U.S. Department of Transportation

Transit System Performance Review

Pittsburgh Prototype Study

August 1987

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Final Report
August 1987

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FOREWORD

In last ten years, management audit studies of transit systems have become popular in many areas of the country. Generally these studies were initiated by local and state governments that were concerned that the local transit system was not being managed in an effective manner. These studies tended to be narrowly focused on the evaluation of current performance. Unfortunately, little attention was given in the studies to ways that performance could be improved.

The Office of Planning Assistance in the Urban Mass Transportation Administration was concerned about this deficiency and agreed to sponsor two prototype management studies. The purpose of these studies was to demonstrate a process for assessing transit performance that yields an action plan for improving performance.

This report is a summary of the prototype management study that was conducted of the Port Authority of Allegheny County (PAT) in Pittsburgh, Pennsylvania. We believe that this study was successful because the results were accepted and utilized by the management at PAT in their attempts to improve system performance.

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I. INTRODUCTION

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Effective resource management is always an important consideration in any business enterprise. Recently, for transit professionals, this topic has become more critical. The need to link methodical resource management to an overall plan has been given new immediacy by the uncertainty surrounding both federal and other forms of operating assistance. Transit managers need to develop strategies which go beyond the basic options of raising fares and cutting service. A comprehensive resource and market assessment is required to foster long-term stability.

This report describes the application of a methodology to assess the effectiveness of resource management in a transit environment. It presents simple techniques which are commonly applied in private enterprise to assess a firm's market strength and the capability of internal operations. The extension of this approach to transit is a logical one. The need to assess changes and opportunities in ridership markets and the structuring of production and support activities to meet those needs is essential to provide and demonstrate value for public money.

The approach and techniques described herein were applied in a management and operations study of the Port Authority of Allegheny County Transit System (PAT). This study was funded through a special Section 8 Grant from the Urban Mass Transportation Administration's Office of Planning Assistance to define and realize productivity improvements from the application of a structured performance review process. This study may be of interest to other transit systems because it represents the realistic applications of these methods under field conditions. The results were in fact accepted by PAT management in an honest effort to improve systemwide productivity.

The PAT prototype study was conducted between 1982 and 1983 in two phases in an effort to isolate issues of greatest concern. Phase One entailed a concise, yet comprehensive overview of management functions. The second phase of this study focused on areas diagnosed as below par in Phase One, in an effort to improve PAT's performance.

The balance of this report describes the conduct and results of the PAT management study, as follows:

- Background, which describes PAT's attributes relative to service characteristics, facilities, fare structure, ridership, revenues, and expenses;
- Approach, which describes the analytical techniques selected for use in the Phase One analysis;
- Methods Application, which describes the results of applying the analytical procedures described in the previous chapter;
- Development and Prioritization of Recommendations, which describe the ranking and prioritization of recommendations to improve management and operations effectivenes;
- Phase II Implementation Studies, which describe the general approach, results achieved, and cost of each study.
- Study Conclusion, which describes the Port Authority's reflections on the overall approach and conduct of the study.

II. BACKGROUND

II. BACKGROUND

Pittsburgh is a transit-rich region, with its bus, light rail, and rail network which claimed a 60 percent share of all trip-ends in downtown's Golden Triangle. PAT was formed in 1964 when the operations of over 30 local private transit operators were consolidated. Between 1964 and 1983, six operations facilities and two busways were constructed, and a major upgrade of the light rail system was initiated and, at the time of the study, was nearly complete. This chapter describes the service characteristics, fare structure, revenues and costs, and new projects of the PAT system, as they existed at the time of this study — 1983.

Service Characteristics

PAT provided bus, light rail, and rail service for more than 100 million annual passengers, as shown in Exhibit 1. Ridership peaked in 1979, partially attributable to fuel price increases. It gradually declined due to a number of economic factors. Service was concentrated in Allegheny County, principally within the City of Pittsburgh, with some transit provided to neighboring Westmoreland, Armstrong, and Beaver Counties. In addition to bus and light rail service, PAT operated the Monongahela Incline and Access Transportation, a door-to-door advance reservation system for the elderly and handicapped. PAT also maintained a contract with the Chessie System for the operation of its commuter rail trains, referred to as PATrain.

In 1983, PAT operated an active fleet of 932 buses and 92 light rail vehicles (LRVs) over a predominantly radial network. The light rail system was undergoing a major expansion and modernization program. During the morning peak, 790 buses and 67 LRVs were deployed over 169 transit routes, the majority of which (164) was bus routes. Weekday base service deployed 374 transit vehicles. An average

Exhibit 1
PAT Prototype Management & Operations Study

PAT RIDERSHIP — 1978-1981

	1978	1979	1980	1981
Bus	94,225,174	101,837,028	99,272,475	94,723,015
Light Rail	6,194,988	6,385,712	6,307,427	5,823,776
PATrain	383,972	375,957	352,257	383,741
Monongahela Incline	445,357	582,0p38	639,564	633,549
Duquesne Incline	—	571,494	627,979	622,072
Charters	259,791	298,706	266,689	229,548
Total	101,499,282	110,050,935	107,466,391	102,415,701

SOURCE: PAT, Transit Operations Statistics, 1978-1981.

vehicle speed of 13.1 miles per hour was maintained over the more than 4,000 round trip route miles. The light rail system was smaller with only 70 round trip route miles. During 1981, more than 36.3 million miles of bus route service were provided, while another 1.8 million miles of light rail service were operated.

Bus service was operated from six divisions. All six facilities were constructed between 1968 and 1973. This construction program was initiated to consolidate the 39 maintenance facilities acquired at PAT's inception in 1964. Light rail service was operated from a new facility, constructed as part of the LRV modernization and expansion program.

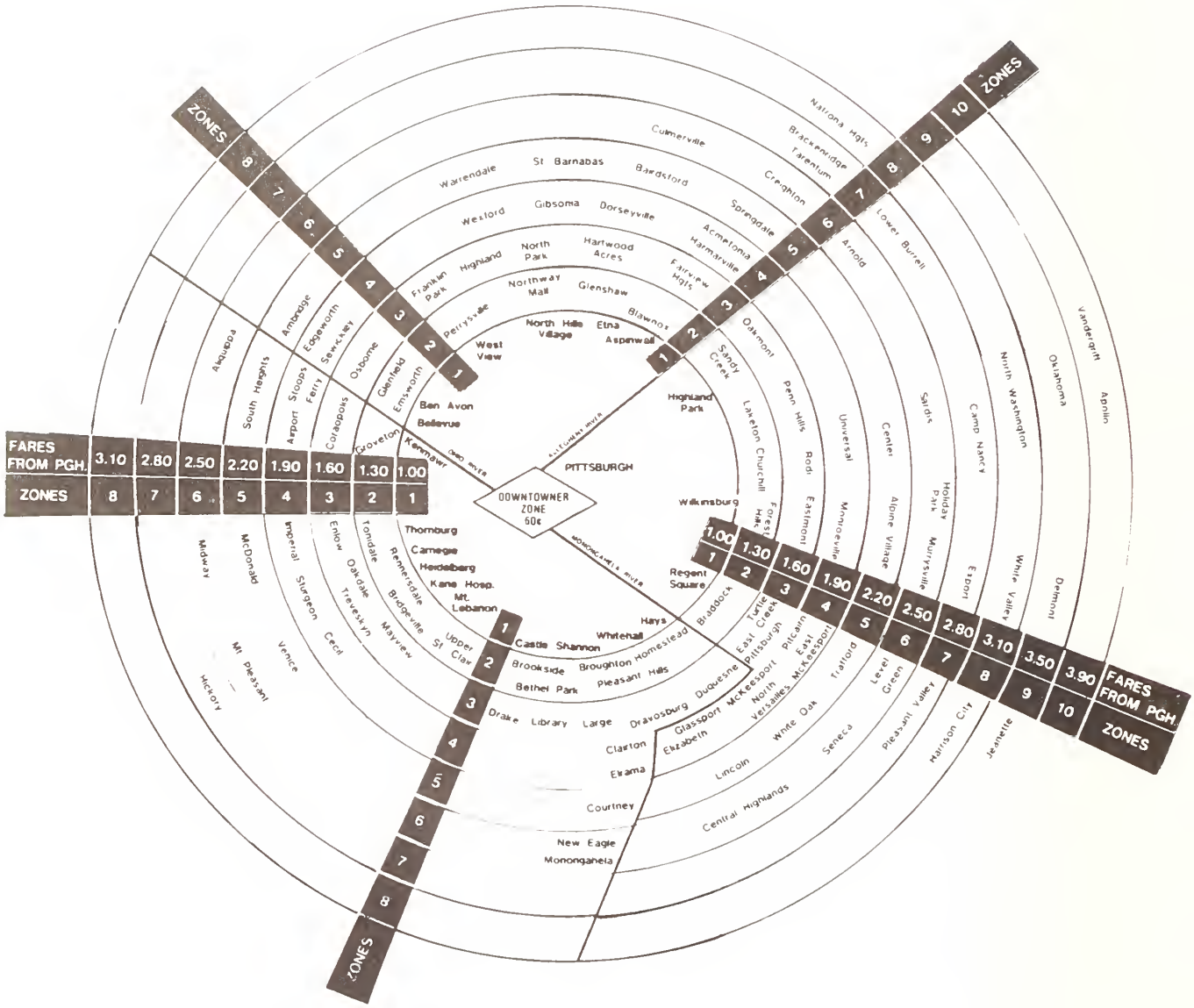
Fare Structure

The 1983 PAT fare structure employed a 10-zone system, as shown in Exhibit 2. The first zone was the largest, having a seven-mile expanse. Its boundaries roughly coincided with Pittsburgh's inner ring of suburban communities. Zones two through ten were spaced at extending 2.5-mile intervals. Planners at PAT estimated that roughly 80 percent of the total travel occurred within zones one and two.

PAT's fares, at that time, were among the highest in the nation. The base fare in Pittsburgh was $1.00. Travel in the outer zones was priced at succeeding 30¢ intervals. There was a slight departure from this pattern in zones nine and ten, where the increment was raised by 40¢ over the previous zone fare. The top cash fare was $3.90, allowing travel between zones one and ten. The lowest cash fare was the Downtowner which, at 60¢, afforded travel in the Golden Triangle. Transfers, priced at 25¢, allowed the passenger unlimited riding for three hours in one zone.

Exhibit 2
PAT Prototype Management & Operational Study

1983 PAT FARE ZONE CONFIGURATION



The impact of these fare levels was somewhat softened by PAT's extensive prepayment program. Three permits — weekly, monthly, and annual — were sold. The weekly permit was priced at $8.00 and was valid for a one-zone ride with a 10¢ cash drop; zone charges were additional. The monthly pass was priced at $35.00 and was valid for a one-zone ride; zone charges were additional. The annual pass was priced at $350 and operated under the same conditions as the monthly pass. Besides the passes, PAT also offered a 10-ride ticket which was discounted at 10 percent relative to the cash fare.

Senior citizens, handicapped persons, and children all traveled at reduced fares. Senior citizens rode free during the off-peak hours and weekends, while handicapped patrons rode at half-fare during the same time periods. Children under six years of age traveled free, and those from six to 11 rode at one-half the adult price.

Revenues and Expenses

As shown in Exhibit 3, revenue totaled about $122 million for fiscal year ending June 30, 1982 , while expenses came to $124 million. Fare revenue — that from riding patrons — accounted for 49 percent of total income and covered 48 percent of total expenses. About $9.8 million of fare revenue was provided by the Commonwealth of Pennsylvania to support ridership by senior citizens. Intergovernmental grants represented $61 million, or about 50 percent of total revenues.

Capital/New Projects

PAT embarked on three major capital projects which provided a distinct time advantage over auto travel along several major corridors. Pittsburgh's hills and rivers present many constraints to directional travel. PAT capitalized on this by constructing two busways which knife through normally meandering and congested routes, and by upgrading its light rail system to improve speed and performance.

Exhibit 3
PAT Prototype Management & Operations Study

PAT REVENUES and EXPENSES
JULY 1981 — JUNE 1982

Revenues		Expenses	
Fares		Operator Wages	$ 35,595,410
Passenger	$ 49,334,071	Other Salaries	29,938,176
Senior Citizens	9,774,984	Subtotal	$ 66,533,586
Special[1]	136,881		
Charter	502,276	Fringe Benefits	$ 28,876,063
Subtotal	$ 59,747,712	Services	2,146,563
		Materials and Supplies	
Auxiliary Revenue		Fuel and Lubricants	10,920,647
Advertising	$ 570,400	Tires and Tubes	1,107,123
Non-Transportation	489,654	Other	10,165,096
All Others	31,935	Subtotal	$ 21,562,866
Subtotal	$ 1,091,989		
		Utilities	$ 2,561,647
Intergovernmental Grants		Casualty and Liability	1,989,764
Local	$ 11,859,062	Taxes	2,822
State	35,577,185	Purchased Transportation	3,253,577
Federal	13,631,307	Miscellaneous	621,775
Subtotal	$ 61,067,554	Expense Transfers	(3,517,186)
Total	$121,907,255	Total	$124,031,477

(1) Represents State Special Fare Reimbursement.

SOURCE: 1981 Section 15 Reports.

The South Busway, which opened in December 1977, served 17,000 daily passengers. One-way travel time savings from using the South Busway ranged from 20 to 30 minutes relative to the old transit route. The cost of construction was $27 million. The East Busway, which opened in February 1983, is a two-lane exclusive roadway for transit. Its construction cost totaled $113 million, and it served 28,000 daily passengers. One-way travel time savings of up to 30 minutes were experienced relative to the old route structure.

PAT's greatest capital investment to date, revitalization of the light rail system, has been underway since 1979. Scheduled for full completion in May 1987, the project includes complete reconstruction of a 10.5-mile link, along with a 1.2-mile subway in the Golden Triangle, and replacement of signal and electrical systems over the remaining 12 miles. In addition to the subway and track construction, a new maintenance facility and storage yard is also included in the reconstruction. As part of this project, 55 new light rail vehicles will be purchased. Forty-five of the existing trolleys will be almost completely rebuilt. Total estimated project cost was $549 million.

III. ANALYTICAL APPROACH

III. ANALYTICAL APPROACH

A given condition in most any management study is that every area of the organization is a candidate for improvement. As a result, the universe of issues which could be investigated almost always exceeds the resources available for the task. Therefore, a screening mechanism is needed to separate substantive issues from those of lesser consequence. Substantive issues are those which currently or could potentially have a significant affect on performance. In order to define and isolate substantive issues, it is necessary to assess how effectively a transit system's resources are being managed. Only after the issues have been defined is it possible to develop an effective strategy for developing practical solutions.

In the PAT management study, screening was accomplished by applying a two-phase approach. In Phase One, issues of greatest concern were isolated through application of several screening techniques. This was primarily a process for evaluating the general health of the organization and identifying specific problems. Solutions were identified in Phase Two to selected problems from those identified in Phase One. A key feature in this two-phase approach was that each problem area was evaluated with respect to its potential improvement of PAT's overall performance record. This performance-based orientation allowed the avoidance of a detailed evaluation where it was not warranted and provided a focus of study resources on problems whose solutions provided the greatest return.

The balance of this chapter describes the procedures and analytical tools used in the two-phase process. Since the work in Phase Two consisted primarily of specific problem solving strategies, the discussion in this chapter focuses primarily on the tools used in Phase One. The general analytical approach to each Phase Two issue and the results achieved are presented in Chapter VI of this report.

Procedure

Phase One consisted of two steps — issue identification and issue prioritization. The first step entailed a concise but comprehensive overview of PAT's operations. All transit systems have three basic functions — transportation, which includes all activities encompassing vehicle operations; maintenance, including vehicle and facility maintenance; and planning, administration and control, which encompasses all other management activities — the first two being line functions and the third being a staff function. These three functions may be organized into any number of units (e.g., divisions, departments), depending on the organization's structure and personnel. In order to identify relevant study issues, the line functions were evaluated quantitatively through use of performance indicators. These indicators are a convenient means to link expenses or resources to production, and thus evaluate efficiency. This approach is more applicable and relevant for line functions because their output is measurable and because they consume the largest share of resources.

In addition, all functions were evaluated qualitatively through interviews with key management personnel. The qualitative analysis was directed at defining relative organizational effectiveness, which does not readily fit into quantifiable terms.

The second step, issue prioritization, stratified concerns relative to ease of implementation and return-on-investment. Prioritization was essential to developing a cost-effective improvement program and focusing agency resources on those issues having the greatest potential payback.

Issue Identification

Issues were identified by applying quantitative tools to measure performance and qualitative tools to measure organizational effectiveness. In this study, performance was interpreted as how efficiently an organizational unit utilizes

resources to provide transit service. Organizational effectiveness was interpreted as how supportive the management structure was in directing and controlling the provision of transit service. The four major tools which were applied in issue identification are described below.

External Peer Group Analysis — This technique was used to compare the Authority's systemwide and function-specific performance indicators with those from a set of peer transit systems (i.e., those of similar size and characteristics). While there are no accepted standard criteria for formulating an external peer group, several key characteristics were used to guide the identification of peers. Salient features of greatest concern included size (e.g., number of vehicles in operation and service population), geographic location (e.g., exposure to extremes in local climate), number of operating divisions/facilities, and modal-mix.

The purpose of the external peer group comparison was to flag those aspects of the Authority's performance which appeared substantially different from what could have been expected. This was done in two ways. The first step was to compare the Authority's performance for a specific measure (e.g., operating ratio) to mean, maximum, and minimum values from the peer group (excluding the Authority). When the Authority's performance fell in the upper range, it was concluded that performance was satisfactory to good. Conversely, a lower range of performance suggested the need for improvement.

The second step in the external peer group analysis was to consider all the measures in a collective sense. Since most performance measures were expressed as ratios, such as the revenue-to-cost (or operating) ratio, it was necessary to perform a cross-check by comparing the relative performance of the ratio's components as well. If, for instance, a weak (i.e., in lower range) performance was recorded in the operating ratio (i.e., revenue/cost), it was necessary to review both

revenue and cost performance. If one component's performance was positive (e.g., high revenue per passenger) while the other component's performance was negative (e.g., high cost per passenger), a point of departure was identified for further analysis (e.g., what could be done to reduce costs?).

The external peer group comparison of the Authority's relative performance was carefully prepared and analyzed to account for varying operating environments and reporting procedures. Also, the comparison made note of unusual occurrences at the Authority during each given year that could have affected relative performance. For example, a labor strike usually has an impact on performance and, therefore, relative ranking among peers.

It must be stressed that, while a peer group comparison is generally not conclusive enough to develop recommendations, it does serve a purpose. A peer group analysis assists in separating substantive issues from perceived issues. Transit systems are a highly visible public asset. Peer group comparisons can confirm or reject the validity of public perceptions regarding cost or performance relative to similar systems. They serve only as an indicative screen and do not require sophisticated statistical analysis to derive initial hypotheses.

Internal Peer Group Analysis — This technique compared performance among cost centers within PAT's organization. Cost centers are organizational units which conduct similar operations but in different locations. Thus, this type of analysis is most applicable to larger transit systems with multiple transportation and maintenance facilities. As with the external peer group above, these comparisons are based on performance indicators which are descriptive of a function's (e.g., transportation) responsibilities, and are used to flag inadequate performance. Since cost centers operate under theoretically consistent cost and labor structures, each center's performance could be compared against the "best" rather than the average performance of the group. If there is a disparity of only

10 percent between best and worst, comparative improvement would probably be only minor in a cost sense since staffing and productivity differences are inherent in each cost center. Greater differences, however, may indicate the potential for good return on time and resources invested in correcting the disparity.

Trend Analysis — This technique was used to compare function-specific performance over time. A four- to five-year time period is desirable, although this time frame may vary in accordance with local occurrences (e.g., major strike, large service change, or fare change). Trend analysis is very helpful in isolating positive and negative performance in both financial and non-financial measures. Financial measures, such as cost per mile, can be expressed both graphically and in terms of annual rate of growth. Annual rate of growth is a derivation of the standard compound interest formula, which describes percentage growth from year-to-year. The formula is:

$$\text{Average Annual Growth Rate} = \left(\frac{\text{Ending Value}}{\text{Beginning Value}}\right)^{\left(\frac{1}{N-1}\right)} - 1$$

Where:

N = Number of years in the trend analysis

The merit of this approach is that once established, the rate can be compared to the average annual rate of growth of inflation to discern how well costs or revenues change with inflation. In this study, the Consumer Price Index for the Pittsburgh SMSA was used as a measure of inflation, principally because it was commonly available and understood. Although the CPI may not be completely sensitive to variations in transit operating cost, it can serve as a consistent benchmark for evaluating growth in cost.

For non-financial measures, such as passengers per mile, the interpretation of positive or negative performance was more straightforward. Since no adjustment was necessary for external factors, such as inflation, the interpretation proceeded

directly from the data. Ridership can be statistically related to exogenous factors such as gasoline prices and unemployment. However, the additional level of research required would only be necessary if these initial comparisons raised concerns about ridership levels. Otherwise, these external factors should be considered in a qualitative perspective within the analysis.

Once the negative trends were identified, the next step was to consider the components of the performance measure being used. If, for instance, cost per mile was increasing above the rate of inflation, the performance trend in cost per mile for each organizational component (e.g., maintenance) would be investigated. Where negative, the trend in subcomponent expense (e.g., repair parts) would be evaluated. Again, the aspect of trend analysis which must be stressed is that it only raises the question "why?", and leads to asking the right question.

Structured Interviews — This qualitative technique assisted in identifying past decisions or events which impacted performance. The structured interview process provided a medium for further investigation of specific performance questions arising from the trend analysis. In addition, this technique was used to identify potential problems relative to span of control, clarity of role, duplication of effort, and communication of objectives. The number and extent of interviews required were influenced by the size of the property, the organizational structure, the extent to which responsibilities and objectives were documented, and the results of the peer group and trend analyses. At minimum, interviews were conducted with the Executive Director, and all division directors and department managers depicted by the organizational structure. As appropriate, additional interviews were conducted in departments with a particularly broad span of control and with those departments experiencing performance problems.

The application of these four tools served as a first screen in defining what activities were to be pursued to improve overall resource management. The findings relative to each organizational unit fell into one of four categories:

- acceptable, needing no further analysis;
- deficient, where a solution was reasonably obvious;
- marginal, where a solution was not apparent and the future implications were unclear; and
- deficient, where a solution was not apparent and impact on performance was tangible.

The first two categories were resolved within the domain of Phase One. The latter two categories were translated into problem statements, or issues, which could not be resolved within the resources available to Phase One. These problem statements became the core of the Phase Two analysis.

Issue prioritization and selection were components of the second screen which served to define which concerns were appropriate for more detailed analysis in Phase Two. Since there was an upper bound on the resources available for the in-depth analyses to follow, prioritization of the issues was accomplished by arraying expected return-on-investment against expected difficulty in implementing a solution, as shown in Exhibit 4. This issue prioritization was a cooperative effort between the Port Authority and consultant staff to assess the comparative return-on-investment and ease of implementation, outline a work approach and estimate the approximate budget for each study issue. The Phase II study resources were then allocated to issues falling into the lower half of the matrix.

The potential return-on-investment was estimated in terms of improved productivity and efficiency (i.e., an internal perspective) or effectiveness (i.e., a user perspective) resulting from problem resolution. The anticipated difficulty in implementing a solution was driven primarily by the estimated cost of, and time required to, develop and implement a program of corrective action. Barriers to implementation were also represented qualitatively within this ease of implementation measure. Concerns exhibiting a high potential return and relative ease of implementation received the highest priority.

