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## Replanning Existing Rural Public Transportation Systems

JON E. BURKHARDT

**A commitment to provide accountable, effective, and responsive transportation services can best be supported by hard factual data concerning effectiveness and efficiency measures. Based on an analysis of system goals versus current performance, a transit system manager can preserve, enhance, alter, or terminate system operations. Methods of improving effectiveness and efficiency are discussed along with methods of handling six common problems: lower ridership than expected, low vehicle use, low revenues, basic changes required, cash flow, and use of incorrect or inappropriate types of vehicles.**

As a relatively new field, rural transportation lacks the historical data bases used by other elements of the transportation industry to consider alternative scenarios [although a number of relatively new training references (1-4) provide important guidance]. So it should surprise no one that even the best-laid plans for rural public transportation will, of necessity, be subject to review, evaluation, and probable changes. After looking at the benefits of changing ongoing systems, this paper discusses some of the initial decisions that are frequently valuable candidates for reexamination once the system and its personnel have some experience against which to test their initial plans, including ridership, system design, cash flow, and vehicle specifications.

**BASIC INGREDIENT: A COMMITMENT TO IMPROVE**

The evaluation of the Section 147 (Federal-Aid Highway Act of 1973) demonstration project (5) showed that projects that experimented with their operations with the idea of making continual improvements were very successful. Of course, the willingness to change had to be implemented in such a fashion as to maintain public confidence in the availability of service. Projects that took a long time to change unproductive routes and practices generally showed

very poor statistics (6-10).

The basis for making such changes must be an evaluation of how well things are going at the present time. That question must be answered by hard factual data concerning factors such as ridership and costs, potential costs of service changes, effectiveness measures, and attitudes of community leaders and others. The need for factual data can only be satisfied by a serious data-collection effort by the system's managers.

The major reasons for evaluating system operations are

1. To better meet the needs of the people and the objectives of the system,
2. To control the costs of service,
3. To support and justify charges to social service agencies and other agencies that have contracts for service,
4. To obtain factual information for purposes of public relations with the local community and government sponsors, and
5. To provide an example for other projects about successful operations.

Whereas some systems do not have a definite procedure for assessing when system changes are required, others have experimented with routes and schedules in a formal way. This means that problems were observed, solutions were designed and implemented, and tests were conducted to monitor the experiment. All stages of the process were written down. In contrast, another system observed noted that it had a real problem knowing when to change routes. It was suggested by the Federal Highway Administration (FHWA) regional office that the system experiment with different times for relatively

unproductive routes or even consider demand-responsive services in some places. In other places, problems were more obvious: After six months, a project decided to drop several routes that "were not generating much traffic at all" (i.e., two or three passengers per trip). (One wonders why it took that long to decide to change; it was probably because approval by the public utilities commission was necessary.) A project in the Northeast had to substantially reduce the scale of its operations in order to survive. The service area was cut by two-thirds and the population served was cut by almost 30 percent; as a result, the system is now one of the most productive and cost-effective. One of the most successful projects continually experimented with new services but also left changes in place long enough for an adequate test to occur. This is a crucial point.

#### EVALUATION MEASURES

In addition to cost, the performance characteristics of a rural system should be measured by their effectiveness and efficiency (11). Effectiveness measures, which tell how well a system is meeting its goals and objectives, include (a) ridership, (b) accessibility and population served, (c) quality of service, and (d) social, environmental, and energy considerations. Efficiency measures, which tell how well a system uses its available labor and capital resources, include (a) cost efficiency, (b) labor productivity, and (c) vehicle use. A "shopping list" of evaluation measures for the categories of efficiency and effectiveness is given below. For efficiency, the evaluation measures are

1. Cost per trip, hour, mile, rider, employee, passenger mile, and vehicle;
2. Vehicle use, including (a) load factor (percentage of seats used), (b) hours of service per vehicle, (c) deadhead factor (revenue miles/total miles), and (d) passenger miles per vehicle mile; and
3. Labor productivity, including (a) vehicle miles per employee, (b) premium pay/total pay, and (c) passengers/labor hours.

