

(e) proposals are usually directed more to changes in federal rules, regulations, and legislation.

Multistate proposals to federal agencies are more likely to be implemented when (a) the issue is addressed enough in advance of key decision points that there is time to coordinate efforts by elected representatives, (b) working relationships are developed with professional staffs of congressional committees, transportation interest groups, and the federal agencies; (c) sufficient funds and adequate staff are available at the multistate organization

to produce a thorough report; (d) the substance and quality of previous and ongoing work are considered appropriate by the transportation professionals (and acceptable to elected and appointed officials) representing at least the multistate area served by the organization; and (e) state and federal transportation staffs are involved with the effort from its inception.

Publication of this paper sponsored by Committee on Statewide Multimodal Transportation Planning.

Improving Usefulness of Section 15 Data for Public Transit

JAMES M. HOLEC, JR., DIANNE S. SCHWAGER, AND MARTA J. GALLAGHER

The purpose of this paper is to accelerate the creative and insightful use of a new and powerful data base. The paper focuses on the use of Section 15 data as a surveillance and monitoring tool for statewide transportation planning and management. Use of Section 15 data for this purpose is receiving widespread attention and is advancing from initial consideration to development and implementation in many areas. This activity is likely to increase with the release of Section 15 data by the Urban Mass Transportation Administration. Two principal methods for improving the usefulness of Section 15 data are discussed in this paper. The first method involves improving the potential user's familiarity with the nature and quality of the data. This familiarity will foster informed analysis and limit misrepresentation of a transit system's financial and operating performance. The second method involves enhancing the data base itself through editing and correcting the initial submissions of transit operators, clarifying reporting instructions (and thereby improving the quality of data submitted), modifying reporting forms, refining data-collection techniques, adding or deleting data elements, and/or augmenting the Section 15 data base with other available data. These methods are introduced by first providing a brief perspective on the type of information contained in the Section 15 data base, discussing specific shortcomings with the current data, and concluding with a summary of methods for improving the usefulness of the data base.

In November 1974, the Urban Mass Transportation Act was amended to introduce federal participation in the financing of transit system operating expenses. Provision of funds for this purpose through Section 5 of the Act was accompanied by a directive to the U.S. Secretary of Transportation to develop, test, and prescribe a uniform system of accounts and records "to accumulate public mass transportation financial and operating information." The directive further specified that, after July 1, 1978, no grantee could receive federal operating assistance through the Section 5 program without complying with this reporting requirement. The portion of the Act that established this new requirement was Section 15.

The first full year of the Section 15 reporting system encompasses the reports of transit systems with fiscal years ending between July 1, 1978, and June 30, 1979. The Urban Mass Transportation Administration (UMTA) has received nearly two full years of data under this reporting system and is planning its initial release of industry summaries for the first full year, reflecting data for more than 300 transit systems.

WHAT IS CONTAINED IN THE SECTION 15 DATA BASE

To obtain a complete understanding of the Section 15 reporting system and the information contained in

the Section 15 data base, it is essential that potential users of these data review the report, Urban Mass Transportation Industry Uniform System of Accounts and Records and Reporting System, and its complementary reporting manuals: Required Reporting Manual and Sample Forms, Level C Reporting Manual and Sample Forms, Level B Reporting Manual and Sample Forms, and Level A Reporting Manual and Sample Forms. This documentation provides detailed instructions and sample forms for filing Section 15 reports in compliance with federal requirements. The report is available through the National Technical Information Service (NTIS); the manuals can be acquired through UMTA's Office of Transportation Management.

The Section 15 system consists of multiple levels of reporting detail reflecting differences in the size of the transit agency submitting data (measured by the number of vehicles it operates in revenue service). For each level of reporting, data are submitted on the sources and uses of funds for capital and operations, and on the physical, service, and utilization characteristics of the operating system. Financial information is provided on an accrual basis of accounting and the reporting schedule is designed to allow for the reporting of audited financial data as required by the Section 15 system. Physical, level-of-service, and utilization characteristics are based on counts at a point in time (e.g., revenue vehicles are reported at the end of the year level), accumulation of data throughout the year (e.g., annual vehicle miles operated or annual accidents by category), or estimates of annual totals based on sample observations collected randomly throughout the year (e.g., annual passenger trips or annual passenger miles).

