Improving Transit System Performance:

Proceedings of the September, 1976 National Conference

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16. Abstract

The first National Conference on Transit Performance was held in Norfolk Virginia, September 18-21, 1977. These proceedings comprise the addresses, issue and resource papers given at the conference, with summaries of problems and recommendations developed in workshop sessions. Subjects include trends in transit performance; concepts and indicators; revenue policy and pricing; service characteristics; labor-management relations; internal management; transit performance indicators; case studies of New York City, Southern California Rapid Transit District and Seattle Metro; the effects of fare changes; and an annotated bibliography.

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THE ADMINISTRATOR

We at the Urban Mass Transportation Administration (UMTA) are pleased to have had the opportunity to sponsor and participate in the Conference on Transit Performance, held in Norfolk, Virginia, in September 1977. I was particularly pleased at the broad representation of interest groups which are concerned with transit performance.

Transit performance is something with which we all must concern ourselves, because it affects both the quality of urban life and the use of public funds. We hope the Norfolk meeting will be the first step in a long-range effort to more fully understand the nature of transit performance, and to develop means of measuring and evaluating it. Particularly significant was the highlighting of the "productivity" issue--the conference provided a solid starting point for improving the state-of-the-art in performance evaluation.

The UMTA staff will be looking carefully at this report, and we intend to actively seek answers to the types of problems identified in Norfolk.

Richard S. Page

Richard S. Page

To All Conference Participants:

It is with great pleasure that we transmit herewith the summary and proceedings of the Transit Performance Conference in which you participated at Norfolk, Virginia in September.

As co-chairman of the Conference, I was very pleased with the balance of views that were elicited from the participants. Even with the broad spectrum of interests represented at the Conference, I personally felt that all participants came quickly to focus on the essential ideas that were highlighted in the position papers.

Obviously, no conference, such as the one we participated in, gives perfect final answers to all -- or for that matter, any -- of the questions posed. Nonetheless, I am well satisfied that the perspectives and understanding of each of the participants was enhanced by the exposure to the many viewpoints and that a much improved overall framework and data base has been established on which to build future studies or evaluations of the subjects explored. This Conference and the proceedings thus should not be viewed as an end in itself, but merely a starting point for further exploration into its idea and structural content. In the American Public Transit Association, we are already beginning the educational process for implementation of our Task Force's recommendations. We look forward to future conference programs to improve the evolving product.

Personally, I believe the Transit Performance Conference was one of the more productive ones that the Urban Mass Transportation Administration has ever sponsored. In this regard, on behalf of Norm Emerson, representing Mayor Thomas Bradley, City of Los Angeles as co-chairman, and myself, I think it appropriate to extent our deep thanks to Public Technology, Incorporated, the staff at UMTA, the workshop chairmen and reporters, the position paper authors and all of the others who contributed so much to making the September conference such a success.

Louis J. Gambaccini
Vice President & General Manager
Port Authority/Trans-Hudson Corp.

PREFACE

During the 1970's, the cost of providing transit services rose drastically, and local governments spent increasingly large proportions of their annual budgets on financial assistance to transit operations. As a result, when the Urban Consortium's Transportation Task Force selected its top-priority problems in 1976, transit system productivity headed the list.

In response, the Urban Mass Transportation Administration undertook a major effort aimed at clarifying the issues related to transit performance and developing recommendations for actions which could be taken to improve transit performance. UMTA project direction was provided by the Office of Program Evaluation. It was assisted in this effort by Public Technology, Inc. (PTI), which serves as secretariat for the Urban Consortium for Technology Initiatives, and the American Public Transit Association (APTA), which represents most U.S. and Canadian transit operators.

The initial result of this joint effort was the National Conference on Transit Performance, held at Norfolk, Virginia on September 19-21, 1977. In preparation for this conference a planning group was formed under the leadership of Louis J. Gambaccini, Vice President and General Manager, Port Authority Trans-Hudson Corporation (PATH), and the Honorable Thomas Bradley, Mayor of Los Angeles. The planning group was supplemented by some 35 technical advisors in various aspects of the problem, and a series of background papers were prepared and distributed in advance to the Norfolk conferees.

This document contains:

- Report on the Conference.
- Background materials.
- Lists of confereees, members of the planning group, and technical advisors.

PART I: CONFERENCE SUMMARY

On September 19-21, two hundred persons broadly representative of local government, transit management and labor, city and regional planning organizations, educational institutions, transportation consulting firms, and State and Federal agencies met at Norfolk to exchange ideas on transit performance.[1]

The interchange of ideas was in itself a valuable experience for conference participants. More importantly, however, there came out of that experience suggestions for positive action to improve the performance of urban mass transportation systems.

The first task of the conferees was the definition of the term transit performance. There was general agreement that the term embraced two quite different concepts:

- Effectiveness--How well a transit system meets the goals which have been set for it.
- Efficiency--How well a transit system utilizes available labor and capital resources.

During the conference, both in the background sessions and in subsequent meetings of the 10 discussion groups, 5 issues clearly emerged. These overlay the more detailed suggestions arising from the meetings and present major challenges to the transit community.

- The effectiveness of public transit cannot be measured and evaluated, either nationally or locally, in the absence of well-defined goals.
  - Local goals (where they do not already exist) should be set locally, in a joint endeavor of transit operators and those local agencies responsible for overall public policy and resource allocation.

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[1] The Norfolk conference was sponsored by the U.S. Department of Transportation's Urban Mass Transportation Administration, the American Public Transit Association, and Public Technology, Inc., acting as secretariat for the Urban Consortium for Technology Initiatives.

- National and State goals should be established and made known, so that provision for their accomplishment can be made in the development and revision of local goals. National and State goals should provide guidelines in areas of concern to those levels of government, but should be sufficiently flexible to allow their adaptation to local conditions.

- National goals should be related not only to areas for which the U.S. Department of Transportation has primary responsibility but also to such larger issues as energy conservation and national urban policy.

- Transit management and labor representatives should work together toward a better mutual understanding of transit performance and possible improvements in effectiveness and efficiency that can be beneficial to both.

  - While the Federal government should not intervene in the collective bargaining process, it can perform a useful function as the convener of national-level discussions between labor and management concerning the effectiveness and efficiency of transit operations.

  - Local labor-management discussions of these subjects, between bargaining periods, should be encouraged.

- There is an urgent and long-unfulfilled need for the interchange of ideas, data, and information with respect to all facets of transit management and operations.

  - The Urban Mass Transportation Administration should take the lead in meeting this need, directly and through its support of the efforts of others.

  - Priority should be given to the interchange of ideas, data, and information that can be of immediate use to those responsible for transit management and operations.

- There is a rapidly-developing need for better training programs for transit managers--particularly those at middle-management levels.

  - Existing programs do not meet the need to train the anticipated influx of persons to transit operating agencies, to train middle-management replacements, or to retrain managers in the face of the rapidly-changing nature of urban mass transportation systems and operations.

  - The Urban Mass Transportation Administration, with the assistance of other elements of the transit community, should more specifically identify and quantify this need, and coordinate efforts to meet it.

- Fare policy should be determined locally on the basis of the goals of the local transit system and local decisions as to the relationship between costs and fare-box revenues.

  - Federal financial assistance should not be conditioned upon the attainment of a prescribed revenue-cost ratio.

  - Further study should be given to the effects of amending Section 5 of the Urban Mass Transportation Act of 1964, as amended, so as to permit the non-federal share of total operating expense to be made up of a locally-determined mix of fare-box revenues and other sources of funds.

The conference was organized into 10 groups, each of which discussed the general background against which the conference was being held and then considered 5 specific aspects of transit performance.

-- Concepts and Indicators
-- Revenue Policy and Pricing
-- Service Characteristics
-- Labor-Management Relations
-- Internal Management

The conferees were provided a series of background papers, and during the conference itself there were several plenary sessions.[2]

The following sections of the conference report are based on the detailed notes made by the reporters assigned each group and a general discussion among the group leaders prior the closing plenary session.[3]

CONCEPTS AND INDICATORS OF PRODUCTIVITY

Because officials at all levels of government are concerned by the increasing costs of providing transit services, they are asking questions about how to judge whether--

-- transit operations are <u>effective</u> in meeting the goals which have been set for them and upon the basis of which they receive public financial support.

-- transit operations are <u>efficient</u> in the utilization of labor and capital to meet these goals.

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[2]The background papers, conference agenda, and texts of talks made by Urban Mass Transportation Administrator Richard Page, Mayor Paul R. Soglin of Madison, Wisconsin, and Louis J. Gambaccini of Port Authority/Trans-Hudson Corp. are annexed to this report.

[3]The observations which follow represent areas in which there appears to be substantial agreement. Unanimity was neither expected nor reached. Nor did all of the groups cover identical ground within the several topics which were discussed.

Transit operators are equally concerned with these questions, and the interest of the Congress was expressed in 1973 by the enactment of legislation which requires a uniform system of reports, records, and accounts for transit systems receiving Federal aid as a basis for "planning transportation services" and "the making of public sector investment decisions at all levels of government."[4]

- The conferees were generally agreed that transit management and agencies responsible for overall public policy and resource allocation decisions need reliable indicators of both transit effectiveness and transit efficiency. However, it was emphasized time and again that valid evaluations cannot be made unless there are well-defined goals against which performance can be judged (see the discussion on page 1, above).

- It was recognized that there is disagreement as to the validity and utility of many of the indicators now in common use. The paper prepared by the American Public Transit Association is a valuable contribution to the state of the art and provides a base for further work in this area by APTA and other members of the transit community.[5]

- Evaluations between transit systems must take fully into account local differences in public policy, social needs and objectives, physical setting, and types of service provided. Although there is emerging agreement that valid cross-evaluations of efficiency can be made, the conferees looked with considerable scepticism upon the validity of cross-evaluations of effectiveness in meeting local goals.

- There is need for better data about performance indicators and their uses. Section 15 will eventually meet much of the need for statistical data relating to transit operations. The Urban Mass Transportation Administration should collect and disseminate information on the nature and use of indicators in the United States and other countries.

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[4]Section 15 of the Urban Mass Transportation Act of 1964, as amended by section 111 of Public Law 93-503. This requirement has been implemented by Project FARE and regulations issued by the Urgan Mass Transportation Administrator on January 10, 1977 (42 Fed. Reg. 3772).

[5]Transit Performance Indicators, prepared by the APTA Productivity and Efficiency Task Force and adopted by the APTA Board of Directors on October 13, 1977, is included with the background papers.

REVENUE POLICY AND PRICING

This subject embraces two separate, but related, topics:

-- Revenue Policy--which establishes the ratio between revenues and expenses and which allocates costs between transit users and taxpayers generally.

-- Pricing Policy--which determines the fare structure and fare collection methods.

It is now almost universally recognized, on the basis of experience under both private and public ownership since the 1950's, that adequate urban mass transportation services cannot be financed out of fare-box revenues. In these circumstances, transit services must be financed as public services, the terms profit and loss are meaningless, and fare levels are set on a policy basis. The policy question is: What proportion of system costs will come from the fare box and what proportion from various tax sources?

Fare structure is likewise a policy issue, closely related to local transit system goals. Increasingly, fare structures reflect social pricing decisions.

During the discussion of revenue policy and pricing, a wide range of ideas were explored by the 10 conference groups, but little concensus was reached except on 3 points:

- There was a high degree of agreement that revenue policy should be made at the local level and that the Federal government should facilitate, not inhibit, this process (see the discussion on page 3, above).

- Fare structure and fare collection methods should be related closely to local goals and strategies, including those with respect to mobility for specific groups within the community, environmental controls, alternative investments, and center city development. However, the relative inelasticity of demand in relation to transit fares means that other strategies are likely to be more effective in meeting established goals.

- Additional research, demonstration, and exchange of ideas and information are needed concerning the impact of various revenue policies, fare structures, and fare collection methods on market segments and on patronage during specific periods during the transit operating cycle. The Urban Mass Transportation Administration should take the lead in this area under existing programs.

SERVICE CHARACTERISTICS

The principal determinants of the costs of providing transit services are the quantity and quality of those services. The service to be provided in a specific situation is a policy decision, the constraints upon which are the overall goals of the transit system and the availability of resources.

In making decisions concerning the provision of transit service the use of existing or new paratransit facilities should not be overlooked.[6] There are many circumstances in which full-scale, fixed route schedules are not justified and where economies can be effected--or service provided where it would otherwise be wholly infeasible--by using smaller vehicles which are deployed in response to specific needs.

Decisions with respect to the quantity and quality of all types of service are frequently documented in a set of formal service policies and standards, which guide transit management and provide standards for the evaluation of performance.[7] Service policies and standards can also assist in the allocation of resources and in making determinations concerning new service and the adjustment or elimination of existing services.

- The conferees strongly supported the concept of formal service policies and standards covering both transit and paratransit operations. It was generally agreed that:
  - Service policies and standards should be based on local goals, but must also reflect mandated Federal and State policies.
  - Service policies and standards should address specifically the equitable distribution of transit benefits to all segments of society without regard to race, color, sex, creed, or national origin.
  - Public officials who determine overall community policy and goals and who are responsible for local resource allocation must be involved in the process of setting service policy and standards. How this is done is a matter of local practice.
- Further study and demonstrations are needed to establish the kinds of situations best-served through paratransit techniques, costs, and solutions to institutional problems, including the relationship between paratransit services and conventional transit operations.

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[6] UMTA has defined paratransit as "flexible, collective transportation services, operated publicly or privately and using small or intermediate-sized vehicles" in a proposed policy on Paratransit Services (41 Fed. Reg. 46412, Oct. 20, 1976).

[7] Two discussion groups preferred the term Service Policies and Guidelines on the basis that it connoted greater flexibility than the use of the word Standards.

- The effectiveness of local transit and paratransit operations should be judged against locally-developed service policies and standards.

- Marketing programs should be related to specific goals, and judged against their effectiveness in assisting management in the attainment of those goals.

LABOR-MANAGEMENT RELATIONS

Transportation services are highly labor-intensive. Wages, salaries, and employee benefits are the largest component of operating costs, and labor-management relations cover a broad range of subjects which are of major significance in the effective and efficient operation of a transit system. Many of these subjects were touched on during the group discussions, but the conclusions reached cluster into four areas:

- It was generally agreed that both management and labor must be aware of the need to furnish essential transit services as effectively and efficiently as possible if local transit systems are to establish and maintain public support and a favorable public image.

- Representatives of both labor and management have been going through a period of adjustment reflecting the broad transition from private industry to public service.

  - One result of this is the need for both sides to have better up-to-date information before they reach the bargaining table.

  - Another result has been a fractionalization of responsibility for bargaining on the behalf of management which has hindered good-faith negotiations. Management should have a single spokesman, who is fully aware of the guidelines and limits set by officials and public bodies that determine public policy and allocate funds.

- Representatives of management and labor should work together toward a better understanding of transit performance and possible improvements in effectiveness and efficiency that can be mutually beneficial. (see the discussion on page 2 above).

- The specific approach taken in the New York supplemental agreement tying cost-of-living increases to productivity improvement programs and returns does not appear to be generally applicable.

INTERNAL MANAGEMENT

Although other factors are usually more significant in terms of the total operating expenses of a transit system, the dollar savings which can be realized through improved internal management may be substantial. More importantly perhaps, improvements in internal management provide an opportunity for the transit operator to enhance the image of the transit system, both with other officials and with the public generally.

Each system is different and has different--sometimes unique--problems. However, there are eight areas common to all systems within which the greatest possibilities for improvement seem to lie.[8]

-- Management techniques
-- Employee training
-- Insurance and claims
-- Internal security
-- Capital investment
-- Purchasing and stores
-- Facility location and design
-- Maintenance

- The conferees overwhelmingly agreed that the primary requirement for the long-term improvement of internal management was the development of better training facilities for transit managers, especially at the middle-management level (see the discussion on page 2, above).

- Although the transit grapevine is justly renown, it does not adequately provide for the interchange within the transit community of ideas, data, and information about transit management and operations. Some better mechanism for this purpose is urgently needed (see the discussion on page 2, above).

- Where general management skills and new management techniques have been neglected, they must be developed. This need should be recognized in the organization of training programs, and by the development and testing by the Urban Mass Transportation Administration, in collaboration with the American Public Transit Association and others, of additional management tools which build on FARE, RUCUS, SIMS, UTPS, and similar programs.[9]

- During the conference discussions, a number of specific opportunities for further study and development were identified. These are listed in the Appendix to this report.

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[8]Each of these areas is discussed in more detail in the Background paper on Internal Management.

[9]FARE--Uniform System of Accounts and Records and Reporting System.
RUCUS--Computerized scheduling of vehicles and manpower.
SIMS--Computerized records and controls for surface vehicle maintenance.
UTPS--Urban Transportation Planning System.

APPENDIX

The following is a list of the opportunities for further study, testing, and demonstration in the area of internal transit management which were identified during the conference.

1. Life-cycle costing of transit vehicles, in terms of the trade-off between maintenance costs and capital outlays for replacement vehicles.

2. Spare vehicle ratios, in terms of the trade-offs among maintenance resources, service reliability, and the costs of retaining additional vehicles in the fleet.

3. Preventative maintenance programs, in terms of the trade-off between preventative maintenance and breakdown maintenance.

4. Use of diagnostic instruments in vehicle maintenance.

5. Inventory levels, in terms of the trade-off between vehicle availability and investment in inventory.

6. Advantages and disadvantages of purchasing spare parts from the original maker rather than from the unit manufacturer.

7. A practical basis for make or buy decisions on parts.

8. Criteria for facility location and design.

9. Fare-handling procedures.

10. Use of part-time employees.

11. Retraining needs of operators, mechanics, and supervisors.

12. Driver incentives related to courtesy and safety.

13. Cash flow analysis and financial management techniques for small- and medium-size transit systems.

14. Insurance programs, including self-insurance, and claims-handling techniques.

15. Performance audit techniques.

16. Improvements in internal security techniques and methods of reducing the incidence and cost of vandalism.

TRANSIT'S PERFORMANCE AND POTENTIAL*

It is a great pleasure to be here today. This is an important conference, and there is a great deal of work to be done. I've read the conference papers and expect they will prove very useful in the days to come.

This is a most distinguished audience, full of experts: past UMTA administrators--Leo Cusick and Bill Hurd--and even a few would-be administrators. I'm also pleased to see friends like Chuck Collins from Seattle and Tom Pryor, who taught a few new Seattleites some basic facts about running a transit system.

I am honored to be included in this gathering. I truly know of no other constituency of a federal program who would or could meet in a forum such as this, to frankly and honestly assess their service and constructively contribute to the government's role in it.

This brings me to what I consider a major purpose of the conference. As I look around the room, I see a number of familiar faces, but I also see many of you who I have not met, but who I'm sure play an important role in assuring the performance of your transit operation.

Invitees to this conference included the familiar transit operators and UMTA staff, as well as local government elected officials and staff persons, labor representatives, traffic engineers, scholars, regional planners, congressional and state assembly staff persons, and many others. The list of invitees was deliberately broad so that it might reflect the total transit constituency. In fact, all we seem to have overlooked are the riders, and I trust a few of us qualify for that category.

A major purpose of this Conference is, then, to bring together representatives from all of the groups who have a vested interest in the future of mass transit. Despite occasional differences in opinion, we're all in this together, and our progress will depend in large part on our cooperation.

Transit, as a public endeavor and as an industry, obviously has some growing pains. They are nothing more than that. I disagree heartily with those who interpret the problem as a serious illness.

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* Remarks by UMTA Administrator Richard S. Page

We have come a long way in a short time. It was only 13 years ago that mass transit was a $40 million program. The bigest decision it faced was whether it should be run by an Under Secretary of Commerce or by the Federal Housing Administrator (the latter won in case you'd forgotten). Our principal constituency was a group of financially deteriorating private owners and a few dedicated Members of Congress.

Now we are one of the largest grant programs, with solid support in Congress, $3 billion a year, 15 million daily riders, and 280 urban areas using federal funds.

There are many things that have put us in the spotlight and subjected us to very legitimate scrutiny: Massive amounts of program dollars; growing operating costs; highly visible new equipment, systems and technology; changing patterns of urban development; complex labor management problems; and the new constraints of land use, environment and energy.

We truly have become a public enterprise, and we have some catching up to do. This has required increasing amounts of non-farebox revenues, and as more and more tax dollars are committed to transit by all levels of governments, we have to demonstrate, more convincingly, transit's effectiveness and efficiency.

We are not just replacing buses anymore - we are mapping areawide transportation strategies and building expandable systems that will serve the growth and development of a generation hence.

In this light, "project justification" is not just a one line blank to be filled in on a grant application--it is a whole planning and political process that must convince the public that it is worth it to commit their interest, involvement and taxes.

Unfortunately, we may sometimes feel burdened by this new public scrutiny, and when we do we look for scapegoats. But we're not here in Norfolk to point fingers or make excuses...speaking for UMTA, we're here to learn.

Some of you may suspect that this gathering could spawn another UMTA policy. You will be relieved to learn that floating out draft regulations is not my reason for being here. And before UMTA considers conditioning Section 5 aid on productivity measures or adopting performance standards, I assure you we will have arrived at some agreement within the industry as to what these programs and standards might be.

We have learned the hard way that there is no such thing as a transit system cookie cutter, that plans can't be xeroxed and used over and over--Detroit's answer won't necessarily be adaptable to Minneapolis' problem; Madison's commuters are not the same as Miami's; Los Angeles is not Philadelphia. But obtaining more information about each others' successes and failures is one very important benefit we all derive from greater public accountability.

The notion of transit performance is not new, nor was it invented by UMTA. Many of you are old hands in the struggle to maintain or improve service levels while accommodating rising costs. And, you've learned a

great deal. We'd like to capitalize on your experiences.

Supporting this Conference is one of the ways UMTA can facilitate this information exchange.

Now let's take a closer look at what really measures transit effectiveness and efficiency.

Transit's performance can be measured with some very sophisticated tools and with some very sobering figures. Two figures that we should remember are that since 1970 the consumer price index has increased by 47 percent, while operating costs rose 103 percent. I trust that Lou's impatience with the UMTA trends paper was with misplaced emphasis, not with the need to document and explain reality.

Many topics fall under the umbrella of performance. I want to talk briefly about three key issues: costs, productivity and revenues.

1. Cost Control. Spiralling costs--both capital and operating--is the albatross that hangs around our collective neck. We know some of the potential solutions to the construction cost problem and now are implementing them in many cities: more standardized equipment and construction components, more modest designs, proven and reliable technology and stringent acceptance testing, construction labor agreements and the displine of alternatives analysis--all will help.

Controlling operating costs, however, is a more complex problem and one that requires the most difficult decisions at the local level.

Public transportation should not be measured by the "for-profit" yardstick. After all, no one asks the local fire department or water authority to justify its existence by a profit/loss statement. But that does not discount the need for fresh and realistic approaches to holding the line on costs.

Every operator can and should examine the potential of adjusting service to budget constraints. A number of transit properties--SCRTD, Tri-Met, MBTA and PennDOT--have developed criteria for routes, so uneconomical routes can be eliminated.

Cost savings also are available in the maintenance area, a fact which the Chicago Transit Authority demonstrated when I visited there last month with their computerized Vehicle Maintenance System.

Actually, computers are just one management tool which the transit industry can make better use of. For example, industrial engineering and management training have proven benefits in other fields; some transit agencies are now pioneering with outside performance audits.

UMTA will do its best to encourage greater implementation of cost-control measures. We have funded and are prepared to fund grant applications for technical studies or demonstration grants which will usefully assist operators to diagnose and control costs, as well as improve management.

2. Enhanced performance and productivity. There are two basic aspects of transit productivity, efficiency and effectiveness. Efficiency is the way in which resources are converted into service; effectiveness is the nature and quality of the service provided, as measured by ridership and other indicators.

At budget time, local governments typically look at transit service more in terms of effectiveness than efficiency. Thus, we have a special obligation to assist them in understanding the cost as well as the benefits of more effective transit service. Factors outside transit's control obviously influence effectiveness, and they must be explained, not blamed.

Reliability contributes to effective service. In recent years, we have seen too many times what happens when insufficient attention is paid to the reliability of new technology and new equipment. As a recent Washington Post editorial stated, public patience is running out on chronically malfunctioning transit equipment.

Transit operators and manufacturers must jointly ensure that the equipment put into revenue service meets stringent tests of reliability. We must stop and think twice before we introduce new and unproven technology, and there must be a real commitment to thorough acceptance testing before the vehicles are put into revenue service. UMTA's Transit Test Center in Pueblo, Colorado provides a full range of real-life testing for rail vehicles of all types.

A number of innovative techniques are not being demonstrated to improve transit efficiency. Contracting certain services to private transportation providers, for instance, offers potential cost advantages and efficiency improvements. UMTA's demonstration of the broker concept is being conducted in Knoxville; Westport, Connecticut and the Twin Cities and there is much promise in that concept.

Efficiency also can be increased through labor/management relations at the bargaining table. New York has taken the initiative by tying wage increases to productivity improvements. The only problem is that the meaning of "productivity" remains undefined. A concerted effort on this is needed.

I want to encourage both labor and management representatives to exercise their good will in addressing the productivity and efficiency issue in the negotiating process. It is in the self-interest of both sides; no one will gain in the long run if labor costs are allowed to escalate faster than the cost of living, year after year.

Work rules and practices should also be examined. Many of the old rules and allowances are no longer appropriate because of technological improvements and service changes. Farebox turn-in time allowances, for instance, are counter-productive when that activity is handled mechanically. Use of split-shifts and part-time employees could help considerably. These are the types of things which labor and management must focus on in collective bargaining in order to improve efficiency and hold down operating costs.

3. Operating Revenue and Policy. Another assumption has been the idea that keeping fares stable will increase transit ridership. The trend has been to stablilized or even reduced fares, accompanied by a growing dependence on Federal, state and local subsidies to make up the difference between revenues and expenses.

Given the widening gap between operating revenues and costs, we must be more aggressive in raising fares - or other local dollars--and in developing more innovative fare policies and structures. There are several directions we might pursue in the development of new fare policies. Perhaps we need to reconsider the possibility of more flexible fares which could accommodate the local rate of inflation. Another possibility would be some sort of two-tier fare structure, permitting user-side subsidies for lower income groups or increasing fares on long-haul and express runs from the suburbs. Other crucial fare questions:

- Should UMTA require a proportion - like 1/3 - of costs to be covered by fares?

- Should UMTA limit Section 5 funds to pay no more than a proportion - say, 25 percent - of the deficit?

- What should be the future and purpose of Section 5?

I could mention many other performance issues, including section 15. Let me turn, however, to one special topic - UMTA's performance.

4. UMTA's performance. You all know by now that we've revised our Section 5 application procedures and have issued a new operating manual on that. We're going to reassess and restructure where necessary our transit management and demonstration program to assure priority attention to increasing transit productivity and cost control. I intend to have UMTA give more emphasis to transit management assistance.

We are in fact decentralizing. We have authorized 50 additional positions for the coming fiscal year, and have allotted 42 to the regional offices. New York, Chicago and San Francisco regions will get about 10 new positions each, making them fully capable of running the programs for those regions.

Three to four positions each will be distributed to the Atlanta and Boston regional offices, and one position will be added to each of the remaining five. Decentralization will be gradual but persistent and consistent. We do expect to move more and more of the headquarters grant functions to the regions over the next two years.

In conclusion, let met suggest that there has been a tendency on all our parts--and it's only been 10 weeks since I was a general manager!--to assume that transit is important, and useful,--that we are the key to sound urban development, environmental protection, energy conservation and mobility for the poor and handicapped. But we have been less willing to face up to the less pleasant realities of rising operating costs, flat productivity and falling ridership.

Performance is the key to our future in this industry. If we can improve our operations to make them more efficient and effective--and if we can successfully demonstrate to consumers and various governments our seriousness about providing worthwhile service--then we'll be on the way to a brighter future.

This conference is a major step forward. My compliments to the Urban Consortium and PTI staff, APTA, and our UMTA staff for their efforts to date. Thank You.

TRANSIT PERFORMANCE*

INTRODUCTION

I would like to share with you some perspectives on mass transit in the City of Madison.

WHY THE MAYOR OF MADISON?

With a few exceptions, the City of Madison has been managed by far-sighted thinkers, planners and politicians in the transportation area for more than three decades. The decisions and policies of the 1950's and 1960's have strongly influenced our transportation situation today. I am sure that I have been asked to speak to you today because Madison is a transportation leader of middle-sized cities across the country. Madison has also enjoyed success in meeting the transit needs of the Madison metropolitan area as witnessed by its receipt of the UMTA Administrator's Award in 1976. Perhaps some of our ideas, guiding principles and adopted policies can be used by both larger and smaller cities.

WHAT IS TRANSIT PERFORMANCE

We are here in conference to discuss transit performance. Exactly what is that? What does that mean? Does that have a different meaning for me, a mayor, and for you, a planner, or administrator of a transit system, or a federal or state agency representative, or a representative of transit laborers? It has many meanings, but all try to accomplish the same goal: to move people and goods at the lowest possible economic and environmental cost in the most efficient manner possible.

Before transit performance can be defined or even evaluated, it is necessary that quantifiable goals and objectives be established by the local municipality or the local agency responsible for transit implementation. The City of Madison, in October, 1975, adopted a report called "Objectives and Policies for the City of Madison". This report makes recommendations in a number of areas of transportation, land use and planning. This document has been the guiding measurement in the last few years and has placed into perspective the necessary goals, objectives and policies which must be fulfilled in order to meet the transportation system requirements of the City of Madison. So therefore, before any transit performance can be evaluated, it is necessary that goals and objectives be established.

Transit performance is not only the ability to move people from Point A to Point B; it is with what quality we move them, how quickly we move them, how expensive it is to move them, how much energy it takes to move them, and how much that movement affects our total human environment.

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*A speech presented by Paul R. Soglin, Mayor, City of Madison, Wisconsin, September 19, 1977, Norfolk, Virginia.

Transit performance is sculptured and measured by public opinion, and sometimes altered by political realities. The City of Madison uses a number of indicators to measure transit performance. I will talk about these in a few minutes; but let me list them, and you can anticipate Madison's evaluation in the later part of this speech.

A. Automobile subsidy versus transit subsidy
B. Total ridership
C. Passengers per mile
D. Cost per passenger mile
E. Public opinion and surveys

Today we are trying to provide good service by taking transit systems that needed attention twenty and thirty years ago and, almost overnight, reshaping them. This could be accomplished if we had unlimited funds at all levels of government. But we don't. With every city competing for needed funds, and every agency within communities vying for tight tax dollars, criteria are necessary to enable the fair distribution of more funds.

SUCCESS OF TRANSIT IN MADISON

Success in the City of Madison and the surrounding Dane County area is largely due to the total involvement in transit performance by people at all levels, including the public, politicicans, the planners, and the administrators. The needs of the community have been identified, the problems involved in meeting those needs have been identified, and a joint effort to adopt policies for the benefit of the whole community which solve these problems and meet the needs has been agressively pursued. I just mentioned five indicators which we in Madison use to measure transit performance. How has Madison done?