For effectiveness, the measures are

1. Ridership by vehicle mile, vehicle hour, and employee and per capita;
2. Quality of service, including (a) percentage of population served, (b) frequencies, (c) waiting time, (d) reliability, (e) safety (accident rate), (f) comfort, (g) convenience, and (h) speed;
3. Comparative attractiveness, including (a) relative travel time and (b) relative cost; and
4. Level of subsidy, including (a) subsidy costs per trip, hour, mile, rider, passenger mile, and employee and (b) the subsidy ratio (subtract the ratio of total system revenues divided by total system costs from one to determine what proportion of the system's operations is subsidized).

Some sources of information for making reasoned judgments concerning the evaluation of rural transportation systems are as follows:

Major Unit of Measurement	Source
Dollars	Accounting functions
Miles	Drivers or maintenance shop
Hours	Supervisors, drivers, or dispatchers
Passengers	Drivers, dispatchers, or survey
User attitudes	Survey, complaint center, or public relations

#### GENERAL ACTIONS OR RESPONSES RESULTING FROM EVALUATION

What a program does with the results of the efficiency and effectiveness measurements collected in its evaluation process depends on many factors. The amount of funds available to make changes, the level of funds already invested, and community political support all affect the manager's decision about what action to take. There are four general categories of possible action that can be taken concerning the local project's current service: (a) preserve, (b) enhance, (c) alter, or (d) terminate. Program administrators can use various methods to help project managers successfully take those actions. The specific strategies for making changes are discussed in the next section of this paper. This section describes general responses of project managers to the evaluation results.

##### Preserve

For systems that have high efficiency and effectiveness values, the general response would be to preserve the current service (i.e., to keep the project going in the same direction). Efforts should be made to hold costs constant where possible, to continue current routing and scheduling within the established service area, and to maintain fares and other service elements at their current level.

##### Enhance

For systems that have relatively high efficiency values but relatively low effectiveness values, the general response would be to enhance the current service (i.e., expand service in the same direction). Special effort should be provided to maintain the service efficiency in terms of costs and revenues, vehicle use, and labor productivity or whatever other variables represent the high efficiency values. Maintaining those values will ensure that, as service is enhanced to increase effectiveness, the system will continue its efficient use of the available resources. Thus, even though efficiency is high, careful attention should be paid to maintaining those efficiency values during the process of improving service quality.

Increasing effectiveness values will involve maintaining the ratio of resources to units of service while improving the quality of service. Enhancing the quality of service may include (a) increasing accessibility to the system, (b) improving reliability, (c) increasing passenger safety, (d) improving passenger assistance, or (e) increasing attention to meeting community needs.

##### Alter

For systems that have relatively high effectiveness values but relatively low efficiency values, the general response would be to alter the current service (i.e., change the activity or direction of the service). Efforts should be continued to maintain effectiveness in terms of service area, schedules, routes, fares, or whatever other variables represent the high effectiveness values found. Maintaining the effectiveness values will ensure that, as service is altered to increase efficiency, the quality of service will be preserved. Thus, even though effectiveness is high, careful attention should be paid to maintaining those effectiveness values while the operation is being adjusted to increase the efficiency values.

Increasing efficiency values will involve either maintaining the amount of service while reducing the

resources required or increasing the amount of service while maintaining the level of resources used. Improving the use of resources may include (a) lowering costs, (b) improving labor productivity, (c) improving vehicle use, (d) improving accounting and record keeping, (e) establishing a more stable cash flow, or (f) securing longer-term, more stable funding.

#### Terminate

In those rare cases where efficiency and effectiveness values are both low, mismanagement is suspected and, if previous efforts at improving those values have failed, funding to that project for its current service may be terminated.

### METHODS OF MAKING CHANGES INDICATED BY THE EVALUATION PROCESS

#### Improving Effectiveness

When the evaluation results indicate enhancing the current service as the general response, the project manager will be attempting to improve effectiveness while maintaining efficiency. Specific strategies include the following methods.

##### Increasing Service Productivity

Changes in scheduling, dispatching, and deadhead time may be necessary. Some discussion between project managers and community leaders may suggest the opportunity for scheduling in some subscription trips. The ideal situation would be a group of passengers going from one origin to one destination on a regularly scheduled basis. One popular example is subscription service each week from an apartment complex to a grocery store.

