeking feasible improvements.

Actual service standards are established in the Massachusetts Bay Transportation Authority report, as well as an evaluation system by which the performance of transit within that region shall be measured. This report also details the administrative actions to be taken in cases of substandard performance. One of the most well-known systems of service standards is that of Portland's Tri-County Metropolitan District (King). The system is based on an explicit set of goals for transportation improvement over the five-year period 1974 through 1979 which include: increasing average daily ridership 100% by 1979; doubling the percentage of downtown travelers arriving by bus by 1979; achieving a farebox support ratio of 40%; and increasing the level of public transportation available to elderly and handicapped both through improved accessibility to regular service and through special service essential to better mobility to these groups. Tri-Met followed these goals with an equally-direct set of service standards based on

principles of access, convenience, speed, and cost. "The criteria spell out where bus lines ought to go, what hours and how often they ought to run, how fast they should reach a given destination, and how much is an acceptable cost." (King, p. 24)

Finally, the evaluation processes created within the Pennsylvania Mass Transportation Assistance Program (see Pennsylvania, Department of Transportation) are reviewed in the paper by Vuchic, et al. The Pennsylvania system specifies operating guidelines and service standards, then establishes the evaluation and enforcement procedures necessary to ensure compliance--either voluntarily or through fiscal leverage. The process later established for evaluation of grant requests under the Pennsylvania program is the subject for Underwood, et al. This paper explains the evaluation process and the actions taken by the funding agency in response to achieved scores.

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THEORETICAL AND OTHER RELATED SOURCES

A large number of sources were reviewed in search of material applicable to the present research project. Many sources were clearly inapplicable and will not be cited. The remaining sources represent many different subject areas and varying degrees of applicability. Broad categories of works which were found to have relevance for this project include evaluation research theory and applied evaluation techniques.

EVALUATION RESEARCH THEORY:

Among the evaluation research theory literature, the work by Suchman is a basic, highly readable volume on the theory and processes of evaluation research and program evaluation. Beginning with a review of the present state of evaluation, it covers types and conduct of evaluation, research design, measurement, and administration of evaluations. More complex collections of articles on various aspects of evaluation theory are not quite so comprehensive, yet more detailed on particular aspects. Typical of these is the two-volume collection by Struening and Guttentag which addresses the context of social research. Within this work, the article "Evaluation Research in the Political Context" by Weiss is particularly good and discusses the political context of governmental evaluation.

The evaluation of social programs also addresses factors common to the transit environment and particularly the existence of unquantifiable outputs and effects. Rossi and Williams provide a valuable collection of readings dealing with the evaluation of social programs and highlight the need for the consideration of secondary effects. That social programs must be evaluated on the basis of secondary effects as well as direct effects is quite significant to the evaluation of transit.

The use of performance measures in general is the topic of Ridgway's article. He analyzes the use of single, multiple, and composite measures of performance and particularly their dysfunctional effects. A composite measure of performance has the least negative effects of these three options, he concludes, yet all have undesirable consequences for overall organizational performance.

APPLIED EVALUATION LITERATURE:

Much of the applied evaluation literature relates the application of cost-benefit analysis to various governmental

functions. Increasingly, attention is being given to the measurement of productivity and to program and policy evaluation in government. The study by Skogan relates the evaluation of efficiency and effectiveness in police services. Skogan presents conceptual and operational definitions of efficiency and effectiveness and emphasizes the application of statistical analysis to program evaluation and the effect of incomplete/inaccurate data on evaluation studies. Keller presents a multiple-indicator evaluation system developed by the District of Columbia's Office of Executive Management and Budget. It includes measures of efficiency, effectiveness, input, output, and productivity and is called the "Performance Measures System". Multiple-measures, Keller points out, facilitate the scheme's use at many levels of government and increase its diagnostic power.

The evaluation of productivity in government is the subject for the studies by Hatry and Ross. Hatry, Winnie and Fisk is an oft-cited primer in the techniques and concerns of program evaluation for state and local officials. It concisely describes the need, administration, techniques, and uses of program evaluation and reviews the range of evaluation possible from pre/post evaluation to controlled experimentation. Ross and Burkhead focus primarily on the evaluation of productivity in the 'soft' government services found at the local level (health, planning, etc.) in which outputs are generally not readily identifiable.

Cost-benefit analysis literature contributes significantly to the present study through particular aspects of its experience and theory. Peterson and Mittlebach compared implementation effects of selected projects with cost-benefit analyses executed during their consideration. They found that significant differences between expected and actual effects could be traced to the overemphasis on tangible economic benefits and costs as compared to intangible. And further, that such analyses are often undertaken to justify predetermined conclusions. Prest and Turvey conclude that cost-benefit analysis is anything but an infallible tool. However, it does force decision-makers to quantify costs and benefits as far as possible. Harrison provides a detailed study of the application of cost-benefit analysis to the external effects of transportation. He focuses especially on the valuation of costs and benefits. He points out that although precise evaluations may be desirable in some circumstances, a range or an upper or lower limit is more realistic and helpful when evaluating alternative proposals.

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APPENDIX B

BIBLIOGRAPHY II

This second bibliography has been compiled as an outgrowth of this current study and has as its emphasis publications which deal with specific transit properties.

APPENDIX B

BIBLIOGRAPHY

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APPENDIX C

SURVEY QUESTIONNAIRE

The Tidewater Transportation District Commission and the Massachusetts Bay Transportation Authority are working together, under the sponsorship of the Planning Research and Evaluation Division of the Urban Mass Transportation Administration on a research project to develop a prototype program for the evaluation of bus system performance.

An early step of this project is to review the current state of bus service evaluation measures. The most important element of this step is finding out what other bus operators in the nation are doing to evaluate their existing bus services, and how proposed new services are initiated.

More specifically, we are interested in answers to the following questions:

1. What specific standards does your authority use to evaluate new and existing services and are these standards official policy statements or informal internal standards?

2. What data do you gather to check whether these standards are being met and how do you gather it?

3. Who is responsible for seeing that the data is collected and analyzed?

4. How often is the data collected?

5. How much does it cost in manpower and dollars to collect the information?

6. How do you use the criteria and information to try and make service changes? How effective has this been in terms of service delivery, ridership, and operating costs?

7. What problems have you encountered in trying to adjust your service in response to the data collected?

8. What is the source of funds for your evaluation efforts?

If you have written materials (e.g., reports, evaluation forms, etc.) which address any of the questions outlined above, we would appreciate receiving copies.

We realize that if this data is not readily available it can be very time consuming to try to provide it. The attached form was developed to make answering questions 1 thru 6 easier. Even if you can only fill in portions of the form, the information you supply will be very useful. Some of your answers will probably be too lengthy and complicated to fit into the format we have provided and we would, of course, welcome any additional sheets you would like to attach.

However, since we will make follow-up phone calls to authorities which have developed evaluation techniques, we may be able to save you some time in organizing the material.

Once this initial survey has been analyzed, a one-day information exchange meeting may be held in Boston or Norfolk with interested authorities which have particularly effective techniques.

During this meeting, as well as during the phone interviews, we would like to deal with the more difficult questions regarding the problems associated with and cost effectiveness of trying to apply service standards.

On behalf of all the project's participants, I wish to thank you in advance for your help. Your response by August 31, 1978 will be greatly appreciated. If you have any questions, please call Leora Jaeger at (617)722-5216.

Sincerely,

John P. Attanucci

John P. Attanucci
Manager
Service Planning

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PROTOTYPE BUS SYSTEM EVALUATION STUDY QUESTIONNAIRE

Company _____

Address _____

Contact Person _____

Title _____

Phone Number _____

Size of Area Served _____

Population Served _____

Total Number of Buses _____

Number of Peak Period Buses Required _____

Number of Bus Garages _____

Last Fiscal Year's Bus Ridership _____

Number of Bus Routes _____

Number of Revenue Bus Miles _____

% of Trips Missed Per Day _____

Total Number of Employees _____

Total Number of Bus Drivers _____

Number of Drivers Assigned to Regular Runs _____

Number of Maintenance Personnel _____

Number of Employees Assigned to Inspect Line Operations _____

Number of Other Supervisory Personnel _____

LIST OF SAMPLE CRITERIA USED TO ASSESS BUS SERVICE

OPERATING PERFORMANCE STANDARDS

Average Operating Speed
Recovery Time
Load Factors
Schedule Adherhance
Trips Lost
Vehicle Availability
Bunching of Trips
Complaints

SERVICE DESCRIPTION

Route Spacing
Directness of Routing
Coordination of Leave/Arrive Times
for Routes with Common Termini
# of Transfers Needed to Complete Trips
Safety Considerations
Service Frequency
Placement of Bus Stops and Shelters

ECONOMIC STANDARDS

Revenue/Cost
Passengers/Hour
Passengers/Mile
Cost/Passenger

INTRODUCTION TO APPENDICES D and E

Appendices D and E summarize the bus service evaluation programs of the 77 authorities which responded to the August, 1978 survey. As was indicated in this paper's introduction, this survey was not intended to provide case studies of selected transit authorities but rather to provide a broad overview of the bus service evaluation programs currently being conducted in the United States and Canada. Consequently, the data received from each authority varies as to the type and detail of information, and this difference is, of course, reflected in the following presentation. Given the scope of this study and the fact that such a large number of authorities completed surveys, the majority of the information presented below is based on these written surveys. Some follow-up data was gathered via telephone interviews.

Appendix D briefly describes each of the authorities' bus operations and reviews the measures used by each to evaluate bus service. In order to facilitate identifying authorities with similar characteristics and evaluation problems, the data is grouped into two categories: small and medium sized authorities (less than 400 buses) and large authorities (400 buses and up). In addition to briefly describing the scope of each authority's bus service evaluation program, any unique and/or particularly cost-effective method for evaluating bus services is presented. Finally, the route specific measures for each authority, which are presented in Appendix E, are listed.

While Appendix D provides a broad overview of various authorities evaluation programs, Appendix E specifically describes the various route specific criteria used, what and how the data is collected to implement the criteria, who gathers the necessary information, who is responsible for seeing that the data is collected and analyzed, and how much it costs to collect the information. As was expected, the cost of implementing various service standards was difficult to estimate since the necessary data for one specific standard is often collected by personnel who are performing other duties simultaneously.

Under the description of each criterion, it has been noted whether the criterion is "formal" or "informal". For large authorities (over 400 buses), "formal criteria" are defined as those which have been adopted by policy makers or have been specified in writing as accepted evaluation standards. "Informal criteria" are those which are used for internal decision making but have not been formalized as accepted standards.

In small and medium sized authorities, the distinction between formal and informal measures is more clear cut. Therefore, in the accompanying charts, "formal criteria" for these systems are simply defined as having explicit numerical values. "Informal criteria" are performance measures for which no numerical values have been specified.

Many authorities which have developed service policies are, to date, only implementing portions of the policy. Only those standards which are currently implemented on a route specific basis, and for which a minimum level of information was provided are included.

APPENDIX D

ABSTRACTS OF AUTHORITIES

Abstracts of the authorities which responded to the survey are presented in this appendix in two sections.

To facilitate use of this appendix, two tables of contents have been prepared for each section. The first is organized by City and the second by Authority. This latter table includes a contact person at each authority.

SMALL AND MEDIUM SIZED AUTHORITIES
(less than 0-400 buses)

SMALL AND MEDIUM SIZED AUTHORITIES
(less than 0-400 buses)

AUTHORITY Capital City District Transportation Authority

110 Watervliet Avenue

Albany, NY 12206

DESCRIPTION - ANNUAL RIDERSHIP : 12,500,000

SIZE OF SERVICE AREA : 100 square miles

POPULATION SERVED : 500,000

NUMBER OF PEAK PERIOD BUSES : 188

NUMBER OF BUS GARAGES : 2

NUMBER OF BUS ROUTES : 52

NUMBER OF REVENUE BUS MILES/YEAR : 6,000,000

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program. The authority collects data on passengers revenue and cost. These data are collected monthly by a transportation clerk and reviewed by the senior planner. The total annual cost is $10,000 for a clerk and $8,000 for contracted data collection.

CRITERIA USED TO ASSESS SERVICE

No standards reported.

AUTHORITY Lehigh and Northampton Transportation District

Twelfth and Cumberland Street

Allentown, PA 18103

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 4,400,000
	SIZE OF SERVICE AREA	: 91.7 square miles
	POPULATION SERVED	: 290,000
	NUMBER OF PEAK PERIOD BUSES	: 51
	NUMBER OF BUS GARAGES	: 2
	NUMBER OF BUS ROUTES	: 29
	NUMBER OF REVENUE BUS MILES/YEAR	: 2,358,000

REVIEW OF EVALUATION PROCEDURES

This authority has a comprehensive evaluation program. Financial and operating data are collected. The data are collected semi-annually. Cost of data collection and analysis have not been estimated. Two employees are assigned on a part time basis to evaluation. This authority has finalized a five year development program.

CRITERIA USED TO ASSESS SERVICE

1) Headways should be 30 minutes during the peak and 60 minutes forbase.

2) Loading should be 150% or less for peak and 100% for base.

3) Schedule Adherence is defined as 3 minutes early to 3 minutes late; peak period 20 minute or less headway should be 75% on time; 20 to 40 minute headways should be 85% on time; and over 40 minutes headways should be 90% on time.

4) New service should be able to cover 30% of its cost during the first 90 days.

5) The system revenue should not be less than 40% of the operating expenses.

6) Route spacing should be consistent with the density of development and economic characteristics of the population.

AUTHORITY Arcata & Mad River Transit System

736 F Street

Arcata, CA 95521

DESCRIPTION -

ANNUAL RIDERSHIP	:	106,592
SIZE OF SERVICE AREA	:	8.5 square miles
POPULATION SERVED	:	12,000
NUMBER OF PEAK PERIOD BUSES	:	3
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	2
NUMBER OF REVENUE BUS MILES/YEAR	:	87,120

REVIEW OF EVALUATION PROCEDURES

This system does not have a comprehensive evaluation program. All data are collected and looked at informally and irregularly. Data collected include ridership, schedule adherence and transferring and user perceptions of services. This effort is conducted by the Transit Manager for $805 per year.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Battle Creek Transit

P O Box 1717

Battle Creek, MI 49016

DESCRIPTION - ANNUAL RIDERSHIP : 1,200,000

SIZE OF SERVICE AREA : 60 square miles

POPULATION SERVED : 77,922

NUMBER OF PEAK PERIOD BUSES : 18

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 10

NUMBER OF REVENUE BUS MILES/YEAR : 540,000

REVIEW OF EVALUATION PROCEDURES

A service evaluation program has not been developed.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Bay County Metropolitan Transportation Authority

621 N. Water Street

Bay City, MI 48706

DESCRIPTION -

ANNUAL RIDERSHIP	:	480,000
SIZE OF SERVICE AREA	:	40 square miles
POPULATION SERVED	:	80,000
NUMBER OF PEAK PERIOD BUSES	:	12
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	10
NUMBER OF REVENUE BUS MILES/YEAR	:	780,000

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program other than to evaluate informally the number of passengers per route. Two part time employees are assigned to evaluation. Data collection cost is negligible.

CRITERIA USED TO ACCESS SERVICE

No formal standards reported.

AUTHORITY Brockton Area Transit Authority (BAT)

106 Main Street

Brockton, MA 02401

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 2,794,181
	SIZE OF SERVICE AREA	: 50 square miles
	POPULATION SERVED	: 125,000
	NUMBER OF PEAK PERIOD BUSES	: 30
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 17
	NUMBER OF REVENUE BUS MILES/YEAR	: 600,000

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Brockton evaluates new and existing services, informally, internally and irregularly. New service is installed when the Authority feels there is a public demand for it. The only time service is reduced is when a review of the ridership indicates it is not being used. Ridership data are collected from registering fareboes. A very small effort is put into service evaluation and only three part time employees are used for this task. Cost of evaluation was not reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Canton Regional Transit Authority

1501 West Tyscarawas Street

Canton, OH 44702

DESCRIPTION -		
	ANNUAL RIDERSHIP	: NA
	SIZE OF SERVICE AREA	: 27 square miles
	POPULATION SERVED	: 213,000
	NUMBER OF PEAK PERIOD BUSES	: 71
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 26
	NUMBER OF REVENUE BUS MILES/YEAR	: 1,275,000

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Data are collected for route transfers, loadings and passengers. Number of employees assigned to evaluation and cost of data collection are not reported.

CRITERIA USED TO ASSESS SERVICE

This authority has informal standards for passengers per vehicle mile, transfers and loadings.

AUTHORITY Chapel Hill Community Transit
306 North Columbia Street
Chapel Hill, NC 27514

DESCRIPTION -

ANNUAL RIDERSHIP	:	1,800,000
SIZE OF SERVICE AREA	:	10.39 square miles
POPULATION SERVED	:	34,000
NUMBER OF PEAK PERIOD BUSES	:	24
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	9
NUMBER OF REVENUE BUS MILES/YEAR	:	690,000

REVIEW OF EVALUATION PROCEDURES

Chapel Hill has a comprehensive evaluation program. Data are collected monthly for ridership and schedule adherence by spare drivers and supervisors. Data are collected daily on revenue and costs. Other data collected include bus stop spacing and accessibility. No personnel are assigned specially to evaluation. Evaluation costs about $12,000 annually.

CRITERIA USED TO ASSESS SERVICE

The following standards are used by the planning staff.

1) Coverage/accessibility - 90% of household should be within ¼ of a bus stop.

2) Loading - the maximum for shuttle service is 175%, express 100% and arterial 100% base and 150% peak.

3) Headway - the maximum is 30 minutes peak service and 60 minutes base.

4) Dependability - 95% of buses should be no more than 5 minutes late.

5) Bus stop spacing - stops no closer than 1/7 mile.

6) Revenue/cost ratio should be at least 50%.

7) If any route's passengers per mile are lower than one-half of the system, the route will be discontinued.

