NATIONAL COOPERATIVE TRANSIT RESEARCH & DEVELOPMENT PROGRAM

9 Synthesis of Transit Practice

Use of Part-Time Operators

TRANSPORTATION RESEARCH BOARD
National Research Council

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Administrators, engineers, and many others in the transit industry are faced with a multitude of complex problems that range between local, regional, and national in their prevalence. How they might be solved is open to a variety of approaches; however, it is an established fact that a highly effective approach to problems of widespread commonality is one in which operating agencies join cooperatively to support, both in financial and other participatory respects, systematic research that is well designed, practically oriented, and carried out by highly competent researchers. As problems grow rapidly in number and escalate in complexity, the value of an orderly, high-quality cooperative endeavor likewise escalates.

Recognizing this in light of the many needs of the transit industry at large, the Urban Mass Transportation Administration, U.S. Department of Transportation, got under way in 1980 the National Cooperative Transit Research & Development Program (NCTRP). This is an objective national program that provides a mechanism by which UMTA's principal client groups across the nation can join cooperatively in an attempt to solve near-term public transportation problems through applied research, development, test, and evaluation. The client groups thereby have a channel through which they can directly influence a portion of UMTA's annual activities in transit technology development and deployment. Although present funding of the NCTRP is entirely from UMTA's Section 6 funds, the planning leading to inception of the Program envisioned that UMTA's client groups would join ultimately in providing additional support, thereby enabling the Program to address a large number of problems each year.

The NCTRP operates by means of agreements between UMTA as the sponsor and (1) the National Research Council as the Primary Technical Contractor (PTC) responsible for administrative and technical services, (2) the American Public Transit Association, responsible for operation of a Technical Steering Group (TSG) comprised of representatives of transit operators, local government officials, State DOT officials, and officials from UMTA's Office of Technical Assistance, and (3) the Urban Consortium for Technology Initiatives/Public Technology, Inc., responsible for providing the local government officials for the Technical Steering Group.

Research Programs for the NCTRP are developed annually by the Technical Steering Group, which identifies key problems, ranks them in order of priority, and establishes programs of projects for UMTA approval. Once approved, they are referred to the National Research Council for acceptance and administration through the Transportation Research Board.

Research projects addressing the problems referred from UMTA are defined by panels of experts established by the Board to provide technical guidance and counsel in the problem areas. The projects are advertised widely for proposals, and qualified agencies are selected on the basis of research plans offering the greatest probabilities of success. The research is carried out by these agencies under contract to the National Research Council, and administration and surveillance of the contract work are the responsibilities of the National Research Council and Board.

The needs for transit research are many, and the National Cooperative Transit Research & Development Program is a mechanism for deriving timely solutions for transportation problems of mutual concern to many responsible groups. In doing so, the Program operates complementary to, rather than as a substitute for or duplicate of, other transit research programs.

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The members of the technical committee selected to monitor this project and to review this report were chosen for recognized scholarly competence and with due consideration for the balance of disciplines appropriate to the project. The opinions and conclusions expressed or implied are those of the research agency that performed the research, and, while they have been accepted as appropriate by the technical committee, they are not necessarily those of the Transportation Research Board, the National Research Council, or the Urban Mass Transportation Administration, U.S. Department of Transportation.

Each report is reviewed and accepted for publication by the technical committee according to procedures established and monitored by the Transportation Research Board Executive Committee and the Governing Board of the National Research Council.

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The Transportation Research Board evolved in 1974 from the Highway Research Board, which was established in 1920. The TRB incorporates all former HRB activities and also performs additional functions under a broader scope involving all modes of transportation and the interactions of transportation with society.

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PREFACE

A vast storehouse of information exists on nearly every subject of concern to the transit industry. Much of this information has resulted from both research and the successful application of solutions to the problems faced by practitioners in their daily work. Because previously there has been no systematic means for compiling such useful information and making it available to the entire transit community, the Urban Mass Transportation Administration of the U.S. Department of Transportation has, through the mechanism of the National Cooperative Transit Research & Development Program, authorized the Transportation Research Board to undertake a series of studies to search out and synthesize useful knowledge from all available sources and to prepare documented reports on current practices in the subject areas of concern.

This synthesis series reports on various practices, making specific recommendations where appropriate but without the detailed directions usually found in handbooks or design manuals. Nonetheless, these documents can serve similar purposes, for each is a compendium of the best knowledge available on measures found to be successful in resolving specific problems. The extent to which these reports are useful will be tempered by the user's knowledge and experience in the particular problem area.

FOREWORD

By Staff
Transportation
Research Board

This synthesis will be useful to administrators, managers, schedulers, and others in the transit industry concerned with using part-time operators. Information is presented on the factors that influence the use of part-time operators and general guidance is given to assist in the consideration of part-time operators, within the context of a system's operating environment, labor agreements, and work rules.

Administrators, engineers, and researchers are continually faced with problems on which much information exists, either in the form of reports or in terms of undocumented experience and practice. Unfortunately, this information often is scattered and unevaluated, and, as a consequence, in seeking solutions, full information on what has been learned about a problem frequently is not assembled. Costly research findings may go unused, valuable experience may be overlooked, and full consideration may not be given to the available methods of solving or alleviating the problem. In an effort to correct this situation, NCTRP Project 60-1, carried out by the Transportation Research Board as the research agency, has the objective of reporting on common transit problems and synthesizing available information. The synthesis reports from this endeavor constitute an NCTRP publication series in which various forms of relevant information are assembled into single, concise documents pertaining to specific problems or sets of closely related problems.

In recent years transit systems have been employing part-time operators in an effort to improve productivity and reduce costs while maintaining the quality of transit

services. This report of the Transportation Research Board describes recent research on the use of part-time operators, and gives some guidance to transit managers who are considering the use of part-time operators. The synthesis gives information on the practices that are more likely to achieve the potential benefits to an agency from the use of part-time operators, even though the use of part-time operators is neither a panacea nor a prescription for the financial problems of a transit agency.

To develop this synthesis in a comprehensive manner and to ensure inclusion of significant knowledge, the Board analyzed available information assembled from numerous sources, including a large number of public transportation agencies. A topic panel of experts in the subject area was established to guide the researcher in organizing and evaluating the collected data, and to review the final synthesis report.

This synthesis is an immediately useful document that records practices that were acceptable within the limitations of the knowledge available at the time of its preparation. As the processes of advancement continue, new knowledge can be expected to be added to that now at hand.

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W. Campbell Graeub, Engineer of Public Transportation, of the Transportation Research Board, assisted the Project 60-1 Staff and the Topic Panel.

Information on current practice was provided by many transit agencies. Their cooperation and assistance were most helpful.

USE OF PART-TIME OPERATORS

SUMMARY

Many transit systems in the United States have introduced part-time vehicle operators into their work force in an attempt to improve productivity and reduce operating cost while maintaining or improving the quality of transit services provided to the public. The characteristics of the transit industry, such as service schedules, labor-agreement provisions, and vehicle operator work rules, offer a potential for savings through the use of part-time operators (PTOs). Consequently, the introduction of PTOs to the transit work force has generated considerable interest in such issues as:

- How can PTOs be best utilized by transit systems to achieve the greatest productivity improvements or cost savings?
- What methods exist to assist transit systems to attain these goals?

This synthesis addresses these questions and surveys a broad range of information and recent research on PTOs in the transit industry. The conclusion of the research summarized in this synthesis is that transit systems should consider using PTOs because they offer a more efficient way to provide service. However, it is prudent for transit managers and decision makers to approach their use with care since the use of PTOs is neither a panacea nor a prescription to remedy the ailments of financially troubled transit systems.

The exact level of potential savings at any individual system cannot be predicted without a direct examination of the transit system's operating environment, labor-agreement provisions, and work rules. In this content, to assist transit systems in their deliberations on utilizing PTOs to increase the cost-effectiveness of service delivery, the following guidelines are presented here and discussed in the final section of the synthesis.

- Understand how the transit service profile in combination with certain labor-agreement provisions influences the cost savings and productivity improvement potential of PTOs.
- Maximize the potential for savings and productivity improvement by avoiding, to the extent possible, labor-agreement provisions that limit management flexibility in the hiring and assignment of PTOs.
- Continue the practice of paying lower fringe benefits to PTOs to retain this method of saving through PTO use.

- Use computerized approaches to perform runcutting and PTO work assignments, and to maximize savings potential.
- Avoid erosion of potential savings by PTOs through increases in full-time employee wage rates.
- Evaluate all costs and benefits of using PTOs.

CHAPTER ONE

INTRODUCTION

Many transit systems in the United States have introduced part-time vehicle operators into their work force in an attempt to improve productivity and reduce operating cost while maintaining or improving the quality of transit services provided to the public. Because of the characteristics of the transit industry (such as service schedules, labor-agreement provisions, and vehicle operator work rules), there is a potential for savings through the use of part-time operators (PTOs). However, as these characteristics vary from system to system, so do the opportunities for savings and productivity improvement through the use of part-time operators.

Recent studies suggest that transit systems may have tended, to date, to pursue the introduction of part-time operators without carefully analyzing the timing of or total potential for savings. Such analyses are useful and should be performed as a first step toward achieving optimal use of, and therefore maximum savings and service improvements from, a part-time work force.

OBJECTIVES OF THIS SYNTHESIS

The introduction of PTOs to the transit work force has generated considerable interest in such issues as:

- How can PTOs be best utilized by transit systems to achieve the greatest productivity improvements or cost savings?
- What methods exist to assist transit systems to attain these goals?

This synthesis addresses these questions and surveys a broad range of information and recent research on PTOs in the transit industry. This includes:

- identifying transit systems that utilize PTOs,
- describing the utilization of PTOs in the delivery of transit services,
- describing the relationship of service characteristics of various transit systems to the benefits of utilizing PTOs,
- summarizing collective-bargaining provisions that constrain the productive use of PTOs,
- describing the methods used to allocate PTO work assignments, and
- suggesting guidelines for improving the use of PTOs.

ORGANIZATION OF THIS SYNTHESIS

The Introduction has touched on some concepts and concerns pertaining to PTOs in the U.S. transit industry.

Chapter 2 provides the historical background of the current use of PTOs by transit systems. It discusses transit systems' need to reduce operating costs and deficits and improve labor productivity; the growth in the utilization of PTOs by transit systems; and the perspectives of interest groups such as transit management, labor representatives, transit boards, and the public.

Chapter 3 includes four sections that discuss the transit service profile and relevant labor-agreement provisions. The chapter begins by describing the nature of the transit service schedule and the predominant types of vehicle operator work assignments within the service profile. The second section discusses transit work rules and labor agreement provisions that, when combined with the service profile and work assignments, result in certain costs and unproductive uses of full-time operators (FTOs). It is these costs and labor uses that have stimulated the introduction of part-time labor throughout the transit industry. The third section in Chapter 3 focuses more specifically on labor-agreement provisions that affect the cost and use of PTOs, and the final section summarizes the cost-savings potential of PTOs for transit systems.

Chapter 4 reviews the existing methods for assigning work to both part-time and full-time operators. This review takes into account the complexity of the service schedule and the requirements and costs associated with the labor agreement and work rule provisions. Although both manual and automated approaches for assigning work to vehicle operators are presented in this chapter, the advantages of the automated approaches are emphasized.

Chapter 5 discusses specific performance issues and costs associated with PTOs. These include costs often associated with acquiring the right to hire part-time labor during the contract negotiation process and the record to date of PTOs on absenteeism, accidents, and attrition. This chapter is based largely on the research of several organizations and academic institutions. As more transit systems are studied and as the use of PTOs increases, the body of research findings may tend to lead to different conclusions.

Chapter 6 briefly summarizes the overall conclusions of this synthesis and provides guidelines for the introduction and use of PTOs. It draws on the findings of the previous chapters to suggest how transit managers can attain the greatest cost savings and productivity improvement from part-time vehicle operators.

CHAPTER TWO

BACKGROUND

During World War II, a shortage of labor resulted in U.S. transit systems employing part-time conductors, ticket takers, and vehicle operators. The practice declined in the post-war period and, until 1978, there were very few U.S. transit systems that employed part-time labor. Today, part-time employees are frequently, although not universally, present in the transit work force. This change occurred over a short period of time and reflects heightened interest in cost savings and improved productivity.

COST SAVINGS AND PRODUCTIVITY IMPROVEMENT: THE IMPETUS FOR PART-TIME LABOR

During the past two decades, transit operating and capital costs have risen steadily. Although certain cost increases of the transit industry have kept pace with inflation or have been comparable to other industries, some costs have risen faster. During this period many transit systems "stabilized" their fares to encourage ridership. This fare policy (recently abandoned by most transit systems) in combination with increased costs resulted in a marked reduction in the proportion of operating costs financed by passenger fares.

