Decision Procedures for Paratransit Management

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Because many transit managers oversee fairly extensive paratransit systems, specialized evaluation procedures are needed as decisionmaking aids for improving existing services and for instituting new services. A framework that describes the transit evaluation process is presented, which incorporates procedures for intramodal evaluation of existing services and intermodal comparison of alternative services. These procedures consist of a set of indicators, measures, and standards for each mode used in the transit system. The measures and standards are used in periodic evaluations that screen failing services for additional analysis with a set of diagnostic indicators. An intermodal alternatives comparison is used in the service design when an existing service is mismatched with a user group or when a mode is to be chosen for a proposed service. An application of the process and procedures to a case-study transit agency, the Tidewater Transportation District Commission (TTDC) in Norfolk, Virginia, illustrates the modification needed in applying the decision aid. Both management perspective and system data were provided by TTDC. The results of the application indicate that the evaluation process and procedures can serve as a decisionmaking tool for paratransit management.

Paratransit services are an integral part of many transportation systems in the United States. Services such as dial-a-ride, carpool matching, subscription buses, jitneys, and rental cars provide transit to commuters, shoppers, and elderly and handicapped riders who otherwise might not be served by public transportation. Paratransit is capable of meeting these diverse travel needs because of its greater responsiveness and adaptability in comparison with conventional services (1).

As with fixed-route bus transit services, it is desirable to evaluate paratransit services from operator and user perspectives. The evaluation process provides the information necessary to monitor and improve the operation and service level of existing services and to make good decisions in replacing failing services or instituting new services.

The majority of transit evaluation procedures developed to date addresses issues that relate to fixed-route services (2-7). Many transit managers, however, deal with fairly extensive paratransit systems, so a specialized evaluation is needed. By using this need for a paratransit-specific management aid as the focus, this paper describes a decision framework for evaluating paratransit services and presents a set of procedures for implementing the framework. The applicability of the procedures is demonstrated with a case study from the Tidewater Transportation District Commission (TTDC) in Norfolk, Virginia.

EVALUATION FRAMEWORK

Figure 1 illustrates a typical transit service evaluation process. This flowchart consists of two major components: the intramodal and intermodal evaluation processes. Each component lists several steps, which include data input, analysis, implementation, test, and feedback for reevaluation.

The intramodal evaluation is used to compare the performance of individual services with the performance of other services of the same type. For example, a shared-ride taxi service that operates in one neighborhood would be compared with all shared-ride taxis in the system. If such a service performs poorly and cannot be adequately improved, an intermodal evaluation assists in the comparison of several alternative modes by helping the manager identify the service that best suits the user, the operator, and the community. The comparison of alternatives is also carried out when a mode must be chosen for a proposed service.

Performance Evaluation

For each mode in the system, a separate set of performance criteria is used to evaluate services. The choice of the indicators, measures, and standards that describe the performance of a mode is important in developing an evaluation procedure that is meaningful and useful (8). Management must first express the explicit and implicit goals and objectives for the transit system. These include the operator's efficiency objectives, the user's effectiveness objectives, and society's fiscal and environmental constraints. Next, indicators are chosen that directly relate transit characteristics to the underlying objectives. For example, a cost-efficiency objective translates into an expense per produced output indicator for many transit services. These indicators are quantified with measures that relate operating characteristics to the indicators and objectives. The final step is to choose a method for judging performance as described by the measures. Here the actual performance of a service is compared with values for that measure that are acceptable. In this paper, the standards are either

1. A desirable standard set (D) at the system average for a service type $\bar{X}$, or
2. A permissible standard set (P) at one standard deviation away from the average.

A service passes the evaluation for one indicator (i.e., for one criterion) if it is better than average. The permissible standard relaxes the desirable level by one standard deviation. These standards are based on recent systemwide performance evaluations. In this manner, standards are generated for a system at a point in time that reflects the current status of the system rather than imposing externally generated, and perhaps unrealistic, standards.

A service will be ranked into one of three possible ranges. The first is passing (P), which occurs when the actual value of the measure for a service is greater than the desirable standard $\bar{X}$. A service that ranks between the desirable standard and the permissible standard ($\bar{X} \pm s$) is assigned an investigation-warranted rating (I). The service that achieves a performance value worse than the permissible standard is rated as failing (F).