AUTHORITY Chattanooga Area Regional Transportation

1617 Wilcox Boulevard

Chattanooga, TN

DESCRIPTION -		
	ANNUAL RIDERSHIP	3,695,626
	SIZE OF SERVICE AREA	587 square miles
	POPULATION SERVED	260,000
	NUMBER OF PEAK PERIOD BUSES	57
	NUMBER OF BUS GARAGES	1
	NUMBER OF BUS ROUTES	24
	NUMBER OF REVENUE BUS MILES/YEAR	2,268,300

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Schedule adherence and passenger data are collected quarterly. Cost for collecting data was not reported. One employee is assigned to evaluation.

CRITERIA USED TO ACCESS SERVICE

This authority uses two formal standards to evaluate service.
Schedule Adherence: on time is defined as zero minutes early to five minutes late.

Passengers per trip less than 5 is unacceptable.

AUTHORITY Corpus Christi Transit

P O Box 5277

Corpus Christi, TX 78408

DESCRIPTION -		
	ANNUAL RIDERSHIP	1,882,000
	SIZE OF SERVICE AREA	109 square miles
	POPULATION SERVED	215,000
	NUMBER OF PEAK PERIOD BUSES	28
	NUMBER OF BUS GARAGES	1
	NUMBER OF BUS ROUTES	18
	NUMBER OF REVENUE BUS MILES/YEAR	1,325,700

REVIEW OF EVALUATION PROCEDURES

Corpus Christi Transit does not conduct any regular system performance evaluations, using either formal or informal standards. The authority collects some ridership data for yearly statistical summaries and uses this information when budget restrictions require a service reduction. No employees are assigned to evaluation. Data collection cost was not reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Metropolitan Transit Authority

1100 MTA Lane

Des Moines, IA 50309

DESCRIPTION - ANNUAL RIDERSHIP : 4,074,184

SIZE OF SERVICE AREA : 96 square miles

POPULATION SERVED : 268,500

NUMBER OF PEAK PERIOD BUSES : 76

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 13

NUMBER OF REVENUE BUS MILES/YEAR : 2,526,000

REVIEW OF EVALUATION PROCEDURES

This authority has developed a comprehensive manual for the analysis of system performance on a periodic basis. Data are analyzed for the system by transit corridor and by route. Financial, operating, demographic, socio-economic, geographic and other data are collected and summarized for periodic reports. Standard criteria are used for evaluations which are then used to develop service proposals. Five employees are assigned to evaluation. Cost of data collection was not reported.

CRITERIA USED TO ASSESS SERVICE

Informal Standards:
- Schedule Adherence
- Transferring
- Passengers per vehicle hour
- Ratio of revenue to cost
- Loading
- Frequency of Service

AUTHORITY Southeastern Michigan Transportation Authority

211 West Fort Street

Detroit, MI 48231

DESCRIPTION -

ANNUAL RIDERSHIP	:	7,632,271
SIZE OF SERVICE AREA	:	1,012 square miles
POPULATION SERVED	:	3,850,000
NUMBER OF PEAK PERIOD BUSES	:	239
NUMBER OF BUS GARAGES	:	4
NUMBER OF BUS ROUTES	:	40
NUMBER OF REVENUE BUS MILES/YEAR	:	8,100,000

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program but does have several written standards for fixed route evaluation. Total cost for data collections $17,199 annually. Ten employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

1) On time performance is one minute early to three minutes late.

2) Passengers per vehicle mile: over 1 acceptable; less than .5 unacceptable.

3) Operating speed - less than 125% of auto travel time per trip.

4) Cut service if peak hour CBD trips have less than thirty passengers in vehicle.

AUTHORITY Erie Metropolitan Transit Authority

127 East 14th Street

Erie, PA 16512

DESCRIPTION -			
	ANNUAL RIDERSHIP	:	6,666,061
	SIZE OF SERVICE AREA	:	81 square miles
	POPULATION SERVED	:	205,737
	NUMBER OF PEAK PERIOD BUSES	:	63
	NUMBER OF BUS GARAGES	:	1
	NUMBER OF BUS ROUTES	:	13
	NUMBER OF REVENUE BUS MILES/YEAR	:	2,190,000

REVIEW OF EVALUATION PROCEDURES

No evaluation program was reported, but three employees are assinged to evaluation. No mention was made of data collection.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Metropolitan Evansville Transit System

Room 304 Civic Center Complex

Evansville, IN 47708

DESCRIPTION - ANNUAL RIDERSHIP : 1,330,000

SIZE OF SERVICE AREA : 37 square miles

POPULATION SERVED : 137,537

NUMBER OF PEAK PERIOD BUSES : 16

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 13

NUMBER OF REVENUE BUS MILES/YEAR : 821,100

REVIEW OF EVALUATION PROCEDURES

This system does not have a comprehensive evaluation program, but doeshave a "Procedure Manual for Transit Operators." Data are collected for system revenue and cost, system ridership, socio-economic data and transit system characteristics. Cost of data collection is approxiamtely $11,890 annually. One employee is assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

Evansville uses two formal standards to evaluate new and existing service:

1) Route segments revenue to cost ratio. If ratio is below 20%, the route is to be modified.

2) Schedule Adherence - Arrivals more than 10 minutes before departure and after departure time are unacceptable.

AUTHORITY Fayetteville Area System of Transit

426 Mayview Street

Fayettevilee, NC 28306

DESCRIPTION -		
	ANNUAL RIDERSHIP	819,757
	SIZE OF SERVICE AREA	30.9 square miles
	POPULATION SERVED	168,643
	NUMBER OF PEAK PERIOD BUSES	15
	NUMBER OF BUS GARAGES	1
	NUMBER OF BUS ROUTES	14
	NUMBER OF REVENUE BUS MILES/YEAR	900,000

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program. The authority performs boarding and alighting counts and schedule adherence checks. Cost of data collection is $5,760 per year. The number of employees assigned to evaluation is two.

CRITERIA USED TO ACCESS SERVICE

No standards reported.

AUTHORITY The Bus Company (Fort Wayne PTC)

801 Leesburg Road

Fort Wayne, IN 46808

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 3,300,000
	SIZE OF SERVICE AREA	: 160 square miles
	POPULATION SERVED	: 250,000
	NUMBER OF PEAK PERIOD BUSES	: 52
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 24
	NUMBER OF REVENUE BUS MILES/YEAR	: 2,250,000

REVIEW OF EVALUATION PROCEDURES

This Authority is in the process of developing a service evaluation process. Type of data collected and cost were not reported. Two employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Fresno Transit

2050 "E" Street

Fresno, CA 93706

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 6,590,910
	SIZE OF SERVICE AREA	: 79 square miles
	POPULATION SERVED	: 300,000
	NUMBER OF PEAK PERIOD BUSES	: 73
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 21
	NUMBER OF REVENUE BUS MILES/YEAR	: 3,918,600

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program. Type of data collected and cost were not reported. Three employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Gastonia Department of Transit

609 W Airline Avenue

Gastonia, NC 28052

DESCRIPTION - ANNUAL RIDERSHIP : NA

SIZE OF SERVICE AREA : 21.9 square miles

POPULATION SERVED : 50,570

NUMBER OF PEAK PERIOD BUSES : 5

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 11

NUMBER OF REVENUE BUS MILES/YEAR : 264,000

REVIEW OF EVALUATION PROCEDURES

No other information is provided. Presently the Gastonia Department of Transit does not have an evaluation program. Two employees are assigned to the evaluation of the bus service. Type of data collected and cost of collection were not reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Halifax Transit Corporation

P O Box 174

Halifax , NS B3J 2M4
Canada

DESCRIPTION - ANNUAL RIDERSHIP : 10,769,184

SIZE OF SERVICE AREA : 20.6 square miles

POPULATION SERVED : 118,000

NUMBER OF PEAK PERIOD BUSES : 92

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 19

NUMBER OF REVENUE BUS MILES/YEAR : 2,370,000

REVIEW OF EVALUATION PROCEDURES

The authority does not have a comprehensive evaluation program. Two employees are assigned to evaluation: a transportation technologist and a transit inspector.

The authority collects the following data:

1) Maximum Load Point Schedule Adherence
2) Transit Cordon Count
3) On Board Surveys
4) Farebox Dump

Schedule adherence provides the actual arrival of each route at its maximum load point; cost $1,800 per year. Transit cordon count provides schedule adherence by CBD cordon line. This is used for planning (only at a cost of $1,836.) For on board surveys, passengers boarding and alighting for each route at least once every five years is obtained. For farebox dump, a revenue check for each route is made quarterly at a cost of $7,456.

CRITERIA USED TO ASSESS SERVICE

No formal standards reported but has several informal standards.

AUTHORITY Capital Area Transit

901 N. Cameron Street

Harrisburg, PA 17105

DESCRIPTION - ANNUAL RIDERSHIP : NOT REPORTED

SIZE OF SERVICE AREA :

POPULATION SERVED :

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

The authority does not have a comprehensive evaluation program. The authority evaluates service by collecting data on the number and classification of every passenger to determine the ratio of revenue to cost. This effort costs approximately $2,500 per year.

CRITERIA USED TO ASSESS SERVICE

47.5% of total cost must be gained through the farebox.

AUTHORITY Connecticut Transit

Hartford Division

Hartford, CT 06106

DESCRIPTION - ANNUAL RIDERSHIP : NA

SIZE OF SERVICE AREA : NA

POPULATION SERVED : 1,381,000

NUMBER OF PEAK PERIOD BUSES : NA

NUMBER OF BUS GARAGES : NA

NUMBER OF BUS ROUTES : NA

NUMBER OF REVENUE BUS MILES/YEAR : NA

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Ridership and cost data are collected. Cost of data collection and employees assigned to evaluation were not reported.

CRITERIA USED TO ASSESS SERVICE

The authority has one formal standard to evaluate new or existing services. The formal standard requires that new service cover 50% of its operating cost through the farebox within a 60 day operating period. Existing service is also required to meet this standard.

AUTHORITY County of Hawaii Mass Transportation Agency

25 Aupini Street

Hilo, HI 96720

DESCRIPTION -		
	ANNUAL RIDERSHIP :	367,773
	SIZE OF SERVICE AREA :	4,038 square miles
	POPULATION SERVED :	75,000
	NUMBER OF PEAK PERIOD BUSES :	11
	NUMBER OF BUS GARAGES :	1
	NUMBER OF BUS ROUTES :	10
	NUMBER OF REVENUE BUS MILES/YEAR :	270,000

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program, but collects the following data:

1) Passengers per month
2) Cost/Revenue
3) Cost per day by route
4) Revenue per day by route

The mass transit analyst is responsible for collecting the data and is paid $13,200 per year.

CRITERIA USED TO ACCESS SERVICE

Subsidy cannot exceed 75% of operating and maintenance cost.

AUTHORITY Indianapolis Public Transportation Corporation

P O Box 2383

Indianapolis, IN 46206

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 10,660,976
	SIZE OF SERVICE AREA	: 392 square miles
	POPULATION SERVED	: 475,380
	NUMBER OF PEAK PERIOD BUSES	: 168
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 33
	NUMBER OF REVENUE BUS MILES/YEAR	: 4,526,400

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program. Data are collected, but the type of data collected was not reported. The cost of data collection is approximately $35,000 a year. The number of employees assigned to evaluation was not reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Iowa City Transit

410 E. Washington Street

Iowa City, IA 52240

DESCRIPTION - ANNUAL RIDERSHIP : 1,500,000

SIZE OF SERVICE AREA : 16 square miles

POPULATION SERVED : 50 ,000

NUMBER OF PEAK PERIOD BUSES : 15

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 12

NUMBER OF REVENUE BUS MILES/YEAR : 600,000

REVIEW OF EVALUATION PROCEDURES

This authority did not report an evaluation program. Time points and passenger loads are checked infrequently. One part-time employee assigned to evaluation. Cost of data collection was not reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Jacksonville Transportation Authority

1022 Prudential Drive

Jacksonville, FL 32207

DESCRIPTION - ANNUAL RIDERSHIP : 14,900,000

SIZE OF SERVICE AREA : 840 square miles

POPULATION SERVED : 580,000

NUMBER OF PEAK PERIOD BUSES : 163

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 54

NUMBER OF REVENUE BUS MILES/YEAR : 6,139,500

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Data are collected on schedule adherence, passengers per vehicle mile and revenue cost ratio. Ten employees are assigned to evaluation. Cost of collecting data is approximately $88,000 annually.

CRITERIA USED TO ACCESS SERVICE

1) Schedule Adherence - on time is defined as two minutes early to three minutes late.

2) Passengers per vehicle mile for a given route should be 1.50 or more.

3) Revenue to cost ratio - if less than .33 close study is given to the route. System wide goal is to obtain .50 or better.

AUTHORITY Red Rose Transit Authority

825 East Chestnut Street

Lancaster, PA 17602

DESCRIPTION - ANNUAL RIDERSHIP : 1,777,557

SIZE OF SERVICE AREA : 948 square miles

POPULATION SERVED : 200,000

NUMBER OF PEAK PERIOD BUSES : 30

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 17

NUMBER OF REVENUE BUS MILES/YEAR : 1,322,700

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Financial and operating data are collected daily to monthly. Cost for data collection and analysis is $7,164 annually. Three employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

This authority has four formal standards.

1) Schedule Adherence: zero minutes to 5 minutes late.

2) Passengers per vehicle mile: over 1.5 acceptable; 1.0 to 1.5 continue to evaluate; and under 1.0 unacceptable.

3) Revenue as a percent of cost: over 50% acceptable; 30% to 50% continue to evaluate; and under 30% unacceptable.

4) Transferring should be held to 25% or less by route.

AUTHORITY Transit Authority of River City

Room 302, 333 Guthrie Street

Louisville, KY 40202

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 16,300,000
	SIZE OF SERVICE AREA	: 375 square miles
	POPULATION SERVED	: 700,000
	NUMBER OF PEAK PERIOD BUSES	: 201
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 36
	NUMBER OF REVENUE BUS MILES/YEAR	: 1,252,800

REVIEW OF EVALUATION PROCEDURES

The authority has a comprehensive evaluation program and collects data on schedule adherence, ridership, revenue costs and headways. The number of hours and miles of operation is also collected.

Ridership data are collected by temporary checkers.

Other data collection procedures were not reported. The cost and number of personnel assigned to service evaluation were not reported.

CRITERIA USED TO EVALUATE SERVICE

The following formal standards are used:

Loading - not to exceed 100% for an extended period of time on regular service; not to exceed 100% four times per month on express service; not to exceed 150% for a period of more than three hours per weekday on circulator, feeder and other short hall service.

Headways - maximum headway on off-peak service will be the time consumed by one bus making around trip on the route.

Schedule adherence - on-time is zero minutes early to 3 minutes late.

AUTHORITY Hudson Bus Lines

70 Union Street

Medford, MA

DESCRIPTION - ANNUAL RIDERSHIP : NOT REPORTED

SIZE OF SERVICE AREA :

POPULATION SERVED :

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

NOTE: No information was provided. This bus line is private and receives no subsidies.

AUTHORITY Middletown Transit System

1 City Center Plaza

Middletown, OH 45042

DESCRIPTION - ANNUAL RIDERSHIP : 339,080

SIZE OF SERVICE AREA : 20 Square miles

POPULATION SERVED : 50,000

NUMBER OF PEAK PERIOD BUSES : 8

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 6

NUMBER OF REVENUE BUS MILES/YEAR : 324,000

REVIEW OF EVALUATION PROCEDURES

The system does not have a comprehensive evaluation program. Ridership and transfer data are collected by route. The cost of data collection is not reported and no employees are assigned to the bus service evaluation.

CRITERIA USED TO ASSESS SERVICE

Frequency of service

Accessibility to routes

AUTHORITY Monterey Peninsula Transit
One Ryan Ranch Road
Monterey, CA 93940

DESCRIPTION - ANNUAL RIDERSHIP	:	1,274,008
SIZE OF SERVICE AREA	:	46 Square Miles
POPULATION SERVED	:	133,000
NUMBER OF PEAK PERIOD BUSES	:	17
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	16
NUMBER OF REVENUE BUS MILES/YEAR	:	628,800

REVIEW OF EVALUATION PROCEDURES

Monterey has a set of very general guidelines. The guidelines do not state any specific standards to be used in evaluating new or existing service. Data are collected through on-board survey checks to determine passenger usage of routes. Three employees are assigned to the bus evaluation involving approximately 25 person hours per week. Dollar cost of data collection is not reported.

CRITERIA USED TO ASSESS SERVICE

Accessibility to routes.

AUTHORITY Montgomery Area Transit System

Montgomery Department of Planning and Development

P O Box 111

Montgomery, AL 36102

DESCRIPTION -		
ANNUAL RIDERSHIP	:	2,805,235
SIZE OF SERVICE AREA	:	52 square miles
POPULATION SERVED	:	155,000
NUMBER OF PEAK PERIOD BUSES	:	28
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	17
NUMBER OF REVENUE BUS MILES/YEAR	:	967,800

REVIEW OF EVALUATION PROCEDURES

Montgomery Alabama uses the MPO for transit planning and services evaluation. The MPO does have a comprehensive evaluation program in manual form. The operator, Montgomery Area Transit System (MATS) collects the data monthly and the MPO analyze the data quarterly. The data collected includes revenue ridership and costs. The cost of data collection was not reported. The MPO uses two individuals for service evaluation.

CRITERIA USED TO ACCESS SERVICE

The following formal standards are used:

1) Revenue per hour - not less than $5.
2) Passenger per mile - not less than 1.5.
3) Subsidy per passenger - not more than $0.60.
4) Retnetion cost per hour - not more than $7.25.

Retention Cost = variable cost less revenue.

AUTHORITY Metropolitan Transit Authority
60 Peabody Street
Nashville, TN 37210

DESCRIPTION -	
ANNUAL RIDERSHIP	8,500,000
SIZE OF SERVICE AREA	500 square miles
POPULATION SERVED	500,000
NUMBER OF PEAK PERIOD BUSES	120
NUMBER OF BUS GARAGES	1
NUMBER OF BUS ROUTES	43
NUMBER OF REVENUE BUS MILES/YEAR	NA

REVIEW OF EVALUATION PROCEDURES

Nashville has a comprehensive evaluation program in manual form. No budget or cost information was provided and no staff size is given. Ridership and schedule adherence data are collected monthly.

