SEPTA Management Study: Process and Results

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A management study of Philadelphia's Southeastern Pennsylvania Transportation Authority (SEPTA) was completed in May 1978. The study process was designed to quickly focus investigative effort on apparent problem areas by means of a series of diagnostic techniques, including interviews, peer-group analysis, flowcharting, and organizational analysis. The in-depth studies that relied on independent data collection were specially designed to test hypotheses. The study revealed that among the areas where SEPTA performance was strong were rapid-transit crew scheduling, grant applications, employee absenteeism, and short-term investment management. The study identified nine priority areas for improvement: (a) cash handling, (b) Consolidated Rail Corporation's purchase-of-service agreement, (c) surface transit operations planning, (d) vehicle use, (e) surface transit maintenance, (f) capital project management, (g) pension management, (h) quality of transit service, and (i) regional fare integration. Funding agencies should expect large transit agencies to have at least a few serious problems that should be identified and studied by the agency. The number and phasing of improvement activities must be feasible for the transit agency to accomplish.

During the years when transit was predominantly a private enterprise, efficiency was judged by standard profit-and-loss and return-on-investment criteria. Even then, however, there was concern about the effectiveness of transit services. Twenty years ago the National Committee on Urban Transportation published Recommended Standards, Warrants, and Objectives for Transit Services and Facilities (1).

In recent years, as transit has required increased public funding just to keep its head above water, there has been a greater concern about transit efficiency and effectiveness on the part of both transit agencies and the sponsoring governments. The state of California has been particularly active in requiring periodic transit performance audits (2, 3). In a policy statement issued on October 13, 1977, the board of directors of the American Public Transit Association (APTA) stated that "There is a universal need for indicators of transit performance" and proceeded to outline key effectiveness and efficiency concepts (4). At the APTA midyear meeting in May 1978, transit performance indicators were a principal topic (5, 6). As part of the Urban Mass Transportation Administration's (UMTA) short-range planning requirements, the inclusion of planning to "address methods for improving the efficiency and effectiveness of the operation of the system" (7) has been proposed.

It is against this national backdrop that a management study of the Southeastern Pennsylvania Transportation Authority (SEPTA) was undertaken from April 1977 through May 1978. The SEPTA management study was commissioned by a steering committee of state and local funding agencies because it was "the desire of the elected officials to be assured that SEPTA provides the most efficient services possible in relation to the investment by the various sources of financial assistance. The management consulting team was led by Booz-Allen and Hamilton.

DESCRIPTION OF THE SEPTA ORGANIZATION

In 1964, Pennsylvania State Act 450 created SEPTA to provide for integrated mass transportation services in the five-county Pennsylvania portion of the Philadelphia metropolitan area. The act established an 11-member SEPTA board of two appointed representatives from each county plus one state appointee. On September 30, 1968, SEPTA took over the transit operations of Philadelphia Transportation Company, which served the city. On January 29, 1970, SEPTA took over the transit operations of Philadelphia Suburban Transportation Company, which served Delaware County. These units were renamed City Transit Division and Red Arrow Division, respectively. SEPTA took over a small transit operator in Montgomery County on March 1, 1976, and changed its name from Schuylkill Valley Lines to Frontier Division.

Today, the SEPTA divisions operate almost 1500 buses and over 100 trackless trolleys on surface transit routes. SEPTA also operates two rapid-transit lines that require more than 350 cars and about a dozen light rail, subway, and surface lines that require about 300 light rail vehicles (LRVs). In total, SEPTA has an active fleet of almost 2300 transit vehicles.

In addition to its operating responsibility, SEPTA administers a purchase-of-service contract with the Consolidated Rail Corporation (Conrail) to provide regional commuter rail service; Conrail runs over 400 city- and SEPTA-owned commuter rail cars. Purchase-of-service contracts are also administered with several small bus companies operating in suburban counties.

To carry out its responsibilities, SEPTA is organized as shown in Figure 1. Nine divisions and departments report directly to the general manager, but 6800 employees, or about 93 percent of the total, work in the transit operations department.