Figure 1 presents the type of information contained in the Section 15 data base and Figure 2 illustrates a typical format for summarizing this information. These exhibits begin to suggest the type of analyses that can be conducted by using Section 15 data and showing the compilation of information in selected categories.

The use of Section 15 data for the surveillance and monitoring activities of state agencies is currently in the formative stages. In this developmental period, it is important for these state agencies to be familiar with the quality of information

submitted in first-year Section 15 reports and efforts under way to improve the accuracy and completeness of the Section 15 data base over time. The nature, extent, and outcome of a review of first-year Section 15 reports are described below to provide potential users with a preliminary assessment of year 1 data quality.

REVIEW OF FIRST-YEAR SECTION 15 REPORTS

Each of the first-year Section 15 reports submitted to UMTA was reviewed at least four times prior to the preparation of computerized output reports that are currently being prepared by UMTA. Three of the review procedures were manual and one included a

limited automated validation as the data base was formed. To the extent possible, corrections were made to the data following each review. The intent of reviewing the data was (a) to ensure that the data were in a form suitable for keypunching; (b) to check that the keypunched data reflected the data submitted by the operator; (c) to check that the data did not contain arithmetic errors; and (d) to ensure that the data appeared reasonable, based on a series of checks performed on selected information in each report.

First Manual Review: Prior to Key punching the Data

Each Section 15 report was manually reviewed before the data were keypunched. The reports were checked for completeness, rounding, and gross errors. The review for completeness included three steps. First, the forms were reviewed to determine that the appropriate forms were included in each report based on the reporting level and number of modes operated. Extraneous forms were discarded and missing forms noted.

Next, the identification data (identification number, fiscal year, reporting level, and mode code) on each form were checked to ensure that the data were consistent within a report. This check was important since the entry of each line of data into the computerized data base includes the identification information. The final review before keypunching involved checking that all subtotals and totals were filled in. When data were missing, it was entered on the report.

The review for rounding involved checking all financial data to ensure that the data were reported to the nearest dollar. In addition, some of the operating statistics were checked to ensure that data were reported to the level of significance specified in the Section 15 reporting instructions. When errors were noted, corrections were made.

During this first manual review effort, some reports appeared to have substantial errors or missing data. These reports were generally not keypunched. UMTA contacted these transit systems and either a more complete report was submitted or the report was not included in the first-year Section 15 data base. For example, transit systems that changed fiscal years or were new starts in FY 79 and had

Figure 1. Summary of Section 15 data by type of information reported.

TRANSIT REVENUE DATA	
Sources of Transit Operating Revenue	
Sources of Public Operating Assistance	
State and Local Taxes Dedicated at Their Source for Transit Operations	
Sources of Public Assistance for Transit Capital	
State and Local Taxes Dedicated at Their Source for Transit Capital	
TRANSIT EXPENSE DATA	
Transit Operating Expenses by Mode and Function	
Transit Operating Expenses by Mode and Object Class	
Employer Paid Fringe Benefits	
Employee Paid Fringe Benefits	
Operators Hours and Wages — Operating Time	
Operators Hours and Wages — Non-operating Time	
Transit System Pension Plans	
TRANSIT NON-FINANCIAL DATA	
Service Supplied and Service Consumed by Mode	
Age Distribution of Revenue Vehicles by Mode	
Operating Labor Employee Count	
Capital Labor Employee Count	
Safety and Energy Consumption Data	
Transit Way Mileage	

Figure 2. Sources of public operating assistance by transit system size.