In addition, careful examination of drivers' logs might show a pattern of deadhead time that suggests the opportunity for better use of vehicle time for specialized runs (e.g., an abbreviated downtown corridor route during idle time). Better coordination of both the subscription service and efforts to reduce deadhead time can be aided by adding those activities to possible uses of the dispatching system.

##### Increasing Accessibility

Redesigning routes and schedules can direct the service to areas where there is the greatest unmet need. Again, community and business leaders, officials, and agency and organization personnel might well work with the project manager in the redesign. Creative routing and scheduling techniques, including point deviation, might better serve unmet needs in terms of geography as well as time of day.

##### Improving Reliability, Passenger Safety, and Passenger Assistance

A number of operational details should be examined to explore the possibility of change in order to improve the quality of service. Such an examination may show that the following alternatives are in order:

1. Establishment of a preventive maintenance program,
2. Encouragement of more professional management and supervisory techniques,
3. The use of a higher spare ratio,
4. Development of a driver training program,
5. Purchase or lease of better supplies and

equipment (or perhaps even sharing with other projects), or

6. More responsive use of the results of periodic on-board passenger surveys.

#### Improving Efficiency

When the evaluation results indicate altering the current service as the general response, the project manager will be attempting to improve efficiency while maintaining effectiveness. Specific strategies include the following methods.

##### Lowering Costs

Some specific expenses, both operational and administrative, might be suitable for some minor adjustments that could lower overall system costs. Some particular services (to particular origins, destinations, or service areas or at specific times) might be purchased by the project from another provider for less than it cost the project to provide that service. Vehicles might be leased rather than purchased (this particularly applies to specialized vehicles for a new service that might be only temporary). Coordination of maintenance with other providers in the area and bulk purchases of fuel are examples of popular joint ventures. In some cases, combining job functions (such as scheduling or dispatching) is appropriate, particularly during certain time periods. Other direct costs might be lowered by (a) hiring fewer drivers and using more part-time drivers, (b) obtaining tax exemptions (e.g., gasoline, tires, sales, and excise), (c) making pay-only-as-needed maintenance arrangements with a local garage, or (d) obtaining the fleet price for insurance where possible (careful attention must be paid to the insurance "classification" criteria used).

##### Improving Labor Productivity and Vehicle Use

By examining drivers' logs and calculating driver hours per day, vehicle miles per driver hour, and passengers per driver hour, certain strategies may emerge. Changes to consider include (a) increasing average working hours, (b) setting objectives for daily mileage and passengers, (c) better supervision, (d) advance scheduling, or (e) time or ride-sharing with other providers.

##### Improving Management

More funding sources; a more flexible package of funding sources; longer-term, more stable funding; better accounting and record keeping; and a more stable cash flow represent the common flaws in managing a small transit service. Assistance could be needed both in the planning process and in setting up a uniform, simple set of accounts. Encouraging the preparation of bills on time, insisting on prompt payment, or billing in advance may also be useful.

### REPROGRAMMING FOR SPECIFIC PROBLEMS

The plans that set up a rural transportation system might not be achieved for a large variety of reasons. Among the headaches that are often unanticipated in the planning stages are the following:

1. Anticipated ridership does not materialize,
2. Basic design or service changes are necessary,
3. Cash flow is a serious problem, or
4. Vehicle requirements are misspecified.

These are probably the most serious issues often

faced, but there may also be adverse consequences from staff turnover, salary issues, or the sudden loss of political support due to electoral changes. These and numerous other circumstances often require reworking what would have been fine plans without the intervention of real-world problems.

#### Failure of Anticipated Ridership to Materialize

Most of the rural transportation systems started to date have based their ridership projections on intuition and guesswork instead of any formalized, documented procedure of demand estimation. Therefore, it is no real surprise that a number of these systems have not attracted the number of riders on which their projections of patronage, revenue, and vehicle requirements were based.

The problems that immediately arise are the embarrassment and then the financial absurdity (if not impossibility) of operating nearly empty vehicles. Systems that have been willing and able to make prompt changes in nonproductive routes and services have generally been able to survive the effects of their planning mistakes (or lack of planning).