On a typical weekday, the SEPTA system averages about 800 000 passenger trips, to which the Conrail commuter rail system adds approximately 240 000. Although annual transit revenue for 1978 approximates $95 million and Conrail collected another $30 million in commuter rail revenue, these revenues do not begin to cover operating costs, which were at the $255 million level for 1978. SEPTA deficit funding is provided by UMTA, the Pennsylvania Department of Transportation (PennDOT), the city, and the four suburban counties. Each SEPTA transit division, as well as the commuter rail operation, is supported by a different mix of funding. For 1978, SEPTA's total operating deficit of just over $130 million was covered by 40 percent federal funds, 40 percent state funds, 15 percent city funds, and less than 5 percent suburban counties funds.

SEPTA MANAGEMENT STUDY PROCESS

A transit agency performs many functions that increase in number in a large multimodal operation such as SEPTA. The first step in the management study was to narrow the focus of inquiry through a series of diagnostics.

Interviews were used to ascertain perceptions of problems from both inside and outside the SEPTA organization. As a result of the interviews, investigation of the Conrail purchase-of-service agreement was added to the work effort, and emphasis was placed on review of SEPTA's use of professional services.

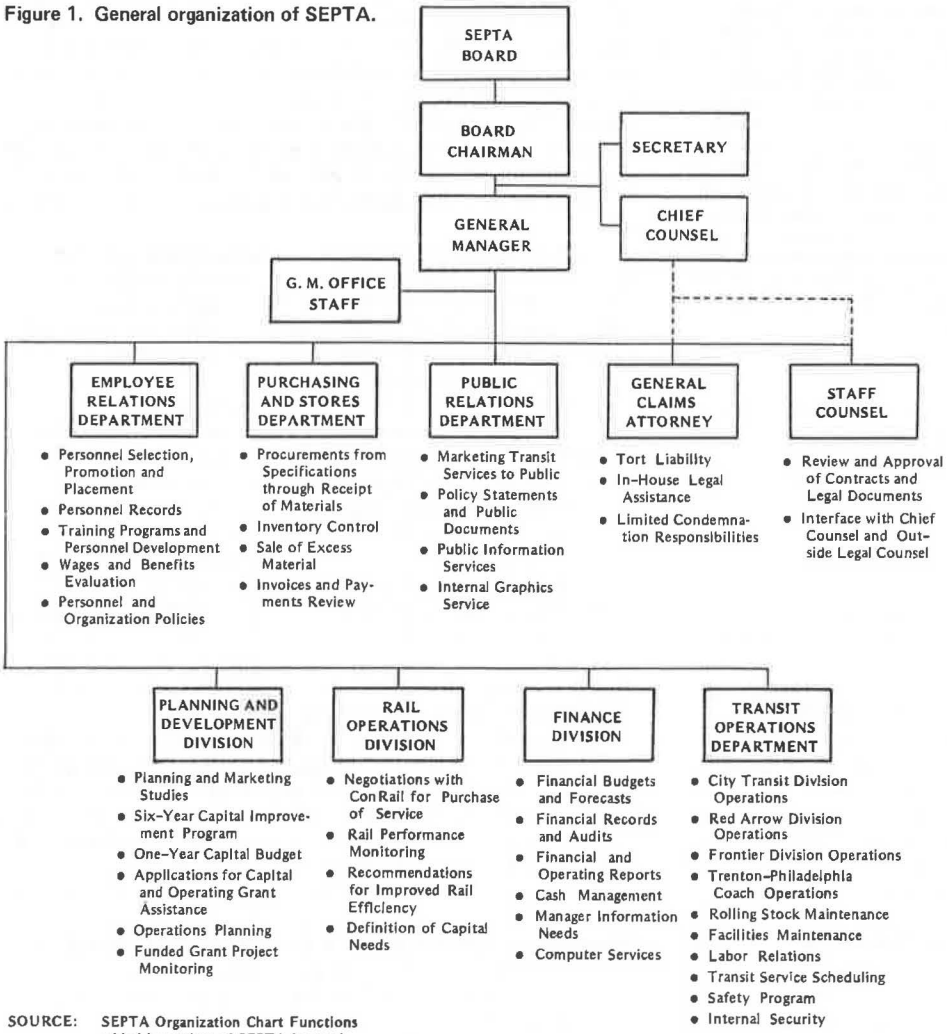
Peer-group analysis proved to be the most contro-