SOURCES OF PUBLIC OPERATING ASSISTANCE	PERCENT OF TOTAL OPERATING ASSISTANCE							ALL SYSTEMS
	SIZE OF TRANSIT SYSTEM: NUMBER OF REVENUE VEHICLES							
	UNDER 26	26 – 49	50 – 99	100 – 249	250 – 499	500 – 999	1000 +	
Federal Government								
Section 5								
Other Federal								
Total Federal Assistance								
State Government								
General Revenues								
Dedicated Sources								
Total State Assistance								
Local Government								
General Revenues								
Dedicated Sources								
Total Local Assistance								
Total Public Assistance	100%	100%	100%	100%	100%	100%	100%	100%
Number Systems Reporting								
Number Systems UMTA								

reported data for less than a 12-month period were not included.

Automated Review

Each Section 15 report was keypunched and a computerized output report replicating the report submitted by the operator was produced (referred to as an ECHO report). During the production of ECHO reports the data were checked for errors in arithmetic, errors in carrying forward subtotals on multiple page forms, and for missing data or incorrect entry of codes specified in the Section 15 instructions (i.e., fuel type and vehicle ownership codes) on selected forms. When these types of errors were identified, an asterisk was printed next to the appropriate line on the ECHO report.

Second Manual Review: Key punch Verification

The second manual review was conducted after the ECHO reports were produced. The primary objective of this review was to verify keypunching and ensure that the ECHO report replicated the data submitted by the transit operator. When keypunch errors were noted, corrections were made on the ECHO report. These corrections were later rekeypunched to produce a "clean" ECHO report. As part of this review, additional errors noted in the automated review were also corrected. Missing data and incorrect codes identified in the automated review were noted. Efforts to correct these errors were incorporated in the next phase of the review process.

Third Manual Review: Reasonableness Check and Telephone Contact

The final manual review effort was the most detailed. The objectives of this effort were to assess the reasonableness of selected data and to correct errors when possible. This effort involved reviewing selected data against a series of reasonableness checks, noting data that appeared questionable, and contacting the transit operator by telephone to verify the data or make corrections if the data were incorrect.

The checks developed for this review effort reflected an understanding of the transit industry and the performance of transit systems and an understanding of the Section 15 reporting requirements. These checks were not exhaustive and will be refined and expanded over time for verification of future Section 15 reports.

Some of the checks included in the review of the first-year Section 15 reports defined reasonable bounds within which the data were expected to fall. Some examples of this are noted below.

Federal funds for both capital assistance and operating assistance were checked against the state and local funds reported to ensure that the federal funds (Sections 3 and 5) did not exceed the expected match allowed by federal law, i.e., 80:20 for capital assistance and 50:50 for operating assistance.

The average cost per gallon of fuel was calculated as a check on the data reported for fuel consumption and fuel expense. The price per gallon was expected to fall between \$0.30 and \$0.70 (reflecting diesel fuel price before June 1979).

Fare-box revenues represent up to 70 percent of total transit system revenues.

Average mileage per vehicle per day was calculated as a check for total and revenue miles of service supplied and number of vehicles in operation. In general, motor buses travel between 50 and 175 miles per day; therefore, the data were expected to fall within this range.

Average transit speed was calculated for an average weekday, Saturday, Sunday, and each period of the weekday. This was to check total and revenue miles and hours of service supplied. Average speed was expected to fall between 4 and 20 miles/h. (Rapid rail vehicle speed was at a higher range.)

Other checks compared data between Section 15 forms in instances where data should have been identical on more than one form. For example, local state and federal assistance reported on Form 201 (or 202), Revenue Summary Schedule, should match local, state, and federal assistance reported on Form 203, Revenue Subsidiary Schedule Sources of Public Assistance; and total fringe benefits reported on Form 331, Fringe Benefit Subsidiary Schedule, should match total expenses for fringe benefits reported on the appropriate expense form (determined by reporting level and number of modes operated).

