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# Analysis of Transit Performance Measures Used in New York State

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A recent study by the New York State Department of Transportation developed transit performance measures to be applied to the full range of the state's transit operations. This paper expands on this initial effort by examining: (a) factors that affect the 15 performance measures developed previously; (b) the interrelationships between measures; (c) the ability of the measures to describe changes in operator performance; and (d) the feasibility of using multimodal measures. The results of this analysis show that the 15 performance measures were not highly intercorrelated or influenced by the component variables used to compute them. The levels of a number of measures did not differ significantly among service types, which suggests their use in multimodal performance evaluations. A preliminary review of the performance levels for the second year reveals the usefulness of the measures as a diagnostic tool to identify possible operator performance problems. Operator levels in future years will be monitored to chart industry changes and to identify the need to modify the department's acceptable and desirable attainment levels.

The massive federal, state, and local investment in public transportation in recent years has led to an increased desire by all levels of government to monitor the impacts of these funds. A number of studies have addressed this need in relation to transit operating assistance and have advocated the use of transit performance measures to evaluate the effectiveness of this assistance (1,2). However, much of the past research into the development of performance measures has suffered from a common problem—that of the collection and use of accurate, reliable, and consistent data. The current collection and dissemination of Urban Mass Transportation Act of 1964, as amended, Section 15 transit operating data should help to alleviate this problem and greatly aid and increase research in this area.

A recent effort by the New York State Department of Transportation (NYSDOT) resulted in the development of transit performance measures to be applied to the full range of the state's transit operations (1). Achievement of at least acceptable levels of performance on each of the appropriate measures is necessary to ensure receipt of all operating aid funds to which an operator is eligible (3). Transit operating data collected by the department from all systems that participate in the state's transit operating assistance program contain many operating statistics not available to earlier researchers (such as employee hours and passenger miles).

This paper expands on initial department efforts by examining, in detail, factors that affect the 15 performance measures developed in 1979. Included are (a) an analysis of the relation between the performance measures and the component variables used to compute the measures; (b) the affect factors outside the control of the transit operator have on the

performance measures; (c) interrelationships among the performance measures; and (d) the ability of the measures to describe changes in operator performance. This effort also addresses concerns about the desirability and feasibility of developing and using multimodal performance measures expressed by the transit operators and the planning and research communities after the department's earlier study in this area was publicized.

## BACKGROUND

Recent efforts to develop transit performance measures grew from earlier research that described the need for such evaluations. Gilbert and Dajani examined the perspectives from which transit service could be evaluated (federal, state, local government, user, and operator) and outlined a framework for developing performance measures (4). A study by Allen and DiCesare identified possible criteria for measuring the level and quality of transit service (5). Work by Tomazinis and others described in detail the methods, problems, and requirements of creating transit efficiency measures (6). The Proceedings of the First National Conference on Transit Performance outlined the issues and problems involved in studying transit performance and presented recommendations for developing performance measures (7). Innumerable other reports have also described the issues involved in transit performance evaluation and presented possible measures for use in evaluations or as criteria for funding programs (8-10).

One of the first studies to develop and analyze performance measures for a large number of transit operators was by Fielding and Glauthier (11). This work was later extended to compare various California operations against the overall performance of all transit systems studied (2). These efforts were hindered by the unavailability of operating data, which resulted in the use of statistics such as the number of employees and passengers carried rather than more descriptive measures such as employee hours and passenger miles. Despite this problem, these and other similar efforts were valuable in that they not only developed sound performance measures but also analyzed factors that could affect the levels of the performance measures developed.

The NYSDOT effort described the background that led to the development of a set of 15 multimodal performance measures for use in New York State (1). These measures were developed for application to all

modes, service types, and sizes of transit operations that participate in the state's operating assistance program. The 15 measures of efficiency, economy, and effectiveness developed are listed in Table 1 along with the mean level and standard deviation of each measure, based on data for state FY 1978/79. The definitions of some terms used in the analysis appear elsewhere (1). Due partly to the range of values and differing distributions of operator levels for each measure, the New York State program evaluates operator performance in relation to an empirically derived minimum level of attainment, not a statistically calculated level. The performance measures are applied in sets so as not to penalize any mode, size, or type of service. As a time series of data becomes available, levels of attainment can be assessed annually to identify trends of individual operators, groups of operators, or the state as a whole. This type of analysis may result in a reassessment of the desirable and acceptable threshold levels initially selected.

