

# Record Keeping and Evaluation

Robert L. Smith, Jr., Department of Civil and Environmental Engineering, University of Wisconsin—Madison

This paper identifies major sources of information, record-keeping issues, and evaluation methodologies. Much is being learned about developing a unified reporting system. Record-keeping needs are addressed in terms of data availability, problems in data collection, and the potential impact of a federal operating subsidy. A systems approach to system evaluation is outlined together with the trade-off or balance sheet evaluation methodology. Service standards are proposed as a means of institutionalizing system evaluation.

If, as expected, federal operating subsidies for rural transit become available with the passage of the new transportation bill now before Congress, many new rural transit systems will be initiated and existing systems will be expanded. Successful implementation and expansion of these systems will depend significantly on the efficiency of the record-keeping and evaluation systems used.

## INFORMATION SOURCES

In placing current issues in perspective, it is helpful to identify key reports and papers that document the state of the art. The general background reports provide information on the nature of rural travel as well as actual examples of how rural travel needs have been met, including both successful and unsuccessful operations. Papers by Brown, Noble, and Burkhardt provide a starting point for detailed consideration of record keeping and evaluation (1).

Major contributions to the state of the art of record keeping and evaluation can be expected from two current federal programs—the Federal Highway Administration (FHWA) section 147 demonstration program and the U.S. Department of Health, Education, and Welfare (HEW) transportation demonstration program on coordination of existing services. The U.S. General Accounting Office (GAO) report shows how funding of transportation programs by federal agencies can affect reporting and accounting requirements (2).

A number of states now provide operating assistance for rural transit systems. Detailed information on record keeping and evaluation required by each state can best be obtained by writing to the respective states.

The record-keeping and evaluation systems used by successful individual rural transit systems are also of interest. Documentation of particularly successful section 147 demonstration program projects may be available in the future. A computerized record-keeping system is used in the Progress for People System (Human Resource Agency) in Decatur, Tennessee. Another innovative system is the Older Adults Transportation System (OATS) in Missouri. Peter Schauer of OATS said that the program is considering the use of a credit card system to reduce the data-processing load. Developments at OATS can be followed by subscribing to the OATS Wheel; this publication includes the monthly schedule for OATS vans as well as items of general interest on rural transportation (3). The Out-County Dial-A-Ride system in Washtenaw County (Ann Arbor), Michigan, has recently begun serving the general public in addition to the elderly and the handicapped. The rural system could be integrated into the computerized scheduling and dispatching system of the Ann Arbor Dial-A-Ride system; however, at this point, with only

six or seven buses in operation the flexibility of manual scheduling and record keeping is still preferred.

A number of Transportation Research Board (TRB) publications are relevant to system evaluation questions. The TRB literature includes several special reports on paratransit. Formal technical discussions of evaluation methodologies are presented in texts by Hutchinson and Stopher (4, 5). Lockwood and Wagner discuss approaches to system evaluation in the context of transportation system management that are directly applicable to the evaluation of rural transportation systems (6).

## RECORD KEEPING ISSUES

Record keeping is not an end in itself. Rather it is a means of determining how well the goals and objectives of the transit system are being met. Basic goals of most transit systems are to maximize the level of service and the number of people served and to minimize the cost of the service. Thus, data collection procedures should provide measures of the level of service, passengers served, and costs. Because costs are obtained from standard cost-accounting procedures, the primary concern here will be with measures of level of service and passengers served.

Given the focus on level-of-service measures, a number of record-keeping issues can be raised as questions:

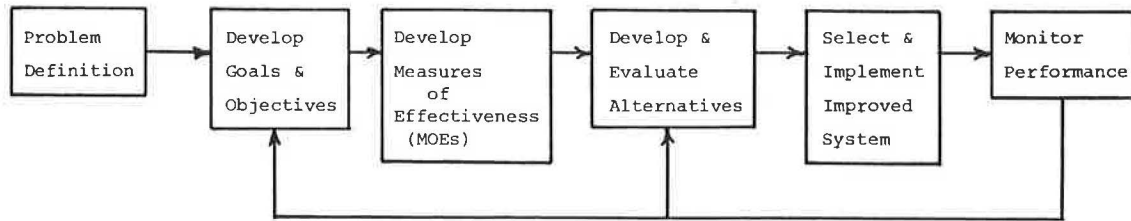
1. What specific data should be collected and what is the best method to collect it?
2. At what level should the data be aggregated?
3. Do the type and amount of data collected depend on whether or not the system is in a demonstration phase?
4. How can the cost-effectiveness of data collection be measured and under what conditions will computerized data processing be cost-effective?
5. Is there a need for uniformity in the amount and type of data collected? If so, should the uniformity be statewide, nationwide, or funding-agency-wide?
6. How does the type of operation—fixed-route versus demand-responsive—and the primary target group—elderly, handicapped, or the general public—affect the data collection requirements?