versial diagnostic technique. SEPTA operating data were compared with a composite transit system formed by averaging the data from nine other systems, as shown in Table 1. As a diagnostic, the peer-group analysis was useful and led to detailed investigations in such areas as road calls and vehicle use. It also suggested that there were personnel shortages in finance and public information. Exclusive reliance on peer-group data for conclusions is inappropriate, and this was cautioned against in the study.

Flowcharts were employed to outline the process by which key functions were being carried out in SEPTA. These proved especially valuable in analyses of cash handling and operations planning.

Organizational analysis, in which functional responsibilities and span-of-control issues were examined,

Figure 1. General organization of SEPTA.



SOURCE: SEPTA Organization Chart Functions added by review of SEPTA internal documents and interviews.

Table 1. Summary of statistics for SEPTA peer group.

Item	City						Transport of New Jersey	Port Authority Trans-Hudson[a]	Port Authority Transit Company[b]	Average	SEPTA
	Baltimore	Chicago	Cleveland	Montreal	Pittsburgh	Toronto					
Active vehicle fleet											
Buses	960	2 400	947	2 004	928	1 225	1 926	0	0	1 484	1 463
Trackless trolleys	0	0	0	0	0	151	0	0	0	151	112
Streetcars	0	0	55	0	95	358	30	0	0	135	343
Rapid transit	0	1 100	116	357	0	494	0	298	75	407	377
Total	960	3 500	1 118	2 361	1 023	2 228	1 956	298	75	2 177	2 295
Employees											
Hourly	1 894	11 971	2 070	5 470	2 429	6 583	2 907	939	173	3 826	5 819
Salaried	184	740	498	1 423	434	1 342	756	88	110	619	950
Total	2 078	12 711	2 568	6 893	2 863	7 925	3 663	1 027	283	4 445	6 769
Average weekly total passengers	1 975 700	11 750 000	2 453 750	6 223 850	2 032 380	11 580 000	2 077 150	801 160	212 000	4 345 110	4 975 310

[a] New York and New Jersey.
[b] Delaware River.

was also employed as a diagnostic technique. This technique was particularly useful in dealing with risk management and capital program activities.

After this series of diagnostics was applied, hypotheses were formed concerning the need for improvements in key functional areas. Then specific plans for detailed investigation were developed to test these hypotheses. For example, one hypothesis was that SEPTA had reduced spare-parts inventories to dangerously low levels during a recent budget-cutting cycle. To test this hypothesis, the inventory control cards of 100 items were examined at random. Of these, 51 had been repeatedly out of stock and were then traced through to their impacts on vehicle downtime.

In many cases, it was determined that independent data collection was needed to test hypotheses. One potential pitfall of management studies is to examine only the data the agency provides. If these data are incomplete or faulty, incorrect judgments may be made by the study team.

RESULTS

The study's final report contained a summary of the most important findings and improvement activities developed in five detailed interim reports. For some functions, such as rapid transit crew scheduling, federal and state grant applications, employee absenteeism, and short-term investment management, SEPTA performance indicators were well above average. For several other functions, such as financial management, claims handling, purchasing of noncapital items, and subway-car maintenance, SEPTA management was found to be doing a competent job, notwithstanding some shortcomings in each area. In nine functional areas, however, serious deficiencies that adversely affect SEPTA performance were identified. Each of these deficiency areas is summarized below and given specific improvement objectives.

Cash Handling

Problem

SEPTA cash-handling security is among the poorest in the transit industry. Obsolete equipment is a major contributing factor to this situation. However, even those transit systems that still use old equipment have taken security precautions not to be found at SEPTA.