Although public assistance provided relief to the transit industry, the deficits throughout the mid- and late 1970s, phasing out of federal support, and increased pressures on state and local government resources from numerous public programs have encouraged transit systems to seek cost-savings measures. Part-time labor, although not capable of eliminating deficits, is seen by the transit industry as one means of reducing the costs of operation.

The concern for cost savings is closely related to the interest in improving labor productivity. If the cost per unit of service delivery can be reduced by the effective use of part-time labor, transit systems may reduce operating costs and/or expand service delivery within current operating budgets.

HISTORICAL HIGHLIGHTS ON PART-TIME LABOR

In 1963 and 1967 the American Transit Association (ATA), the predecessor of the American Public Transit Association (APTA), conducted surveys on the use of part-time employees. The 1963 survey included two questions addressing (a) whether the transit systems had any part-time or temporary vehicle operators, and (b) whether full-time operators were assigned work other than driving to make up the guaranteed work day. The phrase "guaranteed work day" refers to the practice of assuring all full-time employees at least eight hours of pay each day, irrespective of whether they work fewer hours.

Of the approximately 100 transit systems that responded to the 1963 survey, 73 responded negatively to both questions. Twenty-one of the transit systems indicated that they used part-time or temporary operators. Respondents stated that three types of work were filled by these employees: rush-hour service, school service, and vacation relief. At most of these systems, the PTOs were required to join the union, pay union initiation fees and dues, and purchase their own uniforms. Only one of the transit systems indicated that their PTOs were paid less than the comparable FTO wages. In this case, PTOs were paid 25 percent below top FTO wages and were used only to provide school service during the school year.

The Chicago Transit Authority was the largest transit system to indicate in the 1963 ATA survey that it had PTOs. At that time, these employees substituted for full-time employees who were on vacation. Other larger cities whose transit systems employed PTOs in 1963 included St. Louis, Missouri and Miami, Florida. Both of these systems employed PTOs to provide school service. The remaining 18 transit systems that reported that they employed PTOs were from smaller urban areas such as Newport News, Virginia; La Crosse, Wisconsin; Lewiston, Maine; and Eau Clair, Wisconsin.

The 1967 ATA survey asked the transit systems whether they had attempted to hire PTOs and if so, what questions were raised by their union representatives. One hundred and twenty-two transit systems responded to this survey. Only 11 transit systems indicated that they employed part-time employees, each on a very limited basis (generally to provide school service). The comments of the transit systems in the 1967 survey suggest that PTOs were resisted or opposed by union officials. In addition, these responses suggest that PTOs were viewed primarily as a means to ensure service delivery in response to vehicle operator absenteeism or tardiness. Among the 122 respondents, no comments were made regarding use of PTOs to reduce costs or improve productivity.

A review of the literature on labor productivity in the transit industry in the mid-1970s suggests that although cost savings and improved labor productivity were recognized as important concerns, the use of part-time labor to improve the performance of transit systems was not widely considered. In May 1976, the United States Department of Transportation (USDOT) published a report entitled "Labor in the Transit Industry." This report addressed:

- employment and compensation;
- labor management relations;

- Section 13(c) and transit labor protection; and
- labor productivity in the transit industry.

Part-time labor was not mentioned in this report. Although the report commented on the stable or declining productivity of transit systems, it suggested solutions such as modified vehicles (e.g., double-decker), technology improvement, and improved labor-management relations.

Less than two years after the USDOT report was published, the Seattle METRO labor agreement included a provision for part-time employees. Within five years, a large majority of U.S. transit systems had made similar, although generally more restrictive, provisions for employing part-time labor.

WIDESPREAD INTRODUCTION OF PART-TIME OPERATORS

In 1978, three major U.S. transit systems acquired the right to hire part-time employees. The Municipality of Metropolitan Seattle, the first to achieve a provision for PTOs, negotiated a new contract in April 1978 that permitted it to hire as many part-time as full-time vehicle operators (up to 700 at that time). Later in 1978, the Washington Metropolitan Area Transit Authority (WMATA) and Baltimore's Mass Transit Administration (MTA) each won, through arbitration, the right to hire up to 10 percent of their operators as PTOs. At the time, this represented 270 PTOs for WMATA and 145 for MTA. In each case, certain job security protections were provided to full-time operators already employed.

Since 1978, provisions allowing employment of PTOs have been widespread. In most cases PTOs have been introduced through collective bargaining or arbitration. In some cases the introduction of PTOs has involved actions of the state legislature or federal courts. For example:

- In California in 1979 the legislature specified that eligibility for state financial assistance for transit operating expenses required that the transit system's labor agreement not preclude the use of part-time operators.
- In December 1980 the governor of Massachusetts signed an act that gave the management of the Massachusetts Bay Transportation Authority (MBTA) the right to hire and assign part-time employees as it thought appropriate, notwithstanding previous collective-bargaining agreements and past labor prac-

TABLE 1

LARGE U.S. TRANSIT SYSTEMS THAT EMPLOY PART-TIME OPERATORS: SPRING 1984

Urbanized Area/Place	Total No. of Full-Time Employees	Number of Full-Time Vehicle Operators	Number of Part-Time Vehicle Operators	PTOs as Percentage of FTOs
Atlanta, Georgia	2,639	1,229	34	2.8
Baltimore, Maryland	2,527	1,306	83	6.4
Boston, Massachusetts	5,934	1,850	333	18.0
Buffalo, New York	990	590	1	0.2
Chicago, Illinois (RTA)	2,370	967	85	8.8
Cincinnati, Ohio	888	513	30	5.8
Cleveland, Ohio	2,340	1,171	16	1.4
Dallas, Texas	1,041	631	30	4.7
Denver, Colorado	1,666	882	24	2.7
Honolulu, Hawaii	1,166	717	4	0.6
Houston, Texas	2,352	1,295	12	0.9
Kansas City, Missouri	630	368	29	7.9
Los Angeles, California				
SCRTD	8,455	4,612	476	10.3
Orange County	1,431	830	44	5.3
Louisville, Kentucky	676	435	37	8.5
Miami, Florida	2,384	1,011	1	0.1
Milwaukee, Wisconsin	1,446	939	53	5.6
Minneapolis-St. Paul, Minnesota	2,096	1,232	100	8.1
New York (Westchester County)	674	409	29	7.1
Phoenix, Arizona	607	355	46	12.9
Portland, Oregon	1,650	963	103	10.7
Sacramento, California	586	329	16	4.9
Salt Lake City, Utah	747	411	17	4.1
San Antonio, Texas	953	589	2	0.3
San Diego, Caligornia	770	484	31	6.4
San Francisco, California				
AC Transit	2,144	1,415	60	4.2
Golden Gate	562	365	62	17.0
MUNI	3,981	1,763	210	11.9
San Mateo	542	351	18	5.1
San Jose, California	1,597	858	58	6.8
Seattle, Washington	1,947	1,117	882	79.0
Washington, D.C.	7,019	2,705	249	9.2
Average	2,025	1,022	99	8.9

[a] APTA, Statistical Reference Report No. 3, Number of Employees by Type (July 23, 1984)

tices. The Federal Appeals Court subsequently affirmed the legality of the act and in January 1982 the MBTA introduced the first PTOs into its bus service.

- In Illinois the 1983 revisions to the state legislation for the Chicago Transit Authority (CTA) states that collective-bargaining agreements may not prohibit the use of part-time labor, except where prohibited by federal law. Subsequently, the introduction of PTOs was one of many issues addressed in the CTA labor negotiations of early 1985.

In July 1984, APTA reported that of its 278 U.S. member organizations, 213 (or 76 percent) employed part-time employees and, of these systems, 175 had PTOs. Table 1 presents selected data prepared by APTA identifying 32 U.S. transit systems, each with more than 500 total employees, that employed PTOs in mid-1984. Table 2 complements Table 1 by identifying the remaining APTA member transit systems, each with more than 500 total employees, that did not employ PTOs in mid-1984.

Some observations from these data are:

1. Of the 54 U.S. transit systems with more than 500 full-time employees, 32 employ PTOs and 22 do not.
2. Of the eight U.S. transit systems that have more than 5,000 full-time employees, three systems employ PTOs: SCRTD, WMATA, and MBTA. Five systems do not: NYCTA/MABSTOA, CTA, SEPTA, NJ Transit, and LIRR.
3. Seattle METRO's PTO work force is the largest, representing 79 percent of its FTOs. Boston's MBTA has the second highest proportion of PTOs representing 18 percent of FTO work force.
4. The U.S. transit systems with PTOs have on average 8.9 percent of their FTO work force as PTOs.
5. Of the 22 U.S. transit systems that do not employ PTOs, half employ other part-time employees.

At this time, although many transit systems have provisions to employ PTOs and other part-time employees, the transit work forces are still largely composed of FTOs with the exception of Seattle METRO.

TABLE 2

LARGE U.S. TRANSIT SYSTEMS THAT DO NOT EMPLOY PART-TIME OPERATORS: SPRING 1984

Urbanized Area	Number of Full-Time Employees	Number of Full-time Operators
Chicago, Illinois (CTA)	11,979	5,688
Columbus, Ohio	697	441
Detroit, Michigan		
Department of Transportation	1,870	1,111
SEMTA	823	446
Fort Lauderdale, Florida	513	319
Connecticut Transit	806	548
New Jersey Transit	7,696	3,062
New Orleans, Louisiana	1,234	655
New York, New York		
NYCTA & MABSTOA	47,897	12,221
Metro Suburban Bus Authority	862	494
Long Island Rail Road	7,076	1,694
Metro North Commuter RR	5,705	879
Port Authority Trans Hudson	1,129	158
Liberty Lines	516	311
Queens Transit	514	267
Philadelphia, Pennsylvania	7,661	2,815
Pittsburgh, Pennsylvania	2,872	1,598
Providence/Newport, Rhode Island	529	347
Rochester, New York	556	325
St. Louis, Missouri/Illinois	1,929	1,098
San Francisco, California (BART)	2,144	234
San Juan, Puerto Rico	1,436	715
Average	4,838	1,610

[a] APTA, Statistical Reference Report No. 3, Number of Employees by Type (July 23, 1984)

PERSPECTIVES OF AFFECTED INTEREST GROUPS

To date, the perspectives of affected interest groups regarding the introduction of part-time labor to the transit industry are not extensively documented. Most papers or articles on PTOs do, however, provide some conjecture on the perspectives of transit management, labor representatives, and the public regarding PTOs that seem intuitively correct.

Transit Management

Transit management views the introduction of part-time labor as a means of providing added flexibility for management decision making and an opportunity for cost savings or productivity improvements in the delivery of transit services. The use of PTOs has been cited by management as a means of giving employees more choice regarding the length of the work day and type of work; enabling employees to satisfy the demands of their families and social lives; and prolonging employees' ability to continue working on a limited basis, as an alternative to early retirement.

Transit board members, like transit management, generally seem to view part-time labor as a means for cost savings or providing more service to the public within the current funding levels. As long as transit service quality, safety, and reliability are maintained and labor-management relations are not injured, transit boards seem to look favorably on the use of PTOs.

Labor Representatives and FTOs

Labor representatives and FTOs have reportedly expressed some concerns about the new labor practices and believe they may signal the loss of benefits, wages, and job security to union members. These benefits and working conditions have been attained through years of negotiation attempting to overcome the low wages, long work days, and difficult work hours of the transit industry. A related concern is that FTOs' right to select desirable work shifts, a right based on seniority in the transit industry, will be eroded, particularly if PTOs are assigned to work on weekdays thus leaving many weekend shifts to the FTOs.

Labor representatives have also reportedly had a number of concerns for the new part-time employees, including concerns about:

- working conditions, compensation, and benefits for PTOs;
- competence and reliability of PTOs;
- potential problems between FTOs and PTOs; and
- union or non-union status of PTOs.

The Public

The public is generally unaware of PTOs. Some transit systems have even sought to assign their PTOs to the same routes and schedules as a means of providing consistent service and familiar vehicle operators to the public. In addition, currently there are so few PTOs at most transit systems, it is unlikely that the public can detect the impact of this work force on their transit system. To the extent that public funds are saved without service interruption or degradation, one presumes that the public responds favorably to the current use of PTOs by transit systems. The issues raised here and related issues are discussed in greater depth in the remainder of this synthesis.