A third type of check identified data that should generally be included in all of the Section 15 reports. These included matching local or state funds for federal assistance, expenses for insurance or accidents and claims, employee count data, service period schedule (i.e., time of day service is provided), service supplied by time of day, and service consumed by time of day. A total of up to 57 checks for data reasonableness were made to each Section 15 report.

If a data entry did not pass a check, a note was made regarding why the data were considered questionable. After the review of the report was completed, the transit operator was contacted by telephone and each questionable data entry was discussed. In general, the transit operators were cooperative in verifying the data and most problems were resolved.

Not all data that were questioned were incorrect. In some cases, the operator was able to provide a reasonable explanation for the data. For example, several small bus systems that largely provide commuter service into New York City receive more than 90 percent of their revenues from the fare box and several bus systems that largely provide airport limousine service maintain average miles per day and average speeds higher than those expected for a transit system.

If problems were acknowledged and the operator could adjust the data, the ECHO report was corrected and the correction was rekeypunched. If the transit operators indicated that it would be impossible to correct the data in the first-year Section 15 report, they were advised how to avoid similar errors in their future reports. These errors were not corrected and the data were generally not deleted.

QUALITY OF YEAR-1 SECTION 15 DATA BASE

Through this four-step review process the first-year Section 15 data were considerably improved. Many errors were identified and corrected. Other errors, however, were identified but could not be corrected. Therefore, users of the Section 15 data from the first-year reports should consider the potential shortcomings outlined below.

Corrected Errors

Errors in rounding data, arithmetic, identification, and missing subtotals and totals were corrected on all reports. In most cases, errors that resulted from a misunderstanding of reporting instructions were corrected during the telephone conversation with minimal effort by the transit operator. For example, these errors included

1. Many transit operators apparently did not

understand the instructions on Form 401, Transit Service Period Schedule. The 24-h clock was not used as instructed and there was confusion on how to calculate service periods.

2. Many transit operators interpreted the meaning for "average weekday" on Form 406/407, Transit System Service Supplied, Service Consumed and Personnel Schedule, to mean the average during the day instead of the total for the day.

3. Several transit systems did not understand the difference between dedicated taxes, i.e., funds dedicated to transit at their source by a local or state government, and taxes levied directly by a transit authority.

4. Because UMTA had advised transit systems to report data on Form 406/407 in whole numbers rather than in thousands, as is printed on the form, some inconsistencies existed in these data (UMTA decided to change the instructions when smaller operators complained that their data could not be meaningfully reported in thousands).

5. Some operators did not understand the instructions for vehicle type, ownership, and fuel type code on Form 408, Revenue Vehicle Inventory Schedule.

Some of the errors discussed with the transit operator during the telephone conversation required some effort on the part of the operator to make needed corrections. In these instances the transit operator was allowed the necessary time to make these adjustments. These types of errors occurred most frequently when either capital or operating grants were reported on a cash rather than an accrual basis. Some operators reported multiple-year grants as FY 79 revenue or reported no assistance because monies had been applied for and approved but not yet received. These types of errors resulted in an under or overreporting of financial assistance on Form 103, Capital Subsidiary Schedule, Sources of Capital Assistance, and Form 203, Revenue Summary Schedule Sources of Public Assistance. In the majority of cases, corrections were made and the operator indicated that year-2 data would be correctly reported.

Unresolved Errors

Finally, there were some errors that could generally not be resolved. The large majority of these errors represented data that had not been gathered by the transit systems for their first-year Section 15 report. This occurred most frequently with the service consumed (passenger statistics) reported on Form 406/407. To a more limited extent service supplied data and occasionally other operating data had not been gathered. In almost all of these instances the transit operators indicated that they would be unable to provide the missing data in their first-year Section 15 report but would provide that data in future reports.

Unknown Errors

A final type of error may exist in the first-year Section 15 reports. These are errors for which no review was made in the first-year reports. The checks included to review the data in the first-year reports were performed on selected data and were not exhaustive. During the process of checking the reports the need for additional checks was observed. For example, it was noted that transit operators were overreporting the average minutes per unlinked trip on Form 406/407. Some operators had reported the average trip length as hundreds or even thousands of minutes.