Improvement Objectives

SEPTA should establish and adhere to a schedule that would result in operational registering fare boxes at all depots except Allegheny by March 31, 1980. Concurrently, SEPTA should initiate a capital procurement to convert the Allegheny depot and the rapid-transit stations to registering fare-collection equipment by 1982. In the meantime, SEPTA should implement specific procedural changes to tighten the security of the existing fare-collection system.

Conrail Purchase-of-Service Agreement

Problem

In the past two years, during the transition from private railroad to Conrail operation, commuter rail unit operating costs have increased by 45 percent. Initially, commuter rail deficits were absorbed primarily by the federal government, but, beginning October 1, 1978, 50 percent of the deficit amount was paid by state and local governments.

Conrail is not providing SEPTA with the data to adequately certify the propriety of charges, which has led to a contingent liability situation for state and local funding agencies. A recent study, commissioned by SEPTA, concluded that Conrail was overcharging SEPTA by improperly applying Rail Services Planning Office (RSPO) cost allocation standards and making erroneous computations. SEPTA and Conrail report that they have jointly selected a consultant to examine commuter rail efficiency, but this study does not have the benefit of a funding agency.

Improvement Objectives

The critical action that was to be accomplished in 1978 was to get SEPTA, Conrail, and the funding agency to agree on commuter rail cost items and computational techniques and thus to make full use of consultant studies. As a target, commuter rail operating costs for the fiscal year ending June 30, 1979, should be budgeted not to exceed costs for the current fiscal year, with savings identified to fully offset inflationary effects. By early 1979, implementation of commuter rail efficiency study recommendations should have begun, the goal being to stabilize commuter rail operating costs for the succeeding fiscal year as well.

Surface-Transit Operations Planning

Problem

For the past decade, SEPTA surface-transit routes and schedule input data have undergone relatively little change. SEPTA does not have a current data base from which to develop a well-focused annual schedule work program to adjust or completely remake schedules as necessary. Given the current capabilities of the scheduling department and the lead times required to develop schedules, the department has a chance to develop only one solution with general budget guidance from top management.

Improvement Objectives

SEPTA should fine-tune 10-15 surface transit routes each quarter over the next three years with an eye to reducing costs in ways imperceptible to most passengers. As an initial program goal, fine-tuning should be targeted to save $12 million in annual operating costs by the end of the third year.

This does not mean that there is this amount of waste in the system; at least some cuts will inconvenience small groups of passengers. This savings goal may be adjusted upward or downward as the program progresses, but it is important that the operations planning effort be provided with clear fiscal guidelines. Computer assistance should be gradually introduced into scheduling to relieve schedulers of routine chores.

Vehicle Use

Problem

SEPTA's vehicle-related statistics (kilometers per vehicle, kilometers per road call, kilometers per unit of fuel and oil consumption) are among the lowest in the industry. In part, this reflects SEPTA's lack of precision in defining what operational vehicles are and who is responsible for them. Although SEPTA's aggregate per-

centage of surface transit spares is high, it reported a shortage of buses for fall 1977 schedules because of buses assigned to streetcar and trackless trolley routes.

Improvement Objectives

SEPTA should immediately prepare a vehicle inventory to categorize all vehicles in the system into an active, reserve, or rehabilitation fleet status by depot. Based on this inventory, quarterly use reports should be submitted to the board and funding agencies to show distance, days unavailable for revenue service, and other data specified in the management study. Analysis of these data will enable SEPTA to retire the worst vehicles from its fleet and should lead to improved fuel- and oil-consumption rates.

Surface Transit Maintenance

Problem

SEPTA's practice of assembly-line unit overhaul after the failure of just one component may have had some justification in the early 1970s, but it is no longer a cost-effective approach to major maintenance. The failure to keep distance records on overhauled components is a serious deficiency that prevents program evaluation and hinders the scheduling of subsequent component rebuilds. The appearance of the fleet is poor; extensive body damage, loose engine doors, missing battery doors, and interior seat damage compound the unsightliness of widespread graffiti. Transition planning for maintenance of new trackless trolleys and light-rail vehicles is lacking.