Automobile Subsidy vs. Transit Subsidy

Many people, yourselves included, talk about transit subsidies, but very few people talk about automobile subsidies. In the early 1970's when I was an Alderman on the Madison City Council, I requested that the subsidy necessary to support the private automobile be calculated. While it was difficult to arrive at these numbers, most people were astounded to learn that the City of Madison spent almost $10,000,000 of their property tax revenue to support the private automobile. This compares with a transit subsidy of approximately $500,000 in 1970.

Since the automobile/transit modal split is approximately 95-5, the financial ratio seemed reasonable, and we have tried to continue this relationship before considering any fare raises or service cuts. The transit subsidy in 1970 was approximately $500,000 and the local share in 1976 was approximately $534,000 of a total $2,334,000 since the state and federal government paid approximately $1,800,000. Therefore, the cost to the local property tax has been steady, which has removed the need to raise fares or cut services.

I might add that the modal split may not be the most appropriate yardstick by which to determine the distribution of funds to the private vehicle and the

public transit system, in that it fails to consider public policies designed to encourage transit ridership and lessen reliance on the private vehicle. It also fails to account for decades of imbalance when the private vehicle was subsidized in a disproportionate manner at the expense of public transit. Since World War II, the capital investment in highways and parking facilities as well as their continual maintenance has taken place to the detriment of public transit. That capital investment for which we are still paying, as well as the continued operating expenses (or should we call them subsidies) to maintain these automobile facilities, destroyed hundreds of transit systems and provided the private vehicle with an unnatural and unfair competitive advantage. Consequently, it would not be unreasonable in this coming decade to see commitments of capital investments and operating dollars for public transit far in excess of the existing modal split.

Total Ridership

One of the most visual forms of transit performance is ridership. If the buses are full and the service is being used all day, a high level of performamce is perceived. Ridership of the Madison Metro bus system has increased from 7,730,000 in 1970 to 12,410,000 in 1976, an increase of 60.5%. While this ridership increase is important, the total population of the Madison metropolitan area has grown also. A good indication to measure whether transit is gaining in population growth is rides per capita. In 1970 Madison had 37.7 rides per capita and in 1976 61.0 rides per capita, which is one of the highest ratios in the United States.

Passengers/Mile

Another measure of transit performance is the number of passengers carried for every mile of operation. As mentioned above, ridership is important, but ridership without efficiency is self-defeating. Madison watches very closely the measurement of passengers/mile. In 1970 Madison 's passengers/mile was 3.04, which dropped slightly in 1971 due to expanded service, but has increased every year since to a 1976 level of 3.50. In conjunction with this figure, passengers/passenger-mile is another good indicator which takes into account trip length. This figure is not readily available in most systems since average trip length is not measured. Project Fare should make this ratio available to most systems.

Cost per Passenger Mile

The cost of operating a system is important to everyone here. The costs are the first figures reported by many media. We have watched while insurance costs have skyrocketed, fuel costs have tripled, and employees' salaries and fringe benefits have almost doubled, all in the last six years. The cost per passenger mile in Madison has increased from $.82/mile in 1971 to $1.32/mile in 1976. This increase in cost/mile has been controlled through effective cost management procedures including unit cost allocation, inventory control, multiple use of supervisory and management personnel, and effective labor negotiations.

Public Opinion and Surveys

Finally, and also the ultimate measure of transit performance, is user and non-user attitudes and opinions. The City is continually conducting on-board surveys, telephone surveys, and attitudinal questionnaires. A series of surveys conducted in 1975 indicated to us that users and non-users alike were generally satisified with the transit services being offered. The telephone survey indicated that less than 35% of the people never use the bus which means that at some time 65% of the people in the Madison metropolitan area have been on a bus. We feel that figure is the strongest measure of transit performance we can offer.

Transit planning and improvements programming in the area are conducted within a context of a comprehensive and continual planning process. It considers the links between transportation and other aspects of regional development such as land use, environmental, social, and economic concerns, and views transit as one element of a total transportation system that includes a variety of travel modes, including private automobiles, carpools, vanpools, surface transit, air transit, bicycles, pedestrians, rail, etc.

It should be noted that transit planning must become an integral part of the public planning process, whether we are concerned with the city, county, state or federal governments, just as the location of a railroad track and depot determined the future of a community 100 years ago, and just as the future public transit systems will determine land use patterns and social and economic arrangements. Not only is there nothing wrong with that, but we should even go so far as to develop our transit systems for the purpose of influencing land use as well as residential, commercial and industrial development. The link between transportation and the rest of our environment cannot be ignored, and transit must be used positively, which means that those involved in the transportation industry, and particularly transit, must be included in the planning process, and when they are not, it is the obligation of those transit professionals to insist upon their involvement.

Within this planning framework, transportation implementation in the Madison area is based upon a short-range transportation improvement program (or TIP) as well as a transportation system management plan, as required by the Federal government. The TIP is an annually updated listing of transportation improvements anticipated in the next few years. This programming of transportation improvements includes major capital facilities as well as low and non-capital improvements related to all modes of surface transportation.

TSM (Transportation Systems Management), while a new word in the federal bureaucracy, in effect has been implemented in the Madison area for the last fifteen to twenty years. Madison was doing TSM before TSM was ever considered. We have a Department of Transportation which has three divisions: Parking, Traffic Engineering, and Transit. These three divisions work together administratively, and through a transportation commission formed of citizens, politicians, local elected officials, and staff. Some of the TSM programs done in the Madison

area include: preferential lanes for buses; exclusive bus lanes; contra-flow lanes; parking restrictions; turn prohibitons and preference for buses; the counting of people through an intersection versus the number of automobiles through an intersection; signal timing to give more preference to number of people, rather than number of vehicles moved; neighborhood planning, which minimized through-traffic in local neighborhoods; and others. One element that needs more study and definition is the measurement of TSM performances. While our primary purpose here is to discuss transit performance, I feel that tools for TSM performance must also be developed and goals established for TSM activities.

If Transit System Management is to mean anything, the transportation and transit bureaucracy must be integrated into the governmental structure. There can be no independent transit authorities which are not subject to the review of public bodies such as city councils, county boards, and legislatures. Some might protest that this would only lead to political interference in the development of transit systems. To argue that provision is to beg the question. The industry is already highly politicized. Given that public priorities can only properly be established by elected officials who must weigh the value of all governmental functions, it is necessary for public transportation to participate in all of the benefits and liabilities that go into the development of public policy. This may mean that some people who presently do not have direct control of transit probably will begin to have some input into its development; but it also means that transit planners will be able to legitimately address land use problems and related interests, which in the long run will be beneficial to public transportation.

Our transportation systems will develop and flourish in an unprecedented manner when transit planners are able to study and critique development proposals which will affect densities, which of course, are critical in the stability of any public transportation system. It means that transit planners will become involved in the location of new businesses and industries, so that transit ridership might be maximized. It means that location and scheduling of routes will have greater effects on the development of urban areas, particularly the once-dying center city. All of these benefits which are both in the interest of the public as well as those of us concerned with public transportation certainly offset any short-range inconveniences that might occur as transportation systems and transit planning become integrated into the total public planning and budgeting process.

Advances in the Madison area are closely tied to the cooperation of the public. A great effort has been made to involve the people in every step of planning and implementation of transit measures. Surveys, both telephone and on-board, seek public opinion. Annual surveys of elected officials seek information as to where they have had requests for transit service and where it might be possible for the transit system to be more responsive to the needs of the public. Through this public involvement, a coordinated set of land use and transportation goals and objectives and policies have been developed which closely link work, recreation and living situations with transit facilities.

Future Problems

Let us now look at future problems. We recognize the potential for problems in the future that could reserve the success of the past. For example, our policy of controlling auto access to the central business district in order to encourage mass transit can conflect with the goal of brining shoppers who may drive to shop at local retail outlets. Another such problem involves balancing the efficient use of existing street capacity versus removing through-traffic from residential neighborhoods. The City of Madison "Objectives and Policies" adopted in October of 1975 addressed these problems, and all of our transit performances are measured against those objectives and policies.

The increase in the operating deficit costs for transit is caused for concern, but at the same time, not a reason to start raising fares. An important factor in the success of Madison's transportation system has been the continuing availability of financial resources at all levels of government, to fund transit-related projects. The willingness of the local Madison Common Council to vote funds to these projects has been crucial. But these available resources are by no means assured. Therefore, transit deficits and revenue policies are an important matter to us; but at the same time, roadway deficits and revenues are an equally important concern.

We cannot over-emphasize the need to re-enforce the fact that not only do public transit systems need subsidy (or, as I prefer, operating deficits), but public roadways operate at a deficit as well. We have all seen the semis on the highway with the sticker on the back which says, "This vehicle pays $3,680 in highway taxes". I do not mean to single out the trucking industry, but has anyone ever bothered to calculate the total public cost, including capital investment as well as operating expenses, in providing highways and related facilities for the trucking industry?

In analyzing transit deficits, we must always be prepared to answer the question, "What would the cost be if there was no transit system?" In a given community, the deficit may be $2 million or $4 million or $100 million a year. How much would we be spending annually for highway and road construction if that transit system did not exist? And what would be the environmental impact with that many more private vehicles on the road?

Another problem which limits the growth of the public transit development is that ridership occurs mainly by peak-hour commuters. How can we justify large expenditures for a system that is used only during peak hours? We must find better ways to encourage off-peak hour ridership. Madison has had some success in off-peak Saturday and Sunday, but has not had enough success in late evening hours. We have, through a state program, proposed a taxi transit demonstration project to tie taxi and transit services together at night to minimize the expense in the late evening hours.

Another area of concern is the mobility of the transportation impaired, more commonly known as the elderly and handicapped. There is no question as to the need for and provision of services for the elderly and handicapped. However, I feel that each local government unit should be able to assess the needs of their communities and design a system to fit those needs. The federally mandated full accessibility program raises serious financial and mobility questions.

These and other problems need our planning attention now. If we coordinate our thinking by sharing the problem at all levels of the system, especially with the public, then plans for a successful transportation service will result.

In closing, let me urge those of us gathered here to take an organized, open approach in the discussion of transit performance. When discussing revenue policy, or internal management, or any other aspect of transit performance, we should lay all the cards on the table, view each point from all sides and develop a well-organized and solid understanding from which policy can stem. Therefore, all levels of government, all levels of transit management and all levels of public participation can be proud of an efficient, effective, and excellent public transit service which they helped to plan and create.

Thank you.

EVALUATING TRANSIT PERFORMANCE: PURPOSES AND PITFALLS*

This conference is the first that I can recall that has been dedicated to the single theme of Transit Performance in its many aspects and ramifications. The word "performance", for many, is but a euphemism for what is more commonly--though less precisely--called "productivity" or "efficiency". It is a loaded subject with just about as many different perceptions as there are different perceptors. It is a subject about which virtually everyone has opinions--and usually very strong ones.

There has been a growing concern in recent years about the declining financial fortunes of transit operators. Transit systems had their origins as private enterprises and, as a result it has been easy, and indeed common, to view transit in the same familiar conceptual framework applicable to private business. In a business context, there is implied in the word "deficit" a negative connotation that something is wrong. From that negative connotation, it is easy to leap to the conclusion that a deficit enterprise is "mismanaged" or that there is no perceived economic need to continue the service. In fact, that was the prevailing philosophy applied to transit in the 1950's and early 1960's.

That is the legacy of transit's heritage. In fact there are still a number of economists and others around who cling to the belief that if only "market forces" could be loosed on the transit operators, then all of the problems would be solved. Those systems that could not hack it under the rigors of the new ground rules would disappear, presumably because market forces would have clearly demonstrated that there was insufficient "need" for them at all.

Despite the continuing existence of this claque, there is no question that today there is a much greater awareness of the non-transportation benefits that are derived from effective transit systems, which provides a rationale for, or, to state it more forcefully, demands external financial support for the continuation or expansion of services. Yet even with this growing awareness, transit has been stung with many of the old shibboleths, emphasizing deficits, subsidies, featherbedding, unimaginative management, and the like.

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* Remarks delivered at opening session by Louis J. Gambaccini, Vice President and General Manager, Port Authority of Trans-Hudson Corporation.

Often, soaring tribute is given to the external benefits of public transit, but when the hard decisions have to be made, a hasty retreat is beaten to the comfortable certainty of "financial analysis" with the implied criteria that "cheapest" is "best". Whether this process is called "financial analysis", "alternatives analysis", "cost/benefit", or "cost-effectiveness" does not really matter. What matters is that there is a tendency towards overdependence on easily quantifiable factors to the virtual exclusion of the more difficult-to-quantify external or social benefits.

Even where quantification is possible, these data are often in different and non-comparable units. How does the analyst, or decision maker, balance off a reduction of "X" grams per vehicle mile of pollutants against an incremental dollar cost of investment? Or a reduction in crude oil consumption against an increase in public expenditures for operating subsidy? I don't want to infer that dollar expenditures be ignored or deemphasized. As operators, we are not looking for a blank check. Instead, I have argued--and believe deeply--that the perceived costs of transit must be assessed against the total societal costs and benefits of the alternatives, and not on the basis of the profit and loss statements or the balance sheet of the transit system alone. To so focus on balance sheets and profit and loss statements only is to grossly distort reality and to perpetrate a fraud on the public.

With regard to productivity in its generic--not pejorative--sense, the problem has been similar. Increasingly, the public sector at large has been required to provide its financial support for transit purposes. This support is greater, certainly, than the public usually wants to provide and its growth, perhaps, has been more rapid than the tax base seemingly can support especially in a context of competing demands for services. Given these circumstances, and being well aware of the political processes, I can understand why a villain must be found. My problem is that as a transit operator I don't like being the convenient target of opportunity, merely because someone divides a couple of easily available numbers by another couple of numbers and, like a latter-day Archimedes, comes to some profound conclusion that, presumably, will alter the course of human events for a millenium.

This may sound overstated, but it has virtually happened. Recent past policy makers in USDOT, for example, have used the theme of "declining transit productivity" as a peg for requiring that half of the Section 5 operating assistance monies be used for capital purposes--that is, made unavailable for operating expenses. Using APTA data, someone performed a series of simplistic--oversimplistic, I should say--calculations and ended up with a series of ill-founded conclusions about the "alarming" decline of transit productivity which, by their implication and extrapolation, was being facilitated by federal operating assistance. Fortunately, this canard was laid to rest in the subsequent UMTA report on Section 5, but as often is the case, the dispassionate facts never quite caught up to the allegations and the inferences.

The measurement of transit efficiency, transit effectiveness, or transit productivity--however the terms are defined--has importance. We all benefit by having a more precise understanding of transit, whether as operator, funding agency or planner. But what has increasingly inflamed

the transit operators in recent years is the misuse of these measurements and the drawing of unsupported--and unsupportable--conclusions based upon narrow numerical relationships. As I see it, the measurement is not an end unto itself. It is merely the first step in asking the right questions as to what are the causes for the observed phenomenon. Rising deficits per passenger need not reflect inefficiency but perhaps a conscious policy to maintain low fares for other social purposes. A decline in the number of passengers per revenue vehicle mile may simply represent route extensions into less productive areas or the maintenance of "uneconomic" services into, for example, low income areas, again for good social reasons. I know, for example, on PATH that when we reduced the length of trains in off-peak periods for the purpose of conserving energy, we worsened any statistical standard that was based on the car-mile criterion. Thus, the number of car miles per employee was lower, an apparent decrease in efficiency--or, an apparent reduction in transit service to the community.

Just within our PATH experience, I can cite other similar examples. Our car maintenance facilities were constructed in 1908. We know we can improve efficiency with a new car shop. But the increase in efficiency would in no way amortize the added capital costs. Yes, we are in a way inefficient, yet our bad financial situation would be worse, even if we achieved more statistical efficiency through new maintenance facilities.

Further, on PATH we place a high premium on "on-time" performance. Because of the number of trains we operate at very close headways on four different services, we are extremely vulnerable to minor mechanical failures on in service trains which can adversely affect at least two services and delay many thousands of people. To minimize these disruptions, we station car inspectors at key locations on the system during peak periods who can quickly free up a stuck door or adjust a faulty connection. The best thing that can happen to us is that these car inspectors have absolutely nothing to do. Statistically, however, they are unproductive, unless it is related to the management objective of maximizing on-time performance. Even where we can compare like standards internally, one must question the significance. On our Hoboken to World Trade Center service, all eight train sets make at least two round trips in the peak hour, and some make three. In contrast, on our Newark to World Trade Center service, only three of the fifteen train sets can make even the second trip during the peak hour. Statistically, we can say we get more utilization of manpower and facilities on the Hoboken service than from Newark. But realistically, what can we do about it? It is a geographical constraint that we have to live with.

I am sure other transit operators could run through a litany of similar examples where different objectives or constraints have perverse effects on measures of transit performance. I note, for example, that staggered work hours is held as a potential "solution" for improving transit efficiency. We have had a number of years of experience with staggered work hours which has improved passenger amenity levels and potential capacity for PATH. There has been virtually no cost impact.

Increased potential capacity is a valid objective that would permit handling more people in the future at little added cost. But PATH is

somewhat unique in having short running times from terminal to terminal which permits fairly rapid turn-around of equipment. For commuter railroads, or for the NYCTA, where the terminal-to-terminal runs are an hour or more, there is little measurable benefit to be derived from shifting work start and end times by 15 minutes or half an hour.

There are enough difficulties in evaluating performance measurements within any one system. In my view, inter-system comparisions of seemingly like data, without an awareness of the operating climate and physical differences, is, at best, weak, and, at worst, totally misleading. PATH and PATCO, for example, have several obvious similarities. Both are about 14 miles long, and both have approximately the same number of stations. Both are rail rapid transit systems operating off 600 volt third rail.

Now, a few of the differences. PATH operates four services compared to PATCO's basic single line. PATH operates 38 trains during each peak hour compared to PATCO's 13. PATH's car fleet consists of 298 cars versus 75 for PATCO. Each operation is tailored to the needs it must serve. It is not possible, nor even relevant, to try to assess whether one is "better" than the other on the basis of the usual statistical criteria without initimate knowledge of a host of operational and non-operational factors.

Even worse, in my mind, is the attempt to derive penetrating wisdom from the use of aggregative data. There are many treacheries using overall data on a single system, much less trying to construct an industry wide profile of what the efficiency or effectiveness of transit really is.

I can, in my more passive moments, accept such attempts as harmless exercises. But, unfortunately, the results are more often used to heap abuse on transit than anything else.

As a modest example of this point, I need only to refer to the Background Paper - Part II entitled Trends and Transit Performance--1970-76. The four page introductory text recognizes all of the things that I have mentioned up to this point. It closes by noting that "One serious weakness of transportation analysis has been its inability to monitor and measure transit's contribution to broader social objectives...". My sentiments, precisely.

Yet, this is followed up by some 13 pages of statistics showing rising costs, declining usage, rising deficits, with only fleeting references to the root causes. Rather than focusing attention, or shedding any light, on the admitted "serious weakness", the Appendix paper only massages and remassages readily available numbers to establish what we already instinctively know. That is, the changing structure of urban regions--towards dispersal and decentralization--has made it increasingly difficult and expensive to provide adequate levels of transit service. Additionally, transit in the United States is not homogeneous. Different trends affect different urban areas differently. Some urban areas have coped more successfully than others with the problems of land use, or maintaining center city viability. These shadings are submerged in overall statistical compilations.

What has not been identified, nor even hinted at, are the societal costs--in resource usage, land use, environmental degradation, mobility, etc.--both past and prospective, that the continuation of past trends implies. And if the continuation of the trend is socially "too expensive", what are the necessary interrelated policies--transportation and non-transportation--that must be promulgated in order to achieve that goal?

The funding agencies, whether federal, state or local want to know if they are "getting their money's worth" in providing financial support to transit. It is a perfectly proper question. In this framework, it is legitimate to address the productivity and efficiency issues. My belief is that transit is no worse and probably a whole lot better than other governmental sectors in the efficient delivery of public service. I applaud the effort to really find out.

What really bothers me is the obsessive inward focus on operational statistics. Perhaps, through supreme efforts at improving "efficiency", transit deficits in time could be reduced 5 percent--be generous, say 10 percent--a result that inflation would quickly wipe out. I am not suggesting that it shouldn't be done. But after five years, maybe ten years, of this agonizing activity, we still would not be one step closer to answering the basic question as to whether the funding agencies are getting their money's worth through the continued financial support of public transit, unless, and until we address the gut questions of social objectives and public policy goals.

We are here to learn from one another. You are all invited experts with a broad array of perspectives. We all have blind spots--an admission I do not make lightly.

I have been strident in my defense of transit. Others probably will be equally so in setting forth their own views. This conference should not be a test of eloquence or debating technique. We are all here to gain understanding into this complex problem, and to work cooperatively for an insight into the interrelationships of transit policy with other federal, state, and local policies. My essential message to you here at the opening of this conference is let's all try to maintain a balanced perspective--a continuing view of the contexts and frameworks within which transit operations exist. We all want better, more efficient and productive transit. To get it, we must look outward, as well as inward.

BACKGROUND, PART I: INTRODUCTION

Transit performance is of growing concern to all members of the transportation community as persistent inflation and the scarcity of public resources threaten the ability of communities to support continued and improved transit service. The National Conference on Transit Performance is an attempt to address this problem.

Because of its inextricable link with other social goods and functions, and its potential impact on urban social and economic structures, public transportation has been the focus of both laudable attention and critical appraisal. Older cities look upon transit as one of many means of revitalizing center city areas. Growing metropolitan areas expect transit to mold settlement patterns and to help control or limit traffic congestion. On the national level, transit is viewed as a means of addressing broad policy objectives in such areas as energy conservation and air quality.

As a result of the growing acceptance of transit as an essential public service, greater demands have been placed on transit to serve a much wider and more diversified market. These increased services have led to increased costs which have risen at a much greater rate than increased revenues associated with the services, because communities have justifiably stabilized fares to assure continued patronage. As a result, the burden of financing the services has fallen on local, State, and Federal governments. Because of this, the need for wise allocation and better management of resources is crucial. In an environment where it must compete with other public services for funds, public transit must utilize every opportunity to improve its operating and financial performance. To examine ways to measure such performance, the obstacles to such improvement, and to suggest areas where improvement might take place and pay off, this Conference is taking place.

THE CURRENT STATE OF TRANSIT PERFORMANCE

While the effectiveness of transit performance has improved in many respects, the cost of providing service has risen much more rapidly than operating revenues. The gap between costs and operating revenue could be over $2 billion by 1980. Thus, greater burdens are being placed on general revenues, and consequently more attention on community-wide benefits and considerations. This widening gap has been viewed with concern by all members of the transportation community.

The dimensions of this cost/revenue gap are dealt with in detail in Part II of this paper: Trends in Transit Performance: 1970-1976. In order to provide insight into possible solutions to the current situation, we must examine briefly the changes in the past two decades which led to it. While it is always risky to generalize on the subject of transit performance, the following discussion is intended to provide a framework for the more detailed papers to follow.

Suburbanization

Increasing home-to-work trip lengths and increasing reliance on automobile usage--both stemming from suburbanization--have had adverse affects on transit performance. First, transit has not been able to provide attractive off-peak service in these low density areas at reasonable costs; therefore, suburban transit service is usually commuter service oriented toward the CBD. Thus, peak period capacity remains underutilized during the remainder of the day. Second, the extensive public subsidy of automobile travel underprices the true costs of this mode relative to transit. Thus, the individual choice is most often between transit fare and the variable costs of driving.

The Changing Transit Market

Despite recent decreases in patronage nationally, the market for transit services is neither constant or declining. It is in flux and expanding, albeit not in relation to current automobile usage. Among the more recent trends, it is notable that the number of households lacking an available automobile has increased in metropolitan areas since 1970. About 30 percent of these transit-dependent households now reside outside of the central cities. The transit-dependent population can be expected to grow as a larger portion of our population enters retirement, as more youth and women enter the labor force, and as more handicapped persons enter the mainstream activities of society.

Increased Management Responsibility

Recent public attitudes about adequate transit service, changes in the transit market, and availability of governmental financial assistance have generated a need for additional non-driver employees in transit. Services included here involve increased planning and management, security personnel, improved maintenance, and analysis. Expansion of non-driver personnel accounted for approximately ONE FOURTH of all increased operating costs in excess of inflation and service extension during the period from 1970 to 1976.

Increased Labor Costs

From 1970 to 1976, 32% of the increased costs of providing transportation service (total increases amounted to 103% for that period) are attributable to increased labor costs, whereas 51% is attributable to inflation.

General Inflation

All components of operating costs--fuel, insurance, labor, parts, rolling stock--have been greatly affected by inflation. Unfortunately, such increases have greatly outstripped increases in revenue, since revenue capture is largely determined by public policy, and often aimed at counterbalancing inflation by offering service to riders at a rate considerably below actual costs of providing that service.

OTHER CONSIDERATIONS

Several additional problems not directly related to increased costs continue to have a significant impact on transit performance.

Switch from Private to Public Sector

Transit systems in newer cities--where the change from private to public ownership has been recent--have not yet developed the mechansims with which to compete for the limited amount of public money available for financial assistance to all public services. Part of this problem is the fact that transit does not yet have a nationally accepted, or otherwise uniform, set of goals and objectives. Thus, public awareness about what expected services should be and cost is not highly developed or well-established. Without such a consensus, local decision-makers are finding it difficult to justify the allocation of funds to transit. The fact that transit service in these areas operated at a profit only a few years ago compounds the problem, since the general public and its decision-makers sometimes don't understand the dynamics of change that have caused transit's present financial situation.

Lack of Information

Information about transit performance--especially related to efficiency, effectiveness, and financial performance--is not always available to decision-makers in a form which would enable them to justify the much-needed expenditure of scarce revenue. The lack of uniform operational goals and objectives on both the national and local level compound this problem. The transit "image" often suffers.

Perception of Transit

Although most urban transit has transferred from the private to the public sector, the terminology of the former era remains. Transit is described as an "industry", or as "properties", suggesting a profit-making business, not a public service. The financial assistance given it is referred to as "subsidy"; the gap between operating costs and revenues as a "deficit". Since transit has shifted to the public sector, this terminology is no longer applicable. Until the language used to describe transit is altered to reflect present realities, one cannot expect transit to be perceived as the extensive public service it has become.

Lack of Control

Still another problem is that the members of the transportation com-

munity who understand and most need certain changes are powerless to effect such changes, because they don't control the resources or facilities with which to do so. An example of this problem is illustrated by a recent study which showed that an increase of one mile per hour in the average operating speed of a transit vehicle could yield an increase in "productivity" of between 10 and 18 percent. Yet such an increase in vehicle speed can only be realized through a coordinated program of traffic improvements and restrictions--a program over which the transit operator has virtually no control.

PERSPECTIVES AND RESPONSES

Transit is viewed differently by different interest groups.

Transit operators face a most difficult challenge. At the same time that public policy has stimulated socially responsive yet unprofitable service, and where land use policies have encouraged development which led to increasingly longer and more costly transit trips, operators are called upon to improve efficiency. One response has been to cut service. Another has been a reexamination of operating practices, and the implementation of time-and cost-saving technologies, such as RUCUS or SIMS.

Local governments also feel pressured because of the financial support they must increasingly provide to transit. And like Federal officials, they are feeling a financial bind along with the pressure from the heightened emphasis on energy conservation and air quality. Such pressure suggests that there should be "more transit out there". A typical response to this situation has been a critical analysis of marginal routes and a consequent "fine-tuning" of the entire transit system. Toronto, Boston, Kansas City, and Los Angeles are leaders in this area, realizing that a line must be drawn somewhere between the demand and the provision of service.

State governments, often latecomers into the field, have had to contribute financial support to transit, while having limited control over operating policy. One state's response has been a proposal to "draw the line" as to the percentage of transit system operating revenue that must be covered by the fare box (California). Another has proposed determining the projected costs and revenues for each transit operator as the basis for allocating financial assistance (New Jersey).

The Federal government, which contributes a growing portion of operating assistance, has responded by requiring that local officials and operators comply with a process to ensure that the most efficient use is being made of the existing system--as a prerequisite to the receipt of operating and capital assistance (TSM regulations). And the Department of Transportation faces increasing pressure to limit Federal involvement in local operating and financial issues, but to provide more funds nevertheless.

Areawide planning agencies recently have been given the responsibility of coordinating the planning and programming of transportation services among jurisdictions. These agencies have been criticized by local governments largely because the regional mechanism provides suburban jurisdictions with a degree of control over inner-city transit decisions. The chief response of these agencies has been simply to try to do a better job within

their given contraints--a response which has not always satisfied the other members of the transportation community.

Finally, labor has been criticized by other members of the transportation community, as wages and fringe benefits comprise 70 to 80 percent of all operating costs. Wage increases in recent years have been greater than during the last years of private operation, where increases were often restrained by tight budgets and rapidly diminishing profits. As a result, many view recent increases as greater than appropriate. Because labor costs impact so directly on total operating costs, there have been attempts to link wage increases to improvements in productivity. The New York City Transport Workers Union COLA (Cost of Living Adjustment) agreement, whereby cost of living increases to workers are tied to increases in productivity, is an example of such an approach.

ISSUES

In addition to this background material, issue papers (attached) have been prepared to help guide discussion in each of five Conference workshops on the following subjects: Concepts and Indicators, Revenue Policy and Pricing, Service Characteristics, Labor/Management Relations, and Internal Management. While these papers stand on their own merit as necessary reading for each Conference participant prior to the Conference, the follow groups of issues are provided to help set the stage.

(1) What are the goals and objectives of transit?

A. Are these goals the same for all members of the transportation community?
B. Are transit goals and objectives consistent with those of transportation in general? Local community goals and objectives in general?
C. How might a uniformly accepted set of transit goals help improve transit performance?
D. Is the formulation of such a set of goals possible? How might such a set of goals be developed.
E. What transit performance problems are particularly effected by the lack of uniform goals?
F. What transit policies are compatible with each major transit performance goal?
G. Should we spend valuable resources trying to serve existing demand, or should we use transportation to effect more rational land use and other community goals?

(2) How should transit performance be measured?

A. What is the value of an agreed-upon set of standards or indicators?
B. What bases of comparison are valid?
C. What data are necessary to evaluate performance in a meaningful context?
D. What are the costs of obtaining such data? What are the problems involved?
E. What will performance measurement tell us about our transit systems? Our investments? Equity issues? Other community goals?

(3) What is the relationship between efficiency and effectiveness?

A. Does "good" performance necessarily involve both of them: Or are they mutually exclusive?
B. Can a clear notion or concept of "productivity" be based on these two factors: How might that be done? Is there a need for such a notion, or should they be considered separately?
C. Under what conditions, and in what circumstances, might both efficiency and effectiveness be improved?
D. Under what conditions, and in what circumstances, are they mutually exclusive; to what degree?
E. What role should either of these concepts play in the measurement of performance?

(4) What are the relationships between public policy, transit performance, and equity?

A. If serving the public, meeting demand, and addressing community goals lead to poor "financial performance", should they not be done? Or is such a notion of "financial performance" too limited? Meaningless?
B. What, then should be the basis for good transit performance?
C. How might the demand for, and provision of, increased transit service affect the notion of "performance"?