## Data Availability

In order to address record-keeping issues intelligently, it is necessary to identify the level of service and passenger data that can easily be collected at minimal cost and what data would require significant additional effort. For fixed-route systems, only the number of passengers by route and trip (round trip or one-way) is readily available. The number of passengers may not even be counted but computed from fare-box revenues and the average fare per passenger. If passenger characteristics, such as senior citizen status, can be readily identified through a pass system, drivers can record the data; however, additional data, such as origins and destinations, would be time consuming and costly to collect.

For demand-responsive systems, much more data can easily be collected because of the individual contact made with each passenger. The dispatcher can easily

Figure 1. Steps in methodology of system evaluation.



record trip characteristics such as purpose, origin and destination, time of day, and type—standing order, day prior reservation, or on demand—and passenger characteristics, such as student, elderly, handicapped, or wheelchair user. If eligible users are assigned a user number, additional passenger characteristics can be easily obtained for each trip.

Data-processing requirements are minimized if the dispatcher tabulates the basic data manually as the requests for service are processed. The result is one-way frequency distributions for each data item. If the system is not radio equipped, however, tabulations made directly from the driver's log sheets may be more accurate and efficient.

#### Data Collection

In general, the basic passenger and trip data that can easily be collected as part of normal system operation are adequate for system evaluation. The most common measures of system performance are cost per passenger and passengers per revenue kilometer (fixed-route systems) or passengers per vehicle hour (demand-responsive systems). These can easily be computed from basic passenger and operating data.

Passenger data for fixed-route systems may be supplemented periodically by small sample surveys of passenger socioeconomic and travel characteristics. Such information would be particularly important in evaluating lines with low productivity.

The primary need for passenger and trip data beyond that available as a part of normal system operation is to meet the accountability requirements of various funding agencies. Many rural transportation systems are currently funded through a variety of social service agency programs. From the point of view of the social service agency, its transportation funds are budgeted to get its own clients to social services. The agency cannot easily justify providing transportation to individuals who are not its clients. Thus, the transportation system operator may be required to allocate costs to various users on a passenger-kilometer or passenger-trip basis. Because, in general, such detailed data are not required by the transportation system operator, the full costs of such record keeping could legitimately be charged to the social service funding agencies. Data collection requirements are further complicated by the lack of uniform reporting requirements among the various federally funded programs that have transportation components.

#### Impact of Federal Operating Subsidy

The importance of developing specialized record-keeping systems to meet social service funding agency reporting requirements may be significantly reduced by the availability of rural transit operating subsidies under consideration by the U.S. Congress. Under a general operating subsidy program only the simple passenger record that measures system performance will be needed.

Rural transit operators, however, should not become complacent. The proposed subsidy level of \$75 to \$150 million is modest compared to an estimated \$300 million in FY 1976 allocated in federal programs that provide transportation of people in support of program goals (2). The \$300 million is for both urban and rural areas, but excludes expenditures by the U.S. Department of Transportation. The nature of the problems that may be encountered in a gradual transition from social-service-funded transportation programs to transit operations that look more like conventional urban transit authorities needs to be explored.

#### EVALUATION

Evaluation is treated here as a topic separate from record keeping because evaluation of alternatives that involve more than simple incremental changes to the existing system is a separate activity. The records needed to monitor the daily performance of the transit system provide a starting point for evaluation; however, additional data will generally be required for input to the evaluation process. Monitoring of system performance measures, such as passengers per kilometer or passengers per vehicle hour, will identify problem areas. Additional information will then be needed to determine what the problem is and how effective various alternatives might be in solving the problem. Evaluation of alternatives is also important when a new system is being planned. In this case, records become available only after operation is begun.

The development of effective evaluation procedures is particularly important at this stage in the development of rural public transportation. Evaluation procedures are being applied to determine the effectiveness of the large number of demonstration projects currently in operation around the nation under the section 147 demonstration program and several state programs. Evaluation procedures will also be needed in developing the many new systems that will be feasible when federal operating assistance becomes available.

A general systems approach to the evaluation of rural public transportation systems is shown in Figure 1. The systems approach applies equally well to the development of an entirely new system. The goals and objectives for the transit system follow directly from the definition of the problem. For example, in 1972 the development of a rural health demonstration program in Pennsylvania was limited by a lack of transportation available to potential clients. Thus, one goal of the resulting rural transportation demonstration projects sponsored by the Pennsylvania Department of Agriculture was to provide rural residents with access to participating health care centers. Various measures of effectiveness (MOE) could be developed to provide quantitative estimates of how well alternative transportation systems would meet the overall project goals and objectives. For example, one MOE would be the percentage of eligible residents who are provided service within

0.8 km (0.5 mile) of their home. For a demand-responsive system, this might be 100 percent, but for a fixed-route system only 40 percent. Criteria for developing good MOEs have been developed by Lockwood and Wagner in the context of transportation system management (TSM) planning (6). Research on MOEs for TSM planning is currently being funded by the Federal Highway Administration. Some of this research may be transferable to the evaluation of rural public transportation systems, but additional research on MOEs that are directly relevant to rural systems is needed.