CRITERIA USED TO ASSESS SERVICE

The following standards are used:

Maximum Loading - 75% on base, night, and weekends, 100% on express service and 125% on arterial service during peak periods.

No headways should exceed 60 minutes.

All routes with headways less than 10 minutes should be 80% on time; all other headways should be 95% on time. On time is defined as zero minutes early to 5 minutes late.

Bus stops should not be closer than 700 feet.

Passengers per hour - above 80% of system average is acceptable. Between 70% to 80% needs to be studied. Between 60% and 70%, a report must be made to the authority recommending actions to be taken. Below 60% the route will be discontinued unless a social need is prevalent.

Passenger Amenities -

a. Bus shelters shall be provided at any stop having more than 100 passengers per day. Shelters with 200 or more passengers per day shall be heated and lighted. All park and ride shelters shall be heated and lighted. Also park and ride shelters should have a telephone service provided.

b. Central telephone information shall be provided 16 hours per day.

c. 100% of fleet must be air-conditioned and 90% must be in working order at all times.

Buses shall operate on weekdays from 5:00 a.m. to 12:30 a.m. and from 5:30 a.m. to 12:00 midnight on Sundays and Holidays.

AUTHORITY Transit Authority of Northern Kentucky

11th and Lowell Streets

Newport, KY 41071

DESCRIPTION -		
	ANNUAL RIDERSHIP	5,237,745
	SIZE OF SERVICE AREA	350 square miles
	POPULATION SERVED	251,407
	NUMBER OF PEAK PERIOD BUSES	76
	NUMBER OF BUS GARAGES	1
	NUMBER OF BUS ROUTES	15
	NUMBER OF REVENUE BUS MILES/YEAR	2,331,300

REVIEW OF EVALUATION PROCEDURES

This authority has no comprehensive evaluation program. The authority conducts checks on schedule adherence, passengers per vehicle mile, revenue and cost, and load factors. Cost not reported but approximately 2,000 person hours required. Two employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

The following standards are used:

Schedule Adherence - on time is defined as zero to 5 minutes late.

Load Factor - a maximum of 100% or less during base, 100% on peak express, 125% on arterial services.

AUTHORITY Tidewater Regional Transit

P. O. Box 660

Norfolk, VA 23501

DESCRIPTION -	ANNUAL RIDERSHIP	: 10,484,344
	SIZE OF SERVICE AREA	: 1,079 square miles
	POPULATION SERVED	: 725,000
	NUMBER OF PEAK PERIOD BUSES	: 139
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 41
	NUMBER OF REVENUE BUS MILES/YEAR	: 4,887,000

REVIEW OF EVALUATION PROCEDURES

This authority regularly collects financial and operating data for the system and by route. Route data are summarized quarterly and used for evaluating services. Demographic and other information are reported annually. Formal system financial and operating reports are made monthly. Six full time and additional part time employees are used for data collection and analysis for a total cost of about $100,000.

CRITERIA USED TO ASSESS SERVICE

Standards are mostly informal.

Schedule Adherence - 2 minutes early to 3 minutes late.

Transferring - 20% systemwide or less.

Passengers/mile - based on system average.

Deficit/passenger - based on system average.

Passenger/hour - based on system average.

AUTHORITY Metro Area Transit

2615 Cuming Street

Omaha, NE 68131

DESCRIPTION -		
ANNUAL RIDERSHIP	:	10,094,218
SIZE OF SERVICE AREA		125 square miles
POPULATION SERVED	:	425,000
NUMBER OF PEAK PERIOD BUSES	:	154
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	32
NUMBER OF REVENUE BUS MILES/YEAR	:	1,838,400

REVIEW OF EVALUATION PROCEDURES

The authority does not have a comprehensive evaluation program but does collect loading, headway, schedule adherence and bus speed data. Transportation planners and schedulers are responsible for data collection which is done primarily by traffic checkers. Six employees are assigned to evaluation at an annual cost of appoximately $7,000.

CRITERIA USED TO ASSESS SERVICE

The following formal standards are being set:

1) Schedule Adherence is defined as being zero minutes early to five minutes late.
2) Loading - maximum number of passengers as a percentage of seated capacity for peak service will not exceed 130%.
3) Assessibility - five minute or quarter mile standard for walking distance to and from bus stop.

AUTHORITY Greater Oneonta Bus Service

11 Ford Avenue

Oneonta, NY 13820

DESCRIPTION - ANNUAL RIDERSHIP : 362,121

SIZE OF SERVICE AREA : NA

POPULATION SERVED : 16,030

NUMBER OF PEAK PERIOD BUSES : 9

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : Demand Responsive

NUMBER OF REVENUE BUS MILES/YEAR : NA

REVIEW OF EVALUATION PROCEDURES

No fixed route service is provided by this authority. However, an analysis of user characteristics, trip characteristics, and user perceptions of the dial-a-bus system has been conducted. Cost of this study was not reported but two individuals were assigned to this account.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Regional Transit Service

1372 East Main Street

Rochester, NY 14609

DESCRIPTION - ANNUAL RIDERSHIP : NA

SIZE OF SERVICE AREA : 675 square miles

POPULATION SERVED : 750,000

NUMBER OF PEAK PERIOD BUSES : 200

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 46

NUMBER OF REVENUE BUS MILES/YEAR : 5,400,000

REVIEW OF EVALUATION PROCEDURES

RTS does not have a comprehensive evaluation program but collects various types of data and makes comparisons with the prior year. The system collects the following information: systemwide ridership by type, fares by type, revenue miles, vehicle miles, charter service revenue and vehicle miles and individual route ridership. The individual route ridership is collected for approximately $30,000. The other data are collected for $2,400 per year. Ten individuals are assinged to evaluation.

CRITERIA USED TO ASSESS SERVICE

Informal standard: Passengers per vehicle mile

AUTHORITY Rhode Island Public Transit Authority

265 Melrose Street

Providence, RI 02907

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 17,051,334
	SIZE OF SERVICE AREA	: 183 square miles
	POPULATION SERVED	: 842,000
	NUMBER OF PEAK PERIOD BUSES	: 174
	NUMBER OF BUS GARAGES	: 2
	NUMBER OF BUS ROUTES	: 83
	NUMBER OF REVENUE BUS MILES/YEAR	: 5,970,000

REVIEW OF EVALUATION PROCEDURES

The Authority does not have a comprehensive evaluation program. Data are collected on schedule adherence, passenger counts, transfers and line revenue checks. Cost is $6,171.20 per year. One full time employee is assigned to the service evaluation, in addition to part time use of other employees.

CRITERIA USED TO ASSESS SERVICE

There are informal standards using the above data but no written standards other than that operators are cautioned for running more than two minutes ahead of schedule.

AUTHORITY San Diego Transit

P. O. Box 2511

San Diego, CA 92112

DESCRIPTION -	ANNUAL RIDERSHIP	: 36,000,000
	SIZE OF SERVICE AREA	: 385 square miles
	POPULATION SERVED	: 1,200,000
	NUMBER OF PEAK PERIOD BUSES	: 285
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 42
	NUMBER OF REVENUE BUS MILES/YEAR	: 12,600,000

REVIEW OF EVALUATION PROCEDURES

This authority has a comprehensive evaluation program for the analysis of system performance on a periodic basis. Financial, operating, demographic, socio-economic, geographic and other data are collected and summarized for periodic reports. A five year plan has been finalized for 1979-1983.

San Diego has a set of written standards which were adopted in March, 1978. It has a manager of planning and two full time transportation planners. The cost of collecting the data is approximately $45,000 per year.

CRITERIA USED TO ASSESS SERVICE

The authority uses two types of standards, the first type being service standards and the second being operational standards.

The service standards are as follows:

1) 70% of population should be within ¼ mile of a route.
2) 30 minute headways during peak and maximum 60 minute headways at other times.
3) All peak buses 90% or better on time and off peak 95% on time. Definition of on time is zero minutes early to 5 minutes late.
4) No more than 40% transferring.
5) Maximum loading for peak period is 150% off peak is 100%.
6) No bus over 15 years old.
7) 100% of buses to be upholstered and 90% to be air conditioned.
8) Bus stop benches to be provided at any stop at a major generator or with more than 50 persons per day.

Operational Standards -

a) Total passengers per bus hour: 20 or more.

b) Operating ratio: 30% or better
c) Percent revenue hours to total hours: 70% or more

AUTHORITY Santa Clara County Transit District

1555 Berger Drive

San Jose, CA 95112

DESCRIPTION - ANNUAL RIDERSHIP : 15,700,000

SIZE OF SERVICE AREA : 250 square miles

POPULATION SERVED : 1,200,000

NUMBER OF PEAK PERIOD BUSES : 190

NUMBER OF BUS GARAGES : 3

NUMBER OF BUS ROUTES : 44

NUMBER OF REVENUE BUS MILES/YEAR : 10,129,800

REVIEW OF EVALUATION PROCEDURES

This authority has a comprehensive service evaluation program. Two employees are assigned to evaluation. Financial and operating data are collected at an annual cost of $2,520 annually.

CRITERIA USED TO ASSESS SERVICE

1) Passengers per vehicle hour - minimum line ridership is 60% of system average.

2) Average number of seats filled - minimum is 5 seats

3) Percent operating cost recovered-minimum of 50% of system average (proposed standard)

4) Schedule Adherence - 95% of all trips on time; on time is defined as zero minutes early to 3 minutes late.

5) Percent Transferring - maximum 40% of total boarding passengers.

6) Average Load factor - minimum is .30; maximum is .90.

AUTHORITY Utah Transit Authority

355 Rio Grand

Salt Lake City, UT 84111

DESCRIPTION - ANNUAL RIDERSHIP : 16,325,000

SIZE OF SERVICE AREA : 1,581 square miles

POPULATION SERVED : 759,000

NUMBER OF PEAK PERIOD BUSES : 249

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 105

NUMBER OF REVENUE BUS MILES/YEAR : 12,900,000

REVIEW OF EVALUATION PROCEDURES

This authority has a comprehensive evaluation program and developed a manual for this purpose. At present, service evaluation criteria are being tested for a one year period. Data collected include ridership, hours and miles of operations, demographic data, land use data, revenue, costs, schedule adherence, transferring and accidents. Four individuals are assigned to evaluation; however cost of evaluation was not reported.

CRITERIA USED TO ASSESS SERVICE

Operational standards are checked against system performance each month. Operational standards are as follows:

1) Schedule Adherence - on time is defined as being zero minutes early to five minutes late.

2) Transfers - if transferring on a route is over 30%, a through route or new route will be developed.

3) Safety - accidents should not be more than 10% greater than the national average for like-sized systems.

4) Service Frequencies are developed on the basis of medium household income for a given service area. The lower the income, the higher the service level.

5) Route Design - bus stops will be spaced not closer than 660 feet nor greater than 2,000 feet. This can be modified due to population concentrations.

6) Travel time on all routes shall not exceed twice the auto travel time.

AUTHORITY Central New York Regional Transportation Authority

Room 508 Midtown Plaza

Syracuse, NY 13210

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 11,600,000
	SIZE OF SERVICE AREA	: 125 square miles
	POPULATION SERVED	: 360,000
	NUMBER OF PEAK PERIOD BUSES	: 143
	NUMBER OF BUS GARAGES	: 3
	NUMBER OF BUS ROUTES	: 57
	NUMBER OF REVENUE BUS MILES/YEAR	: 4,371,000

REVIEW OF EVALUATION PROCEDURES

This authority has a set of written standards but they are under review and hence are not operational at this time. Passenger data are collected using temporary employees who are paid $3 to $3.50 per hour. For a given year, 2,000 man hours are required to collect this information plus several hundred hours for coding, keypunching and processing. Three part-time employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

Proposed standards

1) Schedule Adherence - on time is defined as being zero minutes early to five minutes late.

2) Passengers per Vehicle Mile - minimum standard of 2.52.

3) Loading - maximum number of passengers as a percentage of seated capacity for peak service will not exceed 155% and for off-peak service 130%.

4) Headways - the minimum headway for urban trunk lines for peak and off peak service is 30 and 40 minutes respectively; for suburban trunk lines, the minimum headways are 40 and 60 minutes respectively.

5) Minimum passengers per hour per route is 33 for urban routes and 20 for suburban routes.

6) Assessbility - it is common for a person six blocks from a bus line with five minute headways to perceive that he has good access to mass transit.

AUTHORITY Tacoma Transit

P O Box 5037

Tacoma, WA 98405

DESCRIPTION -	ANNUAL RIDERSHIP	: 6,500,000
	SIZE OF SERVICE AREA	: 55 square miles
	POPULATION SERVED	: 196,000
	NUMBER OF PEAK PERIOD BUSES	: 106
	NUMBER OF BUS GARAGES	: 1
	NUMBER OF BUS ROUTES	: 17
	NUMBER OF REVENUE BUS MILES/YEAR	: 3,450,000

REVIEW OF EVALUATION PROCEDURES

No evaluation program was reported nor data collected and its cost. Three part time employees are assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

None reported.

AUTHORITY Champaign - Urbana Mass Transit District

801 East University

Urbana, IL 61801

DESCRIPTION -

ANNUAL RIDERSHIP	2,781,114
SIZE OF SERVICE AREA	35 square miles
POPULATION SERVED	108,000
NUMBER OF PEAK PERIOD BUSES	33
NUMBER OF BUS GARAGES	1
NUMBER OF BUS ROUTES	10
NUMBER OF REVENUE BUS MILES/YEAR	1,819,500

REVIEW OF EVALUATION PROCEDURES

This Mass Transit District does not have a comprehensive evaluation program. However, data are collected on schedule adherence, revenue and expenses. There is one individual assigned to service evaluation. The cost of evaluation is $5,400 annually or 90 hours at $5.00 per hour.

CRITERIA USED TO ASSESS SERVICES

A formal standard for schedule adherence is zero minutes early to ten minutes late.

An informal standard for revenue to expenses is 30% covered by farebox; any route with the ratio being 20% is closely checked.

AUTHORITY Savannah Transit Authority

P. O. Box 9118

Savannah, GA 31402

DESCRIPTION -

ANNUAL RIDERSHIP	:	4,844,433
SIZE OF SERVICE AREA	:	53 square miles
POPULATION SERVED	:	163,000
NUMBER OF PEAK PERIOD BUSES	:	42
NUMBER OF BUS GARAGES	:	1
NUMBER OF BUS ROUTES	:	25
NUMBER OF REVENUE BUS MILES/YEAR	:	1,767,900

REVIEW OF EVALUATION PROCEDURES

The authority does not have a comprehensive evaluation program but collects data on schedule adherence, revenue and passengers per bus mile. Data are obtained by supervisors and from accumulated statistics. One employee is assigned to evaluation. Cost of schedule adherence is $4,380 per year.

CRITERIA USED TO ACCESS SERVICE

1) Schedule Adherence - 1½ minutes early to 4 minutes late.

2) Passengers Per Bus Mile for a given route - acceptable range 1.5 to 2.0; below 1.5 re-evaluate.

AUTHORITY South Coast Area Transit

336 Sanjon Road

Ventura, CA 93023

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 1,914,839
	SIZE OF SERVICE AREA	: 80 square miles
	POPULATION SERVED	: 220,000
	NUMBER OF PEAK PERIOD BUSES	: 22
	NUMBER OF BUS GARAGES	: 2
	NUMBER OF BUS ROUTES	: 10
	NUMBER OF REVENUE BUS MILES/YEAR	: 866,100

REVIEW OF EVALUATION PROCEDURES

This authority does not have a comprehensive evaluation program. Two part time employees are assigned to evaluation. The authority only collcts data on passengers per vehilce hour. Cost of collection not available.

CRITERIA USED TO ASSESS SERVICE

Service increase: greater than 40.0 passengers per vehicle hour.
Service continuation: 20.0 - 39.9 passengers per vehicle hour.
Service decrease: 10.0 - 19.9 passengers per vehicle hour.
Service elimination: less than 9.9 passengers per vehicle hour.

AUTHORITY Yakima City Lines

2300 Fruitvale

Yakima, WA 98902

DESCRIPTION - ANNUAL RIDERSHIP : 668,136

SIZE OF SERVICE AREA : 13 square miles

POPULATION SERVED : 51,100

NUMBER OF PEAK PERIOD BUSES : 7

NUMBER OF BUS GARAGES : 1

NUMBER OF BUS ROUTES : 4

NUMBER OF REVENUE BUS MILES/YEAR : 295,500

REVIEW OF EVALUATION PROCEDURES

This authority does not have comprehensive evaluation program. The only data collected by the authority are schedule adherence, passengers per mile, and transfers. Cost for collecting passenger per mile data is $268 every two months. Cost for collecting other data is negligible. One-fourth of an employee is assigned to evaluation.

CRITERIA USED TO ASSESS SERVICE

1) Passengers per vehicle mile - 1.0 or more is acceptable.

2) Transfers - No written standard but a uniform standard is used.

AUTHORITY Western Reserve Transit Authority

604 Mahoning Avenue

Youngstown, OH 44502

DESCRIPTION -

ANNUAL RIDERSHIP	5,159,000
SIZE OF SERVICE AREA	98 square miles
POPULATION SERVED	275,588
NUMBER OF PEAK PERIOD BUSES	78
NUMBER OF BUS GARAGES	1
NUMBER OF BUS ROUTES	17
NUMBER OF REVENUE BUS MILES/YEAR	1,617,900

REVIEW OF EVALUATION PROCEDURES

No evaluation program was reported by this authority. Two employees are assigned to evaluation. No cost reported.

CRITERIA USED TO ASSESS SERVICE

None reported.

LARGE AUTHORITIES (over 400 buses)

LARGE AUTHORITIES (over 400 buses)

AUTHORITY Metropolitan Atlanta Rapid Transit Authority

2200 Peachtree Summit

401 West Peachtree Street, N.E.

Atlanta, Georgia 30308

DESCRIPTION - ANNUAL RIDERSHIP : 79,724,700

SIZE OF SERVICE AREA : 799 Square Miles

POPULATION SERVED : 1,090,000

NUMBER OF PEAK PERIOD BUSES : 704

NUMBER OF BUS GARAGES : 3

NUMBER OF BUS ROUTES : 130

NUMBER OF REVENUE BUS MILES/YEAR : 28,363,400

REVIEW OF EVALUATION PROCEDURES

The Metropolitan Atlanta Rapid Transit Authority allocates approximately $200,000 for 18 full-time traffic checkers. The checkers collect the data necessary to implement the performance standards. Occasionally, operators are asked to gather specialized data such as the number of patrons paying a specific fare.