Improvement Objectives

By July 1, 1978, SEPTA should have a system in place to analyze breakdown data by vehicle and to track vehicle component distance to failure. As SEPTA proceeds with its vehicle rehabilitation program, each rehabilitated vehicle should require a daily driver's slip to report body damage or vandalism; any unreported damage should be grounds for driver discipline. Personnel freed from bus maintenance as a result of shifting to distance-monitored component rebuilds will be needed to maintain the new trackless trolley fleet and to extend the streetcar rehabilitation program. To support new-technology vehicles, a transition plan is needed to phase in training and tools.

Capital Project Management

Problem

SEPTA takes significantly longer on the average to complete a funded capital project than its counterparts in transit organizations. Projects with funding obligations in 1972 and 1974 are still in various stages of implementation, and a few are still waiting for specifications to be issued.

Improvement Objectives

In April 1978, SEPTA awarded the registering fare-box bid, a milestone in the capital improvement program. By September a contract for surface-transit two-way radio communications should have been awarded. A timetable for implementation of a complete streetcar rehabilitation program that would include maintenance facilities, new light rail vehicles, and track rehabilitation should be prepared to commit SEPTA to key dates. Although the procurement of Broad Street subway cars is a city responsibility, SEPTA should work jointly with the city to prepare a precise timetable for getting the first new cars into service by the end of 1980.

Pension Management

Problem

For the past several years, SEPTA management has established the modest goal of stabilizing a $100 million unfunded pension liability. After setting aside restricted funds and reducing the work force, recent increases in the unfunded liability have been relatively small. At the negotiating table, pension increase demands have been valued under the same hold-the-line philosophy. As a result, both SEPTA employees and the funding agencies continue to face uncertainties regarding the sources and expenditure levels for future pension benefits.

Improvement Objectives

SEPTA should present to its board and funding agencies year-by-year pension payout projections, from calculations based on the actual age distribution of participants, of all plans under the current benefit provisions. Plan assets and earmarked income should then be applied against these payouts, by using realistic ranges for economic parameters, to yield annual shortfall estimates. The SEPTA board must make a policy decision, based on these data and the inputs of the funding governments, as to whether further pension benefit increases can be permitted without some participatory arrangement to move toward fully funded plans.

Quality of Transit Service

Problem

Although SEPTA compiles many records within its organization that pertain to quality-of-service measures, there is no top management analysis of trends in this vital performance area. A statistically valid and reliable monitoring system is needed to cover at least the following service-quality factors: missed trips, on-time performance, load factors, safety and security, condition of vehicles, condition of passenger waiting areas, employee courtesy, and public information.

Improvement Objectives

A short (15-page) service-quality report was to be submitted to the SEPTA board and funding agencies to cover the July-September 1978 period, and every quarter thereafter. This report should be laid out so that performance trends can be compared with those of the previous quarter and previous year.

Regional Fare Integration

Problem

SEPTA is going into its second decade as an operating agency without having made significant progress toward regional fare integration, despite the mandate of its 1964 enabling legislation and the repeated requests of funding agencies. An unusual opportunity was missed when SEPTA raised fares in May 1977 without incorporating any fare integration features into the revised structure. Within the commuter rail system, however, there have been successive fare adjustments that have acted to increase pricing uniformity and to improve convenience.

Improvement Objectives

By the end of 1978, SEPTA should be offering monthly passes to transit users within each division, as well as a monthly pass to the passengers who must transfer to 69th Street. A monthly pass good for both commuter rail and transit should also be considered. Because monthly passes are priced in the range of 40 times the cost of a transfer trip, this convenience fare should result in virtually no revenue loss if properly marketed. By the end of 1978, the SEPTA board, with staff technical assistance, was to have adopted a set of regional fare policies to guide the design of an integrated fare system in 1979.

Other Improvement Areas

In addition to the above nine priority improvement areas, many other recommendations were made for improving SEPTA's efficiency and effectiveness. The seven most important of these are summarized below.