(5) What are the new realities and contraints facing transit now and in the near future?

A. What must we do to face those realities?
B. What are the dimensions of these realities?
C. What must be conveyed to the general public about these new realities, and how might that best be done?

(6) What must each member of the transportation community do to improve transit performance?

A. What are the limits of such actions?
B. What roles must each member play?
C. What will cooperation cost each member?
D. What may he or she expect in return (i.e., What are the payoffs to each particular member?).

(7) How does fare policy effect transit performance? Financial performance? Efficiency? Effectiveness? Equity?

A. What are the interrelationships between these things?
B. What have been the impacts of innovative fare structures on performance?
C. How does fare policy relate to transportation and non-transportation goals?
D. How can operating revenues be increased?

(8) To what degree can financial performance be affected by improvements in efficiency? In other spheres of activities (i.e., what are the

potential payoffs?).

(9) How can we--the transportation community at large--convey the present realities of transit service to the general public? To local decision-makers?

A. What roles must each member play?
B. Where do we need support for our programs? How might we best obtain such support?
C. Are the benefactors of transit service the users (employees, shoppers), indirect benefactors (employers, business), or both? How can benefits to non-users be emphasized?
D. How can we make the payoffs of good transit service more visible?

(10) What are the responsibilities that come with being a public employer?

A. Can we continue to deny the use of part-time labor and similar techniques while at the same time ask for increased financial assistance?

(11) What are our responsibilities to the User? The non-User?

A. What rights to service does the potential transit user have?
B. What will such service cost?

(12) How do various components of service effect transit performance?

A. Where and by how much can service characteristics improve financial performance?
B. What service choices exist for meeting certain types of service demands?
C. What value might there be to service standards? How might they best be used?

(13) What are the costs of providing various types of service? And how can they be reduced?

A. Should cities and operators be rewarded for providing good service? Or penalized?
B. What policies at the Federal, State, and local levels encourage the provision of effective service? Efficient service?
C. How must current policy change in order for transit to meet reasonable service objectives and improve performance?

(14) How can transit performance be improved through labor/management relations?

A. What are the constraints?
B. What areas contain flexibility in which to negotiate? What ate the limits of those areas?
C. What are the impacts on transit performance of certain work rules?
D. What would be the impact of certain changes on Labor? Other members of the transportation community? Users?

E. What might labor be offered in return for changing certain rules?

(15) What can transit operators do to improve efficiency under given constraints (equipment, management, computerized systems, etc.)?

A. What technology is available and what does it cost?
B. What are the potential payoffs of various internal improvements?
C. What help do transit operators need from other members of the community?

WHAT DOES ALL THIS MEAN?

This Conference is considered a starting point for a more concerted approach to all these issues. The issues raised in this and subsequent papers cannot be resolved at this three day meeting. Part of the problem is the fact that the issues have not yet been carefully sorted out, and commitments have not been made to resolve them. The National Conference on Transit Performance becomes a vehicle for UMTA, APTA, and PTI -- as secretariat to the Urban Consortium--to do so, along with other members of the transportation community.

BACKGROUND, PART II: TRENDS IN TRANSIT PERFORMANCE

The objectives of this paper are to examine recent trends in transit performance, to analyze the internal and external factors influencing these trends, and to consider the potential of various managerial and operational actions for improving transit performance. This paper provides a brief overview of nationwide trends in transit performance during the period 1970-76, and suggests possible explanations for these trends.

Transit performance cannot be expressed in terms of a single measure. Rather, it can only be assessed by considering a large array of measures, some reflecting operating efficiency and service utilization, others financial performance, and still others the achievement of external, non-transportation goals. Transit performance cannot be evaluated solely in terms of internal transportation-related factors because the objectives of transit are related to much broader community and national goals, such as energy conservation, provision of mobility to transit dependents and handicapped persons, stimulation of the urban economy, and promotion of orderly pattern of urban growth.

Transit performance can be measured in relation to the transit industry as a whole, in relation to individual system or individual routes within a system, and in relation to various functions internal to the system such as management, operation, or maintenance. The level at which transit performance is analyzed should depend on the particular perspective and needs of the analyst.

Because this report deals with nationwide trends, the analysis provides only a rough-grained picture. Nationwide averages tend to mask both the bright spots and the trouble spots, and often obscure variations in transit performance due to local differences in market conditions, demographic characteristics, urban geography, prevailing wage rates, and policy-imposed service and fare requirements. Monitoring aggregate national trends is thus no substitute for more detailed analyses done at the system or individual route level.

Further, it should be recgnized that even if all realistically achievable objectives for improved transit performance were to be realized--a "Nirvana"--the probable net financial impact would be relatively small and short-lived. Such near-term financial saving that could be achieved would, in a longer time frame, be eroded unless the more pervasive historical trends toward urban decentralization are reversed. It is in the context of both these external and internal realities that the issue of transit performance should be evaluated.

TRENDS IN TRANSIT EFFECTIVENESS

Between 1970 and 1976 the amount of transit service provided nationwide increased by 7.6 percent, from 1,883 to 2,026 million vehicle miles.* At the same time, the amount of service used (i.e., transit ridership or usage) declined by 4.4 percent, from 5,932 to 5,673 million revenue passengers.

A perhaps better measurement of transit consumption would be passenger miles. However, data on average trip length are fragmentary. Empirical evidence indicates that trip lengths are increasing. Therefore, by the passenger mile criterion, the apparent decline in transit usage would be lower, or perhaps even show some growth. The main contributing factor to the decline in transit usage has been the continuing trend toward metropolitan decentralization of residences and employment. Suburbanization has reduced the relative demand for the types of trips for which transit can compete most effectively with the automobile--trips to and from the city center.

This phenomenon is evidenced by a recently completed survey of the Bureau of the Census. The share of total urban trips carried by transit has declined between 1970 and 1976. In the 21 metropolitan areas surveyed, transit modal split for home-based work trips (i.e., the proportion of persons using transit for the trip to work) decreased on the average by 20 percent. Even though transit may be maintaining its share of CBD trips, these trips are becoming a smaller proportion of the total travel in the urban areas.

It is difficult to assess recent trends in the quality of transit service. Without a doubt, the upgrading of transit rolling stock with modern air conditioned equipment has improved ride quality by increasing travel comfort. However, a lack of realiable data prevents us from assessing such trends as service reliability (percentage of on-time arrivals), frequency, coverage (vehicle miles per square mile of service area), availability (hours of weekly operation), and accessibility (% of population within walking distance of a transit stop).

TRENDS IN TRANSIT EFFICIENCY AND PRODUCTIVITY

Between 1970 and 1976 operating cost per passenger trip increased 108% from 26¢ to 54¢/passenger; and operating cost per vehicle mile increased 90% from $1 to $1.90 (these represent increases of 43% and 30% respectively in constant dollars). Longer trip lengths due to migration to the suburbs and lower transit usage are primarily responsible for the higher operating costs per passenger trip.

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*This report makes no attempt to distinguish between modes. Thus, aggregate data are provided for bus systems, rail systems, and combined bus-rail systems, but does not include commuter rail operations.

The lack of reliable data and uniform reporting makes it difficult to assess productivity trends in the transit industry. However, with data collected by APTA, it is possible to develop crude aggregate measures of transit labor productivity.

During the period from 1970 to 1976, transit witnessed a decline of 9 percent--from 13,642 to 12,435--in annual vehicle-miles per employee. This trend reflects the widening gap between peak and off-peak ridership, and the inability of transit management to hire part-time workers or to adopt split-shift scheduling which would match the labor force more closely to the fluctuating diurnal demand for transit service.

Labor productivity alone is not an accurate indicator of the efficiency of the labor component. Output (vehicle-miles and trips) is greatly affected by congestion, operating speed, urban form, managerial scheduling skills, and other factors external to the operator's control. Vehicle miles per employee is an indicator of how productively the transit operator uses the labor input, given these geographical, political, and other conditions which vary among urbanized areas and over time.

When the labor input is contrasted with transit utilization, using passenger trips per transit employee as one measure, one notes a 19% decline between 1970 and 1975--from 42,971 to 34,814 annual passenger trips per employee. This trend reflects primarily declining ridership levels, which in turn have been influenced by changing urban development and demographic patterns.

In contrast to these other trends, vehicle productivity has increased. Annual miles per transit vehicle have increased by 3.4 percent, from 30,964 to 31,744. This trend again reflects newer vehicles with less "down time", better maintenance practices, the addition of express bus service, and expansion into less-congested, outlying areas.

TRENDS IN TRANSIT OPERATING COSTS AND REVENUES

Between 1970 and 1976 the cost of providing public transportation service increased 103%, from $1.89 billion to $3.84 billion. 51% of this increase is attributable to general inflation and 32% higher labor costs.* The remaining 17% is attributable to factors such as service expansion and increases in fuel and insurance costs.

During the same period transit operating revenues increased by only 27%, from $1.71 billion to $2.16 billion. The slow growth in revenues is due to declining ridership and a slow rise (29%) in average transit fares from 28¢ in 1970 to 36¢ in 1976. The net decrease in constant dollars is 13%. Local and national policies mandating reduced fares during certain time periods, or for certain target user groups, have affected this result.

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*See Appendix to this paper for further elaboration on this point.

The above trends in operating costs and revenues have produced an 812% growth in revenue shortfall (deficit), from $184 million in 1970 to $1.68 billion in 1976. Looking at it another way, the proportion of operating costs covered by operating revenues--the operating ratio--(i.e. farebox revenues plus other income, e.g., advertising) has declined from 90 to 56 percent during the six years between 1970 and 1976.

This revenue shortfall is partially financed by Federal, State and local contributions. In 1976, the operating assistance was distributed as follows: Federal (Section 5) contribution, 25 percent; State contribution, 22 percent; local contribution, 51 percent; and miscellaneous non-operating income, 2 percent.

TRANSIT AND EXTERNAL IMPACTS

One serious weakness of transportation analysis has been its inability to monitor and measure transit's contribution to broader social objectives such as mobility of transit dependents, preservation and/or stimulation of the urban economy, energy and other resource conservation, or air pollution reduction. Present reporting systems and data collection efforts and seldom designed with such objectives in mind. Consequently any conclusions about transit's effectiveness or ineffectiveness as an instrument of our social, economic, environmental, or energy policy is at present largely qualitative rather than quantitative.

Appendix

TRENDS IN TRANSIT PERFORMANCE

A Statistical Summary

Federal, State and local governments face a growing financial burden in helping transit authorities fill the gap between escalating transit operating costs and relatively stable operating revenues. The causes for this widening deficit are complex; they include rising labor costs, flat labor productivity, inflation, and declining transit ridership. Meanwhile, average fares have increased only slightly -- and have actually declined in constant-dollar terms.

This trend can be best observed in terms of the shrinking revenue/cost ratio, i.e., the percentage of operating costs covered by farebox revenues. In the last seven years, the operating ratio has declined from 90 to 56 percent:

TABLE I

Operating Revenues and Expenses

1970 - 1976

Year	Operating Revenues (millions)	Operating Expenses (millions)	Revenue Shortfall (Deficit) (millions)	Revenue/ Cost
1970	$1,707.4	$1,891.7	($ 184.3)	.91
1971	1,740.7	2,040.5	(299.8)	.86
1972	1,728.5	2,128.2	(399.7)	.82
1973	1,797.6	2,419.8	(622.2)	.75
1974	1,939.7	3,102.4	(1,162.7)	.63
1975	2,002.4	3,534.9	(1,532.5)	.57
1976	2,161.1	3,839.4	(1,678.3)	.56

Projections of these trends suggest that, absent some fundamental changes in local policies regarding fares, levels of service, collective bargaining practices, and other factors affecting operating expenses, the revenue shortfalls will continue to mount, attaining perhaps as much as $3 billion by 1982 (compared to an estimated $1.68 billion in 1976).

If available federal funding as a percent of transit revenue shortfalls were to remain at the present level of about 30 percent, over $1 billion in federal formula funding would be required by 1982 (compared to $900 million expected to be authorized for FY 1980).

The remainder of this paper will discuss trends in:

operating costs
ridership and service
wage rates
operating revenues
revenue sources
revenue shortfall financing
transit productivity

A. Trends in Operating Costs

From 1970 to 1976, operating expenses in the transit industry rose 103 percent, from $1.89 billion in 1970 to $3.84 billion in 1976. This increase can be attributed to the factors identified in Table II.

TABLE II

Breakdown of Transit Operating Cost Increases

1970 - 1976

	$ Amount (millions)	Percent
1. General inflation (GNP Price Deflator)	$990	51%
2. Increase in the amount of service provided (i.e., labor and fuel to meet 8% increase in VMT)	144	8
3. Increase in the cost of fuel (after accounting for general inflation and service expansion)	76	4
4. Increase in the cost of labor (wage and fringe benefits in excess of those attributable to cost-of-living increases)	370	19
5. Additional employment above that needed to meet service expansions (G&A, security, marketing, planning, etc.)	240	13
6. Other (insurance, electricity, repair and replacement parts, etc.)	127	5
TOTAL	$1,947	100%

In addition to these increases in absolute costs, there have also been increases in unit costs, as shown in Table III.

TABLE III

Trends in Unit Operating Costs for Transit

1970 - 1976

Year	Cost/Passenger *		Cost/Vehicle Mile	
	Current $	Constant $**	Current $	Constant $**
1970	$0.26	$0.28	$1.00	$1.09
1971	0.30	0.31	1.11	1.16
1972	0.32	0.32	1.21	1.21
1973	0.36	0.34	1.32	1.25
1974	0.45	0.39	1.63	1.40
1975	0.51	0.40	1.78	1.41
1976	0.54	0.40	1.90	1.42
Percent Change	+108%	+43%	+90%	+30%

* Based on total passenger trips.
** Based on GNP deflator, 1972 = 100.

Changing density and travel patterns over the past decade are partly responsible for these unit cost increases. With suburbanization, trips have become both more dispersed and longer, a situation to which transit operators have attempted to adapt to by extending and adding routes. As a result, the average number of bus miles per route doubled from 1960 to 1974, while the total number of miles of bus service actually declined. Ridership density along routes has also declined, which, along with increasing trip length, is partially responsible for the higher operating costs per passenger shown in Table III above.

Note also in Table III that since 1974 increases in both cost/passenger and cost/vehicle mile have amounted to only 1¢ to 2¢ in constant dollars.

B. Trends in Ridership and Service

Table IV charts trends in transit ridership and vehicle miles of service, showing declines in both through 1972, followed by annual increases through 1976.

TABLE IV

Trends in Ridership and Delivery of Transit Service

1970 - 1976

Year	Revenue Passengers (millions)	Vehicle Miles of Service (millions)
1970	5,932	1,883
1971	5,497	1,846
1972	5,253	1,756
1973	5,293	1,835
1974	5,606	1,907
1975	5,643	1,989
1976	5,673	2,026
Percent Change 1970-1976	-4.4%	+7.6%

Table V shows transit ridership commuting trends for 21 SMSA's from 1970 to 1975 on a more detailed basis.

TABLE V

Trends in Public Transit Usage in Commuting Travel for Selected Metropolitan Areas

STANDARD METROPOLITAN STATISTICAL AREA	Workers Using Vehicles: 1970 (thousands)			Workers Using Vehicles: 1975-76 (thousands)			PERCENT CHANGE
	Total Number	Using Public Transit Number	Percent	Total Number	Using Public Transit Number	Percent	
ATLANTA	556	55	9.9%	608	55	9.0%	- 0.2%
CINCINNATI	476	42	8.9	505	35	6.9	-17.6
CHICAGO	2,557	654	25.6	2,437	483	19.8	-26.2
COLORADO SPRINGS	82	1	1.7	98	2	1.6	+60.0
COLUMBUS, OH	329	29	8.8	347	18	5.1	-39.0
HARTFORD	260	28	10.7	252	19	7.4	-32.5
KANSAS CITY	485	28	5.8	503	20	4.0	-27.9
MADISON	99	8	8.1	122	10	8.5	+28.8
MIAMI	474	46	9.7	509	40	7.8	-13.5
MILWAUKEE	507	67	13.3	543	45	8.3	-33.4
NEW ORLEANS	339	74	21.9	377	48	13.1	-34.7
NEWPORT NEWS	103	9	8.9	115	6	5.6	-28.9
PATERSON-CLIFTON-PASSAIC, N.J.	521	82	15.7	469	58	12.4	-28.9
PHILADELPHIA	1,668	385	23.1	1,767	261	16.6	-32.2
PORTLAND, OR	359	24	6.6	412	36	8.8	+50.4
ROCHESTER, N.Y.	312	28	8.9	317	19	6.1	-30.7
SAN ANTONIO	281	18	6.6	307	15	4.5	-16.7
SAN BERNADINO-ONTARIO	359	3	1.0	387	2	0.5	-30.0
SAN FRANCISCO-OAKLAND	1,155	195	16.9	1,168	200	17.1	+ 2.5
SPRINGFIELD-CHICOPEE-HOLYOKE	188	11	5.6	186	8	4.3	-28.2
SAN DIEGO	452	23	5.2	540	20	3.6	-13.9

SOURCES: 1970 JOURNEY TO WORK STATISTICS, U.S. BUREAU OF THE CENSUS: and SURVEY OF TRAVEL TO WORK SUPPLEMENT TO THE 1975-76 ANNUAL HOUSING SURVEY, U.S. BUREAU OF THE CENSUS (ADVANCE TABULATIONS).

As an insight into the declines in transit use shown in Tables IV and V, data on auto availability are shown in Table VI. While the relative number of households without automobiles has declined in sixteen of the twenty-one SMSA's, the absolute number of households without autos declined in only ten of the SMSA's and increased slightly in the aggregate.

TABLE VI

Trends in Auto Availability

TOTAL HOUSEHOLDS AND HOUSEHOLDS WITHOUT AUTOMOBILE AVAILABILITY:
PERCENT CHANGE BETWEEN 1970 AND 1975-76
(Number of Households in Thousands)

STANDARD METROPOLITAN STATISTICAL AREA (SMSA)	1970 Census			1975-76 Survey			PERCENT CHANGE	
	TOTAL	Without Autos	PERCENT	TOTAL	Without Autos	PERCENT	TOTAL	Without Autos
ATLANTA	429	61	14.3	506	70	13.8	17.9	14.8
CHICAGO	2,182	532	24.4	2,283	506	22.2	4.6	(4.9)
CINCINNATI	431	80	18.5	446	73	16.4	3.5	(8.8)
COLORADO SPRINGS	68	5	7.1	97	9	9.3	42.6	80.8
COLUMBUS, OH	283	40	14.3	308	36	11.7	8.8	(10.0)
HARTFORD	207	30	14.7	219	29	13.2	5.8	(3.3)
KANSAS CITY	409	59	14.5	423	53	12.5	3.4	(10.2)
MADISON	89	13	14.1	104	13	12.5	16.9	-
MIAMI	428	67	15.7	510	99	19.4	19.2	47.8
MILWAUKEE	433	78	17.8	462	73	15.8	6.7	(6.4)
NEW ORLEANS	318	84	26.4	358	81	22.6	12.6	(3.6)
NEWPORT NEWS	83	12	14.5	92	13	14.1	10.8	8.3
PATERSON-CLIFTON-PASSAIC	427	59	13.9	432	53	12.3	1.2	(10.2)
PHILADELPHIA	1,480	345	23.3	1,525	323	21.2	3.0	(6.4)
PORTLAND, OR	342	47	13.8	395	55	13.9	15.5	17.0
ROCHESTER, NY	271	39	14.3	282	39	13.8	4.1	-
SAN ANTONIO	244	35	14.2	272	43	15.8	11.5	22.9
SAN BERNADINO-RIVERSIDE-ONTARIO	362	34	9.5	427	52	12.2	18.0	52.9
SAN DIEGO	423	47	11.0	538	66	12.3	27.2	40.4
SAN FRANCISCO-OAKLAND	1,086	210	19.3	1,170	217	18.5	7.7	3.3
SPRINGFIELD-CHICOPEE-HOLYOKE	165	29	17.8	170	27	15.9	3.0	(6.9)
AGGREGATE TOTAL	10,160	1,906	18.8	11,019	1,930	17.5	8.5	1.3

SOURCES: 1972 COUNTY AND CITY DATA BOOK, (1970 Census).

1975-76 SURVEY OF TRAVEL TO WORK (SMSA), final tabulations.

C. Trends in Transit Wage Rates

Labor is the major component of transit operating costs, accounting for about 80 percent of the total when fringe benefits and pensions are included.

Wages in the transit industry have grown by 60 percent between 1970 and 1976, significantly above the increase in the cost of living as measured by the Consumer Price Index (47 percent over the same period), or by 9 percent in real terms. At the same time, labor productivity, measured in vehicle miles per employee, has decreased by 10 percent (from 13,850 to 12,435 vehicle miles per employee).

Based upon the Census of Governments Survey of municipal employment, transit employees had the highest average monthly earnings ($1,336) of any public sector employees in 1976. This has been the result of a 15-year upward trend: transit wages increased at an annual rate of 11 percent during the period 1962-1975, a rate exceeded only within the housing and urban development sector (11.9 percent).

However, in cities of one million or more, where over 78 percent of municipal transit workers are employed, transit employees came in fourth ($1,392), under police, electric utilities workers, and teachers. In fact, there was no single population category in which transit employees were the highest-paid group of workers. Tables VII and VIII provide more detail.

TABLE VII

Average Monthly Earnings for Selected Municipal Functions

1972 - 1976

FUNCTION	1976	1975	1974	1973	1972
ALL EMPLOYEES	$ 915	850	797	751	696
HIGHWAYS	913	842	793	747	693
POLICE	1,173	1,101	1,015	959	934
FIRE	1,233	1,179	1,073	1,000	921
HOUSING & URBAN DEV.	1,081	989	1,063	868	825
ELECTRIC POWER	1,150	1,060	981	928	858
TRANSIT	1,336	1,280	1,218	1,106	1,015
TEACHERS	1,325	1,250	1,190	1,173	1,077

TABLE VIII

Average Annual Rate of Change in Monthly Earnings

1972 - 1976

(percent change over prior year)

FUNCTION	1976	1975	1974	1973	1972
ALL EMPLOYEES	7.6%	6.6%	6.1%	7.9%	8.6%
HIGHWAYS	8.4	6.2	6.2	7.8	8.1
POLICE	6.5	8.5	5.8	2.7	10.7
FIRE	4.6	9.9	7.3	8.6	9.1
HOUSING & URBAN DEV.	9.3	-7.0	22.5	5.2	6.6
ELECTRIC POWER	8.5	8.1	5.7	8.2	7.9
TRANSIT	4.4	5.1	10.1	8.9	5.1
TEACHERS	6.0	5.0	1.4	8.9	9.7

D. Operating Revenue Trends

The growth trend in operating revenues has been much more gradual than growth in costs. Local jurisdictions have elected to use general revenues rather than to raise fares in order to cover increased costs. Thus, while total operating costs increased by 103 percent from 1970 to 1976, operating revenues increased by only 27 percent. The average fare actually declined 13 percent in constant dollars, as shown in Table IX.

TABLE IX

Trends in Average Transit Fares

1970 - 1976

Year	Current Dollars	Constant Dollars *
1970	28¢	31¢
1971	30¢	31¢
1972	31¢	31¢
1973	32¢	30¢
1974	32¢	28¢
1975	33¢	28¢
1976	36¢	27¢
% Change 1970-1976	+29%	-13%

* Based on GNP deflator, 1972 = 100.

E. Revenue Sources Used to Finance Transit Operating Expenses

In 1976, the revenues required for nationwide transit operations were $3.839 billion. Sources of revenue for this amount are shown in Table X.

TABLE X

1976 Transit Revenue Sources

	Amount (millions)	Percent
Farebox Revenue	$2,026	53%
Other Operating Revenue	135	3%
Non-operating Income	31	1%
Local Contributions	857	22%
State Contributions	367	10%
Federal Section 5 Operating Assistance (Actually Utilized)	423 *	11%
TOTAL	$3,839	100%

Note that available Section 5 funds for FY 1976 are $500 million -- 13% of 1976 operating costs. Unused Section 5 funds remain available through FY 1978.

F. Financing the Revenue Shortfall

In 1976, the revenue shortfall (deficit) for the transit industry was about $1,678 billion. Financing for this shortfall is shown in Table XI.

TABLE XI

Financing the 1976 Revenue Shortfall

	Amount (millions)	Percent
Non-operating Income	$ 31	2%
Local Contributions	857	51%
State Contributions	367	22%
Federal Section 5 Operating Assistance (Actually Utilized)	423	25%
TOTAL	$1,678	100%

Note that available Section 5 funds for FY 1976 are $500 million -- 30% of the 1976 operating deficit. Unused Section 5 funds remain available through FY 1978.

While the aggregate data in Tables X and XI show the Section 5 share of operating cost to be 13 percent and the Section 5 share of revenue shortfalls to be 30 percent, the shares vary widely depending upon the type of urbanized area. Thus, Table XII shows that the federal shares of New York's costs and revenue shortfall in 1976 were only 1/3 the national average.

TABLE XII

Federal Shares of Costs and Revenue Shortfalls

		Section 5 (millions)	Transit Operating Expenses (millions)	Federal Share	Transit Revenue Shortfall (millions)	Federal Share
1. New York	1975	$54	$1,631	3.3%	$588	9.2%
	1976	89	1,893	4.7%	845	10.5%
2. Chicago, Philadelphia, San Francisco, Boston, Cleveland, Washington	1975	$56	$984	5.6%	$456	12.3%
	1976	94	1,141	8.2%	612	15.4%
3. 18 other cities of over one million population	1975	$83	$622	13.3%	$333	24.9%
	1976	139	750	18.5%	432	32.2%
4. All urbanized areas	1975	$300	$3,535	8%	$1,533	19.6%
	1976	500	3,840	13%	1,678	29.8%

Data for categories 1, 2, and 3 above were obtained from UMTA surveys through regional offices. Data for category 4 above were obtained from aggregated APTA data. Data were not available for other categories of cities.

Revenue shortfall per rider is often used in analyses of transit performance. This indicator is presented below in Table XIII, with the caveat that it reflects local political choices as well as transit performance.

TABLE XIII

Trends in Revenue Shortfalls

1970 - 1976

Year	Total Revenue Shortfall (millions)	Revenue Shortfall/Passenger* Current $	Constant $**
1970	$ 184	3¢	3¢
1971	300	4¢	4¢
1972	400	6¢	6¢
1973	622	9¢	8¢
1974	1,163	17¢	15¢
1975	1,533	22¢	17¢
1976	1,678	23¢	17¢
Percent Change 1970-1976	+812%	+667%	+467%

* Based on total passengers.
** Based on GNP deflator, 1972 = 100.

G. Trends in Transit Productivity

While many different indicators are necessary to understand changes in transit productivity, the necessary data are often not available. Therefore, the indicators presented in Tables XIV, XV, and XVI of transit system productivity, labor productivity, and equipment productivity are only a rough overall view of this subject.

TABLE XIV

Trends in Transit System Productivity

1970 - 1976

Year	Revenue Passenger Trips/Vehicle Mile
1970	3.15
1971	2.98
1972	2.99
1973	2.89
1974	2.94
1975	2.84
1976	2.80
Percent Change 1970-1976	-11%

TABLE XV

Trends in Transit Labor Productivity

1970 - 1976

Year	Vehicle Miles/ Employee	Revenue Passenger Trips/Employee
1970	13,642	42,971
1971	13,269	39,513
1972	12,686	37,950
1973	13,042	37,626
1974	12,456	36,617
1975	12,453	35,313
1976	12,435	34,814
Percent Change 1970-1976	-9%	-19%

TABLE XVI

Trends in Equipment Productivity

1970 - 1976

Year	Vehicle Miles/Vehicle
1970	30,694
1971	30,393
1972	28,927
1973	30,794
1974	31,842
1975	31,957
1976	31,744
Percent Change 1970-1976	+3.4%

Increasing interest in the evaluation of transit performance stems primarily from concern about the growing gap between transit costs and revenues. However, financial performance is only one aspect of the evaluation of a public service. Another major aspect is the assessment of how well the service provided is meeting the goals and objectives set by public officials. In the case of transit, these goals and objectives may extend beyond transportation concerns such as increased accessibility and mobility. Transit service may be seen as a way to address such issues as the maintenance of economic vitality of downtown and neighborhood shopping areas, the reduction of air pollution and energy consumption, and the relief of traffic congestion.

Service levels and fares are established to facilitate the achievement of established goals and objectives. These service and fare levels are the primary determinants of costs and revenues. Thus, while operating efficiencies may be possible, significant cost savings may require changes in transit goals and objectives.

The instruments of performance evaluation are indicators that provide information about various aspects of the transit operation--for example, information about service utilization, service costs, productive labor time, and service quality. This information can facilitate the assessment of service effectiveness, aid management in finding ways to reduce costs, and help decision makers determine the level of transit service their community can afford. While many public officials recognize the importance of transit to the achievement of broad economic and environmental goals, there are no generally accepted indicators to measure the extent of that achievement.

CONCEPTS

Transit performance concerns are usually expressed in terms of productivity, efficiency, and effectiveness. The concept of productivity originated in industrial production, and related resource inputs--such as labor or capital--to product outputs. Units produced per labor hour is a measure of labor productivity. Comparisons of productivity from one plant to another are possible because of the uniformity of the product and the production process.

The application of this productivity concept to the evaluation of public services, and to transit in particular, is complicated by several factors. First, the product is not uniform. Some transit systems are oriented to commuter service, others provide full service on a comprehensive network of routes. Service quality and intensity varies. Second,

the product--e.g., revenue vehicle miles or revenue vehicle hours--is not completely consumed. The level of utilization--e.g., passengers/mile or passengers/hour must be considered as well. Third, the conditions for providing transit service vary from community to community. For example, local transit operations are affected by such problems as disproportionate peak period usage and street system congestion. Fourth, those interested in transit performance are concerned with the overall cost of providing a unit of service, not just with the relative efficiency of one factor of production. And finally, the traditional productivity concept does not consider the price charged for a product, and whether that price covers the cost of production.

Because public service evaluation concerns are broad, and since services must be evaluated in relation to the goals and objectives set by local policy makers as well as budget priorities, the term productivity is used today more loosely, and usually broken down into two components--efficiency and effectiveness. Efficiency is concerned with both the costs of providing service and the relation of service outputs to resource inputs. Effectiveness relates to the quality of the service provided, and considers such things as the amount of service offered and its convenience to users. Many believe that the concept of effectiveness should be broadened to include consideration of non-transportation related goals.

A third concept must be added to efficiency and effectiveness in the evaluation of transit performance--the concept of financial performance. Financial performance relates to the level of public financial support required to sustain transit operations. Financial performance is usually not a consideration in the evaluation of other public services, since most are wholly supported by tax revenues. Although transit is now viewed as a public service rather than a for-profit enterprise, the extent to which user charges should cover operating costs is a question of concern to local policy makers.