Both intramodal performance evaluation and intermodal performance comparisons use this technique of comparing performance values, as described by the measures, with standards that have been set on overall system performance. The differences in these two processes of evaluation are in the decision procedure and in the follow-up course of action. Each process is described here, and it is then followed by a specific application.

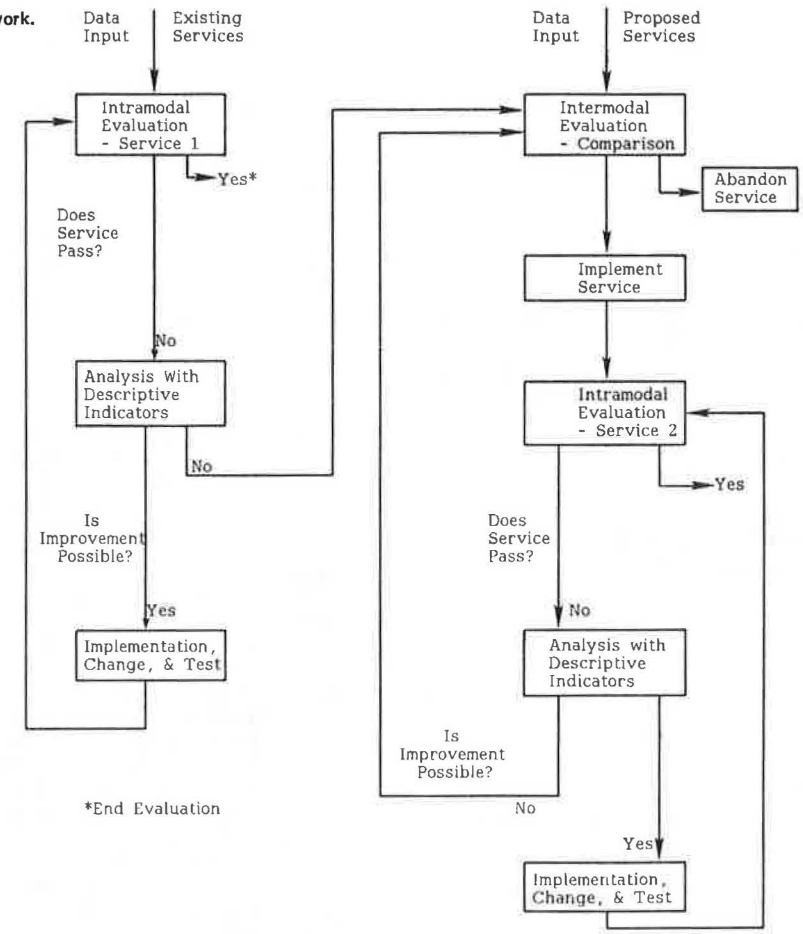
Intramodal Evaluation

A two-step evaluation is recommended for the comparison of individual services with the systemwide performance: (a) general evaluation and (b) diagnostic analysis.

General Evaluation

When using the general evaluation, each service area

Figure 1. Transit evaluation framework.



is screened to detect those areas that are performing poorly. Only a limited number of indicators is required. For example, in Tables 1 and 2, one indicator and one measure are chosen from a larger set developed for each objective and for each mode type (demand-responsive transit and ridesharing). This general measure is listed at the top of each group of indicators in Tables 1 and 2.

Diagnostic Analysis

When the periodic, general evaluation detects a failing service, diagnostic indicators can be applied to the performance data to detect the deficiency. Several indicators per objective are now needed. Tables 1 and 2 list some suggested indicators and measures for each of the objectives and paratransit types.

Intermodal Evaluation

When a set of transit alternatives is considered for an area, the benefits and weaknesses of each possible mode can be determined from measures shown for the indicator categories given in Table 3. Two scoring schemes are combined for the alternatives comparison. The first scheme applies for those indicators that are based on modal factors, specifically the cost-efficiency, effectiveness, and conservation of public funds categories, as shown in Table 3. For the measures in these categories, a point system based on comparison of the service value with the standard is used. Again, both a desirable standard (which reflects the targets set for the system) and a permissible standard (which sets the lowest allowable level of performance) are established. The same scoring allocation is used here as in the intramodal evaluation.

A second scoring scheme is used for the intermodal factors of comparison. Because standards for a transit mode relative to fuel efficiency and air pollutant objectives are unrealistic on a small scale, an intermodal comparison is recommended. Based on manufacturers' estimates and expected ridership levels, an optimum mode can be chosen for each of these two indicators (9). One point is given to this optimum mode; all others receive 0.0 for that indicator.