A "Load Profile and Survey System," not yet in full operation, has been developed to electronically process raw service data into finished internal reports.

PERFORMANCE MEASURES

Loading Standards
Headways
Schedule Adherence

AUTHORITY Massachusetts Bay Transportation Authority

50 High Street

Boston, Massachusetts 02110

DESCRIPTION - ANNUAL RIDERSHIP : 65,000,000

SIZE OF SERVICE AREA : 1043 Square Miles

POPULATION SERVED : 2,800,000

NUMBER OF PEAK PERIOD BUSES : 844

NUMBER OF BUS GARAGES : 10

NUMBER OF BUS ROUTES : 177

NUMBER OF REVENUE BUS MILES/YEAR : 22,564,151

REVIEW OF EVALUATION PROCEDURES

The MBTA Board of Directors adopted a Service Policy in 1976. This very extensive policy covers service goals and objectives, service planning and evaluation processes, standards and guidelines, as well as amendment procedures. One unique characteristic of the policy is that productivity standards take into account the number of autoless, as well as elderly and handicapped passengers on a route.

10 checkers at a cost of $146,000 are employed to help monitor ridership and schedule adherence standards. An ongoing system-wide ridership survey by an outside consulting firm will also be used to help implement these standards.

Methods of updating this survey data and coordinating it with existing ridership data as well as methods for implementing other aspects of the service policy are being developed as part of this present study.

PERFORMANCE MEASURES

Bus Stop Spacing	Schedule Adherence	Passengers/Mile
Directness	Complaints	Passengers/Hour
Loading Standards	Miles/Trouble Call	Revenue/Cost
Headways	Lost Runs	Subsidy/Passenger

AUTHORITY Niagara Frontier Transit Metro System, Inc. (METRO BUS)

P.O. Box 5010

Buffalo, New York 14205

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 43,100,000
	SIZE OF SERVICE AREA	: 941 Square Miles
	POPULATION SERVED	: 1,300,000
	NUMBER OF PEAK PERIOD BUSES	: 369
	NUMBER OF BUS GARAGES	: 4
	NUMBER OF BUS ROUTES	: 45
	NUMBER OF REVENUE BUS MILES/YEAR	: 10,300,000

REVIEW OF EVALUATION PROCEDURES

Metro Bus utilizes two official and two informal bus evaluation criteria.

PERFORMANCE MEASURES

Schedule Adherence
Load Checks
Complaints

AUTHORITY Calgary Transit

801 - 36 Avenue N.E.

Calgary, Alberta T2E 6T9

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 48,776,260
	SIZE OF SERVICE AREA	: 162.9 Square Miles
	POPULATION SERVED	: 503,000
	NUMBER OF PEAK PERIOD BUSES	: 410
	NUMBER OF BUS GARAGES	: 2
	NUMBER OF BUS ROUTES	: 63
	NUMBER OF REVENUE BUS MILES/YEAR	: 13,654,619

REVIEW OF EVALUATION PROCEDURES

Calgary Transit has two official and two informal system effectiveness standards. $36,000 is spent annually on collecting schedule adherence data. An additional $5,000 is used to pay collector for distributing Origin-Destination survey. None of the other surveyed authorities use collectors for survey distribution and collection.

PERFORMANCE MEASURES

Schedule Adherence
Complaints
Passengers/Hour
Revenue/Cost

AUTHORITY Queen City Metro

c/o Soutwest Ohio Regional Transit Authority

4th and Walnut Building, Rm. 1110; 4th and Walnut Streets

Cincinnati, Ohio 45202

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 924,018

NUMBER OF PEAK PERIOD BUSES : 446

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

The Research Planning Division of Queen City Metro developed a formal bus evaluation procedure in 1976. Four indicators are used to conduct annual systemwide reviews of each route. In-depth corridor analyses are also conducted.

A two week preliminary evaluation is conducted on routes which fall below all 4 standards. On-board counts, socio-economic factors, land-use profiles, and comments from riders and drivers are used to confirm if a route is below standards. Affected communities are asked to make suggestions for service changes and meetings are held with these communities to discuss various alternatives.

Following this preliminary analysis, detailed on-board surveys, counts, and schedule adherence, are conducted and used to evaluate ridership needs and transfers, and scheduling data is reviewed. Proposed service changes are then presented to community groups for discussion. The SORTA Operations Committee must then approve proposed changes. After several months of monitoring service changes, routes which do not meet standards are recommended for discontinuance. These recommendations must be approved by the SORTA Board and City Council.*

*Kirby, Ron and Melinda Green - Case Studies on Transit Service Development Practice - June 14, 1978.

PERFORMANCE MEASURES

Passengers/Mile
Subsidy/Passenger
Cost/Hour

AUTHORITY Greater Cleveland Transit Authority

1404 East 9th Street

Cleveland, Ohio 44114

DESCRIPTION - ANNUAL RIDERSHIP : 105,902,000

SIZE OF SERVICE AREA : 475 Square Miles

POPULATION SERVED : 1,700,000

NUMBER OF PEAK PERIOD BUSES : 830

NUMBER OF BUS GARAGES : 9

NUMBER OF BUS ROUTES : 98

NUMBER OF REVENUE BUS MILES/YEAR : 26,462,000

REVIEW OF EVALUATION PROCEDURES

The Greater Cleveland Transit Authority allocates approximately $427,000 to collect performance data, including $120,000 for processing complaints. 3 informal and 5 informal standards are used to evaluate the authority's bus service.

One unique characteristic of Cleveland's evaluation methods is that its service distribution standard, which is reviewed annually, is based on the household income of an area, as well as its density.

PERFORMANCE MEASURES

Service Distribution
Loading Standards
Headways
Schedule Adherence
Accidents
Complaints
Passengers/Hour
Revenue/Cost

AUTHORITY Regional Transit District

1325 South Colorado Boulevard

Denver, Colorado

DESCRIPTION -

ANNUAL RIDERSHIP	34,000,000
SIZE OF SERVICE AREA	2284 Square Miles
POPULATION SERVED	1,600,000
NUMBER OF PEAK PERIOD BUSES	440
NUMBER OF BUS GARAGES	4
NUMBER OF BUS ROUTES	115
NUMBER OF REVENUE BUS MILES/YEAR	19,400,000

REVIEW OF EVALUATION PROCEDURES

In September, 1978, RTD restructured all of its routes and is currently developing service standards.

AUTHORITY Detroit Department of Transportation
1301 East Warren
Detroit, Michigan 48207

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 66,000,000
	SIZE OF SERVICE AREA	: 247 Square Miles
	POPULATION SERVED	: 4,500,000
	NUMBER OF PEAK PERIOD BUSES	: 632
	NUMBER OF BUS GARAGES	: 4
	NUMBER OF BUS ROUTES	: 75
	NUMBER OF REVENUE BUS MILES/YEAR	: 65,979,000

REVIEW OF EVALUATION PROCEDURES

The Detroit Department of Transportation used one informal criteria and periodic passenger checks to evaluate its bus service.

PERFORMANCE MEASURES

Loading Standards

AUTHORITY City of Edmonton Transit

10426-81 Avenue

Edmonton, Alberta, Canada TGE 1X5

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 471,474,

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

Edmonton is currently in the process of developing a comprehensive route evaluation program. The program will include a ranking of all routes based on economic factors, service coverage, operational characteristics, and transit dependency. This initial evaluation is scheduled to be completed by June 1979 at which time the recommendations will be implemented and a monitoring program instituted.

AUTHORITY Houston Transit System (HOUTRAN, INC.)

5700 Polk Street

Houston, Texas 77023

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 30,100,000
	SIZE OF SERVICE AREA	: 232 Square Miles
	POPULATION SERVED	: 1,500,000
	NUMBER OF PEAK PERIOD BUSES	: 372
	NUMBER OF BUS GARAGES	: 2
	NUMBER OF BUS ROUTES	: 36
	NUMBER OF REVENUE BUS MILES/YEAR	: 1,400,000

REVIEW OF EVALUATION PROCEDURES

Houtran has recently adopted a set of service standards and is currently developing a methodology to implement the standards.

AUTHORITY Southern California Rapid Transit District
425 S. Main Street
Los Angeles, CA 90013

DESCRIPTION - ANNUAL RIDERSHIP	: 316,000,000
SIZE OF SERVICE AREA	: 2280 Square Miles
POPULATION SERVED	: 7,000,000
NUMBER OF PEAK PERIOD BUSES	: 1800
NUMBER OF BUS GARAGES	: 11.5
NUMBER OF BUS ROUTES	: 203
NUMBER OF REVENUE BUS MILES/YEAR	: 92,759,000

REVIEW OF EVALUATION PROCEDURES

An intensive line by line checking program began in the Southern California Rapid Transit District in 1975.

Formal service standards were adopted in 1976. Currently approximately one million dollars a year, one half of one percent of the authority's operating cost, is allocated to collect the data necessary to implement the guidelines. 40 checkers conduct point checks and ridership checks.

By February 1978, 150 routes had been analyzed according to the standards. As a result of this analysis the peak bus requirement was reduced by over 100, and annual vehicle miles were cut by 11 million. Without significant passenger loss, the authority saved approximately $20 million. Moreover, over the last few years service levels were substantially increased, particularly in low density areas, without reducing productivity.

There has been a recent shift in emphasis at SCRTD from efficiency to equity of service distribution. As a result the computerized area account system was developed. Area accounts are lists of data accumulated by census tracts. Bus stops are assigned to census tracts and corresponding service and patronage data is obtained from line data. This data can be easily updated as new ridership counts become available. Demographic factors in a census tract

can be compared to the ridership data. After 2 years of effort, SCRTD is beginning to answer questions such as the average speed, occupancy, and cost of service in specific areas.

Factors are also being developed to compare the amount of service actually being provided in an area to the amount that should be provided.

In addition to collecting route and area specific data, a comprehensive systemwide statistical digest is prepared quarterly.

SCRTD staff have addressed many of the problems associated with implementing service guidelines in a series of papers. (see Literature Review and Bibliography).

PERFORMANCE MEASURES

Service Distribution
Loading Standards
Headways
Passengers/Mile
Passengers/Hour
Subsidy/Passenger

AUTHORITY Metropolitan Dade County

3300 NW 32nd Avenue, P. O. Box 520882

Miami, Florida 33152

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 1,500,000

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

The Metro Transit Agency is in the early stages of developing a bus service evaluation program. While to date numerical standards have not been established, the authority does gather basic passenger as well as service reliability data. Within the next year or two the authority hopes to computerize the storage, retrieval, and processing of the data.

PERFORMANCE MEASURES

Load Factors
Schedule Adherence
Revenue/Mile

AUTHORITY Milwaukee Transport Services, Inc.

4212 West Highland Blvd.

Milwaukee, Wisconsin 53208

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 945,000

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

Milwaukee Transit Services, Inc., has adopted a set of system standards. To date, their "service evaluation measures" have been geared to reacting to obvious situations of inefficiency rather than a routine process of in-depth analysis of all services. It is anticipated that a recently approved system service study funded by Section 9 monies will permit ongoing monitoring of the service policies.

PERFORMANCE MEASURES

Bus Stop Spacing
Loading Standards
Schedule Adherence
Passengers/Hour
Revenue/Cost

AUTHORITY Montreal Urban Community Transit Commission

159 Saint-Antoine Street West

Montreal, Quebec H27 IH3

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA : 144 Square Miles

POPULATION SERVED : 1,900,000

NUMBER OF PEAK PERIOD BUSES : 1819

NUMBER OF BUS GARAGES : 11

NUMBER OF BUS ROUTES : 134

NUMBER OF REVENUE BUS MILES/YEAR : 49,626,841

REVIEW OF EVALUATION PROCEDURES

Montreal has a set of written standards which were documented in June, 1978. The Authority has a relatively large staff and budget dedicated to data collection and analysis. The section of the Transportation Department which collects and analyzes service data has a budget of $950,000 and 49 employees. The 1.2 million dollar 1978 Planning Department budget includes the cost of 21 staff members who work on the road as well as a quadrennial origin-destination survey which is used in evaluating how the existing service fits the needs of the population.

The large data collection staff in Montreal allows peak load counts and time checks to be taken 5 times per year on each route; 3 times for weekday service and once each for Saturday and Sunday service.

Of the 25 authorities which responded to this survey, only Montreal conducts regular O-D surveys to determine whether the existing service is meeting the needs of the population.

The first quadrennial telephone survey was conducted in 1970. It is estimated that it would cost approximately $500,000 to hire an outside-organization to conduct the survey. However, the cost has been minimized to approximately $100,000-$150,000 per survey by using in-house personnel for all the key jobs and allocating $80,000 for temporary survey personnel.

During the telephone surveys, households are asked questions regarding the number of persons in the household, their age and sex, the number of cars owned in the household, and full details regarding every trip made by any member of

the household.

Seventy thousand households are contacted over a nine week consecutive period between late September and the beginning of December. The telephone calls are made each weekday evening and the trips surveyed are those made the previous weekday.

When major modifications are under consideration, the information stored in the computer regarding trip patterns may be used in a simulation of the proposed system to determine whether the revised network responds properly to the known needs of present and potential customers. For smaller projects, the information can be analyzed manually.

Information from the origin-destination survey can be validated with screen-line load counts at designated points and can be supplemented by such counts or by passenger counts on board the vehicles.

PERFORMANCE MEASURES

Bus Stop Spacing
Loading Standards
Headways
Passenger Shelters
Schedule Adherence
Passengers/Hour

AUTHORITY Southeastern Pennsylvania Transportation Authority

2028 PSFS Building

12 South 12th Street

Philadelphia, Pennsylvania 19107

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 4,000,000

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

A consulting firm is currently reviewing SEPTA's bus service evaluation procedure.

AUTHORITY PA Transit

Port Authority of Allegheny County, Beaver and Island Avenue

Pittsburgh, Pennsylvania

DESCRIPTION -	ANNUAL RIDERSHIP	: 101,000,000
	SIZE OF SERVICE AREA	: 730 Square Miles
	POPULATION SERVED	: 1,900,000
	NUMBER OF PEAK PERIOD BUSES	: 732
	NUMBER OF BUS GARAGES	: 5
	NUMBER OF BUS ROUTES	: 166
	NUMBER OF REVENUE BUS MILES/YEAR	: 35,700,000

REVIEW OF EVALUATION PROCEDURES

While PA Transit has no official standards, informal ones do exist for management decision making. The Authority is one of the two surveyed which uses the low-cost method of using drivers to collect daily ridership data.

Each operator registers the total at the end of each trip on a form called a "day card." Transfers collected are also recorded on the day card. In order to determine the number of senior citizens and handicapped passengers, on occassion the driver's are requested to only count these two groups of passengers. This information is collected as part of the driver's regular duties and management is confident of the data's reliability.

Completed "Day Cards" are entered into an EDP system and total ridership is available by route each day and an average weekday, Saturday and Sunday. The computer is programmed to print out a list of each route which has ridership of ± 10% of the previous month.

A cost analysis, by route, is made at least semi-annually; the cost per day, mile, passenger and per passenger mile is developed for each route.

In addition to the ridership's data provided by the drivers, 10 checkers collect on-off data on the routes.

PERFORMANCE MEASURES

Ridership Trend
Passengers/Mile
Passengers/Hour
Subsidy/Passenger
Cost/Passenger Mile

AUTHORITY Bi-State Development Agency

3869 Park Avenue

St. Louis, Missouri 63110

DESCRIPTION -	ANNUAL RIDERSHIP	: 66,818,818
	SIZE OF SERVICE AREA	: 360 Square Miles
	POPULATION SERVED	: 2,400,000
	NUMBER OF PEAK PERIOD BUSES	: 815
	NUMBER OF BUS GARAGES	: 5
	NUMBER OF BUS ROUTES	: 161
	NUMBER OF REVENUE BUS MILES/YEAR	: 26,736,593

REVIEW OF EVALUATION PROCEDURES

Bi-State has adopted and begun to implement a set of service standards. An on-going study is currently being conducted to review Bi-State's bus service evaluation.

In addition to employing nineteen (19) traffic checkers at a cost of $300,000 per year, Bi-State drivers are asked to count passengers on each trip of their run. Counts for the entire system are taken on two (2) week days, one (1) Saturday, and one (1) Sunday. Operators are paid $3.00 each day for this special check and the total cost runs about $10,000-$12,000 per year.

PERFORMANCE MEASURES

Service Distribution
Bus Stop Spacing
Loading Standards
Headways
Bus Assignment
Exclusive Bus Lanes
Passenger Shelters
Schedule Adherence
Travel Speed

AUTHORITY Metropolitan Transit Commission

801 American Center Building

St. Paul, Minnesota 55101

DESCRIPTION - ANNUAL RIDERSHIP	:	63,100,000
SIZE OF SERVICE AREA	:	2900 Square Miles
POPULATION SERVED	:	2,000,000
NUMBER OF PEAK PERIOD BUSES	:	818
NUMBER OF BUS GARAGES	:	4
NUMBER OF BUS ROUTES	:	124
NUMBER OF REVENUE BUS MILES/YEAR	:	430,500

REVIEW OF EVALUATION PROCEDURES

St. Paul has a very comprehensive route by route evaluation program based on a set of performance measures. The Routes, Schedules and Planning Department prepares monthly reports by number of passengers, pass users, passenger characteristics, transfers, fares, passengers, route, total revenue, operating costs, and per passenger subsidies. These reports are broken down by route, as well as by weekdays, Saturdays, and Sundays and holidays.

Drivers collect daily ridership data, thereby minimizing collection costs. Research assistants check trips for exact ridership data and 5 full time load checkers and 1 supervisor monitor load standards at an annual cost of $94,600.

The Authority is currently developing standards to be used for making policy decisions.