ANALYSIS OF PERFORMANCE MEASURE CORRELATIONS

A first step in the current analysis was to determine the relation of each of the 15 performance measures to the component data from which they were derived, as well as their relation to a series of variables generally considered outside the control of the transit operator. These variables include the following:

1. Public or private fleet ownership,
2. Total vehicle fleet size,
3. Average passenger trip length,
4. Average fare per passenger,
5. Population served (estimated for local services only),
6. Density of area served (estimated for local services only), and
7. Average vehicle speed.

A correlation matrix of the 15 performance measures and these variables was used to determine the degree of any such relationships. Table 2 summarizes the results of that analysis. Only one of the 15 measures (pass mi/cap hr) was found to be highly correlated (correlation coefficient greater than 0.70) with any other variable. Its correlation to both average passenger trip length and average vehicle speed is not surprising because they are ultimately components of the measure itself. Average passenger trip length, average vehicle speed, and average fare per passenger were moderately correlated with many of the performance measures. Several measures (cost/cap mi, rev and local/pass mi, cost/pass mi, and deficit/pass mi) were neither highly or moderately correlated with any of the variables analyzed, which indicates their particular suitability for intermodal evaluations. Both the population served and density of service area variables were not appreciably correlated with any of the performance measures, and, in fact, had essentially zero correlation with all but two measures (cap hr/emp hr and pass/emp hr). This suggests that the performance measures used in this study are not significantly affected by city size or density.

Surprisingly, none of the component variables (such as total passengers, capacity miles of service, or total employee hours) were highly or even moderately correlated with any performance measure. This indicates that a transit system's operating performance is probably not related to the absolute values of any of these variables. More simply, the size of an operation did not have a direct bearing on its performance.

Table 1. Performance measures developed for use with New York State transit systems.

Performance Measure (abbreviation)	Overall	
	Mean	SD
<b>Efficiency</b>		
Revenue capacity hours per employee hour (cap hr/emp hr)	31.2	17.4
Revenue capacity miles per employee hour (cap mi/emp hr)	516.8	335.5
Revenue vehicle hours per vehicle (veh hr/veh)	1878.8	891.5
Revenue vehicle miles per vehicle (veh mi/veh)	30 924	15 808
<b>Economy</b>		
Operating cost per capacity mile (cost/cap mi)	0.030	0.020
Operating cost per capacity hour (cost/cap hr)	0.511	0.365
Operating revenue per operating cost (rev/cost)	0.603	0.367
Operating revenue and excess local assistance per passenger mile (rev and local/pass mi)	0.182	0.259
<b>Effectiveness</b>		
Revenue passengers per revenue capacity hour (pass/cap hr)	0.355	0.194
Revenue passenger miles per revenue capacity hour (pass mi/cap hr)	3.70	4.53
Revenue passenger miles per capacity mile (pass mi/cap mi)	0.183	0.139
Operating cost per revenue passenger mile (cost/pass mi)	0.325	0.517
Deficit per revenue passenger mile (deficit/pass mi)	0.188	0.460
Revenue passengers per employee hour (pass/emp hr)	10.82	7.95
Revenue passenger miles per employee hour (pass mi/emp hr)	98.27	113.97

Table 2. Correlation of performance measures with other variables.

Performance Measure (abbreviation)	Correlation	
	High	Moderate
Cap hr/emp hr	None	Speed -0.35
Cap mi/emp hr	None	Speed 0.39
		Trip length 0.32
Veh hr/veh	None	Speed -0.42
Veh mi/veh	None	Speed 0.43
		Trip length 0.40
		Fare per passenger 0.32
Cost/cap mi	None	None
Cost/cap hr	None	Speed 0.47
		Trip length 0.42
		Fare per passenger 0.37
Rev/cost	None	Trip length 0.50
		Fare per passenger 0.45
		Public versus private 0.48
Rev and local/pass mi	None	None
Pass/cap hr	None	Trip length -0.36
		Fare per passenger -0.34
Pass mi/cap hr	Trip length 0.79	Fare per passenger 0.58
	Speed 0.72	
Pass mi/cap mi	None	Trip length 0.53
		Fare per passenger 0.34
Cost/pass mi	None	None
Deficit/pass mi	None	None
Pass/emp hr	None	Speed -0.46
		Trip length -0.36
		Fare per passenger -0.36
Pass mi/emp hr	None	Trip length 0.59
		Speed 0.44
		Fare per passenger 0.36

The correlation matrix also provides support for the department's initial use of pairs of performance measures to account for obvious differences in service types (e.g., local versus intercity) (1). For example, the capacity mile per employee hour ratio is positively correlated with speed and trip lengths, and so favors commuter and intercity services, but the capacity hour per employee hour ratio is negatively correlated with speed, thus favoring local services. Similar comparisons can be found in the other instances where this pairing of measures was used in the evaluation.