The lack of riders could be due to a large number of factors, and it requires intimate knowledge of the locality to determine the strategies that can best increase low ridership. For example, it is impossible that the demand is just not there: (a) that there are not enough people to support the services, (b) that most people in the area have access to automobiles, or (c) that the types of trips do not match the services being provided. If the first two possibilities are accurate, services should be cut back. If the third case holds, the services should be redesigned. Another major possibility is that not enough people know about the service. An intelligent marketing program--one that reaches the intended target audience and delivers a message to which they will be receptive--is obviously needed. Such a program need not be expensive, but it does have to be effective. A third major possibility (although less frequent) is that service levels are too low. All available information suggests that ridership on rural public transportation systems is extraordinarily sensitive to the amount of service provided (the number of bus miles of service provided by the system per month is a good proxy measure of service). Thus, the more service that is provided, the more riders will be attracted to the system. Perhaps the level of service should be increased.

Low ridership can lead to a number of other important problems, including low vehicle use and lack of sufficient revenues. These problems may occur whether or not ridership is low, but if ridership is low they will probably occur. It is important to determine whether or not they result from low ridership or from some other factors.

#### Vehicle Use

Driver salaries and wages are the most significant component of a rural transit system. Therefore, it is important to take all possible steps to ensure the maximum productivity of each driver. A bus carrying only one passenger is just like a taxi system--an expensive one at that--and few rural residents or rural governments can afford taxi service. Steps should be taken to ensure as nearly as possible full loads of passengers for each vehicle trip. For some systems, this has meant cutting the overall frequency of service or not providing service on days when too few riders are scheduled (there are some obvious problems with the second

strategy). Other ways to increase vehicle use include the following:

1. Start small. Do not run a tremendous amount of service until the demand for it is there.
2. Schedule in advance (for demand-responsive systems). Make people call in ahead of time so that you can arrange to pick up many persons on the same trip. At least 24-h advance notice is recommended; some systems require as much as one to two weeks.
3. Minimize frequencies (for fixed-route systems). Do not operate 10 runs a day if no one is riding. Of course, it may be more convenient for someone to ride at 2:08 p.m. than at 1:00 p.m., but much of the service to be provided is really a matter of necessity, not convenience.
4. Minimize deadhead time (the time the vehicle operates with no riders). Do you always start each day with the vehicles being driven empty from town to outlying areas to pick up passengers and bring them back to town? If so, then the vehicle is always empty at least half of the time. Consider letting the drivers take the vehicles home for the night (this requires some administrative controls) and thus cut down two deadhead trips (and the commuting time of the driver).

#### Low Passenger Revenues

If revenue projections are based on an anticipated number of passengers times a certain fare, and the actual number of passengers is only half what was expected, the revenues will be only half what was expected unless the fare is increased. Passenger revenues often play a small but significant role in financing rural transit systems (and may well play a larger role in the future), so it is important that revenues from fares be accurately projected. Assuming that a system can determine fairly accurately how many passengers will ride, what sorts of fare strategies are available?

The first strategy begins by recognizing that the true total costs of a particular trip differ according to the different types of services provided. The next step is to realize that different services can command different fares; in fact, it is probably more equitable to all concerned if different services have different fares. For example, in a system that has one flat fare, people who take the longest trips are being subsidized by those who take the shortest trips (since many transit system costs are mileage related). A second important fare strategy begins with the recognition that some classes of riders are willing and able to pay more for their trips than others. For example, off-peak riders have higher fare elasticities than peak-period riders (12), which means that, if all services are subjected to the same percentage fare increases, more off-peak than peak-period riders will refuse to ride under the increased fares.

A third significant fare strategy is to take transportation organizations out of the business of income redistribution. Except for the possible kinds of cross subsidies discussed above, passengers should pay (or have paid for them) the full cost of the ride they take. Part of the payment may well be a general subsidy from the local government so that each individual directly pays only a portion of his or her cost. But the point is that the total cost for that individual has been paid. Similarly, some individuals may benefit from user-side subsidy programs or social service programs and might conceivably not make any direct payment to the system. However, their trip is still paid for in full by the program that sponsors them. This is an important point: Some social service agencies have felt that

it is the "duty" of the transit operation to carry their clients at less than the cost of their rides. Some transit agencies have been willing to accept less than full-cost payments in order to inflate their ridership figures. Current budgetary constraints indicate that such situations are no longer acceptable.