PERFORMANCE MEASURES

Loading Standards
Schedule Adherence
Passengers/Mile
Subsidy/Passenger
Average Fare/Fare Paying Passenger
Revenue/Mile

AUTHORITY San Francisco Municipal Railway

949 Presidio Avenue

San Francisco, California 94115

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 118,685,000
	SIZE OF SERVICE AREA	: 49 Square Miles
	POPULATION SERVED	: 715,674
	NUMBER OF PEAK PERIOD BUSES	: 757
	NUMBER OF BUS GARAGES	: 6
	NUMBER OF BUS ROUTES	: 75
	NUMBER OF REVENUE BUS MILES/YEAR	: 823,764

REVIEW OF EVALUATION PROCEDURES

Muni bus service is evaluated based on routing, operating and transit criteria. The Authority has a very comprehensive procedure for determining future passenger waiting shelter sites.

In addition to Muni's more traditional service standards, the inspector's department has a set of criteria to be met by Muni inspectors. These criteria include the number of daily service checks which must be made by an inspector as well as the number of farebox checks.

PERFORMANCE MEASURES

Service Distribution
Bus Stop Spacing
Loading Standards
Passenger Shelters
Schedule Adherence

AUTHORITY Metro

Exchange Building 8

821 Second Avenue

Seattle, Washington 98104

DESCRIPTION -	
ANNUAL RIDERSHIP	44,905,000
SIZE OF SERVICE AREA	2,128 Square Miles
POPULATION SERVED	1,555,700
NUMBER OF PEAK PERIOD BUSES	591
NUMBER OF BUS GARAGES	4
NUMBER OF BUS ROUTES	103
NUMBER OF REVENUE BUS MILES/YEAR	24,413,000

REVIEW OF EVALUATION PROCEDURES

Seattle Metro adopted a set of service evaluation criteria in 1977. Metro is the only authority which responded to this survey which incorporates both headway and population of an area into route productivity standards.

Using October-November 1976 data, productivity seat availability, and on the reliability for each route was summarized in a 1977 report. A prioritization scheme was developed to rank routes which failed one or more productivity standards. In contrast to most authorities which have limited schedule adherence data, this summary report presents on time performance for each route by service period; this data was collected at peak load points.

Metro has found that establishing and evaluating services based on service standards has been useful in gaining support for management decisions.

"In general, few problems have been encountered in adjusting service where the evaluation criteria have shown a need. Obviously, compromise has been necessary on occasion. Typically, one mere fact that recommendation and subsequent decisions are not made on an arbitrary basis, but rather on tangible supporting data, has often smoothed the path of gaining public, governmental, and internal acceptance of operating changes".*

*August 1978 letter from Donald Munroe, Manager, Transit Development.

PERFORMANCE MEASURES

Service Distribution
Directness
Loading Standards
Schedule Adherence
Accidents
Complaints
Miles/Trouble Call
Last Runs
Passengers/Hour
Subsidy/Passenger
Cost/Hour

AUTHORITY Toronto Transit Commission

1900 Yonge Street

Toronto, Canada M4S 1Z2

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 148,971,581
	SIZE OF SERVICE AREA	: 244 Square Miles
	POPULATION SERVED	: 2,145,243
	NUMBER OF PEAK PERIOD BUSES	: 1,043
	NUMBER OF BUS GARAGES	: 7
	NUMBER OF BUS ROUTES	: 102
	NUMBER OF REVENUE BUS MILES/YEAR	: 46,141,867

REVIEW OF EVALUATION PROCEDURES

The Toronto Transit Commission adopted "Standards for Evaluating Existing and Proposed Routes" in August 1977. $550,000 is allocated for traffic checkers which collect data necessary to implement the established standards.

Unlike many authorities, which are only responding to obvious situations of inefficiency, Toronto has developed and is implementing an annual review program of all routes.

"Under the Service Standards program, maximum and minimum acceptable vehicle loading ranges have been specified for the various modes and different periods of operation. In addition, minimum service levels for the different periods of operation have also been detailed.

By utilizing stationary and riding counts, a comparison is made between vehicle loading ranges and observed average vehicle loads on the various routes. Service changes are implemented only when (a) average vehicle loads on a given route exceed maximum acceptable vehicle load for the time period under consideration or if (b) average vehicle loads are less than the maximum acceptable vehicle load and service reductions would not result in the level of service being greater than the minimum service level for the time period under consideration.

Existing route performance, over the long term, is also monitored through the quarterly analysis of reported revenue passengers. Through this procedure, TTC attempts to identify trends in ridership on all routes in the system.

For example, if a route has had a significant decline or increase in ridership, a check is made to see if mileage on the route has declined or increased proportionately. If, for some reason, the change in mileage has not kept pace with the change in ridership, the route is investigated in detail to determine the reasons for the change and to ascertain what service options are possible. This includes a comparison of average vehicle loads on the given route to loading ranges and the frequency of service to minimum service levels.

In addition to the above detailed procedure for the evaluation of the level of service on existing routes, new service requests are also evaluated under the Service Standards program. New service requests are compared to existing poor performing routes by utilizing six evaluation factors: revenue costs, access, transit dependency, transit travel times, land use planning and physical constraints. The new service requests and existing poor performing routes are then ranked based on the above factors and recommendations for implementation are made to the municipality if the new service requests place higher in the evaluation than existing routes.

In 1977, as a result of the rigid application of vehicle loading ranges and minimum service levels, a net saving of approximately $1,528,000 was realized.

Studies are currently underway with the purpose of determining the impact of service changes on ridership."*

*Taken from an August 28, 1978 letter from H.S. Sansom.

PERFORMANCE MEASURES

Bus Stop Spacing
Loading Standards
Headways
Ridership Trend
Revenue/Mile
Service Improvement

AUTHORITY British Columbia Hydro and Power Authority

850 Southwest Marine Drive

Vancouver, B.C. V6P 521

DESCRIPTION - ANNUAL RIDERSHIP : 87,291,366

SIZE OF SERVICE AREA : 448.75 Square Miles

POPULATION SERVED : 1,064,000

NUMBER OF PEAK PERIOD BUSES : 763

NUMBER OF BUS GARAGES : 6

NUMBER OF BUS ROUTES : 128

NUMBER OF REVENUE BUS MILES/YEAR : 32,731.811

REVIEW OF EVALUATION PROCEDURES

The BC Hydro and Power Authority currently utilizes several informal productivity service standards. The Authority is in the process of reviewing its performance indicators and informal service standards in order to develop a formal set of standards.

PERFORMANCE MEASURES

Loading Standards
Passengers/Trip
Lost Runs

AUTHORITY Washington Metropolitan Area Transit Authority

600 Fifth Street

Washington, D.C. 20001

(Theodore D. Lutz)

DESCRIPTION - ANNUAL RIDERSHIP :

SIZE OF SERVICE AREA :

POPULATION SERVED : 2,500,000

NUMBER OF PEAK PERIOD BUSES :

NUMBER OF BUS GARAGES :

NUMBER OF BUS ROUTES :

NUMBER OF REVENUE BUS MILES/YEAR :

REVIEW OF EVALUATION PROCEDURES

While Washington Metro has not adopted route specific service standards, the authority has done extensive work on developing and implementing systemwide quarterly measures of efficiency and effectiveness.* The first systemwide report was prepared in May 1978. Metro's standards are unique in the emphasis that is placed on measuring the operating efficiency of vehicles and manpower.

Future plans include gathering performance measures by routes and establishing garages as cost centers.

* Since to date these measures are not gathered on a route by route basis, they have not been incorporated into Appendix B, "Route Specific Measures".

AUTHORITY Winnipeg Transit System

100 Main Street

Winnipeg, Manitoba, Canada R3C-1A5

DESCRIPTION -		
	ANNUAL RIDERSHIP	: 65,600,000
	SIZE OF SERVICE AREA	: 220 Square Miles
	POPULATION SERVED	: 567,000
	NUMBER OF PEAK PERIOD BUSES	: 488
	NUMBER OF BUS GARAGES	: 3
	NUMBER OF BUS ROUTES	: 53
	NUMBER OF REVENUE BUS MILES/YEAR	: 15,800,000

REVIEW OF EVALUATION PROCEDURES

Winnipeg has adopted a set of formal service standards and allocates approximately $175,000 to implement the standards.

Winnipeg Transit is the only authority which indicated that it uses drivers to help monitor schedule adherence standards. Drivers are required to punch clocks, located at selected terminals, as they leave the terminal. Clock cards are turned in at the end of each day, checked, and summarized for daily reports.

PERFORMANCE MEASURES

Directness
Loading Standards
Schedule Adherence
Complaints
Passengers/Mile
Revenue/Cost

APPENDIX E

ROUTE SPECIFIC MEASURES

CRITERIA USED TO ASSESS BUS SERVICE -- Ratio of Revenue to Cost

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Captital Area Transit Harrisburg, PA	An attempt is made to re-coup 47½% of total cost of operation through farebox revenue.	Fare revenue and cost data	Every route every day for revenue data	Analyzed by the marketing and research department and studied by management.	Not reported
Central New York Regional Transportation Authority, Syracuse, NY	Informal standard Cost and fare equity - it is not recommended that individual routes be evaluated on a revenue to cost basis since they often have very little relationship. Evaluate the ratio of fare paid to trip length, cost and performance. Establish higher fares for long trips in low density areas.	Fare, trip length and cost data	Not reported	Not reported	Not reported
Champaign Urbana Mass Transit, Urbanna, IL	Farebox contributions to expenses: Goal systemwide - 30% Routes scrutinized - Below 20%	Daily revenue sheets are periodically reviewed. Composite statements completed monthly. Farebox contributions to expenses	Monthly	Controller and Transportation Planner	90 hrs $5/hr; $5400 annually
Chapel Hill Community Transit, Chapel Hill, NC	Revenue to cost ratio: Standard - 50% Present - 55%	Data are collected by spare drivers and supervisors through boarding and alighting checks.	Three times a year	Not reported	Each boarding & alighting check cost $1,000.

CRITERIA USED TO ASSESS BUS SERVICE -- Ratio of Revenue to Cost

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Connecticut Transit, Hartford, CT	At least 50% of operating cost must be recovered through the farebox.	Not reported	Monthly	Collected by the Finance Department	Not reported
County of Hawaii Mass Transportation Agency, Hilo, HI	Subsidy cannot exceed 75% of operations and maintenance cost.	Driver count sheets, bank deposit slips, and vendor billings serve as the data source. Ridership, revenue and cost data are collected.	Monthly	Mass Transit Analyst	$13,000 per year
Jacksonville Transportation Authority, Jacksonville, FL	The system average for passenger revenue divided by operating cost is .45. System-wide goal is to achieve and maintain a ratio of .50.	Passenger revenue and operating cost	Semi-annual	Superintendent of Transportation	Annual cost of $2,000
Lehigh and Northampton Transportation Authority, Allentown, PA	Cost sharing objective - the system revenue shall not be less than 40 percent of the operating expenses.	Fare revenue and operating costs	Not reported	Not reported	Not reported
Metropolitan Evansville Transit Syystem, Evansville, IN	Route revenue to cost ratio: Acceptable - 20% or greater Route to be modified - Below 20%	Individual routes are divided into 15 to 20 segments. One-half of each rider's fare is then credited to the segment boarded in and the other one-half is credited to the alighting segment.	Every two to three years by on-board survey	Transit Planner	768 hrs per 2 yrs at $3.50 per hour

CRITERIA USED TO ASSESS BUS SERVICE -- Ratio of Revenue to Cost

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Metropolitan Transit Authority, Des Moines, IA	Informal standard Ratio for May, 1977 and May, 1978 was .44 (Total revenue divided by total cost).	Average cost per mile Revenue per mile	Not reported	Not reported	Not reported
Montgomery Area Transit System, Dept. of Planning & Development, Montgomery, AL	Retention Cost (variable cost less revenue) of not more than $7.25 per hour Subsidy/passenger not more than $.60	Revenue by route Cost by route	Monthly	Planning Technician	$10 per Qtr
Red Rose Transit Authority, Lancaster, PA	Revenue as a percentage of cost: Acceptable - over 50% Continue to evaluate - 30 to 50% Unacceptable - under 30%	Through accumulated statistics derive revenue, and total costs based on mileage, hours and peak bus (overhead) costs.	Monthly	Controller	Negligible
Rhode Island Public Transit Authority, Providence, RI	Informal standard for revenue - cost ratio per operating hour	Special Register's cards issued for day or days.	Random	Supervisor of Schedules	Negligible
San Diego Transit, San Diego, CA	Operating ratio: Revenue generated by route divided by the cost of the route. Standard - 30%	Data Source: Monthly reports and financial statements Fare revenue Operating cost	Not reported	Planning Department	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Ratio of Revenue to Cost

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Santa Clara Community Transit District, San Jose, CA	Proposed standard Minimum 50% of system average	Monthly revenue reports Average fare per passenger divided by average cost per passenger	Quarterly	Scheduler	15 hrs Qtr @ $7 per hour
Tidewater Regional Transit, Norfolk, VA	Informal standard Ratio of revenue to operating cost for fiscal year 1978 was .47.	Annual revenue and cost data	Yearly	Accountant	Negligible
Transit Authority of Northern Kentucky, Newport, KY	Informal standards related to passengers per mile and measuring benefits as opposed to costs.	Cost per mile and revenue per mile	As required	Accounting Dept.	Negligible
Transit Authority of River City, Louisville, KY	Informal standard	By route - Cost/mile Cost/hour Revenue/mile Revenue/hour Revenue/passenger	Monitored monthly	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Central New York Regional Transportation Authority, Syracuse, NY	On time = 0 minutes early to 5 minutes late. 80% of buses must be on time with 10 minute or less headways. 95% must be on time with headway no longer than 10 minutes.	Part-time traffic checkers ride the bus and record arrival time at each time point.	Not reported	Not reported	Not reported
Champaign Urbana Mass Transit District, Urbanna, IL	On time = 0 minutes early to 10 minutes late	Street supervisors monitor system reporting variances by radio to central dispatcher.	Continually	Street Supervisors	Not reported
Chapel Hill Transit, Chapel Hill, NC	On time = 0 minutes early to 5 minutes late	Not reported	Not reported	Not reported	Not reported
Chattanooga Area Regional Transportation, Chattanooga, TN	On time = 0 minutes early to five minutes late	By checkers at entrance and exit points of CBD	Quarterly - all routes	Director of Research and Schedules	60 hrs per quarter (Cost not reported)
Jacksonville Transportation Authority, Jacksonville, FL	On time = 2 minutes early to 3 minutes late	Check points selected in and near the CBD. Traffic checkers are stationed at the locations. Loads are also checked.	Continuous process (daily) Route summary monthly	Superintendent of Transportation	$84,000 per year

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Lehigh & Northampton Transportation Authority, Allentown, PA	On time = 0 minutes early to 3 minutes late	Checked at selected time points along route and at all transfer points.	Not reported	Not reported	Not reported
Metro Area Transit, Omaha, NE	On time = 1 minute early to 5 minutes late	Checked by traffic checker stationed at time points along route.	Weekly with a monthly summary by route	Transportation Planner	$37,440 per year
Metropolitan Evansville System, Evansville, IN	On time = 10 minutes before departure time to departure time	Surveyors are placed at the beginning, midpoint and end of each route along with several floaters up and down the route at other time points.	Every six months for all routes	Transit Planner	$1,092 per year
Metropolitan Transit Authority, Des Moines, IA	On time = 0 minutes early to 5 minutes late Headway / % on Time 10 min. 75% 10 to 30 min. 85% 30 to 60 min. 95% Special 95%	Trail check of buses	Monthly for all routes	Not reported	Not reported
Red Rose Transit Authority, Lancaster, PA	On time = 0 minutes early to 5 minutes late	Data collected by road supervisor and reported by radio.	Not reported	Road Supervisor and Administrative Assistant	$640

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
San Diego Transit, San Diego, CA	On time = 0 minutes early to 5 minutes late	Checked by traffic checkers stationed on buses. Checked at each time point along route.	Monthly for all routes	Transit Planner	Part of total data collection for $45,000 per year
Santa Clara Co. Transit District, San Jose, CA	On time = 0 minutes early to 3 minutes late 95% of all trips on time	On-board traffic checks; actual and scheduled arrival times compared at time point	Quarterly	Scheduler	15 hrs/ qtr @ $7 hour
Savannah Transit Authority, Savannah, GA	On time = 1½ minutes early to 4 minutes late	Checked at check point. Headway and schedule times are checked.	Checked by supervisors quarterly and daily in CBD.	Superintendent of Transportation	$4,380 per year
Southeastern Michigan Transportation Authority, Detroit, MI	On time = 1 minute early to 3 minutes late	Checked at maximum load point, route end and intermediate check points along route.	Bi-monthly for all routes	Service Evaluation	$17,199 per year

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Tidewater Regional Transit, Norfolk, VA	On time = two minutes early to three minutes late	Thirteen checkpoints mainly outside the CBD near the maximum load point	Bi-monthly	Transportation Technician	Bimonthly $665.00
Transit Authority of No. Kentucky, Newport, KY	On time = 0 minutes early to 5 minutes late	Supervisors conduct random checks.	Three trips are checked randomly every two days.	Superintendent of Schedules	Approx. 7 person hours per day
Transit Authority of River City, Louisville, KY	On time = 0 minutes early to 3 minutes late	Not reported	Not reported	Not reported	Not reported
Utah Transit Authority, Salt Lake City, UT	On time = Not early to 5 minutes late	Checked by supervisors at time points and by traffic checkers.	Monthly for all routes	Manager of Marketing and Research	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Accessibility to Routes

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Central New York Regional Transportation Authority, Syracuse, NY	Overall Bus Route Spacing Standard Pop Density / Route Spacing / Max Walking Distance to Bus Lines Urban Area (3600 persons per sq. mile) / ½ mile (6-8 blocks) / ¼ miles (3 - 4 blocks) Suburban Area (1800 -3600 persons per sq. mile) / 1 mile (12-14 blocks) / ½ mile (6 - 7 blocks)	Route spacing and walking distance to bus lines	Not reported	Not reported	Not reported
Chapel Hill Community Transit, Chapel Hill, NC	Accepted Standard: 100% of the households within the service area of the transit system should be within one-fourth mile of a bus stop. Minimum standard: the system should have a stop within one-fourth mile of 90% of the Chapel Hill households.	Not reported	Not reported	Not reported	Not reported
Jacksonville Transportation Authority, Jacksonville FLA	New service initiated by requests of the residents of the area.	Survey of the area is made to determine the viability of the proposed route. Data on population density, demographic characteristics, costs and potential revenue is collected.	Upon the requests of the residents of the area	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Accessibility to Routes