Next, the interrelationship among the performance measures was analyzed. By examining the resulting correlations presented in Table 3 we note that few performance measures are highly correlated with other measures. Not surprisingly, most of the related measures are those that are companion measures (e.g., operating revenue plus excess local assistance and operating cost). In general, the efficiency measures are not highly related to either the economy or effectiveness measures, which supports the opinion that efficient service does not ensure effective service (4).

Among the more significant correlations found in the matrix is the relationship of the revenue to cost ratio, as well as the revenue and local assistance per passenger mile ratio, to most of the effectiveness measures. This intuitively should be the case because more-effective service is characterized by higher passenger use, which generally results in more operating revenue per unit of service than is the case for less-effective services.

The passengers to capacity hour ratio is not correlated with most of the performance ratios, but tends to increase as efficiency (in terms of cap mi/emp hr and veh mi/veh) decreases, thus favoring locally oriented services. On the other hand, passenger miles per capacity hour is correlated with most other measures and favors intercity and commuter services due to significantly longer trip lengths that are reflected in the passenger mile component. The passenger to employee hour ratio is moderately correlated with capacity hour ratios (which favors local service), but passenger miles per employee hour is usually correlated with capacity mile ratios. Note that, as in the passengers per capacity hour and passenger miles per capacity hour correlations, passengers per employee hour and passenger miles per employee hour are not correlated with each other. This phenomenon appears to be due to the range of the absolute data used to construct the ratios and its impact on the various ratios.

In general, then, the original intents of NYSDOT to (a) select measures that were relatively if not entirely independent of one another, (b) select measures that were not surrogates for conditions over which the operator has little or no control, and (c) pair measures to minimize or eliminate intuitive or known differences related to service type, all appear to have been adequately addressed by the 15 measures.

#### Analysis of Performance Measures by Service Type

The aggregation of mode and service types to develop multimodal performance measures and set levels of attainment for New York State systems also raises the issue of comparability of performance levels across various service types. Figures 1-3 indicate graphically, for each performance measure, the mean level of each service type (fixed-route local, commuter, intercity, and demand responsive), the overall mean level (for all service types combined), and the acceptable and desirable levels of attainment as determined by NYSDOT. The shaded portion of each graph depicts one standard deviation from the overall mean to give an indication of the dispersion of values for each measure.

In nearly all of the cases, the average level of attainment of each service type on each measure is within one standard deviation of the overall mean. Only demand-responsive services appear to deviate significantly from the overall mean, and then only on 8 of the 15 measures. Similarly, when compared with the established levels of acceptability and desirability, the service types (on the average) indicate general acceptability. The six cases where the service type averages do not meet the accepted levels of attainment (cap hr/emp hr, cap mi/emp hr, cost/cap hr, rev/cost, deficit/pass mi, and pass/emp hr) can be explained by either the significance of a few operators or the anticipated results of a particular service type. Demand-responsive services, for example, do not as a group meet the acceptable level for capacity hours per employee hour. Such a result is not surprising when the vehicle passenger capacities of the demand-responsive services (9-25 passengers) are compared with that of other service types (45-80 passengers). Also, the results of demand-responsive service for several of the performance measures would be adversely affected by the type of area served (generally, population and densities low enough to not support regular fixed-route service) and by the quality of service provided (door to door) for the price paid.

Note that Figures 1-3, as well as rankings of the individual operations for each measure, reveal a great deal of overlap among the performance levels of operators of different service types. These overlaps continue to suggest that aggregation of the service types for evaluation purposes is not unreasonable.

Table 3. Correlation coefficients for performance measures.