The final step in this comparison, after calculating the indicator scores, is to determine the weights for each indicator category. This system gives the transit evaluator the flexibility to accurately reflect the goals for the system.

The perfect score for this evaluation is 1.0 and is attained when all evaluation objectives have been fully met. This condition rarely occurs, so the mode that receives the best score is typically chosen. A minimum allowable score is assigned to a no-transit-service alternative so that only viable alternatives will be chosen for implementation in this analysis.

APPLICATION OF EVALUATION PROCESSES

The intramodal and intermodal evaluation procedures are illustrated through a case study of certain services of TTDC in Norfolk, Virginia. The TTDC Maxi-Taxi and vanpool-leasing services illustrate the use of the demand-responsive and pooling intramodal evaluations. In total, two intramodal evaluations

Table 1. Demand-responsive transit evaluation.

Objective	Indicator	Measure
Cost efficiency	Expense per produced output	Cost per passenger mile
	Labor productivity	Vehicle hours per employee
	Vehicle use	Vehicle hours per vehicle
	Administrative efficiency	Office personnel per vehicle
	Pricing	Revenue per cost
	Ridesharing ratio	Passenger occupancy
Service effectiveness and use	Consumed output	Avg number of passengers per hour of operation
	Travel time	Transit trip time per automobile trip time
	User cost	Fare
	Directness of service	No. of passengers transferring per total passenger trips
	Safety	No. of accidents per 100 000 miles
	Vehicle comfort and cleanliness	Inspection results
	Driver courtesy and skill	No. of complaints
	Vehicle access	Wheelchair accessibility
	Public awareness	Percentage of market group answering positively in survey

Table 2. Ridesharing evaluation.

Objective	Indicator	Measure
Cost efficiency	Expense per produced output	Cost per passenger mile
	Trip length	One-way trip mileage
	Seat use	Riders per vehicle occupancy
Service effectiveness and use	Success rate	Percentage of pools surviving a 12-month trial period
	Travel time	Transit trip time per automobile trip time
	User cost	Fare
	Reliability	Wait time (lateness)
	Vehicle comfort and cleanliness	Percentage of users satisfied with vehicle condition
	Safety	Percentage of users satisfied with safety
	Public awareness	Percentage of market group answering positively in survey

and two intermodal evaluations are described. The intermodal evaluations reflect modal changes within a service area in the Tidewater region, which are then compared with the no-transit-service alternative. Maxi-Taxi is compared with local bus service, and the vanpool option is compared with express bus service.

Indicator and Measure Modification for TTDC Case Study

In applying the general evaluations, changes are made in the basic indicator and measures sets (Tables 1 and 2) to adapt the procedures to the specifics of the TTDC case study. These variations represent user group restrictions and data limitations.

The major change in the demand-responsive service evaluation is the substitution of cost per passenger for cost per passenger mile (see Table 1). Although federal reporting requirements include a passenger-mile value, transit authorities only report a system average that is based on sample data. The passenger-trips value is an adequate output measure for the Tidewater Maxi-Taxi service because the service areas are relatively small and homogeneous. The trip-length component of the passenger-mile measure, then, is not considered a factor in cost efficiency for this service.

Table 3. Intermodal evaluation scoring description.

Indicator Category	Measure	Maximum Possible Score
Cost efficiency	Cost per passenger mile	1.0
Effectiveness		
Travel time	Transit trip time per automobile trip time	1.0[a]
User cost	Fare	1.0[a]
Reliability	Wait time	1.0[a]
Conservation of public funds	Revenue per cost	1.0
Fuel efficiency	Passenger miles per gallon	1.0
Pollutant minimization	Grams per passenger mile	1.0

[a] 3.0 ÷ 3 = 1.0.

Other changes in the Maxi-Taxi evaluation are in the measures for the descriptive indicators. For labor productivity, cost per hour is used, since labor costs are represented by an hourly figure. Cost per mile for vehicle use and cost per vehicle for administrative efficiency are used for similar reasons.

The indicator for vehicle accessibility is eliminated in the Maxi-Taxi evaluation. Tidewater provides a special transportation service (STS) for transportation disadvantaged citizens in the region, and wheelchair-accessible vans are available through STS. Transportation for the elderly and the handicapped is not provided by Maxi-Taxi.