EXHIBIT 4

SYSTEMATIC PRIORITIZATION OF ISSUES

Return to System	Ease of Implementation			
	Easy →			Difficult
LOW ↓ HIGH	*Low*	*Low*	*Very Low*	*Very Low*
	Medium	*Low*	*Low*	*Very Low*
	High	*Medium*	*Medium*	*Low*
	High	*High*	*Medium*	*Medium*

NOTE: Priority category in italics

IV. METHODS APPLICATION

IV. METHODS APPLICATION

This chapter describes the findings resulting from the application of the methods described in Chapter III of this report. Four techniques — external peer group analysis, trend analysis, internal peer group analysis, and structured interviews — were applied to evaluate performance in the following categories:

- Summary
  - General System Productivity
  - Financial and Operating Effectiveness
- Detailed Categories
  - Transportation Productivity
  - Maintenance Productivity
  - Organizational Effectiveness

The results of applying the techniques to the PAT system are organized by category to demonstrate the cumulative and supporting impacts of data interpretation, and the combined use of more than one technique.

General System Assessment

A general assessment of system performance was performed prior to a more detailed analysis of the transportation, maintenance, and organizational effectiveness. The general assessment was used as a point of departure for assessing the system's strengths and weaknesses.

An external peer group comparison is a useful tool for identifying major strengths and weaknesses among the components of transit operations. While not definitive enough to identify specific problems, the peer group comparison does bound an expected range of performance. The first step toward the external peer group analysis was to select a group of transit systems which exhibited characteristics similar to PAT. Attributes considered included total number of transit vehicles in operation, number of operating divisions and geographic location. Due to the diversity in light rail technology and fleets among those systems providing this service mode, the peer group analysis was limited to bus operations only.

The size of the external peer group was limited due to constraints on data quality and availability. At the time of this analysis, there were definitional concerns regarding certain Section 15 data and also availability for the most recent two years (1980 and 1981) which were unavailable in full published form. Therefore, individual transit systems that met the comparative operational conditions were directly contacted to request their Section 15 reports. The following three transit systems were selected for this external peer group analysis because of their comparable operating conditions, similar reporting definitions and availability of their most recent Section 15 reports:

- Milwaukee County Transit System (MCTS), Milwaukee, Wisconsin;
- Greater Regional Cleveland Transit Authority (GRCTA), Cleveland, Ohio; and
- Bi-State Transportation Authority (Bi-State), St. Louis, Missouri.

A larger peer group was preferred; however, quality data and comparable operations were more important than a larger peer group. Though the size and composition of each peer system varied, as a group, the systems presented average characteristics which were similar to PAT's and provided a reasonable basis for comparison. The key attributes of these systems and those of PAT are presented in Exhibit 5.

Exhibit 5
PAT Prototype Management & Operations Study

CHARACTERISTICS of the PAT PEER GROUP for BUS OPERATIONS

	Milwaukee	GCRTA	Bi-State	PAT
Vehicle Hours(1)	1,717	1,935	2,198	2,602
Vehicle Miles(1)	21,403	25,328	27,491	35,197
Passengers(1)	79,153	105,112	71,442	99,519
Active Vehicles	631	1,016	998	961
Peak Vehicles	521	665	765	810
Operating Employees	1,486	1,975	2,234	2,548
System Revenue(1)	$27,091	$26,461	$26,911	$45,179
Passenger Revenue(1)	$23,916	$25,000	$20,172	$43,615
Operating Expenses(1)	$57,380	$84,267	$85,297	$96,231

(1) Thousands

SOURCE: Section 15 Reports for Fiscal Years ending between July 1, 1980 and June 30, 1981.

The next step in applying the external peer group technique was to collect Section 15 reports for each property for the same, as well as the most recent, fiscal year (i.e., 1981). Once the data sources were assembled, performance categories and indicators were selected for evaluation. These are displayed in Exhibit 6. An explanation of the performance categories is as follows:

- Financial performance - the ability to recover cost through system-generated revenues;
- Service effectiveness - the rate of consumption relative to service provided;
- Service efficiency - the rate of cost and income relative to service provided;
- Cost-effectiveness - the rate of cost and income relative to consumption;
- Labor utilization - the amount of labor required relative to production; and
- Maintenance performance - the factors affecting maintenance expense.

The results of applying the external peer group analysis to the PAT study are displayed in Exhibit 7. Overall, the analysis indicated that PAT performed favorably in comparison to similarly configured transit systems. Interpretations of the findings are discussed below, by category.

Farebox Operating Ratio -- PAT's recovery of operating expenses from the farebox was higher than any of the peer systems. PAT has historically relied upon passenger fares as a primary revenue source. Its high operating ratio, relative to the peer group, reflected not only PAT's pricing policies, but also need. GCRTA, of Cleveland, received 50 percent of its operating income from local taxes, thus allowing a lower fare. Bi-State, of St. Louis, was also able to charge a lower fare due to rather substantial local revenue support (i.e., 42 percent of total income).

Exhibit 6
PAT Prototype Management & Operations Study

CATEGORIES and INDICATORS

Performance Category	Indicator
FINANCIAL PERFORMANCE	. Farebox Operating Ratio
SERVICE EFFECTIVENESS	. Passengers per Mile . Passengers per Hour
SERVICE EFFICIENCY	. Revenue per Mile . Cost per Mile . Deficit per Mile
COST EFFECTIVENESS	. Revenue per Passenger . Cost per Passenger . Deficit per Passenger
LABOR UTILIZATION	. Average Operating Speed . Platform Hours per Driver . Active Vehicles per Mechanic . Miles per Maintenance Employee . Miles per Employee (Total)
MAINTENANCE PERFORMANCE	. Parts Cost per Mile . Miles per Vehicle . Spare Ratio . Average Fleet Age

Exhibit 7
PAT Prototype Management & Operations Study

BUS OPERATIONS PEER GROUP PERFORMANCE
FISCAL YEAR ENDING in 1981

Performance Category/Indicator	Peer Group Scores High	Low	Avg	PAT	Percent Better/(Worse) than Peers' Average
Financial Performance					
Farebox Operating Ratio	41.7%	23.7%	31.7%	45.3%	42.9%
Service Effectiveness					
Passengers per Mile	4.15	2.60	3.48	2.83	(18.7%)
Passengers per Hour	54.33	32.50	44.31	38.24	(13.7%)
Service Efficiency					
Revenue per Mile	$1.27	$0.98	$1.10	$1.28	16.4%
Cost per Mile	$3.33	$2.68	$3.04	$2.74	9.9%
Deficit per Mile	$2.29	$1.41	$1.94	$1.46	24.7%
Cost Effectiveness					
Revenue per Passenger	$0.38	$0.25	$0.32	$0.45	40.6%
Cost per Passenger	$1.19	$0.72	$0.91	$0.97	(6.6%)
Deficit per Passenger	$0.81	$0.38	$0.58	$0.52	10.3%
Labor Utilization					
Average Operating Speed	13.09	12.47	12.69	13.52	6.5%
Platform Hours per Driver	1,804	1,526	1,671	1,586	(5.1%)
Active Vehicles per Mechanic	4.62	3.22	3.89	4.73	21.6%
Active Vehicles per Maintenance Employee	2.77	1.63	2.17	1.68	(22.7%)
Miles per Employee (Total)	14,403	12,306	13,178	13,813	4.8%
Maintenance Performance					
Parts Cost per Mile	$0.196	$0.148	$0.168	$0.151	10.1%
Miles per Vehicle	33,919	24,929	28,878	36,625	26.8%
Spare Ratio	52.8%	21.1%	34.8%	18.5%	46.6%
Average Fleet Age	12.18	9.55	10.88	8.74	19.7%

Service Effectiveness — In terms of both passengers per mile and per hour, PAT was at the lower end of the range represented by its peer group. A number of variables could affect service effectiveness. PAT's performance could have been reflective of a constrained ridership market, an oversized service area, relatively higher passenger fares, or a combination of these, plus some effect from external factors. Because of PAT's low ranking, these issues were further examined in an assessment of service effectiveness of each operating division.

Service Efficiency — Efficiency was measured as the net cost per unit of service provided. PAT's high revenue per mile and moderate cost per mile combined to minimize net cost, or deficit, per mile. PAT's performance was substantially better than the peer group average, and was at the upper range defined by the peer group.

Cost-Effectiveness — Cost-effectiveness describes the amount of resources (or cost) required to transport one passenger. It is a way of gauging the balance between service provided and service used. Net cost, or deficit, is the difference between revenue and cost. The positive effect of PAT's high revenue per passenger was offset by its relatively high cost per passenger. As a result, deficit per passenger was only slightly better than the peer group average. This contrasted with PAT's strong performance in service efficiency, with the difference in performance being attributable to PAT's lower ridership rates.

The combination of these indicators suggested an excess level of service, especially compared to ridership levels. This issue was therefore highlighted for further analysis in the trend line and internal cost center evaluations.

Labor Utilization — Five indicators were used to measure labor utilization. PAT's performance closely matched the peer systems' average performance. The indicators were:

- Average Operating Speed - PAT scored slightly better than average in operating speed, which directly impacts driver and vehicle requirements. Completion of the East Busway should further improve operating speed.

- Platform Hours per Driver - PAT's performance on this indicator was slightly below the peer group average. Platform hours per driver measures the time spent behind the wheel by an average driver for one year. Maximum driver availability is about 1,900 hours annually. Some factors which could have contributed to PAT's performance here, as compared to the peer group average, included fewer platform hours per daily driver assignment, a greater number of vacation days and holidays, or higher absenteeism.

- Active Vehicles per Mechanic - PAT's performance in mechanic productivity was superior to the peer group. PAT maintained more buses per mechanic than its peers.

- Active Vehicles per Maintenance Employee - Overall maintenance labor productivity was below the peer group average. This could have indicated more extensive maintenance labor overhead than experienced by peers, given that PAT's mechanic productivity was significantly higher. It also could have indicated PAT's utilization of busways and the corresponding facility maintenance staff required for these busways.

- Miles per Employee - PAT's overall labor utilization was slightly higher than the peer group. On average, PAT required fewer personnel in its service production than did the peer group.

Maintenance Performance — PAT achieved higher performance in vehicle maintenance than the peer group. The peer group comparison demonstrated that PAT had slightly lower parts cost per mile, a significantly higher vehicle utilization rate, and a substantially lower spares ratio than the peer systems' average. A contributing factor was PAT's newer fleet.

Summary — It was concluded that PAT performed well relative to the peer transit systems included in this analysis. PAT's strengths included superior revenue generation performance, high service efficiency, good maintenance performance and good utilization of mechanics. The most pronounced weakness which surfaced for PAT was its ridership capture rate relative to the level of service provided.

This negatively affected both service effectiveness and cost effectiveness. This suggested that a strategic assessment of service and ridership markets was appropriate to identify the characteristics of this concern and to develop a program of corrective action. An additional concern was the amount of overhead staff in the maintenance function, which appeared high relative to the peer systems. Platform hours per driver were also below the peer group average indicating either higher absenteeism or inefficient scheduling.

The external peer group analysis demonstrated that PAT enjoyed respectable performance at this one point in time. The analyses which follow examined the trend in PAT's performance between 1978 and 1982.

Financial and Operating Performance

A trend-line analysis was used to gauge financial and operating performance over a period of four to five years. The trend-line analysis created a longer-term perspective than was afforded by the external peer group analysis. In this part of the study, the trend line was applied to assess overall financial and operational performance.

Two analyses were performed to overview financial and operating performance. First, PAT's performance against budget was described on a fiscal year basis for a five-year period (1978-1982). Second, trends in performance indicators were evaluated. Most of these indicators were included in the peer group analysis; in this analysis, however, the indicators were used to address the entire system rather than bus operations alone.

Performance versus Budget — This analysis relied upon internal system documents, such as budget and performance reports, to develop the following annual statistics:

- Operating revenue,
- Expenses,
- Expenses in excess of revenue,
- Public funding by source, and
- Surplus (deficit).

Although PAT did a good job of containing expenses over the last two years of the period, shortfalls in operating revenues and lower than expected public funding resulted in deficits (Exhibit 8). Over the five-year period, an $8.2 million deficit was accumulated. While causes of the annual shortfalls varied, there appeared to have been a general tendency toward optimistic revenue and public funding forecasts. In 1982, for example, almost the entire deficit was attributed to lower than expected public funding. Actual public funding also fell below expectations in 1980 and 1981.

Financial and Operating Performance Trends - This analysis relied upon internal documents prepared by the Accounting and Operations Departments. The Consumer Price Index (CPI) for the Pittsburgh metropolitan area was used to discern how well the average annual rate of change in cost indicators tracked with inflationary trends.

Once the data were assembled, performance indicators were developed to measure system-wide financial performance, service effectiveness, service efficiency, and cost effectiveness. The indicators of financial performance included the overall operating ratio (i.e., the percentage of operating expenses recovered from all system-generated revenue) and the percentage of operating expense recovered from fares alone. Service effectiveness relates transit output (i.e., level of service provided) to consumption (i.e., rides taken) and was measured by examining boarding passengers per mile of operation. Service efficiency, which examines financial requirements relative to service output, was assessed through evaluation of three indicators: revenue per mile; cost per mile; and deficit per mile. Cost effectiveness is the relationship of the cost of service provision to the amount of service utilized or consumed and was measured with three indicators: revenue per passenger; cost per passenger; and deficit per passenger.

Exhibit 8
PAT Prototype Management & Operations Study

BUDGET OUTTURN and PUBLIC FUNDING
FY '78 — FY '82
($s in Thousands)

	1978	1979 (a)	1980	1981	1982
Operating Revenues	$37,915	$20,475	$ 44,127	$ 57,082	$ 60,839
Favorable/ (Unfavorable)	(464)	569	(323)	(1,092)	(833)
Expenses	81,613	45,236	100,101	112,960	124,712
Favorable/ (Unfavorable)	(2,273)	(869)	1,676)	614	960
Expenses in Excess of Revenue	43,698	24,762	55,794	55,878	63,872
Public Funding					
Allegheny County	6,720	4,000	9,400	10,800	11,859
Commonwealth of Pennsylvania	21,475	13,081	26,929	30,030	35,577
Federal Government	12,988	7,730	15,800	15,963	13,631
Favorable/ (Unfavorable)	222	1,488	(1,846)	(1,393)	(2,933)
Surplus/(Deficit)	(2,516)	48	(3,845)	915	(2,805)

(a) Six-month fiscal year as PAT transitioned to a July-June Fiscal Year from a Calendar Year.

While PAT's operating performance was generally positive over the four-year period of 1979 to 1982, a downturn was experienced in 1982, as shown in Exhibit 9. Overall, each performance indicator exhibited negative performance between 1981 and 1982. Prior to 1982, revenue growth exceeded cost growth, though both slightly outpaced inflation, and ridership gradually declined. In particular, the following observations were noted:

- Recovery of operating expenses from system-generated revenue generally improved from 1979 but declined in 1982; recovery from fares alone was essentially flat.

- Service effectiveness was declining at a slow rate.

- Revenues had outpaced costs, except in 1982 when that trend was reversed:

  - Both revenue and cost growth exceeded inflation;

  - Slowdown in 1982 revenues was in part a function of delayed fare increase; and

  - Deficit per mile jumped by 18.5 percent between 1981 and 1982 after having grown at the rate of inflation.

Cost-effectiveness measures mirrored the above finding, but growth rates were more pronounced because of the decline in passengers per mile. Deficit per passenger outpaced inflation from 1979 to 1982 and was more than double the rate of inflation in 1982.

Summary — The trend-line financial and operations analysis confirmed the external peer group finding that a strategic assessment of service and ridership markets was needed. PAT relied heavily on passenger fare increases to cover rising operating costs. This was due to the absence of a dedicated local and/or State predictable funding base. Total reliance on passenger fare revenues is a short-term solution to a more long-range problem. PAT needs, instead, a long-range strategy to better control these challenging cost and funding issues.

EXHIBIT 9
PORT AUTHORITY TRANSIT
FINANCIAL AND OPERATING PERFORMANCE MEASURES

	1979	1980	1981	1982	Average Annual Rate of Change[b]	1981-82 Rate of Change[b]
Financial Performance						
Operating Ratio (Overall)	46%	44%	51%	49%	2.1%	(3.9%)
Farebox Operating Ratio	38%	37%	41%	39%	0.8%	(4.9%)
Service Effectiveness						
Passengers per Mile	2.87	2.99	2.77	2.73	(1.6%)	(1.4%)
Service Efficiency						
Revenue per Mile	$1.09	$1.20	$1.54	$1.70	15.8%	10.4%
Cost per Mile	$2.39	$2.73	$3.05	$3.49	13.3%	14 4%
Deficit per Mile	$1.30	$1.53	$1.51	$1.79	11.1%	18.5%
Cost Effectiveness						
Revenue per Passenger	$0.38	$0.40	$0.56	$0.63	18.2%	12.5%
Cost per Passenger	$0.83	$0.91	$1.10	$1.28	15.4%	16.3%
Deficit per Passenger	$0.45	$0.51	$0.54	$0.65	12.9%	20.4%
Pittsburgh CPI[a]	*205.2*	*229.2*	*262.0*	*281.8*	*11.1%*	*7.6%*

(a) Urban Wage Earners Consumer Price Index at mid-year.
(b) Parentheses denot negative rate of change.

Transportation Productivity

The Transportation Department employed more people than any other unit within PAT's organization. Its performance, in terms of passengers carried and total labor cost, was affected to a great measure by two other departments — Rates and Services, and Scheduling. These departments were responsible for route planning and vehicle/driver scheduling, respectively. Transportation then implemented the service that Rates and Services and Scheduling designed. Thus, the three departments were collectively evaluated in a broad interpretation of the transportation function.

Both trend and internal peer group analytical techniques were used to evaluate transportation performance, as shown in Exhibit 10. Four transportation-related topics were explored in depth:

- Wages and Benefits, which represented PAT's largest expense item;
- Service Effectiveness, which arose as a concern in both the external peer group and trend analyses;
- Labor Productivity, which measured the amount of pay hours per driving hour, thereby directly influencing the wage and benefit line item; and
- Operator Absenteeism, which affected the number of drivers and thus cost required to operate PAT's scheduled service.

Performance by category is described below.

Wages and Benefits — Trends in PAT operator wage and benefit costs were developed from Section 15 reports covering four fiscal years. These expenses were divided by platform hours (i.e., productive driving time) to express them as a rate. Operator salaries and wages were collected from Form 311, Direct, Joint and Total Expenses by Object Class and Mode. The form relating to revenue vehicle operations was used; Form 321, Operator Wages Subsidiary Schedule, was also

Exhibit 10
PAT Prototype Management & Operations Study

TRANSPORTATION ASSESSMENT TECHNIQUES

	Trend Analysis	Internal Peer Group Analysis
Wages and Benefits	X	
Service Effectiveness	X	X
Labor Productivity		X
Operator Absenteeism	X	X

used. Platform hours were derived from Form 406, Transit System Service Supplied, Service Consumed, and Service Personnel Schedule, which reported statistics by average weekday, Saturday, and Sunday. These service statistics were then factored (254 weekdays, 52 Saturdays, 59 Sundays) to represent annual conditions.

Results of the operator wage and benefit analysis are shown in Exhibit 11. Overall, total wage and benefit expense for operators increased below the rate of inflation; wage expense increased at about three points below the inflation rate. This was considered a product of two events. First, the Cost-of-Living Adjustment (COLA) formula in effect during most of this period (i.e., from December 1979) constrained COLA growth. Although operators received periodic wage increases in addition to COLA, these increases did not result in an above inflation growth rate over the four-year period. Second, labor utilization improved; that is, more wages were paid for productive time, or platform hours, than in other non-productive pay categories.

The benefits expense growth slightly exceeded the inflation rate. This was partly attributable to increases in the Social Security tax and the cost of fixed benefit (e.g., medical) programs.

Service Effectiveness — A combination trend and internal peer group technique was used to evaluate service effectiveness. Two data sources were consulted to perform this assessment: mileage, by operating division, was obtained from the Scheduling Department; and, passenger statistics were supplied by the Rates and Services Department. These statistics were summarized from PAT's Ridership Monitoring System and were originally generated from its electronic farebox system.

Results of the service effectiveness analysis are displayed in Exhibit 12. While systemwide weekday ridership declined by about five percent between 1981 and 1982, there was little overall change in service effectiveness. Though service

Exhibit 11
PAT Prototype Management & Operations Study

TREND in OPERATOR WAGE and BENEFITS EXPENSE 1979 - 1982

	1979	1980	1981	1982	Average Annual Rate of Change
Wages (000s)	$26,768	$29,794	$32,594	$32,689	
Cost per Platform Hour	$9.78	$10.76	$11.71	$12.36	8.12%
Benefits (000s)	$11,492	$12,360	$14,525	$15,315	
Cost per Platform Hour	$4.20	$4.46	$5.22	$5.79	11.29%
Total Expense (000s)	$38,260	$41,154	$47,119	$48,004	
Cost per Platform Hour	$13.98	$15.22	$16.93	$18.16	9.11%
Pittsburgh CPI[1]	205.2	229.2	262.0	281.8	11.10%

(1) Urban Wage Earners Consumer Price Index at mid-year.

SOURCE: Section 15 Reports.

EXHIBIT 12
SERVICE EFFECTIVENESS
AMONG PAT OPERATING DIVISIONS

Division	Passengers[a] per Mile			Passengers[a] per Hour		
	June 1981[b]	June 1982[c]	Percent Change[d]	June 1981[b]	June 1982[c]	Percent Change[d]
Ross	2.53	2.54	0.4%	34.01	35.58	4.6%
Collier	2.28	2.32	1.8%	32.28	33.80	2.8%
South Hills	3.28	3.81	16.2%	38.24	44.92	17.5%
West Mifflin	2.40	2.31	(3.8%)	31.63	30.51	(3.5%)
East Liberty 'A'	5.33	5.10	(4.3%)	55.11	52.89	(4.0%)
East Liberty 'B'	3.34	3.14	(6.0%)	41.65	39.16	(6 0%)
Harmar	1.40	1.40	–	22.04	22.65	2.8%
PAT Total	2.73	2.69	(1.5%)	35.91	36.03	0.3%

(a) Unlinked passengers per weekday.
(b) Total passengers equalled 323,753.
(c) Total passengers equalled 307,761.
(d) Parentheses denote negative change.

effectiveness was stable between 1981 and 1982, it varied considerably among operating divisions. The variation among the divisions was partially due to differences in schedule and passenger markets but also indicated an inconsistent approach to overall service and ridership levels.

Changes in service effectiveness between 1981 and 1982 were more pronounced for passengers per hour than for passengers per mile. This was due to increases in operating speed, indicating relatively productive service changes. The drastic improvement in service effectiveness for South Hills was the result of concentrating ridership within fewer hours and miles of service in conjunction with new light rail construction.

Variations in service effectiveness among operating divisions reflected relative strengths in rider submarkets. Service effectiveness was highest in areas of dense population where trips were short. The areas served by East Liberty had the highest population density in the service area. South Hills' effectiveness was high because that division primarily served the peak travel market. Harmar, on the other end of the scale, served the most outlying ridership market and was in most direct competition with the automobile.