The heart of the evaluation process is the methodology used for the actual evaluation of alternatives. In general, one alternative will not be clearly superior across the entire set of objectives and MOEs. Instead, one alternative will be more costly, provide a higher level of service, and benefit one user group more than other user groups; another alternative will provide a different set of costs, benefits, and user impacts. The selection of the best alternative, then, involves making trade-offs based on the evaluator's concept of what is an equitable balance among the costs, benefits, and impacts.

Many different evaluation methodologies have been described in the transportation literature, including objective weighting methods, rating and ranking methods, and cost-benefit analysis. The primary limitation of these approaches is that the information on trade-offs and impacts is obscured in a total score. The implicit assumption of these techniques is that the distribution of impacts does not matter; the total net benefit or total score should be the decision criterion.

A more appropriate evaluation methodology is the trade-off or balance sheet method (6). In the balance sheet method a matrix is developed in which the alternatives are arrayed against the objectives and related MOEs. The cells of the matrix, then, give the values of the MOEs for each alternative. All of the relevant information on level of service, costs, and impacts is presented. Each analyst reviews the data and reaches an aggregate judgment based on his or her own concept of an equitable distribution. No attempt is made to compute total scores for the alternatives.

Once the best system is selected and implemented, system performance must be monitored. For a demonstration project many of the same MOEs used in evaluation of alternatives can be monitored. Given more limited resources only a few key MOEs may be monitored. The results of the monitoring program are fed back to reassess the system goals and objectives and to reevaluate the alternatives.

#### SERVICE STANDARDS

The general systems approach to evaluation is also applicable to the evaluation of regular transit system operations. The MOEs are replaced by service standards and the scope of possible alternatives may be limited, but the overall approach is the same.

Most urban and rural transit systems lack a formal performance evaluation procedure. Decisions on line extensions or cutbacks, headway changes, or changes in operating mode are generally based on ill-defined rules of thumb and often made in response to political pressure. A notable exception is the Massachusetts Bay Transportation Authority (MBTA) in Boston. The MBTA has recently formulated service goals and objectives, service standards, and a formal process for con-

tinuing performance evaluation and analysis (7). The Ann Arbor Transportation Authority in Michigan, which operates citywide dial-a-ride service, also has developed formal service standards (8).

Service standards and monitoring of system standards should also be instituted for rural systems. Considering the range of local conditions and needs, uniform standards set by federal or state agencies are not appropriate; however, guidelines that could serve as models for local operators can and should be developed. Such guidelines could be developed and implemented as part of the FHWA section 147 demonstration program and various state demonstration programs.

#### CONCLUSIONS

Efficient record-keeping and evaluation systems are needed to improve the performance of existing rural public transportation systems and the new systems that will be feasible when federal operating subsidies become available. Progress in developing improved record-keeping and evaluation systems can be expected as the result of FHWA's section 147 demonstration program, HEW's demonstration program on coordination of existing services, and the Mid-Continent Federal Regional Council's work on developing a unified reporting system. One appropriate role for federal agencies at this point is to analyze, document, and disseminate the results of the demonstration programs and other studies in a timely fashion. At the same time, state and local agencies and governments need to develop the institutional mechanisms and the technical staff that will be required to implement improved record-keeping and evaluation systems. State departments of transportation in particular should be developing training programs so that field personnel can begin to give technical support to local transportation providers. As rural public transportation systems mature, service standards and programs for monitoring of the standards will be needed in order to provide the most cost-effective service.

#### REFERENCES

1. D. J. McKelvey, ed. Proc., First National Conference on Rural Public Transportation. North Carolina A&T State Univ., Greensboro, Oct. 1976.
2. Hindrances to Coordinating Transportation of People Participating in Federally Funded Grant Programs. Comptroller General's Report to the Senate Committee on Environment and Public Works. U.S. General Accounting Office, Oct. 1977.
3. OATS Wheel. Older Adults Transportation System, Columbia, MO, 1978.
4. B. G. Hutchinson. Principles of Urban Transport Systems Planning. McGraw-Hill Book Company, New York, 1974.
5. P. R. Stopher and A. H. Meyburg. Transportation Systems Evaluation. Lexington Books, Lexington, MA, 1976.
6. S. C. Lockwood and F. A. Wagner. Methodological Framework for the TSM Planning Process. TRB, Special Rept. 172, 1977, pp. 100-118.
7. Service Policy for Surface Public Transportation. Massachusetts Bay Transportation Authority, Boston, 1977.
8. 1977 Annual Report. Ann Arbor Transportation Authority, Michigan, 1977.