1. Street control and supervision: Operators should be required to adhere to intermediate time points as well as to end-of-the-line times. The installation of two-way radios in the surface-transit fleet is critical to improving street control.
2. Passenger security: The Philadelphia police department is doing a good job of apprehending criminals on transit, and the city's department of public property is pursuing capital improvements for subway security. SEPTA should play a role in coordinating security programs and improving customers' security perceptions.
3. Sole-source procurements and inventory management: SEPTA bidders' lists and specifications should be more broadly drawn to encourage competitive bidding. Across-the-board inventory cuts are creating shortages of items needed to keep vehicles on the street.
4. Cashier handling: That SEPTA's commitment of peak-period cashier augmentations is not always justified was shown by independent station queue-length observations. On a weekly basis for the Broad Street subway only, it would appear that about 300 cashier-hours could be saved, without appreciably reducing service, for an annual savings in the $130 000 range.
5. Service contracts: Annual savings of $80 000 are achievable, without detriment to current activities, through consolidation of electronic data-processing contracts. SEPTA spends a relatively large amount for outside legal services: 1977 outside general legal fees were $450 000, about $200 000 more than a reasonable SEPTA target. Ongoing activities, such as the extended Conrail negotiations, should be high priorities for transfer to in-house counsel. SEPTA independent auditing and marketing expenditures are relatively low, and increases may be justified to support expanded activities.
6. Investments and receivables management: Although SEPTA's finance department is doing about as well as could be expected in these areas, given its staffing level, additional staff for investments and receivables should more than pay for themselves. In the area of investments, intensive management would allow another $5-$10 million to be put into government securities. These yield a $100 000 annual income gain to SEPTA. There is also the opportunity to reduce error rates on receivables to a level that would protect against tampering with the accounts.
7. Risk management: Although SEPTA's claims department has done a good job relative to trend, there is potential for reducing insurance and claims cost through an aggressive risk-management program. Risk management would encompass those functions now scattered throughout the SEPTA organization: safety programs, insurance coverages, workmen's compensation claims, and claims for injury and damages.

To support these improvement actions, the following specific organizational changes were recommended for first-year implementation.

An internal audit group should be created to report directly to the board and be responsible for in-house as well as contracted audits. The scheduling section should be relocated in the planning and development division and should have increased access to computer facilities. The three engineering sections should be centralized into one engineering department headed by a chief engineer and reporting to the general manager. A director of passenger security programs should be established to initially report to the general manager and to work under a joint city-SEPTA board policy committee. Finally, a risk manager should take responsibility for all insurance coverages, safety programs, accident analyses, and claims handling.

All major improvement activities were pulled together in concise, readily understandable narrative, then phased over the succeeding two years on a quarter-by-quarter basis. The resulting milestone schedule can be used as a checklist for noting accomplishments. The list below displays excerpts from the milestone schedule.

1. April-June 1978 milestones:
   a. Award registering fare-box contract (accomplished by SEPTA),
   b. Complete study of Conrail commuter rail charges under RSPO standards (accomplished by SEPTA),
   c. Collect operating data on the initial 10-15 routes designated for fine-tuning, and
   d. Prepare a SEPTA revenue vehicle inventory, by depot, that classifies all vehicles into an active, reserve, or rehabilitation status.
2. July-September 1978 milestones:
   a. Complete a program of near-term, low-cost, cash-handling security improvements as recommended in the management study,
   b. Achieve agreement by Conrail, SEPTA, and the funding agencies on commuter rail cost items and computational techniques,
   c. Complete route profiles and proposals on the initial 10-15 routes and start data collection on the next set, and
   d. Gather vehicle-use data as specified by the management study and submit monthly use reports during this quarter.
3. October-December 1978 milestones:
   a. Commission an independent audit of cash-handling procedural improvements,
   b. Cut schedule changes based on initial 10-15 route profiles and proposals (after public hearings, if necessary), complete second set of profiles and proposals, and begin data collection on the third set,
   c. Convert to a quarterly vehicle-use report for this quarter and thereafter,
   d. Award contracts for shop and garage equipment capital items that will improve maintenance efficiency, and
   e. Identify maintenance cadre responsible for new trackless fleet and schedule manufacturer-sponsored industry and in-house training courses.