Operator Productivity — An internal peer group approach, as shown in Exhibit 13, was used to calculate operator productivity. Operator productivity can be measured by the ratio of pay hours to platform hours. This measure describes how many hours are paid for each hour of driving time. Two pay hour to platform hour ratios were used in the analysis — scheduled pay hours to platform hours and actual pay hours to platform hours. The scheduled ratio describes scheduling effectiveness and represents the minimum number of hours to be paid for each hour of driving. This ratio is generally correlated with the peak/base ratio, a statistic which indirectly describes scheduling complexities introduced by split shifts. The

Exhibit 13
PAT Prototype Management & Operations Study

RATIO of PAY HOURS to VEHICLE HOURS AMONG PAT GARAGES — FY '82

	Scheduled	Actual[1]	Percent Difference
Ross	1.147	1.260	9.85%
Collier	1.137	1.244	9.40%
South Hills	1.266	1.476	16.60%
West Mifflin	1.128	1.233	9.30%
East Liberty 'A'	1.128	1.231	9.10%
East Liberty 'B'	1.136	1.260	10.90%
Harmar	1.175	1.283	9.20%
PAT Total	**1.147**	**1.260**	**9.85%**

(1) Excludes vacation, holidays and other paid absences.

actual ratio describes how many hours are eventually paid beyond those which are scheduled and measures the effectiveness of the transportation function in implementing scheduled service. The percent difference between scheduled and actual pay hours per platform hour provides a relative indication of how well unscheduled pay time is managed. Two types of data sources were consulted to carry out this analysis. Actual pay hours were extracted from the payroll. Platform hours and scheduled pay hours were derived from schedule summaries by pick.

The overall scheduled pay hour to platform hour ratio of 1.147 was in the acceptable range for a transit system with PAT's service characteristics. This scheduled ratio typically ranged between 1.10 and 1.16 for the larger bus transit systems. The scheduled ratio for South Hills was highest, at 1.266, because of scheduling constraints caused by a high peak-to-base ratio and the inability to interline vehicles. Harmar's ratio of 1.175 was likewise higher than its bus division counterparts due to its highly peaked service.

The productivity analysis indicated that operator hours increased by about 10 percent when scheduled activity was implemented. Overall, about 1.26 wage hours were paid for each hour of driving time, meaning that about 10 percent of PAT's operator pay hours were beyond those scheduled. In most cases, the drivers were actively involved in some non-driving activity or in unscheduled transit service (e.g., charter service). About three percent of the 10 percent gain was attributed to time spent on report or non-productive time paid while waiting for an assignment.

The actual pay hour to platform hour ratio of 1.26 could potentially be improved. This ratio was higher than other similar-sized bus systems, but it included the utilization of drivers outside the revenue service function. One of the factors contributing to 1982's ratio was the use of drivers to exchange vehicles which failed while in operation. Typically, in comparable transit systems, maintenance staff such as mechanics, road call crews and/or bus garage shifters are used to perform this function.

South Hills and, to a lesser extent, East Liberty "B" Divisions exceeded the system average for extra pay hours, measured as the percent difference between scheduled and actual pay hours per platform hour. This was indicative either of excess manpower levels or higher manpower levels to cover excess absenteeism.

Operator Absenteeism — Operator absenteeism was assessed by analyzing:

- Trends in operator absenteeism;
- Operator absenteeism among PAT operating divisions; and
- Hours of service lost among PAT operating divisions.

In order to perform the trend analysis shown in Exhibit 14, the PAT "Vacation and Absentee Report" was consulted. Total time lost by type of absence was divided by the total number of operators to calculate average days lost per driver. The trend analysis indicated that operator absenteeism declined slightly in 1982 after having remained at a stable, high level for several years.

PAT's average operator sick days per year (18.28 for 1982) were more than two-thirds greater than the three-system peer group average. More importantly, PAT's 1982 injured-on-duty days lost (7.89) were more than three times the same three-system average. Of positive note was the requested days off work where PAT was significantly below the five-system average. Overall though, absenteeism was already recognized by PAT as being a high priority issue.

PAT implemented a performance code in 1976 to reduce absenteeism. Also, a consultant study was commissioned in 1979 to examine the problem. Though the six-year trend for three categories of operator absenteeism indicated that some reductions had occurred, total absenteeism was still high. Salient changes in absenteeism patterns were:

EXHIBIT 14
PAT OPERATOR ABSENTEEISM
CALENDAR YEARS 1977 – 1982 [a]

Year	Annual Days Missed per Operator		
	Sick	Requested Off Work	Injured on Duty
1982	18.28	0.73	7.89
1981	19.40	0.99	8.21
1980	19.56	1.03	10.62
1979	19.23	1.13	12.02
1978	19.25	1.94	9.73
1977	22.38	1.65	11.45

(a) Average Days per Operator per Year.

Source: PAT "Vacation and Absentee Report," Year-to-Date Totals for Pay Periods ending December 31.

- Sick leave came down in 1978, plateaued until 1981, then decreased by five percent in 1982;

- Days requested off had declined by 40 percent over the period, and represented less than five percent of absenteeism; and

- Injured-on-duty, or workers' compensation, losses had been reduced by about 31 percent since 1977.

It was estimated that the cost of replacement operators and paid leave for operator absenteeism approached $5 million in 1982.

Since the trend-line analysis indicated a high level of absenteeism, an internal peer group analysis was performed to isolate those divisions where lost time was above the system average. It should be noted that the divisional data presented in Exhibit 15 were not directly compatible with the data set used for the trend-line analysis, as they were slightly understated within particular categories. The divisional data included an "other" category which represented absences outside the three categories in the systemwide statistics, plus some absences which were later reclassified within these three categories. Despite the incompatibility between system and divisional data sets, the latter was still useful for identifying differences in absenteeism among locations.

The internal peer group analysis indicated that operator absenteeism varied considerably among PAT divisions, particularly with respect to sick leave and injury-on-duty. While some differences may have existed in operator health or work place safety, these findings suggest that existing loss-control mechanisms and/or labor relation techniques yielded different rates of success among the PAT operating divisions.

For instance, sick leave, which accounted for 62 percent of days lost, ranged from a high of 25 days per operator at East Liberty "B" to a low of 11.7 days per operator at South Hills. Injury-on-duty, which accounted for 26 percent of days lost, ranged from 12.5 days at East Liberty "A" to 3.7 days per operator at West Mifflin. Therefore, absenteeism control policies and the responsibility for implementation of these policies required further clarification to effect equitable improvement.

EXHIBIT 15

ESTIMATED OPERATOR ABSENCES[(a)] AMONG PAT DIVISIONS 1982

Division	Sick	Requested Off Work	Injury on Duty	Other	Total
Ross	15.25	0.73	9.08	1.95	27.01
Collier	13.71	0.96	4.46	2.33	21.46
South Hills	11.69	1.18	7.33	3.15	23.35
West Mifflin	14.86	0.82	3.65	1.41	20.74
East Liberty 'A'	22.55	1.41	12.45	3.18	39.59
East Liberty 'B'	25.24	1.05	8.76	3.30	38.35
Harmar	15.55	0.91	4.95	2.23	23.64
PAT Total	16.99	0.97	7.05	2.35	27.36

(a) Days per operator per year.

Source: "Analysis of Extra Work Performed by Operators" Monthly Reports, July 1981 – June 1982.

As a concluding step, vehicles not dispatched by cause were analyzed to determine whether the Transportation Department was effective in minimizing service lost due to absenteeism. The service loss analysis was performed using an internal peer group technique, as shown in Exhibit 16. Despite the high levels of absenteeism, Transportation held service losses to 0.15 percent of scheduled service hours during 1982. This system average compares favorably with the majority of garages falling below 0.10 percent. However, the internal comparison also illustrates room for improvement at the two East Liberty garages — "A" and "B". As evidenced in Exhibit 16, most service losses in FY '82 were due to lack of equipment. The characteristics of this problem were addressed in the maintenance assessment section.

Maintenance Assessment

PAT's Maintenance Department was responsible for upkeep, repair, and servicing of buses, streetcars, rail right-of-way and power distribution, and other fixed facilities. The bus fleet represented the largest operational maintenance investment. The light rail system, under reconstruction, was scheduled to come fully on-line in May 1987; it will include new vehicles as well as rebuilt streetcars. The acquisition of 410 new Neoplan buses, 30 articulated buses, and a new light rail vehicle fleet was placing new demands on Maintenance because of increased vehicle componentry and increased complexity of each component.

As with the Transportation Assessment, both the trend and internal peer group techniques were applied to evaluate performance. The following topics were explored:

- General performance — which illustrates the time trend performance of key maintenance indicators;
- Bus availability — which identifies how well maintenance meets scheduled service requirements;
- Fleet mileage distribution — which may indicate over or under utilization of equipment;

EXHIBIT 16

HOURS OF SERVICE LOST
DUE TO LACK OF OPERATOR OR EQUIPMENT
JULY 1981 – JUNE 1982

	Operator		Equipment		Total	
	Hours	Percent[a]	Hours	Percent[a]	Hours	Percent[a]
Ross	584	0.12%	3,331	0.66%	3,915	0.78%
Collier	169	0.04%	762	0.17%	931	0.21%
South Hills	116	0.08%	0	0.0%	116	0.08%
West Mifflin	220	0.04%	4,724	0.80%	4,944	0.84%
East Liberty 'A'	1,901	0.52%	5,098	1.40%	6,999	1.92%
East Liberty 'B'	843	0.26%	3,206	1.00%	4,049	1.26%
Harmar	143	0.05%	161	0.06%	304	0.11%
PAT Total	3,976	0.15%	17,282	0.66%	21,258	0.81%

(a) Hours lost divided by scheduled vehicle hours.

- Inspections — which identify the extent of the preventive maintenance program; and
- Material requisitions — which illustrate the divisional and historical perspectives to increasing material expenses.

Overall, the analyses indicated that, while maintenance had improved relative to the disruptive vehicle availability problems of the Winter of 1982, additional investment was required to bring the situation under continuing control.

General Performance — Though the external peer group analysis indicated that PAT performed better than its peers, detailed examination of more recent periods and individual line items revealed unfavorable trends in certain areas. In particular, both labor and materials cost had increased well in excess of inflation since 1979, as shown in Exhibit 17. Labor cost per mile increased 53 percent from 1979 to 1982, and materials cost per mile nearly doubled. Further, labor productivity for the entire Maintenance Department and for mechanics exhibited a slight decline.

The dramatic increases in labor and materials rates of change in 1982 reflected the cost of the effort required to change the downward trend of vehicle availability. Substantial use of overtime was a primary reason for labor cost increase. Materials cost increase was most likely an attribute of more repairs, older vehicles, and accelerated parts ordering. Overall, these indicated a limited systematic capability to plan, schedule and control the maintenance program. These conclusions were supported by the analyses in the remaining topic areas.

Bus Availability — In order to perform this combination trend and cost center analysis, the ratio of available buses to assigned active fleet was computed by division for a five-year period. Vehicle availability reports were consulted to perform the analysis.

EXHIBIT 17
PORT AUTHORITY TRANSIT
MAINTENANCE PERFORMANCE

	1979	1980	1981	1982	Average Annual Rate of Change	1981-82 Rate of Change
Labor Cost per Mile (a)	0.36	0.41	0.46	0.55	15.0%	19.6%
Materials Cost per Mile (b)	0.12	0.14	0.17	0.23	24.0%	35.3%
Peak Vehicles per Maintenance Employee (c)	1.23	1.20	1.19	1.15	N.A.	N.A.
Peak Vehicles per Mechanic (d)	4.08	4.15	4.16	3.88	N.A.	N.A.
Pittsburgh CPI (e)	*205.2*	*229.2*	*262.0*	*281.8*	*11.1%*	*7.6%*

(a) Maintenance administration, revenue vehicle servicing, inspection, maintenance, accident repairs.
(b) Excludes fuel.
(c) Total maintenance employees reported in Form No. 404.
(d) Revenue vehicle mechanics reported in Form No. 404.
(e) Urban Wage Earners Consumer Price Index at mid-year.
Source: Section 15 Reports, 1979-82.

A trend analysis of bus availability showed that bus maintenance problems were not new. Bus availability by division, presented in Exhibit 18, demonstrated that, even in 1981, availability was sliding downwards. The last two years (1981 and 1982) had resulted in a 10 percent reduction with a declining fleet size.

A critical point in bus availability was reached in August of 1981. At that time, buses available for service began to slip below peak requirements, as shown in Exhibit 19. The combined effect of fiscally prompted service reductions and the stepped-up bus maintenance effort supported a return of bus availability to peak demands. There was still, however, little flexibility with spare vehicles. This overtime method of improving vehicle availability is an expensive approach and typically results in only short-term improvement.

Fleet Mileage Distribution — A trend analysis in the distribution of mileage by age of vehicles was performed to determine whether PAT's vehicle utilization rate (miles per vehicle) contributed to maintenance problems. Section 15 reports were used as the data source for this particular analysis. The analysis, as shown in Exhibit 20, indicated that PAT's vehicle utilization rate had been increasing over the last several years even as the fleet aged. The last new vehicles were brought into service in 1980, excluding the recent Neoplan procurement of 410 buses, with delivery beginning in 1982.

PAT operated nearly 50 percent of its annual mileage on vehicles which were 12 years of age and older. Twelve years is significant since it is generally considered to be the expected life of a transit bus. This heavy utilization of older buses contributed to the increasing materials cost and declining bus availability. While PAT moved to resolve this issue with its 1982 Neoplan procurement, these newer vehicles also introduced particular constraints and demands on maintenance. Newer vehicles require a more sophisticated approach to maintenance because of the increased componentry in recent bus designs plus the

EXHIBIT 18

BUS AVAILABILITY BY DIVISION (a)

1978 – 1982

Division	1978	1979	1980	1981	1982
Ross	90.6%	90.8%	86.6%	74.7%	74.1%
Collier	90.4%	84.7%	85.3%	83.6%	90.4%
West Mifflin	82.4%	82.6%	87.9%	82.9%	77.6%
East Liberty	84.0%	87.3%	88.5%	85.4%	73.7%
Harmar	92.1%	88.9%	94.2%	94.3%	86.9%
Total	87.2%	86.6%	88.2%	83.3%	79.3%

(a) Percent of active fleet available for duty on last Friday in June.

EXHIBIT 19
PORT AUTHORITY TRANSIT MANAGEMENT STUDY

BUS REQUIREMENTS AND BUS AVAILABILITY

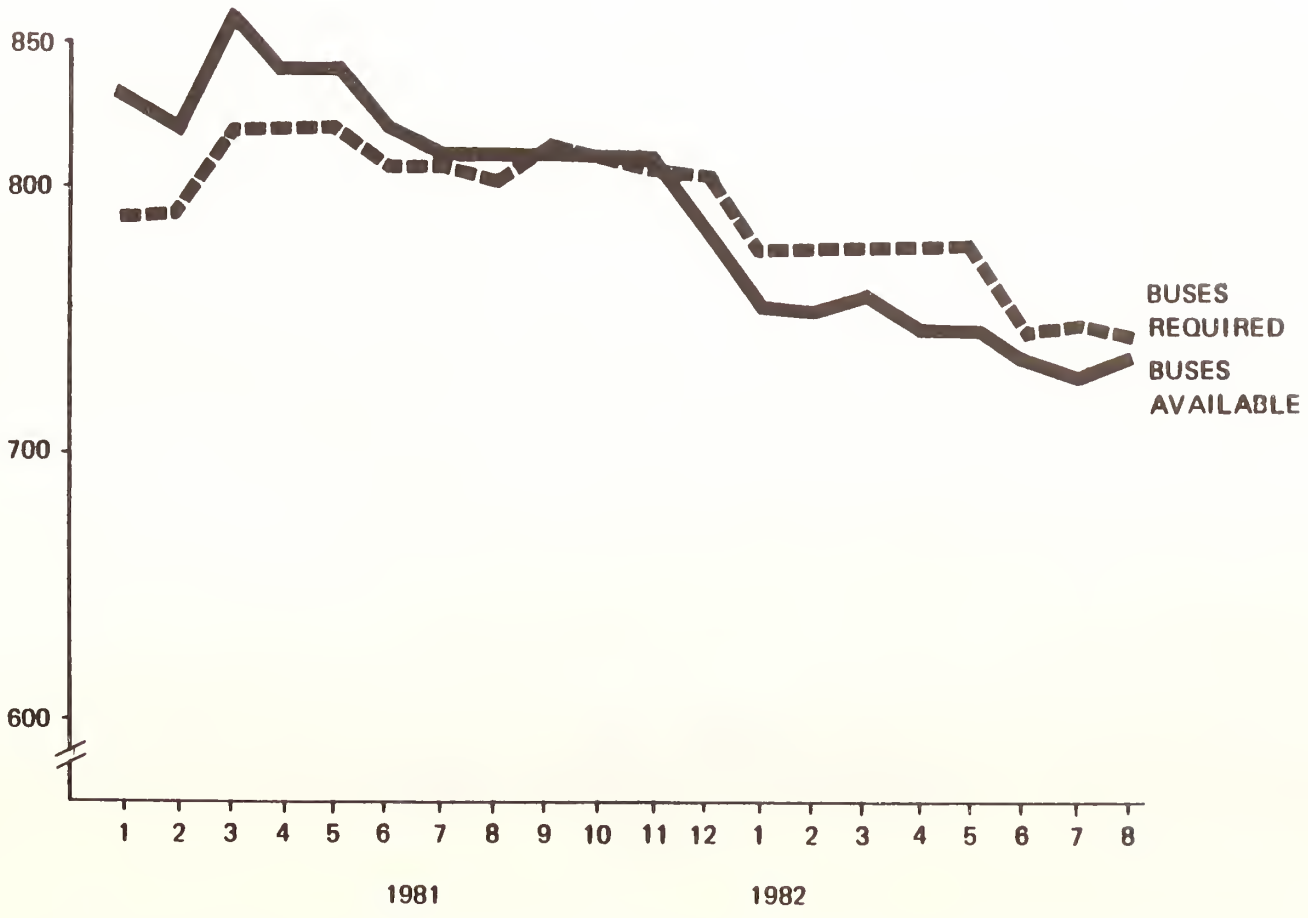


EXHIBIT 20

TREND IN DISTRIBUTION OF MILEAGE BY AGE OF VEHICLES

Vehicle Age	1979 Percent of Total Miles	1979 Miles[b] per Vehicle	1980 Percent of Total Miles	1980 Miles[b] per Vehicle	1981 Percent of Total Miles	1981 Miles[b] per Vehicle	1982[a] Percent of Total Miles	1982[a] Miles[b] per Vehicle
1	0.8%	14.3	3.9%	10.8	—	—	—	—
2	19.9%	36.1	1.3%	23.2	20.4%	50.6	—	—
3	1.4%	37.5	22.2%	42.2	1.1%	20.3	21.5%	51.4
4	—	—	1.3%	35.7	19.9%	38.0	1.3%	22.7
5	10.0%	49.0	—	—	1.4%	37.9	18.2%	33.7
6	—	—	8.6%	43.7	—	—	1.5%	38.6
7	—	—	—	—	7.0%	36.3	—	—
8	—	—	—	—	—	—	7.3%	38.7
9	25.7%	44.7	—	—	—	—	—	—
10	0.9%	39.2	24.4%	43.1	—	—	—	—
11	—	—	0.8%	34.5	22.8%	40.6	—	—
12	—	—	—	—	0.8%	33.9	22.5%	39.1
13	0.2%	25.3	—	—	—	—	0.8%	33.9
14	20.7%	36.6	0.2%	25.5	—	—	—	—
15	11.6%	30.0	18.5%	33.7	0.2%	26.0	—	—
16	8.6%	28.9	11.4%	30.0	16.1%	29.6	0.2%	31.0
17	0.2%	20.7	7.1%	31.0	10.0%	26.7	16.5%	36.2
18	—	—	0.3%	26.8	—	—	8.1%	33.1
19	—	—	—	—	0.3%	34.0	1.7%	30.3
20 + Over	—	—	—	—	—	—	0.4%	38.5
All Vehicles	100.0%	36.8	100.0%	34.0	100.0%	36.6	100.0%	38.2
Average Fleet Age	*9.42*		*9.70*		*8.74*		*9.78*	

(a) Excludes leased vehicles.
(b) Miles in 000's
Source: Section 15 Reports

increased complexity of each component. Therefore, while certain short-term problems may be resolved through investment, a systematic maintenance approach will become an even greater necessity in the near-term future.

Another finding resulting from the fleet mileage analysis was the distinct gaps in the age and, hence, technology of PAT buses. These procurement gaps in fleet age place cyclical demands on the maintenance workload because major repair cycles (e.g., engine and transmission overhaul) occur during the same year for a disproportionate share of the fleet. A longer-range service and capital plan would aid a more evenly distributed vehicle procurement cycle, thus eliminating these cyclical demands.

Inspections -- Inspection records for 1981 and 1982 were analyzed to determine whether vehicle inspections were being performed on-time. The monthly trend analysis indicated that the maintenance backlog had resulted in less than 30 percent of inspections being performed on-time. PAT's policy was to inspect buses every 4,000 miles.

In 1982, the understandable pressure to increase bus availabilty forced postponement of many inspections, as presented in Exhibit 21. While not an inappropriate strategy under the circumstances, inspection deferral eventually manifested itself as in-service failures, thereby substituting one costly problem for another.