CHAPTER THREE

FACTORS THAT INFLUENCE THE USE OF PART-TIME OPERATORS

Part-time operators provide an opportunity for cost savings and productivity improvement in transit systems because of the combined effects of transit service schedule characteristics, labor-agreement provisions, and work rules on the assignment of work to vehicle operators. It is important to begin by stating that each transit system is likely to be unique with respect to its combined service and labor environment. Consequently, while generalizations can be made about the potential for cost savings and productivity improvement through the use of PTOs, the situation at each transit system will be unique and may change with time as service characteristics, labor-agreement provisions, and work rules change.

This chapter includes four sections on PTOs and their potential effect on transit service costs and labor productivity. The first section describes the transit service profile and the predominant types of FTO work assignments. The second section discusses transit work rules and labor-agreement provisions that result in unproductive use of FTOs when combined with the service profile. The third section focuses more specifically on the labor-agreement provisions that currently affect the cost and use of PTOs. The fourth and final section summarizes the cost savings potential of PTOs considering the transit service profile and certain key characteristics of transit labor agreements and work rules.

Figure 1 illustrates how labor-agreement provisions and work rules for both full- and part-time vehicle operators interface with the service schedule profile to influence vehicle operator work assignments and cost-savings potential achievable by transit systems. The remainder of this chapter discusses each element of this figure.

TRANSIT SERVICE PROFILE AND FULL-TIME OPERATOR WORK ASSIGNMENTS

The transit service schedule is a product of transit service planning in which routes and vehicle-service frequency along these routes must conform to public policy and passenger demand for service. Consequently, transit services typically exhibit an uneven service profile in which more service is provided during the morning and evening work-trip rush hours than at other periods of the day. Figure 2 illustrates a two-peaked transit service delivery pattern, which is typical of many transit systems in the United States.

The extent of peaking varies from place to place, both in terms of the difference between peak and midday base service (i.e., peak-to-base ratio) and the time between the beginning of the morning peak and ending of the evening peak (i.e., peak shoulder duration time). The number of hours transit services are provided each day, the level of service, and the peaking characteristics directly influence the number of vehicle operators necessary to provide the service at any given time during the day. Figure 3 shows the service profile presented in Figure 2 and identifies the three types of vehicle operator work assignments typically required in the conduct of a transit service schedule: straight runs, split runs, and trippers.

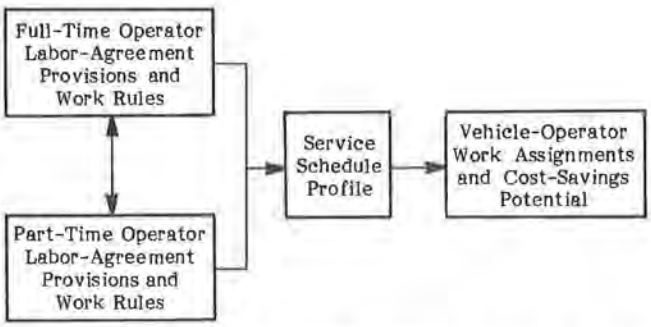

FIGURE 1 Interface of labor-agreement provisions and work rules with the service schedule profile that influences work assignments and cost-savings potential.

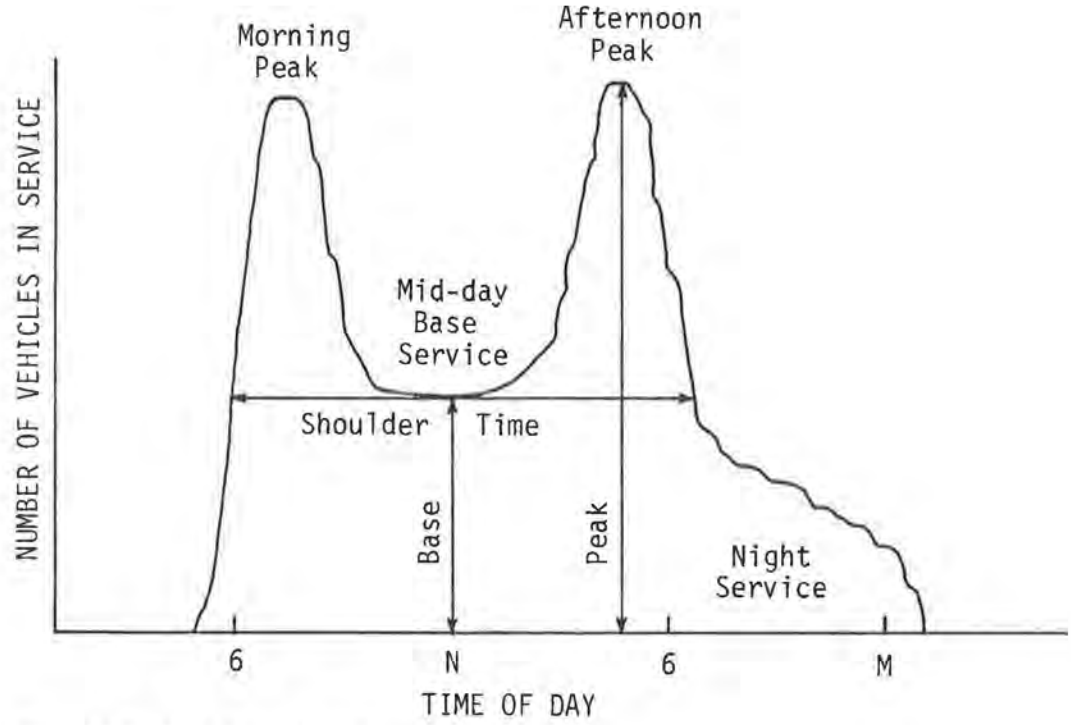

FIGURE 2 Typical transit service profile.

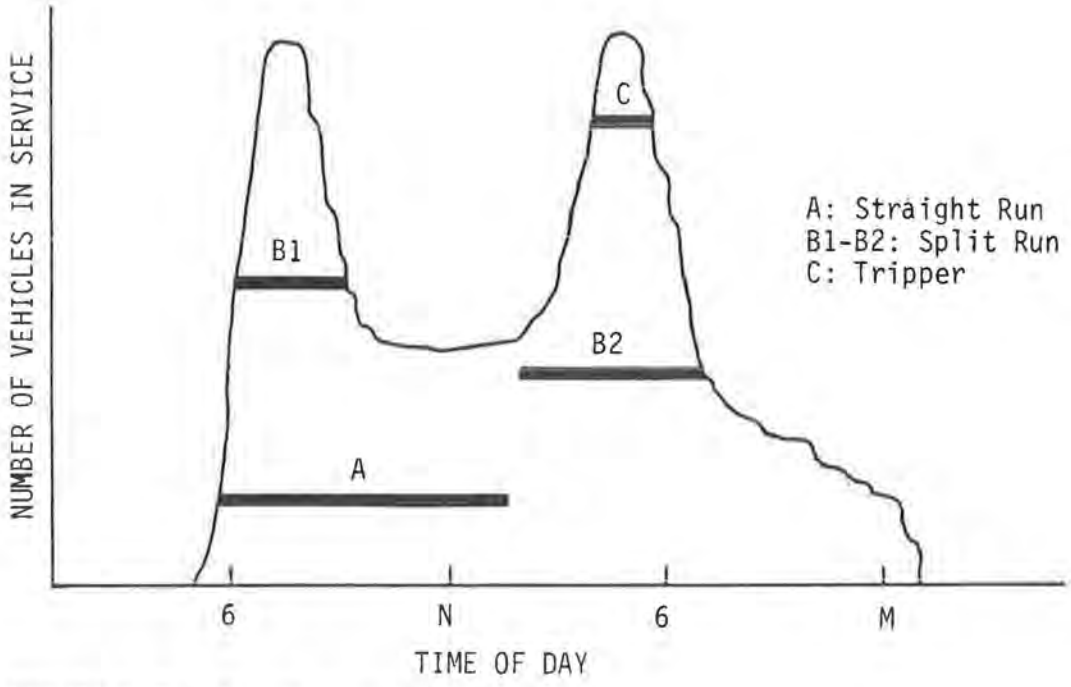

FIGURE 3 Typical transit operator work assignments.

Straight Runs

Straight runs are continuous operating work assignments, generally about 8 hours in duration. The actual productive time (i.e., time spent providing transit service to the public) may be less because the vehicle operator is allowed time to:

- prepare for the work assignment,
- reach the beginning or terminal of the route (deadheading),
- break for rest or meals,
- layover at scheduled stops, and
- check in at the end of the work assignment.

Straight runs are considered the most efficient type of work assignment by transit management because they provide the greatest amount of revenue service per operator pay hour. In addition, these work assignments are generally considered the most desirable type of work by vehicle operators because they are preset, predictable, and involve a reasonable work day.

Split Runs

Split runs are work assignments broken into two or more pieces with time off between each work piece. These assignments result primarily from the unevenness of the service profile (i.e., the peak hours) and are frequently less efficient to operate than straight runs. The example in Figure 3 shows a split run in which an FTO's work assignment consists of 3 hours in the morning from 6 am to 9 am (B1) and 5 hours in the afternoon from 2 pm to 7 pm (B2). Although the operator is only required to work 8 hours in this example, the work is spread over a period of 13 hours, creating a very long work day.

Trippers

Trippers are short driving assignments that cannot be combined with other assignments to form a full day's work. Like split runs, these work assignments generally result from the unevenness of the service profile and are often the most expensive type of service to provide. Trippers are expensive when operated by FTOs because (a) overtime pay may be incurred if the tripper is conducted in addition to a straight run, or (b) unproductive time may be incurred for which a full day's pay is guaranteed if no other work is available for assignment.

LABOR-AGREEMENT PROVISIONS AND WORK RULES AFFECTING THE USE OF FULL-TIME OPERATORS

Specific work rules and pay practices for FTOs have evolved largely in response to the two-peak service profile and the resulting vehicle operator work assignments. Figure 4 illustrates common types of labor-agreement provisions and work rules that have been developed and instituted through the transit collective-bargaining process. The precise language of labor agreements varies from place to place as do the number and combination of provisions included in the agreements. As the interaction of labor-agreement provisions, work rules, and the characteristics of the service schedule determine the cost of transit services, the differences in these factors determine the relative cost-effectiveness of service operation among transit systems.

The labor-agreement provisions and work rules identified in Figure 4 fall into two general categories: FTO compensation practices and FTO work assignment provisions. It is the cost effects of these two categories that make the use of PTOs attractive to transit managers. Stated very simply, the following can be said about the effects of the labor agreement provisions for FTOs in conjunction with the service schedule:

- FTO compensation practices typically protect the FTO by requiring payment, often at premium rates, for onerous or undesirable working conditions. These provisions result in payment beyond base wage rates and benefits for most long work assignments or provide a full day's pay for less than a full day's work assignment to FTOs.
- FTO work assignment provisions typically limit the overall duration of the work day and number of onerous work assignments for FTOs. Although these provisions protect the vehicle operator, they also result in: (a) an unproductive use of labor (such as the provision of service when there may be little ridership during the midday base period); (b) the creation of additional work assignments, which can increase the work-force size requirements (such as trippers that may receive supplemental or guarantee pay); and (c) added complexity of the vehicle operator work assignment process.

Because the labor-agreement provisions and work rules are interdependent, it is difficult if not impossible to ascertain the effect of a given labor-agreement provision or work rule without considering its precise relationship to the other rules and the service schedule. A proper examination of labor-agreement and work-rule impacts on operating costs often relies on time-consuming manual or more sophisticated automated techniques, which will be discussed subsequently in this synthesis.

LABOR-AGREEMENT PROVISIONS AND WORK RULES AFFECTING THE USE OF PART-TIME OPERATORS

The introduction of part-time operators at transit systems has been accompanied by new labor-agreement provisions and work rules. These new provisions and rules, in combination with the service schedule and the labor-agreement provisions and work rules for FTOs, determine the extent of PTO utilization and the potential for cost savings or productivity improvements.

A recent study of PTOs characterizes the typical PTO at a U.S. transit system as (*1*):

- a union member,
- paid at or near the FTO wage scale,
- permitted to work only tripper service,
- receiving no guarantee or premium pay per work assignment,
- receiving reduced fringe benefits compared to full-time counterparts,
- not having transferable seniority, and
- generally laid off before any FTOs.

FTO COMPENSATION PRACTICES

Overtime Premium This provision provides additional compensation to operators working more than a specified daily or weekly number of hours (typically 8 hours per day or 40 hours per week). The additional compensation is generally half the operator's normal hourly wage rate applied to the overtime hours.

Guarantee Pay This labor-agreement provision stipulates that all full-time operators be paid a full day's wages (e.g., 8 hours per day) regardless of whether or not they are assigned productive operating work. For example, a full-time operator may only conduct a single 3-hour tripper but would be compensated for 8 hours of work.