No substitutions are made for the vanpooling evaluation. Although few of the measures are currently available, the transit authority is capable of obtaining all suggested measures in an increased data-collection effort.

Tables 4 and 5 summarize the intramodal evaluations and define the objectives, indicators, measures, and standards for both Maxi-Taxi and vanpooling. For the intermodal evaluations, the major substitution is for the effectiveness indicators. Rather than computing the travel-time ratio, fare, and wait-time values for each alternative, the same effectiveness indicators from the intramodal evaluations are used. Maxi-Taxi is assessed on passengers per hour, and vanpooling is rated on the success rate for the effectiveness objective. This method is simpler for existing service evaluation, although the three-component effectiveness measure may be a better choice when dealing with predicted service attributes.

Intramodal Evaluation

Standards

As the next step in fitting the evaluation procedures to a transit region, standards must be chosen that reflect the community's objectives and goals. For TTDC, policy is not in a form that can be translated into evaluation standards, which prevents the use of policy as a basis. For this study, then, the standards are derived from system and industry averages.

For the general evaluation of the intramodal procedure, ranges about the system averages for each measure are used as standards. The desirable standard (D) is set at the average, which encourages long-run improvement, since the standard adjusts as the overall level of service improves. The permissible standard (P) is set at the average plus or minus the standard deviation, which allows for a more liberal level of performance. The standard, then, is based on both the current performance of the overall system and the sensitivity of the measure to variance in the average. This type of stan-

Table 4. Intermodal evaluation for TTDC Maxi-Taxi.

Objective	Indicator	Measure	Standard[a]
Cost efficiency	Expense per output	Cost per passenger mile	1
	Labor productivity	Cost per hour	1
	Vehicle use	Cost per mile	1
	Administrative efficiency	Cost per vehicle	1
	Ridesharing level	Riders per vehicle occupancy	1
	Pricing	Revenue per cost	1
Service effectiveness and use	Consumed output	Passengers per hour	1
	Travel time	Trip time ratio	2
	User cost	Fare comparison with drive-alone automobile	1[b]
	Directness of service	No. of passengers transferring per total trips	2
	Reliability	Wait time	2
	Vehicle comfort and cleanliness	Inspection results	2
	Safety	No of accidents per 100 000 miles	2
	Driver courtesy and skill	No. of complaints	2
	Public awareness	Percentage of market group answering positively in survey	2

[a]1 means $P = \bar{X} \pm s$, and $D = \bar{X}$; 2 means industry average as used in conventional services.
[b]P = 80 percent and D = 100 percent.

Table 5. Intermodal evaluation for TTDC vanpool service.

Objective	Indicator	Measure	Standard[a]
Cost efficiency	Expense per output	Cost per passenger mile	1
	Modal efficiency	Trip length	1
Service effectiveness and use	Success rate	Percentage of pools surviving a 12-month trial period	1
	Travel time	Trip time ratio	2
	User cost	Fare	1[b]
	Vehicle comfort and cleanliness	Percentage of users satisfied	2
	Safety	Percentage of users satisfied with driver's skill	2
	Public awareness	Percentage of market group answering positively in survey	2

[a]1 means $P = \bar{X} \pm s$, and $D = \bar{X}$; 2 means industry average as used in conventional services.
[b]D = 80 percent (drive-alone automobile cost) and P = 100 percent (drive-alone automobile cost).

dard works well in a transit system that has a wide range in levels of performance, as is the case with the Tidewater region.

The standards for the Maxi-Taxi general indicators are shown in the table below (note that $\bar{X}$ = average and s = standard deviation):

Measure	$\bar{X}$	s	$\bar{X} \pm s$	$\bar{X}$
Cost per passenger ($)	4.59	1.16	5.75	4.59
Passengers per hour	2.8	0.8	2.0	2.8

The statistics are calculated from the TTDC data files. The standards for vanpool general indicators are compiled in the table below:

Measure	$\bar{X}$	s	$\bar{X} \pm s$	$\bar{X}$
Cost per passenger mile (¢)	3.79	0.7	4.5	3.8
Percentage of pools surviving	89	7	82	89

The cost per passenger mile statistics are calculated from a sample of operating characteristics for TTDC vanpools that were available at the TTDC office. The percent-failure values, however, are assumed as representative because data of this type have not been collected. The assumed failure rates are verified as reasonable and representative by the service development manager at TTDC. These data are one of the additional data needs for the transit authority.