LESSONS LEARNED

The specific findings of the SEPTA management study cannot be generalized. SEPTA's improvement areas are unique to SEPTA; another transit system may perform well in a functional area of great concern to SEPTA but need improvement in an area of strong performance by SEPTA.

There are, however, some attitudes and procedures apparent from the SEPTA study that should have general applicability.

Funding governments can expect transit agencies, particularly those serving the larger cities, to have at least a few serious problems. Running a transit agency is an extremely difficult enterprise.

Modest cost increases lead to substantial deficit increases if revenues do not grow. Change is hard to effect, given strong unionization and the habits of transit riders. Public financial assistance results in red tape and pressures to undertake projects that exacerbate deficits. As a service well used by the young and the poor, transit is prone to security problems. In this environment, it would be highly unusual for a big-city transit system to be problem free. In order for a transit management study to be properly evaluated, funding governments must have an appreciation of these inherent difficulties.

Management studies are more effective if transit agencies recognize problem areas and enlist study efforts to develop solutions. These studies run contrary to human nature. People who work in an organization may be apprehensive during the course of a management study and defensive in review of study findings. These reactions are normal and should not reflect on either the employee or the study effort. Such responses can be attenuated by the transit agency's definition of its own problems, by placing the study team in a problem-solving capacity. However, the problems defined must go beyond general types, such as needing more money, to specific difficulties that can be improved through management action.

Diagnostic tools of themselves are not strong enough to support definitive conclusions. Peer-group analysis is a particularly controversial diagnostic tool. Peer-group statistics alone should never be the sole basis for a study finding. What the analysis can do, however, if carefully applied, is to focus detailed study efforts on critical areas. Other diagnostic tools, such as interviews, flowcharting, and environmental analyses, are similarly unreliable as the sole basis for conclusions.

In-depth research is needed for each suspected problem area and often requires independent data collection. After diagnostics are used to form hypotheses, in-depth research tasks should be specially designed to test these hypotheses. There is no cookbook approach to this phase of a management study; the work must be tailored to fit the situation. One possibility that cannot be overlooked is that management is making the wrong decisions based on erroneous data. In these cases, independent data collection can provide a new perspective for management.

The improvement program resulting from a management study must be digestible in terms of both feasibility and phasing of improvement objectives. A management study that concludes with 118 shotgun recommendations is generally not very useful. Recommendations should be focused, prioritized, and phased into an implementable improvement program. This is not to say that each activity will be easy to accomplish or that all activities will be completed on schedule, but only that, as a program, it appears to be within the limits of management's capabilities.

REFERENCES

1. National Committee on Urban Transportation. Recommended Standards, Warrants and Objectives for Transit Services and Facilities. Public Administration Service, Chicago, 1958.
2. Peat, Marwick and Mitchell. Transit Operators Performance Audit Guide. Comprehensive Planning Organization of the San Diego Region, July 1976.
3. Financing and Evaluating Public Transit Systems in California: Report of the Office of the Auditor General to the Joint Legislative Audit Committee. California Office of the Auditor General, Sacramento, 1977.
4. American Public Transit Association. Policy Statement: Transit Performance Indicators. Oct. 13, 1977.
5. D. H. Goss. System Performance Indicators—The Need for Action Is Now! Presented at American Public Transit Association Mid-Year Meeting, Houston, May 18, 1978.
6. W. C. Underwood. Performance Indicators—A Necessary Management Tool? Presented at American Public Transit Association Mid-Year Meeting, Houston, May 18, 1978.
7. C. H. Graves. A Preliminary Proposal to Improve the Review of Short-Range Planning Activities. UMTA Memorandum, Dec. 14, 1977.

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Impact of the 1977 Transit Strike in Knoxville

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The six-week strike from February 14 to March 28, 1977, of the Knoxville Transit Corporation (KTC) stranded 7000-8000 daily riders of regular bus routes and 600 daily riders of the express bus service. It also provided an opportunity to assess the impact of a temporary interruption of