Performance Measure (abbreviation)	Cap hr/emp hr	Cap mi/emp hr	Veh hr/veh	Veh mi/veh	Cost/cap mi	Cost/cap hr	Rev/cost	Rev and local/pass mi	Pass/cap hr	Pass mi/cap hr	Pass mi/cap mi	Cost/pass mi	Deficit/pass mi	Pass/emp hr	Pass mi/emp hr
Cap hr/emp hr	1.00														
Cap mi/emp hr	0.64	1.00													
Veh hr/veh	0.35	<sup>a</sup>	1.00												
Veh mi/veh	<sup>a</sup>	0.25	0.55	1.00											
Cost/cap mi	-0.21	-0.42	<sup>a</sup>	<sup>a</sup>	1.00										
Cost/cap hr	-0.48	-0.19	-0.20	<sup>a</sup>	0.66	1.00									
Rev/cost	<sup>a</sup>	0.20	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	1.00								
Rev and local/pass mi	<sup>a</sup>	-0.26	<sup>a</sup>	<sup>a</sup>	0.49	0.25	<sup>a</sup>	1.00							
Pass/cap hr	<sup>a</sup>	-0.28	<sup>a</sup>	-0.38	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	1.00						
Pass mi/cap hr	-0.22	0.24	-0.36	<sup>a</sup>	<sup>a</sup>	0.44	0.45	-0.28	<sup>a</sup>	1.00					
Pass mi/cap mi	<sup>a</sup>	<sup>a</sup>	-0.20	<sup>a</sup>	0.26	0.45	-0.38	<sup>a</sup>	0.77	1.00					
Cost/pass mi	<sup>a</sup>	-0.24	<sup>a</sup>	<sup>a</sup>	0.45	<sup>a</sup>	-0.32	0.90	<sup>a</sup>	-0.30	-0.41	1.00			
Deficit/pass mi	<sup>a</sup>	-0.22	<sup>a</sup>	<sup>a</sup>	0.41	<sup>a</sup>	-0.42	0.80	<sup>a</sup>	-0.24	-0.34	0.96	1.00		
Pass/emp hr	0.64	<sup>a</sup>	<sup>a</sup>	-0.30	<sup>a</sup>	-0.44	<sup>a</sup>	<sup>a</sup>	0.63	<sup>a</sup>	-0.21	-0.23	<sup>a</sup>	1.00	
Pass mi/emp hr	0.28	0.66	-0.20	<sup>a</sup>	<sup>a</sup>	<sup>a</sup>	0.40	-0.29	<sup>a</sup>	0.70	0.67	-0.32	-0.27	<sup>a</sup>	1.00

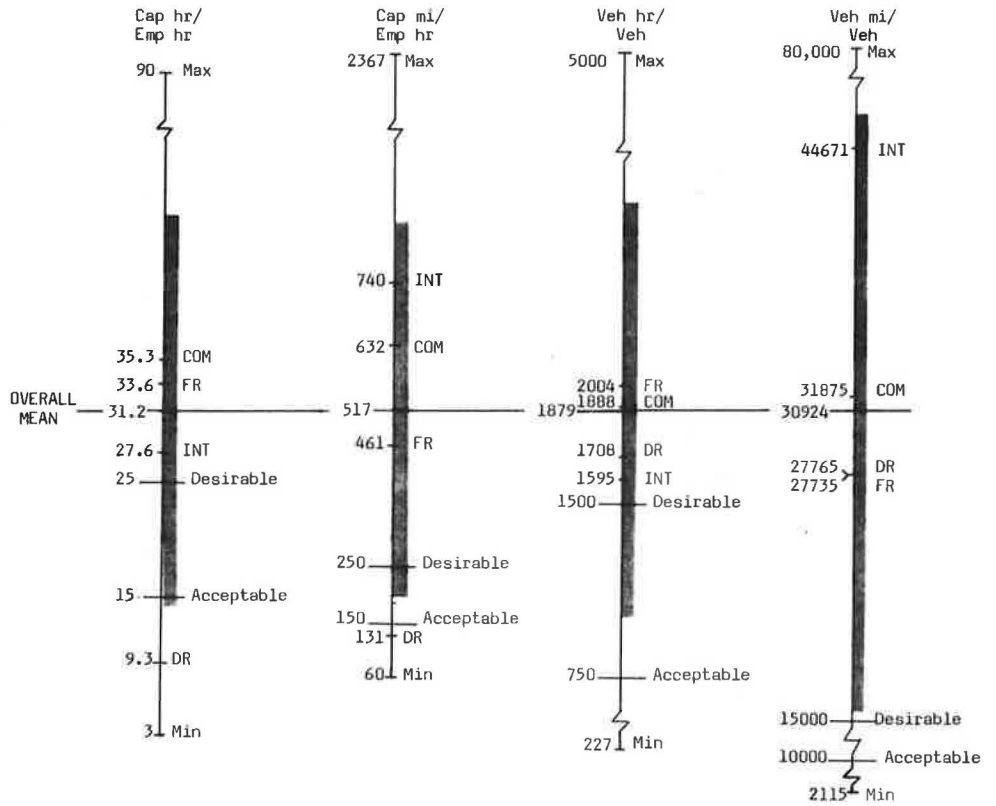
<sup>a</sup>Not significant.