For the descriptive indicators in both intramodal evaluations, TTDC has little or no data currently available for the paratransit modes. Many of the same measures are used for conventional bus services and are considered reasonable as paratransit measures. But, because of the data availability problem, standards cannot be set and services cannot be tested here at the descriptive indicator level.

Tables 4 and 5 contain the suggested form for the recommended standards for the descriptive measures. Many indicators are easily quantified, and a range about the average can be used to set the permissible and desirable standards. Other indicators are quantified in user surveys and by measures that are commonly used in the transit industry. For these indicators, standards may be set at TTDC bus evaluation levels and, where needed, standards for the paratransit evaluation are based on comparative values of competing alternatives.

Maxi-Taxi Service

TTDC currently operates the Maxi-Taxi service in seven communities in the Tidewater area. These service areas have received varying levels of service, so both good and poor services are evaluated with the prescribed procedures.

The evaluation for demand-responsive services focuses on three service areas--Deep Creek, Great Bridge/Greenbrier, and Churchland. The general evaluation is performed to determine whether the service is meeting the standards for the operating criteria of transit management and the needs of the users. The results are summarized in Table 6.

The Deep Creek service evaluation shows that both of the service performance statistics achieve the desirable standard limit; therefore it passes both categories. No further evaluation is required for this service.

The Churchland service passes the evaluation for the effectiveness category but rates an I on the efficiency category. The service is sufficient because it surpasses the permissible standard limit, yet an investigation of the service is warranted because changes in the service may improve its efficiency. Descriptive indicators (such as vehicle productivity, labor productivity, ridesharing level, administrative efficiency, and pricing) should be checked to determine the high cost factor and followed by efforts to improve this aspect.

The Great Bridge/Greenbrier evaluation shows a service that fails in both efficiency and effectiveness. In this case, changes in the existing service should be sought, followed by an intermodal comparison if sufficient improvement cannot be achieved within the service mode. The transit manager, in this particular example, reduced the hours of service by cutting the service fleet from two vans to one van and the performance indicators both adjusted to within the acceptable ranges. The cost per passenger dropped to $5.33 and the number of passengers per hour increased to 3.0.

Vanpool Leasing Service

TTDC transit policy encourages all forms of ridesharing, from conventional bus service to carpooling. As a program under this policy, TTDC promotes the vanpooling option through contact with employers. In this evaluation, then, the market groups are organized by employer. The three groups studied were the General Electric (GE) plant in Portsmouth, the Norfolk Naval Shipyard (NNSY), and the Newport News Ship Building and Dry Dock (NNSB&DD). Two perspectives were considered in this modal evaluation--that of TTDC, the leaser-organizer, whose objective is to provide the most cost-efficient service possible, and that of the user (including both rider and operator). The general indicators are cost per passenger mile and percentage of pools surviving the 12-month trial period.

As with the Maxi-Taxi evaluation, the general evaluation is performed to assess the adequacy of the service by comparing the operating characteristics with the standards. The results are given in Table 7 for the three employers mentioned.

The performance ratings show that this service is satisfactory for NNSY vanpoolers. The high failure rate of this last group indicates that the service is not meeting the needs of the users. The descriptive indicators would identify the problem attributes of vanpooling in this market area for both the effectiveness and efficiency indicators. Because the data needed for the application of the descriptive indicator set were not available, this part of the evaluation is omitted here.

Intermodal Evaluation

Standards

For the intermodal evaluation, the standards from each intramodal evaluation are used. This allows for inherent varying levels of service between modes. For example, bus passengers per hour should not be compared with Maxi-Taxi passengers per hour levels. Maxi-Taxi, then, has the same standards for the cost per passenger and passengers per hour measures. Vanpooling evaluation at the intermodal level uses the same standards for the cost per passenger mile and percent-success measures.

Fixed-route conventional bus service standards that are needed for the intermodal evaluation are calculated from performance data of all routes in the Tidewater region and are presented in the table below:

Measure	$\bar{X}$	s	$\bar{X} \pm s$	$\bar{X}$
Cost per passenger ($)	1.43	1.24	2.67	1.43
Passengers per hour	26.9	13.9	13.0	26.9

Table 6. Maxi-Taxi evaluation results.