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Lehigh & Northampton Transportation Authority, Allentown, PA	Route spacing should be consistent with the density of development and economic characteristics of the population. A route spacing guide is provided using average family income and population density. The directness of routing is to be measured through the ratio of actual bus miles along a route to the shortest travel time highway miles to connect the route's terminal points. Peak -the ratio should be less than 1.33, Off-peak - no more than 1.50 .	Average family income and population density data	Not reported	Not reported	Not reported
Metro Area Transit, Omaha, NE	Quarter-mile or five minute standard for walking distance to and from bus stop	Section map and on-board survey	Data is collected when needed to implement new route or revise current route. Also, annual on-board surveys are conducted.	Transportation Planner.	80 hrs per year at $5 per hour
Metropolitan Evansville Transit System, Evansville, IN	Walking Distance Information will be categorized accoridng to the number of passengers walking less than one block, two blocks or three blocks to or from the bus lines.	On-board survey	Every two to three years	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Accessibility to Routes

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Metropolitan Transit Authority, Nashville, TN	Bus Stop Spacing: In general bus stop spacing should not be closer than 700 feet. In low density areas, spacing should not be governed by a fixed criterion. In commercial and industrial areas the number and location of bus stops should be controlled by concentration of patrons more than by "rule of thumb" spacing standards.	Maps are used.	Not reported	Not reported	Not reported
Middletown Transit System, Middletown, Ohio	The policy is to serve most of the city within two blocks of the residents.	No data collected	No data collected	Not data collected	None
Montery Peninsula Transit, Montery, CA	Provide service within approximately one-half mile walking distance, except in remote areas. Provide benches where significant numbers of passengers board.	Not reported	Not reported	Not reported	Not reported
Rhode Island Public Transit Authority, Providence, RI	Informal standard for new lines or extensions	On board checks	As needed	Supervisor of Schedules	Negligible

CRITERIA USED TO ASSESS BUS SERVICE -- Accessibility to Routes

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
San Diego Transit, San Diego, CA	Seventy percent of the population in the service area should be within a quarter mile of an existing route.	Not reported	Not reported	Planning Department	Not reported
Tidewater Regional Transit, Norfolk, VA	Informal standard Percent population served - 4.2% for fiscal year 1978	Total ridership and census population	Yearly	Transportation Research Analyst	Negligible
Transit Authority of River City, Louisville, KY	Service will be added on new and extended service in accordance with approved loading standards.	Loading data	Reviewed monthly	Not reported	Not reported
Utah Transit Authority, Salt Lake City, Utah	The distance between bus stops will not be closer than 660 feet nor greater than 2,000 feet.	Not reported	Not reported	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers per Vehicle Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Central New York Regional Transportation Authority, Syracuse, NY	Minimum passengers per hour for individual routes: Urban - 33 Suburban - 20	Passengers per route collected by temporary employees and by a radio system.	Not reported.	Not reported.	Temporary employees are paid $3 to $3.50 per hour.
Connecticut Transit, Hartford, CT	Informal standard Range: 23 to 32	Total Passengers Total Route Hours	Monthly	Collected by the Finance Dept., Schedule Dept. and Planning and Marketing Dept. Department heads are responsible for analysis.	Not reported
Metropolitan Transit Authority, Des Moines, IA	Informal standard for weekday corridor passenger per hour Range: 10 to 2,517 (for a sample day)	Corridor and route ridership per hour	No more than four times a year	Not reported	Not reported
Metropolitan Transit Authority, Nashville, TN	Route Ridership Per Hour Criteria: Continue the route if the ridership exceeds 80% of the system average. Review route if ridership falls between 70% and 80% of the system average. If ridership falls between 60% and 70% of system average, recommend possible actions for improvement or discontinue.	Passengers per route per hour	Monthly	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers Per Vehicle Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
	If ridership falls below 60% of system average, continue in six month intervals or discontinue.				
San Diego Transit, San Diego, CA	Total passengers per bus hour is equal to total number of passengers on a route over a time period divided by the number of bus hours the route operates in the same time period. The standard is 20.	Total passengers Bus hours	Monthly reports	Planning Department	Not reported
Santa Clara County Transit District, San Jose, CA	Minimum line ridership should equal 60% of system average.	Generated from revenue report	Monthly	Senior Transportation Engineer	Negligible
South Coast Area Transit, Ventura, CA	Passengers per vehicle hour by route. Planning guidelines Service increase: greater than 40 Service continuation:20 - 39.9 Service decrease: 10-19.9 Service elimination: less than 9.9	An average fare factor is used to translate route farebox revenue into passenger boardings.	Continually	Assistant General Manager	$15,000 to $20,000 per year
Tidewater Regional Transit, Norfolk, VA	Informal standard Average for fiscal year 1978 is 23.	Accumulated statistics developed from passenger data collected from boarding and alighting counts.	Monthly	Transportation Planner and Accountant	Negligible

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers Per Vehicle Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Transit Authority of River City, Louisville, KY	Informal standard	By route - Total passengers Total route hours	Monitored monthly	Not reported	Not re-ported

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers Per Vehicle Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Bay County Metro Transit Authority, Bay City, MI	Informal Standard New routes compared to other routes.	Drivers tally the riders per route per day.	Daily	Manager and Planner	Negligible
Canton Regional Transit Authority, Canton, Ohio	Routes with 600 or more pass./day are good. 500 or less - below average. 300 or less - service can be improved or too much is being provided.	On-board surveys and estimates based on farebox revenue. Ridership by type: free riding student; paying student; regular riders (adults & E&H): ride and shop patrons, and participants in the Nutritional Program.	Yearly on-board surveys Revenues collected daily	Not reported	Not reported
Central New York Regional Transportation Authority, Syracuse, NY	Revenue Passengers Per Miles Minimum - 2.52 Goal - 3.0	Onboard passenger data is collected using temporary employees.	Not reported	Not reported	$3 to $3.50 per hour for temporary help
Chapel Hill Community Transit, Chapel Hill NC	Any route with passengers per vehicle mile lower than one-half of the system average passengers per vehicle mile should be cut. System passengers per system mile (for 1975-76) was 1.81.	Data is collected by spare drivers and supervisors by boarding and alighting checks.	Three times a year	Not reported	Each boarding & alighting check costs $1,000
Jacksonville Transportation Authority Jacksonville, FLA	Less than 1.5 requires reevaluation.	Operator provides radio reports on ridership.	Semi-annually	Scheduler	Annual cost of $2,000

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers Per Vehicle Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Montgomery Department of Planning & Development, Montgomery, ALA	A route with passengers per vehicle mile below 1.5 should be closely examined.	Number of passengers by route	Monthly	Planning Technician	$10/ Qtr
Red Rose Transit Authority, Lancaster, PA	Acceptable - Over 1.5 Continue to evaluate - 1.0 to 1.5 Unacceptable - Less than 1.0	Based on accumulated statistics of monthly passengers and revenue miles.	Monthly	Controller	Negligible
Regional Transit Service, Rochester, NY	Informal standard A comparison is made with prior year.	Collected by registering fareboxes and on-board checkers. Vehicle mile ridership by trips and individual route ridership data are collected.	Monthly Yearly/route	Finance Department (Chief Accountant) Daily on-board counts by Transportation Technician	Approx $30,500 year Approx 6,000 person hours
San Diego Transit, San Diego, CA	Informal standard Passengers Per Mile Route Range: .3 to 6.1	Ridership data	Not reported	Planning Department	Not reported
Savannah Transit Authority, Savannah, GA	Passengers Per Bus Mile for a given route Average for the overall system is 2.6 Acceptable range: 1.5 to 2.0 To be reevaluated: Below 1.5	Ridership data	Monthly	Finance Officer	Negligible

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers Per Vehicle Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Southeastern Michigan Transportation Authority, Detroit, MI	Less than .5 unacceptable	Obtained from checker's daily report	Annually	Service Evaluator	Negligible
Tidewater Regional Transit, Norfolk, VA	Informal standard Acceptable: 1.5 or more To be reevaluated: 1.0 to 1.5 Unacceptable: Less than 1.0	Accumulated statistics developed from passenger data. Collected from boarding and alighting counts.	Monthly	Transportation Planner and Accountant	Negligible
Transit Authority of Northern Kentucky, Newport, KY	Informal standards applied to specific events which appear out-of-line with system averages.	Developed from revenue and mileage statistics.	Monthly	Accounting Dept.	Negligible
Yakima City Lines, Yakima, WA	1.0 or more is acceptable	Random checkpoints selected on all routes throughout the day.	At least every two months	Operations Supervisors	40 hours $268

CRITERIA USED TO ASSESS BUS SERVICE -- Loading

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Canton Regional Transit Authority, Canton, OH	If bus ridership/bus capacity during a.m. peak (7-9 a.m.) is 1.57 to 1.84 and/or if maximum ridership/bus capacity for single largest run during a.m. peak is 1.67 to 2.22 there is a potential overcrowding problem.	On-board survey Ridership for each major route by type Bus capacity derived from number of runs during period	Not reported (implied yearly)	Stark Co. Area Transportation Study	Not reported
Central New York Regional Transportation Authority, Syracuse, NY	Passengers as a percentage of seated capacity Peak - Maximum for any one trip is 155% Off-Peak - Maximum for any one trip is 130%	On board passenger data collected by temporary employees and passenger counts radioed by drivers.	Not reported	Not reported	Temporary employees are paid $3.50 per hour
Chapel Hill Community Transit, Chapel Hill NC	Recommended Standard Passengers as a percentage of seated capacity. Route type / Base / Peak Shuttle 175% 175% Express 100% 125% Arterial 100% 150%	Data is collected by spare drivers and supervisors by boarding and alighting checks.	Three times a year	Not reported	Each boarding & alighting check cost $1,000
Halifax Transit Corp., Halifax, NS	Informal standard for peak loading. Informal standard for profile	Data collected for specific routes at their maximum load point in the a.m. and p.m. peaks. Route #, run #, bus #, arrival and/or departure load, arrival times and scheduled arrival times are recorded. 50% to 100% sample in both directions during selected period of the day On/off counts Travel times, delays and cause of delay are recorded.	Quarterly Minimum of every 5 yrs/route. Prefer every year on major routes. Surveys should be taken in May.	Transportation Technologist	100 hrs per qtr @ $4.50 per hour

CRITERIA USED TO ASSESS BUS SERVICE -- Loading

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Halifax (cont'd)					1 person for on/off data/ 1 person for speed/ delay data.
Metro Area Transit, Omaha, NE	Passengers as a percentage of seated capacity Peak hours - maximum of 130%	On-board survey: Traffic checkers at intersections and drivers fill out check sheets.	Traffic checker assigned when needed. Check sheets filled out as needed for special checks.	Transportation Planner and Scheduler	120 hrs per week at $6 per hour
Metropolitan Transit Authority, Des Moines, IA	Percent vehicle capacity per trip. Range for corridors: 13.40% to 46.20%	Percent vehicle capacity per trip	No more than four times a year	Not reported	Not reported
Metropolitan Transit Authority, Nashville, TN	Maximum loading standards (Passengers as a Percentage of Seated Capacity) Express / Arterial Peak Hour 100% / 100% Nonpeak 75% / 75% Night 75% / 75% Saturday/ Sunday 75% / 75%	Passengers per route and per time period	Monthly	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Loading

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
San Diego Transit, San Diego, CA	Standard: Base: Passengers as a percentage of seated capacity should not exceed 100%. Peak: Passengers as a percentage of seated capacity should not exceed 150%	Ridership data from passenger counting program	Not reported	Planning Department	Not reported
Santa Clara County Transit District, San Jose, CA	For average number of seats filled, the minimum is five seats; no maximum. Proposed standard Average load factor minimum .30 maximum .90	Developed from accumulated on board traffic check data.	Quarterly	Scheduler	15 hrs per qtr and $7 per hour
Southeastern Michigan Transportation Authority, Detroit, MI	Maximum of 55 passengers per vehicle, providing six standees standing for no more than twenty minutes. Cut service if peak hour CBD trips have less than thirty passengers per vehicle. Cut peak hour crosstown service if less than ten passengers per vehicle.	Passengers per vehicle Obtained from checkers during regular assignment.	Annually	Service Evaluator	Negligible
Transit Authority of No. KY, Newport, KY	Passengers as a percentage of seated capacity should not exceed 100% on peak express service and 125% on arterial service.	Passengers are counted at maximum load point of route.	As required	Scheduling Dept.	20 person hrs per event

CRITERIA USED TO ASSESS BUS SERVICE -- Loading

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Transit Authority of River City, Louisville, KY	Passengers as a percentage of seated capacity should not exceed 100% for an extended period of time. Passengers as a percentage of seated capacity on express service should not exceed 100% more than four times per month.	Operators are required to report the presence of standees.	Whenever standees are present.	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Central New York Regional Transportation Authority, Syracuse, NY	Minimum policy headways (minutes) Weekdays Peak / Off Peak Urban Trunk Lines 30 / 40 Suburban Trunk Lines 40 / 60	Collected by temporary employees and by a radio system.	Not reported	Not reported	Temporary employees paid $3 to $3.50 per hour.
Chapel Hill Community Transit, Chapel Hill, NC	Recommended standard Maximum headways of 30 minutes in the peak and 60 minutes in the base unless the loading indicates more service is needed.	Data is collected by spare drivers & supervisors by boarding and alighting checks.	Three times a year	Not reported	Each boarding & alighting check cost $1,000.
Lehigh and Northampton Transportation Authority, Allentown, PA	As a general policy, regular route services should operate on 30 minute headways during peak periods, 60 minute headways during midday and 120 minute headways during evening service hours.	Load Factors	Not reported	Not reported	Not reported
Metro Area Transit, Omaha, NE	Headways range from 12 to 16 minutes.	Survey taken on passenger waiting time.	Annually and as needed	Transportation Planner and Scheduler	120 hours per wk at $6 per hour

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Metropolitan Transit Authority, Des Moines, IA	Informal standard for week day inbound trips per corridor and hour	Inbound trips by corridor and hour of the day	Not reported	Not reported	Not reported
Metropolitan Transit Authority, Nashville, TN	Policy Headways should not exceed 60 minutes.	Data obtained from schedules.	Monthly	Not reported	Not reported
Middletown Transit System, Middletown, Ohio	All routes operate on ½ hour headways.	No data collected.	No data collected.	No data collected	No cost
Rhode Island Public Transit Authority, Providence, RI	Headways are adjusted according to findings.	Not reported	Not reported	Supervisor of Schedules	Not reported
San Diego Transit, San Diego, CA	Thirty minutes should be the maximum allowable time between buses in peak periods, except for some routes which serve low density areas. Sixty minutes should be the maximum allowable time between buses in the base period.	Not reported	Not reported	Planning Department	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Transit Authority of River City, Louisville, KY	Maximum headway for off-peak service will be the time consumed by one bus making a round trip on the route. Every effort will be made to establish clock headways insofar as acceptable loading standards are maintained.	Time of travel for a round trip Number of buses required to meet passenger demand	Not reported	Not reported	Not reported
Utah Transit Authority, Salt Lake City, UT	Policy Headways in Minutes Weekday Peak / Base / Evening 10 or more dwelling units/acre Median Household Income $5,000: 10 / 20 / 30 5,000 to 10,000: 10 / 20 / 60 10,000 to 15,000: 30 / 30 / 90 Over 15,000: 30 / 40 / 90 6 to 10 dwelling units/acre Median Household Income $5,000: 20 / 30 / 60 5,000 to 10,000: 20 / 30 / 60	Not reported	Not reported	Not reported	Not reported

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA				HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Utah Transit Authority (cont'd)		Peak	Base	Evening				
	10,000 to 15,000	30	40	90				
	Over 15,000	30	60	90				
	2 to 6 dwelling units/acre							
	Median Household Income							
	$5,000	20	30	60				
	5,000 to 10,000	30	40	90				
	10,000 to 15,000	30	60	90				
	Over 15,000	40	60					

CRITERIA USED TO ASSESS BUS SERVICE -- Transferring

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Canton Regional Authority, Canton, Ohio	Transfers at a bus stop greater than 35 per five day period reviewed.	Five days of transfers	Not reported (Implied yearly)	Not reported	Not reported
Metropolitan Transit Authority, Des Moines, IA	Informal standard Range: 9% to 12% of total ridership	On-board passenger surveys	Not more than four times a year	Not reported	Not reported
Red Rose Transit Authority, Lancaster, PA	Maximum 25% of passengers by route	Transfers received by route	As received	Administrative Assistant	Negligible
San Diego Transit, San Diego, CA	No more than 40% of the riders of the entire system should be required to transfer.	Bus drivers are requested to turn in all transfers for a given day.	Not reported	Planning Department	Not reported
Santa Clara County Transit District, San Jose, CA	Proposed standard Maximum - 40% of total boarding passengers	Operators record passenger boardings by fare category.	Quarterly	Scheduler	15 hrs per Qtr @ $7/hr
Tidewater Regional Transit, Norfolk, VA	20% systemwide rate or less is acceptable.	Transfer tickets are collected.	One day per year	Transportation Planner	Negligible

CRITERIA USED TO ASSESS BUS SERVICE -- Transferring

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Utah Transit Authority, Salt Lake City, Utah	90% of the persons transferring should be able to do so within an average of one-third of the connecting route's headway. If more than 30% of a route's riders require a specific transfer new or through routes should be established or scheduled transfers created with a five minute maximum waiting time.	Not reported	Not reported	Not reported	Not reported
Yakima City Lines, Yakima, WA	Informal standard	Tabulated from drivers records.	Daily	Drivers & Dispatchers	Negligible

APPENDIX E

ROUTE SPECIFIC MEASURES

II. Large Systems (over 400 buses)

A. Service Design Measures

Service Distribution
Bus Stop Spacing
Directness of Service
Loading Standards
Headways
Exclusive Bus Lanes
Passenger Shelters
New Service Design

CRITERIA USED TO ASSESS BUS SERVICE -- Service Distribution

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Cleveland, Ohio	Service coverage standards are based on dwelling unit density and Medium Household income. (Only applicable in Central City) Formal	Standard adherence is revieved by staff,	Annually.	Director of Service Development.	$12,000/yr. 120 hrs./ yr.
Los Angeles California	Standards are for local service (4 or more stops/mile). The level of service for a given density is described in terms of headways and distance to the route.	Bus stops are assigned to census tracts and corresponding service and patronage date is obtained from line data.	As needed to support service improvements	Service Analysis Section.	
San Francisco, California	Standards are based on time of day, development density, terrain, and type of service.		Transit Planner		
Seattle, Washington	Minimum service coverage standards during the peak period are based on population density. Service should be provided within 1/4 mile of an area identified as an "activity center". Formal	Routes are plotted on population and area map.	As necessary.	Transit Planners.	
St. Louis, Missouri	Route spaced 1/2 mile apart where there's sufficient density. Service should be provided within 1/4 mile of an area identified as an "activity center". Formal	Street maps with routes is shaded 1/4 mile on either side of routes and visual checks are made of areas not being served.	Once/year as part of Transit Improvement Program.	Transit Planner.	Minimal.