Materials Requisition -- Since a previous analysis indicated that materials cost had been increasing at an accelerated rate, a more detailed trend analysis was performed to isolate potential causes. In order to complete the analysis displayed in Exhibit 22, PAT's Inventory System Control Reports for a three-year period were consulted. Reports were analyzed by quarter in order to derive an average monthly materials requisition value for an extended period of time. The

EXHIBIT 21

PORT AUTHORITY TRANSIT

PERCENT OF ON-TIME VEHICLE INSPECTIONS

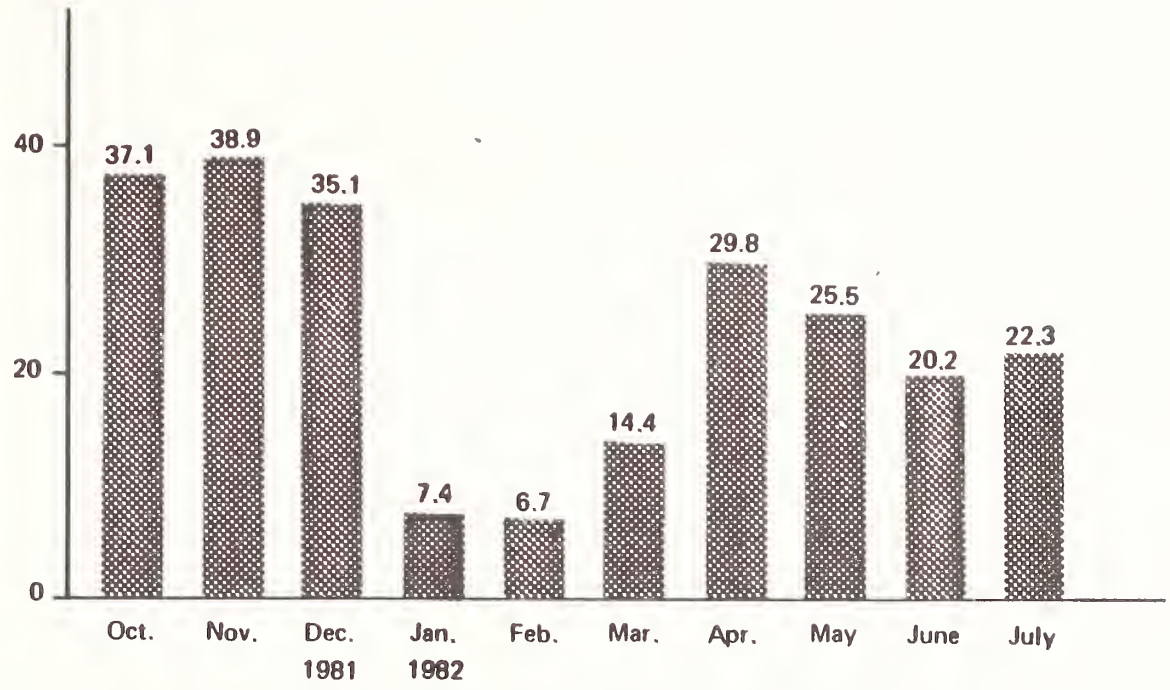


EXHIBIT 22

AVERAGE MONTHLY MATERIALS REQUISITIONS BY QUARTER

JULY 1980 – SEPTEMBER 1982

Quarter	Central Shops	Ross	Collier	South Hills	West Mifflin	East Liberty	Harmar	Total
Jul-Sep '82	$242,614	$93,639	$57,468	$57,891	$49,262	$90,816	$44 868	$636 558
Apr-Jun '82	206,559	82,503	52,497	60,762	61,688	86,403	50,119	600 531
Jan-Mar '82	201,712	86,712	49,135	69,441	67,957	88,134	37,223	599,954
Oct-Dec '81	153,777	61,614	36,560	70,852	56,362	61,323	30,696	471,184
Jul-Sep '81	183,467	63,307	41,110	59,223	44,007	69,268	33,723	494,105
Apr-Jun '81	150,595	47,777	34,755	39,378	41,051	62,833	25,948	402,337
Jan-Mar '81	174,724	46,938	49,222	55,883	35,139	63,818	29,526	455 250
Oct-Dec '80	128,631	42,338	33,642	45,146	36,604	69,190	24,414	379,965
Jul-Sep '80	122,922	38,113	33,486	55,687	42,523	61,614	23,973	378,118

trend analysis revealed that materials requisitions from operating divisions were running $142,000 per month ahead of the prior year's rate. Over the period July 1980 to September 1982, average monthly materials requisitions increased by 68 percent. In the last year of the three-year period (1982), average monthly requisitions increased by 29 percent.

These findings were discussed with several PAT managers to determine which factors were contributing to the escalation in parts expense. Several site visits were also completed. The primary factors which indicated a contribution to this situation included:

- Increases in fleet age and annual miles per bus were combined to increase material requirements;
- Maintenance philosophy changed from one of fixing the apparent problem to repairing all operational defects when the bus was entered for service;
- Parts cannibalization ceased;
- While standard operating procedures were under development, this development needed to be coordinated with the training, work scheduling and production control needs of maintenance to ensure an overall systematic approach was attained;
- Inadequate training on complex systems reduced troubleshooting accuracy and resulted in higher materials cost from replacement of functional parts;
- Parts ordering from the divisions was based on perceived need, not usage, and no visibility existed for parts cost; and
- There was no control over access to parts at the divisions, and stock areas were inadequately organized and maintained.

The first three factors were acceptable explanations for increased parts usage. The last three factors suggested that opportunities abounded for parts usage and cost to exceed real need. This not only increased material expenses, but also invalidated any predictions for future parts need.

In general, PAT maintenance had limited structure to capture important information about the operation. Parts usage or consumption was only documented upon delivery to each garage storeroom, not to particular vehicles. Man-hours required for each repair type were not recorded; thus, manpower planning and repair performance measurement were not available. PAT could benefit from a more structured, systematic approach to maintenance which would, in turn, improve its capability to plan, schedule and control the maintenance work requirement.

Organizational Analysis

Unlike the financial, transportation, and maintenance analyses, the organizational assessment was dependent upon the use of qualitative rather than quantitative techniques. Structured interviews were utilized for defining management objectives, span of control, accountability, communications, authority, and roles and responsibilities. This structured interview technique was based on the development of a formalized interview guide which was used to ensure that each issue area was covered in the discussion. Consistency across issue areas and individual interviewers was the objective of the structured interview technique. The analysis which follows also included reviews of organizational charts and budgets.

Organizational effectiveness was assessed by applying general management principles to the managerial environment at PAT. A key consideration in evaluating organizational effectiveness is the extent to which management styles reflect the organization and operating environments. Management style may instill centralized control by concentrating the authority for decision-making at the upper levels of the managerial hierarchy, or impart relatively decentralized control by dispersing decision-making authority to managers further down the hierarchical structure.

Senior managers exercising centralized control require detailed information concerning performance in all activities of the organizational unit (e.g., department) on a continuous basis and, therefore, centralization is best suited for departments with a narrow span of control. Senior managers practicing decentralized control require less detailed performance information on activities of primary importance on a periodic basis, thus allowing the executive to address a broader range of activities and embrace a greater span of control. Lower level managers and supervisors are generally utilized heavily in a decentralized structure. Conversely, centralized control frequently results in reduced responsibility and accountability at lower management levels as these managers have little decision-making authority. While centralized control frequently promotes a high level of internal coordination, decentralized control can improve timeliness of decision-making, as the manager who discovers a problem can take remedial action without waiting for instructions from superiors.

PAT's existing (1982) organization structure is presented in Exhibit 23. The findings for each division and department are summarized below.

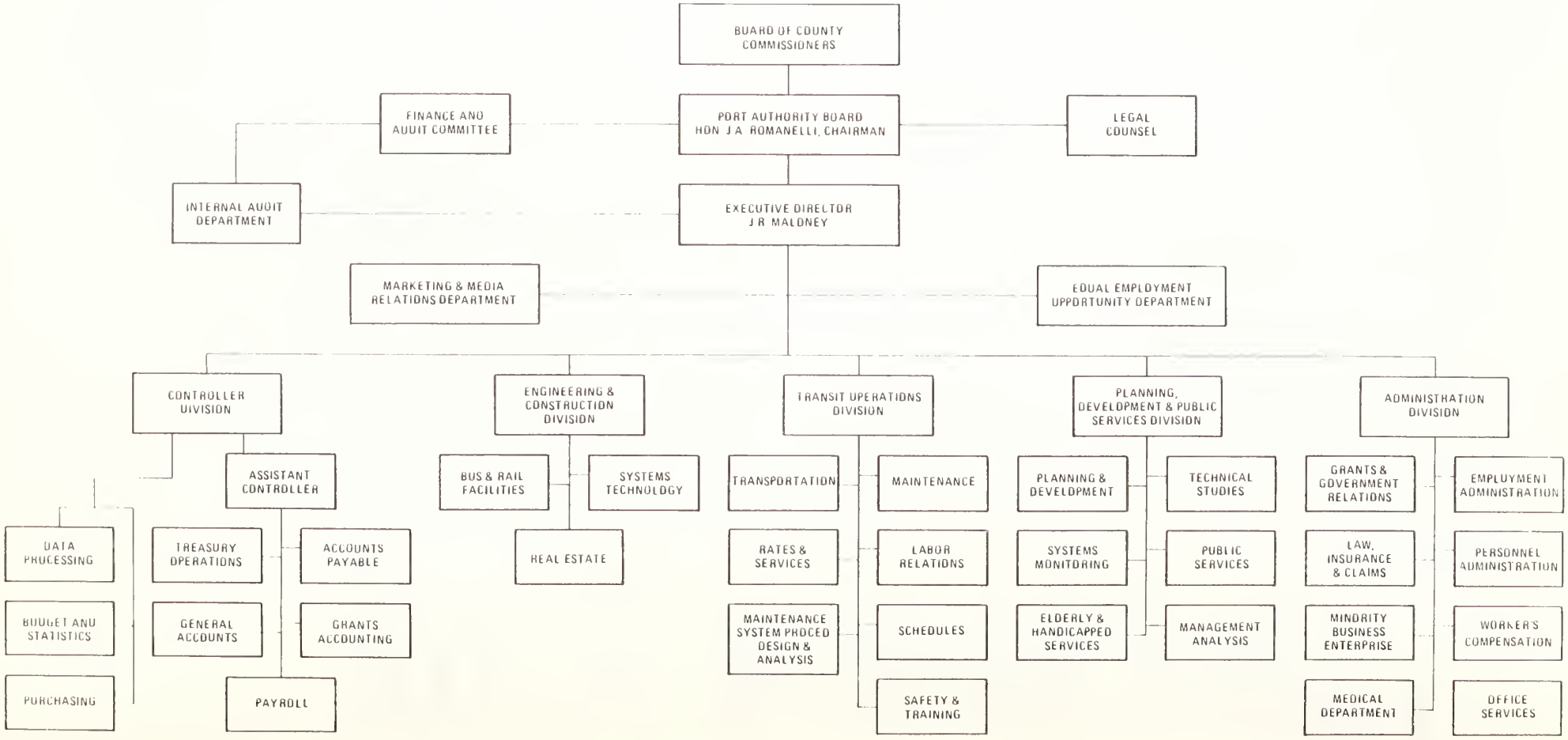
Transit Operations Division — This division, which employed 93 percent of the Authority's 2,800 employees, consisted of six departments:

- Transportation,
- Maintenance,
- Rates and Services,
- Schedules,
- Safety and Training, and
- Labor Relations.

Besides these six departments, there was a Manager of Maintenance Systems Procedures. Excluding some administrative activities, the Transit Operations Division was responsible for all activities from service design to service implementation, as well as labor relations. The organizational analysis found a

EXHIBIT 23

PORT AUTHORITY OF ALLEGHENY COUNTY
ORGANIZATION CHART



broad span of control which acted to reduce the accountability by and visibility of major activities. This conclusion was supported by the following analyses:

- Transportation Department — Decision-making authority was centralized within headquarters, with limited control vested in the seven operating divisions. Three layers of management existed within headquarters — manager, assistant manager, and general superintendent of division operations and road operations. Budget, manpower planning, and road operations coordination responsibilities rested solely with headquarters. Division superintendents could have been more productively utilized — they had limited supervisory authority and spent about 60 percent of their time on clerical activities associated with administrative controls and procedures.

  Another area of potential improvement between headquarters and the divisions was that lines of reporting could have been better defined. Dispatchers, who theoretically were responsible to division superintendents, also received direction from the supervisor of dispatching at headquarters regarding labor policy. They also received location assignments from this supervisor. Ad hoc communications with superintendents were handled by the manager, assistant manager, general superintendent, or administrative assistants.

  Another potential area for improvement was communication on performance objectives. Although all transportation managers inherently understood their responsibilities, no performance targets were established. Additionally, the existing reporting systems were not designed to inform managers of performance trends at each division. Control was exerted by monitoring detailed reports. For instance, detailed overtime and absence reports were used to flag problems, but the larger trends of increasing or decreasing staff needs and utilization were not monitored on a uniform basis. Thus, policy impacts and extent of implementation were not visible issue areas.

- Maintenance Department — As was the case with the Transportation Division, control of maintenance was highly centralized at headquarters. Three layers of management existed at headquarters — manager, assistant manager and general

superintendent. Additionally, an assistant to the manager and two assistant general superintendents were assigned to headquarters. This hierarchical arrangement potentially created redundancy at headquarters and could have possibly obscured the intended contribution of divisional level maintenance managers. Administrative control systems had limited ability to monitor maintenance performance or to plan future campaigns. While several systems were being developed and implemented, such as the road failure system accessible by division via Cathode Ray Tube (CRT), the systems were not functionally integrated. Moreover, the methodology for computing vehicle mileage raised data credibility questions regarding component failure rates. Additionally, the systems were not designed to capture and report information on cost and production rates. Therefore, the evaluation of divisional management performance was obscured by the lack of quality evaluation information.

- Rates and Services — This department was responsible for implementing service changes. They regularly reviewed route performance, and several service modifications improved route productivity and increased PAT's cost-effectiveness. Rates and Services maintained good communications with Road Operations and external agencies whose activities impacted PAT operations (e.g., City Traffic Engineering).

- Scheduling Department — Though this department was a separate unit, major schedule and service changes suggested by it required approval by Rates and Services. The majority of activities conducted by the Scheduling Department related to maintaining and updating driver and vehicle schedules.

- Labor Relations Department — This department played a strong supportive role to the rest of the Division in developing consistent labor relations practices. Among its contributions were a reference system for arbitration cases and strategies for improving grievance settlements.

- Safety and Training Department — The role of this department changed substantially from 1981 to 1982 as PAT curtailed the hiring of operators. Safety and Training's historical role had been the training of new operators. As no new operators had been hired since June 1981, the department conducted retraining programs, worked successfully to reduce accident rates, and

dedicated a significant amount of time to ride checks (i.e., making contact with drivers). A more formal redefinition of their role during times of limited hiring was identified as an improvement opportunity. The identification and targeting of specific programs for utilizing the 24-man work force, for instance, could identify opportunities for expanding the role of instructors (e.g., as counselors for health or attendance problems). At the time of this study, only their accident prevention program appeared to be focused on an objective.

Administrative Division — This division encompassed the following activities: Grants and Government Relations; Law; Insurance and Claims; Minority Business Enterprise; Medical; Employment Administration; Personnel Administration; Workers' Compensation; and Office Services. Grants, Law, Minority Business Enterprise, and Office Services required little integration.

The remaining components all related to personnel activities and thus had many points of interface. This introduced some ambiguity regarding their respective roles. The boundaries among Personnel Administration, Employment Administration, and Labor Relations, for instance, did not appear to be well established. Personnel administered the Collective Bargaining Agreements, which obscured the responsibilities of Labor Relations. Moreover, both Personnel and Employment interfaced with the unions, establishing potential for diffusion of management strategies.

Planning, Development, and Public Services Division — This division performed the following activities: Planning and Development; Systems Monitoring; Technical Studies; Public Services; and Elderly & Handicapped Services. In general, the responsibilities of this division were highly skilled, but represented an unrelated set of activities not supportive of a strategic outlook for PAT's future. Principal findings were as follows:

- Public Services, which included telephone information and complaint handling, had no relationship to Planning and would have probably been more effective if reporting to some other organizational component.

- Elderly & Handicapped Services also had little functional integration with Planning, but was performing well, independent of these organizational ties.

- Although an annual and five-year plan was submitted via the TIP/TSM process, no planning product was embraced by PAT as an effective action plan. As a result, the service adjustments introduced by Rates and Services, albeit effective, were not related to an overall financial and operating plan.

The role of the Planning, Development, and Public Services Division could be reorganized into a more valuable department by focusing its skills on defining PAT's future. In so doing, a more productive connection with short-range planning could be established.

Engineering and Construction Division — This division encompassed three activities — Bus and Rail Facilities; Systems Technology, and Real Estate. Its principal responsibility was coordination of the capital program and management of associated consultant contracts. Overall, the Engineering and Construction Division's role was well-defined, its activities were visibly accountable, and the results of its work had been positive.

The E&C Division was effectively organized to achieve timely and cost-effective completion of PAT's major capital projects. Most staff time in the recent past had been dedicated to the East Busway and LRT projects. The East Busway had just been completed, and the LRT's engineering phase was about 80 percent complete. Additionally, relocations associated with the LRT were about 70 percent complete.

Controller Division — This division encompassed the following activities: Data Processing; Budget and Statistics; Purchasing; Treasury; Accounting; and Payroll. Responsibilities within this division were well-defined and understood; however, there were concerns relative to several technical issues, as follows:

- Data processing was accomplished on a dated mainframe with reliability problems and capacity constraints, and future system expectations exceeded current resources;
- Investigation of microcomputer needs had been proceeding without respect to an overall hardware or systems plan;
- PAT was evaluating several options for meeting the system's word processing needs;
- Budgeting had done a good job of estimating expenses, but the centralized process did not encourage any sense of manager "ownership" of its budget; and
- Conflicts existed with Maintenance over stores control, but these could not be effectively addressed until a base condition had been established.

Marketing and Media Relations Department - This department was responsible for pass sales and information, promotions, advertising, news releases, and all external communications other than those handled through public services. The effectiveness of the Marketing and Media Relations Department was diluted by inclusion of marketing activities in other divisions. If Marketing is to be an effective tool for PAT, boundary problems with other activities should be addressed. Specifically, public information and complaints, presently administered by the Planning Division, are candidates for teaming with Marketing. Moreover, public presentations and user materials (e.g., timetables) were, at least, candidates for coordination with PAT marketing efforts.

Equal Employment Opportunity Department — The EEO Department played a crucial role in investigating charges by employees or potential employees which related to racial or sexual discrimination. This functional department reported

directly to the Executive Director. Because of the criticality and sensitivity of EEO's duties, this position in the organizational structure was an important element in its success. Overall, the Equal Employment Opportunity Department was effectively situated to discharge its responsibilities.

Internal Audit Department — The Internal Audit Department's function did not appear to be consistent with its organizational position. The function of the internal auditor was to serve as a high level and objective investigator on sensitive or vital issues. Most time in this department was spent auditing third-party contracts. The position appeared to be elevated above the department's actual role, and there appeared to be no compelling reason for a reporting relationship with the Board or Board Committees.

* * * * *

In summary, the PAT organization could be depicted as a strongly centralized structure with only minor decision-making authority at the divisional level. Division managers had limited control because of this structure, the insufficient performance reporting information, and the subsequent informalized performance objective and monitoring systems. The departmental organization fit the needs of the PAT operation with only minor suggested shifts in reporting lines. Operational performance could be improved through the development of formalized divisional performance objectives and performance measurement systems.

V. RECOMMENDATIONS

V. RECOMMENDATIONS

The preceding review of PAT's management and operations system revealed the need for some constructive modifications relative to PAT's systems, procedures, and organizational structure. The primary concerns identified in the initial phase of this Prototype Management Study are presented in Exhibit 24. These concerns represent the entire range of findings within each analytical stage of the study. These findings were then summarized into pertinent issue areas, along with the subsequent conclusions and recommendations. The relationship of the recommendations to the conclusions and specific issues identified in this analysis is depicted in Exhibit 25.

The recommendations are listed in a prioritized sequence. Priority was determined by ease of implementation, return to system, and system criticality. Ease of implementation represents the measure of start-up time, resources and effort required to fully implement each recommendation. Return to system refers to the net present value of the expected benefits (e.g., cost savings and revenue enhancement) and one-time costs (e.g., capital costs) of each recommendation. System criticality refers to the immediacy of the problem plus the secondary ramifications of leaving a noted deficiency uncorrected. Judgmental values of the three criteria were collectively defined by both consultant and PAT staff. The prioritization was based on the combination of ease of implementation and return to system through the application of the systematic process noted in Chapter III - Analytical Approach, Exhibit 4. System criticality was qualitatively applied to these prioritized recommendations to finalize the rank ordering.

The nature of PAT's problems permitted a quick determination of priorities without the need for rigorous cost/benefit analysis. The relative priority for implementing corrective management actions was defined through a cooperative effort between PAT and Booz, Allen staff.

EXHIBIT 24

SUMMARY OF PRIMARY CONCERNS

External Peer Group Analysis

- Ridership is low relative to service levels
- Driver productivity is below peer group average
- Maintenance overhead is above peer group average

Financial and Operating Performance

- Public funding expectations not met
- Ridership is declining relative to service levels
- Revenue and cost exceeded inflation
- Deficit per passenger and mile is rising

Transportation Assessment

- Ridership is declining relative to service levels
- Operator absenteeism remains high

Maintenance Assessment

- Labor and materials cost increases exceed inflation
- Bus availability falls below needs
- Vehicle utilization rates are increasing with fleet age
- Inspections are frequently behind schedule
- Materials requisition costs are increasing at an accelerated rate
- Parts access is uncontrolled at divisions
- Parts ordering is not based on usage
- No visibility exists for parts cost
- Inadequate training on complex systems has reduced trouble shooting accuracy
- Standard operating procedures are being developed, but should be accelerated

EXHIBIT 24

SUMMARY OF PRIMARY CONCERNS
(Continued)

Organizational Analysis

- Transportation Department

  - Division superintendents have limited supervisory authority
  - Lines of reporting could be better defined
  - Performance objectives have not been formalized
  - Reporting systems do not monitor larger trends

- Maintenance Department

  - Division managers have limited control
  - Headquarters alone has three layers of management
  - Control systems have limited ability to monitor performance
  - The methodology for computing vehicle mileage is questionable
  - Cost and production data are not captured or reported

- Scheduling Department

  - Though a separate unit, service changes require approval from Rates and Services

- Safety and Training Department

  - The current role of instructors is not well-defined
  - Instructors appear to have fragmented responsibilities when hires are low

EXHIBIT 24

SUMMARY OF PRIMARY CONCERNS
(Continued)

Organizational Analysis (Continued)

- Administrative Division
  - Roles of Personnel Administration, Employment Administration, and Labor Relations do not appear to be well defined
  - Both Personnel and Employment interface with unions

- Planning, Development and Public Services
  - Public Services is unrelated to planning
  - No planning product is embraced as an effective action plan

- Controller Division
  - Mainframe is dated and has reliability and capacity problems
  - Microcomputer needs are being assessed without respect to a systems plan
  - Conflicts exist with Maintenance over stores control

- Marketing and Media Relations Department
  - Marketing activities are diffussed at PAT
  - Public information and complaints are not tied to Marketing

EXHIBIT 25

RELATIONSHIP OF PRIMARY ISSUES AND RECOMMENDATIONS

Recommendation	Primary Conclusions	Supporting Findings
1. Develop a structured approach to maintenance activities		
1.1 Achieve control over stores	Stores is not adequately managed under current organization	. Parts access is uncontrolled . Materials costs exceed inflation . Conflicts exist with Controller over stores
1.2 Establish control over rotable components inventory & production	Rotable components are not efficiently managed	. Materials costs are not adequately controlled . Parts ordering is not based on usage . Cost & production data are not reported
1.3 Accelerate development of standard operating procedures	Standard operating procedures could enhance trouble shooting accuracy, and result in lower costs	. Standard operating procedures are being developed, but should be accelerated . Inadequate training on complex systems has resulted in reduced trouble shooting accuracy . Reduced trouble shooting accuracy has resulted in increased parts cost

EXHIBIT 25

RELATIONSHIP OF PRIMARY ISSUES AND RECOMMENDATIONS
(Continued)

Recommendation	Primary Conclusions	Supporting Findings
1.4 Develop mileage estimates based on scheduled vehicle assignments and changeouts	Current mileage estimates negatively impact labor and materials scheduling	. Fuel-based mileage estimates are questionable . Work scheduling is based on mileage estimates
1.5 Evaluate management responsibilities	Management control and effectiveness could be improved	. Division managers have limited control . Management decisions are centralized . Labor cost increases exceed inflation . Maintenance overhead is above peer group
1.6 Develop a maintenance information control system	Current management information does not adequately support control	. Parts ordering is not based on usage . No visibility exists for parts cost . Control systems have limited ability to monitor performance . Cost & production data are not reported . Inspections are frequently behind schedule . Vehicle utilization rates are increasing with fleet age
1.7 Develop a training & testing program for maintenance	Current training program is not reflective of vehicle systems complexity	. Inadequate training on complex systems has reduced trouble shooting accuracy . Bus availability falls below needs

EXHIBIT 25

RELATIONSHIP OF PRIMARY ISSUES AND RECOMMENDATIONS
(Continued)

Recommendation	Primary Conclusions	Supporting Findings
2. Develop a strategic plan	A strategic assessment of ridership, service and control tools is needed	. Ridership is low relative to service levels . Public funding expectations not met . Deficit per passenger & mile is increasing . Revenue & cost exceed inflation . Performance monitoring is inadequate . No planning product is embraced as an action plan
3. Develop an absenteeism reduction program	Absenteeism is a costly problem which can be improved	. Operator absenteeism, while decreasing, remains high . Driver productivity is below the peer group
4. Evaluate transportation management responsibilities	Management control and effectiveness could be improved through selected changes in responsibilities	. Division superintendents have limited supervisory authority . Lines of reporting could be better defined . Performance objectives have not been formalized
5. Several organizational and technical recommendations could be implemented in the immediate future		
. Consolidate & elevate the marketing function	. The diffusion of marketing activities reduces effectiveness	. Marketing activities are diffused . Public information & complaints are not tied to marketing
. More clearly define responsibilities among Labor Relations, Personnel, Administration and Employment Administration	. The overlap of labor responsibilities establishes potential for diffusion of management strategies	. Roles of Personnel, Employment & Labor Relations appear to overlap . Both Personnel & Employment interface with unions

EXHIBIT 25

RELATIONSHIP OF PRIMARY ISSUES AND RECOMMENDATIONS
(Continued)

Recommendation	Primary Conclusions	Supporting Findings
5. Organizational & technical recommendations (Cont'd)		
. Consider formalizing the relationship between Scheduling & Rates and Services	. It may be more appropriate to make Scheduling responsible for Rates and Services	. Scheduling is a separate unit, yet service changes require approval from Rates and Services
. Consider the use of a word processing pool	. Use of a word processing tool could minimize hardware cost and maximize hardware productivity	. PAT is evaluating several options for word processing utilization
. Evaluate the role of instructors	. Productivity could be improved by focusing & scheduling miscellaneous activities presently conducted ad hoc	. The current role of instructors is not well defined . Instructors appear to have fragmented responsibilities when hires are low
. Develop a Systems Plan	. Computer needs & investment decisions appear to be progressing in a disjointed fashion	. Mainframe has reliability & capacity problems . Microcomputer needs are being assessed without respect to a systems plan . Additional computing capability available through CRIS hardware
. Evaluate increasing management responsibilities in budget preparation	. Increasing management involvement in budgeting may improve management responsibility to budget	. Budgeting is centralized and reduces sense of management ownership of budgets

The large number of issue areas and the significance of these issues in the prioritization assessment resulted in the maintenance program receiving the highest priority. The individual maintenance issues were symptomatic of the need for a comprehensive formalized approach to maintenance. While labor and material costs were increasing dramatically, bus availability due to equipment shortages was falling below the scheduled vehicle requirements. Therefore, the lack of investment in maintenance problem resolution could negatively impact PAT's financial position and ability to meet scheduled services. Although the implementation horizon for maintenance recommendations included certain long-term issues, system criticality and return to system were very high.