The extent of errors of this type is, of course, unknown at this time. UMTA intends to conduct additional research in the future to further refine and correct the future Section 15 reports. As information is obtained to correct and improve reporting practices, Section 15 report forms will be improved and the transit operators will be advised to ensure the refinement of the Section 15 data base over time.

Summary of Review Process

During the first-year review of Section 15 data, 57 individual checks for data reasonability were conducted. These checks involved the assessment, at varying levels of detail, of 432 out of a total of more than 800 fields of data contained in each Section 15 report submitted. The most intense review was concentrated on 147 of these fields.

A measure of the reasonability of the year-1 Section 15 data base can be obtained by examining a sample of the property submittals as illustrated below:

<u>Factor</u>	<u>No. of Data Checks</u>
Possible checks (57 per property)	1995
Questionable data identified	195 (9.8 percent of possible checks)
Questions resolved	145 (74.4 percent of questionable data)
Questions unresolved	50 (25.6 percent of questionable data)

For this sample, a total of 2.5 percent ($50 \div 1995$) of the data checks made in the year-1 Section 15 review remain unresolved and represent questionable, if not incorrect, data within the data base.

IMPROVING USEFULNESS OF SECTION 15 DATA FOR PUBLIC TRANSIT

Anticipating the use of Section 15 data beyond year 1, UMTA is continuing to implement a program to upgrade the quality of the Section 15 data base in order to improve its usefulness for public transit. This effort is being concentrated in four areas: (a) editing of data submitted by transit operators, (b) clarifying data definitions and instructions, (c) improving data-collection techniques, and (d) organizing for the creative dissemination of Section 15 reports. These efforts are evolving as familiarity with the Section 15 data base improves and specific reporting problems become known.

Three improvements are currently being considered with respect to the editing of data submitted by transit operators. The first involves the development of "tighter" edits by using data reported in year 1 to review subsequent submittals. The second involves the addition of edit checks not included in the year-1 review. These additional checks could take two forms: checks of specific data items not previously reviewed and checks of selected performance indicators not previously reviewed. The third improvement involves the automation of the data-checking process; this improvement is designed to reduce the possible errors introduced in the tedious manual checking process.

In addition to the review and improvement of submitted data, efforts are under way to upgrade the data at its source. These efforts are focused on the clarification of data definitions and instructions and the development of improved data-collection techniques. The principal mechanism being used to clarify data definitions and instruc-

tions (aside from direct communication with transit agencies) is the Section 15 Accounting and Reporting Release series initiated by UMTA Circular C2710.5 on February 11, 1980. This series, which is planned as an intermittent publication, elaborates on Section 15 definitions and instructions in a question-and-answer format with extensive use of examples.

Efforts to develop improved data-collection techniques are focused on those items of data for which annual estimates are prepared based on randomly collected samples throughout the year (e.g., the annual passenger trips and annual passenger miles). These efforts are concerned with methods to reduce the required sample size for all transit agencies in general and for smaller transit systems in particular.

In addition to activities designed to improve the quality of the data, efforts are under way to improve the usefulness of the Section 15 data base by organizing for the creative dissemination of reports and analytical access by potential users. These efforts are focusing on the development of core reports providing published access to the bulk of the data and information contained in the Section 15 system, methods for preparing ad hoc, customized reports on request, and methods for allowing potential users direct access to the full data set. These efforts are currently in the developmental stage within UMTA.

APPLYING SECTION 15 DATA BASE FOR STATEWIDE TRANSIT ANALYSIS

The keys to the use of Section 15 data as a surveillance and monitoring tool are (a) confidence in the data base, (b) familiarity with the data base, and (c) understanding the meaning of reported data (recognizing the nature and extent of the information contained in the reported values submitted by individual transit agencies).