Given the unique characteristics of transit as a public service, concepts of transit performance evaluation must be appropriately defined. Among the issues that should be considered are the following:

(1) What are the goals and objectives of transit service?

(2) How are broad urban goals such as maintenance of economic vitality and reduction of air pollution and energy consumption related to transit performance?

(3) How important is financial performance in the overall evaluation of transit?

The Uses of Indicators

A variety of ratios and indicators describe various aspects of transit efficiency and effectiveness; some can be used in the evaluation

of overall system performance and/or route performance, others in the evaluation of a single transit function, such as maintenance or procurement. Some indicators are particularly useful to those who make decisions regarding transit funding; others enable transit operators to improve their operations. The importance and utility of any given measure depends on the perspective of those interpreting it.

From a policy standpoint, transit performance indicators reflect much more than the quality or economy of system management. They reflect government decisions directly or indirectly affecting transit operations, local operating conditions and local transit usage patterns. For example, fare policies established by local decision makers greatly affect financial performance indicators. Regional wage differentials affect cost efficiency indicators. Disproportionate peak period transit use affects labor productivity and vehicle utilization indicators.

Clearly, comparisons of transit performance between modes or jurisdictions should not be made strictly on the basis of indicators. Similarities and differences of various communities and transit operations should be carefully considered, along with potential differences in data element definition, when making such comparisons.

On the other hand, indicators can be a valuable aid to operators in the comparison of performance on different routes in a single system. For example, routes may be ranked on the basis of indicators such as fare box revenue/operating cost, passengers/vehicle hour, or passenger miles/vehicle mile. Another valuable use of indicators is to trace changes in system performance over time. Indicators can chart cost and ridership trends and changes in trip patterns and overall service levels.

Several issues regarding the use of indicators can be identified:

(1) Can a set of standard indicators be established for all transit properties, nationwide?

(2) If so, how are they to be applied?

(3) How do the data needs of policy makers and transit operators differ?

(4) What precautions should be taken to avoid misinterpretations of indicator values?

Financial Performance

Financial performance indicators cannot be classified as either efficiency or effectiveness measures since they reflect the combined effects of policy decisions, ridership, management efficiency, and the local operating environment. These indicators simply relate costs to

revenues or to service provided, and as such can help public officials make decisions about service and fare levels, and identify routes that are most costly to operate.

The most widely used measure of financial performance is the ratio of operating revenues to operating costs, often named the operating ratio.* Operating ratios can be calculated for individual routes as well as averaged overall system operations. Heavily used routes may bring in sufficient revenues to cover their operating costs; many other routes may not. Thus, the operating ratio is one indicator that can help transit operators make service level decisions.

Differences in overall operating ratios from one property to another often reflect the policy choices of local transit boards rather than different levels of operating efficiency. For example, two transit systems with similar service levels and costs will have different operating ratios if one has a forty cent fare and the other a thirty cent fare.

Two related measures are cost/passenger trip and cost/passenger mile. Both of these measures reflect ridership and service levels. The first assigns a single cost to each trip, regardless of trip length. The second assigns the cost of a trip on the basis of distance traveled, giving less weight to short trips and more to long trips. Nationally, cost/passenger mile has remained steady, while cost/passenger trip has been increasing. This reflects national trends of increased bus miles, increased trip lengths, and relatively stable ridership, as well as increased costs. Passenger-mile data has not been collected by most properties, but should become available when the new Federal reporting requirements are implemented (see the section on data needs).

Some financial performance issues are:

(1) How are financial performance indicators to be used?

(2) What is the relationship between financial performance and the level of public support to a transit property?

EFFICIENCY MEASURES

Cost Efficiency

Cost efficiency indicators reflect the cost of system operations. These indicators are independent of service and fare policies and ridership,

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* This definition of operating ratio is different from that used by the Interstate Commerce Commission. ICC defines the term as operating cost divided by operating revenue. This is understandable as most ICC carriers are profitable operations and the agency need not be concerned with operating assistance programs.

but are affected by the operating environment and peak-to-base period ridership differentials. Common cost efficiency indicators include operating cost/revenue vehicle mile, and operating cost/revenue vehicle hour. The first relates cost directly to the amount of service provided, but is greatly affected by operating speed. The indicator value will be higher for a system with slow average operating speed and for systems with a high proportion of service scheduled during congested peak hours. Operating cost per revenue vehicle hour is much less sensitive to variations in speed.

Labor Productivity

Labor productivity indicators include annual revenue vehicle hours/employee, total platform hours/pay hours, and annual vehicle miles/employee, and passenger trips/employee. These measures reflect the utilization of the labor force, which is a function of scheduling efficiency and the extent of variation in peak hour and off-peak ridership. Labor agreements sometimes limit split shift scheduling and the hiring of part-time workers, hindering transit management efforts to schedule workers for the peak hours only. Passenger trips/employee primarily reflects transit ridership levels, which are in turn influenced by population densities and urban configuration.

Total platform hours/pay hours is the most precise measure of productive labor time, but data necessary to calculate this indicator are often unavailable. Annual revenue vehicle hours/employee is more commonly used. The other commonly used measure, vehicle miles/employee is heavily influenced by system operating speed.

It should be noted that labor productivity measures do not necessarily have a direct bearing on transit costs. For example, by running trains all day long a subway operator could probably improve performance according to most of the indicators discussed above. However, this improvement in indicator values would be accompanied by a considerable cost increase and little if any increase in revenues.

Vehicle Utilization

Vehicle utilization indicators are similar to labor productivity indicators except that they relate the quantity of service provided to the number of vehicles operated by a property. Commonly used indicators include annual revenue miles/vehicle and annual revenue hours/vehicle. Equipment utilization rates are primarily affected by variations in peak and off-peak ridership--if ridership levels are fairly constant throughout the day, most equipment can be used all day long, whereas high peak ridership and low off-peak results in the use of many vehicles only during peak hours. Thus, equipment utilization rates are lower for transit operations oriented to commuter service. As with the similar labor productivity measure, annual revenue vehicle miles/vehicle is affected by system speed.

EFFECTIVENESS INDICATORS

Service Utilization Measures

Service utilization indicators are useful in evaluating the levels of service that should be provided on various routes in a system. When calculated for an entire system, they allow comparisons of transit usage characteristics of different localities. Service utilization indicators include passenger trips/population served, passengers/revenue vehicle hour, passengers/revenue vehicle mile, and passenger miles/revenue vehicle mile. The first measures the level of transit trips generated along a specific route, or throughout a transit service area. The others are closely related to the per-passenger costs discussed in the section on financial performance.

Accessibility

Accessibility measures indicate the number of people who have access to (live within walking distance of) transit, and reflect policy decisions about route coverage. Percent of population served and percent transit dependents served are examples of accessibility measures.

Quality of Service

Quality of service indicators include system reliability (% trips on time), and vehicle revenue miles/square mile of service area. These indicators reflect scheduling effectiveness and the quantity of service available, respectively. The first can be calculated for the entire system or a single route.

Economic, Environmental, and Energy Considerations

Although policy makers often stress the advantages of transit in addressing economic, environmental, and energy concerns, there are no authoritative indicators measuring transit impacts in these areas. Transit service can affect the distribution of retail sales, gasoline consumption, and vehicle miles of travel (VMT). The adverse effect of a transit strike on downtown merchants is often cited as a measure of the economic impact of transit.

DATA NEEDS

Studies of transit system productivity have been hindered by lack of a common data base in the industry. Inconsistent data element definition limits comparability of some performance indicators. For example, revenue passenger totals based on fares collected vary depending on whether a transit system distributes free transfers. This affects comparability of indicators using passenger trip data. Other particularly useful measures cannot be calculated because of data deficiencies. For example,

ratios of output per employee hour, while more precise than ratios of output per employee, cannot be calculated because of the lack of publicly available data on part time and overtime work hours of transit employees.

Comparisons of cost-related indicators have been impossible because of wide variations in accounting practices. Different procedures have been followed in assigning costs to different cost categories--overhead, operations, and personnel. Personnel classification procedures (e.g., management vs. operations) have not been consistent. Furthermore, in some cases certain transit costs are omitted from the transit balance sheet, as, for example, when a municipal garage performs bus maintenance activities and costs are not attributed to the transit operation.

Many of these problems will be corrected with the implementation of the Uniform System of Accounts and Records developed by UMTA with the assistance of a committee of transit industry representatives. This system, based on Project FARE, establishes standard data element definitions that must be adhered to by all reporting properties. However, the system omits some more conventional data elements such as revenue and non-revenue passengers. Furthermore, reporting by operators will be annual, although some states and regional agencies presently require shorter reporting intervals. Consequently, the Uniform System will probably not supplant many state and regional reporting systems.

(1) Will the new Federal reporting requirements have the desired effect of providing comprehensive uniform data on transit performance?

(2) Will the new requirements help operators improve transit performance, as well as provide information for performance auditing?

(3) What further action is necessary to ensure the availability of adequate transit performance data?

REVENUE POLICY AND PRICING

Nationally, transit costs continue to rise, while revenues remain relatively stable. Financially strapped local and State governments are hard pressed to fund the widening gap between costs and revenues. Where the financial strain is greatest, local officials are showing new interest in pricing as a means to increase transit revenues. However, pricing policies that increase revenues usually limit the potential for increased ridership and the achievement of related transit goals, such as reduced reliance on the automobile and increased mobility for the disadvantaged.

Pricing affects two aspects of transit performance--revenues and ridership. Pricing policy can be set to maximize revenues, improving financial performance, or to promote ridership, furthering other transit goals. Different fare structures and fare levels encourage or discourage transit trips. Revenues vary accordingly.

BACKGROUND

Public takeover of mass transit systems (and granting of public assistance to most of the remaining private systems) occured when private systems could no longer be profitably operated. For a profit-oriented transit firm, fare policy was primarily a question of economics. To ensure that revenues covered costs, fares were raised; runs that did not generate sufficient ridership at the new fare level were eliminated.

With public ownership, the pressures to raise fares and/or reduce service were eased. Public money supplemented fare revenues to support desired service levels and reasonable fares. Both fare and service level decisions became matters of public policy, determined on the basis of local goals and objectives. Among these goals and objectives were the maintenance of a comprehensive transit network, providing mobility to those without access to an automobile; and diversion of auto trips to transit, hopefully reducing congestion, pollution, and energy consumption. Ridership was to be encouraged. Service coverage was expanded, fares stabilized, flat fares instituted, and reduced fare programs initiated for special groups, such as students and elderly and handicapped persons.

In recent years some local governments, bearing the burden of increasing transit costs, have begun to reconsider fare policies adopted at the time of public takeover. Some major systems have increased fares. There is renewed interest in distance-based (as opposed to flat) fares, which price transit according to the amount of service used.

FAREBOX REVENUE AND THE OPERATING RATIO

The level of public assistance required to operate a transit system is determined by the gap between costs and revenues generated. Costs are

directly proportional to the extent and quality of service provided. Revenues depend on fare levels and associated ridership.

The operating ratio--fare box revenue divided by operating cost--measures the proportion of operating expenses covered by revenues (primarily passenger revenues).* The last year that the average U.S. transit property broke even was 1968. According to a Federal study of the impact of the Section 5 Federal Operating Grant program, the average operating ratio in 1975 was 47 percent, within a sample of 80 Section 5 applicants. The increasing gap between revenues and costs reflects increasing trip lengths, ridership losses, cost increases (often due to inflation), and decisions to expand service and hold fares steady.

Operating ratio has become a focus of concern in jurisdictions where transit places increasing demands on the government budget. Some public officials feel that a minimum proportion of operating costs should be covered by the fare box. In the San Francisco Bay area, for example, the Metropolitan Transportation Commission has proposed State legislation that will require MUNI, AC Transit, and BART to recover at least 35% of operating costs out of the fare box. However, the recovery of operating costs may be accomplished at the expense of service-related goals.

Decisions about fare policy must be consistent with service policy decisions. If a decision is made that fares should cover some percentage of costs, then there is an implicit acceptance that service with the lowest operating ratios will have to be discontinued (although some cost savings may be achieved through management efficiencies or labor productivity increases).

Many argue that transit pricing should be considered in the context of overall transportation system costs. They point out that money spent on transit operations may reduce costs elsewhere. To the extent that passengers are diverted from automobiles to transit, the need for public investment in expanded highway and street systems may be reduced.

Another argument is that transit users should not be expected to pay the full costs of transit service, since automobile users have long been subsidized through government highway building programs, and since transit service furthers social goals that benefit the entire population, not just transit users.

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* This definition of operating ratio is different from that used by the Interstate Commerce Commission. The ICC defines the term as operating cost divided by operating revenue. This is understandable as most ICC carriers are profitable operations and the agency need not be concerned with operating assistance programs.

These arguments raise some fundamental pricing issues:

(1) Should revenue-generating potential be the primary criterion for setting transit fares?

(2) Should fare box revenues cover some minimum percentage of transit operating costs?

(3) Should the value of overall transportation system efficiencies (e.g., reduced congestion, pollution, and road construction requirements) be a consideration in transit fare policy deliberations?

CHARACTERISTICS OF TRANSIT DEMAND

An understanding of transit demand is necessary to predict the effects of a change in fare policy. The amount of additional revenue that can be raised through fare increases is limited. As fares increase, patronage decreases to a point beyond which revenues decrease. On the other hand, there are upper limits to the ridership increases that can be achieved through fare reductions.

For any given price and level of service, the characteristics of transit demand for the local area determine the resulting level of ridership and revenues. Transit demand varies for different groups, for different trip purposes, and for different times of day. Thus fare changes affect different groups differently--there is no single transit market.

Demand elasticity is a measure used to describe the effect of fare or service changes on transit ridership. Averaged for all markets, demand elasticity with respect to fares (termed fare elasticity) is low. An early figure long used as a rule of thumb by transit managers and regulatory agencies was -0.33; that is, a one percent increase in fares would result in a 0.33% decrease in patronage. Studies of the effects of fare increases by the American Public Transit Association show overall fare elasticity varying widely for different cities from -0.004 to -0.97, and averaging -0.33. There have been no comparable studies showing the effects of fare decreases.

Fare elasticities, however, vary for different markets. Fare elasticities are generally higher for the senior citizen, off-peak, and low income markets--price is a significant consideration, and trips may be forgone or diverted to another mode. Higher income and peak period (work trip) markets are less sensitive to fare changes; price is not a major choice criterion for these riders.*

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* Convenience in paying the fare is also a factor affecting ridership. A study in Seattle showed that transit riders would be willing to pay 50¢ upon boarding a bus, but would be discouraged by a fare collection procedure requiring a 25¢ payment upon boarding and upon leaving the bus.

Demand elasticity with respect to service changes (service elasticity) is significantly higher than for changes in price. Improvements in travel time, comfort, convenience, and dependability are far more effective in increasing ridership than fare reductions. In setting transit fares, policy makers must carefully consider the relative effects of fare reductions and service improvements on costs and ridership. The cost of service improvements needed to achieve a specified ridership increase may be less than the cost of fare reductions needed to achieve a comparable result.

TRANSIT GOALS AND FARE POLICY

In establishing fare policy, public officials have two primary concerns--accomplishing local goals and objectives and financing transit service. While these concerns are complementary, usually only one or the other is addressed.

When transit financing is a principal concern, economic criteria are often suggested as a basis for transit pricing. Economists suggest that transit be priced according to the long-term average or short-term marginal cost of providing the service. Briefly, fares based on long-term average cost include the annualized costs of equipment and facilities, while fares based on marginal cost include only operating costs--the cost of providing an extra unit of service. Long-term average cost fares would be appropriate for peak period fares, since peak period service determines equipment needs; marginal cost fares would be appropriate for the off-peak periods. Fare policies based on economic criteria could not support the operation of all (and in some systems most) routes and runs; low yield routes would have to be discontinued and off-peak service on remaining routes cut back.

While direct application of economic criteria is often infeasible, fare policy can be manipulated to encourage or discourage ridership at different times of day. Increased peak period fares may reduce ridership enough to allow service cuts, resulting in cost savings to the transit operator. Similarly, lower off-peak fares can increase ridership during those periods when transit supply is underutilized. While probably not significantly increasing overall revenues, off-peak fare reductions increase system utilization.

Another means of improving transit finances through fare policy would be to take advantage of the characteristics of the transit market, providing more affluent transit markets with premium quality service, priced to generate a revenue surplus. While such service might marginally improve transit finances, it is politically and legally questionable whether public services can be differentiated for different groups.

In those communities where revenue generation is not the primary concern, fare policy may be established to further any of the following goals:

- Improved mobility for the poor
- Enhanced downtown and neighborhood business
- Reduced dependence on the automobile
- Energy conservation
- Reduced air pollution
- Income redistribution

Most of these goals promote increased ridership as an intent or an effect, either for the entire population or for a specific group.

Improved mobility for the poor and enhanced downtown and urban neighborhood business can be accomplished through fare reductions targeted for center city areas. Reduced shuttle bus fares encourage transit usage for downtown shopping. Reduced fares throughout the center city area increase transportation opportunities to lower income residents. Free fare zones have been implemented in some cities. The increased ridership achieved through these policies might be more cheaply accomplished through service improvements. In any case, public benefit of such policies must be carefully weighed against their costs.

The goals of reduced dependence on the automobile, energy conservation, and reduced air pollution, are obviously linked. These are accomplished through increasing the attractiveness of transit vis-a-vis the automobile, particularly during rush hour periods. While fare policy can reduce the relative cost of a transit trip, investments on transit service improvements or automobile disincentive programs might be more cost effective.

Low transit fares are sometimes implemented as a means of income redistribution. For example, in order to gain approval of a sales tax levy to finance rapid transit system construction, the Metropolitan Atlanta Rapid Transit Authority agreed to keep surface bus fares at 15¢ through 1979. The rationale for the low bus fare was that it would benefit poor people, compensating for the regressive effects of a sales tax. It is not clear just how much benefit actually accrues to the target population, since public financial assistance goes to all those riding transit including high income, long distance commuters as well as lower income riders.

Two issues regarding fare policy rationale are:

(1) What criteria should be used to set fares?

(2) How effective is fare policy in achieving goals such as reduced auto dependence and income redistribution?

INSTITUTIONAL CONSIDERATIONS

Institutional and political constraints limit the ability of local officials to modify fare policy to accomplish desired goals. To begin with, fare policy is highly political. Fare reductions may be popular with the electorate, while fare increases are usually met with substantial public opposition.

To the extent that local officials want to set fares on the basis of economic criteria, Federal or State requirements may be an obstacle. For example, transit agencies receiving Federal operating assistance funds are required to provide reduced fare programs for elderly and handicapped persons.

A large number of organizations and actors influence fare policy decisions--including government at all levels and the general public, as well as transit agencies. In particular, government agencies that provide operating assistance and fare-paying riders want a say. In order to ensure rational fare policy decisions, a fare-setting process must be established that provides appropriate roles for all the actors.

The following are some issues relating to the institutional aspects of fare policy:

(1) To what extent do political considerations dictate fare policy?

(2) Do Federal and State regulations limit fare policy flexibility?

(3) How can those concerned with fare policy be accommodated in the fare process?

TYPES OF FARES AND FARE COLLECTION TECHNIQUES

Different types of fares and fare collection techniques are the tools for implementing a pricing policy. There are three basic fare types--flat fare, distance-based fare, and time-differentiated fare.

The flat fare tends to encourage long trips and discourage short trips. The result is that fewer trips are made than would be with a distance-based fare. Flat fares, however, are very convenient for both the user and operator, and require the fewest mechanical aids. Since flat fares do not differentiate between trips on the basis of cost of service or value to the user, they are most appropriate to smaller systems, with more uniform trip lengths.

With a distance-based fare the price the user pays is more proportional to the amount of service consumed. Short trips are thus relatively less expensive to the user. The degree of sophistication of the distance-based fare depends on the type of fare collection equipment available. Automated fare collection devices used primarily on rail systems enable

transit operators to closely relate fares to trip length increments. In most bus operations, simple zonal charges or transfer fees are used. Although the distanced-based fare relates price to the cost of service on the basis of trip length, it is not clear whether this fare type generates more total revenue than the flat fare.

Time-differentiated fares have been implemented in many jurisdictions to encourage use of transit during off-peak periods, and to charge a premium for the financial burden of disproportionate peak period usage. In addition, in many systems reduced fare programs for special groups such as the elderly and handicapped are only in force during the off-peak periods, to discourage increased peak period use. It should be noted that studies of time-differentiated fares in New York State showed that different fare combinations increased either ridership or revenues, but not both; however, the results of this study might not apply in every community.

Fare collection techniques determine the feasibility of different fare types, and also affect operating efficiency and user convenience. Certain collection systems may increase dwell-times at stops and require special arrangements for the payment of fares, discouraging ridership.

On-board collection of exact fares--particularly suited to the flat fare structure--is the most straightforward method of fare collection. It is compatible with simple time-differentiated fare structures and special fare programs.

Prepayment plans involve the advance purchase of a ticket, token, or pass. Such plans facilitate the differentiation of fares for different groups. Monthly passes and multi-ride ticket books sold at reduced prices encourage ridership, but have little effect on revenue. In general, prepayment plans provide greater convenience to the passenger and increase the speed of fare collection.

NON-FARE BOX REVENUES

Because of the limited potential for increased revenue generated at the fare box, many transit properties attempt to find other sources of income to offset unrecovered costs of regular service. Charter service has the greatest potential for increasing revenue. Unfortunately many properties are legally prevented from providing charter service since they will be competing with private firms. Another approach that has been traditionally used by transit properties is the selling of advertising on buses or rail cars, although this method generates only limited revenue. Some properties, notably New York's MTA, have also marketed consumer products such as T-shirts.

Some issues concerning the potential for non-fare box revenues are:

(1) How do Federal and State laws or regulations restrict the ability of transit agencies to generate non-fare box revenues (e.g., through charter service)?

(2) What other means are there to increase revenues?

SERVICE CHARACTERISTICS

The principal determinants of the cost of providing transit service are the quantity and quality of that service.

Within a wide range of choices, this element of cost is controllable through public policy decisions. The constraints, particularly at the lower limits of choice, are the purposes for which transit service is provided in a particular urban area.1/ Most of these purposes are within local control; some are mandated by State or Federal action.

Service policies and standards, in which the characteristics of transit service are controlled, may be based upon traditional practices or transitory pressures. Increasingly, however, as the costs of providing transit services have more and more effect on public budgets, service policies and standards are being formally established by action of the transit agency and, in some instances, other public agencies or bodies that supply transit operating funds.2/

Formal service policies and standards --

- Document decisions with respect to transit goals, policies, and services.
- Guide transit management in planning, providing, and controlling services.
- Provide standards against which to evaluate an existing or proposed service.
- Provide standards against which to evaluate transit management.
- Assist public bodies directing or financing transit services in the allocation of resources and in making determinations with regard to new services and the adjustment or elimination of existing services.

1/ One reason for substantial increases in transit costs are the changes in basic policy with respect to the provision of transit service which inevitably, and properly, accompany the transition from private to public operation. This is not necessarily a one-time effect.

2/ The adopted standards of service should be attainable within available financial resources. If this cannot be done, the standard should be lowered to reflect what is attainable. There may, of course, be alternative policies and standards -- to meet specific contingencies, such as a drastic fuel shortage -- and there may be objectives, which exceed the adopted standards, which would be made effective were additional funds to become available.

The service characteristics which are of the most significance in determining the cost of providing transit service are:

- Route structure
- Schedules

Other service characteristics which are commonly covered in formal statements of service policies and standards include:

- Load factors
- Service reliability
- User services
- Distribution of transit benefits

ROUTE STRUCTURE

The number of route miles over which service is provided obviously affects the cost of transit service.

Transit routes are laid out so as to serve the greatest number of persons for which transportation is to be provided at least cost. This involves two major policy decisions, upon the basis of which determinations can be made as to the type of transit network, location of specific routes, and spacing between routes and stops. These are:

(1) Identification of the clientele to be served by the transit system. For what purpose is public transportation being provided in the community? As a matter of public policy, is the system intended to serve principally the transit dependent, or is it intended also to serve some proportion of actual or potential choice riders?

(2) Convenience of access to the system. The question, from a policy point-of-view, is (a) how far does an individual have to walk, or use another mode of transportation, before entering, or after leaving the transit system and (b) how convenient will it be to transfer between modes or between transit routes?

Practical decisions with respect to route location must take into consideration other factors which may impair the rational solution to a problem. Some of these factors are:

- Tradition. Many bus routes follow buried street car tracks because they replaced trolley service. Changes in routing may not have been made because of sheer inertia, despite shifts in the location of the user markets.3/

- Geographic constraints. The most rational route on a map may not be practical on the ground because of such constraints as excessively steep grades, inadequate turning radii, load limits on streets and structures, lack of turnaround space, or chronic bottlenecks.

- Political constraints. Route structures may be established to satisfy political constraints which cannot be ignored. These may involve demands for new routes, as well as objections to the discontinuance or relocation of existing routes. The elimination of excessively circuitous routing may be politically impracticable because of the objections of property owners along the proposed route.

- Offsetting costs. Even minor changes in route structure, such as a short line extension which is in itself a service improvement, may have major cost implications. The most common example is when a route extension makes it impossible to operate a schedule without additional equipment and manpower.

The following issues should be considered in evaluating route structure:

(1) Can jurisdictions afford to provide the number of route miles to meet their local objectives?

(2) Does the present route system efficiently serve current travel needs, or are some routes obsolete?

(3) What political and other constraints/considerations affect route structure?

(4) What are the costs of route structure changes?

SCHEDULES

Schedules, which deploy equipment and manpower to operate service on established routes, also have a major effect on transit operating costs.

3/ However, the old route may still provide the best service for the greatest (or a significant) number of persons. And drastic or frequent changes in routes are confusing to gransit users and may result in loss of riders with offsetting gains.

Frequency of service is the principal determinant of the number of vehicles and vehicle operators required to operate service over a particular route. In the aggregate, the level of service provided during the highest peak period determines fleet size and, as a result, affects most other system costs.

In their simplest form, frequency of service decisions can be made on the basis of the intervals at which, during various times of the day, full loads are ready to be transported. Frequency-of-service decisions are, however, rarely found in their simplest form. More commonly, these decisions result from the establishment of policy headways, which dictate the time intervals between vehicles on a particular route during particular periods of the operating cycle: base periods, peak periods, nights, weekends, and holidays. The trade-off is between the efficiency of operating with full loads and the convenience to the user of more frequent transit service.

Other factors taken into account in building a schedule include:

- Securing optimum utilization of equipment and manpower within the constraints of the current labor contract (see paper on Labor-Management Relations).
- The need to coordinate schedules on various routes so as to--
  - -- facilitate passenger transfers.4/
  - -- permit the transfer of equipment and operators to other routes.
- The desirability, from a marketing viewpoint, of clock headways.5/
- The desirability of minimizing travel times for the greatest number of riders.
- The practicality of using short-turns to reduce service on the less heavily-used outer portion of a line or to curtail night, weekend, or holiday service. 6/
- Allowing sufficient running and recovery time to permit a reasonable level of on-time performance.

4/ The schedule manager of a large system estimates its grid system of routes requires 10% to 20% more service in order to provide convenient transfers than would be required for a radial system of routes.

5/ A vehicle is at a particular stop on its route at easily remembered intervals, such as 9:00, 9:30, 10:00, 10:30, etc., rather than at 9:00, 9:28, 9:56, 10:24, etc., and at the same time each hour.

6/ Short-turns involve turning back vehicles before they reach the outer terminal of a route.

There are also some factors largely external both to the transit operation and to policy decisions with respect to schedules which affect the running time of surface systems and may permit the more efficient use of equipment and manpower.[7] These include:

- General improvements in traffic flow.
- Elimination of traffic bottlenecks.
- Preferential treatment for transit vehicles.

Scheduling issues include the following:

(1) What are the trade-offs between cost and service considerations?

(2) How can agencies responsible for traffic flow help shorten transit running times?

LOAD FACTORS[8]

The number of standees to be factored into the development of a transit schedule involves a policy decision. Obviously, the larger the number of revenue passengers on a trip, the better the revenue-cost relationship for that trip. The trade-off is between cost-effectiveness and passenger comfort and convenience.

Most urban transit systems establish a policy load factor, at least for peak periods, larger than 1.0.[9] This may vary with type of service. The tendency under public operation is to reduce policy load factors and to move toward a seat for every passenger.

Allowable average load factors are generally specified in the set of service policies and standards. The most important consideration affecting user acceptability of load factors greater than 1.0 appears to be the length of time which riders may expect to stand. The necessity of standing at any time may, however, make regular transit service unavailable to some elderly and handicapped persons and unacceptable to some choice riders.

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[7] Savings in running time of less than a full headway may be worthwhile in terms of better service to transit riders, but they do not permit cost savings.

[8] Ratio (sometimes expressed as a percent) of the number of riders to the number of seats, measured at the maximum load point on each route. At 1.0 (or 100%), all seats are filled and there are no standees. At 1.25 (or 125%), all seats are filled and standees equal one-quarter of the seated load.

[9] Regulatory agencies frequently establish maximum load factors for privately-owned carriers.

Load factor standards raise these questions:

(1) What are the trade-offs between costs and user comfort?

(2) What is the priority of user comfort among transit objectives?

SERVICE RELIABILITY

Transit service is reliable when:

- Schedules are adhered to.10/
- No scheduled trips are missed.

Service policies generally include on-time performance standards. The minimum acceptable on-time performance is usually less when headways are short (say 10 minutes or less) than for longer headways.11/

High levels of service reliability are not attained without costs. The policy trade-off is between those costs and the effects of service unreliability on the ability and willingness of individuals to use the transit system.12/

A high level of service reliability requires:

- The building of schedules which allow sufficient running and recovery time to permit the schedule to be run, under varying (but not extreme) conditions of traffic and weather, within the acceptable limits of on-time performance.

10/ In no circumstances should transit vehicles run ahead of schedule. The definition of on-time performance used locally may include trips which are a few minutes (usually not more than 5) late.

11/ Although there is no "standard" standard in this area, acceptable on-time performance on short-headway schedules may well range between 75% and 85%, while acceptable levels on long-headway schedules will be closer to 95%.

12/ A separate question for policy consideration is the extent to which the system should be capable of providing at least basic services during unusual emergency conditions, such as a severe blizzard or flooding.

- A level of mechanical inspection and preventive maintenance which minimizes road failures of equipment (see the paper on Internal Management for a discussion of maintenance practices).

- Adequate operator training and supervision, including prompt and adequate supervisory response to abnormal operating conditions and emergencies.

USER SERVICES

The term user services, as it is employed here, covers a wide spectrum of services and amenities which facilitate the use of the transit system and add to passenger comfort and convenience. In some instances, these services and amenities may be directly related to efforts to attract new transit riders. In other instances, while they may incidentally have this effect, they are intended primarily to serve present riders.

In large measure these are accessory items, not as significant in transit operations as route structure, schedules, or service reliability, yet significant enough to be considered at a public policy level and to be incorporated into a formal set of service policies and standards.

While the costs of providing these user services are easy to ascertain, their benefits are difficult to quantify. No really accurate means yet exists, for example, by which the effectiveness of transit marketing programs can be judged. Nor is it yet possible to quantify the value of bus stop shelters, readily-available and easily-used timetables, or telephone information services.