Strategic planning issues received the next highest priority because of the eroding ridership base, the financial implications of this market decline and the need to establish an overall direction for the Authority. Implementation of a strategic plan and updating process could provide only minor direct benefits in the near-term, but would establish direction for the Authority (both internally and externally) in all phases of the operation and, therefore, strong future benefits. The strategic plan should include particular strategies aimed at the reversal of the ridership and deficit trends which could improve PAT's financial integrity and revenue base.

The third priority was operator absenteeism levels which, while decreasing, were estimated to cost the Authority approximately $5 million in 1982. This recent decline in absenteeism still left the Authority below the peer group average in operator productivity. Therefore, if these absenteeism levels remained high, they could diminsh PAT's cost efficiency.

Transportation management and organization issues were ranked as the fourth priority. The extent of centralized control evident in this department diminished decision-making authority and management responsibilities at the divisions, where the Authority could effect the most benefit. Due to the extent of centralization, lines of management reporting were not clearly defined and/or communicated to the divisional (garage) level. Therefore, failure to resolve these issues could continue to limit management control and effectiveness at this critical level.

A corollary need of a more decentralized organization is increased emphasis on management information. Pertinent information at the appropriate level of detail will become more essential to higher-level management to monitor divisional management performance and set policy directives for their implementation. Reporting information was also an issue within the Maintenance Department. Thus, a well-structured management reporting system was included within this fourth priority.

The remaining organizational, operational and technical recommendations received the lowest priority because they represented relatively minor cost and systemwide performance impacts compared to the previously identified issue areas. Since the approach is based on a focused resolution of the highest priority issue areas, the remaining issue areas were selected for Phase II analysis.

* * * * *

The following discussion presents each specific recommendation within the prioritized order of each issue area. The recommendations were developed to resolve the identified deficiencies and to prevent any erosion of the current PAT performance levels.

1.0 PAT SHOULD IMMEDIATELY MOVE TO DEVELOP A STRUCTURED APPROACH FOR ITS BUS AND RAIL MAINTENANCE ACTIVITIES.

Of all the areas analyzed in the PAT Study, the need for maintenance reform surfaced as the most pressing priority. The preceding analysis revealed potential weaknesses in both maintenance management and materials management. Since these two activities are functionally integrated, they should be jointly analyzed. A comprehensive maintenance analysis is proposed which includes the following elements:

1.1 Achieve Control over Stores at the Divisional Level.

Material costs had been increasing at an accelerated rate. Between the period from July 1980 to September 1982, average monthly requisitions had increased by 68 percent. Overall, material requisitions from operating divisions were running $142,000 per month ahead of the prior year's rate of expenditure.

In order to achieve control over material management, the following actions should be taken:

- Document division-based maintenance activities and associated materials management controls;
- Define specific materials management control needs;
- Design forms and procedures for materials management control;
- Define personnel requirements for division-level stores management; and
- Design division stores layouts and define facilities improvements.

1.2 Establish Control over Rotable Components (e.g., Engines, Transmissions) Inventory and Production.

Rotable components are those which can be removed, rebuilt, and then placed in any one of a number of vehicles. Since these are typically not ordered anew when they fail, it is essential that

visibility be maintained on how many spare components are in inventory, and how long it takes to process a component through the rebuilt cycle. This information is imperative when failure rates deviate from the norm, and also for planning and scheduling of maintenance work under normal circumstances.

1.3 Accelerate the Development of Standard Operating Procedures Already Underway.

This recommendation suggests a higher priority be given to the development of standard operating procedures (SOPs) for all major functions, including inspections, servicing and cleaning, and unit overhaul. The merit of developing SOPs is that they document both the process and time needed to carry out specific functions. In turn, management is in an improved position to plan budgetary and manpower requirements, while supervisors can better regulate routine work loads.

1.4 Develop Mileage Estimates based on Scheduled Vehicle Assignments and Changeouts, rather than the Current Fuel Usage-Based Estimates.

Mileage is a critical measurement of exposure in establishing labor and materials needs, and for maintenance evaluation in general. Thus, it must be accurately measured. The most accurate method of establishing vehicle mileage is to rely on schedule information (i.e., the number of miles operated per vehicle assignment per day), modifying it for deviations from the schedule (e.g., returning a bus to its home or other division due to mechanical failure).

1.5 Evaluate the Responsibilities of Maintenance Management personnel as Related to the Functional Requirements of a Maintenance Program.

This recommendation is a corollary to the strategy which suggests that standard operating procedures be developed but at a different level. In order to achieve a successful maintenance program, a number of functions must be both present and integrated. This approach is important in both organizational design and estimating staff requirements. The peer group and organizational analyses inferred that PAT's maintenance organization could be improved to achieve a more structured maintenance program. This recommendation suggests that a more detailed evaluation is required before specific structural and staffing recommendations can be accomplished.

1.6 Develop and Implement a New Maintenance Information Control System.

Information is the central nervous system of a maintenance program. While PAT had some components of the information required for effective maintenance management, the value of an information system is to be able to integrate the various informational components to suit a variety of operational, tactical, and strategic needs. The new information control system should be work order-based and include the capability to capture warranty repairs and monitor component failure rates.

1.7 Develop a Training and Testing Program for Bus Maintenance Personnel.

The intent of this recommendation is to ensure an adequate and stable supply of mechanic skills. Insufficient formal and ongoing training may have contributed to the maintenance problems experienced in

1982. The prevailing practice for supervisors and line mechanics was to acquire skills on the job. While this practice may have been sufficient in the past, the advent of new and sophisticated equipment requires enhanced skill levels. Training course work should stress fundamentals of operational maintenance of such basic units as engines, generators, and batteries. The program, however, should also include specific skills training, such as repairs for electronic fareboxes.

2.0 PAT SHOULD DEVELOP A STRATEGIC PLAN WHICH COMPREHENSIVELY ADDRESSES OPERATING, CAPITAL, AND FINANCIAL PLANS, INCLUDING TOOLS FOR MONITORING PROGRESS.

The purpose of a strategic plan is to establish a structure for making resource allocation decisions. PAT's peer group ranking, as well as ridership shifts occasioned by recent fare increases, indicated that PAT should evaluate its market potential, and define service levels within a known or perceived financial bound. PAT's upcoming Capital Needs Study affords an excellent opportunity to review fixed-facility and rolling stock resources, and to develop a financial plan. These activities should be accompanied by the following developments:

- An operating plan, defining levels and coverage of service;
- A performance monitoring program, to continually evaluate the system and redirect activities, where appropriate; and
- A monthly report to the Executive Director, to establish and monitor performance of PAT's operations.

3.0 DEVELOP AN ABSENTEEISM REDUCTION PROGRAM.

While the scale of this problem had been defined, the characteristics were not. PAT should make the reduction of absenteeism a priority within Transportation, and evaluate the organizational and procedural options for increasing attendance.

4.0 EVALUATE TRANSPORTATION MANAGEMENT ROLES AND RESPONSIBILITIES.

The centralization of decision-making within the Transportation Department placed division superintendents in a position of limited control over division-based operations. One result of this situation is reduced supervisory authority, potentially contributing to higher attendance and discipline problems. Selected decentralization of authority, coupled with appropriate reporting mechanisms to monitor accountability, could make a positive contribution to the effectiveness and productivity of PAT's managers and hourly employees.

5.0 SEVERAL ORGANIZATIONAL AND TECHNICAL RECOMMENDATIONS COULD BE IMPLEMENTED QUICKLY WITH ONLY MINIMAL ADDITIONAL STUDY.

- Consolidate and elevate the marketing function;
- More clearly define responsibility conflicts among Labor Relations, Personnel Administration, and Employment Administration;
- Consider formalizing the relationship between the Scheduling Department and Rates and Services;
- Consider the use by Office Services of a word processing pool to minimize hardware cost and maximize hardware productivity;
- Evaluate the role of instructors in periods of minimal hiring and improve instructor utilization by focusing and scheduling miscellaneous activities presently conducted ad hoc;
- Conduct a comprehensive data processing needs assessment and develop a corresponding systems plan to guide future mainframe and microprocessor investment decisions; and
- Consider increasing the department managers' role in the budgeting process to improve the sense of management responsibility to the budget.

VI. PHASE TWO STUDIES

VI. PHASE TWO STUDIES

Following the completion of the Phase One work effort, four issue areas were selected from the Phase One recommendations for further in-depth analysis. The work programs for these topic areas were jointly prepared by Port Authority and Booz, Allen staff to focus on the highest priority items and utilize study resources (Phase Two budget) in the most effective manner for both client and consultant.

The four Phase Two issue areas included:

- Maintenance Program Evaluation;
- Material Control Program Evaluation;
- Strategic Plan Development Assistance; and
- Executive Reporting System Definition.

Maintenance and material control were combined because of their inherent interrelationships in the supply of materials to maintain buses. The development of the strategic plan was designed as a cooperative effort, combining the resources of both Port Authority and consultant staff. The third priority recommendation, absenteeism, was already the focus of a concentrated effort by the Port Authority. The decentralization of the Transportation Department, the fourth recommendation, was implemented by the Port Authority. One of the important aspects of decentralization is the need for an effective performance reporting system. This mechanism, therefore, became the third issue area for the Phase Two analysis.

The following sections describe the analytical approach, a summary of results and the study resources utilized for the three major issue areas of this Phase Two analysis. The summary of results presents the highlights of each issue area and includes excerpts from the detailed reports.

Maintenance and Material Control

The highest priority issue areas for the Phase Two analysis were the maintenance management and material control programs. The overall objective of this evaluation was to develop an improved approach which would increase PAT's ability to conduct and manage the maintenance function more effectively in the future. The bus maintenance program was selected for the evaluation because it represented a larger proportion of the total maintenance budget than light rail and also because of the reduced rail service levels during system reconstruction.

A case study approach was employed to focus study resources on a single bus garage. East Liberty bus garage was selected because it was the largest and also at or near the lowest-performing garage in the PAT bus system. East Liberty, therefore, provided the widest scope for the study and the visibility of the maintenance and material control-related issue areas.

Effective and efficient maintenance management, like that of any production line operation, will be attained when management has the ability to plan, schedule, control and document the major individual activities. Conversely, management can plan, schedule and control these functions only when it has the necessary visibility of these activities in the 24-hour maintenance environment of a large public transportation environment. Management visibility is attained through the availability and use of decision support and information reporting systems which make available the support data for effective decision-making.

The focus of this maintenance and material control evaluation was to identify improvements to these particular areas. This would, in turn, provide the capability for management to better utilize its resources (labor, material and support facilities) in maintaining Port Authority buses. The resulting symptoms of increasing material costs, high absenteeism, insufficient bus availability, and late inspections should improve as a result of this approach to maintenance which increases the direct responsibility of line managers and provides them with the proper tools to successfully undertake this responsibility.

Analytical Approach — This evaluation examined the methods, procedures, and information availability used to manage PAT's bus maintenance program. Maintenance program management consists of the methods used to plan, schedule, control and document each activity in the maintenance operation. These methods include the policies and procedures to perform each activity and the data collection, documentation, and information to guide the utilization of maintenance resources.

The techniques applied in this evaluation were driven by the style of maintenance and material control operation in effect at the time. Historically, maintenance has benefitted and suffered from two styles — formal and informal. In a formal structure, the procedural and information support systems are well defined and are documented in a consistent manner. The planning and assignment of maintenance tasks are systematically structured to optimize maintenance staff and the support facilities to ensure the required vehicle availability. The formalized work scheduling process permits a constant flow of maintenance tasks, thus avoiding the peak and ebb work flow of the more informal maintenance approach.

The informal system, which reflected the existing operation of PAT, is comprised of undocumented procedures and insufficient information systems, and is usually more reactionary to vehicle maintenance needs and more focused on the scheduled vehicle requirement. Planned maintenance tasks typically represent a smaller proportion of the total work time in the informal system. This approach is also more "people" dependent as compared with the formal systematic approach and is susceptible to changing conditions of new employees, vehicles and/or equipment.

The procedures and daily practices in the PAT system needed to be documented through interviews and observations with management, supervisory staff and work force representatives prior to system evaluation. The following techniques were employed first to document the current operation and then to evaluate the maintenance program management and material control procedures.

- In-Depth Interviews -- This technique is especially useful in determining informal procedural, accountability and control methods, and documentation of data capture, information reporting responsibilities and reports generated in the conduct of bus maintenance and material control activities.

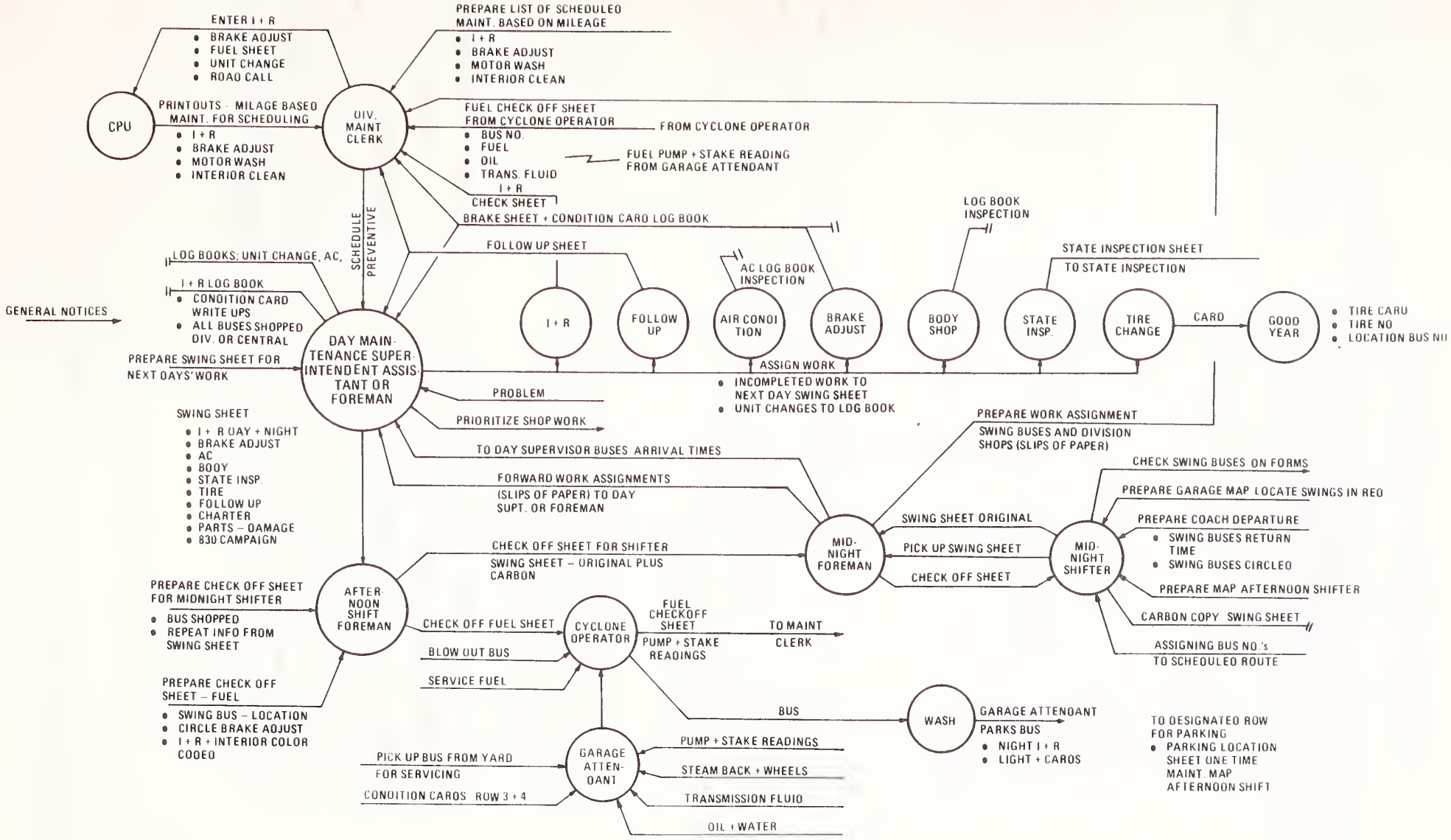
- Structured Analysis Technique — This technique involves the development of diagrams for position descriptions and process flows to depict the informal procedures and the capture, reporting, and utilization of information in the maintenance and material control process.

The combination of these techniques was employed to prepare work flow diagrams such as the work scheduling and control diagram for the East Liberty bus garage as illustrated in Exhibit 26. These process flow diagrams were used to analyze the maintenance system and then develop a preferred approach. The maintenance and material control procedures were documented for each functional activity — preventive and corrective maintenance, bus servicing and cleaning, material requisitioning, and consumption. Charts were developed for each functional activity to define process flow. Each major job classification involved in the activities was also diagrammed to further describe its involvement.

The maintenance and material control information systems were cataloged to identify the type of information used to manage these functions. This involved an indexing of the forms used, primary users, data collected, how the data are processed and what information is reported and used. This effort described the information available to support the planning, scheduling and control of maintenance activities.

The results describe PAT's approach to the issues of maintenance program management and material control, and graphically show the procedures in place to support these efforts. These baseline procedures were subsequently evaluated for clear definition of objectives, closed-loop operation and data collection, and a defined set of checks and balances for the control and allocation of maintenance resources.

EXHIBIT 26
PORT AUTHORITY TRANSIT
WORK SCHEDULING and CONTROL DIAGRAM
PROCESS FLOW — EAST LIBERTY DIVISION



The level of staff effort, in hours, was developed to estimate the cost to support the maintenance information documentation system. This cost in staff time was then compared with its impact on the management of maintenance and material control functions. Deficiencies were then identified within this program structure. The recommendations stemming from this analysis were formulated into short- and long-term improvement programs.

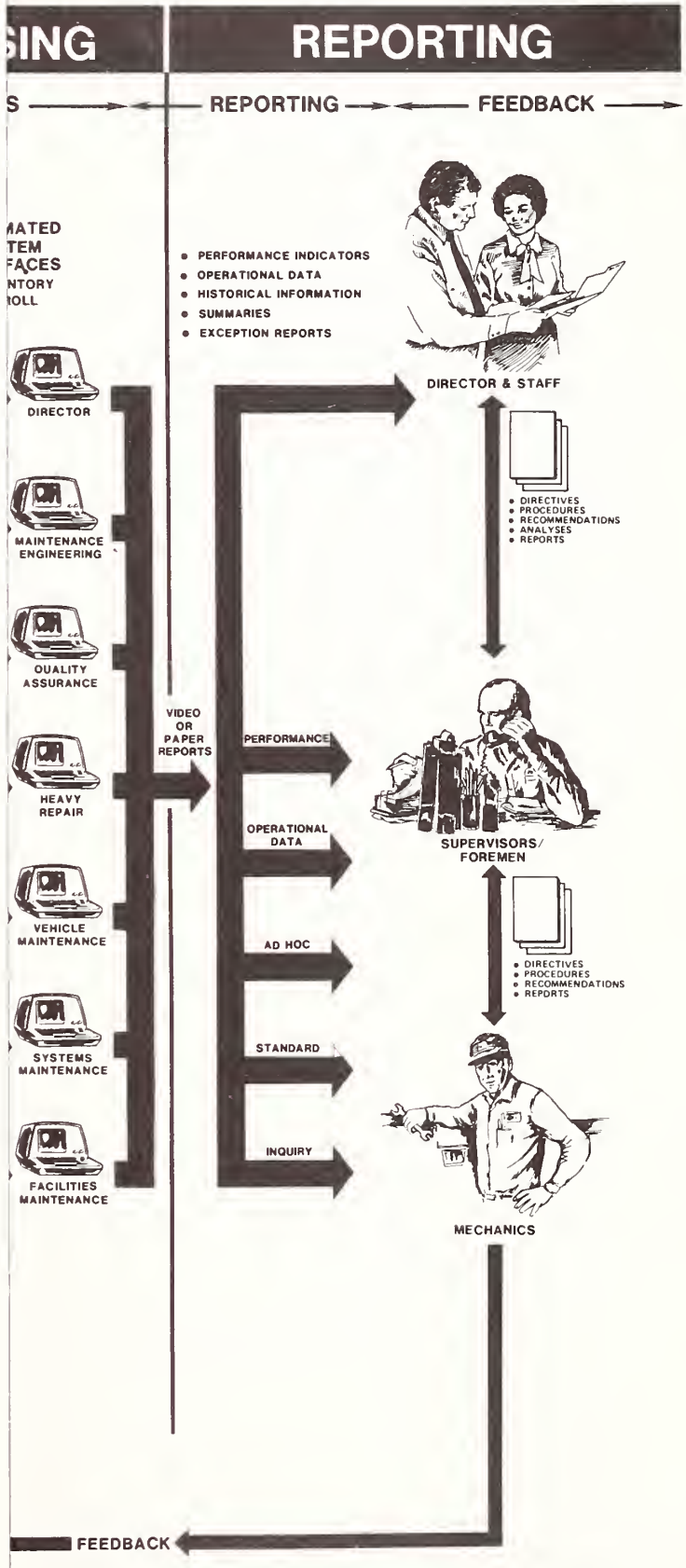
Maintenance System Concept — The objective of a documentation system is to supply management with the information support to maximize maintenance productivity and vehicle reliability and thereby minimize maintenance cost. This can be achieved by improving the capability of management to plan, schedule, and control maintenance tasks to be performed — today, next week, and further into the future.