CRITERIA USED TO ASSESS BUS SERVICE -- Bus Stop Spacing

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	Residential areas - maximum every 660 feet. Commercial areas - maximum every 440 feet. Formal	For new routes and requests for additional stops on existing routes. Traffic Improvements Section designates stops based on field work.	As needed.	Traffic Improvement Officer.	$6,000/yr.
Milwaukee, Wisconsin	Express-(via freeways) - One mile or more. Express-(via arterials)- Intersections with other transit routes, major traffic generators. Local- Every 600-1250 feet.				
Montreal, Canada	Every 80 feet. Formal				
San Francisco, California	Placement based on safety considerations.			Transit Traffic Superintendent.	
Toronto, Canada	400'-1500' with an average of 750'. In downtown core may fall below 400'. Formal				
St. Louis, Missouri	Every 500-1000' in residential areas. Commercial and industrial stops based on existing and projected density patterns. Informal	Route segments are examined.	Rarely.	Planning or Evalu- Division.	

CRITERIA USED TO ASSESS BUS SERVICE -- Directness of Service

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	No more than 25% of riders should require more than 1 transfer to complete their trip by surface transit. Where 20% or more riders/hour transfer between routes, the 2 routes become candidates for linkage. Where a route extension of 1 mile or less would eliminate a transfer for 20% of the riders, such extensions should be implemented. Formal	On-board surveys.	Upon request or as needed.	Service Planning; Operations Planning.	
Seattle, Washington	Minimize route deviations; related to passengers gained vs passengers inconvenienced. (Maximum of 10 passenger minutes per net rider gained). Formal	Roadside count of passengers/bus.	Continuous.	Ridership Information Planner, Transit Planner.	
Winnipeg, Canada	Number of transfers needed to complete trips.	Simulation model.			

CRITERIA USED TO ASSESS BUS SERVICE -- Loading Standards

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Atlanta, Georgia	Peak - 150% If over 150%, headway reduced to bring load to - 125%. If under 100%, headway increased to bring load to 125%. Formal	18 Traffic checkers collect peak load counts.	On a daily basis rotating throughout system.	Chief of Evaluation.	$200,300/yr. salaries for 18 checkers. @ $4.93/hr.
Boston, Mass.	Feeder, Crosstown, Inter-town- Peak 30 minutes - 140% Total peak - 120% Midday - 100% Evening - 100% Intra-community- Peak 30 minutes - 120% Total peak - 110% Midday - 100% Evening - 100% Linehaul - Service scheduled to yield average loads less than 100% to allow excess capacity for ridership growth. Formal	10 Traffic checkers collect peak load counts; chief traffic checker summarizes information.	For all routes with 2 or more buses, scheduled counts are taken 4 times/year.	Plans and Schedules, Supervisor.	$72,865/yr.- 50% of 10 traffic checkers and 1 chief checker's time is spent on peak load counts.
Buffalo, New York	Formal Criteria	Peak load counts.	Daily on various routes at various times.	Supervisor of Schedules.	
Cleveland, Ohio	Peak - 125% Off peak - 100% Formal	Traffic checkers take peak load counts.	Monthly or semi-annually depending on passenger volume.	Chief Schedule maker.	$180,000/yr.- 18,000 hrs.

CRITERIA USED TO ASSESS BUS SERVICE.-- Loading Standards

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Detroit, Michigan	Informal Criteria	Peak load counts.		Superintendent of the route.	
Los Angeles, California	Peak (maximum 20 minutes) - 140% Off peak - 100% Long distance and Busway Service (maximum half hour) - 100% Formal	Checkers collect peak load counts.	An average of once every 14 months for each route.	Scheduling department.	Total ridership collection cost =$1,000,000
Miami, Florida	Informal	2 Traffic analysts collect peak load counts.	As needed.	Clerk under direction of a senior planner.	
Milwaukee, Wisconsin	Peak - Express (Via Freeway) - 100% Off peak - 100% Arterial Express and local - 133%	Checkers collect peak load counts.	3 times/year on each route.		
Minneapolis/ St. Paul, Minnesota	No more than 20 standees/bus. No passenger should have to stand for more than 20 minutes. Informal	Five load checkers collect data. Data keypunched in data processing section. Data includes; Route #, run #, actual and scheduled arrival time and load count here instead.	Ongoing.	Supervisor of Data Collection.	$94,000/yr. salaries for five checkers @ $7.75/hr. and 1 supervisor @ $14,000

CRITERIA USED TO ASSESS BUS SERVICE -- Loading Standards

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Montreal, Canada	Peak - 167% Off peak - 100% Formal	Major routes: Peak load counts taken 3 days for weekday service, 1 day each for Saturday and Sunday service. Minor routes: On board counts.	5 times/year.	"Service du Transport"	(See abstract of Montreal)
San Francisco, California	Peak (on main lines): Motor coach & trolley coach - 150% Street car - 180% Cable car - 225% Formal	Checkers collect on-board and standing counts; includes the number of passengers passed up.	Each line at least once/year.	Transit traffic Supervisor.	
St. Louis, Missouri	Peak - Express - 120% at maximum load point. 100% at 10 minute point. Local - 140% at maximum load point. 100% at 10 minute point. Formal	19 Traffic inspectors collect peak load counts; smaller routes checked on-board. Drivers take occassional on-board counts.	Inspectors: Major lines - 4 times/year. Minor routes - Once/year. Drivers: 2 weekdays/ year, 1 Saturday/ year, 1 Sunday/ year.	Scheduling Division	Inspectors - 19 man years & 3 clerical staff. Drivers - $3.00/day/ driver- $10,000-$12,000/yr.
Seattle, Washington	Peak period - passenger loads not to exceed 135% of bus capacity 60% of the time - no standees for more than 20 minutes. Off peak - No standees. Formal	Peak load counts.	Ongoing.	Ridership Information Planner, Transit Planner.	

CRITERIA USED TO ASSESS BUS SERVICE -- Loading Standards

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Toronto, Canada	Peak (maximum 30 minutes)- 160-180% Peak (maximum 1 hour) - 135-160% Transition period between peak and (maximum 1 hour)- 100-135% Off peak (maximum 1 hour) 100%	49 Checkers collect on-board ridership counts.	Quarterly.	Treasury; Operators; Research; Transit; Planning.	Total budget for checkers -$550,000/yr.
Vancouver, Canada #17	Peak - Standing load. Off peak - 100% Formal		As required.	Schedule Analysis Supervisor.	Varies (15 traffic checkers on staff)
Winnipeg, Canada	Major routes- Peak -150% averaged over 15 minute period. Off peak -100% Major routes-formal. Minor routes-informal.	Major routes: Peak load counts taken by observers in mobiles shelters. Minor routes: On board on-off counts.	Major routes: Every 10-15 days. Minor routes: 1-3 times/year.	Superintendent of Schedules.	$75,000/yr.

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Atlanta, Georgia	Minimum headway - 60 minutes. If demand doesn't warrant 60 minute service, service should be examined, modified, or terminated. Headway should not exceed round trip run time, including layover. Service should be scheduled so that the following load standards are maintained. Early a.m. - 100% Peak (average peak hour) - 125% Peak (peak 15 minutes) - 150% Weekday (off peak) - 100% If this results in excessive headways frequencies should be based on a 50% load or a sixty minute maximum headway. Weekend - same as off peak weekdays. Formal	18 Traffic checkers conduct peak load counts.	Daily rotating basis throughout the system.	Chief of Evaluation.	$200,000 for 18 full-time checkers which also conduct on-board counts
Boston, Mass.	Regular Route- Peak - 30 minutes Midday - 30 minutes Evening - 60 minutes Community Based- Peak - by demand Midday - 60 minutes Evening - 60 minutes Formal	Routes which do not meet policy standards are reviewed to determine whether they could meet ridership standards with the improved headways. 10 traffic checkers conduct peak load counts.	Rarely.	Operations Planning; Service Planning.	

CRITERIA USED TO ASSESS BUS SERVICE -- Headways

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Cleveland, Ohio	Type of Service Express, Local Crosstown, Feeder / Collector Distributor Weekday Peak 15 / 15 Weekday Base 30 / 30 Saturday 30 / 20 Sunday 60 / 30 Evenings 60 / 30 Owl 60 / 60 formal	Standard Adherence is reviewed by staff.	Annually.	Director of Service Development.	120 hrs./yr. $12,000/yr.
Los Angeles, California	Weekday Service: Density — Headway 4,000 people or greater/square — 30 minutes Less than 4,000 people/square mile — 60 minutes		As needed to support service improvements	Service Analysis Staff.	
Montreal, Canada	Peak - 15 minutes Off peak - 30 minutes At maximum load point, passengers/vehicle must not exceed 75. Formal	Peak load counts are collected for each list period - 3 weekdays, 1 Saturday, and 1 Sunday.	5 times/year.	Service de la Planification.	See abstract
St. louis, Missouri	Peak - 15 minutes Midday - 30 minutes Late Even - 60 minutes Midday service is provided on all routes except Express and Park and Rides Formal	Schedules examined and average headways computed.	Evaluation Division.	Negligible.	
Toronto, Canada	Peak - 20 minutes Off peak - 30 minutes Formal				

CRITERIA USED TO ASSESS BUS SERVICE -- Exclusive Bus Lanes

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
St. Louis, Missouri	Transit volume on exclusive lane should equal and in the future exceed the maximum number of passengers that can be carried by private automobiles operating in the same lane: 45-50 buses per lane per hour in the peak on freeways, 25-30 on arterial streets.	Existing and proposed services are analyzed.	Rarely.	Planning Section.	

CRITERIA USED TO ASSESS BUS SERVICE -- Passenger Shelters

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Montreal, Canada	A valid location for a shelter must 1) have sufficient lighting, 2) not impede visibility, 3) have a minimum of 100 boarding passengers from 6:30am to 6:30pm, 4) allow for proper snow clearance, 5) have the consent of the land owner. Formal				
San Francisco, California	Sites are selected based on the following variables: a. type of area (e.g. transfer point, commercial center) b. weather c. patronage d. frequency e. geographic service area f. space available g. scope of site h. overhead obstruction i. isolation j. impact on adjacent buildings k. impact on neighborhood characteristics l. importance to urban fabric and clarity of transit Formal	Variables a - e are evaluated based on available in-house data. Variables f - l are evaluated based on field inspections.			
St. Louis, Missouri	Shelters will be provided if 1) serves senior citizen complex and/or handicapped. 2) serves one or more major activity centers 3) serves a major transfer point, a point of major ridership or the loop or terminus of a route or 4) serves a route which has a large headway.	Varies. Activity centers are noted on a transit map. O.D. survey is examined for high transfer points and suggestions taken from general public and political jurisdictions.	Not regularly	Planning Section.	Unknown

CRITERIA USED TO ASSESS BUS SERVICE -- New Service Design

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Atlanta, Georgia	New routes should achieve 75% of systemwide average passengers/mile or passengers/hour by end of 90 day trial period. Trial period may be extended after 90 days if ridership is increasing. New all day service - should only be initiated if 600 passengers/day can be expected. New radial routes - should be as direct as possible. New suburban and rural routes - should be operated express for the greatest length feasible. New cross-town routes - should intersect the maximum number of radial radial routes and provide access to optimal number of major activity centers. Formal	Feasibility studies initiated based on public requests for new services. Studies include: ridership estimates headways equipment needed	As needed	Manager of Bus Scheduling.	Varies
Boston, Mass.	New services should meet same ridership and economic standards as existing services. Informal	Requests for service charges may be submitted by any individual or group and are screened by the Service Committee. Proposals which pass this screening are evaluated based on; cost assessment impact on affected community deficit/passenger passengers/vehicle hour passengers/mile	Service requests are reviewed quarterly.	Operations Planning, Service Planning	

CRITERIA USED TO ASSESS BUS SERVICE -- New Service Design

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Cincinatti, Ohio	Based on demand. Informal Criteria	Service requests submitted by a community council or organization. General proposals are part of a Five Year Plan Technical Work Study Program. Census is primary source of data to estimate demand. Surveys of demand markets are conducted periodically. A 1974 comprehensive survey of demand was conducted by soliciting information through community meetings and newspaper campaigns. A 1977 survey determined the location and needs of elderly and handicapped citizens.	Work Program updated annually.		
Montreal, Canada	Any new route or deviation must fit into an existing, intergrated transit system. The bus network patterns is updated every 4 years.	An in-house telephone original destination survey is conducted of 70,000 households. Information from this survey can be validated with screen-line load counts, and on-board counts.	OD survey every 4 years.	"Service de la Planification".	For O-D Survey - $100,000 - $150,000. $80,000 is for temporary survey personnel.

CRITERIA USED TO ASSESS BUS SERVICE -- New Service Design

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
San Diego, California	Travel demand and neighborhood socio-economic analyses were used in a 1975 action plan to identify areas of potential demand. Major travel movements between traffic zones were identified and compared to the existing bus routes. Six factors were used to rank neighborhoods based on their ridership potential: medium income population/residential area population autos/person % elderly and youth # of trips generated by zone		The number of seat miles of service provided in each neighborhood was compared to its ridership potential to indicate underserved neighborhoods.		
Toronto, Canada	First priority - improve service on existing routes which meet productivity standards and require service improvements. Second priority - poor economically performing routes and new services. Existing routes in the bottom 25% on economic performance (net cost/mile) will only be compared to proposed new services if the economic performance of the existing routes cannot be improved and they have a low average occupancy. For new and existing routes which do not rank above the bottom 25% on net cost/mile access to transit is considered and routes not meeting net revenue or access time filters will not be considered further. (Continued)	Estimates of access. Time in person minutes. (The time required for people of an area to get to transit services): A formula is used based on walking distance from existing transit services, number of persons which will be measured, and frequency of transit service currently available. Estimates of Net Revenue/Mile. For existing services: see criteria Revenue/Mile. For new services: Ridership projections made using manuel method. 1) Trip distribution pattern is established. 2) Major attraction or production zones identified. 3) Present modal split is estimated based on available information (continued)		Treasury Department; Operations; Research; Transit Planning.	

CRITERIA USED TO ASSESS BUS SERVICE -- New Service Design

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Toronto, Canada (continued)	Remaining improvements go through following filtering process: 1) Rank all services, both new and poor performing, based on net revenue, change in access per unit cost. 2) Implement those in top 10% all of these factors. 3) Implement those in top 10% of ridership per unit cost and change in access. 4) Implement those in top 10% of ridership per unit cost. 5) Implement those in top 10% of access per unit cost. 6) Repeat foregoing in 10% increments up to 100% or until resources are depleted. Formal	4) Ridership estimate made. Cost projections made using formula that combines marginal and fixed costs.			

APPENDIX E

ROUTE SPECIFIC MEASURES

II. Large System (over 400 buses)

B. Operating Performance Measures

Schedule Adherence
Travel Speed
Accidents
Complaints
Miles/Trouble Call
Lost Runs

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Atlanta, Georgia	On time = 50 seconds early - 5 min. late Informal	18 traffic checkers take peak load counts.	On a daily basis rotating throughout the system.	Chief of Evaluation & Analysis; Transportation Division Managers; Point Supervisors; Traffic Checkers.	$200,300/yr.- Salaries for 18 checkers @ $4.93/hr.
Boston, Mass.	On time for terminal departure = ± 0 minutes. On time at intermediate points = 0 - 5 minutes. Formal	10 checkers conduct time checks during on-board counts used to estimate passengers/mile and passengers/hour. Starters and inspectors at various locations check bus departure times by using trip sheets; system currently being expanded.	As needed (35-40 routes per year).	Plans and Schedules; Operations Planning.	$72,865/yr.- 50% of 10 traffic checkers & 1 chief checker time is used to do on-board counts which include schedule adherence checks
Buffalo, New York	On time = less than 2 min. ahead of schedule - less than 4 minutes late. Formal	Checks by supervisors and traffic checkers at time points.	Daily on various routes at various times.	Chief Supervisor and Supervisor of schedules	
Calgary, Canada	On time = ± 5 minutes in rush hour = ± 2 minutes in off-peak Formal	Checks at peak load points.	3 times/year/route	Transit Operations, Schedules Supervision	$36,000/yr.- 5760 hours
Cleveland, Ohio	On time = ± 1 min. of scheduled run time Informal	Schedule adherence sampled on an individual route basis.	As needed.	Superintendent of schedules.	$120,000/yr.- 6000 hrs/yr.
Miami, Florida	Informal Criteria	Two traffic Analysts make checks at time points.	As needed.		
Milwaukee, Wisconsin	On time = 1 min. early - 3 min. late	Traffic checkers make checks at peak load points.	3 times/year		
Minneapolis/ St. Paul, Minnesota	On time = 0 min. early - less than 5 min. late. Informal	5 full time checkers continually gather this data.	Ongoing.	Supervisor of Data Collection.	$94,600/yr.- Salaries for 5 checkers & 1 Supervisor
Montreal, Canada	On time for terminal departure = ± 0 minutes. On time at check points = 1 minute early - 2 minutes late. Formal				See abstract

CRITERIA USED TO ASSESS BUS SERVICE -- Schedule Adherence

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
San Franciso, California	On time = 2 minutes early - deliberately late. Informal	Checks are taken by inspectors at 26 fixed posts via 19 radio car shifts. Each inspector must file in writing 2 thirty minute checks each day.	Ongoing	Inspector	
St. Louis, Missouri	On time = 1 min. early - 3 min. late; 85% of trips in peak and 95% of trips in base and late evening periods should meet this standard. Formal	From reports of traffic inspectors with some input from supervisors.	Larger lines 4 times/year. Minor routes 1/year	Evaluation and Scheduling Division.	
Seattle, Washington	Peak: 80% of the trips should be on time (0-5 min. late). Midday & Sat: 90% of the trips should be on time (0-5 min. late). Night & Sun: 95% of trips should be on time (0-3 min. late). Formal	Roadside monitoring of actual vs. schedule time at peak load points.	Continuous	Ridership Information Planner; Transit Planner.	
Winnipeg, Canada	On time = 1 to 5 min. late depending on headway. Early not acceptable. Major routes: Formal Minor routes: Informal	Drivers punch clocks at selected terminals as they leave. The cards are turned in each day and summarozed	Major routes: every 10-15 days. Minor routes: 1-3 times/year.	Superintendent of Transportation.	$12,000/yr. salary for 1 clerk.