Analysis of Performance Measures Over Time

Operator performance levels for the second year will provide insight into how well the evaluation measures describe changes in operating performance. It

will also give an indication of the overall direction of change of each performance measure and signal the possible need to modify levels of acceptable and desirable attainment or to adjust current policies that may be responsible.

**Figure 1. Efficiency measure levels by service type.**



**Figure 2. Economy measure levels by service type.**

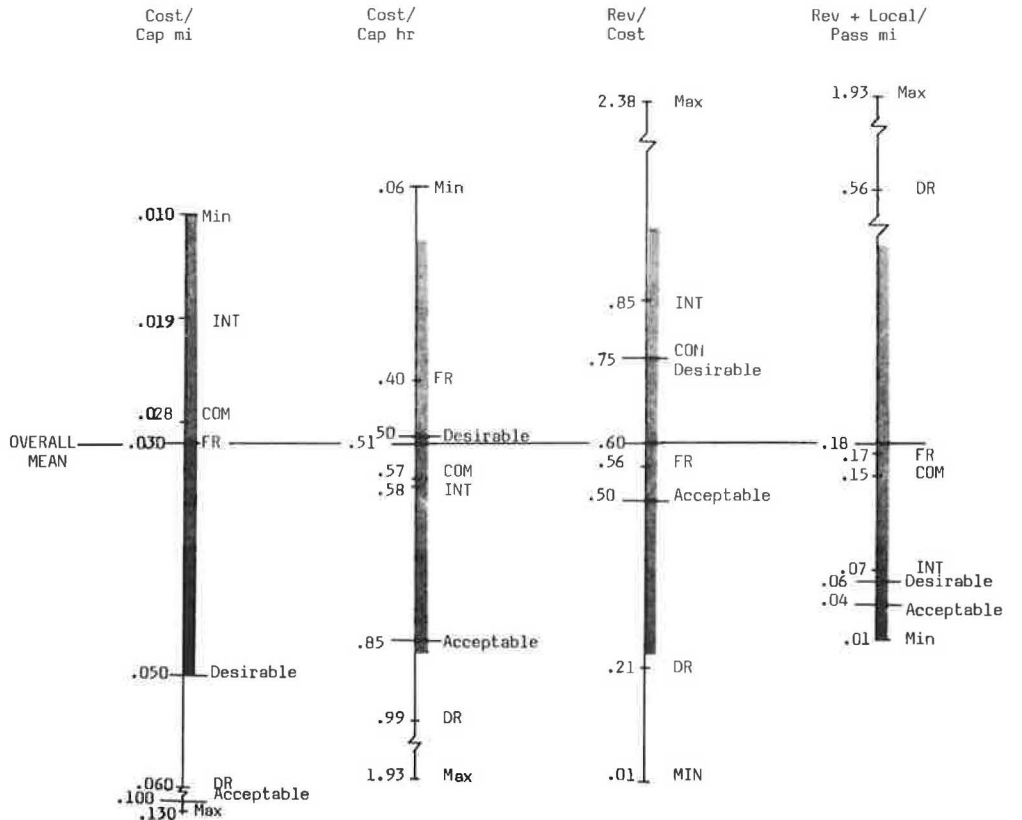
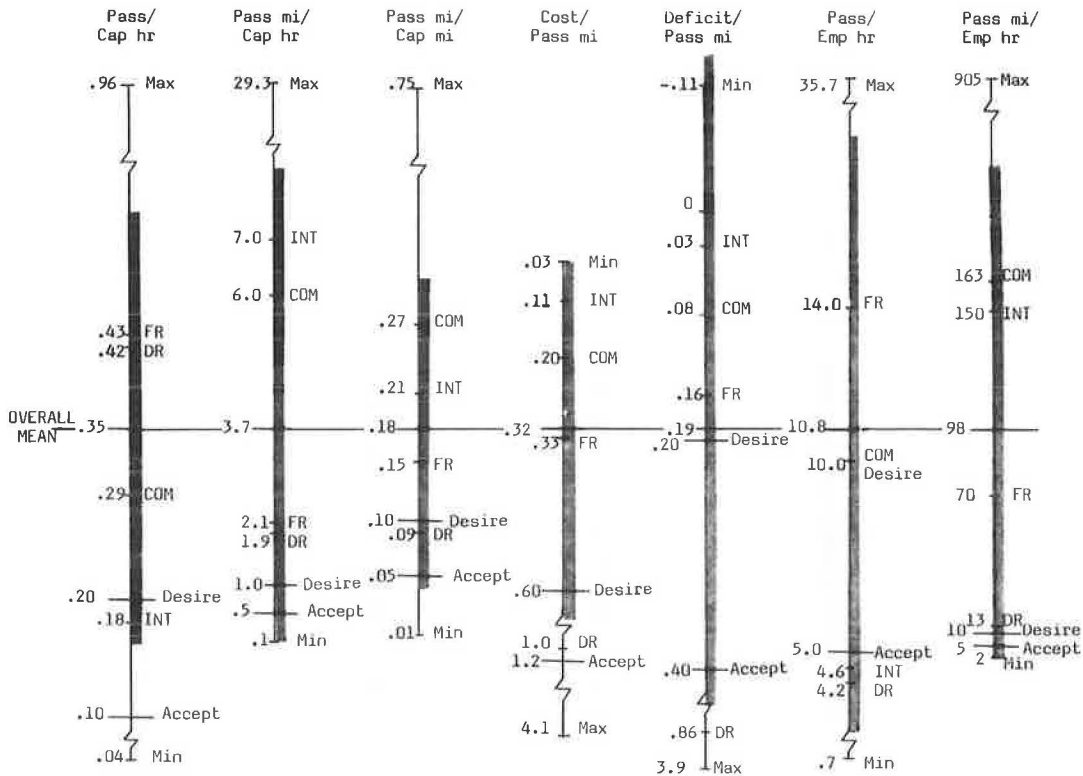