Spread Premium This provision provides additional compensation to full-time operators for work whose duration extends beyond a specific number of daily hours. The additional compensation is typically in the form of a wage rate premium (e.g., 50% of the regular wage rate) attached to all hours worked beyond the specific number. For example, if an operator works a split run whose actual operating work constitutes 8 pay hours but whose assignment begins at 6 am and is completed at 6 pm, the total spread duration of the work assignment is 12 hours. If spread premium is paid for all time beyond 11 hours, then the actual pay hours for conducting the assignment would be equal to 8 hours plus 50% of the wage rate for one hour (12-hour duration minus 11-hour spread rule) or 8.5 hours of pay.

Pyramiding A term denoting the practice of paying more than one wage premium for the same work (e.g., paying both overtime and spread premium). Using the same spread situation cited in the example under Spread Premium, if the operating work assignment were a 9-hour split run, a pyramiding contract provision might compensate the operator with 9 pay hours for spreadtime premium or a total of 10 total pay hours.

Other Premiums Included in this category would be premiums for shift work (e.g., night hours), operating special equipment (e.g., articulated buses), and tripper premiums (e.g., all trippers pay time and one-half the regular wage rate).

Intervening Pay This provision provides for pay to full-time operators, generally at regular wages, for the time between split runs if such time is less than a specified number of hours (typically one hour). The effect of this provision may cause split runs to be paid as if they were a continuous straight run.

FTO WORK ASSIGNMENT PROVISIONS

Percentage of Straight Runs This provision specifies the minimum percentage of all runs that must be straight or continuous work assignments. This may result in artificially increased intervening pay or require split runs to be broken into trippers resulting in increased guarantee and overtime premium pay.

Maximum Spread This provision limits the duration of an operator's work day. It may have the effect at certain transit systems of creating more tripper work assignments, particularly if the time between the beginning of the A.M. peak and end of the P.M. peak is long. Also, it may prohibit the advantageous assignment of certain trippers to full-time operators at overtime and require the employment of extra full-time operators to conduct the work. These operators increase the fixed fringe-benefit costs of the transit system and may incur added wage guarantee payments.

Coupling Provision This provision requires that any two pieces of work that can be combined into a split assignment (e.g., an A.M. tripper and a P.M. tripper) and whose total work time exceeds a specified number of hours (e.g., 7 hours), must be made into a run guaranteeing a full day's pay. The effect of this type of provision may be to increase the payment of full-time operator wages for less than a full day's operating work.

FIGURE 4 Common types of pay practices and work assignment provisions affecting the utilization of full-time operators.

Transit labor-agreement provisions and work rules affecting the use of PTOs fall into the same categories as FTOs:

1. PTO compensation practices, and
2. PTO work assignment provisions.

PTO Compensation Practices

Use of PTOs can achieve operating cost reductions at transit systems partly because of the way PTOs differ from FTOs in three kinds of compensation:

1. Wage rates
2. Guarantee and premium pay
3. Fringe benefit costs

The current practices of the transit industry in each of these areas and the potential for savings offered by the use of PTOs are summarized as follows.

Wage Rates

At most transit systems PTOs are paid the same top wage as FTOs with equal seniority. About 25 percent of the transit systems that responded to APTA's 1984 survey question on top operator wage indicated that their PTOs are paid less than FTOs; about half were being paid 80 to 90 percent of the FTO top wage and half paid less, from 48 to 77 percent of the FTO top wage rate.

However, despite the comparability of top operator wage rates, PTOs on average are paid a somewhat lower wage rate than FTOs because of wage-rate progression. The time in service based on hours of work required to attain the top wage rate is often the same for FTOs and PTOs. Consequently, while it generally takes an FTO about 2½ years to attain top wage, it may take a PTO almost 3½ years. Because PTOs are a new addition to most transit systems and lack tenure, many have not yet attained top pay rates. Nevertheless, the cost-savings potential of PTOs resulting from PTO/FTO wage differences is not substantial, since the difference in wage rates is not great in most cases.

Guarantee and Premium Pay

A more significant difference in wage payment practices for PTOs is that they do not generally receive guarantee payments or any operating premiums such as spread and overtime compensation. Some transit systems indicate that they guarantee pay to their PTOs but this is generally two hours pay per day, with one system reporting a guarantee as low as one-half hour's pay per day and two transit systems reporting the high guarantee of four hours pay per day for PTOs.

Because they do not receive guarantee or premium pay, PTOs are a more efficient means of providing tripper and split-run work assignments. A PTO may be assigned one four-hour tripper without receiving guarantee pay for an eight-hour workday or may work two trippers without incurring spread premium pay. In short, the use of PTOs allows transit systems to better match vehicle operator work assignments with the transit service profile while reducing guarantee, overtime, and other premium pay.

Fringe Benefits

Fringe benefits represent an important cost to transit systems, averaging approximately 50 percent of industry wages and salaries. The difference in fringe benefits between PTOs and FTOs is generally substantial. The large majority of transit systems provide neither sick pay, holiday pay, vacation pay, health insurance, nor retirement benefits to PTOs. The only benefits provided by the majority of transit systems to PTOs are free transportation and uniforms. In many cases where some or all benefits are provided, they are at reduced rates or proportional to the hours worked.

The left side of Table 3 summarizes the fringe benefits provided to PTOs based on APTA's May 1984 data on comparative labor practices for PTOs. An interesting observation about PTO benefits can be made by comparing the information on both halves of Table 3. The comparison suggests that the proportion of transit systems in each category providing no benefits is decreasing while the proportion providing reduced benefits or benefits comparable to FTOs' is increasing. This indicates that as PTOs become more widespread they are increasingly receiving fringe benefits, as well as wages, comparable to full-time employees. This may, over time, reduce the cost-savings potential of PTOs except for the savings attained through reduced guarantee and premium pay.

Chomitz and Lave (*2*) conducted an analysis of PTO cost-savings potential at five transit systems. Their research examined the effect of full (i.e., prorated by hours worked) and reduced fringe benefits (i.e., at 10 percent of the wages). Figure 5 shows the results of their research and indicates an average savings of about 2 percent of the total operator cost (i.e., operator wages and fringe benefits) attributable to reduced fringe benefits. Al-

TABLE 3

PART-TIME OPERATOR BENEFITS

	Percentage of Agencies					
	1984[a] PTO Benefits Compared to FTO			1983[b] PTO Benefits Compared to FTO		
Benefit	Same	Less	None	Same	Less	None
Sick leave	15	15	70	10	13	77
Holiday pay	17	21	62	12	17	71
Vacation	15	25	60	13	23	64
Health insurance	18	25	57	15	17	68
Retirement	24	11	65	21	7	72
Free transportation	37	14	49	n.a.	n.a.	n.a.
Uniform	42	24	34	n.a.	n.a.	n.a.

[a] APTA, Comparative Labor Practices Report No. 5, Part-Time Operators (5/31/84). 176 agencies.

[b] APTA, Comparative Labor Practices Report No. 4, Part-Time Operators (4/83). 112 agencies.

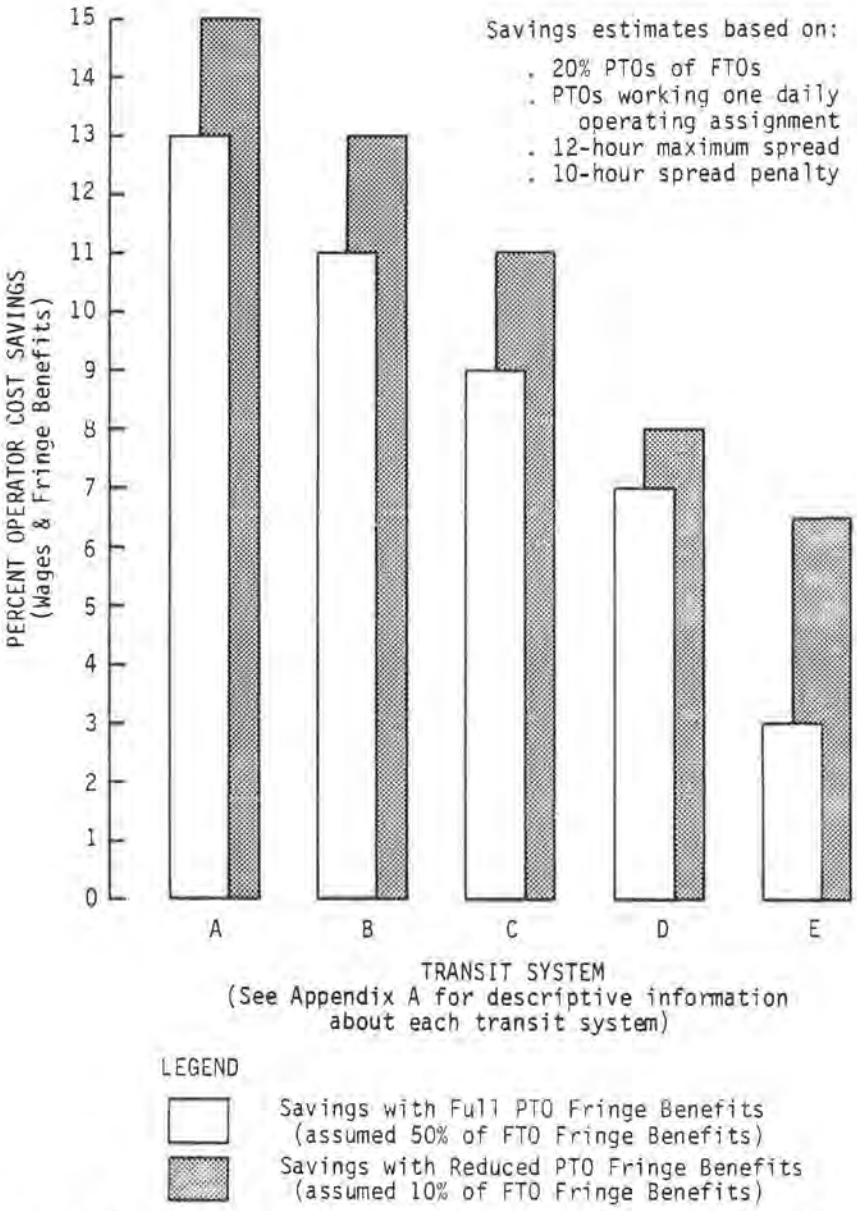

FIGURE 5 Effect of fringe benefits on the cost-savings potential of part-time operators (adapted from *2*).

though 2 percent may seem small, savings potential attributable to reduced fringe benefits of PTOs may range from:

- *Case A*—about 10 percent of the total cost savings, owing to the utilization of PTOs under service schedule conditions with a high peak-to-base ratio and narrow spread-time rules; to
- *Case E*—more than 50 percent of the total cost savings, owing to the utilization of PTOs under service conditions with a low peak-to-base ratio and wider spread-time rules.

The research suggests that granting increased fringe benefits to PTOs is much more critical to the preservation of cost savings at transit systems with lower peak-to-base ratios and relaxed (i.e., wide spread time) rules than it is to transit systems with higher peak-to-base ratios and strict (i.e., narrow spread time) rules.

PTO Work Assignment Provisions

Contract language often limits the effective or total use of PTOs by transit systems. PTO work assignment provisions are typically stated in terms of restrictions in one or more of the following areas:

- the number of PTOs,
- the number of hours and days worked by PTOs,
- the length of PTO work assignments,

- type and time of work assignment available to PTOs, and
- restrictions on the hiring of PTOs and the reduction of FTOs.

In each case the limitations may reduce the cost savings and productivity improvement potential of PTOs. APTA's Comparative Labor Practices Report No. 5 indicated that transit systems actually employed only 60.5 percent of their permitted number of PTOs as of March 1983.

Limitations on the number of PTOs that can be hired were found in 49 percent of the 176 transit systems that permit hiring of PTOs (as reported to APTA in 1984). The transit systems that included this type of limitation typically stated that the maximum number of PTOs would be determined as a percentage of the FTO work force. The restrictions ranged from 5 to 100 percent of the FTO work force and averaged about 15 percent. Some transit systems specify an actual number of PTOs allowed while others limit the number of PTOs based on service characteristics such as the number of scheduled or biddable runs, unassigned trippers, or peak-hour trippers. Other transit systems specify the limitations on PTOs on a division or garage basis rather than systemwide.

Limitations on the number of hours or days worked and the length of work assignments for PTOs are generally designed to prevent PTOs from operating runs and to restrict them to trippers or special assignments. Consequently, it is common to find restrictions in labor agreements on the maximum length of daily work assignments for PTOs. About 75 percent of transit systems with PTOs impose daily work-hour restrictions and over 75 percent restrict the weekly amount of work for PTOs. Also, 46 percent specify that the maximum hours per week will be between 20 and 30 hours. In some cases, a minimum duration for work (i.e., guarantee) is also specified on a daily or weekly basis. In addition, provisions in the labor agreement may also limit PTOs to weekday work only.