The process of collecting, storing, analyzing, and reporting maintenance information is the nervous system of a maintenance organization. The quality and completeness of that information directly influences the effectiveness and efficiency with which maintenance activities are executed. Therefore, the definition of this documentation system concept will set the stage for program management improvement.

The general characteristics, flow and capabilities of a preferred approach are illustrated in Exhibit 27. This illustration is a conceptual model for the PAT bus maintenance documentation system.

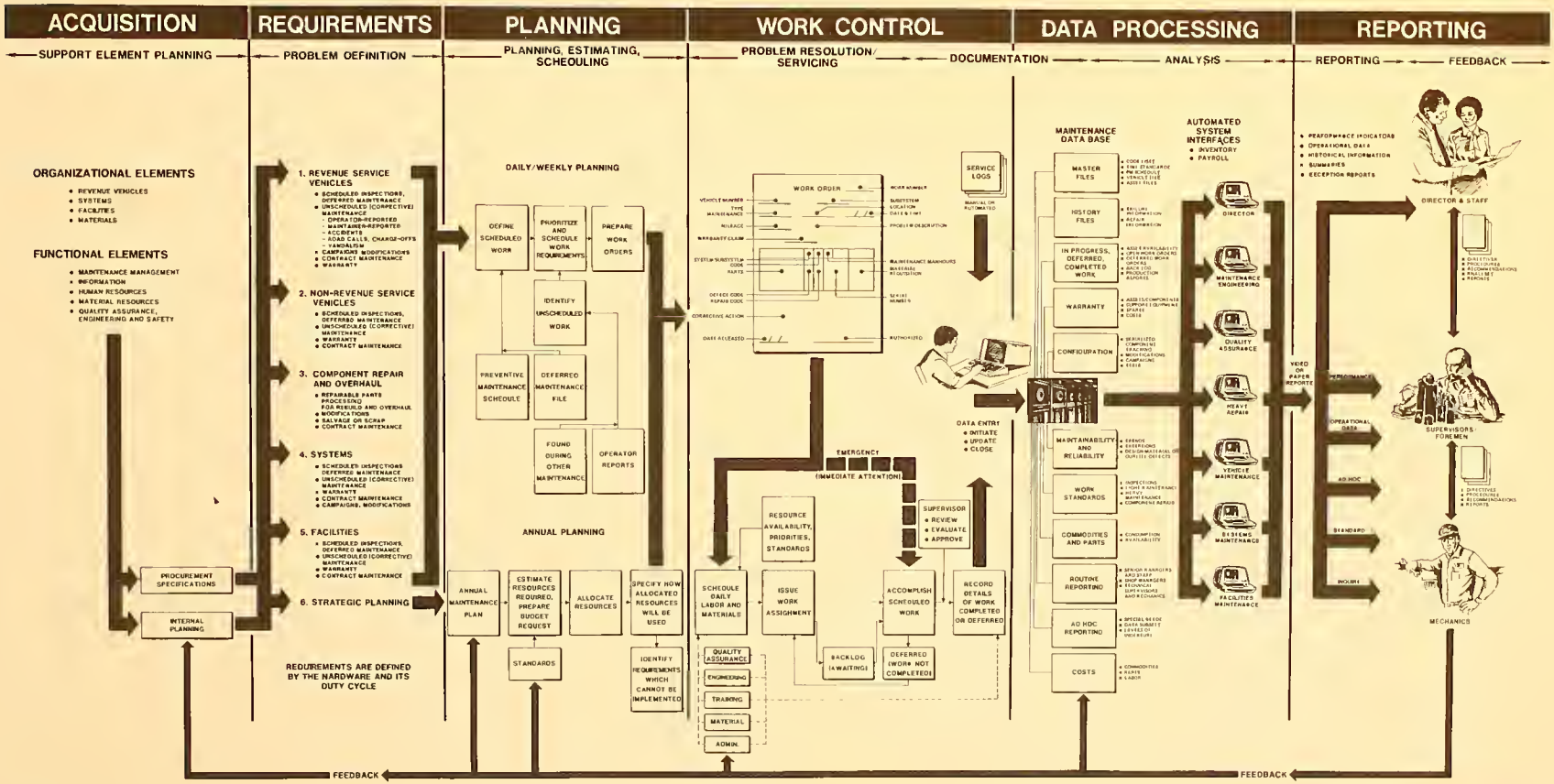
The model begins with a definition of the system support requirements. The six subject areas noted are specific to PAT. The given conditions of the PAT operation are noted alongside the capabilities a documentation system should provide in each subject area. If PAT decides to implement this approach, the first step in the development of this maintenance program is the detailed definition of the system support requirements. The system is represented by the scheduled level of service and the resources available to maintain the operation of this service.

STEM CONCEPT



The level of staff effort, in hours, was developed to estimate the cost to

A BALANCED MAINTENANCE MANAGEMENT AND INFORMATION SYSTEM CONCEPT



The second stage of the model is the general procedures for planning, scheduling, and controlling maintenance. The advantage of the model in this stage is that this approach emphasizes and delivers the capability to increase the amount of maintenance time applied to preventive activities from a current estimate of 25 percent to as high as 75 percent. If 75 percent of maintenance time could be preplanned and then controlled through a central control center, the peak vehicle demands would not interrupt the scheduled flow of maintenance work through each work day.

The third stage is the heart of the concept with the identification of the main data collection form. This form is a work order which replaces a significant number of the manual reports and logs currently used. The work order would be completed for every type of maintenance activity. It would also be the key source of assigning work and identifying it in the control center. The work order numbering system should also be tied into the operations control center where revenue incidents are recorded and logged. The two numerical identification systems could be interlocked where the roadcall incident number would automatically become the work order number. This process would increase the capacity for maintenance engineering — problem definition and the component redesign of its solution.

The fourth stage follows this line of collecting the type and detail of data which can contribute to problem identification and problem resolution. The model displays 11 major categories of information analysis and support. The majority of these topic areas cannot be routinely analyzed within the current system. Analysis of reporting information available in this stage supports improvement in the key maintenance indicators of mean time to repair and mean time between failures.

This type of information will not only benefit the maintenance operating divisions but also other departments in PAT which actively interface with maintenance. This interface capability can be accomplished in two ways. One would be access into the maintenance system via printed reports and CRT video

screen file access. The other way is through direct system-to-system automated interface. Both of these methods should be considered because ultimately they could reduce maintenance manpower time applied to manual reporting. A summary of the current operating and support interfaces and the additional options available under this model are presented in Exhibit 28.

The final stage of the model is the definition of reporting and system access capacity. Standard performance reports should be automated and delivered to the appropriate manager without any direct contact or input from the operating divisions. The required information should be directly accessible. The job standards, preventive maintenance interval tracking and equipment status positions will contribute to a more practical and useful maintenance work schedule. Also, the troubleshooting and diagnostic analyses performed by the lead mechanics and foremen will improve through readily available CRT access to the bus history files.

The conceptual model that has been presented here is a significant change from not only the current documentation system but also the entire program management. To be successful, this proposed system would require in-depth pre-planning and personnel training to transition into the PAT operating environment.

Material Control — The establishment of an effective material control system and procedures to support bus maintenance activities is complex and dynamic. The control process must begin at the point of acquisition and procurement. This requirement can only be satisfied by the existence of an effective asset management and property control accounting system, whereby management visibility is maintained on material entering (or leaving) the system inventory. Unfortunately, it is not unusual to find significant breakdowns in coordination and control between the operating activities concerned with purchasing and those activities concerned with consuming materials. Likewise, it is not unusual to find that the fundamental interfacing, operating and control

EXHIBIT 28
PORT AUTHORITY TRANSIT
MAINTENANCE DIVISION-LEVEL INTERFACE ACTIVITIES
(Current and Potential)

Departmental Interface	Major Current Interface Activities	Additional Interface Activities
Accounting/ Payroll	Multiple Manpower Reporting Records Absenteeism Reporting Accident/Injury Reporting	Material & Manpower Cost Accounting by Division & Maintenance Function
Budgeting	Limited Interface	Manpower & Skill Level Forecasting Material Consumption Forecasting
Maintenance Engineering	Limited Interface	System & Subsystem Performance Evaluation Defective Parts Identification Preventive Maintenance Program Modification
Operations	Daily Status Reporting Roadcall & Bus Change Notification	Rail-Time Status Reporting Real-Time Roadcall & Bus Change Resolution
Personnel/ Training	Manpower Reporting (Staff Avail.) Accident/Injury Reporting Absenteeism Reporting	Training Needs Programming (Staffing & Skills Level Comparison with Work Load) Exception Reporting of Mechanical Performance below Standards
Purchasing/ Procurement	Parts/Consumables Requisitioning Parts Requirement Liaison	Actual Material Consumption by Task and Bus Services Reclaim Unit Life Cycle Documentation Defective Parts Identification Back Order Priority - Buses Out-of-Service, Awaiting Parts

policies and procedures have either not been formally defined or, in total, do not consist of a complete closed-loop system. The benefit of formal control policies and procedures in a closed-loop system is the supplier-user coordination necessary to support maintenance and reduce total material costs.

The common result of an informal system is the tendency to over-requisition quantities and indulge in parts' and materials' hoarding at the expense of total organizational performance. Although not precisely quantified, the dollar consequences associated with over-requisitioning and hoarding are significant. Moreover, these same practices are in direct conflict with efficient stock status and inventory control objectives. Excessive requisitioning and parts stock produce negative impacts in the inventory control process. They disrupt stock level accounting and ultimately contribute to invalid usage or consumption data, incorrect stockage and reorder point objectives.

The automated inventory control system at PAT performs well within the existing operating constraints. The evaluation identified deficiencies in the overall material support process which can be corrected through minor modifications in the short term. Priority codes should be initiated for the requisitioning of bus parts from central stores. This priority code would define the necessity for the part and would guide the central stores and expedite functions on fulfilling requisitions on a basis of need.

An on-hand stock status for each division storeroom should be established to limit the process of requisitioning to fill bin storage space as opposed to bus maintenance requirements. This should reduce the excess inventory situation (East Liberty) and thereby reduce inventory carrying costs. A reclaim unit control tag should also be initiated for the short-term manual control of reclaim units. The tag should stay with the unit throughout its life cycle to track the mileage on the unit and its remaining life span. This control tag will also support a manual production control system for the central shops.

The parts room attendant staffing level of one full-time, single-shift operation at East Liberty should continue. With the large number of buses and bus types assigned to East Liberty, it would not be feasible to go to a bench stock situation with no parts room attendant.

Performance monitoring of the material control process should be initiated. This could be an additional reporting loop of the automated inventory control system. Examples of pertinent material control performance measures include:

- Requisitioning Status — no stock, partial fill, and complete fill (percent of total);
- Backorder items as a percent of total requisitions; and
- Time line portrayal of backorder status and requisition status — total versus time to fill.

These performance measures are not meant to exclude other reports which may be desirable, especially on an ad hoc basis. These recommended measures focus on requisitioning activity between the divisions and central stores. As such, they would promote improved management visibility of the material control process.

In the long term, the inventory control system should be expanded to the division storeroom level to work in conjunction with the recommended work order control maintenance program. At that time, it would be more appropriate to expand the divisional storeroom staffing to full coverage and operate the storeroom as a secure unit with counter service for mechanical parts requirements.

Implementation Plan — The acquisition and implementation of an automated system for maintenance would not correct deficiencies or program imbalances that are already inherent in the maintenance operating concept, work control method, or organizational structure. Consequently, it has proven to be much more effective to establish an appropriate baseline maintenance program first, and then develop an information system that conforms to the predetermined information support requirements. From a systems design viewpoint, the information system should be designed to conform to the maintenance operating concept, not the reverse.

For PAT, the recommended approach is, in the short term, to develop a manual work order-based maintenance control program for the maintenance divisions and central shops. Once the data collection forms and procedures are finalized to fit PAT, the supporting maintenance procedures should be formalized to conform with this new process. A status control center at each division maintenance office should be introduced as a key feature of the work control program to identify the status of buses requiring maintenance action — all on a pre-planned and scheduled basis.

The objectives of this work order-based maintenance control program would be to introduce a systematic methodology to the conduct of bus maintenance; to establish a more effective maintenance data collection and documentation system; and to direct more management and supervisory time and effort to the primary business of planning and controlling maintenance. Too much management time and effort is currently concentrated and expended on meeting daily bus availability to fulfill revenue service requirements and the paperwork documentation of the operation. This management style is reactive in nature and focused on issues which can no longer be controlled and are after the fact. The proposed work control method would formalize the daily routines of scheduling, performance and documentation of maintenance and therefore preserve management time for the more appropriate planning and controlling functions.

In the longer term, PAT should automate and integrate the entire work order control maintenance operation. This system will then fully support the maintenance planning, scheduling and controlling functions. The maintenance program and supporting information system will interact with material control through the documentation of material consumption by maintenance transaction, and payroll accounting through manpower availability and manhour consumption to transaction.

To accomplish these recommendations, PAT will require a firm commitment to automation. This commitment will surface in an increased staffing requirement of maintenance clerks, increased emphasis on maintenance training -- both existing

and new staff and increased data center availability — from 12 hours a day to 24 hours a day, seven days a week. The PAT maintenance improvement program, as presented, is a bold step forward compared to the existing PAT maintenance operation. This approach has been initiated by other transit systems and has also proved effective in other transportation operating environments.

Study Resources - Maintenance and Material Control — The combined evaluation of the maintenance and material control programs increased the integration of the analysis, thus coordinating the recommendations to account for both issue areas. Specialist staff were added to the study team with the necessary experience in maintenance and material control program development. This combined study required a budget of $73,000, which was funded through the overall Phase Two budget.

Strategic Business Plan

The development of the Port Authority Transit's first Strategic Business Plan was identified in the Phase One study as a priority issue area. The actual preparation of the Plan was undertaken by the Planning and Business Development Division of Port Authority Transit. Booz, Allen's role was to prepare the process design and then provide direct support in the definition of the goals and objectives in cooperation with the PAT Board and Executive Director and assist in the development of tactical programs for the achievement of each objective.

The following discussion presents the definition of the process and then a summary of the actual Strategy Plan. The process definition is oriented toward guidance in the development of an effective strategic planning process and plan for PAT. The Plan summary is an excerpt provided by the Port Authority's Planning and Business Development Division which describes the general results of the final Strategy Plan. A more detailed version of the full Strategy Plan is available directly from Port Authority Transit.

Introduction -- Transit systems operate in an environment characterized by complex operating, revenue and service problems. Traditional management philosophies employed by transit officials are being scrutinized because of concern over their appropriateness in dealing with a less certain future. The public has become increasingly resistant to the standard crisis management reaction of boosting fares and cutting service. The transit management dilemma could become more intense as the Federal government attempts to reduce its assistance to urban transit.

Analytical Approach — Port Authority Transit recognizes that an effective strategic planning system will help PAT optimally solve its complex problems. Since the existing management process and organizational structure is designed to run the business and not to do planning per se, managers of different activity centers may not be able to synchronize their individual planning efforts to implement the best overall solutions for PAT.

The ideal strategic planning approach is to integrate the role of each department to:

- resolve critical issues;
- clarify objectives;
- define expectations; and
- control results.

Overall, the two major components of the process involve management's establishment of a system which provides the Authority with identity and control of its activity centers.

- Identity — Identifying direction for the Authority by first specifying its operating environment; and second, formulating plans (including contingencies) to operate within the environment.

- Control — Implementing actions to achieve plans by mobilizing resources in a systematic and synchronized manner.

The process will establish a more effective operation by providing a framework in which to:

- Identify Direction, which involves:
  - building an advance warning system of environmental changes -- demographic, economic, social, political, technological;
  - defining the role of market analysis in structuring fare policies;
  - defining the optimal relationship between the regional planning and political organizations and the transit agency; and
  - increasing private-sector participation where appropriate.
- Establish Control, which involves:
  - determining structure to assess future hardware and facility needs;
  - defining procedures to effectively expend funds for capital assets;
  - linking the Strategic Plan to the budget;
  - optimizing labor and service costs; and
  - establishing a performance monitoring system.

Organizing to Plan -- The strategic planning process should be designed by the managers who will eventually use the process to make decisions. The participating managers should seek to implement a process that minimizes the Authority's need to fight fires.

Everyone concerned with providing transit service should be represented in the strategic planning process at PAT. The Planning Department should head-up a Management Committee which consists of senior executives of the organization to guide the process. The Strategy Committee, consisting of Planning Department managers and senior technical representatives from the other departments should guide staff training, technical analysis, conflict resolution, technical content and deadline management.

The Management Committee should develop:

- a budget for the process;
- a timetable for the process;
- a defined set of task leaders and subcommittees; and
- a mechanism to review task reports.

The Management Committee should also have the ability to engage others in the planning process for specific periods, when needed.

The strategic planning cycle should be scheduled to precede the annual budgeting process. The first few times through the development process will require a more concentrated study effort but should eventually involve updates to the environmental scan and the strategic options based on the identified changes. This will also involve "re-visiting" the objectives of the Authority and particularly the selected performance standards in reflecting on actual performance.

Business plans should be developed by each departmental unit to tie the Strategy Plan to operational implementation. These unit-level business plans should relate the Authority goals and objectives into direct-line operational measures of performance. In addition, the individual business plans should set schedule and performance targets to ensure that the Authority's strategies are implemented.

- Demonstrate how the strategies should reduce the firefightng of each manager's day-to-day decision-making;

- Eliminate the natural managerial conflicts of interest created by the difference in timeframes of the one- to five-year Plan versus the weekday operating cycle; and

- Eliminate any potential conflicts from a perceived overlap of activities by optimally dividing responsibilities and working out differing points of view.

The Planning Process — The strategic planning process PAT employs should involve 10 interactive steps. Exhibit 29 presents a flow diagram of the major steps required to help management establish direction and control for the Authority and its activity centers. The first six steps listed below provide a mechanism for PAT management to set the direction of the Authority in the context of its environment:

- External Environmental Analysis;
- Situation Audit;
- Stakeholder Expectations;
- Strategic Options;
- Quantify Options; and
- Mission Statement.

The remaining steps are essential to controlling actions and results and consist of:

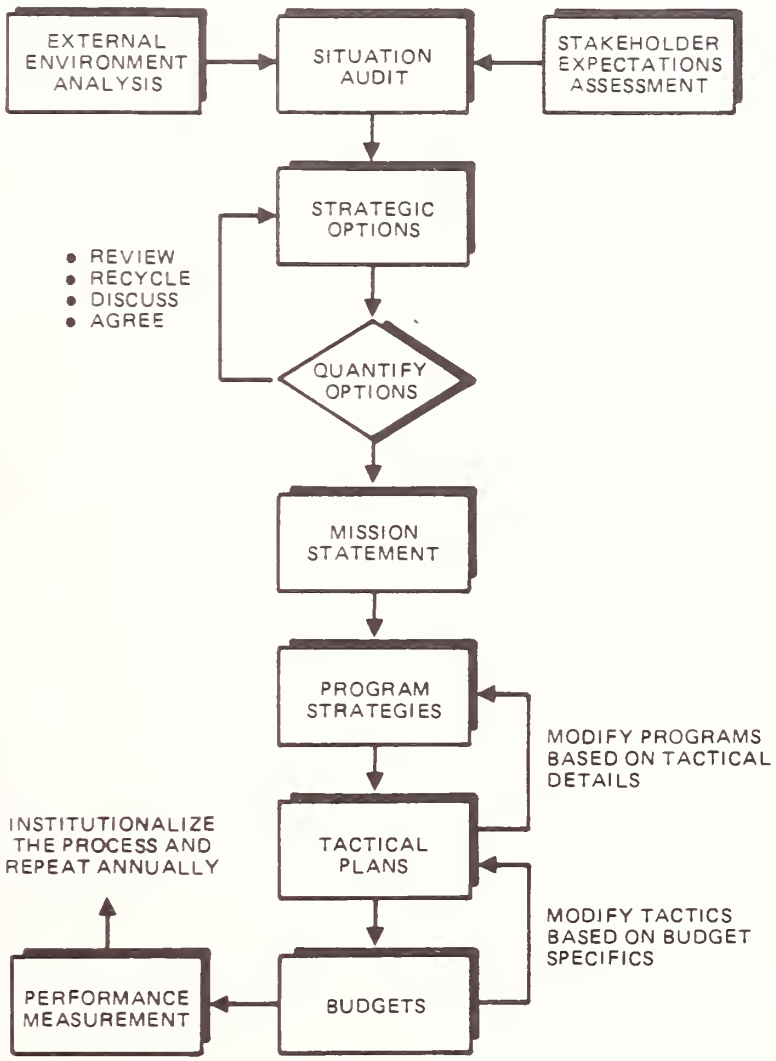
- Program Strategies;
- Tactical Plans;
- Budgets; and
- Performance Monitoring.

Establishing Direction — Step I: External Analysis — The purpose of the environmental analysis is to:

1. Help define strategic options;
2. Assess future financial and market constraints;
3. Define the organizationl structure required to confront externalities; and
4. Help define the mission statement.

In analyzing the external environment, PAT strategic planners should identify the long-range economic and demographic factors which shape the supply and demand for transit services. All too often, management underestimates the impact these factors have on the implementation of their business plans. The factors include:

EXHIBIT 29
PORT AUTHORITY TRANSIT
STRATEGIC PLANNING PROCESS FLOW DIAGRAM
of MAJOR STEPS



- Unemployment levels which show a significant correlation with transit use;
- Government financial support (Federal, state, local) which is increasingly unpredictable;
- Competition for market share and financial resources;
- Changes in disposable income, automobile ownership, population and other demographc factors; and
- Regulatory policy impact on energy and claims costs.

To analyze the impact of these factors on PAT, the Strategy Committee should identify specific data required to define and then monitor the environment. PAT strategic planners may find most of the data are available from various government agencies, the local Metropolitan Planning Organization or the Chamber of Commerce. Other valuable sources of demographic and economic information include local public finance departments and universities.

Effective external analysis may involve a wide range of analytical methods. Their use is grounded in tradition and the discretion of the strategic planner. These methods might include:

- Secular analysis;
- Correlation analysis;
- Expected value analysis;
- Input-output analysis;
- Business cycle analysis;
- Legislative tracking analysis;
- Cost-benefit analysis;
- Unit cost and other ratio analysis;
- Cash flow analysis;
- Attractiveness/benefits arrays;
- Regional financial analysis;
- Actuarial analysis; and
- Goal-programming analysis.

Many analyses will not fall within a specific category. In fact, most analyses simply involve organizing the environmental data in a way that management can use them to assess the positive and negative implications of a situation.