Figure 3. Effectiveness levels by service type.



As a preliminary review of second-year change, four major regional transportation authorities in New York State were analyzed. Changes in performance in the second year are shown in Table 4. The actual levels of each measure are shown in Table 5. Remaining operations will be analyzed as operating data for the second year become available.

The four transit authorities generally improved their performance on 7 of the 15 measures over the previous year's level. On two other measures, cost per capacity mile and cost per capacity hour, the four operators increased in an unfavorable direction. There was no consistent trend, and in some cases considerable variation among operators, on the remaining six measures.

Some comment on the apparent reasons for the results shown in Table 4 is worthwhile. The large increase in capacity hour per employee hour and capacity miles per employee hour for operator D is caused by the decrease in total employee hours over the previous year, since all four operators generally increased vehicle miles and vehicle hours of service. The remaining efficiency measures increased slightly for all operators.

The cost per capacity mile and cost per capacity hour ratios increased because the increase in total operating costs outweighed the capacity mile and hour changes. Changes in revenue to cost ratios varied by operator and can best be explained by the change in the effectiveness measures. All operators increased passengers and passenger miles carried; however, two operators (B and D) had twice the increase of the next operator. This, coupled with the corresponding larger increase in passengers per employee hour and passenger miles per employee hour in these areas, results in an increase (or lower decline) in the operating revenue to cost ratio. Also, the operating cost component has an affect on the revenue to cost ratio. Operator C had a larger

Table 4. Percentage change in performance levels in second year.

Performance Measure (abbreviation)	Operator				Favorable Direction	Overall Direction for Four Areas
	A <sup>a</sup>	B <sup>b</sup>	C	D <sup>b</sup>		
Cap hr/emp hr	- <sup>c</sup>	+3	-3	+17	Increase	Varies
Cap mi/emp hr	- <sup>c</sup>	+8	+2	+12	Increase	Increase
Veh hr/veh	+2	-5	+2	+6	Increase	Varies
Veh mi/veh	+1	- <sup>c</sup>	+7	+2	Increase	Increase
Cost/cap mi	+10	+10	+21	+8	Decrease	Increase
Cost/cap hr	+12	+13	+25	+2	Decrease	Increase
Rev/cost	-2	-4	-12	+7	Increase	Varies
Rev and local/pass mi	+7	-9	+4	-3	Increase	Varies
Pass/cap hr	+5	+34	+10	+14	Increase	Increase
Pass mi/cap hr	+6	+33	+10	+14	Increase	Increase
Pass mi/cap mi	+6	+27	+5	+19	Increase	Increase
Cost/pass mi	+6	-15	+14	-10	Decrease	Varies
Deficit/pass mi	+9	-13	+27	-15	Decrease	Varies
Pass/emp hr	+6	+38	+7	+34	Increase	Increase
Pass mi/emp hr	+6	+38	+7	+34	Increase	Increase