Limitations on the types and times of work assignments that can be operated by PTOs also exist. More than 100 of the 176 transit systems that permit PTOs (as reported to APTA in 1984) indicated that they had no restrictions on the types of work that could be performed by PTOs. Those that had limitations specified that PTOs could only provide tripper service (generally on weekdays), school service, or other special services.

PTOs are sometimes restricted from working trippers that entail road reliefs. This restricts available work to garage-to-garage assignments. Some transit systems specified that existing FTO work assignments not be divided as a means of creating additional trippers for PTOs. However, because of schedule and service changes over time, this restriction has been found to be generally unenforceable.

Restrictions on the hiring of PTOs and reduction of FTOs have typically been included in labor agreements to maintain the current number of FTO jobs or ensure the job security of existing full-time employees. These provisions have been stated in a variety of ways, such as:

- no reductions may be made in the current (or some specified) number of FTO positions,
- no FTOs can be laid off until all PTOs are laid off,
- FTOs must be hired back before PTOs may be hired or rehired,
- PTOs can be hired to fill positions only through attrition of FTOs or through service expansion,
- PTOs cannot be assigned work if the work could be coupled into a full-time work assignment.

These provisions, in combination with the others discussed above, often prevent transit systems from filling all the PTO positions or work hours allowed in the labor agreement, causing an underutilization of PTOs. This is particularly true for transit systems that are not expanding or that are actually reducing their service level. The current financial position of many transit systems makes expansion of service, even expansion restricted to peak hours, infeasible. Similarly, attrition rates of FTOs have been low, in part, because of recent high unemployment rates. Many transit systems have found that they will not be able to fully use their PTO allowance unless other provisions in their labor agreement are changed or that it may take a number of years to fill the available positions because of provisions that currently affect the hiring or use of PTOs.

SUMMARY: COST SAVINGS POTENTIAL OF PART-TIME OPERATORS

Chomitz and Lave (*2*) concluded that savings from PTO utilization would vary from 2 to 15 percent with a typical cost savings potential of about 6 percent of the total operator cost. The differences in savings potential, as shown by three scenarios in Figure 6, reflect differences in work rules for various service schedules.

The horizontal axes in each part of the figure represent the percent of potential operator cost savings (i.e., based on vehicle operator wages and benefit costs.) The vertical axes show different peak-to-base ratios ranging from no peak (at 1) to a highly peaked service profile (with 4 times more service in the peak period than base period). The shaded bands in each figure show the range of potential cost savings under different spread rules. The left boundary shows the minimum potential savings presuming that PTOs represent only 10 percent of the FTO work force and work only one assignment each day. The right boundary shows the maximum potential savings presuming that (a) PTOs represent 20 percent of the FTO work force and work one assignment per day, or (b) PTOs represent 10 percent of the FTO work force and work two assignments per day.

Three examples are shown and discussed below to illustrate how the graphs in Figure 6 can be used in estimating potential operator cost savings when PTOs are introduced to the transit work force.

- *Case A*—Under a 12-hour maximum spread and a 10-hour spread penalty, a transit system with a peak-to-base ratio of 3.4 might expect to save around 14 percent of its operator costs if the number of PTOs are 20 percent of the FTO work force and are permitted a single daily work assignment. The potential cost savings might be about 7 percent if PTOs are 10 percent of FTO work force and are permitted to work one assignment per day.
- *Case B*—Under a 13-hour maximum spread and a 10-hour spread penalty, a transit system with a peak-to-base ratio of 2.4 might expect to save approximately 6 percent of its operator costs if the number of PTOs are 20 percent of the FTO work force and are permitted to work one assignment per day. The

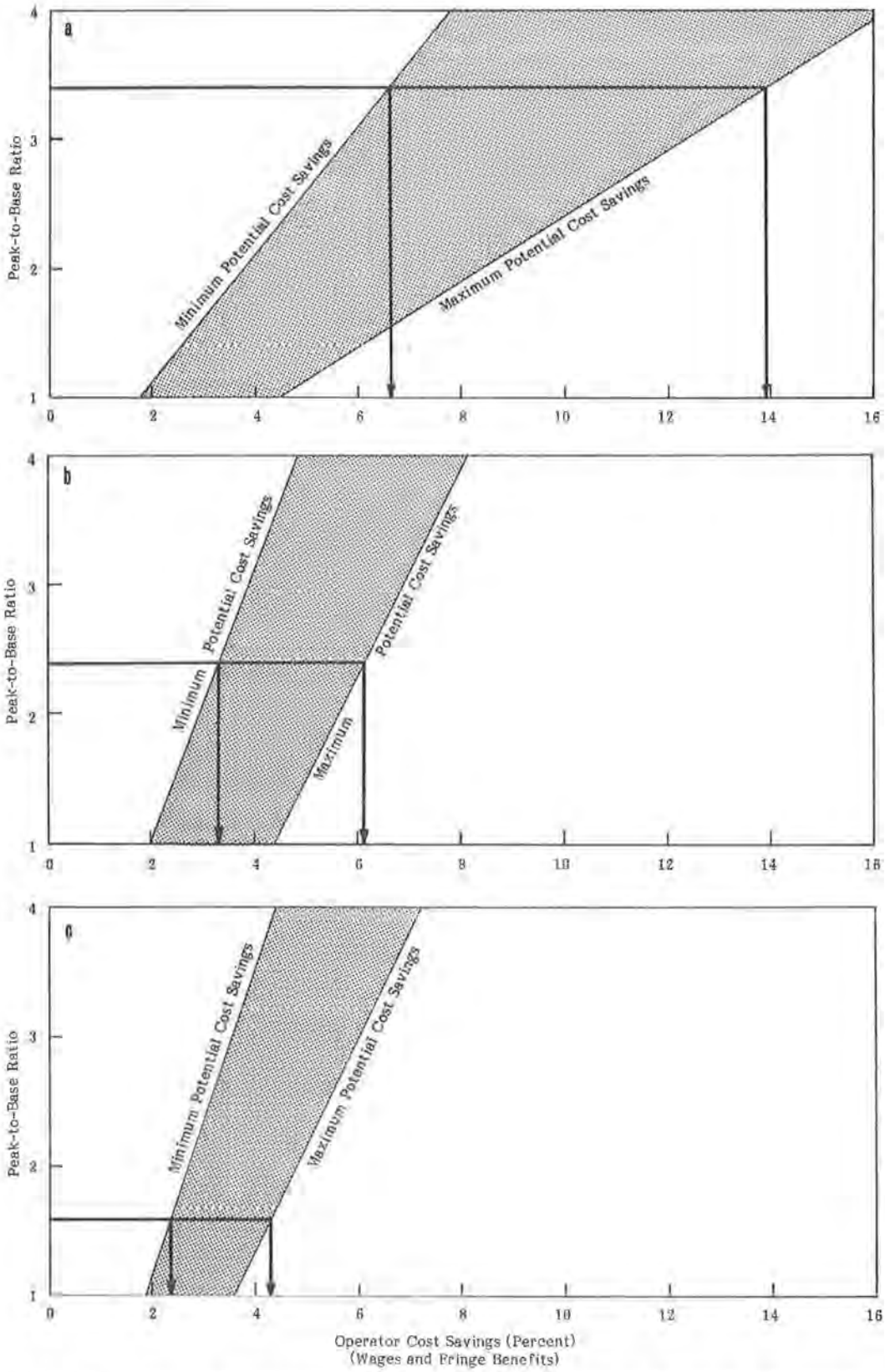

FIGURE 6 Effects of the vehicle service profile and FTO spread rules on the cost-savings potential of PTO use (a) under a 12-hr maximum spread and a 10-hr spread penalty, (b) under a 13-hr maximum spread and a 10-hr spread penalty, and (c) under a 13-hr maximum spread and a 12-hr spread penalty (based on data in *2*).

same approximate result in operator cost savings would occur if PTOs are 10 percent of the FTO work force and are permitted to work two daily assignments; but if only permitted one assignment, savings would be about 3 percent.

- *Case C*—Under a 13-hour maximum spread and a 12-hour spread penalty, a transit system with a peak-to-base ratio of 1.6 might expect to save approximately 2.5 percent of its operator costs if the number of PTOs are 10 percent of the FTO work force and are permitted to work one daily assignment, or 4 percent if permitted two assignments.

Figure 6 illustrates that transit systems will attain greater cost savings from the use of PTOs if:

1. the service profile has a high peak-to-base ratio,
2. the spread times including both maximum and penalty are short (i.e., Figure 6a shows the greatest savings potential), and
3. PTOs are permitted to work two assignments each day.

The extent of cost savings clearly varies by system. Increasing the savings involves decision making and action by transit management, labor, and policy makers.

CHAPTER FOUR

DEVELOPING PART-TIME OPERATOR WORK ASSIGNMENTS

A goal of transit management is to utilize both FTOs and PTOs in a cost-effective way to provide transit services within existing labor-agreement provisions and work rules. The optimal condition is attained when the scheduled transit services are delivered at the least cost in accordance with the labor-agreement provisions and work rules.

More specifically, this means that within the terms of the labor agreement and work rules transit system managements should:

- minimize guarantee pay and unproductive time;
- minimize allowances for travel times, intervening time, meal breaks, layovers, etc.;
- minimize overtime and other premium pay;
- minimize fringe benefit costs; and
- maximize the use of lower-cost labor.

It is difficult to realize such objectives simultaneously. This chapter addresses the process and techniques used by transit managers to assign work to FTOs and PTOs to meet the above objectives. Three topics are discussed. The first is a general review of the transit runcutting process. The second addresses more specifically the current approaches used in developing work assignments for PTOs. The third discusses automated procedures for assigning work to vehicle operators.

RUNCUTTING

Runcutting is the process that produces vehicle operator work assignments from the transit service schedule. The objective of runcutting is to find the least-cost arrangement of work assignments that satisfies the transit service schedule and conforms with existing labor-agreement provisions and work rules. Considerations of work quality, including inconveniences or onerous work assignments for employees, are normally included in the objectives. This is a complex task requiring considerable skill and experience. Up until the 1960s runcutting was performed manually within the scheduling departments of transit systems.

The general runcutting approach is to initially obtain a feasible arrangement of work assignments and improve the arrangement of work assignments by iterative modification in an effort to obtain the lowest cost. The process involves cutting the vehicle schedules into operator work pieces. Work pieces that cannot be formed into straight runs, the most efficient type of FTO work, are combined into split runs or left unmatched as tripper assignments. Traditionally, the number of total FTO pay hours has been used as a measure of determining when the runcutting process has approached the least-cost arrangement.

Although minimizing total FTO pay hours is an effective way of determining the best arrangement and use of FTOs, the process is made more complex when PTOs are introduced as a potential cost-saving measure. Although the direct substitution of PTOs for FTOs may save labor expenditures in terms of wage and benefit costs, it is more effective to consider precisely how work should be arranged and conducted by PTOs in combination with FTOs to result in the least cost. This means that cost savings through reduced guarantee pay, premium costs, and fringe benefits should be considered simultaneously.

APPROACHES IN DEVELOPING PTO WORK ASSIGNMENTS

Although the objective of using PTOs is generally similar among transit systems, there are several approaches used for

incorporating PTOs into overall work assignments and reducing total cost. These approaches can be categorized according to the method used to determine cost trade-off considerations. The approaches for developing PTO work assignments include:

- *post-runcut PTO assignment,* considering PTOs after the runcut of full-time operators;
- *stepwise FTO and PTO runcutting,* considering both FTOs and PTOs separately during the runcut using a stepwise process; and
- *simultaneous FTO and PTO runcutting,* considering the work assignments of FTOs and PTOs together during the runcut.

Post-Runcut PTO Assignment

Many transit systems wait to consider how PTOs will be utilized until after the development of FTO work assignments. Trippers and other short pieces of work that remain (or fall out) after work assignments for FTOs are identified and are then available for PTOs in accordance with labor-agreement provisions and work rules.

Because the PTOs are not included in the FTO runcutting process, cost trade-off considerations tend to be more manageable but less comprehensive. The basic strategy of this approach is to identify the remaining unassigned work that would be most expensive to operate with FTOs and assign these work pieces to PTOs. This minimizes potential FTO guarantee pay, overtime premiums, and spread premium pay. In addition to these efficiency considerations, the effectiveness of PTOs may also depend on maximizing their use (i.e., achieving as many PTO work hours as the existing labor-agreement provisions and work rules allow). Post-runcut PTO assignments may lead to the underutilization of PTOs since they are fitted to the remaining unassigned work when it could be more efficient to tailor the work assignments to optimally utilize available PTO hours.