Measure	Value	Standard	Performance[a]
Deep Creek[b]			
Cost per passenger ($)	3.49	P 5.75 D 4.59	P
Passengers per hour	4.1	P 2.0 D 2.8	P
Churchland[b]			
Cost per passenger ($)	5.03	P 5.75 D 4.59	I
Passengers per hour	2.8	P 2.0 D 2.8	P
Great Bridge/Greenbrier[c]			
Cost per passenger ($)	9.63	P 5.75 D 4.59	F
Passengers per hour	1.5	P 2.0 D 2.8	F

[a] P = pass, I = investigation warranted, and F = fail.
[b] January-March 1981.
[c] December 1980-February 1981.

Table 7. Vanpool evaluation results.

Measure	Value	Standard	Performance[a]
GE			
Cost per passenger mile (cents)	4.0	P 4.5 D 3.8	I
Percentage of pools surviving	86	P 82 D 89	I
NNSY			
Cost per passenger mile (cents)	3.96	P 4.5 D 3.8	I
Percentage of pools surviving	80	P 82 D 89	F
NNSB&DD			
Cost per passenger mile (cents)	3.35	P 4.5 D 3.8	P
Percentage of pools surviving	97	P 82 D 89	P

[a] P = pass, I = investigation warranted, and F = fail.

Revenue per cost is a measure of the conservation of public funds. The actual ratios (with an upper limit of 1.0 for a service that at least equals the cost with the revenues) are used as both the measure and the point allotment in the evaluation. A direct comparison is used because a low operating ratio is not an acceptable condition and, for this objective, the highest ratio is always optimal.

The fuel-efficiency and air pollution indicators are also not compared with standards. The optimum mode is chosen for each measure, and the total score is allotted to that mode.

The no-transit-service alternative should be chosen whenever the sum of the weighted indicator scores is below some minimum acceptable level. To reasonably ensure that any newly implemented service will be successful, in this study a minimum of 0.20 is chosen. The transit service that meets two or more criteria to a partial degree could be chosen. Any service ranking below this minimum, even if it is the optimum, has a doubtful chance for success and would at best have a marginal operation. Any deficit funding, as well as administrative effort, would be better spent on another service.

Maxi-Taxi and Local Bus

The weights for the indicator categories in Tables 9 and 11 (given later) represent TTDC policy. Equal emphasis is placed on efficiency, effectiveness, and public-fund conservation, with slight weights for fuel-efficiency and air pollution minimization.

In November 1980, a Maxi-Taxi service was instituted in the Ocean View/Bayview area of Norfolk, which replaced bus route number 14. The statistics for each of these services, along with the intramodal standards and scoring, are summarized in Table 8. Also noted are the comparative indicators and the distributed scores. Table 9 organizes the scores, weights, and ratings for each alternative and the no-transit-service alternative. Maxi-Taxi is clearly the superior alternative, and the no-service alternative is the second choice. Based on this evaluation, conventional bus should not be implemented in this service area with the stated level of service, for it does not meet the objectives of the transit operator, user, or community.

Vanpooling and Express Bus

NNSY is served by two express bus routes (numbers 45 and 47) as well as 22 TTDC-owned vanpools. The intermodal evaluation is applied to this case study to test the pooling modes. The statistics are compiled in Table 10 for both modes and then incorporated into Table 11.

The results of the evaluation show that, in this case, express bus is the superior mode for the market group. Vanpooling, however, has a fair rating, so this alternative can also be offered for those commuters who are adverse to bus transit.

Table 8. Intermodal evaluation indicator ratings—Ocean View/Bayview.

Service Type	Cost Efficiency	Effectiveness	Conservation of Public Funds	Fuel Efficiency	Pollutant Minimization
Fixed-route bus					
Measure	Cost per passenger ($)	Passengers per hour	Revenue per cost	Passenger miles per gallon	Grams per passenger mile
Value	5.32	5.6	0.06		
Standard					
D	1.43	26.9			
P	2.67	13.0			
Score	0	0	0.06	1.0	0.0
Maxi-Taxi					
Measure	Cost per passenger ($)	Passengers per hour	Revenue per cost	Passenger miles per gallon	Grams per passenger mile
Value	3.81	4.0	0.10		
Standard					
D	4.59	2.0			
P	5.75	2.8			
Score	1.0	1.0	1.0	0.0	1.0

Table 9. Intermodal evaluation results—Ocean View/Bayview.