Notes: Total vehicle miles of service for operator A were 10 335; for operator B, 7395; for operator C, 6381; and for operator D, 4459. Total passengers carried for operator A were 36 462; for operator B, 20 579; for operator C, 13 901; and for operator D, 13 025.

<sup>a</sup>Operator had fare increase during the operating year.  
<sup>b</sup>Operator had fare increase near the end of the operating year.  
<sup>c</sup>Change was less than one percent.

increase in operating cost than did the other operators, thus the revenue to cost ratio was adversely impacted. Operator A showed a somewhat lower percentage change in performance measure levels than did the other operators but appears to maintain its revenue to cost ratio due to a fare increase midway through the operating year combined with no loss in ridership. This operator expects to raise its revenue to cost ratio in the third year of the evaluation program. Note that the operator that

Table 5. Comparison of first- and second-year's performance levels.

Performance Measure (abbreviation)	Operator A		Operator B		Operator C		Operator D		Acceptable Level	Desirable Level
	1978	1979	1978	1979	1978	1979	1978	1979		
Cap hr/emp hr	31.67	31.67	36.46	37.57	41.08	39.81	31.45	36.83	15	25
Cap mi/emp hr	349.3	347.4	433.6	470.1	491.5	500.7	376.6	423.3	150	250
Veh hr/veh	1951	1992	2445	2327	2109	2150	2200	2337	750	1500
Veh mi/veh	21 530	21 850	29 091	29 116	25 227	27 037	26 342	26 863	10 000	15 000
Cost/cap mi	0.030	0.033	0.029	0.032	0.024	0.029	0.024	0.026	0.10	0.05
Cost/cap hr	0.327	0.367	0.350	0.397	0.287	0.360	0.290	0.297	0.85	0.50
Rev/cost	0.57	0.56	0.50	0.48	0.51	0.45	0.44	0.47	0.50	0.75
Rev and local/pass mi	0.086	0.092	0.139	0.127	0.094	0.098	0.087	0.084	0.04	0.06
Pass/cap hr	0.425	0.448	0.367	0.490	0.371	0.409	0.377	0.430	0.10	0.20
Pass mi/cap hr	2.123	2.241	1.285	1.716	1.483	1.636	1.584	1.808	0.50	1.00
Pass mi/cap mi	0.192	0.240	0.108	0.137	0.124	0.130	0.132	0.157	0.05	0.10
Cost/pass mi	0.154	0.164	0.272	0.231	0.193	0.220	0.183	0.164	1.20	0.60
Deficit/pass mi	0.066	0.072	0.137	0.119	0.095	0.121	0.102	0.087	0.40	0.20
Pass/emp hr	13.44	14.20	13.38	18.42	15.23	16.28	11.86	15.85	5	10
Pass mi/emp hr	67.20	71.00	46.83	64.48	60.92	65.12	49.82	66.58	5	10

has the best effectiveness measure levels in Table 5 (operator A) has the highest revenue to cost ratio.

This preliminary analysis suggests that the use of performance measures can provide a method for identifying changing conditions (e.g., operator A's fare increase) or impending problem areas (e.g., operator C's unusually large increase in operating costs) that should be addressed. The fact that trends in the magnitude of some of the performance measures can be ascertained even from this small sample also suggests that a routine review of acceptable and desirable levels of attainment is necessary and that, perhaps, a periodic change in those levels may be required. It is at best difficult, if not impossible, to say whether the fact that the state has made the attainment of acceptable performance criteria a condition for the receipt of state operating assistance played, or will play, any role in influencing the performance trends.