The listing which follows is necessarily incomplete. It covers the more common user services, comments briefly upon them, and provides a basis for further exploration of their relationship to transit productivity.

A. Printed Schedules

Most transit systems have made substantial improvements in recent years in the provision of printed ("hand") timetables for the use of riders and prospective riders. The principal improvements have been --

- Greater availability on transit vehicles, as well as through mailings and the use of literature racks in public places.

- Increased usefulness, through the use of better maps and more readible typography.

B. Telephone Information Services

Transit telephone information services have been justly notorious for their busy signals. Many systems, with the aid of public funds, are

building up their telephone information facilities, losing fewer calls, and providing a wider range of telephone information. An outstanding example is the establishment by the Regional Transportation Authority, through arrangements with Chicago Transit Authority, of a telephone information service which operates on a 24-hour basis and covers all types of local transportation services in the seven-county area of Northeastern Illinois.

C. Posted Schedules

A few transit systems post schedules at bus stops. These are expensive to prepare and revise if they are tailored to the stop. They are also extraordinarily subject to vandalism and weather damage. It may be less costly, and at least as effective, to give headways rather than scheduled times and to include this information on the bus stop sign itself.

D. Bus Stop Signs

The trend is toward more visible and more easily identifiable bus stop signs. Bus stop signs may display route information. Less frequently, they also display fare and schedule information--the problem here being the costs of updating to reflect changes in fare structure and schedules.

E. Employees as a Source of Transit Information

Despite all the expenditures for timetables and informational services, the principal source of information about routes, transfer points, schedules, and fares is still the transit employee. And a large proportion of the observations of transit patrons with regard to a transit system concern the degree to which its employees are courteous and helpful. How well transit employees perform these public relations and marketing functions appear to be directly related to (1) employee training, (2) supervision, and (3) management attitudes.

F. Bus Stop Shelters and Benches

Many transit systems have embarked upon programs to provide bus stop shelters at the most heavily-used bus stops and benches at those less heavily used. The costs, particularly of shelters, are substantial, and in exceptional cases only can the expense of lighting and heating be justified.

The principal concerns are (1) the development of criteria which locate these amenities where they are most needed and which insure equity in their distribution, (2) possible objections from adjacent businesses and residents, and (3) architectural treatments which are consistent with the neighborhoods in which shelters are located and which at the same time facilitate maintenance, discourage vandalism, and do not offer opportunities for street crimes. A policy issue upon which much local

emotion may be expended is whether or not to accept benches or shelters which are provided without cost to the transit system because they carry advertising.

G. Transit Marketing

Transit marketing probably has three purposes, although only the first is a marketing function in the strict use of that term. The three purposes are:

(1) Increasing transit patronage.

(2) Developing community understanding of the need for public transportation services and their value to both users and non-users.

(3) Reducing vandalism directed against transit facilities.

Marketing staffs attempt to accomplish these purposes through a wide range of techniques including advertising, posters, flyers, mailing pieces, hand schedules, radio and television spots, exhibits, special promotions, and personal contacts with civic groups, citizen's associations, schools, and other groups. There are problems, however:

- There are no commonly accepted tools available by which the effectiveness of a marketing program can be judged.

- Marketing goals with respect to increasing transit patronage are usually diffuse and may well be counter-productive.

  -- What kind or rider is the transit system trying to attract? Choice riders? During what periods? Those who do not have access to other means of transportation and who would use the system if they were aware of what it offered and knew how to use it? Those now using another means of transportation?

  -- For what purpose is the transit system trying to attract new riders? What are the real trade-offs between increased transit costs and external benefits, such as the reduction of congestion or air pollution and energy savings? To what purpose, for example, does the transit system in a smaller city try to attract choice riders during peak periods if this will require additional equipment and manpower?

Issues regarding user service include:

(1) What are the locational and design considerations for bus stop shelters and benches?

(2) What is the relationship of marketing to transit finances and service quality.

(3) What are the cost implications of marketing program targeted to increase peak period ridership?

(4) How can the effectiveness of a marketing program be evaluated?

DISTRIBUTION OF TRANSIT BENEFITS

Title VI of the Civil Rights Act of 1964, as amended, provides that no person in the United States shall, on the ground of race, color, or national origin, be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving Federal financial assistance. Discrimination on the basis of sex is prohibited under section 12(f) of the Urban Mass Transportation Act of 1964, as amended, and section 324 of the Federal-Aid Highway Act of 1973.

Service policies and standards should contain specific criteria for the establishment and maintenance of equity in the provision of transit service.

PARATRANSIT SERVICE

In low-density areas (which may embrace the entire area of a small city or the less-densely populated sections of a larger city), it may be possible to reduce transit service costs and provide a high degree of mobility by substituting paratransit service, using publicly or privately operated small or intermediate-sized vehicles, for regularly scheduled transit service on fixed routes during all or part of the day. This may be the only practicable means of providing mass transportation service in low density areas.

Paratransit service may be operated as a combination of scheduled service on fixed routes and demand-responsive service. Ordinarily, however, service is provided in response to individual requests, made at some minimum specified time before service is needed. The vehicle fleet is centrally-dispatched and the schedule and route for each trip is laid out so as to pick up and transport to their destinations as efficiently as possible those persons who have requested service. In suburban areas, demand-responsive service can be used as feeders to, and distributors from, regular transit routes.

The types of service which can be provided and the dispatching techniques which can be employed are so varied and complex as to preclude further description here. In any event, demand-responsive service must be carefully and skillfully tailored to local requirements and conditions. Service policies and standards should be set forth in the same manner as those for conventional transit services.

SPECIAL SERVICES

For the purposes of this paper, two kinds of special service are identified and briefly discussed:

- Contract service.
- Special service (including speical equipment on regular routes) for elderly and handicapped persons who are unable freely to use regular transit services.

A. Contract Service

Contract services are those mass transportation services which are provided under some form of contract which pays or guarantees the cost of providing the service. Such service may be provided on a onetime basis, or it may continue over a period of time. Ordinarily, the use of the service is restricted to a specific group, such as the employees of the firm contracting for the service or the members of a church group. The purchaser may pay for the service, or may contract to make up the difference between what the rider pays through the fare box and the contract price.

Contract services are easy to provide, because the need is known in advance and the contract can be declined if the facilities to provide the service will not be available. And contract services are quite likely to be the only services provided by a publicly-owned carrier which not only pay for themselves but can be made to return a profit.

Two constraints upon the provision of such service by publicly-owned carriers outside the carrier's urban area are the restriction on charter bus operations contained in section 3(f) of the Urban Mass Transportation Act of 1964, as amended, and the provisions of Title 23, U.S. Code, which relate to the use of highway funds for transit purchases. The provision of school service under contract is restricted by section 3(g) of the Act and by similar provisions in Title 23.

The effect of these restrictions on some publicly-owned transit systems has been to reduce charter revenues substantially and, as a result, to increase the need for local, State, and Federal financial aid.

B. Special Service for Elderly and Handicapped Persons

For elderly and handicapped persons who are able to use freely regular transit facilities and equipment, the best assurance of mobility is a strong basic transit network serving the entire urban area, accompanied by special efforts to see that concentrations of such individuals are well-served by regular routes, and special fares.

For those who are unable to use regular service, special efforts must be made. These include (1) designing and equipping regular transit facilities and equipment so as to make it usable by them and (2) providing special service. Standards with respect to the provision of transit service for elderly and handicapped persons are prescribed, in the case of transit systems receiving aid under the Urban Mass Transportation Act of 1964, as amended, by the U.S. Department of Transportation.13/

The principal modifications which are available as options in the design of standard transit buses to make them more readily usable by elderly and handicapped persons who cannot freely use regular equipment are:

- A kneeling device, which lowers the right front end of the vehicle so as to decrease floor height above ground level to not more than 24 inches.

- Wheelchair lifts, ramps, and tie-downs

Aside form the initial capital costs (a lift currently may add $7,000 to the price of a bus), the major concern among transit operators with respect to these devices is their possible adverse effects on maintenance costs, overall schedule times, and service reliability. The impact cannot be factually ascertained until experience is available on the basis of actual operating conditions.14/

Regulations issued by the Urban Mass Transportation Administration on September 23, 1977, require the use of standard specifications, effective September 30, 1979, for Federally-assisted purchases of full-sized urban transit buses. These specifications require a stationary floor height of not more than 18", and a ramp for boarding and exiting.

Special services, usually with small vehicles, some of which are equipped with wheelchair lifts or ramps and tie-downs, are already available to substantial numbers of elderly and handicapped persons in most urban and rural areas.

13/ 23 CFR Part 450 (41 Fed. Reg. 18235, April 30, 1976); 49 CFR Part 609 (41 Fed. Reg. 18236-41, April 30, 1976; 41 Fed. Reg. 45842, October 18, 1976; 42 Fed. Reg. 9654, February 16, 1977; 42 Fed. Reg. 13816, March 14, 1977); 49 CFR Part 613 (41 Fed. Reg. 18234, April 30, 1976; 42 Fed. Reg. 48339, September 23, 1977).

14/ Bi-State Development Agency (St. Louis, Missouri-Illinois) has 60 lift-equipped buses (out of a fleet of 938) which it will place in service on 10 lines for a one-year pilot program to determine the effects on schedules, recovery time, maintenance costs, and riders. Ninety-seven more lift equipped vehicles are to be added on a total of 17 lines by December 1977.

These services are operated principally by public and private non-profit health care and welfare agencies for their own particular clientele. Federal funds may be used under section 16(b)(2) and a variety of categorical grant programs administered by the U.S. Department of Health, Education and Welfare.15/

There is considerable indication that sufficient equipment is already available in urban areas to meet a substantial portion--if not all--of the need for special services, provided that it could be used jointly and dispatching were coordinated by a central agency. This possibility should be explored in developing regional plans for the transportation of elderly and handicapped persons under the Federal guidelines mentioned earlier.16/

Issues regarding special services include:

(1) What is the financial impact on transit agencies of restrictions on charter bus operations?

(2) What are the institutional considerations involved in substitution of demand-responsive service for fixed schedule service?

(2) What are the comparative costs and benefits of equipping standard transit buses with special equipment so that they can be accessible to elderly and handicapped persons, and providing special services to such persons?

(3) How can central agency coordination of special services be accomplished?

15/ Section 16(b)(2) of the Urban Mass Transportation Act of 1964, as amended, made Federal aid in meeting the special needs of elderly and handicapped persons available to private non-profit organizations.

16/ The institutional barriers are significant. Local agencies resist the loss of direct control over "their" vehicles. And it is commonly believed that HEW policies and regulations prohibit joint use. One place in which a consolidated system of vehicle use, servicing, maintenance, and dispatching has been achieved, however, is Bedford and Somerset counties, Pennsylvania, where a consolidated system also operates across county lines.

LABOR/MANAGEMENT RELATIONS

LABOR/TRANSIT PRODUCTIVITY BACKGROUND

In order to effectively discuss the issues surrounding labor/management relations, it is important to have an understanding of labor and the labor movement in the transit industry.

Briefly, the transit industry is highly unionized, with transit unions dating back over one hundred years. The three major unions representing transit industry employees are the Amalgamated Transit Union (ATU), the Transport Workers Union (TWU), and the United Transportation Union (UTU). All three unions are AFL-CIO affiliated.

An overwhelming percentage of the transit companies have long-standing collective bargaining contracts. Most of these companies have one union representing their employees. In some instances where the system is large, management may have to negotiate with two or more unions representing the employees. However, this is often avoided by setting up joint bargaining discussions.

An increasing need to study the productivity of employees evolved from the post World War II decline in the profitability of the industry. In addition, the industry's growing dependence on operating assistance provided by Federal, State and local governments has given rise to the following questions:

(1) What impact has the infusion of Federal assistance had on productivity?

(2) What increases in transit productivity are possible, and by what means (technology, work rules, etc.)?

(3) To what degree can increases in "productivity" contribute to improvements in overall transit performance?

One essential element in increasing transit performance through higher productivity gains is cooperation between labor and management. In general, relations between labor and management in the transit industry are good. "Most transit contract disputes are settled by arbitration . . . strikes affect a much smaller portion of the labor force in transit than in many other industries. Although the frequency and severity of transit strikes have increased in the past decade, in 1974 the number of employee days lost as a result of work stoppages constituted only .18 percent of the total working time . . ."[1] The fact that public employee strikes are

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[1] John R. Meyer and Jose A. Gomez-Ibanez, "Improving Urban Mass Transportation Productivity", (February 1977) pg. 68. UMTA study.

illegal in some states has certainly been a factor in maintaining this low work stoppage percentage.

One labor/management issue is representation at the bargaining table. Labor sometimes claims that it is very difficult for them to deal with people representing management who are neither their counterparts nor have the final say on negotiated matters. Labor has at times been forced to negotiate with each representative separately. To address this problem, labor is calling for a "single authoritative counterpart" that can speak for all of those involved. However, there may be some advantage to labor in its dealings with multiple management representatives, in that a separate pledge might be extracted from each negotiator. Management has a tendency to send staff persons into negotiations without giving them significant direction or authority, claiming that the certainty of intervention by local public officials discourages upper echelon management personnel from participating in the negotiations. The intervention of local officials into the bargaining process, has increasingly been viewed by both management and labor to be confusing and frustrating.*

Labor and management have not been very successful in actively negotiating for productivity improvements (except in the recent New York City supplemental labor agreement). In remarks given in Atlantic Beach, Florida in March 1976, Louis J. Gambaccini (Vice President and General Manager of the Port Authority/Trans-Hudson Corp.) speaking about Labor and Management in the Future of Public Transportation stated, "If wages and benefits were accompanied by productivity gains, then their impact would be less of a threat to our industry. For example, on the Port Authority/Trans-Hudson (PATH) System, train operators were offered a $1.21 hourly increase--at the time almost a 45% increase in the basic rate--in the first contract after public takeover in 1964. However, the cost of the wage increase was, in the years to follow, more than offset by jobs which we were able to eliminate. No employee on the property was furloughed and more importantly no employee was given an unreasonable workload. However, in return for a large wage increase we were able to eliminate scores of work rules which would have required us to continue filling unneeded jobs in the future."

There are several variables which contribute to the labor/management relationship. Firstly, there are those variables which are dictated by a contractual agreement. Variables such as these can be negotiated at the bargaining table, but once adopted are usually strictly adhered to. The use of split shifts, part time employees, seniority rules, and discipline rules all fall under this category. A second set of variables are management oriented. It is up to the discretion of management to determine such things as the level of service, vacation schedules, absenteeism rules, personnel and administrative prerogatives. A third set of variables are those governed by traditional practices, which, due to their longevity, become expected customs which are difficult to break away from. Fourth are

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* Decision from the Third Circuit Court of Appeals en banc, State of New Jersey, September 22, 1977 Amalgamated Transit Union vs. Governor Brendan T. Byrne, (D.C. Civil No. 76-698).

external variables and staggered work hours which impact directly on many of the daily activities and practices of both labor and management.

This issue paper will present each of the four variables: Those dictated by 1) contract 2) management 3) traditional practices and 4) external measures, and then will discuss those elements of the labor/management relationship which are affected by these variables. The paper will examine from a labor/management viewpoint what methods and technologies might be implemented to assist all concerned in increasing productivity savings. The paper will then go one step further to pose the question that--even if there is an increase in productivity savings will this contribute to an overall improvement in transit performance?

THE LABOR CONTRACT

The labor contract dictates the core of the labor/management relationship. Negotiation of the labor contract, therefore, is very important. The art of negotiating a labor contract is a key to assuring productivity improvements, as the elements discussed during negotiations can all be designed to yield productivity returns.

A. Work Rules

Work rules in the transit industry are periodically updated in contract negotiations. Although work rules vary greatly among properties, labor and managment have agreed, for the most part, on the need to change work rules to meet new service and equipment demands, and have done so. Yet there may be room for further changes. "...The most important of these, by far, is adjustment in work rules governing operators...since...[they] constitute the largest single group of transit employees."[2]

Work rules governing craft-organized employees are the most restrictive because of the large number of unions representing them and the special nature of the craft employees' jobs. Labor feels that changing these unique work rules for the craft employees might bring more tension and confusion than productivity gains.

The following are some issues concerning the negotiation of work rules in the labor agreement:

(1) To what extent, if any, will the realignment of work rules increase labor productivity? What are the overriding external factors here (both positive and negative)?

(2) Do the work rule requirements being included in labor agreements reflect prevailing conditions?

(3) How can the impact of work rules on labor productivity be measured?

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[2] John R. Meyer and Jose A. Gomez-Ibanez, "Improving Urban Mass Transportation Productivity" (February 1977), p. 77. UMTA study. (However, it is important to recognize that the role of the operator is more pronounced in surface transportation than in rail transit).

B. Scheduling

Scheduling may be affected by sections of the labor contract that, if negotiated properly, can yield productive returns. Management feels that work schedules can be revised to increase the utilization and effectiveness of each employee or crew.

Of major concern to labor are the changes in load factors associated with increased headways. Labor feels that an increase in headways from 5 to 10 minutes, which provides the vehicle with additional passengers, constitutes a productivity gain. Management contends that such an increase in headways is merely a service reduction measure, and as such, not an increase in productivity at all. Another problem here is that oftentimes unions will not permit operators to work on more than one transit route, which also hampers potential productivity gains.

Average operating speed has a direct impact on schedule efficiency. Therefore, data on system averages should be examined and evaluated. Labor contracts often specify recovery, turn-in, and accident report times, which may not reflect actual operating needs. Recovery time--an important component of the vehicle's schedule--is affected by several factors: trip frequency, roundtrip running time, and traffic variations throughout the day. Accident report times are preset, regardless of the actual time required.

Important scheduling issues include:

(1) How will changes in times affect productivity? What changes are possible?

(2) How can adjustments be made to the schedule without upsetting work rules? What adjustments are these? What impacts on work rules will these changes have?

The option of utilizing split shifts and part-time employees is also dictated by the labor contract. Labor agreements often offer the driver a 12-hour day with a four-hour break somewhere in the middle of the day. The driver is to be paid for the hours worked (usually eight) plus spread-time compensation. The issue is whetner work can be given after the peak hours to prevent spread-time requirements?

By contrast, part-time employment is generally prohibited by labor contracts. Labor contracts usually clearly stipulate the amount and length of both split and straight shifts.

The key issues involving part-time drivers and split shifts are:

(1) What can be done with the extra drivers available during the off-peak hours to make the system more productive?

(2) Will utilization of drivers during the off-peak for non-driver-related tasks result in service improvements and increased productivity, or merely higher labor costs with limited or no productivity gains?

(3) What are the alternatives to split shifts (i.e., having the driver perform different tasks during the off-peak period)? What are the productivity payoffs of such strategies?

(4) Can an increase in straight shifts (with just the normal lunch and coffee breaks) and advances in run cutting techniques yield any significant labor productivity results?

Another item that should be negotiated during labor contract discussions is the concept of overtime versus "new hires". Here again the question must be asked: Which is the most cost-saving procedure--paying full-time workers overtime to perform necessary peak tasks, or hiring additional employees to handle these jobs?

These are difficult questions. Labor is understandably concerned about work loads and about the choices between overtime employees versus new hires. Through compromises a satisfactory program utilizing both approaches might possibly be achieved.

C. Vacations

Vacations as a right to the employee are covered under the labor agreement. However, the details of vacation scheduling are directed by management.

(1) Under what circumstances is the use of the extra board or the use of overtime employees for vacation relief the most cost-saving procedure?

(2) To what degree should management become involved in the scheduling of vacations?

D. Wages

Wages are an important issue in every labor/management discussion. In recent years, wage gains within the industry as a whole have exceeded increases in the cost of living (this followed a period during which wages were held down due to declining revenues). The transit industry now has relatively high wages compared to other public sector activities.

Important issues in this area include:

(1) Should wage increases be measured and evaluated on a historical basis? An industry-wide basis?

(2) How do transit industry wages compare to those of other municipal employees? For what levels of government? Are such comparisons fair? Valid?

(3) Do the above methods for determining wage increases provide any leeway for the discussion of productivity improvements?

(4) How do split-shifts and overtime payments affect the transit employees' wages?

(5) Is the New York City approach--tying cost of living increases to productivity improvement programs and returns--a practical one? How applicable is it to other jurisdictions?

(6) With the growing fiscal crises in many cities today, are the recent approaches for increasing transit workers' wages reasonable?

With the discussion of wage increases comes the topics of fringe benefits, seniority, and job security. For example:

(1) Is it productive to tie hiring and promotion procedures closely to seniority, as most transit companies now do?

(2) What mechanisms can be developed to give both labor and management a fair part in evaluating performance? How would such an evaluation affect job security?

(3) Should fringe benefit increases be tied to productivity increases along with wage increases, or should they be negotiated separately?

Once labor and management have finished negotiating the issues of work rules, shift requirements, run cutting advances, part-time drivers, split versus straight runs, overtime versus new hires, absenteeism, vacations, wages, fringe benefits, seniority rules and job security stipulations, the next step is the application of the labor agreement to the operation.

Defining what each side means by <u>productivity</u> and <u>productivity savings</u> is important from the outset. The labor agreement could all too quickly become a useless document if these definitions are not agreed to before the implementation process begins.

MANAGEMENT

There are elements of the labor/management relationship which are not contractual, but rather governed by management itself. An examination of these factors reveals the opportunity for both productivity savings and gains.

A. Scheduling

Scheduling, as described earlier, is covered under the labor contract. However, assignments on the schedule board, as well as scheduling policies, are directed by management.

(1) How can the schedule board affect productivity gains?

(2) What scheduling policies can be implemented to aid performance and productivity?

B. Absenteeism

Absenteeism is a problem which often troubles labor/management relations. When employees who can afford to do so take days off (without pay), gaps on the scheduling board result.

Possible solutions and measures to address this issue include:

(1) Should work rules be updated to reduce unnecessary absenteeism?

(2) What impact does this type of absenteeism have on overtime?

(3) Should names on the extra board be increased to avoid overtime payments?

(4) Should adjustments in the sick call rules be made to compensate for the problem caused by excessive absenteeism?

C. Vacation Scheduling

Vacation scheduling is also a critical topic which management has a great deal of control over. Key issues involved here include:

(1) How can economical control of vacation scheduling be dealt with in contract negotiations?

(2) What impacts do vacation schedules have on productivity?

Management is also responsible for personnel and administration. Well-planned employee recruitment and selection processes are essential in order to further improve labor productivity. The transit industry custom of promoting from within the company may have discouraged many well-trained "outsiders" from pursuing jobs within the industry. The attrition policy which many of the companies have been forced to adopt will act as a further deterrent to balanced recruiting.

What are needed are programs which reach out to the college campus and the vocational high school to encourage students to prepare for a career in the transit field, and which ensure them that positions will be available for them to enter. UMTA has funded such training programs in several areas, from management to maintenance.

Promotion and merit increases are incentives in some transit jobs, but in others, there is little room for monetary increases. Some operators begin the first year at a high wage rate, but have little opportunity for monetary advancement thereafter. One way to ensure increased performance is to provide labor incentives in salary and wage agreements. If these incentives are reached early in the employment career, performance may fall off.

Key questions to consider include:

(1) Should employee recruitment and selection programs be expanded?

(2) Should future training programs be established?

(3) Will developing promotion programs which reflect the work of the driver improve morale?

(4) Should first year wages be lowered to create room for monetary growth in the future?

It is management who determines level of services, service reductions, and who is ultimately responsible for employee morale. It therefore becomes obvious that management plays a crucial role in guiding both transit performance and productivity.

TRADITIONAL PRACTICES

Many customs and practices have become built-in elements in labor/management relations. As described earlier in this paper, employees tend to grow accustomed to practices which are not dictated by the labor contract. Yet, when management decides to eliminate or change these practices, problems arise amongst the employees. It is very difficult for management to "get back something" after it has become a traditional practice. Key issues here are:

(1) How significantly do traditional practices affect productivity levels?

(2) What can management do to help define and regulate traditional practices? . . . what can labor do?

EXTERNAL MEASURES

There are factors which seemingly have no direct link to labor/management relations, but when examined closely are shown to have a great impact on this relationship. These factors develop outside the control of either labor or management, and vary widely in scope (from surface congestion to Section 13(c) of the 1964 Urban Mass Transportation Act).

One of these external measures is the peaking problem. The peaking problem is of concern to both labor and management. John R. Meyer and Jose A. Gomez-Ibanez state in their report to UMTA (Improving Urban Mass Transportation Productivity, p. 82) that "since only minor adjustments may have a significant impact on labor productivity and costs, both labor and management might benefit from negotiating changes that partially alleviate the peaking and operator scheduling problem." Questions to be asked here are:

(1) What traffic control measures can be implemented to alleviate the peaking problem?

(2) Can work schedules be restructured to lighten the peak burden?

(3) How might staggered work hours in other industries and businesses help? Under what circumstances will staggered work hours result in under-utilized transit vehicles? In lower load factors during the peak period? What are the other impacts of such strategies (latent demand, etc.)?

(4) Should changing headways through advanced run-cutting techniques be considered productivity improvement?

Surface congestion, including parking problems, is another measure which should be evaluated.

(1) How can surface congestion be dealt with during peak hours? . . . off peak hours?

(2) Can the alleviation of surface congestion result in productivity gains?

A third external measure which has direct impact on labor/management relations is Section 13(c) of the 1964 Urban Mass Transportation Act.

Section 13(c) was included in the 1964 Act because of two concerns which were advanced vigorously by organized labor:

(1) That public bodies which acquired the assets of privately-owned companies, using Federal aid, would not continue the recognition of existing labor organizations.

(2) That changes in organizations, operating methods, and technology made possible through Federal aid would result in a worsening of the positions of individuals with respect to their employment.

The statute sets out five specific provisions:

(1) the preservation of rights, privileges, and benefits (including continuation of pension rights and benefits) under existing collective bargaining agreements or otherwise;

(2) the continuation of collective bargaining rights;

(3) the protection of individual employees against a worsening of their positions with respect to their employment;

(4) assurances of employment to employees of acquired mass transportation systems and priority of reemployment of employees terminated or laid off; and

(5) paid training or retraining programs.

The administration of Section 13(c) is vested in the Secretary of Labor -- the original version of the Section, which vested this authority in the program administration, having been amended during floor debate. The Secretary of Labor determined that the most equitable means of administering Section 13(c), when there was an existing labor organization, was through the negotiation of an agreement between the transit operator and the union.

Currently, most operating assistance projects are covered by a National Agreement, negotiated between the American Public Transit Association and the major unions, to which transit operators and local unions may become signatories. Capital projects are covered by individually negotiated contracts, which ordinarily are carried forward (piggy-backed) to cover subsequent capital projects.

The basic provisions of both types of agreement follow the specific requirements of Section 13(c).

Section 13(c) protects the existing collective bargaining rights of the employees of acquired systems and sets forth the protection which will be afforded transit employees in the event that their positions are worsened as a result of a Federally-aided project. Some transit managers feel that Section 13(c) also limits the possibilities of effecting increases in operating efficiency.

Several issues are posed by section 13(c):

(1) Does Section 13(c) strengthen the position of labor in negotiating labor agreements other than those specifically related to Section 13(c) itself?

(2) To what extent have negotiated Section 13(c) agreements gone beyond the intent of the act?

(3) Does Section 13(c) hamper management efforts to improve transit operating efficiency?

Also external in nature are support programs which have the potential of assisting labor productivity.

Some recently developed programs have been designed to expedite transit planning, management, and operations, and at the same time introduce cost savings into the system.

RUCUS is a computerized run cutting and scheduling system. RUCUS schedules both operators and vehicles much the same way as that done manually by the industry. By computerizing trips, blocks, and runs, however, RUCUS can develop a schedule with many alternatives rather quickly.

Because RUCUS has not been widely used, measuring its effectiveness has been difficult, and of limited value. San Diego, Fort Worth, Syracuse and Portland are major cities currently using the RUCUS system. Some claim that RUCUS has been more valuable in the development of run cutting schedules than it has been in developing drivers' schedules. RUCUS does offer the potential to large firms of effecting productivity improvements through the use of computerized scheduling. Yet, just how much productivity savings can be achieved cannot be determined until more companies begin employing the system.

The UMTA Act as amended requires that all recipients of Federal transit operating money will be required to report cost and revenue data in a uniform way. The industry has been working with UMTA on Project FARE to develop and implement such a uniform reporting system, which could have some long-range productivity implications.

AGREEING ON WHAT PRODUCTIVITY IS

No matter how one categorizes the variables discussed in this paper, one fact holds true throughout: unless labor and management agree on a definition of productivity, gains can never be measured.

For both labor and management to agree on the definition of productivity is a difficult and often seemingly impossible task. The current situation in New York City involving negotiations between unions and the Emergency Financial Control Board (EFCB) is an example of where labor, management and the local governing agency could not agree on such a definition. The supplemental labor agreement signed by the transit unions and the transit authority (TA) calls for cost-of-living adjustments to be tied to labor productivity improvements. The TA and the unions at once set out to establish programs that would yield high productivity improvements. Seventy-two programs were identified by both the TA and the unions as productivity programs. The programs also included newly developed tracking systems for revision of vacation schedules; control of sick leave; reductions in the number of pay stations; extended cleaning cycles; reduction of manning in token booths; increase of relay repair output in signal shop maintenance; car insepction--new standards, increase of productivity in renovation and sweeping; requirement of medical proof for sick leave after first five instances; and reduction of quota for yard jobs for road motorman.

When the cost of living adjustments recently came before the Emergency Financial Control Board for approval, 50% of the productivity savings claimed by the Transit Authority and the transit unions were declared invalid. The EFCB declared these savings invalid on the grounds that the programs established to produce the savings were service reduction programs rather than productivity improvement programs. For example, EFCB took the position that cutting back on man-hours and employees by closing token booths represented a service reduction savings no matter how much more work was allocated to the remaining employees. EFCB further claimed that if a headway was stretched from two to four minutes the savings was the result of service reduction--even if the driver ended up carrying twice the usual amount of passengers.

Labor's reaction to these positions and rulings was one of astonishment. Negotiations are now taking place to decide which programs actually qualify as labor productivity programs. Labor feels that when an extra burden is placed upon its employees which results in an increase in output, such an increase should be considered a productivity improvement.

The key problem here is that no single definition of "productivity" has been established. Had all the parties concerned agreed to a definition before finalizing the Supplemental Labor Agreement, many of the problems could probably have been avoided. Critical components to such agreements should include:

(1) Agreeing to a definition of productivity before finalizing the labor contract;

(2) Discussing the differences between service reduction programs and productivity programs; and

(3) Discussing and defining other ambiguous terms related to productivity or the labor contract.

CONCLUSION

Improving labor productivity in the transit industry is perhaps the single most significant aspect of transit system performance. There seem to be many opportunities for realizing such improvements--provided the affected parties agree that such actions are to their mutual advantage.