Products resulting from this step, which will probably originate from other agencies, include the changes in land use and its implications for transit needs. Studies by other organizations, which forecast the future economy of the region, will indicate the level of transit service that the region can afford.

Studies which forecast technological change may be equally as important as studies of factors which influence future transit demand and affordability; although subtle, technological change will continue to play a major role in shaping the environment of work and recreation. The Authority will also have to respond to these changes if it is to remain a valuable public service.

Step II: Stakeholder Expectations — The stakeholder analysis defines the "reason to be" for an Authority. It is the major step in defining the charter for an Authority. Stakeholder analysis involves defining interest groups and their expectations of the Authority. The stakeholder analysis step assesses the "human" dimension of the environmental analysis. This step is an adjunct to the external analysis step which assesses the "physical" dimension of the environmental analysis.

Stakeholders generally fit into six broad categories:

1. Providers of funds (governments and riders);
2. The citizenry at large;
3. Locally-elected officials;
4. Employees and managers;
5. The Board; and
6. Special interest groups.

PAT should inventory the positions and expectations of each stakeholder, including their written policy statements. There exists a stakeholder expectation for every aspect of the Authority's existence. The expectations are targeted at every level of the Authority's hierarchy. Therefore, PAT might design a meeting schedule to elicit stakeholders' views. These meetings might also involve soliciting their recommendations as to how the Authority should operate within its environment.

PAT should attempt to systemize its evaluation of all stakeholder expectations. A matrix analysis might identify the position and expectations of each stakeholder on each policy issue. PAT might assign different weights to each position and expectations as a function of the particular stakeholder and policy issue which gives genesis to the position or expectation. Next, the Authority might summarize and rank the alternative positions and expectations of the diverse stakeholder groups to determine the range and sensitivity of its policy options. A ranking system could help PAT develop a clear and defendable perspective of the often conflicting stakeholder demands it confronts. A clear perspective of stakeholder expectations will often provide the mandate a transit agency needs to overcome the decision paralysis which public controversy perpetuates.

Step III: Internal Environmental Analysis — The purpose of the internal environmental analysis is to identify "levers" for improving current resource utilization. The internal analysis will identify the strategic options transit managers possess to respond to the expectations of stakeholders and the constraints imposed by the external environment.

The internal analysis is a comprehensive assessment of the current state of operations, facilities, rolling stock, personnel and organization. Thus, the analysis provides a "balance sheet" of the strengths and weaknesses of both the Authority's physical and human assets.

The Strategy Committee should work with the operating managers to determine criteria of evaluating asset strengths and weaknesses. For example, asset values may be assessed by comparing the condition of the Authority's assets with industry averages. Variables such as equipment age, mileage, maintenance costs, operating costs, capital costs, operating problems, training requirements, number of breakdowns or failures, and various ratios of each variable will often provide sufficient criteria to evaluate asset condition.

Further, PAT should design a method to translate the various asset assessments into a common ranking system to fairly compare the status of unlike assets. The opportunities and threats associated with the condition or value of each asset will help prioritize future resource needs. Thus, the relative importance of PAT's resources will be established against various demands and constraints imposed by the external environment.

Step IV: Strategic Options — Discussing the available options will be a critical step to determine the appropriate direction for PAT within its complex operating environment. PAT should totally integrate the results of the environmental scan with an audit of its tangible and intangible resources. Cause and effect relationships should be identified among all the variables in the environmental scan. This integration might range from a general qualitative linkage to a sophisticated input-output model. Regardless of the approach selected by PAT, management should define a complete picture of the operating environment. However, developing an accurate picture of a complex environment is not easy. Effective option definition first relates all the variables which shape the different views of the government. Next, once the points of view are clarified, the option analysis provides a forum in which the alternative, disputes, or controversial positions are acknowledged by management. The positions are analyzed and presented for debate by the Strategy Committee.

Step V: Quantify Options — During the review of alternative scenarios, management should form its conclusions by assigning probabilities or expected values to the expected implications of each scenario.

Focused and unbiased options analysis (at the system level) is vital to optimum transit decision-making. The issues which exist within and across the finance, marketing, operating, facilities, personnel and administrative departments have proven themselves too complex for individual departments to manage in isolation. For example, are PAT financial resources ever "fixed"? If financial resources become "fixed", what should be the effect on service levels, operations, facility expenditures, personnel levels and organization? Do across-the-board or marginal service cuts represent the optimum decision? The answer to these and other options will require the ability to calculate (at a system level) revenues and operating and capital cost implications for different scenarios.

Step VI: Mission, Objectives and Goals — The formation of the mission statement and supporting goals and objectives will specify the intended direction of PAT. Once the environmental issues have been resolved and the options for direction have been defined, PAT could develop a workable mission statement. The mission statement would define the desired role of the Authority within its operating environment. The mission statement will be the key means in which PAT communicates its direction and means of control. The mission statement will provide concrete communication to the stakeholders and it will provide guidance to managers throughout the Authority.

The mission statement and associated goals and objectives can reduce the vacuum in which lower management must often make decisions. The Board of Directors and General Manager are not directly involved in the myriad of daily decisions which are made throughout the organization. Therefore, the mission statement will help middle management make compatible decisions which advance PAT in the chosen direction. The mission statement will also guide management in establishing departmental and unit specific goals and objectives.

Goals are the future achievements or accomplishments PAT wishes to attain in view of its mission. Overall goals might involve:

- Satisfying regional transit service needs;
- Coordinating the development of land use;
- Solving regional social problems;
- Preserving environmental resources, air and energy; and
- Maintaining a stable financial base.

Objectives are the quantitative attributes which surround goals such as timing and financial and operating performance measures. The issue analysis will define the ability of the internal environment to withstand risk while the external and stakeholder analysis defines the universe of opportunity and risk.

The Strategic Planning Committee will be the facilitator for this analysis. They will ensure that the analysis reflects the implications of each option for the Port Authority. However, the final responsibility for establishing the overall direction of PAT will rest with the Board. Therefore, the Strategic Planning Committee should provide clear analyses on options and issues and succinctly communicate these to the Management Committee, Executive Director and Board.

Maintaining Control - Step VII: Strategy Development — Port Authority Transit management should determine how it will attain its goals by identifying, evaluating and selecting strategic alternatives. The strategy development process should integrate management understanding of its intended direction with controlling the pursuit of the transit agency's future.

Effective strategy formation stems from defining courses of action (including contingency plans) which will lead to the achievement of goals and performance objectives while considering the environmental constraints. The constraints might exist as contractual agreements, funding agency or other regulations.

The strategies should involve a mix of areas, including:

- Ridership;
- Pricing;
- Regional development;
- Cost efficiency;
- Marketing;
- Employee productivity;
- Operating performance; and
- Financial potential.

The key parameters that the Strategy Committee will use to ensure that PAT strategies optimally support PAT objectives will involve checking the strategies for:

- Compatibility with other strategies;
- Consistency with the external environment;
- Relevancy with available resources;
- Satisfactory return;
- Satisfactory risk;
- Correct time horizon;
- Workability; and
- Management consensus.

Step VIII: Tactical Project Programming — Tactical project programs integrate the formation of the overall Strategic Plan with the development of Business Plans detailing annual operating and capital budgets. Programming first entails identifying projects whose activities compete for resources, including:

- Labor;
- Materials;
- Services;
- Equipment; and
- Facilities.

These resources are distributed among and controlled by the various departments and supporting units within PAT which might include:

- Affirmative Action;
- Board;
- Budgets;
- Capital Development;
- Claims;
- Community Affairs;
- Data Center;
- Equipment Engineering/Maintenance;
- Executive Director;
- Facilities;
- Field Revenue;
- Financial Services;
- General Attorney;
- Insurance/Pension;
- Internal Audit;
- Labor Relations;
- Law;
- Management Services;
- Materials Management;
- Operations Planning;
- Personnel;
- Public Affairs;
- Real Estate;
- Safety;
- Strategic Planning;
- Transportation;
- Treasury; and
- Workers' Compensation.

A significant part of the tactical planning process should involve analyzing the various proposed project activities to determine which will best support Authority strategy. Traditional project analysis approaches should be used to evaluate projects, including:

- Resource cost/benefit effectiveness;
- Operations analysis; and
- Return-on-investment.

Project programs should be selected by senior management during a series of meeting presentations organized by the Strategy Committee and the operating groups. The presentations of alternative programs will force management to deal with the conflicting demands each project presents.

Once management selects a particular program, it should select a program manager to manage each project. The program manager should work across

organizational lines to ensure that the detailed aspects of the project are reflected in the capital and operating budgets of the relevant PAT departments. Matrix organizational structures are typically used to temporarily reassign employees from regular staff duties to contribute to these special teams.

Step IX: Budgeting — Budgeting should involve assessing the impact of the strategies on the operating levels of each PAT department. Gross estimates for the relative resource demands of each program will be determined by each department. A major product should be a conversion matrix which provides a crosswalk from the tactical programs to the organization budgets. These present line item detail for the various resources utilized by department. Management might structure the operating and capital budgets similar to the following for each department:

	Equipment Maintenance ($000s)					
	1985	1986	1987	1988	1989	1990
Program Activity						
1. Add a New Route						
Labor						
Materials						
Supplies						
Services						
Equipment						
2. Build Maintenance Shop						
Labor						
Materials						
Supplies						
Services						
Equipment						
...						
...						
...						
20.						

Step X: Performance Measurement — The Strategy Committee, working with the budgeting people, should provide input to the reporting of management results and the measurement of performance. In Step X, the planners should ensure the reporting system format tracks the planned versus actual achievements. Finally, in Step X, the strategic planners should determine the consequences of Plan deviations for analysis and decision-making in future planning cycles.

Timetable/Milestones — For each of the 10 steps of the presented planning process, the following general activities should be undertaken to facilitate task management:

- Activity 1 — Define required analysis.
  - Present
  - Proposed
- Activity 2 — Define the procedures for applying the results of the analysis.
- Activity 3 -- Assign individual responsibilities for conducting the analyses.
- Activity 4 — Construct a network plan to control the timeliness of the analysis and presentations.
- Activity 5 -- Construct a calendar of analysis completion dates and meeting schedules.

The Strategy Committee should integrate all of the planning and analysis done by each activity center. In addition, the Strategy Committee might recommend other analyses to supplement or complement existing planning methods in the various transit agency departments.

The Strategy Committee should develop flow diagrams to describe planning and analysis procedures. The diagrams would identify the planning tools applied in each step. The flow diagrams might also depict process procedures by identifying the relationships between the planning and analysis assignments in each activity center. One set of flow diagrams would also identify how the specific inputs and

outputs of various analyses interact. Another set of flow diagrams would depict the required interaction between all members of management to implement the planning process.

To ensure the timely synchronization of each activity in the planning process, the Strategy Committee should employ a version of the network planning technique to manage the strategic planning process. Thus, the Strategy Committee should have little difficulty using the technique with Authority department managers and senior executives. The Strategy Committee should apply the key milestones from the network analysis to a calendar for Fiscal Years 1985 and 1986. During the year, executive management will be able to use the calendar to manage the planning activities throughout the Authority. If an activity misses a target date or has occurred ahead of schedule, the Strategy Committee will be capable of helping senior management determine:

- The impact of the situation;
- The degree of available flexibility; and
- Options to stay on schedule.

By providing this capability, the Strategy Committee will become a valuable aid in establishing dynamic control of the planning and analysis activities throughout the Authority.

* * * * *

The Plan - The Strategic Business Plan has been developed to enable the Authority to increase its effectiveness by targeting scarce resources to have the greatest impact.

The Authority's problem areas can be restated as a set of goals, achievement of which will permit the organization to more effectively carry out its basic mission and provide service more responsive to transit riders' needs.

The seven goals which have guided the development of the Strategic Business Plan were announced by the Port Authority Board in June 1984 and are listed below:

1. Improve financial stability through cost reduction and revenue enhancement;
2. Improve service and increase ridership;
3. Improve the effectiveness of the organization;
4. Improve public image;
5. Upgrade and improve property, plant and equipment;
6. Increase employee development and organizational loyalty; and
7. Update the Strategic Business Plan.

Given the current fiscal crisis, it appears that the first goal -- improve financial stability — is the top priority of the Authority today. A resolution of that problem alone, however, is not possible. For example, a cost reduction program might require improved employee productivity which in turn requires an increase in employee development (Goal 6). The goals are synergistic, and the Strategic Plan must address each goal area to be effective.

In the future, the goal areas can be expected to change as the Authority's internal and external environments change. Therefore, the goals will be updated each year.

Because of the comprehensive scope of the Strategic Business Plan, it is important to identify strategies that the Authority should follow as it works towards achieving its goals in FY 1986 and 1987. Exhibit 30 lists the highest priorities that have been identified within each goal area.

In developing the specifics of the Strategic Plan, a set of objectives was developed which more clearly state how the goals will be achieved. Then one or

EXHIBIT 30
PORT AUTHORITY TRANSIT
HIGHEST PRIORITIES of STRATEGIC PLAN

Goal 1: Improve Financial Stability

- Improve financial control and ability to live within funding constraints.
- Pursue changes to Second Class County Port Authority Act in order to provide management more control over expenses.
- Pursue dedicated funding for transit and coalesce support of groups interested in this issue.
- Establish an appropriate control environment and system to assure resources are protected, Authority programs are efficient and effective, and control information is reported promptly.

Goal 2: Increase Ridership and Improve Service

- Develop service standards and examine service on a systematic basis.
- Market PAT's strengths: Martin Luther King, Jr. East Busway, South Busway, Downtown Subway, Senior Citizen program, ACCESS paratransit program.

Goal 3: Improve the Effectiveness of the Organization

- Implement the recommendations of the Loaned Executive Program including a staged reorganization.

Goal 4: Improve Public Image

- Improve direct contact between PAT employees and transit customers through training and retraining.

Goal 5: Upgrade and Improve Property, Plant and Equipment

- Complete South Hills Stage I LRT system and bring on-line as soon as possible.
- Undertake comprehensive rehabilitation of the East Liberty, Ross, Collier, West Mifflin and Harmar division garages and Manchester main shop.

Goal 6: Increase Employee Development and Organizational Loyalty

- Remove obstacles and strengthen incentives for good employee performance.
- Communicate more openly with all PAT employees.

more programs were developed to carry out each objective. These programs are the elements of the Business Plan. Exhibit 31 lists by objective the number of programs to be implemented during the initial period which has been defined as the period April 1986 to June 1987, as well as the programs to be implemented in the remaining years from July 1987 through June 1990. There are 97 first-year programs and 23 latter-year programs for a total of 120.

The programs were not only developed by Port Authority but also, where applicable, reflect the recommendations from recent reports: the September 1985 report of the Greater Pittsburgh Chamber of Commerce Loaned Executive Committee, the 1985 majority and minority reports of the Pennsylvania House of Representatives Local Government Subcommittee on Counties, and the August 1985 report of the State Auditor General released in January 1986.

The programs of the five-year Business Plan were developed to achieve each goal and objective. A staff advisory team helped rate each program based on the program's estimated benefit and ease of implementation. Initial programs were then selected using the ratings as a guide. Programs are listed in priority order and include those planned for current year action and those to be started during the remaining years of the Business Plan. Those programs requiring more than one year to implement are specifically noted. The department(s) responsible for implementing each program and the benefits of each program are also noted.

Most programs in the Business Plan are within the Authority's sole control to implement. Some, however, are not such as programs requiring legislative actions. Examples of these are:

- Enactment of a dedicated source of funding for transit; and
- Changes to the labor provisions of the Second Class County Port Authority Act.

EXHIBIT 31
PORT AUTHORITY TRANSIT
STRATEGIC BUSINESS PLAN PROGRAMS SUMMARIZED by GOAL

Goal Number and Title	Number of Objectives	Initial Period No. of Programs 4/86 - 6/87	Remaining Years No. of Programs 7/87 - 6/90
1. Improve Financial Stability	8	34	8
2. Increase Ridership and Improve Service	7	14	9
3. Improve the Effectiveness of the Organization	6	10	1
4. Improve Public Image	6	13	0
5. Upgrade and Improve Property, Plant and Equipment	10	14	2
6. Increase Employee Development and Organizational Loyalty	6	10	3
7. Develop a Strategic Plan	2	2	0*
TOTAL	45	97	23

* The initial period programs under this goal will be continued in the remaining years.

Another program requires that labor agreements be modified to eliminate inefficiencies. Port Authority will work with the appropriate parties to implement these and similar programs.

Several programs, listed below, are recommended for early implementation, but can not be implemented until the new mainframe computer is installed.

- Computerize non-central stores inventory control;
- Establish on-line absentee reporting; and
- Computerize workers' compensation records.

Implementation of these programs will begin as soon as the mainframe software conversion has been completed.

Implementation Framework — Implementation of the initial period programs will be the responsibility of a Management Committee. This Committee will include Port Authority Division Directors and will be chaired by the Executive Director. The first task of the Committee is to assign specific staff responsibilities to each program along with starting and completion dates.

A regular progress reporting mechanism will be developed by the Planning Department to measure how well each first-year program is achieving its objective. If implementation roadblocks are discovered during monitoring, programs can be modified or implementation schedules can be adjusted, as necessary. This monitoring step is especially important since the exact details and precise costs of many programs are to be developed during implementation.

Annual Update — The 1986-1990 Plan is judged to be a good first effort and also one which can be improved in subsequent years. The present document, although called the Strategic Business Plan, in fact contains two distinct parts:

1. Strategies which are the statement of goals and objectives resulting from a consideration of the Port Authority's role or mission, and environment.

2. A Business Plan which translates the strategies into action through specific programs.

It is the experience of a number of private businesses that corporate planning and program implementation can be clarified and strengthened by separating the preparation of these two elements. Typically, the top policy-makers in an organization will decide on the corporation's strategies, whereas the operating officers are charged with the responsibility of developing cost-effective programs which follow the strategies.

The following recommendations are made as a prescription for improving corporate planning at Port Authority during the first Plan update which will begin in late 1986.

1. Port Authority should develop two separate documents, a Strategic Plan and a Business Plan.

2. The Strategic Plan should be developed by the beginning of each calendar year and formally adopted by the Board of Directors. It would be a concise statement of goals and objectives for a three- to five-year period.

3. The Business Plan should be developed to coincide and dovetail with the Operating Budget. It would be a one-year set of special programs guided by the Strategic Plan. The Management Committee would be responsible for developing and implementing the Business Plan.

Annual updates of the Strategic Plan and Business Plan will be the staff responsibility of the Planning and Business Development Division. The success or failure of prior-year programs, as well as changes in the Authority's environment, will be evaluated as part of the update process.

Study Resources — Strategic Plan — The preparation of the process design, plus direct support to the plan development, required Board-level consulting experience and wide-ranging expertise in the public transportation field. The study resources necessary for this strategic planning assistance task reflected these requirements — $50,000.

Performance Reporting System

This Phase Two effort entailed the review of existing (1984) reporting systems and development of a recommended plan that reflected the increased information reporting needs of the decentralized organizational approach adopted by PAT. Decentralization of the Transportation Department was a recommendation of the Phase One analysis. In addition, the development of the maintenance and material control program represented a more decentralized approach for these functional areas. Increased decentralizaton of authority and responsibility places greater emphasis on the performance reporting mechanism to top-level management, the Executive Director, and the Board. The focus of this effort, therefore, was the definition of the necessary information and the appropriate level of detail for this performance reporting system.

Introduction — The full task report prepared for PAT contained a review of the existing system, division and department level reports available within the Authority. Two prototype report layouts were constructed for the performance reporting system. The first report was an Executive Staff Report which would communicate the details of each business unit to the Executive Director and associated top-level management staff. This report was intended to provide performance information to the management meetings. Thus, it would provide the necessary communication link from the decentralized units. The second report was prepared as a performance summary for the PAT Board. This report was oriented to identify overall financial and operational trends, and to highlight particular exceptions to the budgeted expectations.

Analytical Aproach — To accomplish the objective of defining this reporting system, the following techniques were employed:

- A series of interviews were conducted with executive-level management to determine what and how information was prepared, distributed and utilized.
- Those identified reports were documented in terms of the information reported, level of detail, reporting frequency, comparative reliability, and practicality to the recipients.
- Pertinent portions of these reports, with some modification to organization, reporting frequency, and level of detail, were combined into a layout and content plan for the two performance reports.

These reports were designed to address the information needs of each particular audience and to formalize a program to regularly monitor PAT's operational and financial performance.

In addition to the performance reporting emphasis of decentralization, the strategic planning process and implementation monitoring require performance information. During the refinement of the strategic plan and planning process, this performance reporting system should be reviewed and adjusted to reflect the Authority's adopted goals, objectives and targeted performance levels.

Executive Director Report — Four division directors and two department managers reported directly to the Executive Director in the 1984 organization. Each division director, in turn, had several department managers reporting directly. A performance report to the Executive Director should enhance control over major activities occurring throughout the organization's divisions and departments and must be sensitive to changes in operational and financial performance, which could affect, positively or negatively, the overall Authority performance.

On a regular monthly basis, the Executive Director received a fairly comprehensive and detailed Performance Report as well as an assortment of

special purpose documents. The Monthly Performance Report compiled by the Controller Division should be used as the foundation for the proposed executive reporting system. This lengthy report presented operating, labor and financial statistics for the monthly period. Expense and revenue figures were compared to budget for the month and for year-to-date with corresponding variances. Most non-financial items were presented with comparisons to previous months in the fiscal year and/or the previous fiscal year. With the exception of a few graphs, most data were presented in detailed tabular format.

The Monthly Performance Report was a confidential report distributed to the following individuals:

- Executive Director
- Assistant to the Executive Director
- Director of Controller Division
- Assistant Controller
- Manager of Budget and Statistics
- Director of Transit Operations Division
- Manager of Transportation, and
- Manager of Maintenance.

It was distributed approximately 24 days after the end of the month. Since Board meetings were held on the fourth Friday of the month, the report provided limited assistance in preparing for these Board meetings.

The Executive Director also received other performance-related reports. These included the following:

- Registrations, Weekday Averages — This report presented monthly weekday average ridership for the total system, for corridors and facilities, and for all individual routes. Current monthly ridership was compared to the same month in the previous year and the magnitude and direction of change was indicated. The report was prepared by the Rates and Services Department and distributed to the Planning and Development Division, Transit Operations Division, Controller Division and the Executive Director.

- Fact Sheet, Monthly Registrations — This document summarized total system ridership and was used for public information purposes.

- Monthly Personnel Report — This report presented detailed changes in personnel by department/division and a comparison to the previous year. It also included salaried personnel hires, promotions and terminations by individual name and position.

- Workers' Compensation — A three-page, detailed historical report was prepared by the Administration Division.

- Out-of-Service Report — A computer printout of accumulated out-of-service time for the system and for each garage was detailed by day of month and summarized for all days in the month. Lost time was tracked by cause: operator absenteeism and unavailable equipment. Historical data were presented in tabular format.

- Monthly Financial Report — This report was a compilation of PAT's monthly financial statements, including comparative summary of accounts.