Trade-offs in developing PTO work assignments are made between minimizing FTO pay hours and fringe benefits while maximizing use of contractually available PTO work hours. Cost savings depend on a proper balance between these two work-assignment considerations. Because potentially effective PTO work assignments may be eliminated from consideration through the post-runcutting process, it is important for transit systems using this approach to consider the trade-offs that are available at this level.

Stepwise FTO and PTO Runcutting

Some transit systems incorporate the development of PTO work assignments as a step in the runcutting process. In such cases, work pieces may be (a) tailored to maximize PTO utilization (i.e., attempt to use the maximum number of PTOs or PTO pay hours allowed in the labor agreement); and/or (b) selected to take advantage of inefficient FTO pay provisions such as guarantees, overtime, and spread pay premiums.

This runcutting method provides more flexibility than post-runcut procedures in developing a cost-effective arrangement of PTO and FTO work assignments. However, the cost trade-offs made in this approach are similar to those of the post-runcut approach. The main difference between the two runcutting methods is that instead of directing the cost trade-offs at limited pieces of work that drop out of the runcut, stepwise runcutting considers the trade-offs before most of the work is frozen into FTO assignments.

Simultaneous FTO and PTO Runcutting

Complete integration of PTO assignment development into the runcutting process involves simultaneous consideration of FTO and PTO pay provisions and utilization constraints in developing work assignments for both FTOs and PTOs. This is the only approach that can, theoretically, produce an optimal FTO and PTO work-assignment arrangement. However, because of the added complexity of simultaneously considering the numerous work-assignment alternatives, in practice, optimal solutions can only be approximated. Recent advances in automated runcutting techniques have met with some success in using integrated methods to add greater precision to this process.

AUTOMATED RUNCUTTING

Transit systems and private consulting organizations have developed computerized runcutting procedures that have enhanced the development of vehicle operator work assignments. Most of these automated techniques incorporate PTOs into the runcutting process either through a stepwise or simultaneous runcutting approach. One of the primary benefits of automated runcutters is the greater number of alternative work-assignment arrangements that can be reviewed and evaluated. Most of the runcutting software packages available contain highly interactive features allowing transit schedule makers to exert direct control—overriding or influencing computer-generated solutions. Not only do automated procedures help produce better work-assignment solutions than manual methods, but they are also useful in evaluating the potential impact of work rule changes and service schedule modifications in preparation for labor contract negotiations. Such tools are not intended to replace decision makers; they act as an aid to achieve faster and more effective decision making.

Automated runcutters employ heuristic procedures and/or mathematical programming methods in deriving FTO and PTO work assignments. Heuristic procedures are not mathematically precise but, rather, reflect the time-tested rules of thumb that transit schedule makers have historically employed. They essentially mimic the manual methods of runcutting. The earliest version of a heuristically based runcutter was RUCUS, developed for UMTA by the Mitre Corporation. RUCUS has since been updated and has led to the introduction of other heuristically based runcutting packages, most notably those developed by SAGE Management Systems Corp. and VISTA Systems, Inc.

Mathematical programming runcutting methods rely on a set of algorithms in an attempt to derive optimal work assignment

solutions. Such methods may be used to supplement heuristically based methods or may be the primary method of runcutting. Computerized runcutters that are mathematical-programming-oriented essentially consider the work-assignment process as an exercise in constrained optimization. The complexity of the problem generally requires some relaxation or simplification in simultaneously addressing all cost trade-offs, constraints, and potential feasible work-assignment arrangements. Two products that rely predominantly on mathematical programming techniques are the HASTUS system developed by GIRO, Inc. and the RAMCUTTER developed by Research Applications for Management, Inc.

CHAPTER FIVE

COST AND PERFORMANCE ISSUES OF USING PART-TIME OPERATORS

This chapter discusses the costs associated with attaining labor-agreement provisions for PTOs and the effects reported to date of PTOs on transit service safety and reliability. Recently there have been several papers and reports that focus on or peripherally address these issues. Some researchers believe that these important subjects have been overlooked by many transit systems in their efforts to introduce part-time labor to their work forces.

COSTS ASSOCIATED WITH ATTAINING PART-TIME OPERATORS

As part of their research on PTOs, Chomitz and Lave (*2*) have considered numerous transit system scenarios to analyze the cost-savings potential attained by introducing PTOs. These scenarios specify the number of PTOs hired, the amount of fringe benefits paid, the type of work performed, and the existing service and labor-agreement characteristics including spread times and spread premiums of transit systems. In addition, the scenarios include a variety of compensating pay increase alternatives that may be provided to full-time employees to attain labor-agreement provisions for PTOs.

Chomitz and Lave examined the costs associated with attaining the right to hire part-time labor and concluded that compensating increases in wages to FTOs erodes the savings attainable through the use of PTOs. The researchers state that the reduction in pay hours realized by PTOs occurs only once while pay increases to FTOs may occur and compound over several years. In short, these researchers warn transit managers to avoid such trade-offs in labor negotiations because they are expensive.

Figure 7 summarizes and graphically displays the conclusions made by Chomitz and Lave from this research. The horizontal axis of the figure is a time line beginning at the date that labor-agreement provisions are introduced to allow the use of PTOs. The vertical axis is a scale with the percent increase in compensating wages paid to full-time employees for the right to hire PTOs. It includes pay increases above any cost-of-living adjustment that may be negotiated as part of the collective-bargaining process. The curves translate increases in full-time employee wage rates to equivalent percentage increases in FTO pay hours. Two illustrations presented on the figure are described as follows.

- *Case A*—A transit system that attains a 5 percent reduction in FTO pay hours through the use of PTOs but provides a 3 percent compensating increase in wages to its full-time employees, loses almost all of the effective pay-hour savings from its PTOs by the end of the first year of the contract.
- *Case B*—A transit system that attains a 10 percent reduction in FTO pay hours through the use of PTOs but provides a 2 percent increase in full-time employee wages each year in the first two years of the contract reduces the FTO pay-hour savings effect by about 6 percent leaving only a 4 percent net pay-hour savings. If the 2 percent pay increase was continued each year (i.e., compounding the wage increase), the FTO pay-hour savings would be eliminated between the end of the third and fourth years of the contract.

This analysis suggests that, during negotiations, transit managers should focus on issues other than pay increases for full-time employees, such as the improvement in working conditions that results from use of PTOs. Overtime and premium pay that are provided as compensation for undesirable work should not be regarded as part of the normal wage.

TRANSIT SERVICE SAFETY AND RELIABILITY

Both transit managers and labor representatives have expressed concerns that PTOs are less reliable and more likely to be involved in accidents than FTOs. Because of these concerns, the performance of PTOs has been researched at several transit systems. The focus of this research was on accident rates, absenteeism, and attrition of FTOs and PTOs. The most extensive research in these areas, to date, has been conducted by the Massachusetts Bay Transportation Authority (MBTA) based on

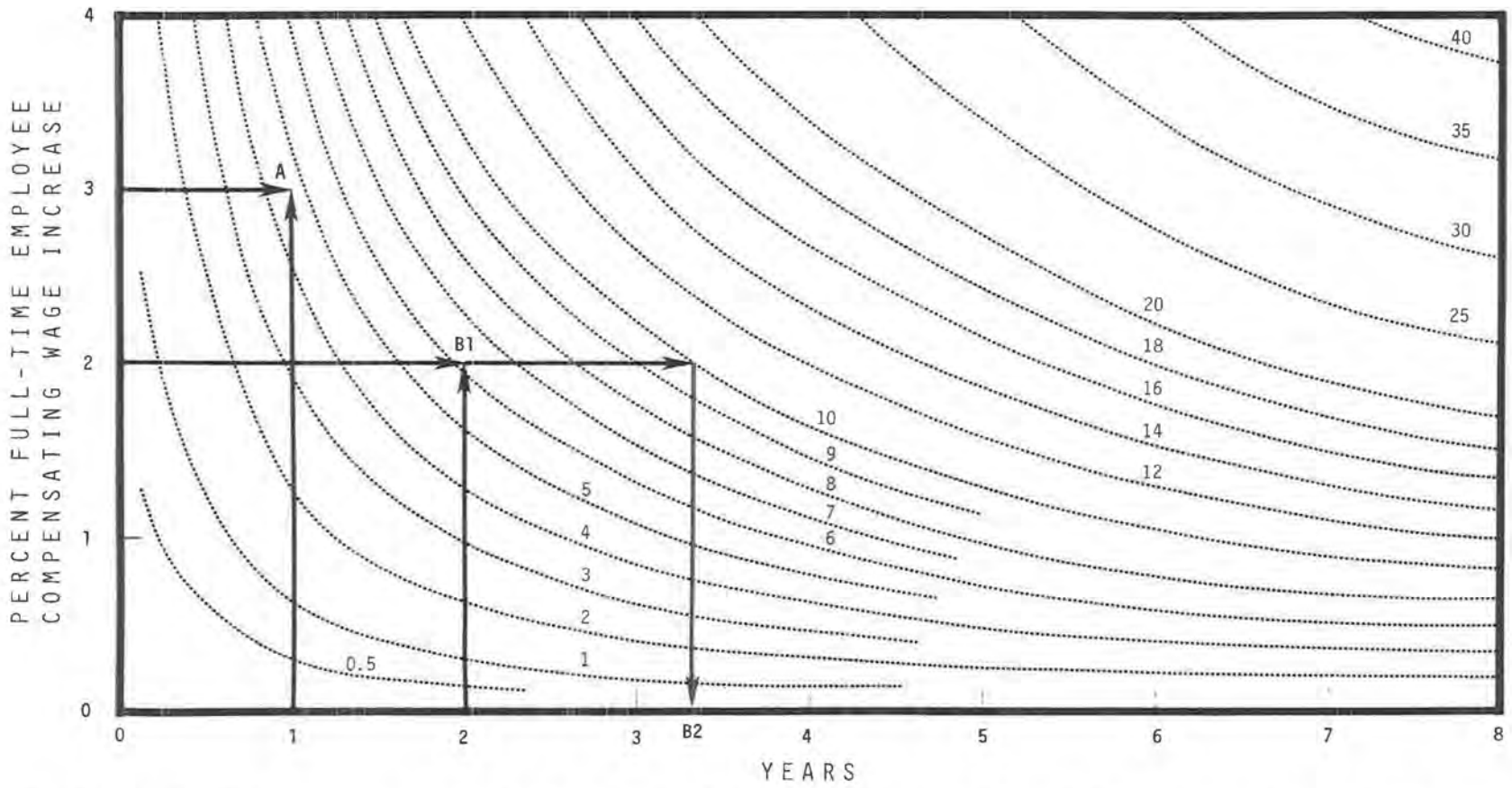

FIGURE 7 Relationship of compensating employee wage rates over time to the increase in operator pay hours. The curves represent the equivalent percentage increase in FTO pay hours that would occur if compensating full-time employee wage increases were granted and compounded over time (adapted from *2*).

MBTA's experience with PTOs since 1982 (*4*), and by the University of California at Irvine (Chomitz, Lave, and Giuliano), which analyzed a group of transit systems under an UMTA-funded research grant (*5,6*). Highlights of the research findings are presented below.

PTO Accident Rates

In January 1982, the MBTA introduced 20 PTOs into one of its divisions. By the fall of 1984, it had expanded its part-time employee work force to include 380 bus operators and 27 rapid-transit doormen. A concern of the MBTA with respect to PTOs was passenger safety and the potential for increased accidents. Consequently, safety performance by FTOs and PTOs was monitored. Based on two years' data, the following observations were made:

- The overall accident rate for all operators increased by about 17 percent from the first quarter of 1981 (before the introduction of PTOs) to the first quarter of 1984.
- The higher accident rates of PTOs accounted for this increase since the accident rate of the FTOs was stable.
- Over time, as the PTOs gained experience, their accident rate improved. This change is similar to that of FTOs whose accident rates are also twice as high in their first two years as when they have five years of experience.
- Comparison of the accident rates of PTOs and FTOs with comparable experience (6 months to 1 year of service) indicated, however, that the PTOs at the MBTA had 48 percent higher accident rates than FTOs.

Once it was concluded that MBTA's PTOs appeared to have more accidents than FTOs, the reasons for this difference were investigated. First, it was suggested that the higher accident rate might be attributed to driving in the peak periods when traffic was more congested. However, an analysis of morning peak, midday off-peak, evening peak, and evening off-peak accident records did not support this theory, since FTOs had more accidents during the midday and evening periods when there was less congestion but higher speeds.