In the preceding section, some of the shortcomings with the first-year Section 15 reports were outlined to provide initial guidance to potential users in considering analyses based on these data. This is a sound foundation on which to build an appreciation for the strengths and limitations of the first-year Section 15 data base; however, it provides only broad guidelines to assist with the analysis and interpretation of individual transit agency reports. States considering the use of Section 15 data as a surveillance and monitoring tool must first determine the relevance of these shortcomings for the systems it intends to routinely review. This will require a careful screening of the hard-copy submittals of individual transit agencies to ensure complete, valid, and reasonable reports. Once this prescreening is complete, the more difficult task of taking advantage of the information content contained in these reports can begin. For this purpose, states considering the use of Section 15 data in surveillance and monitoring activities are looking to this data base as a foundation for a performance measurement system using selected performance indicators.

Figure 3 illustrates the type of performance indicators that can be developed by using the most rudimentary reporting level (the required level) within the Section 15 system. This figure represents a subset of the performance indicators being considered for routine performance monitoring by the State of Michigan.

Figure 4 provides an example of the type of instructions necessary for the development of performance indicators from the Section 15 data base. The instructions identify (a) the performance indicator, (b) the data elements included in each indicator

(generally by report form and line number), and (c) the arithmetic operation required to develop each indicator. As surveillance and monitoring activities become more routine, these instructions can be automated to eliminate the manual computation of indicator values.

To begin to appreciate the information content of the data it is suggested that the state agency define the measures of performance as shown in Figure 5. This approach gives meaning and content to the measures evaluated by the state and provides a uniform basis for interpreting the results of performance measurement.

With this foundation, three types of indicator analyses can be suggested: (a) comparison of single-year indicator values for each system to a statewide average value (or to an average value for peer systems selected regionally or nationally), (b) comparison of the value of an indicator and its rate of change to an average value for a selected peer group, or (c) comparison of the performance trend of each indicator over time.

Figure 6 shows the type of analysis that can be conducted, by using the first approach. In this exhibit, data from a sample of six Section 15 reports are used to determine the dispersion of individual property data in relation to the reported average indicator values for a peer group. The information obtained from this analysis can be used to focus the attention of the state on specific transit agencies with apparent performance well above or well below average, and direct further analysis efforts to determine improvement opportunities within the state.

Figure 7 shows the type of analysis that can be conducted by using the second approach. The value of each indicator can be tracked over time and compared with the average value and average rate of change for a peer group. As shown in this figure, six scenarios might be observed in comparing each indicator with a peer group average, with each scenario calling attention to different patterns of performance over time. The scenarios represent:

1. A--The indicator is below the statewide average value in year 1, increasing at a slower rate than average, and is below the statewide average value in year 2;
2. B--The indicator is above the statewide average value in year 1, increasing at a slower rate than average, and is below the average value in year 2;
3. C--The indicator is below the statewide average value in year 1, increasing at a faster rate than average, and is below the average value in year 2;
4. D--The indicator is above the statewide average value in year 1, increasing at a slower rate than average, and is above the statewide average in year 2;
5. E--The indicator is below the statewide average value in year 1, increasing at a faster rate than average, and is above the statewide average in year 2; and
6. F--The indicator is above the statewide average value in year 1, increasing at a faster rate than average, and is above the statewide average in year 2.

Scenarios A and F represent the most extreme situations in terms of an indicator differing from the statewide average in both value and rate of change. While it would be informative to assess the values of all of the indicators in relation to each of these scenarios, this could be prohibitively time consuming; the analysis requirements can be conveni-

Figure 3. Illustrative indicator structure: vehicle operations labor expense.