INTERNAL MANAGEMENT

Significant opportunities for improvement may exist in the internal management of transit systems.[1] In terms of benefits, improvements in this area are unlikely to be as significant as those discussed in the papers on "Service Characteristics" and "Labor-Management Relations." However, they offer potential for worthwhile savings and -- perhaps of equal importance -- for improving the public image of transit systems. Improvements in this area include:

- Management techniques
- Employee training
- Insurance and claims
- Internal security
- Capital investment
- Purchasing and stores
- Facility location and design
- Maintenance

MANAGEMENT TECHNIQUES

Transit systems in many instances have been slow to accept and use management techniques which are common in both the private and public sectors. These include techniques in such areas as policy and procedural development, organizational and functional analysis, personnel management, budgeting and financial management, management by objectives, management information systems, public relations, and marketing.[2]

The development of general management skills, where these have been neglected, is an essential objective of transit management in the last quarter of the Twentieth Century. The issue here is how to best introduce such management techniques to transit agencies.

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[1] Many of the ideas advanced in this paper are drawn from a talk by Philip J. Ringo, President, ATE Management and Service Co., Inc., at the APTA Mid-Year Meeting, Norfolk, Virginia, on May 18, 1977. Mr. Ringo is a member of the UC/PTI Productivity Planning Group.

[2] These skills are of general application and do not require detailed discussion here. The items which follow (in no significant sequence) are of more specialized applicability to the management of transit systems.

EMPLOYEE TRAINING

Transit systems traditionally train new vehicle operators. In a typical bus system the training period may extend over a period as long as three to five weeks. Transit systems also usually provide retraining on the basis of accident records and supervisory reports.

The need for retraining as a preventive measure is not widely recognized. There is, however, evidence that chargeable accident rates can be reduced by a retraining period for operators in the 22 to 25 year age group eighteen months after the initial training period. Appropriate time periods for retraining other age groups need to be determined.

Systematic training and retraining in other areas, such as maintenance, is desirable as a means of retaining and increasing skills levels and updating techniques. Training requirements may be expected to increase with the introduction of new transit vehicles and such features as wheelchair lifts and floor-level change mechanisms.

Training needs in these and other areas -- such as management skills -- can be determined by systematic skills inventories and the development of a training program designed to meet specific needs.

INSURANCE AND CLAIMS

The costs of insurance and claims handling vary widely among transit properties. Accurate and complete records of accidents and claims are essential in order to handle individual claims properly and to analyze the carrier's experience as a basis for action to reduce claim cost.

Recent increases in liability insurance rates and, in some instances, inability to find an insurance carrier willing to write transit liability insurance, have led many systems to institute self-insurance programs and to buy insurance only to protect against the largest claims and catastrophic incidents.[3]

In either case -- whether the transit system carries first-dollar coverage or is self-insured -- constant attention to the reduction of claims costs, through improved safety programs and improved methods of claims handling, can minimize the effects of the inflated settlements experienced in recent years.

Issues in the area of insurance and claims include:

(1) How can liability insurance rates be stabilized?

(2) What are the costs and benefits of self-insurance?

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[3] In a typical 200-bus system with a good safety record, combined insurance and safety costs rose from $275,000 in 1973 to $500,000 in 1977. This represented 4.9% of costs in 1973; 5.6% of costs in 1977.

INTERNAL SECURITY

Internal security, as the term is used in this paper, refers to protection against loss from (1) cash handling, (2) theft of tools, parts, and supplies, and (3) vandalism. The trade-off is between actual and potential exposure and the costs of protecting against loss or damage.

Despite claims to the contrary, no one has yet brought forth a fare collection and cash handling system that cannot be broken. Protection against the loss of cash requires (1) fare equipment and cash handling facilities that are as nearly foolproof as the state of the art permits, (2) periodic reviews of the procedures for collecting and handling cash, (3) periodic review of fluctuations in revenue which may indicate losses of cash, (4) follow-up of circumstances indicating that an employee may be living beyond his known means and of tips from other employees, transit riders, and others, and (5) regular use of professional checkers on both a planned and random basis.

The theft of tools, parts, and supplies can be made more difficult by the use of secure storage areas, inventory controls, separation of such functions as purchasing, receiving and issue, and formal requisition procedures. Secure storage should also be provided for employee-owned tools.

Vandalism is a continuing concern of the transit industry. Although the frequency and severity of incidents varies greatly among properties, it is likely that these variations more accurately reflect the local environment than they do efforts of the transit system to prevent or reduce vandalism.

A major problem is the difficulty of apprehending persons who commit vandalism against vehicles and the reluctance of vehicle operators to become involved in situations from which personal injury may result. One metropolitan area bus system has markedly reduced vandalism by the use of radio alarms, which have resulted in the apprehension by police patrols of more than 90% of the observed vandals on board its buses.

Many systems make regular visits to schools, and arrange visits of classes to the transit facility, in an effort to change attitudes toward the abuse of vehicles and other facilities. Little information is available on the effectiveness of these and other programs aimed at reducing vandalism. Further research is needed in this area.

Aside from these efforts to control and reduce vandalism, considerable work is being done in the development of vandal-resistant (or easily repaired or cleaned) surfaces and fixtures. An unmet need is some better way of exchanging information concerning such developments.[4]

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[4]During the early 1970's, many transit systems were experimenting with vandal-resistant substitutes for window glass, yet no private or public research organization took up this common problem on a systematic basis. Why? Because it was too mundane! The result: Each system had to learn the hard way that, for example, some glass substitutes were very good -- except that they were flammable.

CAPITAL INVESTMENT

The transit industry in the past has been financially unable -- and in many instances has also been unwilling -- to try new methods and new hardware. And, outside the industry, the tendency has been to focus research efforts on exotic long-range hardware, rather than on those things which might solve current problems and increase the efficiency of existing systems.

Little has been done, for example, to increase the fuel efficiency of transit vehicles, to develop more efficient ways of collecting fares, or to use the kinds of software that are commonly found in other industries. Many transit agencies are still reluctant to invest in two-way radio systems, in spite of the example of private industries with much less complicated dispatching and operating conditions. Again, this is an area where more research and information sharing is needed.

Despite these generalizations, significant developments have occurred in such areas as the computerized scheduling of vehicles and manpower (RUCUS) and computerized records and controls in surface vehicle maintenance (SIMS).[5]

Issues concerning investments to improve the operations of transit systems include:

(1) What technological innovations are needed to increase the efficiency of existing systems?

(2) How can transit agencies take advantage of SIMS and RUCUS?

PURCHASING AND STORES

The transition to public ownership introduced (or made possible) changes in the purchasing methods employed by transit systems.

The most discussed and controversial change has been the shift to competitive procurement practices, in part mandated by regulations relating to the expenditure of Federal grant funds and in part required of local public agencies by State law or local ordinances.[6] Whether competitive procurement results in higher or lower prices in the long run, or in better or inferior products than can be obtained without competition in procurement, is the subject of debate within the industry and elsewhere. Nevertheless, and without regard to these debates, it is likely that public policy will continue to insist upon competitive procurement whenever public funds are involved.

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[5] Estimates of savings which may be obtained through the use of RUCUS in run-cutting range from 2% to 4% of driver costs.

[6] Despite criticism of the Federal requirements of competitive procurement, many States apply even more stringent requirements to municipalities and local authorities.

Within the framework of competitive procurement, savings and product improvement can be achieved through the use of procurement techniques which have been developed and used by private industry and government since World War II.

In routire purchases, particularly of smaller recurring items, the purchasing agent can survey the market to learn where and what the best bargains are at a particular time. The frugal homemaker does this every week. One company, which habitually bought paper towels under annual contracts, found by reading newspaper advertisements that the same quality towel could be bought more cheaply at the corner supermarket.

Considerable savings -- lower prices and shared administrative costs -- may be possible through the use of State or local annual supply contracts or by combining requirements with those of the city or another public agency. Consideration can be given to combined purchasing arrangements with other transit systems within the region.

Stores. Although economic reorder points can be determined and used as a guide in establishing inventory levels, current uncertainties in lead times and the degradation of service reliability which results from an excessive number of vehicles deadlined for lack of parts, make a fat inventory more acceptable than in other situations. In many cases the penalty is small: lost interest.

A major expense in stock room management arises out of the need to stock parts for more than one make of vehicle as a result of competitive procurement policies. Short of the development of a standard bus, there appears to be no solution to this problem that does not negate competitive procurement policies.

Key questions regarding purchasing and stores are:

(1) What are the advantages and disadvantages of competitive procurement?

(2) How can the problems with competitive procurement be ameliorated?

(3) How significant are the savings resulting from inventory reduction?

FACILITY LOCATION AND DESIGN

Facility location and design is an area in which major long-term savings can be realized through adequate planning and recognition of transit operating and maintenance requirements.

When existing facilities are inadequate or obsolete, the decision depends largely upon the relative advantages between renovation and new construction. At this time, in systems with more than one operating station, the trade-off between the location and number of facilities should be examined.

Storage, service, and maintenance facilities should be located so as to minimize deadhead mileage and time. The least costly site may in the long run prove a very costly alternative to one better located in terms of the requirements of the transit system. Whenever new facilities are to be built, a location study should be made to determine the best alternative locations in relation to current and prospective service configurations, permissible land uses, site development problems and costs, environmental impacts, and land costs.

The facility should be designed with the assistance of persons familiar with transit requirements and local operating conditions, so as to eliminate excessive hostlering, time-consuming and accident-causing backup movements, and other undesirable design features. Because the design of transit facilities is an infrequent occurrence, local architects should not be expected to design this kind of facility without such assistance.[7]

MAINTENANCE

Equipment maintenance is the second largest item in the transit system expense budget. This is an area in which efficiency measures can be developed and in which comparisons -- with other transit properties and with comparable operations in other industries -- can readily be made.

Some maintenance standards may be included in a formal statement of service policies and standards (see the paper on "Services Characteristics"). These include:

- Average and maximum vehicle age and mileage, based on an analysis of the relative benefits and costs of (1) keep and repair, (2) rebuild, and (3) replace. From this is derived the short-term vehicle replacement schedule. This, in turn, supports the short-term capital budget.
- Mechanical and operational inspection intervals and coverage.
- Service standards, including first echelon maintenance, cleaning, and washing.
- Preventative maintenance standards, based on the need for reliability of service and the trade-off between preventative maintenance and breakdown maintenance.

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[7]The Urban Mass Transportation Administration has available a guide to transit facility layout that will also be of assistance in this area.

- Minimum standards of acceptable performance in areas directly related to service reliability and passenger convenience and comfort, such as the frequency of road calls and the serviceablity of special equipment (e.g., air-conditioning, wheelchair lifts).

Other policies and standards which affect maintenance costs but are not reflected in the formal statement of policies and standards are developed and documented through experience and reference to manufacturer's manuals and other sources. Some of these aids, such as manuals describing maintenance procedures, should be made available on an industry-wide basis.

More or less elaborate systems are available for recording mainentance histories, evaluating the performance of mechanics, scheduling inspections and routine maintenance, assuring that deficiencies noted by vehicle operators or inspectors are corrected in a timely manner, and otherwise controlling and reporting on maintenance operations. The type of system needed, and the amount which can effectively be expended on its installation and operation, depends principally on the size of the vehicle fleet.

Issues with respect to maintenance are:

(1) Should national standards be established for transit maintenance?

(2) What are the costs and benefits of a computerized maintenance records system?

ISSUE PAPER: TRANSIT PERFORMANCE INDICATORS*

APTA Productivity and Efficiency Task Force

INTRODUCTION

The resources available to operate public transit systems and services are constrained by the limited funds available for all public services. Maintaining adequate mobility in the face of these budgetary constraints requires that transit facilities and equipment be used so as to generate the most transportation service from the reosurces devoted to this purpose.

Maximizing transportation performance requires a comprehensive, integral approach to all modes, since no mode operates in isolation from the others. One element of that comprehensive approach is the improvement of public transit performance.

To accomplish the improvement of transit performance, transit managers must collectively take a leadership role in developing, implementing, and evaluating transit performance indicators which the public and sponsoring funding agencies can accept and understand. Such active participation by transit agencies will help to assure that indicators are appropriately defined and applied.

The purpose of this paper is to accomplish the following:

- To provide guidance for defining the concepts of "efficiency", "productivity", and "effectiveness".
- To suggest a system of indicators which will provide a balanced and appropriate basis for measuring system performance. No attempt will be made to recommend quantitive measurement ranges for these indicators since such measures are totally dependent on local operating policies and conditions.

THERE IS A UNIVERSAL NEED FOR INDICATORS OF TRANSIT PERFORMANCE

The continuing demand for demonstrating that public financial support for transit at the Federal, state and local levels is paying off dictates that transit managers develop a set of rational indicators of performance. In accomplishing this objective, the following considerations should be

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* This paper has been adopted as an official APTA policy statement (see Appendix to this paper).

taken into account:

- Performance indicators are useless unless the system's goals and objectives are explicitly stated. Goals and objectives for a system should be closely related to community goals and national transportation goals when available. Furthermore, in evaluating the performance of any one system over time, that performance must be weighed against changing policies and objectives.

- Performance indicators are most readily applicable for use in the examination of the historic trend of a transit operation's performance, whether the operation be an entire system, a division, a class of transit service within a system, or a single route.

- Performance indicators can also be used to compare different transit operations within a system at the same point in time. Comparisons among systems of their individual performance indicators should be avoided since too much depends on independent variables at the local level over which transit operators and funding agencies have no control. If systems are carefully selected, gross comparisons of performance indicators can be a useful diagnostic tool for an individual transit manager to determine how his system compares to other systems/areas with similar characteristics.

- "Macro-performance measurements" such as impact on air quality, congestion, community development, mobility of the handicapped and elderly, energy conservation, quality of life, downtown viability, travel-time, mode split, avoided highway and other infra-structure construction, and similar transit impacts are important indicators of the effectiveness of a transit system, but are beyond the scope of this paper. The primary focus of this paper is to emphasize the need for short-term strategies to upgrade the measurement of transit system performance. Considerable additional work needs to be undertaken in developing meaningful macro-measures of transit performance before they can become a useful component of this effort.

- No single indicator truly reflects the performance of a system or its management.

- There is a need for simplicity in the indicators developed in order for them to be easily understood.

THE CONCEPT OF "EFFICIENCY" AND "EFFECTIVENESS"

This paper is concerned only with the definition of efficiency and effectiveness as they relate to transit performance. The broader term productivity is often used as a basic element of performance, but because of definitional problems, it is strongly recommended that it not be used in the future.

Effectiveness: The degree to which outputs are consumed or utilized, and/or relative measures of the quality of outputs provided.

Efficiency: Amount of input(s) required to produce various units of outputs; a ratio of the quantity of outputs to the quantity of resource inputs.

WHAT IS THE BASIC INDICATOR OF TRANSIT SYSTEM EFFECTIVENESS?

The key indicator of transit system effectiveness is ridership expressed either in number of passengers or in passenger-miles but not by farebox revenues. The amount of farebox revenue collected is inappropriate as an indicator of transit system effectiveness, particularly for comparison purposes, because of the wide variations in fare structures among systems, resulting primarily from local policy decisions. While ridership is an easy concept to understand, it is not always reported on the same basis, making valid comparisons of two systems or of one system to a national trend or average difficult.

Reasonable indicators of effectiveness include:

- total ridership,
- ridership by category of rider,
- ridership per route mile of service,
- ridership per vehicle mile,
- ridership per vehicle hour,
- ridership per capita,
- ridership per employee,
- ridership per dollar of expense.

Other useful indicators can be used to measure the quality of a system's operation such as on-time performance, average waiting time, service coverage, span of service, condition of equipment, reliability, safety, comfort, and convenience. These are all means to the end of improving a system's effectiveness, but in most cases, can be difficult to express in quantitative terms.

WHAT ARE THE INDICATORS OF EFFICIENCY?

The basic indicators of efficiency relate units of cost or work by a system's employees or vehicles to units of service or other types of output. Examples of these kinds of indicators include the following:

- Labor utilization indicators such as ratio of platform time to pay time, mechanics per vehicle, miles and/or hours per operator, miles and/or hours per mechanic.

- Vehicle utilization indicators such as annual miles of service per vehicle or annual hours of service per vehicle.

- Cost indicators such as costs per hour, per mile, per employee, per rider, per passenger-mile, per vehicle, as well as the percentage of total costs which each function represents.

FUTURE DIRECTIONS

It is important to reemphasize that no one indicator of efficiency or effectiveness will reveal the relative or absolute performance of a system's management. Furthermore, the set of indicators illustrated above is not in any way meant to be exhaustive, but is intended as an example of kinds of indicators for which data can be reasonably obtained, which can be understood, and which can--when carefully and consistently applied--be a means of tracking the performance of any individual system over time. However, until transit managers appreciate the importance of instituting transit performance assessment systems as part of their management programs, there is little likelihood that a meaningful and realistic set of transit system performance indicators can be developed and implemented. Therefore, it is extremely important that APTA take a leadership role to (1) make all transit managers aware of the importance of instituting individual system performance assessment programs, (2) develop a consensus, among transit managers and funding agencies, as to the most "appropriate" indicators of effectiveness and efficiency, (3) undertake the necessary informational/education efforts to insure that the resultant performance assessment systems are implemented, and (4) evaluate the impact of this process on improving transit system performance.

APPENDIX

POLICY STATEMENT
TRANSIT PERFORMANCE INDICATORS

Adopted by the Board of Directors
American Public Transit Association
October 13, 1977

The Board of Directors of the American Public Transit Association has considered the growing involvement of local, State and Federal government in providing the financial support necessary to improve public transportation services in our nation's urban areas.

Transit operators are required to increase their accountability to public agencies and to the public at large. Increased attention has been given to measures of efficiency and effectiveness as useful tools for internal management and to enhance communication with the public.

APTA has reviewed the attached paper on Transit Performance Indicators produced by a task force of the Planning Committee.

The Board of Directors endorses the concepts of the paper and urges all APTA members to individually develop and implement a system of performance indicators.

APTA members should use performance indicators to measure progress toward internal goals and objectives, to assist in the evaluation of each transit system from year to year, to evaluate individual improvements and services as they are implemented, and to communicate with government agencies.

APPLYING PERFORMANCE INDICATORS IN TRANSIT MANAGEMENT

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Any uniform set of transit performance indicators must be constructed with due regard to both their intended use, and to the limitations of available data. This paper presents and applies nine possible performance indicators which might be used for annual, comparative evaluation of transit system performance. The nine indicators comprising this set rely, with one exception, on generally available operating and financial data; they are able to reflect changes in system management and policy and they minimize the effects of differing operating environments. While minimized in their effect, environmental factors must be included in the case studies used to illustrate the application of the performance indicators.

Although transit operators are apprehensive about the use of performance indicators, they should appreciate the benefits. Performance indicators provide an opportunity to elevate the general understanding of transit's capabilities and costs by emphasizing the productive use of capital and labor, rather than focusing performance only on ridership and operating costs.

Indicators can assist public policy evaluations by allowing study of the effect of programs over time or between different properties, and by indicating the return on public investment in transit. They also facilitate the establishment of clearly defined and measurable goals and objectives for public transit.

For management, performance indicators may serve to organize the volumes of data upon which decisions must be based and to signal areas

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which require special attention. In addition, indicators will assist in establishing performance goals for individual departments and routes within the property and the monitoring of such goals.

INDIVIDUAL INDICATORS

The selected performance indicators, their construction, and their focuses are summarized in Figure 1. Each of these indicators has been chosen to reveal different attributes of transit efficiency and effectiveness.

Revenue Vehicle Hours Per Employee: As an efficiency measure of labor productivity, this indicator will be affected by the size of the administrative staff of a property, its peak/off peak ratio, and hours of service. The use of a simple employee total in this measure introduces some error as workday and workweek lengths may differ significantly between properties and yet appear the same in this measure. Total employee hours would be a better denominator, but it is not generally available.

Revenue Vehicle Hours Per Vehicle: As an efficiency measure of vehicle utilization, this indicator is affected by the service hours of the property, the peak/off peak ratio, and the daily service vehicle/total fleet

Indicator	Construction	Focus
Efficiency:		
Revenue Vehicle Hours Per Employee	Total Revenue Vehicle Hours / Total System Employees	Labor Productivity
Revenue Vehicle Hours Per Vehicle	Total Revenue Vehicle Hours / Total Revenue Vehicles	Vehicle Utilization
Operating Expense Per Revenue Vehicle Hour	Total Operating Expense / Total Revenue Vehicle Hours	Cost Per Produced Output Unit
Effectiveness:		
Revenue Passengers Per Service Area Population	Total Revenue Passengers / Total Service Area Population	Utilization of Service
Total Passengers Per Vehicle	Total Passengers / Total Revenue Vehicles	Utilization of Service
Revenue Passengers Per Revenue Vehicle Hour	Total Revenue Passengers / Total Revenue Vehicle Hours	Utilization of Service
Operating Expense Per Total Passenger	Total Operating Expense / Total Passengers	Cost Per Consumed Output Unit
Operating Expense Per Revenue Passenger	Total Operating Expense / Total Revenue Passengers	Cost Per Consumed Output Unit
Percent Population Served	Total Service Area Population / Total Coverage Area Population	Accessibility of Service

Figure 1. Selected Performance Indicators for Transit.

ratio. Both of the above indicators have the advantage of using only physical measures of production inputs, rather than dollar measures, and, hence, are both relatively independent of the differences in wage rates between cities. Also, since they both use Vehicle Hours as their measure of output, they are relatively independent of differences in speed, congestion, and trip length between cities.

Operating Expense Per Revenue Vehicle Hour: As an efficiency measure of total inputs per unit of provided service, this indicator is affected by a property's peak/off peak ratio, hours of daily service, and labor unionization. Properties which share particular support facilities and services with other organizations, such as a municipal operator whose maintenance and accounting is done by the larger municipal organization, may achieve somewhat inflated efficiencies on this indicator if costs of such services are not fully billed to the transit operation.

Revenue Passengers Per Service Area Population: As an effectiveness measure of the penetration of transit into its potential market, this indicator is significantly affected by the definition of the property's service area, hence its size is subject to political considerations rather than management decisions. The "Revenue Passengers" statistic is synonymous with "passenger trips" or "linked trips."

Total Passengers Per Vehicle: As an effectiveness measure of system patronage and capacity utilization indexed to an average transit vehicle, this indictor is affected by average trip length, rate of transfers in the system, peak/off peak and daily service vehicle/total fleet ratios.

Revenue Passengers Per Revenue Vehicle Hour: As an effectiveness measure of system patronage per unit of produced service, this indicator is affected by the peak/off peak ratio, hours of service, vehicle capacity and average trip length of a property. The use of "revenue passengers" rather than "total passengers" corresponds to the evaluation of overall system performance on passengers served, not the segmented trips they may be required to make by virtue of system's route structure.

Operating Expense Per Total Passenger: This is an effectiveness indicator of total inputs per unlinked trip. This indicator and the one which follows, Operating Expense Per Revenue Passenger, are overall performance measures for a transit system, combining efficiency (total operating costs) with the system's effectiveness (passengers). As such, they serve the function of bringing together the two aspects of performance evaluation into an integrated ratio. One significant problem with this measure is that it ignores operating revenues. A system that charged extremely low fares, thereby attracting more passengers, would look very good on this measure even though its operating ratio was very poor.

Operating Expense Per Revenue Passenger: This is an effectiveness indicator of total inputs per individual passenger or linked trip within a system.

Percent Population Served: As an effectiveness measure of accessibility of provided transit service to an area's residential population, this indicator may be affected by the definition of the property's service area. This indicator has the weaknesses of not considering frequency of service and of relying upon data elements which are not available from all transit properties at this time. A measure of walking accessibility to transit services will be required under the UMTA Section 15 requirements.

APPLYING THE INDICATORS

Operating and financial data were collected from 46 public transit properties throughout California for fiscal year 1975-1976. In order to receive tax monies from California Transportation Development Act, these properties must submit annual reports to the state, including certain operating and financial data. These annual submissions were verified with, and additional data collected from, representatives of each transit property.

Although usable data were obtained through this collection effort, we discovered that operating and financial information available from public transit operators is generally inadequate and unreliable. Much less data were available than anticipated, and a significant amount of that which is available is actually dissimilar due to differences in definitions and generation procedures.

The performance indicators described above were computed for each of the 46 transit properties. Analysis of these achieved values has investigated the comparability of indicator values between properties operating different service modes (fixed-route versus demand-responsive), between types of organization (transit districts versus municipal operators), and between operators in service areas with different population densities. These analyses found that different types of organizations and properties with different population densities are generally comparable using these performance indicators. However, demand-responsive and fixed-route operators were not found to be comparable due to the character of services provided. Mean indicator values for demand-responsive and fixed-route properties are shown in Figure 2.

	Efficiency			Effectiveness					
	Rev Veh Hrs/ Employee	Rev Veh Hrs/ Vehicle	Oper Exp/ Rev Veh Hr	Rev Pass/ Svc Area Pop	Tot Pass/ Vehicle	Rev Pass/ Rev Veh Hr	Oper Exp/ Tot Pass	Oper Exp/ Rev Pass	Percent Pop Served
Total Sample (46 cases)	1,282.5	2,236.7	$ 16.28	15.1	50,259.6	18.7	$ 1.28	$ 1.42	.82
Fixed Route (38 cases)	1,177.4	2,263.3	$ 17.69	17.9	58,513.3	22.0	$ .87	$ .98	.79
Demand-Responsive (8 cases)	1,729.3	2,123.4	$ 10.28	1.6	11,054.0	5.0	$ 3.27	$ 3.47	1.00

Figure 2. Comparison Between Fixed-Route and Demand-Responsive Properties

INTERPRETING THE INDICATORS: THREE CASES

To illustrate the possible use of these indicators and to give a better feel for their relative uses, a sample analysis of three different transit properties is provided. Although public information was used in the calculation of these indicators, we have chosen not to disclose the identity of the properties.

Case 1:

Efficiency			Effectiveness					
Rev Veh Hrs/ Employee	Rev Veh Hrs/ Vehicle	Oper Exp/ Rev Veh Hr	Rev Pass/ Svc Area Pop	Tot Pass/ Vehicle	Rev Pass/ Rev Veh Hr	Oper Exp/ Tot Pass	Oper Exp/ Rev Pass	Percent Pop Served
1,082.8	2,498.8	$ 23.20	8.3	60,678.8	20.8	$ .96	$ 1.11	.75

Figure 3. Performance Indicators for a New Transit Property.

This property is a new transit district created through the acquisition of two municipal systems and serving a low density suburban area. It operates fixed route services for several cities and adjoining county territory.

When compared to the mean indicator scores for fixed route properties (Figure 2), this district rates unfavorably in 2 of 3 efficiency measures and 4 of 6 effectiveness indicators. These unfavorable indices for cost-related measures and Revenue Vehicle Hours Per Employee are to be expected. As a newly-created district, it can be expected to have higher costs and more employees than established systems because of the start-up costs and special demands (marketing, planning) connected with implementing service.

The two indicators based on service area population, Revenue Passengers Per Service Area Population and Percent Population Served, are also unfavorable--the first, appreciably, the second only slightly. These both are affected by the large size of the property's service area and the difficulty of developing ridership when population density is under 500 persons per square mile. Because of the extreme dispersion of population in this area, it is possible that patronage cannot be developed to the level achieved in other areas. The value of comparison with established properties is that such comparison provides objectives for such developing properties and guidance for estimating future ridership and equipment needs.

Case 2:

Efficiency			Effectiveness					
Rev Veh Hrs/ Employee	Rev Veh Hrs/ Vehicle	Oper Exp/ Rev Veh Hr	Rev Pass/ Svc Area Pop	Tot Pass/ Vehicle	Rev Pass/ Rev Veh Hr	Oper Exp/ Tot Pass	Oper Exp/ Rev Pass	Percent Pop Served
632.7	1,476.3	$ 17.49	3.2	17,350.5	10.8	$ 1.49	$ 1.62	1.00

Figure 4. Performance Indicators for a Demand-Responsive Property

Case 2 is a municipal demand-responsive operator. When compared to other demand-responsive systems (Figure 2), this property receives unfavorable efficiency scores, but very favorable effectiveness scores. The unfavorable score on employee productivity, Revenue Vehicle Hours Per Employee, is due in part to a data error. The statistic was computed on a reported figure of 11 full-time drivers, which should actually be 3 full-time and 8 part-time. When employee productivity is recomputed counting 7 drivers (part-time drivers counted as ½ a full-time driver) the indicator value is raised to 1265.4--still below average but much improved. This again reinforces the necessity of clearly defined data items if accurate data are to be obtained.

The unfavorable efficiency indicators, as a whole, reflect the limited service hours provided by this property. These indicator scores could be improved through lengthening of service hours, possibly with commensurate increases in patronage. However, this decision must take into consideration local travel desires, and the willingness of local agencies to contribute the additional matching subsidy.

Case 3:

Efficiency			Effectiveness					
Rev Veh Hrs/ Employee	Rev Veh Hrs/ Vehicle	Oper Exp/ Rev Veh Hr	Rev Pass/ Svc Area Pop	Tot Pass/ Vehicle	Rev Pass/ Rev Veh Hr	Oper Exp/ Tot Pass	Oper Exp/ Rev Pass	Percent Pop Served
1,177.6	2,338.8	$ 19.41	35.2	91,410.1	36.2	$ .50	$ .54	.97

Figure 5. Performance Indicators for a Fixed-Route Property.

This property is a municipally-owned fixed-route operator providing service over long-established routes in a high-density service area (6929 residents per square mile). When compared to other fixed route properties, it scores favorably on two of three efficiency indicators and very favorably in all effectiveness indicators.

The one unfavorable efficiency score, Operating Expense Per Revenue Vehicle Hour, is approximately 10% above the mean cost for fixed-route properties ($17.69).

The property's highly favorable effectiveness scores reflect its well-established routes, service area density, and the probable presence of a large segment of the population who are reliant upon transit.

The combination of a high rating on Revenue Passengers Per Revenue Vehicle Hour, only slightly-above-average scores on Revenue Vehicle Hours Per Employee and Revenue Vehicle Hours Per Vehicle, and the below average score on Operating Expense Per Revenue Vehicle Hour suggests that few unproductive hours of service are provided. Longer service hours could bring all scores above the mean, yet there is no indication that any real benefit would be achieved through such action.

The preceding cases have demonstrated the utility of performance indicators for the evaluation of transit performance as well as their shortcomings. It shows, further, that at the present state-of-the-art interpreting performance indicators is not a simple task.

The effects of misreported and inaccurate data become evident when focusing on individual properties. The accurate reporting of uniform data must be achieved before systems for comparative performance evaluation can be implemented. The reports required by Section 15 of the UMTA Act will provide the basis for an accurate, uniform data set.

These case studies present one side of another issue: the direct comparison of properties. In these evaluations, properties were compared against mean values of similar properties, not against specific properties. These mean values constitute a form of "par" against which comparisons may be made by either outside agencies or by the managers of a property. An alternative form of comparison would be to match similar properties and then compare achieved values on the performance indicators. Both these techniques are of value, yet our understanding of factors affecting performance indicators may be insufficient to safely permit direct comparison of properties on other than an informal basis at this time.