In most areas, PAT was collecting and processing performance data in great detail on a frequent basis. The Monthly Performance Report, however, was not fully utilized by management to evaluate current performance or for deciding when and how to redirect or reallocate the Authority's resources. Several reasons explain the report's limited utility. First, its long length and tabular format discouraged full review and comprehension for the time-constrained manager. Second, except for the three pages of summary discussion of revenue and expense budget items at the front of the report, there was no narrative analysis of the presented performance measures. Interpretation of the statistics was left to the reader. Third, trends, either favorable or unfavorable, were not readily apparent from the tables, nor were exceptional or unsatisfactory levels of performance. And fourth, significant measures of performance were mixed with detailed statistics out of proportion to their importance for management decision-making. In instances where great detail was presented, a lack of clarity or narrative emphasis tended to conceal key facts and specific trends.

For example, the significant increase in Time-On-Report between July 1983 and January 1984 was not readily apparent by the four pages of data and one graph describing operator wage performance in the January 1984 Performance Report. In

fact, Time-On-Report increased 68 percent in that time period and in terms of expense was $126,900 over budget. In the same January 1984 Report, operator lost time measures were presented on a single page, whereas a full section of approximately 12 pages were devoted to listing all purchased services for the past six months by major account by department.

A top-down approach to executive reporting would ensure that management needs would determine the structure of the reporting system, not current data availability or data processing capabilities. Such a reporting system must be sensitive to changing aspects of systems operations to allow for effective control over service delivery. An executive report is not, however, intended to replace all other information currently collected, but to supplement this information by highlighting key performance measures of major PAT activities.

All regular monthly performance reports to the Executive Director should be contained in a single volume, herein referred to as the Executive Staff Report. This report, a condensed and modified version of the Performance Report should serve as the focus for discussion among division directors and the Executive Director at weekly staff meetings, and should also provide a point of departure for more detailed analysis of those items identified as exhibiting exceptional or unsatisfactory performance. Appendices to the report should be used for supporting documentation.

The following guidelines were recommended to improve the utility of the Monthly Performance Report and to reorient the report to a top-down approach.

- Use Graphic Presentation Techniques -- Charts and trend line graphs quickly convey a positive or negative trend where it is advantageous to examine long term performance. Their use requires the careful selection of a limited number of measures which accurately and reliably represent the key areas of managerial control. The benefit of this approach is that managerial attention is focused on summary statistics. In the absence of established targets or standard levels of performance, graphs can clearly display danger signals as well as areas of improvement. Trend lines can also identify hidden relationships among activities.

- Rank Items by Their Significance — Greatest managerial attention should be given to those expense and revenue items with the largest impact on financial performance. Most financial reports list variances from budget in the standard order of accounts without any indication of the priority order in which negative variances shuld be addressed. A summary listing of accounts according to the magnitude of their variance in absolute dollar amounts would focus attention on those items with the largest impact on financial performance.

- Compare Actual Financial Performance to Previous Year(s) as well as to Budget -- Previous year's expenditures and revenues provide an additional benchmark against which managers can compare their present performance.

- Reduce Duplication — The Executive Staff Report should be a centralized source of information for the Executive Director to use in evaluating overall Authority performance; for identifying areas of favorable and improving performance; and, for identifying problem areas requiring investigation and corrective action. Supporting documentation should be appended to the report for reference, e.g., the Weekday Average Registration Report. Financial analysis should be included in the Executive Staff Report, while the detailed Monthly Financial Report should be accessible to the Executive Director as a source document for further detail.

  Other status reports need not be regularly submitted to the Executive Director because of repetition. For example, the employee summary currently found in the Performance Report should supersede the additional Monthly Personnel Report. The listing of individual names, positions and actions should be transferred to the Monthly Report if that information is desired. The separate Workers Compensation Report and Out-of-Service Report should only be available on an as-needed basis.

- Include Interpretive Analyses — Interpretation of measures and indicators would save management time and effort by explaining the underlying cause and effect for a specific functional area's performance. Its use also increases a manager's accountability for each area of responsibility. Analyses should be used to explain exceptional or unsatisfactory performance compared to budget or standard.

- Distribute Prior to Board Meetings — The Executive Director and Division directors should have the opportunity to meet and discuss the month's performance prior to presentations to the Board. It is therefore suggested that the Executive Staff Report be distributed by the third Friday of the month.

- Experiment With Cost Centers — A cost center approach should be used for the purpose of improving the sensitivity of the reporting system to changes in operational and departmental performance, not only for simply comparing the performance of one garage to another. Systemwide totals can distort or conceal underlying trends. A cost center approach isolates exceptional performance and trends and also conforms with the decentralization approach of the Authority. PAT currently reports maintenance cost per scheduled mile and maintenance performance compared to budget by garage. Additional indicators of operational reliability, safety and labor productivity are candidates for garage level aggregation. These include:

  - miles between service interruptions;
  - time or runs out-of-service or late;
  - accident rates;
  - unscheduled overtime premium; and
  - absenteeism rates, controllable and contractual categories.

- Add Measures to Provide a Comprehensive Picture of Performance — PAT staff compiled about 90 percent of the statistics needed for a comprehensive executive report. Many were already presented in the Monthly Performance Report; other statistics were available but not submitted to the Executive Director. The other 10 percent should be available in the near term or had not been viewed as important for managerial decision making.

  The following measures and indicators were recommended for inclusion in the Executive Staff Report at the systemwide, modal and garage level of detail:

  - Missed service and late pullouts (bus runs not dispatched or late)
  - Reasons for missed and delayed service
  - Miles between service interruptions
  - Reasons for service interruptions
  - Accidents per million miles of service and percent chargeable to operator
  - Parts requisitions by major system*
  - Materials cost per vehicle mile
  - Maintenance labor cost per mile
  - Maintenance employee overtime*
  - Operator lost time*
  - Operator time-on-report*
  - Operator unscheduled overtime*
  - Workmen's compensation and sick leave payments*

Systemwide Only

- Trend line of monthly revenues and expenses
- Ratio of passenger revenue to operating cost (recovery ratio)
- Number of average daily complaints and types of complaints received
- Number of labor grievances and percent to arbitration
- Personal liability and property damage claims

The PAT Board Report -- A performance report to the Board should be designed to emphasize overall system performance, although more detailed information should be provided in functional areas on an exception basis.

The PAT Board received three monthly reports: the red book of preliminary authorization and resolutions; the grey book containing the Authority's financial statements; and the blue book presenting the Staff Report to the Board. The latter two constituted the Board's current performance reporting system.

The Monthly Financial Report contained approximately 35 pages of financial statements in eight schedules. No written narrative analysis was provided to explain the net effect of the numerous financial statistics.

The monthly Staff Report to the Board contained reports on the following divisions and departments:

- Controller
- Transit Operations
- Engineering and Construction
- Planning, Development and Public Services
- Marketing and Media Relations

*Currently reported systemwide or by mode.

This report was referenced by staff members in their oral presentations to the Board. For the most part, the report described departmental activities during the preceding month. With the exception of the Comparative Summary of Revenues and Expenses, Estimated Cash Operating Projection, ridership reports and a graph of monthly revenues and expenses, the material was presented in narrative format.

Over nearly a year, the Planning and Development Division was developing a Vital Signs Report which graphically captured the status of the transit system in an historical perspective. The report contained information in a number of areas including ridership, maintenance, operations, financial and public relations. This report was utilized as the basis for the recommended PAT Board report. Further developmental interaction resulted in the refinement of the Vital Signs Report and recommended use as the Board report.

A graphical format of the Vital Signs Report as illustrated in Exhibit 32, was applicable for the Board report. Components of each indicator and sources of data were explained. A trend line was used to compare performance of the transit system from month to month and to previous years. The brief analysis below the graph provided the opportunity to identify exceptional performance, to comment on expected performance levels, to note external or internal factors influencing performance, and to present a recommended course of action.

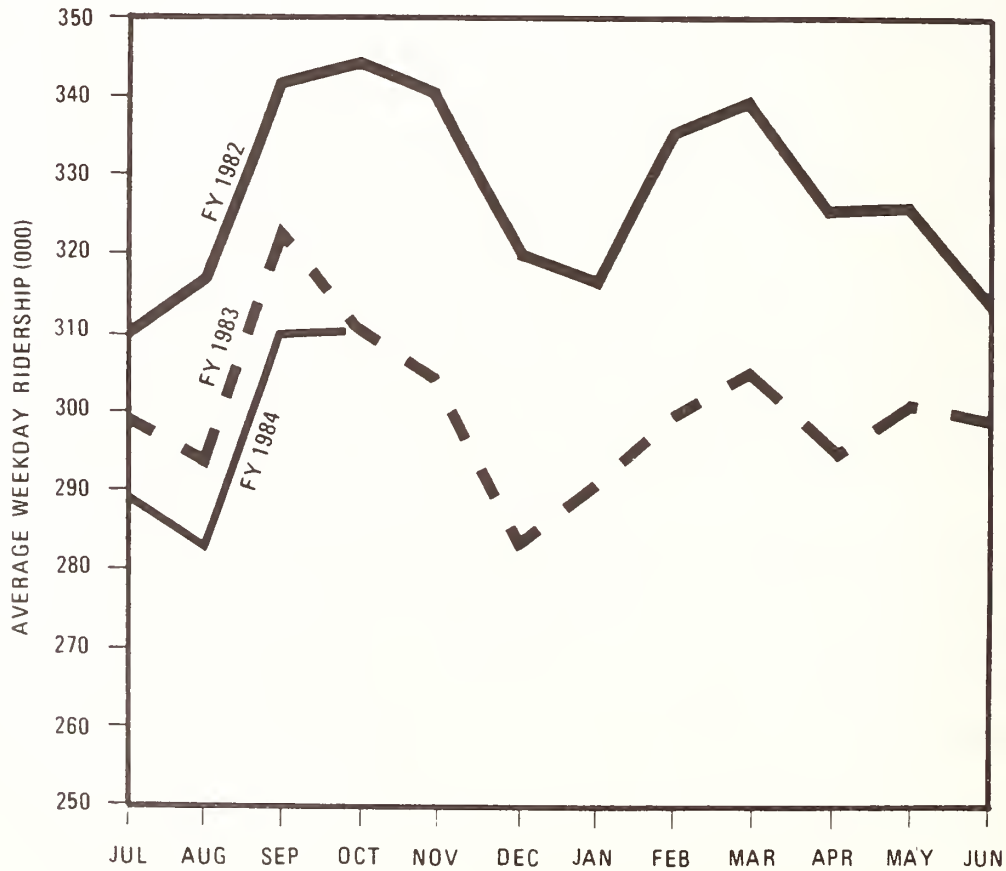
The refinement of the Vital Signs Report provided the foundation for a monthly performance report to the Board. Recommendations to improve its usefulness include coordinating its production with the Executive Staff Report and reconsideration of several indicators previously discarded from its content.

To ensure consistency in performance reporting, the development of the Vital Signs report should be coordinated with the Executive Staff Report. Many of the aggregate systemwide measures recommended for the Executive Director's report are either currently an element of or should be incorporated into the Vital Signs Board Report. These measures include:

EXHIBIT 32
PORT AUTHORITY TRANSIT
FORMAT OF THE VITAL SIGNS REPORT

VITAL SIGN: AVERAGE WEEKDAY RIDERSHIP: Average weekday ridership is a measure of the number of passenger boardings on Port Authority buses, streetcars, Monongahela Incline and the PATrain on an average weekday for each month. It is obtained from driver counts of the number of passenger boardings (registrations) for each vehicle trip, cumulated to system average for weekdays.

ANALYSIS: Average weekday ridership in October 1983 was 309,924, up 0.2% over September 1983 and down 0.3% from October 1982. The slight difference between October 1982 and 1983 seems to indicate that average weekday ridership has recovered to the level of the fare increase one year ago.



- Average weekday ridership
- Missed and late service
- Miles between service interruptions
- Accident rates
- Operating expenses and revenues
- The ratio of passenger revenue to operating costs
- Employee lost time
- Workmen's compensation payments
- Personal liability and property damage claims cost
- Passenger complaints

Additional details, i.e., statistics by department, should only be provided on an exception basis.

Additional indicators should include passengers per service hour and a comparison of cumulative cost and revenue to budget, year-to-date. The former is an overall measure of service effectiveness; the latter provides a clear sign of the financial health of the organization.

Several of the indicators presented in the Vital Signs Report could be eliminated without losing an overall sense of system performance. These include:

- Average Saturday ridership
- Average Sunday ridership
- Percent of service hours completed, and
- Monthly operating cost.

The recommended list of Vital Signs for monthly review by the Board, therefore, includes the following:

Ridership and Financial

1. Average Weekday Ridership
2. Ridership per Serice Hour
3. Passenger Revenue
4. Revenue per Passenger
5. Operating Cost Per Vehicle Service Mile
6. Cumulative Cost per Vehicle Service Mile
7. Ratio of Passenger Revenue to Costs

Operations

8. Missed Service
9. Late Service
10. Miles Between Service Interruptions
11. Employee Lost Time
12. Workmen's Compensation Payments

Other

13. Accident Rates
14. Personal Liability and Property Damage Claims
15. Average Weekday Complaints

To enhance clarity, a maximum of three years should be represented on any one graph; two would in most cases be preferred. Once the Vital Signs Report is maintained and produced by computer, information should be presented for the current month and the preceding 11 periods rather than on the fiscal year basis as is currently presented. The Vital Signs Report could be incorporated as a section of the monthly Staff Report to the Board.

The Board's Monthly Financial Report should be used to provide supporting documentation to the financial trends presented in the Vital Signs Report. The Statement of Revenue and Expenses was a good example of this type of support. Budget allocations were listed for both major revenue and expense line items along with the difference between budget and actual levels. The bottom line of the report is the difference between funding needs and funding availability. This format supports a quick evaluation of budget performance by major line items.

Two additional summary reports would be useful to Board members in reviewing the Authority's financial status:

1. Department budget vs. actual operating expenditures; and
2. Capital project budget vs. actual expenditure summary.

The unabridged Monthly Financial Report contained a 3-page "Comparative Summary of Expenses by Departments". While the column format of the report showing monthly and year-to-date variances should remain as presented, the

number of different departments should be reduced. Departments serving an overall function such as maintenance, operations or marketing should be grouped together for presentation to the Board. PAT's organization chart should be used as a guide for consolidation.

The second table would summarize the status of PAT's long list of capital projects. The balance sheets and analysis tables currently contained in the Board's Financial Report do not convey adherence to budget or percent complete. A summary table delineating expenses to date, budget, variance, percent complete and scheduled completion date should be cross-referenced to the Engineering and Construction Division's Staff Report of the Authority's progress on its capital projects.

Study Resources — Performance Reporting System — This task utilized the available information resources available at the Port Authority and provided guidance and assistance in the definition and graphical presentation of pertinent information to both the PAT Board and Executive Staff Reports. The key ingredient was the focusing of the appropriate level of detail, measures, frequency and narrative to most effectively report the performance of the Authority. Both consultant and Authority staff from the study team were used to complete this task to further the integration with the related decentralization and strategic planning activities. Phase Two study resources of $20,000 were applied to the completion of this task.

VII. HISTORICAL PERSPECTIVE

VII. HISTORICAL PERSPECTIVE

This project was completed in 1985 with the submission of the Phase Two task reports and technical memoranda. Since that time, PAT has progressed in many areas, including all of the issue areas noted in this study. This chapter provides unique insight into the application of the noted techniques through an historical perspective. This hindsight is especially important in evaluating the overall process taken in the study, the pertinence of the analytical techniques, and the net effect resulting from the project.

This effect is summarized in a discussion of the results achieved through the various recommendations. Each section first describes the particular roles of the client and consultant and how it was organized under this contracting relationship to achieve the positive results of the study. The remainder of each section is dedicated to a description of the lessons learned throughout the conduct of the study and also from the viewpoint of a couple years of implementation and hindsight.

Results Achieved

The recommended approach to maintenance and material control is currently almost fully operational for the PAT light rail system. PAT decided to implement this approach on the light rail system before the bus system because of the opportunity provided by the reconstruction of the entire light rail network. A new central maintenance shop, plus refurbished and newly procured light rail vehicles, furnished the right opportunity to take this important step.

Based on the experience gained with the rail system, PAT is planning to implement a similar approach with the bus system in the near future. However, particular items have already been implemented on the bus side to better prepare for the eventual implementation. The decentralized organizational structure has been implemented and a formalized set of procedures and job descriptions are under development. Thus, an improved baseline management structure is already in-place and prepared for the eventual changeover.

Port Authority Transit published its first Strategic Plan in March 1986 and is preparing an expanded update for 1987. Two major issues highlighted in the first strategic plan have already been achieved. Modifications to the Second Class County Port Authority Act have increased management capability to control labor expense and work rules. Limitations to claims costs have been approved by the State which should help reduce the escalation of this line item expense. Both of these points have been affecting PAT over a period of time. The development of the Strategic Plan helped highlight their importance and focus the necessary attention and Authority resources to effect their change.

The performance reporting system has been partially implemented. The Vital Signs Report which included recommended refinements was drafted and subsequently modified to satisfy "ACT 76" requirements and will be the lead focus for PAT performance reports. These and other results of this cooperative effort have been achieved through the development of a good working relationship and continuous interaction throughout the course of the study.

Port Authority Perspective

Port Authority of Allegheny County received a grant from the Urban Mass Transportation Administration (UMTA) to conduct this Prototype Management Study. UMTA was interested in a study that would develop and apply innovative management techniques to transit, and would include

an independent review of the transit system's efficiency and effectiveness by an outside consultant. The study was undertaken from the perspective that such a review is a good one for an organization to take on a periodic basis, which would result in development of ideas for improving performance. In addition, it was hoped that the study could provide insight into particular problem areas faced at the time of the study, such as the Authority's uncertain funding situation, the recent decline in ridership, and problems in meeting the scheduled peak requirement of buses.

In the two years since the project was completed, the Authority has undergone a number of substantial changes such as a reorganization, decentralization of Transit Operations, changes in the state enabling legislation, opening of the Stage I portion of the Light Rail Transit System, replacement of half the fleet with new buses, balanced operating budget for four consecutive years with maintenance of the same base fare for five years, adoption of the first Strategic Business Plan and first comprehensive Capital Needs Study, and increased computerization including new mainframe computer.

It is interesting that nearly all of the changes listed above were either recommendations of or related to problem areas discussed in the Prototype Management Study. The question to be asked is how many of the improvement areas would not have been attained had the study not been done. This is difficult to answer, especially since there were a number of other studies of Port Authority done at that time, including a comprehensive review by the State Auditor General and a report of the Loaned Executive Committee of the Greater Pittsburgh Chamber of Commerce, that addressed many of the same areas of concern.

The consultant effort of the study cost $229,000, including Phases I and II. With UMTA paying for 80% of project costs, this type of study certainly bears a lot of fruit for the money invested. Would the same conclusion hold if only local money were involved? Certainly $229,000 is a

large amount of money, although it is not a large percentage of PAT's $150 million operating budget. Perhaps the best answer is that if it has been a long time, say more than five years, since a comprehensive review of management and operations has occurred by an outside organization, or if there are particular problems of large importance facing the agency, then such a study is worthwhile.

Should an outside consultant be the reviewer, or should the study be done in-house? Certainly, the latter course is possible. However, it is difficult to expect an internal department to be able to devote the significant amount of time required to observe the problems, to collect and analyze the descriptive data required, and to make the significant recommendations. Second, review by an independent entity is an important perspective of the study that would be missing if it were an internally-derived effort.

Is a two-phase study required, or is one phase sufficient? The difference is to some extent a question of semantics, since either approach would involve an initial effort at problem identification with subsequent follow-up on particular problem areas. A two-phase study which involves two or more different consultants would be a different approach than the one described herein. It would certainly allow for different perspectives to be applied to the two phases. Second, it would allow for study resources for Phase II to be increased or reduced depending on the problems identified and the conclusions of Phase I. However, it is felt that the risk of potential loss of time and momentum between the two phases is not worth any advantages of separate consultant efforts.

There are three requirements to the successful undertaking of a study of this type. First is the willing involvement of the top officers of the transit agency. The study is intended to identify and assess the major issues facing the organization, and to make recommendations for improvement which hopefully can be implemented. Only with the committment of the top managers can the study be sure of addressing all relevant issues and identifying areas for strategic improvement. The second is project management by a department or project team that can bring an agency-wide

perspective to the project and which deals with all areas of the organization on a regular basis. Third is the cooperative effort by all departments to see that the study is carried out to a successful conclusion.

In conclusion, the Management Prototype Study reviewed and made recommendations concerning a number of operational, financial and organizational issues. Many of the study's recommendations have been implemented, as demonstrated in Exhibit 33. Although other reviews of Port Authority completed during the same period covered many of the same areas of concern, the Management Prototype Study served as a catalyst for a number of actions that were carried out.

Therefore, Port Authority should consider conducting a management and performance review, similar to the one described herein, on a periodic basis or as particular problem areas arise that can be addressed by this type of study.

EXHIBIT 33
PORT AUTHORITY RESPONSE TO STUDY RECOMMENDATIONS

REPORT RECOMMENDATION	ACTION BY PAT
1. Develop a structured approach to maintenance activities.	
1.1 Achieve control over stores.	Personnel not added to improve division-level stores management. However, improved control and parts tracking procedures instituted.
1.2 Establish control over rotable components inventory and production.	See 1.1 above.
1.3 Accelerate development of standard operating procedures.	Standard operating procedures completed for some job categories.
1.4 Develop milege estimates based on scheduled vehicle assignments and changeout.	Current system continued, although recalibrated and reviewed for accuracy.
1.5 Evaluate management responsibilities.	As part of the overall agency re-organization implemented in 1985 and 1986, the Transit Operations Division was decentralized. Direct management of both the transportation and maintenance functions was placed under an Operations Manager at the six garage divisions.
1.6 Develop a maintenance information control system.	MIS system completed for light rail system. Will be expanded to cover buses.
1.7 Develop a training and testing program for maintenance.	Not accomplished.
2. Develop a strategic plan.	Strategic Business Plan for 1986 to 1990 completed and implemented. For second year, Strategic Plan covering 1987-1991 and Business Plan for FY 1988 to be separate documents.

EXHIBIT 33
(Continued)

3. Develop an absenteeism reduction program.	Newly-established Organizational Development Department has as one of its major responsibilities an attendance improvement program, with major Authority emphasis placed on this area.
4. Evaluate transportation management responsibilities.	See 1.5: Operations Division Decentralization.
5. Implement various organizational and technical improvements.	
5.1 Consolidate and elevate marketing functions.	Marketing activities consolidated into Marketing Department within Planning and Business Development Division. Comprehensive marketing program developed annually.
5.2 More clearly define responsibilities among Labor Relations, Personnel, Administration, and Employment Administration.	These four functions placed under one division, Human Resources, and their responsibilities were restructured.
5.3 Formalize relationship between Scheduling and Rates & Services Departments.	Relationship redefined when the Schedules and Service Development Departments placed within Planning and Business Development Division.
5.4 Consider use of a word processing pool.	Word processing pool not developed. Use of word processors significantly expanded.
5.5 Evaluate the role of Instructors.	Instructors placed under the Operations Managers at the six operating divisions.
5.6 Develop a Systems Plan.	New mainframe installed. New Management Information Systems management and technical committees formed to oversee MIS development. Microcomputer use expanded. Computer-based scheduling and computerized public information consolidated within minicomputer.

EXHIBIT 33
(Continued)

5.7	Evaluate increasing management responsibilities in budget preparation.	Budget reviews held monthly and quarterly involving department heads and division directors. Managers held responsible for budget performance results.

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TECHNOLOGY SHARING

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PROGRAMS OF THE U.S. DEPARTMENT OF TRANSPORTATION