Service Type	Cost Efficiency	Service Effectiveness[a]	Conservation of Public Funds[a]	Fuel Efficiency[b]	Pollution Level[b]	Rating
Maxi-Taxi	1.0	1.0	0.10	0.0	1.0	0.68
Conventional transit	0.0	0.0	0.06	1.0	0.0	0.068
Status quo (no service)						0.20

[a]Weight = 0.3. [b]Weight = 0.05.

Table 10. Intermodal evaluation indicator ratings—NNSY.

Service Type	Cost Efficiency	Effectiveness	Conservation of Public Funds	Fuel Efficiency	Pollutant Minimization
Express bus					
Measure	Cost per passenger ($)	Passengers per hour	Revenue per cost	Passenger miles per gallon	Grams per passenger mile
Value	0.60	37.8	0.46		
Standard					
D	2.67	26.9			
P	1.43	13.0			
Score	1.0	1.0	0.46	0.0	0.0
Vanpooling					
Measure	Cost per passenger mile (cents)	Percentage surviving	Revenue per cost	Passenger miles per gallon	Grams per passenger mile
Value	3.96	80			
Standard			1.07		
D	3.8	89			
P	4.5	82			
Score	0.5	0.0	1.0	0.0	1.0

Table 11. Intermodal evaluation results—NNSY.

Service Type	Cost Efficiency[a]	Service Effectiveness[a]	Conservation of Public Funds[a]	Fuel Efficiency[b]	Pollution Level[b]	Rating
Vanpool	0.5	0.0	1.0	1.0	0.0	0.50
Express bus	1.0	1.0	0.46	0.0	1.0	0.74
No transit service						0.20

[a]Weight = 0.3. [b]Weight = 0.05.

CONCLUSIONS

The procedures demonstrated in this paper present a framework for the development of a common paratransit evaluation strategy for application at the system and individual service levels. Transit operators can use the structure to evaluate their current operations as an aid in decisionmaking about service changes. The results show the feasibility and practicality of formalized indices in paratransit performance evaluation. The logical development of the performance evaluation is highly appropriate for explaining transit management options to citizen groups.

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Computer-Assisted Management Information System for Regional Advance-Reservation Bus Service

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A historical and technical review of the computerized management information system (MIS) implemented by the Cape Cod Regional Transit Authority (CCRTA) in 1980 is presented. The paper attempts to evaluate its success and recommends further research into options for the use of computers by paratransit providers. CCRTA's MIS meets the present operational and administrative information needs associated with the 25-vehicle b-Bus regional demand-responsive bus service, including innovative procedures for allocating costs to towns and collecting revenue from riders. The MIS generates monthly invoices for mailing to riders, who are charged according to trips taken and kilometers traveled. A similar charging scheme is used to allocate costs to member towns for service provided to their residents. The many reports generated by the MIS have proved valuable to managers, administrators, and policymakers, and the scheduling component of the MIS has resulted in faster, more efficient, and more reliable service for riders. The MIS uses a Data General Nova minicomputer, two hard-disk drives, three cathode-ray tube terminals, and a dot-matrix printer. The MIS costs about $50 000 (including hardware and software and excluding finance costs).

Demand-responsive bus service has inherently complex information needs and, as a result, a significant portion of the costs involved in providing such services can usually be identified as information management costs. Demand-responsive services frequently employ one office worker for every three or four drivers. Each individual trip involves answering a telephone; obtaining the name, address, destination, date and time desired, billing information, etc.; finding a bus that will be in the right areas at the right times; and scheduling the bus to make the pickups and drop offs. Human service agency invoices must be prepared, user fees must be collected, and statistical reports must be generated.

The significance of information management has been amplified by the wave of fiscal austerity now sweeping the nation. In many areas sponsors of such services are being forced to consider cutting service levels, increasing fares, and/or finding ways to reduce costs. Information management is relevant for two reasons: (a) policymakers need good information in order to make such decisions intelligently and (b) information management is one area where cost savings might be realized.

In addition, lower subsidy levels generally lead to higher costs for both users and local sponsors. Increases in user costs show the importance of equity in the generation of revenues, and increases in the local shares paid by municipalities magnify the importance of equity in the allocation of costs between municipalities.

Demand-responsive services that serve many towns have particularly complex information needs. Costs and revenues must be allocated among member towns. Each town needs to know what service they are receiving; thus, all statistics must be kept separately for each town. The variety in trip lengths is greater, so it becomes important to develop trip-length and passenger-kilometer information.

This paper describes the particular information needs of the b-Bus, a regional advance-reservation demand-responsive service provided by the Cape Cod