CRITERIA USED TO ASSESS BUS SERVICE -- Travel Speed

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Winnipeg, Canada	System average - 11 mph. Attempt to maintain or improve. Informal	Developed from accumulated statistics.	Monthly.	Research Officer.	$65,000/yr. to collect passenger/mile, revenue per hr. and operating speed.
St. Louis, Missouri	Local - 15 mph. average. Express on Arterials - 20-25 mph. Express on Freeways - 30-40 mph. Unworkable standard due to low speeds on urban routes. Formal	Exam schedules and actual run time.	At most once/year.	Planning Division.	Unknown.

CRITERIA USED TO ASSESS BUS SERVICE -- Accidents

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Cleveland, Ohio	Comparison to previous year's rate of passenger and traffice accidents per 100,000 vehicle miles of operation. Informal		Monthly.	Training and Safety Specialist.	
Seattle, Washington	Reduce accidents to 64 per million miles. Informal	Developed from accumulated statistics.	Monthly.	Maintenance Analyst and Management Analyst.	

CRITERIA USED TO ASSESS BUS SERVICE -- Complaints

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	1 Quartile deviation from the system average complaints per 100 revenue hours for the quarter being analyzed. Formal	3 Customer service employees answer telephone and letter complaints. District supervisors are notified of complaints. Complaints are categorized by type and route, in tri-weekly reports.	Data collected daily, compiled every three weeks.	Manager of Customer Service, Department of Community Affairs and Marketing.	$68,000
Buffalo, New York	Informal	Time checks, load checks, rides by inspectors, unobserved inspections.	As needed.	Transportation and Marketing Depts.	
Calgary, Canada	Informal			Schedule Supervision.	
Cleveland, Ohio	Comparison to previous year's rate by category. Informal	Summary of customer complaints by category.	Monthly	Director of Advertising.	$120,000/yr. 6,000 hrs./ yr.
Seattle, Washington	Maintain driver related complaints at 2.5 per operator per year. Maintain complaints on coach upkeep and condition of shelters, bus zones, etc. to 18/month. Informal	Derived from accumulated statistics.	Monthly.	Information Operator/ Management Analyst.	
Winnipeg, Canada	Informal Criteria	Complaints are forwarded to section for action.	Collected daily, compiled monthly.		

CRITERIA USED TO ASSESS BUS SERVICE -- Miles/trouble call

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	10,000 revenue miles/trouble call. Formal	Defect cards are completed and turned in to maintenance shop. Cards include the length of time a vehicle on the road carrying passengers is disabled.	System currently being implemented.	Operations Planning.	
Seattle, Washington	2500 miles/trouble call/month. Informal	Developed from accumulated statistics.	Monthly.	Maintenance and Management Analysts.	

CRITERIA USED TO ASSESS BUS SERVICE -- Lost Runs

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	99.9% of all scheduled trips must be completed each quarter. Formal	The number of trips added or lost for each route is reported daily, by garage, to the Treasurer's Office; the data is keypunched by data processing from the submitted forms. Starters report lost runs on a daily basis by phone to Operations Planning; this data is compiled by hand.	Data sent to the Treasurer's Office is collected on a daily basis and compiled quarterly. The MBTA is currently developing a computerized system to use this data to estimate lost runs on a regular basis. Reports of lost runs from station masters are compiled daily.	Operations Planning, Treasurer's Office.	
Seattle, Washington	Maintain runs lost due to mechanical reasons to 5/month. Informal	Developed from accumulated statistics.	Monthly.	Maintenance and management analysts.	
Vancouver, Canada	0 desired Informal	Data gathered on whether runs are cancelled due to lack of manpower or equipment.	Irregularly	Economic Planning Analyst	

APPENDIX E

ROUTE SPECIFIC MEASURES

II. Large Systems (over 400 buses)

C. Economic/Productivity Measures

Ridership Trend
Passenger/Mile
Passenger/Hour
Passenger/Trip
Revenue/Cost
Subsidy/Passenger
Average/Fare
Revenue/Mile, Cost/Mile
Revenue/Hour

CRITERIA USED TO ASSESS BUS SERVICE -- Ridership Trend

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Pittsburgh, Penna.	If a routes' ridership deviates 10% from the previous month's ridership it will be analyzed. Informal	Drivers record daily ridership on a counter and record total passengers and transfers at end of each day on a "day card". Day cards are entered onto an EDP system. Total ridership is available by route for each day and an average weekday, Saturday, and Sunday.	Ridership is collected daily. Costs allocated at least semi-annually.		Ridership data collection regular part of drivers' duties.
Toronto, Canada	If a route deviates 10% from the average trend for all routes, a riding count will be taken; if the trend is confirmed, service will be analyzed for service adjustments. Formal	Revenue passengers determined from farebox revenues. Checkers collect peak load counts.	Quarterly.	Treasury, Operations, Research, Transit Planning.	Total budget for traffic checkers - $550,000.

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	Regular routes- Peak - 2.5 Off peak - 1.5 For routes serving 75% or more transit dependents (without auto available) or 15% elderly or handicapped- Peak - 2.5 Off peak - 1.0 Formal	10 checkers collect on-board counts for ridership data; chief traffic checker summarizes. On-board system-wide survey being conducted by outside consultant. Methods to update this data being developed.	On-board counts taken by checkers as needed (35-40 routes/year).	Plans and Schedules, Service Planning Section.	$72,865 - 50% of 10 traffic checkers and 1 chief checker's time is used to do on-board counts. Counts also used for passengers/hour and schedule adherence. $410,000 for systemwide survey.
Cincinatti, Ohio	1.5 passengers/mile - minimum accepted value for 1978.	Calculated using sample counts and revenue collections.	Revenue counts collected daily.	Research and Planning Staff.	
Los Angeles, California	Local service - 2.5 in peak 1.5 all day Express service - 250 passengers miles/bus hour. Formal	Checkers collect on-board data. Data is keypunched.	System-wide average for all routes-is every 16 months.	Schedule Department Planning Department	Total ridership collection cost (not including that required strictly for scheduling purposes) is $1,000,000.

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Miami, Florida	Informal	2 Traffic analysts collect on board and peak load counts.	As needed.	Planning and Marketing Department.	
Minneapolis, St. Paul, Minnesota	Actual vs. budgeted. Informal	Finance Department gatners weekday, Saturday, and Sunday sample data primarily from drivers' trip sheets.	Monthly.	Staff Accountant.	$31,200/yr. salaries for 2 employees @ $7.50/hr. Counts also used for passengers/ mile.
Pittsburgh, Pennsylvania	Analysis of passenger/vehicle mile and passenger/service mile. Informal	Drivers record daily ridership on a counter and record total Passengers and transfers at end of each day on a "day card". Day cards are entered onto an EDP system. Total ridership is available by route for each day and an average weekday, Saturday and Sunday.	Ridership collected daily.		Ridership data collection regular part of drivers' duties
Winnipeg, Canada	Routes with less than 1.5 passengers/mile must be re-evaluated. Informal	Developed from route revenues.	Collected daily. Reported Monthly	Research Officer.	$65,000/yr. combined with operating speed and revenue /hour.

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	Regular routes. - 30/hr. Routes serving 75% transit dependents (without auto available). - 20/hr. Routes serving 15% elderly or handicapped. - 20/hr. Formal	10 Traffic checkers collect on-board counts, chief traffic checker summarizes. On-board systemwide survey being conducted by outside consultant; methods to update this data being developed.	On-board counts taken by checkers as needed (35-40 routes per year).	Plans and Schedules, Service Planning.	$72,865 - 50% of 10 traffic checkers and 1 chief checker's time is used to do on-board counts. Counts also used for passengers/hour and schedule adherence. $410,000 for systemwide counts.
Calgary, Canada	23/hour Formal	Data is gathered using fare box revenues, and on-board passenger counts.		Accounting.	
Cleveland, Ohio	15/hour - for entire route and for route segments. Informal	Drivers collect total passenger counts. Checkers collect boardings and alightings by stop to examine route segment productivity.	Drivers collect data quarterly. On-off counts are ongoing.	Research Specialist responsible for driver's counts. Director of Service Development responsible for on-off counts.	$5,000/yr. 500 hrs./yr. for research specialist. $120,000/yr.-6,000 hrs./yr for collectors.

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Los Angeles, California	Local service - 20/hour. Formal	Checkers collect on-board data.	An average of once every 16 months for weekday service.	Schedule Department. Service Analysis Section.	Total ridership collection cost (not included that required strictly for scheduling purposes) is approximately $1,000,000.
Milwaukee, Wisconsin	Standards for new service- Weekdays - 22/hour Saturdays - 15/hour Sundays Holidays - 10/hour Formal	Traffic checkers collect peak load counts.	3 times/year.	Research and Planning Division.	32 hrs./yr. for analysis.
Montreal, Canada	25/hour Formal	Peak load counts collected on larger routes - 3 days for weekday service, 1 day for Saturday, 1 day for Sunday, On board counts on smaller lines.	5 times/year.	Service du Transport.	See abstract.
Pittsburgh, Pennsylvania	 Informal Criteria	Drivers record daily ridership on a counter and record total passengers and transfers at end of each day on a "day card". Day cards are entered onto an EDP system. Total ridership is available by route for each day and on average weekday, Saturday, and Sunday.	Ridership counts collected daily.		Ridership data collection regular part of drivers' duties.

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Seattle, Washington	Standards for peak and off peak are based on population density of a route's service area. Standards range as follows- Peak - 2,500 persons/square mile or less - 22/hour. 13,000 persons/square mile or greater - 63/hour. Midday - 2,500 persons/square mile or less 12/hour. 13,000 persons/square mile or greater - 52/hour. Formal	Peakload and onboard passenger counts; factors are applied to peakload counts to estimate total ridership. Population density calculated by aggregating the census tracts which a route passes through.	As needed.	Ridership Information Planner, Route Planner.	

CRITERIA USED TO ASSESS BUS SERVICE -- Passengers/Trip

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Seattle, Washington	Standards are based on average headways. Peak - Minimum passengers/trip at maximum load point in primary direction of travel only. Midday - Peak load counts in both direction. Formal	Peak load counts.	Continuous; each route a minimum of 3 times/year.	Ridership Information Planner; Route Planner.	
Vancouver, Canada	Informal Criteria	15 Traffic checkers conduct on-board counts.	As required.	Schedule Analysis Supervisor.	

CRITERIA USED TO ASSESS BUS SERVICE -- Revenue/Cost

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	Regular Route .30 Premium Route .50 School Route .10 Contract/Manifest 1.00 Industrial .50 Community-based .20 Routes serving 75% transit dependents (without auto available) or 15% elderly or handicapped ..... one-half of above values. Formal	Drivers collect revenue information by route for one-week periods. Occasional revenue counts are made by surveyors. On-board systemwide survey being conducted by outside consultant includes collection of revenue data.	Drivers collect revenue information four times/year.	Treasurer's Office, Operations Planning, Service Planning.	$40,000-$45,000/yr. 10 minutes/day at flat pay for each run.
Calgary, Canada	.25 Formal			Accounting.	
Cleveland, Ohio	.30 Informal		Annually.	Director of Budget.	
Milwaukee, Wisconsin	Revenue/cost for new services should not be less than .50				
Winnipeg, Canada	Routes with less than .20 revenue/cost ratio must be re-evaluated and reported to policy committee. Formal	Route revenues collected daily by route.	Collected daily, reported monthly	Research Officer.	$65,000/yr. for passengers/mile, revenue/hour and operating speed.

CRITERIA USED TO ASSESS BUS SERVICE -- Subsidy/Passenger

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Boston, Mass.	Informal	Estimated ridership for new services is divided by manpower and mileage cost.	Used as needed in allocating resources for new services.	Service Planning, Operations Planning.	Minimal.
Cincinatti, Ohio	.80 Subsidy/passenger - maximum accepted value for 1978. Formal	Revenue is calculated from daily fare collection totals. Costs are based on two allocation formulas. Costs are a function of hours of service, vehicle mileage, passengers carried, and administrative and maintenance overhead. The per hour cost attributed to operating vehicles on tripper runs is higher than regular service because of higher labor and vandalism costs on school runs. Fixed costs are based on a peak hour vehicle basis. Passenger counts are calculated using sample counts and revenue collections.	Revenue collected daily.	Research and Planning Staff.	
Minneapolis /St. Paul, Minnesota	$1.25 Subsidy/per passenger average on any route. $1.50 Subsidy/per passenger on individual runs of a route. Formal	Route average derived from analysis of driver trip sheets (sample days). Run average derived from on-board data collected by research assistants.	Quarterly by route. As needed by run.	Director, Routes, Schedules, and Planning.	$1600/yr. - 40 hours/wk. @ $10.00/hr. for route subsidy. Negible for run average.
Pittsburgh, Pennsylvania	Informal Criteria	Drivers record daily ridership on a counter and record total passengers and transfers at end of each day on a "day card". Day cards are entered onto an EDP system. Total ridership is available by route for each day and an average weekday, Saturday, and Sunday. Cost analyses by route are made allocating operator's benefits, cost/pay hour, cost/mile, cost/scheduled peak vehicle, and cost/run.	Ridership is collected daily. Costs allocated at least semi-annually.		Ridership data collection regular part of drivers' duties.

CRITERIA USED TO ASSESS BUS SERVICE -- Subsidy/Passenger

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Seattle, Washington	$.94 Subsidy/passenger. Informal	Developed from accumulated statistics and derived using Transit Dept. expenditures only.	Monthly.	Accountant/Management Analyst.	
Los Angeles California	Informal Criteria	Developed from available on-board counts and a cost allocation formula.	As needed.	Service Analysis Section	

CRITERIA USED TO ASSESS BUS SERVICE -- Average Fare/Fare Paying Passengers

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
St. Paul, Minnesota	Actual vs budget - includes no pays and reduced fare riders. Informal		Monthly.	Staff Accountant.	Negligible.

CRITERIA USED TO ASSESS BUS SERVICE -- Revenue/Mile, Cost/Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Miami, Florida	Informal Criteria	Drivers enter fare box readings and numbers of transfers on cards which are relayed to the Accounting Department. Accounting Department convert revenue and transfer data to passengers by classification.	Collected daily. Tabulated monthly.		
Minneapolis/ St. Paul, Minnesota	Actual vs. budgeted. Informal	Finance department gathers weekday, Saturday, and Sunday sample data, primarily from drivers' trip sheets.	Monthly.	Staff Accountant.	$31,000/yr. salaries for 2 employees @ $7.50/hr. Counts also used for passengers/ mile.
Pittsburgh, Pennsylvania	Informal Criteria of cost/passenger mile.	Drivers record daily ridership on a counter and record total passengers and transfers at end of each day on a "day card". Day Cards are entered onto an EDP system. Total ridership is available by route for each day and an average weekday, Saturday, and Sunday. Cost analyses by route are made allocating operators' benefits, cost/ pay hour, cost/mile, cost/scheduled peak vehicle, and cost/run.	Ridership collected daily. Costs allocated at least semi-annually.		Ridership data col regular part of drivers' duties.

CRITERIA USED TO ASSESS BUS SERVICE -- Revenue/Mile, Cost/Mile

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Toronto, Canada	Based on net cost/mile, bottom 25% of existing routes are evaluated for possible service changes and compared with proposed services Formal	Revenue per route is allocated based on the number of transfer and non-transfer passengers/route. Costs per route are allocated based on system-wide average cost and adjusted by the portion of labor that varies with the operating speed. Routes are ranked in order of net profit or loss per mile. The following data is collected to allocate revenues and cost: 1) Revenue passengers are determined from farebox analysis. 2) Total passengers is collected through stationary and on-bound counts.	On-board surveys: once/year/route. Stationary counts: four/year/route. Revenue passengers/route: calculated quarterly. Revenue/cost: calculated and analyzed annually.	Ridership counts by checkers. Collection of Revenue Data by Treasury Dept. Analysis of data by Treasury Dept., Operations, Research, Transit Planning.	Total budget for traffic checkers $550,000.

CRITERIA USED TO ASSESS BUS SERVICE -- Revenue/Hour

AUTHORITY	DESCRIPTION OF CRITERIA	HOW AND WHAT DATA IS COLLECTED?	HOW OFTEN IS THIS DATA COLLECTED?	WHO IS RESPONSIBLE FOR COLLECTION AND ANALYSIS OF DATA?	COST
Cincinatti, Ohio	$6.49 revenue/hour - minimum accepted value for 1978.	Calculated from daily fare collection totals.		Research and Planning Staff.	

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