A second explanation proposed for the higher accident rate of the PTOs at the MBTA was that PTOs might have reported a number of minor accidents that went unreported by FTOs. This theory was also found unsupported by the data on accidents, which showed that 9.5 percent of PTOs accidents had no damage or injury as compared to 13.6 percent of the FTO accidents—suggesting that PTOs were not reporting any more minor accidents than FTOs. In addition, the records indicated that the PTOs had a higher percentage of "more severe" accidents, 40 percent as compared to 22 percent by FTOs. This difference was largely attributed to inexperience.

Concern for public safety prompted the MBTA to investigate which employees were having the most accidents. It was observed that about one-third of the PTOs accounted for two-thirds of the accidents and that this relationship was even more skewed when only preventable accidents were considered. The analysis also showed that PTOs with two or more accidents in their first six months had a significantly higher accident rate thereafter. The conclusion drawn from this investigation was that more effort should be placed on retraining or "weeding out" poor operators early in their careers. The decisions to place greater emphasis on training or screening are important since the position of PTO might be used to extend the probationary period of future FTOs. Transit systems have the opportunity to better prepare future FTOs through the employees currently on part-time status, many of whom may be seeking full-time positions.

The analysis of accident rates of FTOs and PTOs being conducted by the University of California at Irvine interestingly reports more favorably than the MBTA on PTO accident rates. This research reports that PTO accident rates are lower than those for FTOs, without making adjustments for driving exposure. The research concludes that once adjustments for exposure are made, the accident rates of PTOs and FTOs are probably roughly similar.

More extensive research and investigation of PTO accident rates to further support or refute the MBTA and California experiences is warranted. Accurate conclusions on accident rates may require consideration of factors such as transit-system characteristics, labor market, employee-selection practices, and training programs rather than focusing solely on full-time versus part-time employment status.

PTO Absenteeism

Another factor affecting transit service safety and reliability is PTO absenteeism. Research indicates that PTOs have lower absence rates than FTOs; that PTOs are, in other words, more reliable with respect to attendance than FTOs. The first explanation typically offered for the differences in absence rates is that because PTOs receive significantly lower fringe benefits and are in fact frequently not paid for sick leave, they are absent less often. A second and closely related explanation for the differences in attendance is that because PTOs work fewer hours, they earn less money, and therefore cannot afford to be absent, particularly if they are not paid for sick time.

In each of the transit systems analyzed by Chomitz, Lave, and Giuliano the FTO sick rate is higher than the PTOs' with the FTO absence rate, on average, 2.3 times higher than the PTO rate. Absence rates of PTOs and FTOs have been examined (a) considering duration of employment, (b) excluding long-term illness, which can bias statistics, (c) including and excluding absence because of injury, and (d) considering the extent and type of fringe benefits received. In each case, the research suggests that PTOs have lower absence rates than FTOs.

One analysis of absence rates even tracked the attendance record of employees who were permitted to switch from full-time or part-time status while retaining their full sick benefits. In this case as well, the sick rate declined after the operator switched to part-time work. The researchers hypothesized that possibly there is something inherent in part-time work assignments that produces lower sick rates; that it is easier, perhaps, to work a short work assignment than a long one when one does not feel well.

The subsequent research conducted by the Institute of Transportation Studies at Irvine, California also examined absence rates for PTOs and FTOs in relation to the allowable number of sick days. This research found that observed sick rates increased along with increases in allowable paid sick days. Their data indicated that FTOs with no sick pay were absent on

average 7.7 days per year. PTOs were observed to have an average sick rate of about four days per year, irrespective of the benefits they received.

It appears, therefore, that the general conclusions about PTO absence rates that can be drawn from current research are that (a) PTOs have lower absence rates than FTOs; (b) absence rates are likely to increase with increased benefits; and (c) some absence can be anticipated from PTOs each year, independent of the amount of sick leave benefit received.

Attrition or Turnover Rates

The third area analyzed regarding PTOs and their effect on transit service reliability is attrition or turnover of PTOs. Attrition influences the need for additional hiring and training of new employees. It therefore affects both the administrative costs of the transit system for recruitment, selection, and training and the reliability and quality of transit services, since more experienced operators have better performance records (safety and on-time schedule adherence) than those with less experience.

Research on PTO attrition rates indicates that higher turnover can be anticipated with PTOs than FTOs. The main explanation suggested for the higher attrition rate of PTOs is that they are interested in full-time positions, either with the transit system as an FTO or a full-time employee with another employer. Lave (6) suggests that a monitoring of PTO turnover and general local economic conditions, as measured by local employment rates, shows that PTO turnover rises when unemployment is low and decreases when unemployment is high. In short, people are more likely to stay in part-time jobs when the economy is bad and it is more difficult to find full-time jobs.

Based on this research, it appears that transit systems should generally expect higher turnover by PTOs unless they can identify and hire individuals who are not interested in full-time positions. Screening during employee selection by this criteria is likely to be very difficult. Some transit systems have solved this problem, at least partially, by initiating the practice of hiring FTOs mostly from their PTO labor force. In this way, job candidates understand that filling PTO positions, while not guaranteeing a full-time job, is part of the process of attaining full-time employment as a vehicle operator. This practice provides several benefits to the transit system including generally ensuring more applicants for the PTO positions and allowing the PTO position to serve as a means of extending the vehicle operator probationary period.

While transit systems may incur added administrative costs for recruitment, selection, and training of PTOs, the employment of PTOs does provide a good opportunity for screening future FTOs.

CHAPTER SIX

GUIDELINES FOR THE USE OF PART-TIME OPERATORS

This chapter contains guidelines for transit systems that already utilize PTOs as well as for those that may be considering the introduction of PTOs. These guidelines are based on the conclusions of the research summarized in this synthesis. Although it is generally believed that transit systems should consider using PTOs because they offer a more efficient way to provide service, it is prudent for transit managers and decision makers to approach their use with care.

The use of PTOs is neither a panacea nor a prescription to remedy the ailments of financially troubled transit systems. However, PTOs can reduce operating costs at most transit systems. The exact level of potential savings at any individual system cannot be predicted without a direct examination of the transit system's operating environment, labor-agreement provisions, and work rules. In this context, the following guidelines are presented to assist transit systems in their deliberations on utilizing PTOs to increase the cost-effectiveness of service delivery.

Understand how the transit service profile in combination with certain labor-agreement provisions influences the cost-savings and productivity improvement potential of PTOs.

As discussed in Chapter 3, the cost-savings potential from the use of part-time operators is sensitive to the shape of the transit service profile and the labor-agreement provisions and work rules affecting operators. Transit systems with some or all of the following characteristics can expect the greatest cost savings from the potential use of PTOs:

- high peak-to-base ratios,
- great peak shoulder-to-shoulder duration time, and
- narrow spread rule times (both maximum and penalty.)

Maximize the potential for savings and productivity improvement by avoiding, to the extent possible, labor-agreement provisions that limit management flexibility in the hiring and assignment of PTOs.

Transit managers should examine the ways they can influence savings potential through the use of PTOs. It is very important for transit managers to consider how labor-agreement provisions and work rules will influence savings potential at their system and to maximize the opportunities for savings to the extent possible.

Admittedly, labor agreements evolve slowly with each negotiation and involve trade-offs by both labor and management. Recognizing the complexity of the labor-negotiation process, transit managers should attempt to pursue the following types of labor-agreement provisions to attain cost savings through PTO utilization:

- maximize the potential use of PTOs through higher allowable levels of PTOs in the work force,
- maximize flexibility in assigning PTOs to work by avoiding provisions that limit their work schedules, and
- avoid provisions that preclude or limit the hiring of PTOs or require them to be laid off.

Continue the practice of paying lower fringe benefits to PTOs to retain this method of saving through PTO use.

Fringe benefits represent an important cost of transit operations. Consequently, the savings from lower fringe benefits of PTOs should be recognized as important and therefore continued. Although PTOs have historically received lower benefits than FTOs, this practice seems to be changing as increased benefits are provided to the PTOs. As in the case of other labor-agreement provisions, the potential for savings attributable to the lower fringe benefits received by PTOs is influenced by the service profile and other labor provisions and work rules.

Use computerized approaches to perform runcutting and PTO work assignments, to maximize savings potential.

During the preparation of this synthesis, a variety of methods and procedures to effectively utilize part-time operators were identified and reviewed. It is apparent that manual runcutting procedures employed by transit systems are unable to comprehensively address the objectives of labor optimization because of the complexity of simultaneously considering the service scheduling and labor-agreement provisions, particularly since the introduction of part-time operators. Although it is possible to develop optimal solutions with manual procedures, state-of-the-art computerized techniques have generally outperformed those methods.

An important benefit of the automated runcutting procedure is that numerous alternative solutions for work assignments of PTOs and FTOs can be tested before implementation and the needs of collective bargaining can be more efficiently addressed.

Avoid erosion of potential savings by PTOs through increases in full-time employee wage rates.

The results of the research conducted at the University of California at Irvine (*2*) indicate that the cost of compensating wage increases for full-time employees that may be traded during the collective-bargaining process for the right to use PTOs can quickly errode savings achieved through PTO utilization. This is true, in part, because PTOs are historically a relatively small percentage of the total work force. The focus of negotiations for the introduction of PTOs should therefore not be the potential loss in wages for FTOs, but instead, the need for systemwide cost savings and the possibility of reducing onerous work assignments.

Evaluate all costs and benefits of using PTOs.

Transit systems should consider certain indirect cost and performance concerns related to use of PTOs, including PTOs effect on service reliability, safety, and administrative costs. The research to date suggests that PTOs have higher accident and attrition rates but lower absence rates. Determining the exact cost or benefits of PTOs attributable to absence or accident rates is difficult because research in this area has been sparse. In addition, the experience of each transit system is likely to be different and can be influenced by management practices.

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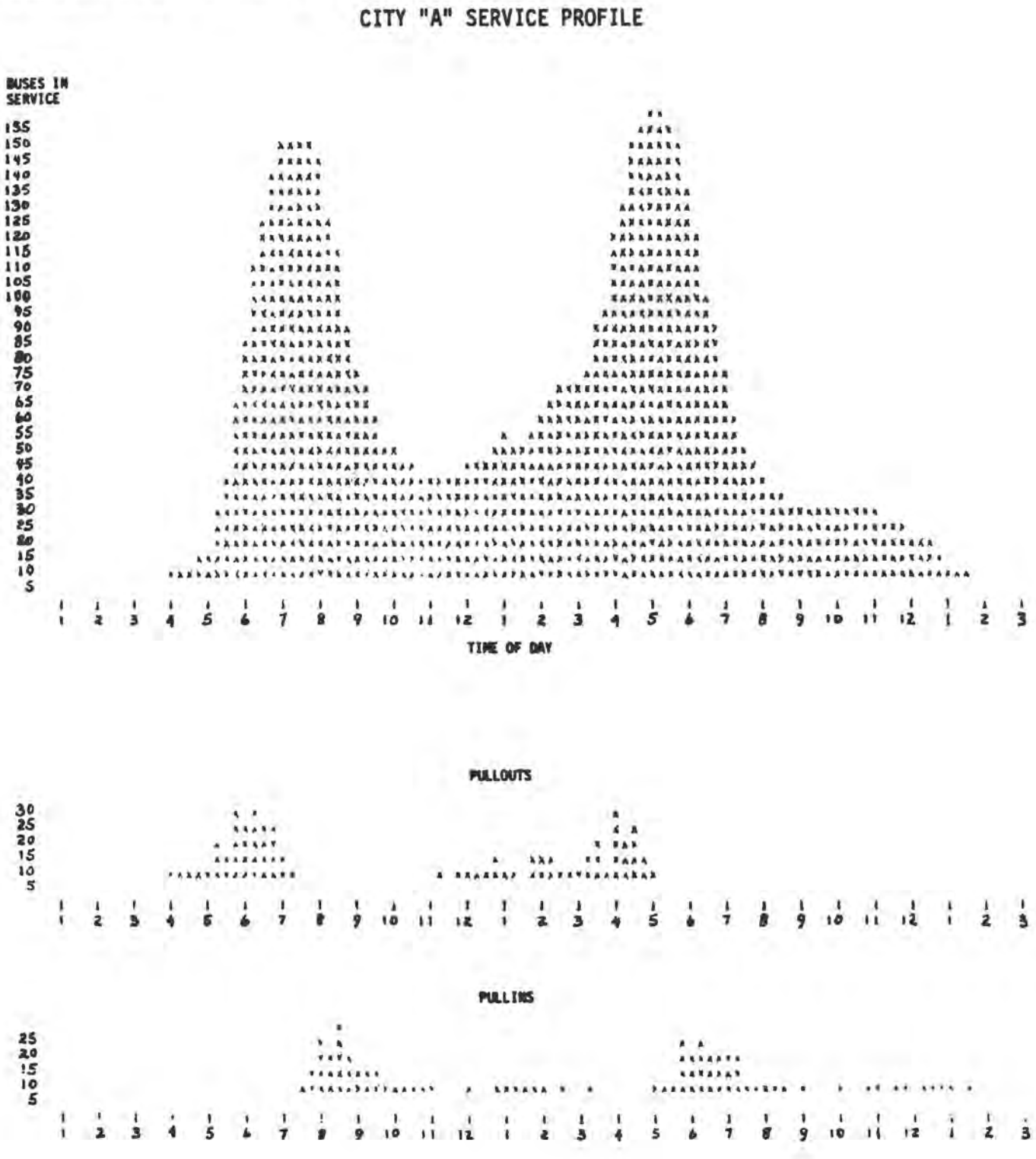
APPENDIX