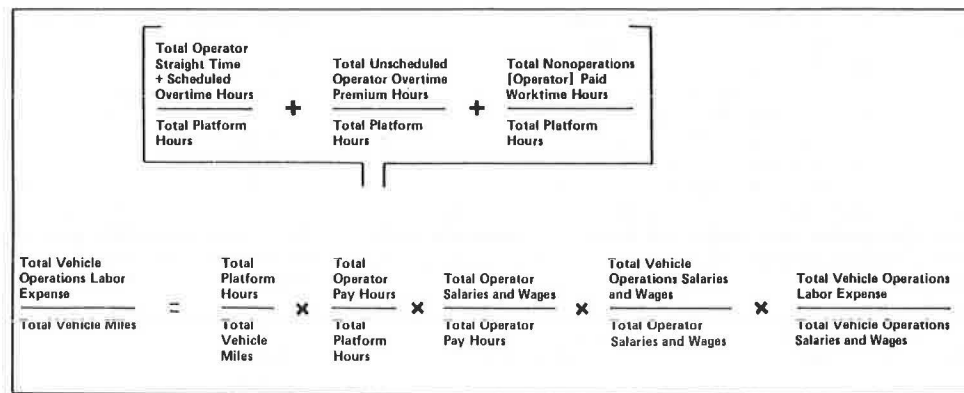


Figure 4. Indicators of total system efficiency: administrative labor expense detail.

Data Source: Section 15 Report Forms		
Special Instructions: * These data elements represent the sum of the data reported for all modes operated.		
INDICATOR	DATA ELEMENTS	INDICATOR ESTIMATE
Total Administrative Labor Expense	(Form 310 (pg. 1) Ln 1e + 2a + 3e)	
Total Vehicle Miles	(Form 408, Sum Col. K)	
Total Vehicle Miles	(Form 408, Sum Col. K)	
Total Number of Administrative Employees	(Form 404, Ln 9b + 9c + 10b + 10c)*	
Total Administrative Salaries and Wages	(Form 310 (pg. 1) Ln 1e + 2e)	
Total Number of Administrative Employees	(Form 404, Ln 9b + 9c + 10b + 10c)*	
Total Administrative Labor Expense	(Form 310 (pg. 1) Ln 1e + 2a + 3e)	
Total Administrative Salaries and Wages	(Form 310 (pg. 1) Ln 1e + 2e)	

Figure 5. Components of major efficiency indicators: administrative labor expense per vehicle mile.

INDICATOR	ANNUAL STATISTIC	RELEVANCE
Administrative Employees Per Vehicle Mile (1)	Total Vehicle Miles (1) Total Administrative Employees	Measure of administrative labor productivity. Reflects the number of employees relative to service provided.
Administrative Salaries & Wages Per Administrative Employee	Total Admin. Salaries & Wages Total Administrative Employees	Measures average wage not including benefits. This is a major factor in explaining administrative expense.
Total Admin. Labor Expense Per Admin. Salaries & Wages	Total Admin. Labor Expenses Total Admin. Salaries & Wages	Measures the fringe benefit multiplier which reflects the amount of labor expense that is made up of benefits. Important in explaining administrative expense.

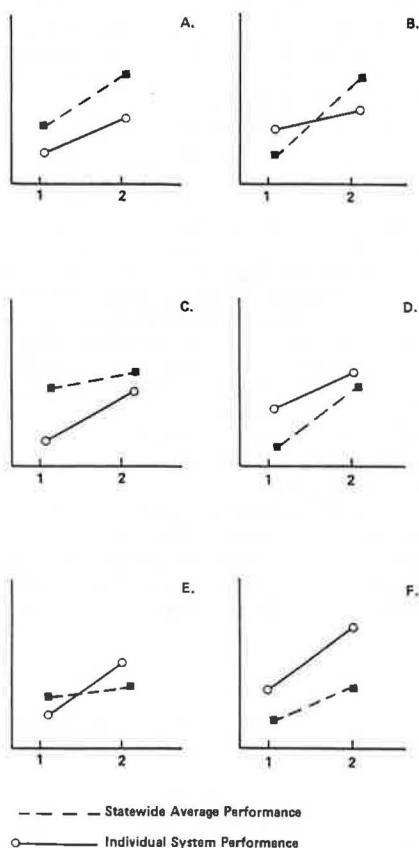
(1) Total vehicle miles includes both revenue and non-revenue vehicle miles.