#### CONCLUSION

This research continues to support the multimodal transit performance measures developed in New York State as useful tools in evaluating a transit operator's performance. The 15 performance measures were found not to be highly intercorrelated, which indicates that operator performance on one measure does not significantly influence performance on all measures. As a result, the performance measures do, in fact, measure the aspects of transit performance that they were intended to, without being influenced by other measures. This analysis has also shown that efficiency measures were not highly related to the other performance measures, which indicates that efficient transit operations may not necessarily be the most effective or economical. Component variables used to calculate the ratios were not found to influence operating performance, which indicates that the overall size of an operation does not necessarily influence performance. Apparently, most transit operations are now closely tailored to their operating area conditions to provide an economical, efficient, and effective service that the specific area can support.

Perhaps the most interesting result of this study is the comparability of performance levels of various service types. A number of measures do not differ significantly between service types, which suggests the multimodal, multiservice use of performance evaluations. The multimodal use of these measures will be monitored closely to ensure that no particular service is discriminated against.

A preliminary look at the levels of performance

for the second year reveals the direction of change of each measure and suggests that further work in this area is warranted to identify desirable methods to establish appropriate attainment levels for systems as they develop. The analysis has also shown that the evaluation measures may be used as a diagnostic tool to identify possible operator performance problems.

Overall, this paper has extended earlier research by presenting relative magnitudes of the relation between the performance measures and the variables that may affect them.

#### FUTURE RESEARCH

Many transit professionals agree that measuring and evaluating operating performance is important. A policy statement issued by the American Public Transit Association recommends establishment of performance measures at the local level (12). It has also published a report on current use of performance evaluation among various sizes and types of transit operations (13). Several New York State transit operators are currently studying improved management information systems and the development and implementation of overall system and individual route performance evaluation methods.

Research in the area of transit performance should be intensified with the availability of Section 15 data. The potential increased quality and consistency of this data will aid these efforts. Topics for future research should include the following:

1. Analysis of performance measures over time to monitor change, reasons for change, and to adjust levels of attainment when appropriate;
2. Use of performance measures to identify services that would benefit from more in-depth study;
3. Determination of the transferability of the performance measures developed in New York State to other areas;
4. Analysis of the potential for other groupings of performance measures, such as by trip length, ownership type, or speed; and
5. Development of methods to relate these, or other, performance evaluation measures to local goals, objectives, and operating conditions.

To assist in the operator-evaluation effort, the department is requesting that each major transit system submit a service (evaluation) plan. The initial submission will obtain information on transit system goals and objectives, service coordination,

and service problems and needs. These service plans will add to the comprehensiveness of the evaluation program by identifying local factors that were not easily recognizable in the operating data collected and used in the preceding analysis.

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#### *Abridgment*

## Use of Service Evaluation Plans to Analyze New York State Transit Systems

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Recent state legislation mandated that the New York State Department of Transportation develop a transit service evaluation plan reporting requirement to be used along with transit performance measures in the evaluation of the state's major transit systems. This paper describes the development of the service plan submission and summarizes the results of the plan submittals for the first year. The results of the two reporting groups of transit systems (public authorities and county sponsors) are compared on each of four topics (use of goals and objectives, operating performance evaluation, service coordination, and service problems and needs). It is concluded that the service plans provide a basis for relating transit system performance to local service objectives and operating conditions and also for improving the performance monitoring of New York State's major transit systems.

A number of recent studies have advocated the use of transit performance measures to evaluate the efficiency and effectiveness of publicly funded transit service (1,2). Many of these studies as well as the American Public Transit Association (APTA) have recommended that performance evaluations must be made in light of the goals and objectives of the transit system and the local conditions that affect service (3). The New York State Department of Transportation (NYSDOT) began a performance evaluation program in 1979 under a state legislative mandate to certify the performance of transit operators that participate in the state operating assistance program (1). The operating and financial data used

to evaluate performance were obtained through annual surveys of transit operators. However, these data alone did not reveal the complete transit operating picture.

In recognition of the need to obtain other non-statistical information from state-sponsored transit services to supplement the department's existing performance evaluation program and to relate operating performance to local goals, objectives, and special conditions, NYSDOT implemented a service plan reporting requirement for 1980 (4). This paper describes the development of the transit service plan submission for the initial year, presents a comparison of the plans received by the two distinct groups that submitted responses, and recommends ways in which the service plans can be used by NYSDOT and local governments.

#### BACKGROUND AND DEVELOPMENT OF QUESTIONNAIRE

The 1980-1981 New York State transit operating assistance appropriation legislation requires the department of transportation to certify as to the economy, efficiency, and effectiveness of each major public transportation system (those systems that annually carry more than one million passengers or operate more than one million vehicle miles of ser-