#### Necessity of Basic Design or Service Changes

Many service plans have not been well thought out. For example, the problems of implementing a completely fixed-route system in a low-density rural area are probably as great as the problems of implementing a purely demand-responsive service for the same area. A good deal of creativity and experimentation may be necessary to come up with a productive and efficient system.

Some kinds of mistakes should be obvious in certain plans as soon as they are committed to paper. For example, plans to serve a very large area with only a handful of vehicles are immediately suspect. Unclear or contradictory schedules for fare structures will drive away patrons and reduce revenues. Systems that exclude particular kinds of trips--for example, work trips--will perform more poorly than those that include work trips. Systems should not exclude certain kinds of riders (e.g., the general public) without considering the revenue and ridership consequences of such actions.

#### Cash-Flow Problems

Cash flow was the most severe problem for many projects in the rural transit demonstration program, especially those that were unfamiliar with standard FHWA reimbursement procedures. In fact, some of these projects had no cash at all and so to operate on any form of reimbursement was a hardship for them. Some projects were quite surprised to find what more experienced operators already know: that expenditures often substantially exceed revenues.

A number of projects compounded their own cash-flow problems by the lateness of their reports and vouchers. The importance of timely submissions was recognized by other projects that received authorization to be reimbursed for certain expenses incurred but not yet paid. This occurred most often with respect to vehicle requisition: The projects billed the states when they had signed the contract for the vehicles, but the manufacturer did not need to be paid until after the delivery of the equipment. The projects then used this cash on hand to pay for immediate expenses.

Resolving cash-flow problems requires cooperation at several levels of government. Several states imposed unreasonably long delays on the projects. In one project, payment was not made until five months after the first expenses were incurred. For many of the very small private operations under contract, this time lapse was critical.

Projects that operate under the brokerage concept can also experience the familiar cash-flow problems of cost reimbursement. The providers submit invoices on a monthly basis. The turnaround time is approximately one month for the project to verify the invoice, bill the agencies, receive payment, and transmit payment to the operators. From the perspective of the private carriers, the maximum period between the time when they incur costs and the final payment is two months.

The reimbursement procedures of the Section 147 demonstration program caused many problems. Some of the better solutions to this problem included the following:

1. Having the state set up an account with a

month's advance against which the project could draw;

2. Allowing semimonthly submittal of invoices to the state;
3. Obtaining multiple sources of funding;
4. Obtaining, if possible, at least one funding source that provides some flexibility as to payment dates and allowable expenditures;
5. Using funding sources that are not tied to a reimbursement procedure but able to put in money "up front";
6. Establishing a month's advance on all billing;
7. Submitting vouchers for expenses (such as vehicles) when the commitment to purchase is made rather than when delivery actually occurs;
8. Obtaining a source for emergency borrowing (this occasionally ran afoul of local opinion that public agencies should not incur large debts),
9. Submitting vouchers on time, and
10. Insisting on payments at least as frequently as once per month.

#### Misspecification of Vehicle Requirements

Actual vehicle requirements have often turned out to be different from those originally anticipated. One Section 147 project in the Southwest could not be persuaded, despite some heated discussions, to change its plans to use 45-passenger buses to provide service in an area that had a population density of three persons per square mile. Now the system operators wonder why their trips always take so long and their vehicle use is so low. Had these changes been made (as suggested) in the planning stages before operational costs were incurred, the project would now be much more successful.

Other kinds of equipment changes that have been necessary include (a) more heavy-duty vehicles than anticipated, (b) more need for one or two larger vehicles for those systems that had a number of vans or small buses, and (c) more spare or backup vehicles (many systems have not ordered backup vehicles and have been forced to curtail services when major repairs were being performed).

#### SUMMARY

The process of replanning an ongoing rural transportation system requires a serious commitment of time and energy. A highly formalized planning structure is not necessary, nor are glossy documents, but some organized collection and analysis of data are required to reflect a serious commitment.

Replanning is what some people think of as management and what others think of as evaluation. Whatever name is used, a serious commitment to making changes can greatly improve decisions made in the initial planning stage that affect system efficiency and effectiveness.

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