FARE CHANGES--SELECTED LOCAL EXPERIENCES

The following case studies were condensed from the 1976 publication Transit Marketing Management Handbook: Pricing, available from the Office of Transit Management, Urban Mass Transportation Administration, U.S. Department of Transportation. The case studies illustrate the following pricing techniques and their effects:

- General fare increase
- General fare reduction
- Prepayment plans
- Off-peak discounts
- Free fares
- Promotional fares

In the cases presented, goals included revenue increases, ridership increases, reduction of auto usage, retail trade stimulation, and better public relations.

GENERAL FARE INCREASE

MTA/New York City

In 1975 the base fares on New York City buses and subways were raised from 35¢ to 50¢. Simultaneously, tolls on most interborough bridges and tunnels were raised.

GOAL:

To increase revenues.

RESULTS:

- Ridership during 4 month period decreased about 7 percent over previous year. This reflected a 4 percent decrease in subway ridership, and a 10 percent decrease in bus ridership.

- Revenues during 4 month period increased about 29 percent over pervious year. This reflected a 35 percent increase in subway revenues and a 20 percent increase in bus revenues.

COMMENTS:

- Before the fare change, transit ridership was down over previous year by about 4 percent. Thus no more than 3 percent of ridership decrease can be attributed to the fare change. This was less than expected.

- Bus ridership loss was much closer to expectations than subway ridership loss. This apparently results from the increased tolls and the fact that buses are primarily used for intra-borough trips (requiring no bridge or tunnel crossing, if trip were made by auto). Subways on the other hand are used for most of the interborough trips.

- Bridge and tunnel revenues increased while vehicles using these facilities decreased following the change. Indications are, however, that use of these facilities is again approaching previous levels.

GENERAL FARE REDUCTION

SDTC/San Diego, California

In 1972 San Diego reduced its base fare from 40¢ to 25¢, while increasing vehicle miles operated about 20%.

GOAL:

To increase ridership.

RESULTS:

- Ridership has more than doubled (up 115%) and is still increasing. In particular, comparing March 1975 with March 1974 (a month during the fuel shortage) ridership increased another 15%.

- Revenues have increased (estimated at about 30%). Costs have also increased significantly however, leading SDTC to subsequently increase fares again.

COMMENTS:

Fare reductions do not always result in such dramatic ridership gains. In Atlanta, where in 1972 MARTA reduced base fares from 40¢ to 15¢, ridership increased by about 30% in three years. One factor that might help account for the smaller increase is that MARTA carries a far higher percentage of person trips in the Atlanta area than SDTC does in San Diego. Apparently San Diego had a large number of potential transit riders who had not been using the service.

PREPAYMENT PLANS

MBA/Boston, Massachusetts

In 1974 Boston implemented a program of selling transit passes in cooperation with major employers, using the payroll deduction mechanism to pay for the passes. Passes cost $8.75 to $17.50 per month or $105.00 to $210.00 per year, varying with the type of service covered.

GOALS:

- To reduce auto usage for work trips.
- To increase commitment of riders to transit.
- To increase ridership by 30 percent over a five year period.

RESULTS:

- Annual passes are being sold to approximately 20,000 employees in 117 companies. Over 100 additional companies have expressed interest in joining the program.

- Annual passes account for 6 percent of transit revenues and 8 percent of transit riders.

- No significant change in ridership or revenues has been noted.

COMMENTS:

- Efforts are underway to provide a monthly pass in addition to the annual pass. No more employers are being added to the program until this change is implemented.

- Although ridership and revenue have not yet shown significant increases as a result of the passes, the program is felt to be very effective in that, at minimal cost to the transit system, it appears to be creating the desired commitment to transit.

- Some of the administrative burden of this pass program fell on the employers. Their willingness to accept this reflects their commitment to transit in the Boston area. In addition, the employers are experiencing some direct benefits:

  - Employers can use the passes as a fringe benefit, giving or discounting the passes to employees. Many employees view the passes as a fringe benefit even if they pay full price.

  - Employers with limited parking facilities sometimes use potential employees' intent to buy the passes as one consideration in hiring.

  - The passes apparently produce some reduction in job absenteeism. The employees are apparently reluctant to waste the prepaid pass.

  - Employers are beginning to evaluate the cost of providing parking to their employees in comparison to their costs in administering the pass program.

OFF-PEAK DISCOUNTS

MERCER METRO/Trenton, New Jersey

In 1971 the 30¢ base fare was reduced to 15¢ between 10 a.m. and 2 p.m. and after 6 p.m. on weekdays and Saturdays, and all day Sundays. In addition, a shopper's coupon was established, whereby merchants provide riders discounts on return transit trips in proportion to their purchases. Merchants cover all costs.

GOAL:

To increase off-peak transit use.

RESULT:

Off-peak ridership increased 50%.

FREE FARES

METRO TRANSIT/Seattle, Washington

In 1973 Seattle inaugurated a free transit zone in the Central Business District (CBD), effective all hours, seven days a week. Ten buses were added to handle increased CBD ridership.

GOALS:

- To reduce auto usage in CBD.
- To stimulate retail trade in CBD.
- To increase transit usage.

RESULTS:

- CBD traffic volume reduced about 2%.
- Ridership in the free zone tripled.
- 40% of riders indicated they had switched from other transportation modes; 25% indicated they had not made the trip before the free service.
- Retail sales in the CBD have increased about $5 million a year, with a majority of the increase concentrated around the noon hour.

COMMENTS:

- Although CBD ridership increased dramatically, auto usage was only slightly reduced. This policy did produce a major increase in retail business activity in the CBD.
- There appears to have been some increase in ridership in outlying zones (generally toward the CBD) due to the establishment of the free zone.
- The free zone appears to have significantly increased mobility of people once they are in the zone, especially for workers during the midday break.

PROMOTIONAL FARES

MTA/New York City

During 1972 and 1973 MTA initiated a half-price Sunday fare, a 75¢ "Night-on-the-Town" ticket permitting unlimited ridership during the period from 6 p.m. to 2 a.m. Monday through Saturday, and a 75¢ Mid-Town Shoppers' Special ticket for unlimited use during specific off-peak periods in the Mid-Town shopping grid.

GOALS:

- To encourage people not to use cars on Sunday during fuel shortage.
- To help reacquaint population with the transit system.
- To increase off-peak ridership.

RESULTS:

- Sunday ridership increased by 30% during the first year.
- During that same period, Sunday revenues declined 12%; however some lines (especially the commuter railroad) increased their Sunday revenues.

COMMENTS:

The effects of the "Night-on-the-Town" and "Mid-town Shoppers' Special" programs have not been determined.

TRANSIT GOALS AND POSSIBLE IMPACTS OF

REVENUE POLICY OPTIONS

GOAL A. INCREASE RIDERSHIP GENERALLY[1/]

Option 1. No fare

Impacts:

- Ridership — Substantial increase probable.
- Revenues — Decrease to zero.
- Costs — Will probably increase operating and capital costs[2/]. Will eliminate fare collection costs.
- Other — Benefits economically disadvantaged. May promote needless trips and result in control problems. May be politically unpalatable; viewed by some as socialistic.

Option 2. Reduced fares. (Includes general fare reduction and reduction in, or elimination of, zone and transfer charges).

Impacts:

- Ridership — Will increase to some extent.
- Revenues — Decrease.
- Costs — May increase operating and capital costs[2/].
- Other — Benefits economically disadvantaged.

GOAL B. INCREASE RIDERSHIP SELECTIVELY

Option 1. Reduced fares during peak periods.

Impacts:

- Ridership — Will increase to some extent during peak periods. Some of the increases may be riders diverted from off-peak periods.

1/ This outline deals solely with fare policy options. There may be other, more effective, ways of accomplishing these goals.

2/ Whether changes in ridership will affect operating and capital costs depends largely upon load factors, which will vary by system, route, and time of the day, week, and year.

- Revenues — Will be reduced substantially.
- Costs — May result in very high costs for equipment and manpower which can be used only during peak periods.
- Other — Most likely option to have a favorable impact on congestion and air quality. Economic benefits flow generally to those who least need them.

Option 2. Reduced or no fares during off-peak periods.

Impacts:

- Ridership — Will increase to some extent during off-peak periods. A substantial proportion of the increase is likely to be riders diverted from peak periods.
- Revenues — Will be less, unless substantial numbers of new riders can be attracted.
- Costs — Savings can be realized if enough riders are diverted from peak periods to permit reductions in peak period service levels.
- Other — Economic benefits flow generally to those who are not regularly employed.

Option 3. Reduced fares for specific categories of persons. (This option includes free fares, as well as reduced fares. The categories most commonly granted reduced fares are elderly and handicapped persons, school children, and uniformed municipal employees).3/

Impacts:

- Ridership — Will increase ridership among the persons entitled to reduced fare or to ride free.
- Revenues — Will decrease revenues.
- Costs — Will not substantially increase costs if restricted to off-peak trips.

3/ Reduced fares (not to exceed one-half of regular fares) for elderly and handicapped persons during off-peak hours are required of systems receiving Federal operating assistance.

• Other	May result in a transfer of costs from welfare to transit budgets. Economic benefits flow generally to those who most need them. Presence of uniformed police and fire department employees may defer vandalism and disorderly conduct on transit vehicles.

Option 4. Reduced fares for specific categories of trips. (This option includes free fares, as well as reduced fares. The most common trips for which reduced fares are provided are those to or within a retail business district, but there are many other applications).

Impacts:

• Ridership	Will increase in relation to the area covered by the reduced fare plan.
• Revenues	Will decrease, unless revenue losses are off-set by purchase-of-service payments.
• Costs	Will not substantially increase costs if restricted to off-peak trips on regular routes. Involves high costs if new services -- e.g., a downtown circulation route -- and equipment are required.
• Other	May help in implementing plans for the development of central business and other retail areas.

GOAL C. INCREASE TRANSIT REVENUES[4/]

Option 1. Increased fares during peak periods.

Impacts:

• Ridership	Will decrease somewhat.[5/]

4/ Again, we point out that we are dealing with fare options--not with the general subject of how to increase transit revenues.

5/ The impacts of increased fares are, of course, affected by the amount of the increase. We are assuming a reasonable increase, which will divert some riders from the peak to the off-peak period, but which will not divert any substantial numbers of journey-to-work riders to alternative means of transportation.

- Revenues — Will increase.
- Costs — May decrease, if general decrease in ridership permits service reduction.
- Other — Increased revenue is gained at the expense of higher costs for regular transit users.

Option 2. Increased fares. (Includes a general fare increase and increase in, or the imposition of, zone and transfer charges).

Impacts:

- Ridership — Will decrease, particularly among those who can forego trips which would otherwise be made.
- Revenues — Will increase.
- Costs — May decrease, if general decrease in ridership permits service reductions.
- Other — Increased revenue is gained at the expense of (1) lessened mobility and (2) higher costs for many who can least afford them.

Option 3. Distance-based fares. (A distance-based fare is determined on the basis of the distance travelled by the individual rider, either through the use of a mileage rate or zone charges. The alternative is a flat fare, in which the same fare is charged for each trip without regard to distance).

Impacts:

- Ridership — No effect.
- Revenues — Will increase.
- Costs — No effect, except for some additional fare collection costs, depending on the system used.
- Other — Generally perceived as equitable, as cost is related to service provided.
  Political problems may arise in (1) setting zone boundaries and (2) in cities accustomed to a flat fare system.
  Increased revenue is derived, generally, from those best able to pay among the transit riding group.

Option 4. Transfer charges. (These are extra charges for transferring from one route to another).

Impacts:

• Ridership	Will decrease, as for a general fare increase for that portion of riders who are affected regularly.
• Revenues	Will increase.
• Costs	Will increase fare collection costs.
• Other	Transfer charges have a negative connotation: the rider pays now for the inconvenience of having to change vehicles one or more times.6/ Transfers, unless closely controlled, are subject to abuse and facilitate fare avoidance.

Option 5. Premium fares. (Includes extra fares and charges for express service or for special services and equipment).

Impacts:

• Ridership	Will increase to the extent that the service attracts new riders.
• Revenues	Will increase.
• Costs	Impact depends upon the situation. -New service may require more equipment and manpower. -Improved service may permit more effective use of equipment and manpower.
• Other	Premium service directed toward suburban communities or persons at relatively high economic levels may not be politically palatable, even when excess costs are met through premium fares. Most likely options to secure additional revenues through the attraction of new choice riders.

6/ The adverse effect may be minimized by treating the transfer as a pass, good in any direction over any route, for a specified period. Transfer time limits may also be set so as to permit a stopover.

SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT CASE STUDY

Faced with the need to cut expenses because of reduced local operating assistance funds, the Southern California Rapid Transit District used effectively a service evaluation plan, which had been developed originally in anticipation of the need to distribute service increases, to eliminate 2 million miles of service and 134 buses from its peak requirement during the first 9 months of a continuing economy effort.

BACKGROUND

The Southern California Rapid Transit District (SCRTD) was created by the California legislature in 1964 to provide transit service in that portion of Los Angeles County lying south of the San Gabriel Mountains. In March 1977, SCRTD provided service for nearly 800,000 daily riders over 185 regular routes covering approximately 3,400 route miles. It used 1,954 regular transit buses during the P.M. peak period. More than 103 million miles of service was operated in the fiscal year ending June 30, 1976.

In 1971, the legislature extended the State sales tax to gasoline sales and a portion of the proceeds from this tax was made available to local transit agencies. In 1974, Federal operating assistance became available for the first time. Both of these sources of funds provide substantial, and relatively stable, support for SCRTD operations.

ESTIMATED FEDERAL AND STATE OPERATING FUNDS AVAILABLE TO SCRTD IN FISCAL YEAR 1977

	Amount (millions)
Federal (Section 5)	$44.1
State (sales tax)	55.5

Source: SCRTD Short Range Transit Plan, 1976.

SCRTD also has operating assistance agreements with a number of local jurisdictions within its service area. The most significant of these is the County of Los Angeles, which in 1976 provided 9% of SCRTD's operating budget. The County of Los Angeles's appropriation to SCRTD has, however, been significantly curtailed over the past two years.

COUNTY OF LOS ANGELES OPERATING PAYMENT

Fiscal Year	Amount (millions)
1975	$27.4
1976	15.4
1977	6.8

Source: SCRTD Short Range Transit Plan, 1976

The latter development gave rise to SCRTD's current service evaluation program.

SERVICE EVALUATION PROGRAM

Between 1973 and 1976, the operating assistance funds available to SCRTD from Federal, State, and local sources permitted a rapid expansion of service levels. By June 30, 1976, the number of buses being operated had increased by more than 50% and the number of miles of service by more than 60%.

Year	Buses	Amount (millions)
CY 1973	1,756	63.8
CY 1974	2,060	60.3
CY 1975	2,356	91.1
FY 1976	2,356	103.5

In July 1975, the SCRTD Board of Directors adopted a Service Evaluation Program, [1] and in May 1976, the board adopted level-of-service policy guidelines.[2] These documents were intended primarily to guide the distribution of anticipated service increases. They now are being used to guide the reductions in service made necessary by the reduced County operating payments. With their use SCRTD, between September 1, 1976, and May 31, 1977, eliminated 2 million miles of service and cut 134 buses from its peak requirements as part of a continuing program of service reduction.

[1] See Exhibit 1

[2] See Exhibit 2

THE PROGRAM IN OPERATION

In actual operation, service levels on major lines are determined on the basis of the loading standards contained in the level-of-service policy guidelines (Exhibit 2). Service on other than major lines is evaluated under the Service Evaluation Program (Exhibit 1) on the basis of the service effectiveness standards contained in the level-of-service policy guidelines.

Riding checks are made, generally at the rate of one line a day, by a group of 60 schedule checkers. Because of workload, the checks are currently being concentrated on "other than major lines."[3] SCRTD would like to check these lines twice a year, but at the present time is only able to check on an annual basis.

As a result of the on-board checks, routes are arrayed by the number of riders per bus hour. Those showing less than 20 passengers per bus hour are then subjected to more detailed analysis as low performance lines in accordance with the criteria and procedure set forth in the Service Evaluation Program.

The Planning Department then performs a detailed service analysis and recommends the restructuring or elimination of the line. In most instances, the service in the area under review can be restructured so as to improve bus utilization through adjustments in service levels, reroutings, line consolidations, and similar techniques. In a few instances only has SCRTD found justification for the abandonment of service.

The recommendations of the Planning Department are considered by a Service Review Committee (consisting of the manager of operations, manager of planning and marketing, comptroller, and governmental affairs officer) and, in turn, by the Board of Directors.

The elapsed time between the point where the line check triggers action to final decision is from one to six months, depending upon the significance of the action proposed and the degree to which it may be controversial.

AN EVALUATION OF THE EVALUATION PLAN

The two documents adopted by the SCRTD Board of Directors in anticipation of a continuing requirement for the distribuiton of service increases have also been effective tools in making major service reductions.

Those involved in the process recognize that the guidelines for the initial measurement of service effectiveness are what one participant calls "simple-minded criteria," the purpose of which is merely to point out

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[3] This has required temporary deferral of periodic adjustments on the major lines.

those situations upon which the more detailed and complex analyses should be concentrated. In this role, the criteria function well, and the entire process has facilitated an orderly retrenchment of service in difficult circumstances. The significant points are:

1. A rough and easily applied means of identifying lines to be studied in depth.

2. A workable procedure for the analysis in depth and for making a final decision within a reasonable period.

The system does not-- and this is well-understood by SCRTD top management-- take the place of the review of fundamental purposes and policies which SCRTD must undertake in the face of rising costs and possible further reductions in local support funds.

EXHIBIT 1

SCRTD SERVICE EVALUATION PROGRAM

POLICY STATEMENT

Growing demand for transit, coupled with limitations on funding, have created a need to free underutilized buses for new service opportunities. Although RTD has always evaluated and adjusted its services in order to make the most of its resources, there is now a need for an explicit and comprehensive policy statement on this issue, and for the development of clearcut and consistent procedures to implement such a policy. The policy can be stated as follows:

> In order to obtain the maximum overall effectiveness in the use of public funds, RTD will intensify the examination of its operations on a line by line basis, to find those underutilized resources which can be shifted to other services offering greater potential.

EVALUATION FACTORS

Factors which will be considered in effectiveness ratings fall into three categories:

(1) Cost, revenue and ridership related;
(2) Transit dependence (individual and community wide);
(3) System integrity.

Cost and revenue related factors include dollar measures such as cost per ride or operating ratio; also figures of merit like riders per bus hour, riders per bus mile and peak-hour usage. Many of these can be obtained directly or indirectly from the data of the Line Summaries.

Transit dependence considers the characteristics and needs of the patrons of the line: the extent of their access to travel alternatives other than transit. The most obvious means of considering this factor is to determine the proportions of the ridership that are elderly, handicapped, in poverty, etc., and where possible, to determine the personal importance of the trips made on the line. It also must recognize where the bus line may be the only public transit connection to an area.

System integrity is the measure of the importance of a given line to the completeness of the transit network. Is the line a critical link in the overall system, or does it merely duplicate other services? What is the line's proximity to another RTD or municipal bus line?

EVALUATION PROCEDURE, EXISTING SERVICE

The procedure for line evaluation establishes a continuing process which periodically evaluates each line in the system. New lines, and lines which fall below a minimum benefit level of performance, are given special treatment. The elements of the procedure are as follows:

1. Evaluation Cycle.

Analyses at two levels of detail will be performed periodically on each line. Line Summaries, such as those already submitted to the Board, will be published twice annually. They contain summary data for type (1) factors: cost, revenue and ridership related.

Once each year, the more extensive Line Profiles will be obtained for each line, covering the factors of all three types. In addition to the inclusion of transit dependence and system integrity factors, the economic factors will be given in much more detail than is possible in the Line Summaries.

These one-year and half-year cycles are envisioned as a continuing process.

2. Special Treatment for Low Performance Lines.

In the course of the normal evaluation cycle, a few lines may be found to be performing very poorly. A finding that a line is carrying less than 20 passengers per bus hour will automatically trigger a process:

a. Supplementary line profile data would be obtained, and a technical analysis would set forth appropriate corrective steps. The gathering and analysis of data to derive the evaluation factors must be consistent from line to line. As the summaries and profiles show where corrective action might improve bus utilization, recommendations would be made.

b. The Board of Directors of the Southern California Rapid Transit District, upon receipt of the supplementary data and the recommendations, will then act to take whatever corrections it deems appropriate.

c. If action by the Board includes service deletions, alterations or improvements affecting present riders, those riders, as well as the community in general, will be given adequate advance notice of the alternatives.

NEW SERVICE PROCEDURE

New services, which are proposed by the RTD Board and/or staff, local elected officials and community groups, riders, etc., are processed in

accordance with the general procedures adopted by the Board of Directors on June 20, 1972. Under these procedures, a New Services Review Board, which is a multidisciplinary top level staff group, reviews the proposal in accordance with the following criteria (as amended by this proposal):

1. The District must have or be able to acquire in a reasonable time, the physical capability--rolling stock, maintenance facilities and related requirements--to fulfill the request.

2. The requested service must show a potential for filling an existing need in the community of origin, or must constitute a new demonstration project in local public transportation of potential value and utility to all communities. The requested service must be compatible with the comprehensive regional transportation concept.

3. New service requests should be considered in part from the standpoint of the geographical location in order that there be some equitable distribution of new services throughout the District's service area.

4. The new services granted will be geared to the Board of Director's annual appropriation of funds for new public transportation service experiments.

5. If a new services request is specialized in nature; that is, a routing exclusively for senior citizens to shopping centers, services specifying minibuses, low fare service, or similar types of special service, and would be an obvious departure from the standard of District services rendered, staff would recommend that the service be offered if additional funding from outside is provided.

Each new service must be approved by the Board.

If a 90-day Line Profile shows the new line to be below the 20 passengers/bus hour level, the same accelerated evaluation and correction process that applies to other low-performance lines would be undertaken, as described in #2, "Special Treatment for Low Performance Lines" above. The Board of Directors of RTD will have the option of eliminating the service at this time, or continuing the service for a six-month trial period.

ADOPTED: July 2, 1975; amended November 5, 1975

EXHIBIT 2

SCRTD LEVEL-OF-SERVICE POLICY GUIDELINES

Increases in tax support for transit have enabled SCRTD to expand services to a level far greater than that which could be supported by fare revenues alone. As a result, the District has an obligation both to its riders and to the general taxpaying public to provide a wide distribution of transit service while making effective use of available resources. This has created the need for an explicit statement of policy to define a consistent rationale for distributing service throughout the District's service area.

Assuming the availability of funds and equipment, it is the District's policy to maximize transit accessibility and mobility within its service area, consistent with the following accessibility and service effectiveness objectives.

ACCESSIBILITY:

A. Population coverage. These objectives apply to local service only, which for this purpose is defined as service with four or more stops per mile and with no restrictions on passenger boarding or alighting.

   (1) In areas where population density is greater than 8,000 per square mile, service with a weekday base headway of 30 minutes or less will be provided to within one-quarter mile of 90% of the population.

   (2) In areas where population density is 4,000 to 8,000 per square mile, service with a weekday base headway of 30 minutes or less will be provided to within one-half mile of 90% of the population.

   (3) In areas where population density is 4,000 or fewer persons per square mile, service with a weekday base headway or 60 minutes or less will be provided to within one-half mile of 90% of the population. This statement will represent the minimum service standard throughout the service area.

B. Line Spacing. The population coverage objectives imply spacing objectives (e.g. spacing of one-half mile or less in at least one direction for areas with population density greater than 8,000 per square mile). Appropriate spacing will vary according to terrain, the street system, and the relative demand for travel in different directions.

C. Loading. In order to provide an accessible and dependable transit system, headways on local services should not exceed the policy headways described under the population coverage objectives. All parts of the transit system should also have adequate capacity for safety and to attract and keep riders.

(1) Loading ratios for individual lines should not exceed 140% measured for the peak 20 minutes at the maximum load point.

(2) Loading ratios should not exceed 100% for base periods and evenings.

(3) Loading ratios for long distance freeway and busway services should not exceed 100% measured for the peak half-hours.

SERVICE EFFECTIVENESS:

New services should be designed to meet the objectives specified below. New or existing services not meeting these objectives will be evaluated for remedial action or deletion in accordance with the procedure for treatment of low performance lines outlined in the District's Service Evaluation Program.

A. For local services:

(1) at least 20 passengers per bus hour (all day)

(2) at least 2.5 passengers per bus mile in the peak period; and

(3) at least 1.5 passengers per bus mile (all day).

B. For express service:

At least 250 passenger-miles per bus hour.

ADOPTED: May 5, 1976

SEATTLE METRO CASE STUDY

Seattle Metro Transit, faced with a potentially serious cash-flow problem, has launched an all-out effort to bring costs under control, while retaining a goal of increasing riders by 36% between 1976 and 1980.

Although most of the planned actions to accomplish this are just underway, the approach taken by Metro Transit will be of interest to officials in other areas with similar problems.

TRANSIT BACKGROUND

Privately-owned transit service began in Seattle in the 1880's.[1] In 1903, eleven private carriers were consolidated through the Seattle Electric Company. The City of Seattle opened its first publicly-owned street railway line in 1912, and in 1918, under the pressures of rising costs, labor disputes, jitney competition, and wartime traffic demands, all of the private lines serving the city came under public ownership. The last cable car ran in 1940 and the last street car in 1941. The fleet in 1941 included 235 trackless trolleys and 213 buses.

In 1968 and 1970, referendums authorizing construction of a rail transit system failed. Subsequently the State legislature authorized a three-tenths of 1% retail sales and use tax for municipal corporations providing transit service on a metropolitan area basis. In 1972, the Municipality of Metropolitan Seattle was authorized by referendum to levy the sales and use tax throughout King County and to operate the regional transit system.[2]

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[1] 1884, first horse car line; 1888, first cable car line; 1889, first electric car line.

[2] The Municipality of Metropolitan Seattle (Metro) is a municipal corporation, originally established to provide for sewage disposal in the Seattle metropolitan area. Metro is headed by an Executive Director, appointed by and responsible to a 36-member Council composed of elected and appointed officials representing principally the local general-purpose governments in Metro's service area.

METRO TRANSIT

Metro Transit, a division of the Municipality of Metropolitan Seattle, purchased the city-owned Seattle Transit System and the privately-owned suburban Metropolitan Transit Corporation on January 1, 1973. It provides service in King County (1970 population: 1.2 million) and, under contract, to cities in adjacent counties.[3] It also provides incidental package service between Seattle and suburban communities and operates the Seattle Monorail under a cost-reimbursement contract with the City of Seattle.

Metro Transit operates 75,000 miles of service on the average weekday over 120 routes, using 536 buses and 59 trolley coaches. The base fare is 30¢, with one 20¢ zone. Transfer passes, good for one hour, are issued free. A new monthly pass is sold for $13 (good in one zone) and $20 (good in two zones). The fare for elderly and handicapped persons is 10¢. "Magic Carpet" on any bus within the downtown area of Seattle is free.

REVENUE PASSENGERS (in Millions)

	Seattle	Metropolitan	Combined
1940	57.0	NA	
1945	131.0	NA	
1972	29.2	1.8	31.0
1973			32.4
1974			35.1
1975			38.0
1976			41.8

A CASH-FLOW PROBLEM

Beginning in 1973, Metro Transit rapidly increased service and inaugurated an aggressive marketing program directed toward a goal of 57 million riders in 1980. In three years, patronage increased 29%. But costs increased even more rapidly, until they began to outstrip revenues and the financial assistance available through the sales and use tax and Federal urban mass transportation programs.[4]

Faced with a cash-flow problem of serious proportions, Metro Transit management proposes to retain the 1980 partonage goal while cutting back the rate of cost increases to not more than a projected 6% annual inflation rate. The significance of this is indicated by the following year-end cash-flow projections:

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[3] Metro Transit is the principal ground carrier in the area. Washington State Ferries provide commuter service on five water routes. There are three small suburban carriers operating under contract with Metro transit

[4] See Figure 1.

YEAR END CASH BALANCES (in millions of dollars)

Alternative	1978 Budget	1979 Est.	1980 Est.	1981 Est.	1982 Est.	1983 Est.
Costs increase 6% annually						
• 4% increase in service and passengers in 1982 and 1983	0.9	(6.3)	(5.6)	(5.8)	(0.3)	2.1
• No 1982 or 1983 increases	0.9	(6.3)	(5.6)	(5.8)	(1.6)	8.3
Costs increase at 9% annually (3% more than the assumed inflation rate)						
• 4% increase in service and passengers in 1982 and 1983	0.9	(7.8)	(10.4)	(16.0)	(18.7)	(27.7)
• No 1982 or 1983 increases	0.9	(7.8)	(10.4)	(16.0)	(16.5)	(20.4)

Source: Metro Transit estimate of 5/18/77. Based on 1977 fare structure, continuation of Federal aid programs and the local sales and use tax, and an increase in ridership to the 57 million level in 1980.

AN ACTION PLAN

The objectives of the plan developed by Metro Transit to meet its cash-flow problem are--

- To reach its earlier goal of 57 million revenue passengers by 1980
- To hold costs within an assumed local annual inflation rate of 6%

The attainment of these objectives requires--

- An effective program to increase ridership.
- An effective program to increase productivity.

The following sections of this paper outline the principal elements of these programs. Most of them are still in the early stages of development and in only a few instances are the results yet visible. They do, however, suggest a range of actions which could be considered by other transit properties in similar circumstances.

MARKETING PROGRAM[5]

The Manager of Marketing has accepted a management-by-objective approach to the development of the marketing program. His long-range objective is to reach Metro Transit's goal of 57 million revenue passengers in 1980, while at the same time the marketing program contributes to the attainment of the productivity program objectives. The basic strategy is to increase[6] riding among present transit users and to attract additional commuters.

The key to this effort is placing emphasis on the new monthly pass, which sells for $13 (good in one zone) and $20 (good in two zones). The widespread use of the monthly pass is expected (1) to increase ridership and (2) decrease vehicle dwell-time. The 1977 objective--starting from a zero base--is to reach a level of 9,500 passes a month.

Other quantifiable 1977 marketing objectives, and the rationale for them, include:

- Increase revenue passengers to 44.5 million. This would be an increase of 2.7 million, or 7%, over 1976. In the absence of a marketing effort, it is estimated that a recent 5¢ fare increase would cause a loss of 1.2 million passengers and a revenue shortfall of $400,000 in 1977.

- Increase household penetration by 20,000 households. This is based on the correlation between household penetration and ridership and the perception that rider households tend to produce additional ridership.

- Increase one-way commuter trips among present riders from 22 to 24 per month. Present riders are the best potential source of new rides. An increase of two trips per month would equal 1.6 million additional rides in 1977.

- Reduce the unit costs of material production and distribution by 10%. Note that this relates to unit costs and does not necessarily indicate a reduction in quantities or total budgeted costs.

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[5] The 1977 marketing program covers 120 pages. It provides a detailed situation analysis, outlines objectives and strategies, sets forth the year's program and budget, and provides criteria for its evaluation. The program is based in large part on data collected in 1976 during an extensive Metro Transit Attitude and Awareness Study.