Figure 6. Indicators with values at least one standard deviation above or below statewide average.

INDICATOR	RANGE	MEAN	ONE STAND. DEVIATION	SYSTEM IDENTIFICATION					
				(1)	(2)	(3)	(4)	(5)	(6)
Total Operating Expense Total Vehicle Miles	.634-.1,484	1,150	± .254	+ ¹	—	—	—	+	
Total Vehicle Operations Labor Expense Total Vehicle Miles	.284-.831	.558	± .156	+		—		+	
Total Maintenance Labor Expenses Total Vehicle Miles	.033-.255	.157	± .064	+	—	—	—		
Total Administrative Labor Expenses Total Vehicle Miles	.022-.112	.062	± .032					+	—
Total Material and Supplies Expense Total Vehicle Miles	.109-.229	.177	± .047			—	+	+	+
Total Other Expense Total Vehicle Miles	.040-.347	.166	± .101	—	—		+		

(1) Each plus and each minus represents one standard deviation above or below the median respectively.

Figure 7. Comparisons of transit system performance indicators to statewide average values over time.



ently reduced by focusing on those indicators that fit scenarios A and F. Classifying indicators by using these scenarios does not imply either exemplary or poor performance. Rather, it focuses attention on the indicator for more detailed investigation.

In selecting indicators to review the use of this decision rule, it is particularly important to consider the relationships among indicators. An increase in expense for one indicator may be accompanied by an increase in productivity or a decrease in expense in another indicator. Alternatively, a change in productivity or the rate of wage increases may be accompanied by a negotiated change in fringe benefits. These interrelated factors must be carefully assessed.

In addition to comparing the performance of a transit system with that of other systems, a system can be compared with itself over time. In this type of analysis, the focus is on the magnitude and direction of change for each indicator value to identify indicators that appear to merit detailed evaluation by, for example, (a) comparing the change in expense-related indicators with the consumer price index, (b) comparing the change in fuel price indicators with a nationwide fuel price index, or (c) comparing selected indicators performance with an acceptable limit such as changes in value of more than 20 percent.

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Planning for Options and Commitments: An Approach to Transport Planning in Uncertainty

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Much transport planning is concerned with proposals of wide-ranging implications that are to be implemented over an extended period. During this time the context and the decisionmakers may change, and the original objectives may no longer be valid. The paper outlines an approach to planning and decisionmaking in such a situation of uncertainty. The approach requires inventing alternative futures for the system as a whole, developing scenarios for proposed intervention and, after evaluation, formulating time-limited commitments and credible options that are worth retaining. The process is incremental and open ended and involves collective learning and selective decisionmaking in which the only firm plans are those that are actually committed. The approach, in a greatly simplified form, is illustrated by a proposal to construct a major road in an inner area of Sydney, Australia. Four alternative futures are invented and examined to determine what strategic options seem worth retaining for the system as a whole. The results may not only show which aspects of the new road require consideration, but also what options are available for its introduction and the kind of commitment that can be made.

Transport planning has become like a game of chess in which it is difficult to plan more than one or two moves ahead. The opponents are many and the game requires great skill because some of the rules

are no longer observed. To make matters worse, the board itself is changing.

Uncertainty has always been a critical variable in planning, but it has become more obvious in recent years. Greater public awareness and concern for the environment and the impact of development proposals, energy constraints, technology and its impact on employment and leisure, curtailment of public capital expenditure, changes in population growth and structure, and many other influences have undermined the confidence in longer-term planning.

It has been customary to define objectives and develop proposals that meet these objectives, but uncertainty about the future creates problems in such a closed-system approach. The context giving rise to the objectives may change during the implementation of the proposals. A similar problem exists with forecasting and evaluation models, calibrated on the basis of existing data. Transport planning is particularly vulnerable because it is often concerned with the formulation and implementa-