[6] Metro Transit's peak load factor is about 80%.

WORK RULES

It is generally recognized that the work rules embodied in the labor agreement are a major determinant of transit operating costs. The labor agreement is reached through the collective bargaining process, and advance speculation on the possible positions of the parties may interfere in that process. For the purposes of this paper it is sufficient to note that Metro Transit officials are reviewing, in a systematic way, a wide range of possible negotiation items and quantifying their impacts on efficiency and costs. As a part of this program, a comprehensive negotiations plan and handbook is being developed for use by the management negotiating team.

A substantial amount of work is also being done on the development of a statistical approach, based on probability, to the levelling of manpower needs within the work rules. This involves such items as the trade-off between new hires and the use of overtime, assignments of work, vacation scheduling, and the control of excused absences. It is anticipated that most of these items can be reduced to fairly simple mathematical equations which a base planner or dispatcher can use in real time to determine least-cost alternatives.

RUCUS has been evaluated in one of the small Metro Transit bases. Efforts are now underway to enhance its data and report capability for such functions as the preparation of schedule pages, run cards, time tables, statistical reports, and driver sign up sheets. [7]

DRIVER PERFORMANCE

Special efforts are being made to deal with three specific problem areas which are adversely affecting driver performance. These are:

- Passenger complaints involving drivers, which have increased by one-third in the past 18 months.
- Chargeable accidents, which have increased substantially in the past 18 months, though the rate is now decreasing as new drivers gain experience and older drivers become familiar with new bus equipment.

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[7] RUCUS is an UMTA-developed computer program package for Run Cutting and Scheduling. The package, in part, is designed to optimize within the work rules, the scheduling of vehicles (schedule making) and drivers (run-cutting).

- Unexcused absences and late reporting for duty, both of which have increased substantially.

Three avenues of approach are being taken:

- Development of a reporting and data system which is adequate for statistical analysis and the formulation of corrective strategies.

- A study of the feasibility of applying goal-setting, behavior-modelling, performance appraisal, and specialized training techniques in improving relations between transit drivers and transit patrons. This study, by an outside consultant, is expected to be completed and the results ready for testing late in 1977.

- Voluntary participation by drivers against whom a number of complaints have been made in a 4-hour training session in which role playing is stressed. This program is based on a more comprehensive program developed by Southern California Rapid Transit District.

SERVICE STANDARDS

In 1975, the Metro Council asked Metro Transit to develop a means of reporting productivity at the route level as a basis for decisions to increase or decrease transit service.

During 1976, representatives of the planning division, along with consultants and citizen advisors, selected service indicators and prepared a statement of service standards. Because of their possible legal effect, the Council did not act formally on the recommended plan. As an alternative to formal adoption, the Council directed that staff recommendations for route changes be accompanied by a study based on the service evaluation criteria.

The criteria being used by Metro Transit relate to weekday peak and midday service.[8] They measure productivity (defined as passenger-carrying efficiency) in terms of passengers-per-trip at the maximum load point and passengers-per-bus-hour of operation. Each route is compared graphically against a pre-determined "minimum standard"

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[8] Night and weekend service standards will be developed by the end of 1977.

curve for various headways (in the case of passengers per trip) and population densities (in the case of passengers per bus hour) in both peak and midday periods.[9]

Each route receives four pass-or-fail ratings which provide a rough indication of productivity and from which priorities for further detailed examination can be derived.

Routes thus identified are studied, together with other routes in the service area, to determine what can be done to bring them up to standard with minimum adverse rider impact. This may involve restructuring area service through rerouting or line consolidations, changing service levels on one or more routes in the area, or, in rare instances, service abandonment. The first staff evaluation under the new service evaluation criteria was completed in March 1977.

Service evaluation is perceived as a continuous process. It is estimated that the elapsed time between the riding checks and final action will be about one-year.

MAINTENANCE

Metro Transit has installed the first module of SIMS.[10] The second and third modules are not being used because Metro is satisfied with its own programs in these areas.

A locally-devised Coach Operations Reporting System (CORS) is used to record and analyse what vehicles are doing on the street. All delays and reroutes are recorded. These data can be compiled by vehicle, driver, mechanic, and cause of delay.

Budgets are developed on a unit-time basis. Work-unit standards have not yet, however, been developed.

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[9] The most significant change in the standards during the policy review process was the minimizing of population density as a factor in the evaluation because density tended to favor city routes over county routes. The factors used are neutral in this respect.

[10] SIMS--an UMTA-financed computer program covering a Service, Inventory, and Maintenance System for transit operations. The three modules are (1) Service (preventative maintenance and vehicle service), (2) Inventory (stock control), and (3) Maintenance (daily maintenance activities.)

MANAGEMENT BY OBJECTIVES

The Metro Transit annual budget is developed and monitored on the basis of management-by-objectives (MBO).[11] Performance in relation to objectives is formally monitored by the Director of Metro and his staff in a monthly management meeting.

A listing of selected 1977 objectives will indicate the scope of the system:

Organization	Selected Objective	
Equipment and Facilities	Miles/trouble call	2100
	Overtime	4% of budget
	Coach/man ratio	2.45
Operations	Preventable accidents	Reduce 15%
	Driver complaints	Reduce 15%
Marketing	(Previously discussed)	
Planning	Overtime costs in scheduling	Reduce 30-50%

[11] The conference room is equipped with sliding chart panels showing, by organizational unit, performance with relationship to the principal objectives for that organization. Other charts show budget vs. actual revenues and costs by month and organizational units, data on service evaluations, and measures of system productivity, such as passengers/hour, passengers/trip, passengers/mile, and cost/passenger.

PART III: ANNOTATED BIBLIOGRAPHY

This selective bibliography was compiled by the staff of Public Technology, Inc., in conjunction with the Office of Policy and Program Development, Urban Mass Transportation Administration, U.S. Department of Transportation. In general, works are included which are recent publications, reflect a local government perspective rather than a highly theoretical one, and pertain to transit productivity. This bibliography is organized under these categories--

I Public Sector Productivity
II Labor and Financial Statistics
III Transit Productivity
- A. Performance Indicators
- B. Fiscal Issues
- C. Levels of Service
- D. Labor
- E. Maintenance

PUBLIC SECTOR PRODUCTIVITY

Balk, Walter L. "Improving Government Productivity: Some Policy Perspectives." Sage Professional Papers in Administrative and Policy Studies, Volume 3, Series no. 03-025. Beverly Hills, Calif.: Sage Publications, 1975.

Theoretical approach to forming policy for productivity improvement programs. Emphasis on motivation techniques, measurement, information systems, and implementation of programs. Includes examples of existing programs.

Committee for Economic Development. Improving Productivity in State and Local Government. New York, N.Y.: 1976.

Defines the dimensions of state and local government productivity, identifies the principal areas for improvement, outlines approaches that can motivate jurisdictions to take action, and proposes steps that the states and Federal government can take to encourage productivity.

International City Management Association. Guide to Productivity Improvement Projects. Third edition. Washington, D.C.: U.S. GPO, 1976.

(Formerly called the Jurisdictional Guide to Productivity Improvement Projects.)
Compilation of productivity improvement projects undertaken by cities and counties of all sizes; discusses the problem, the solution, the results, and provides a contact in the city or county for further information.

Urban Institute and International City Management Association. Measuring the Effectiveness of Basic Municipal Services; Initial Report. Washington, D.C.: 1974.

Identifies measures of service effectiveness to determine the extent to which goals and objectives of various city and county services are being met. Suggests data collection procedures for specific effectiveness measures.

LABOR AND FINANCIAL STATISTICS

American Public Transit Association. Labor Information Review. Revised edition, 2 Vols. Management Seminar, Las Croabas, Puerto Rico, March 14-18, 1976. (Available to APTA Members Only).

"Second annual summary of APTA Statistical Department current labor information records contributed by APTA Labor Practice Service Participants." Volume I includes top wage rates and 1975 labor agreement provisions for vehicle operators and mechanics, and reprints of recent articles on transit labor practices. Volume II includes alphabetical list of transit systems in U.S. and Canada, ranked list of transit systems by population size or urbanized area and labor agreements information.

American Public Transit Association. Transit Fact Book. Washington, D.C.: Annual.

Summary of information for the U.S. transit industry for each calendar year in such areas as total passengers, passenger revenue, operating revenue, labor costs. Includes brief history of U.S. transit industry.

American Public Transit Association. Transit Financial Assistance Reported for Calendar/Fiscal Year 1974. Washington, D.C.: 1976. (Available to APTA Members Only).

Annual financial information based upon voluntary responses by transit operators to APTA questionnaires. Includes information on operating assistance, capital assistance, reimbursements, demonstration grants and taxing authority.

American Public Transit Association. Transit Operating Report for Calendar/Fiscal Year 1975. Washington, D.C.: 1976.

Annual financial data and operating statistics based upon voluntary responses to APTA questionnaires. Includes information on individual transit system sector bus operations, heavy rail operations, light rail operations, trolley coach, inclined plane, and ferries. Indexes by population size, vehicle fleet size, operating expense, total passengers carried, and vehicles operated.

U.S. Department of Labor, Bureau of Labor Statistics. Current Wage Developments. Washington, D.C.: U.S. GPO. Monthly.

Monthly report summarizing wage and benefit changes in major collective bargaining situations and unilateral management decisions.

U.S. Department of Labor, Bureau of Labor Statistics. Handbook of Labor Statistics, 1976, Bulletin 1905. Washington, D.C.: U.S. GPO, 1976.

Annually published handbook on labor statistics which compiles major series of Dept. of Labor. Supplements the 1975 Reference edition which contains complete historical data. The 1976 edition begins with 1967 data through 1975 calendar year. See especially Table 91, "Average Union Rates for Selected Trades by City, 1967-74", which includes transit vehicle operators wage rates for cities of 100,000 population or more. Essential reference manual on labor statistics.

U.S. Department of Labor, Bureau of Labor Statistics. Statistics on State and Local Government Employment and Payrolls. Monthly publication.

U.S. Department of Labor, Bureau of Labor Statistics. Union Wages and Hours: Local-Transit Operating Employees. Washington, D.C.: U.S. GPO, Annual

Essential reference for local transit wage statistics in selected cities of the U.S. Data based upon collective bargaining agreements. Recommend comparing figures for local transit to those of local trucking industries and book and job printing.

TRANSIT PRODUCTIVITY

Altshuler, Alan. "The Decision-Making Environment of Urban Transportation," Public Policy (Spring 1977), forthcoming.

Examines urban transportation's political decision-making environment in light of the predominance of the private sector. Emphasizes the paradox between the collective and individual forces of the American public. As a collective political force, the American public brought about a remarkable shift in the national transportation investment priorities (highways to transit), while individually in the market place, Americans resist interference in their lives, including the right to drive their own cars. Concludes that this problem accounts for the overall ineffectiveness in shaping the urban transportation pattern.

Council on Municipal Performance. City Transportation. New York, N.Y.: 1975.

Citizen's guide to evaluating public transportation. Provides criteria for the quantity and type of transportation cities should offer. Evaluates public transportation performance in 28 cities based upon ability to get citizens to and from work. Looks at hidden costs of America's car dependence and problems due to automobile subsidies.

Control Data Corporation. Wells Research Company. Trends in Bus Transit Operations, 1960-1974. Prepared for the U.S. Department of Transportation. Washington, D.C.: U.S. Department of Transportation, 1977.

Analyzes fifty of the most complete sets of APTA bus transit financial and operating records from 1960 through 1974. Studies patronage versus supply of services, revenue versus costs, trends in selected cost categories, utilization of employees and vehicles, and fuel consumption costs.

Eisele, Donald O. "Operational Efficiency of Suburban Railroads." Proceedings of the Speciality Conference on Urban Transportation Efficiency. New York, N.Y., July 26-27, 1976. New York, New York: American Society of Civil of Engineers, 1977.

Examines ways to improve productivity in railroad operations, including revenue collection, fare structures, scheduling, and implementation problems.

Gomez-Ibanez, Jose A., and John R. Meyer. "Productivity Growth and Labor Relations in Urban Mass Transit." Presented at the Transportation Research Board Conference on Labor Relations Issues in Urban Public Transportation, December 6-7, 1976, Washington, D.C. (unpublished).

Explores opportunities for improving transit productivity, many of which can be quickly implemented. These include increased express services, bus priority techniques, deployment of some buses larger and smaller than the standard model, negotiation of changes in split shift rules, adoption of computerized scheduling, and tailoring of fares, service quality, and schedules to conform to transit's distinct markets.

Jones, David W., Jr. The Politics of Metropolitan Planning and Programming--Implications for Transportation System Management. Prepared for U.S. Department of Transportation. Berkeley, Calif.: University of California. Institute of Transportation Studies, 1976.

Case studies and analysis of planning and implementation of Transportation System Management strategies in Metropolitan Chicago, Los Angeles, Minneapolis-St. Paul, and the San Francisco Bay Area. Examines obstacles to productivity improvement posed by inter-jurisdictional and inter-agency conflict.

Regional Plan Association. Urban Densities for Public Transportation. Prepared for the Tri-State Planning Commission. New York, N.Y.: 1976

Chapter Three, "Costs of Supplying Public Transportation," provides a comparison of costs for different transit modes, including operating and capital costs. Modes include fixed rail, bus, taxi, dial-a-bus, and guideway. Discussion of how costs can be reduced and cost-benefit considerations in allocation of resources to transit construction.

PERFORMANCE INDICATORS

Arthur Anderson and Company. Project FARE Task IV Report: Urban Mass Transportation Industry Financial and Operating Data Reporting System. Washington, D.C.: U.S. Dept. of Transportation, Urban Mass Transportation Administration, 1973. (NTIS PB 226-353).

The report contains a description of the uniform reporting system for the urban mass transit industry designed and tested in Project FARE, including methodology, research summary, reporting system forms and instructions.

Fielding, Gordon J. (Pete), and Roy E. Glauthier. Distribution and Allocation of Transit Subsidies in California. Irvine, Calif.: University of California, Irvine. Institute of Transportation Studies, 1976.

Analyzes 49 performance indicators on the basis of data availability, methodological correctness, and bias. Five are selected which measure system effectiveness and efficiency and allow comparison of one system to another. The measures are analyzed with data for several California transit operations. The study suggests that performance indicators might be used in an incentives program to supplement fixed subsidy of basic transit services.

Fielding, Gordon J. (Pete), and Roy E. Glauthier. Obstacles to Comparative Evaluation of Transit Performance. Irvine, Calif.: University of California, Irvine. Institute of Transportation Studies, 1977.

Prepared for presentation at the National Planning Conference of the American Society of Planning Officials, San Diego, California, April 20-28, 1977. Reviews data collection problems and extent to which Section 15 Reporting Requirements may solve these problems. Concludes that "accurate financial and operating data for the public transit industry is presently not available nor can it be resonably collected " (p.2), and that without such data, comparability between systems cannot be expected.

Gilbert, Gorman, and Jarir Dajani. Measuring the Performance of Transit Service. Durham, N.C.: Duke University, 1975.

Examines 5 different perspectives (Federal, State, local, transit user, and transit operator) on performance indicators and their interrelated nature. The conceptual framework outlines three levels of indicators--efficiency, effectiveness, and impact measures--with emphasis on effectiveness, defined as public mobility. Explores ways in which funding could be allocated to increase effectiveness.

Kansas City Area Transportation Authority. Planning Department. "Transit Route Monitoring and Planning System." Kansas City, Mo.: 1977.

Companion to transit standards and criteria published in 1976 (see "Levels of Service"). Specifies data to be collected and measures to be calculated to determine whether standards and criteria are being met. Characteristics of each route to be monitored include usage, financial performance, and operational effectivenss. A process for using data and measures in evaluation and analysis is outlined. Covers maximum headways, minimum number of trips, revenue and ridership minimums, load limits, and express service criteria.

Meyer, John R., and Jose A. Gomez-Ibanez. Measurement and Analysis of Productivity in Transportation Industries. Cambridge, Mass.: Harvard University, Department of City and Regional Planning, 1975.

Analyzes problems of assessing output of transit industry. Emphasizes need to consider social characteristics, quality of service, and history of the industry. Indicates that performance indicators are designed and used for different purposes. Concludes that vehicle-miles, although a crude measure, is useful insofar as it reflects to some extent both passenger service and social outputs which transit produces.

Roess, Roger P. "Criteria for Measuring Rail Transit Efficiency." Proceedings of the Specialty Conference on Urban Transportation Efficiency. New York, N.Y., July 26-27, 1976. New York, N.Y.: American Society of Civil Engineers, 1977.

Reviews indicators of overall operating efficiency and labor productivity. Discusses problems in comparisons, factors affecting values of the measures. Recommends disaggregation of labor measures by type of work. Also mentions non-efficiency criteria that should be considered in evaluation of service.

Tomazinis, Anthony R. Productivity, Efficiency, and Quality in Urban Transportation Systems. Lexington, Mass.: D.C. Heath and Co., 1975.

Theoretical study of how to evaluate performance of total transportation systems, public and private. Discusses a number of measures applicable to transit. Emphasis on four actors: operator, user, society, government.

U.S. Department of Transportation. Urban Mass Transportation Administration. "Comparing the Efficiency of Privately-and Publicly-Owned Bus Systems." Prepared by Cindy Burbank. Washington, D.C.: 1976. Draft Paper.

Discussion of efficiency measures and factors affecting efficiency. Data from an UMTA survey of 25 largest urbanized areas is used to show that public operators are as efficient or perhaps more efficient with respect to service offered than private.

U.S. Department of Transportation. Urban Mass Transportation Administration. "Transit Performance, Productvity, and Efficiency." Prepared by Doug Gerleman. Washington, D.C.: 1977. Draft Paper.

This study of transit performance indicators analyzes what various commonly used quantitative measures (such as passengers/vehicle-mile, farebox revenue/operating expense, and vehicle-maintenance employee/vehicle) indicate about a transit operation and city. The study is aimed at assisting transit funding and review agencies at the Federal, State, and local levels who wish to evaluate transit systems without spending the time, manpower, and funds needed to perform more detailed analyses of transit performance and efficiency.

Vuchic, Vukan R., et al. Design for a National Urban Transportation Reporting System--Final Report. Philadelphia, Pa.: University of Pennsylvania, 1976.

Based on reporting system of the Pennsylvania Department of Transportation. Recommends set of data items and indicators for evaluating transit system efficiencies and their comparative analysis.

FISCAL ISSUES

California. Office of the Auditor General. Financing and Evaluating Public Transit Systems in California; Report of the Office of the Auditor General to the Joint Legislative Audit Committee. Sacramento, Calif.: 1977.

Reviews trends in public transit in California. Notes the inadequacy of current auditing procedures, and the need for a system for measuring transit system efficiency and effectiveness. Includes recommendations to reduce or minimize transit deficits, to establish a performance evaluation system, and to improve audit requirements. Evaluates a number of performance indicators.

Comprehensive Planning Organization. Transit Operators Performance Audit Guide. Prepared by Peat, Marwick, Mitchell and Co. San Diego, Calif.: 1976.

A step by step guide to compliance with California statutes requiring measurement of bus transit operators' efficiency and effectiveness reviews.

New York State. Department of Transportation. "Cost Increases, Cost Differences, and Productivity of Transit Operations in New York State." Preliminary Research Report 110. Prepared by William C. Holthoff and Robert G. Knighton. Albany, N.Y.: 1976.

This study analyzes transit costs and operational productivity in New York State public transit properties. A breakdown of costs is presented. Differences in productivity from one property to another are identified, but productivity is not rigorously defined. One conclusion of the study is that average vehicle speed increases of 1 mile per hour would result in cost savings of 8 to 19%.

New York State. Department of Transportation. "Revenue, Ridership, and Equity of Differential Time-of-Day Fares." Preliminary Research Report 99. Prepared by David L. Weiss and David T. Hartgen. Albany, N.Y.: 1976.

Examines the impact of different time-of-day fares on transit ridership, revenue, and equity in seven cities in New York State. The advantages of higher peak period fares are the reduction of ridership losses that result from a uniform fare increase and an improved distribution of costs and benefits. The study found that

- Ridership and revenues cannot both be increased through differential fare policies
- Some fare policies can improve revenue or ridership with less than 5% loss in the other
- Fare increases result in permanent loss of riders
- Increased ridership with a slight loss of revenue is preferable over the long term

Peat, Marwick, Mitchell and Co. Study of Public Transportation Fare Policy. Two volumes. Prepared for the U.S. Department of Transportation. n.p.: 1976.

Examines transit fare policy from three perspectives--institutional, demand, and pricing rationale. Institutional considerations include fare trends, types of fares, fare collection techniques, and the groups affecting fare policy. Demand considerations include the effects on ridership of changes in fares and service characteristics. Pricing rationale considerations emphasize the costs of providing transit service.

Reilly, Jack. "Transit Costs During Peak and Off-Peak Hours." Presented at 1977 Annual Meeting of the TRB, Washington, D.C. Albany, N.Y.: Capital District Transportation Authority, 1977.

Compares the relative costs of providing peak and off-peak transit service in Albany, New York. Implications for transit pricing policies are examined from the perspective of economists and transit operators.

Simpson and Curtin. Standards for Bus Service Contract Payments and a System of Incentives. Prepared for the New Jersey Department of Transportation. n.p.: 1976.

Presents a complex formula for determining operating assistance levels to private transit companies in New Jersey. Operating assistance is based on the difference between projected revenues and "standard costs" calculated on a route by route basis. Employee-related and other company specific costs are determined for each company. Operating, maintenance, and administrative costs are standardized for all operators. Revenues in excess of projections are kept, and short falls absorbed by operators. Additional incentive payments or penalties would be applied on the basis of service quality evaluation.

U.S. Department of Transportation. Urban Mass Transportation Administration. Transit Performance and the Impact of the Section 5 Program. Washington, D.C.: 1976.

A study of the impact of the Section 5 program--where funds are used, for what purposes, and to what effect. Also examines transit trends, and provides statistical data on the use of Section 5 funds.

LEVELS OF SERVICE

Allen, William G., Jr., and Frank Dicesare. Transit Service Evaluation: An Introduction and Preliminary Identification of Variables Characterizing Level of Service. Prepared for presentation at the 55th Annual Meeting of the Transportation Research Board, Washington, D.C., January 1976.

Goeddel, Dennis L. An Examination of the Run Cutting and Scheduling (RUCUS) System--A Case Analysis. Cambridge, Mass.: U.S. Department of Transportation, Transportation Research Center, n.d.

Examines the utility of RUCUS in preparing driver and vehicle work schedules for the Massachusetts Bay Transportation Authority (MBTA). The system, developed for the U.S. Department of Transportation by the Mitre Corporation, generated schedules in close agreement with manual MBTA schedules, demonstrating a capability to produce reliable and cost efficient schedules.

Kansas City Area Transportation Authority. Public Transportation Standards and Criteria: Kansas City Metropolitan Region. Kansas City, Mo.: 1976.

Provides a set of standards responsive to the needs of local transit management, the regional planning agency, and Federal regulations. Emphasizes performance and operating criteria for individual bus routes. Also covers paratransit, transit services for the elderly and handicapped, non-scheduled service, fares, and criteria for capital improvements.

Massachusetts Bay Transportation Authority. Service Policy for Surface Public Transportation. Boston, Mass.: 1975.

Outlines legal and policy framework, service goals and objectives, service design standards, operating standards, and other standards, along with process for evlauation of present service, and service improvements or reductions.

Metropolitan Dade County Department of Traffic and Transportation. Dade County Transit Development Program, Vol. 1, Report in Brief and Mass Transit Service Standards. Miami, Fl.: 1973.

Outlines steps for:

- Establishment of local transit service standards
- Measurement of present system against these standards
- Correction of present and projected deficiencies through a program of service improvements

Service standards presented in this report are designed particularly for Dade County, with the assistance of County agencies. Fourteen quantifiable or observable evaluation categories are established and performance criteria are specififed for each.

Mitre Corporation. Vehicle Scheduling and Driver Run Cutting, RUCUS Package Overview. Prepared by K.R. Roberts. McLean, Va.: 1971.

This brochure describes the Run Cutting and Scheduling (RUCUS) package, a set of computer programs to assist in headway sheet development, vehicle scheduling and driver run cutting developed under the sponsorship of the Office of Research, Development and Demonstration, Urban Mass Transportation Administration.

National Committee on Urban Transportation. Better Transportation for City. Procedure Manual 4A: Measuring Transit Service. Procedure Manual 8A: Recommended Standards, Warrants, and Objectives for Transit Service and Facilities. Chicago: Public Administration Service, 1958.

These reports were among the first to address the planning of transportation as a comprehensive urban system and to specify service standards, objectives, and measurement techniques for transit.

Pennsylvania Department of Transportation. Operating Guidelines and Standards for the Mass Transportation Assistance Program. Jan. 1973.

Presents standards for level of service and marketing activities for Pennsylvania transit properties receiving operating assistance funds.

Tober, Ronald J. "Improving Service Quality and Efficiency Through the Use of Service Standards." Paper presented at TSM Conference, Transportation Research Board, November 7-10, 1976, Hotel Leamington, Minneapolis, Minnesota.

Paper describes the MBTA's Service Policy for Surface Public Transportation and its use in urban transportation system management. Asserts that such a policy provides framework for monitoring service performance and identifying remedial actions to improve quality of service and allocation of resources.

Toronto Transit Commission. Policies for Discussion: Standards for Evaluating Existing and Proposed Routes. Toronto: 1977.

Presents a methodology for evaluating existing and proposed routes on basis of route economics, access to transit, transit dependency, transit travel time, land use planning impacts, and physical constraints. Provides detailed methods for determining economic performance and access characteristics of routes, along with initial discussion. Methods of projecting ridership on new routes are discussed and a case study included.

Vuchic, Vukan R., Edson L. Tennyson, and William C. Underwood. "Application of Guidelines for Improving Transit Service and Operating Efficiency." Transportation Research Record, No. 519, 1974.

Review of the evaluation processes for grant requests within the Pennsylvania Mass Transportation Assistance Program. The Pennsylvania system specifies operating guidelines and service standards, then establishes the evaluation and enforcement procedures necessary to ensure compliance--either voluntarily or through fiscal leverage.

LABOR

Barnum, Darold T. From Public to Private: Labor Relations in Urban Mass Transit. Lubbock, Tex.: Texas Tech University Press, forthcoming.

Comprehensive study of collective bargaining in American urban transit, including history of the transit unions, membership problems, the Federal role in shaping bargaining, and productivity. Chapters Five and Six focus on worker earnings, fringe benefits, and productivity. Provides a statistical analysis of productivity in bus transit systems for last decade. Determines that type of ownership (public or private) and property size (number of employees) were the significant factors determining worker productivity. Concludes that public ownership and smaller size, lead to higher productivity.

MAINTENANCE

Haenisch, George C., and Floyd G. Miller. "Increasing Productivity in Bus Maintenance Functions." Proceedings of the 27th Annual AIEE Conference and Convention. St. Louis, May 18-21, 1976. Atlanta, Ga.: American Institute of Industrial Engineers, 1976.

Describes a joint effort between members of the Methods and Standards area of the Chicago Transit Authority and the Department of Systems Engineering, University of Illinois at Chicago Circle. Objective is to determine standard performing times and procedures for specific bus maintenance tasks. As a result of the study, productivity gains are in excess of 30%.

Martin-Vega, Louis A. Increasing Efficiency in Bus Maintenance Operations. Prepared for Commonwealth of Puerto Rico Metropolitan Bus Authority. Mayaguez, Puerto Rico: Transportation Research Institute, University of Puerto Rico, 1976.

Shop performance and productivity is evaluated on the basis of fleet and shop analyses. An integrated control system is developed for routine utilization of shop data and monitoring of future shop performance. Recommendations for increasing maintenance efficiency are presented.

The Mitre Corporation. Bus Maintenance Facilities: A Transit Management Handbook. Washington, D.C.: U.S. Department of Transportation, 1975.

Guidelines are given for estimating the cost of a new maintenance facility by transit management. A background of recent construction costs is provided, including cost parameters (in dollars per square foot) for maintenance functions of bus storage, shops and servicing.

The Mitre Corporation. SIMS Implementation Handbook. Washington, D.C.: U.S. Department of Transportation, 1974.

The Service, Inventory, and Maintenance System (SIMS) has been developed to aid bus transit properties in managing their servicing and maintenance activities. This automated information system is currently operational and consists of three components: the Service/Unit Change System, Inventory System, and Repair Cost System. General descriptions of the system's data requirements and the reports it produces have been published, and detailed soft-ware documentation is available for each of the three components. This handbook furnishes guidance to management in planning the implementation of the SIMS components at individual properties by outlining such steps as data base generation, training, and acquisition of data processing services.

Lieb, Robert C. Labor in the Transit Industry. Washington, D.C.: U.S. Department of Transportation, 1976.

This study examines the labor component of the transit industry to provide an understanding of this matter which might be useful in developing future policies and programs. Among the matters examined are employment and compensation trends, labor/management relations, government involvement in transit labor and employee productivity.

Mundy, Ray A., and John C. Spychalski. Managerial Resources and Personnel Practices in Urban Mass Transportation. n.p.: The Pennsylvania State University College of Business Administration, 1973.

A survey of urban transit managerial personnel conditions, practices and policies in transit systems in the U.S. and Canada. Findings: lack of planning for management personnel development; inadequate personnel resources, training and development programs; most trained management people will retire soon, with few back-up people trained to replace them.

New York State. Office of the State Controller. Summary of Audit Reports on New York City Transit Authority Operations. Albany, N.Y.: New York State. Office of the State Controller, 1976.

The audits examined employee utilization and productivity in car cleaning, car inspection, maintenance, and token booth operations, as well as purchasing and inventory practices, over-time practices, and other matters. Comparisons were made with other properties. Recommendations for improved performance and lower costs were included.

Yunich, David L. "Public Transportation Efficiency and Productivity." Paper presented at the 1976 APTA Annual Meeting, Hilton Hotel, San Francisco, California, October 20, 2976.

Outlines the New York Metropolitan Transportation Authority's productivity bargaining labor contract, as well as their productivity improvement manuals for servicing vehicles.

Wilson, David Gordon. "Incentives in a Metropolitan Public Transportation System." Proceedings of the 1976 Intersociety Conference on Transportation, Los Angeles, July 1976.

MBTA legislation claims that early legislation affecting MBTA had widespread disincentives to productivity due to (1) accounting practices that assessed communities based on number of passengers picked up, (2) bus costing procedures, (3) decreased employee morale due to political patronage system, (4) veto power of every group over other groups, (5) increased union competition and overall increased wage and benefits, (6) lack of incentives for individual sections to be efficient. Reviews proposed legislation which revises accounting of bus costs to reflect fixed costs, hourly (peak vs. off-peak) costs, and mileage costs, which would provide incentives to increase ridership in off-peak. Also encourages employees to provide better service at lower costs by instituting profit-sharing for towns and employees.

PART IV: APPENDIX

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Section D:

TRANSIT PERFORMANCE CONFERENCE ATTENDEES
Norfolk, Virginia
September 18-21, 1977

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