DESCRIPTIVE TRANSIT SYSTEM INFORMATION



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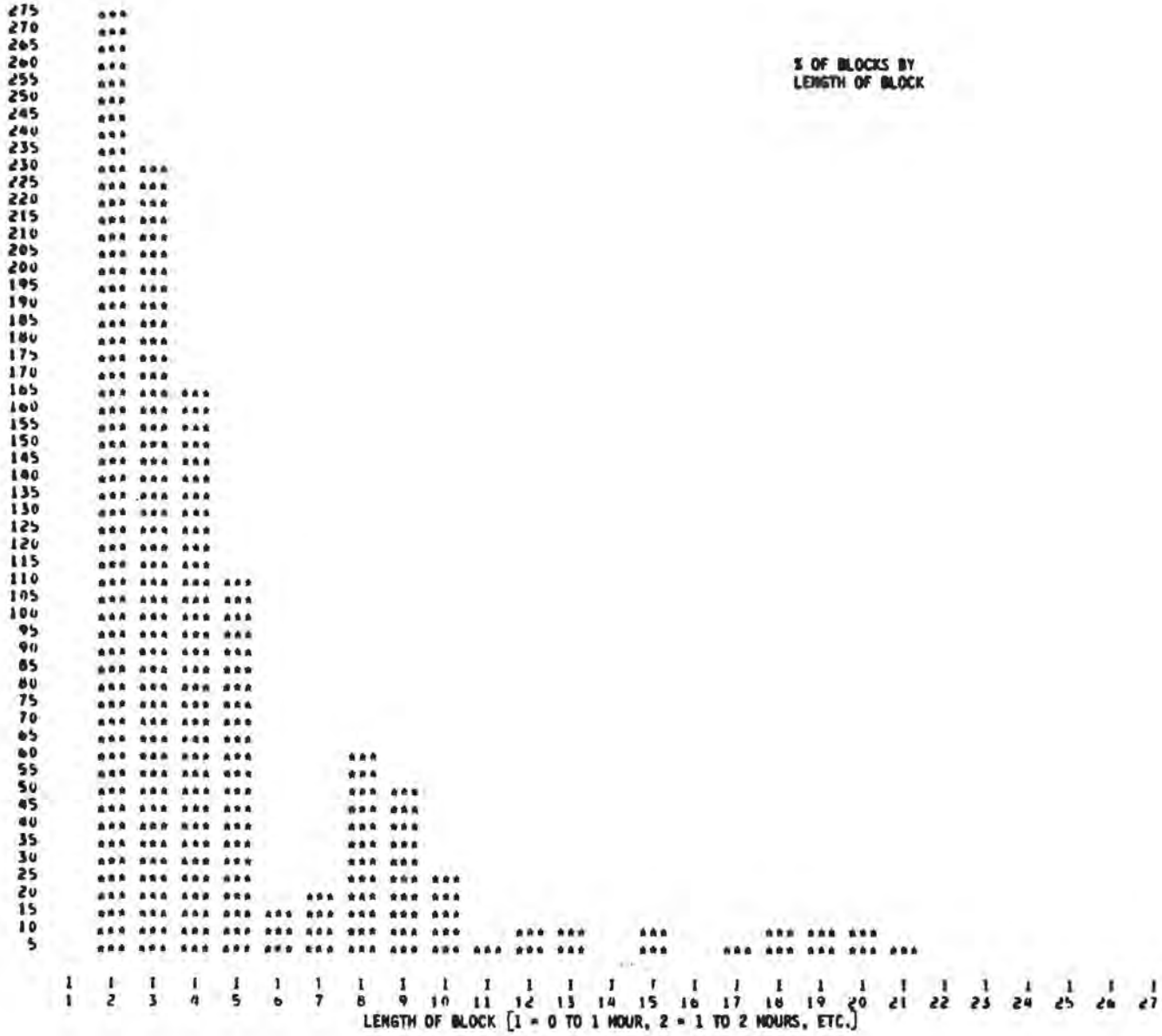

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MAXIMUM SPREAD TIME:	13:00
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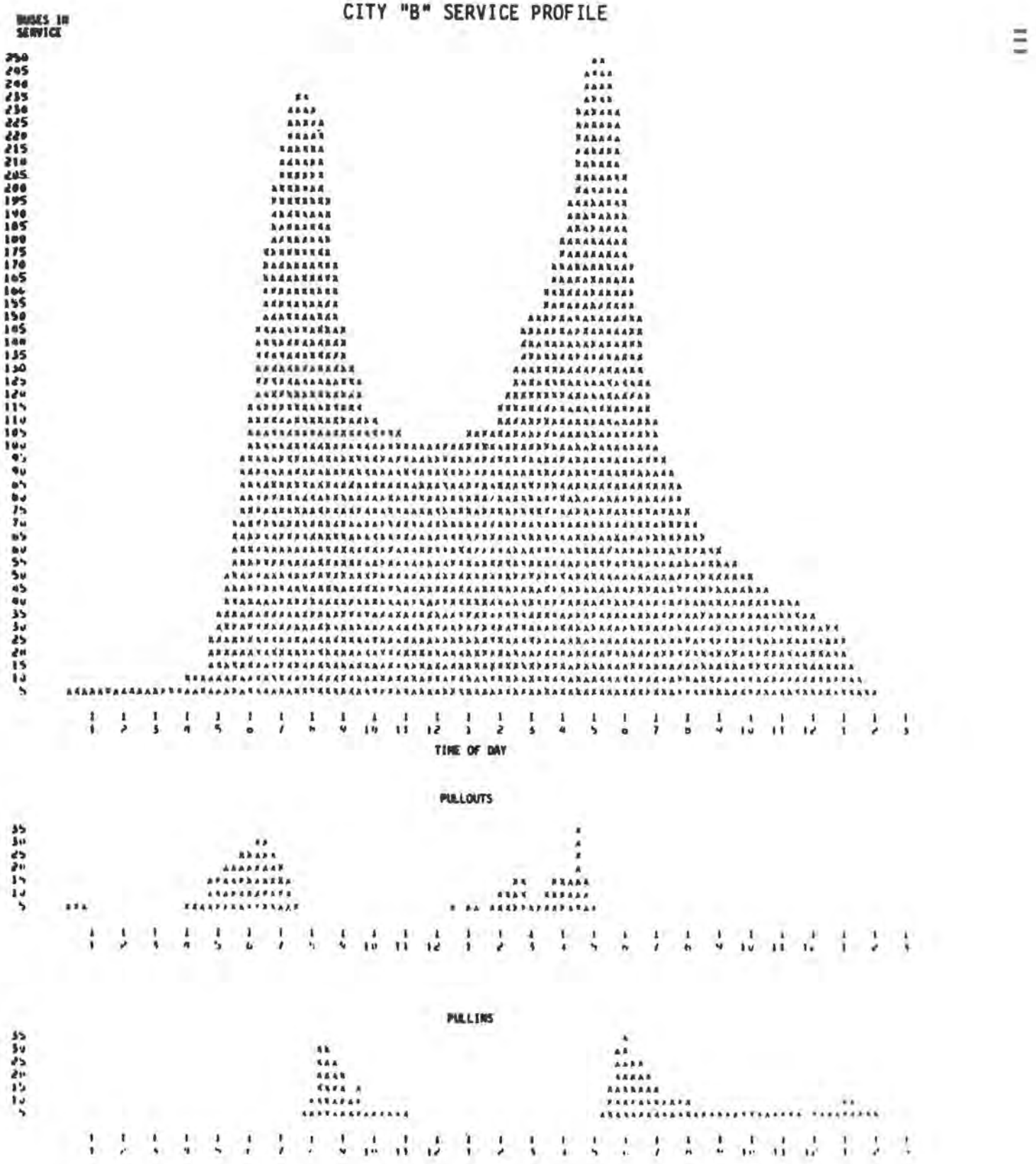
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BUSES IN SERVICE
TIME OF DAY
PULLOUTS
PULLINS

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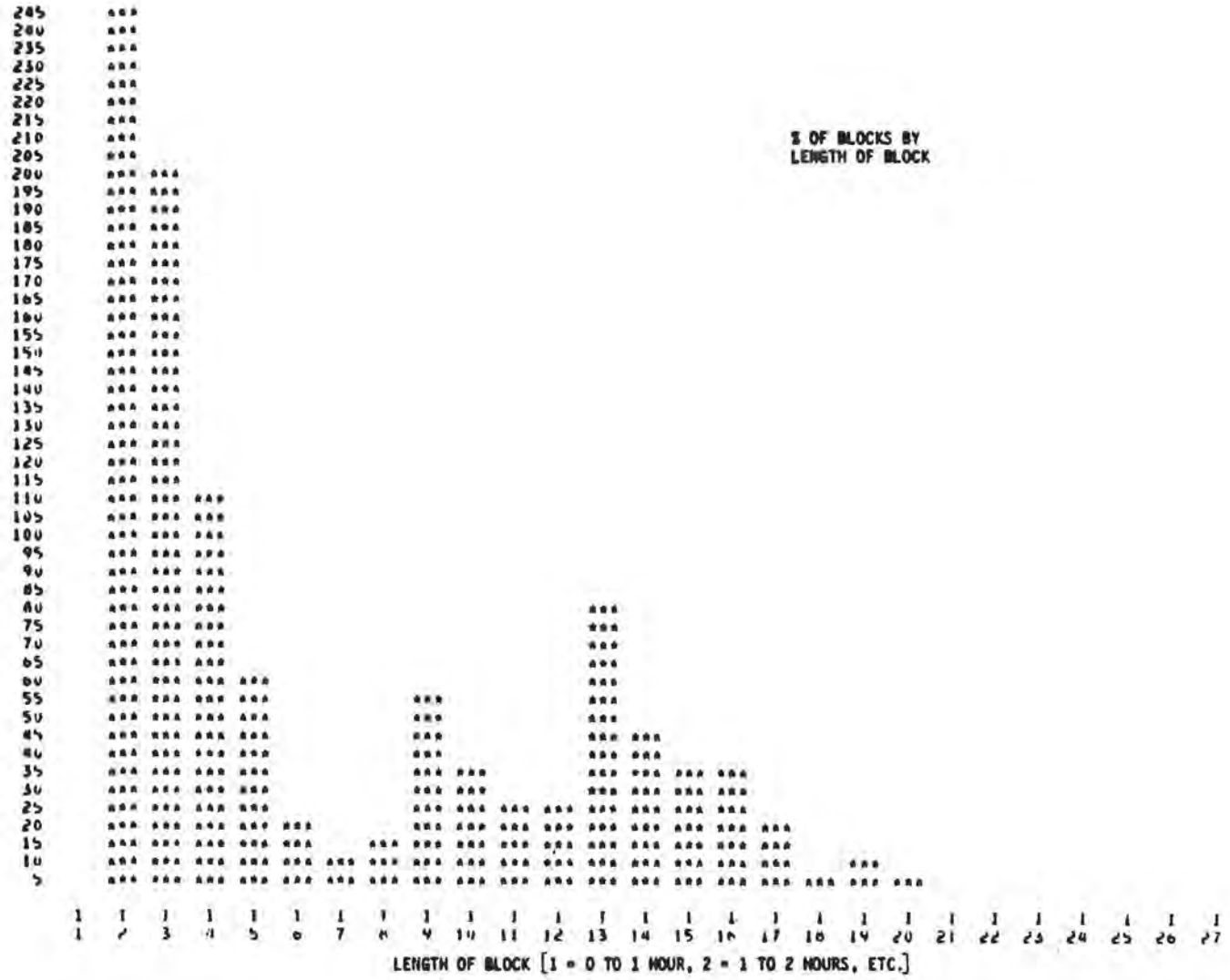

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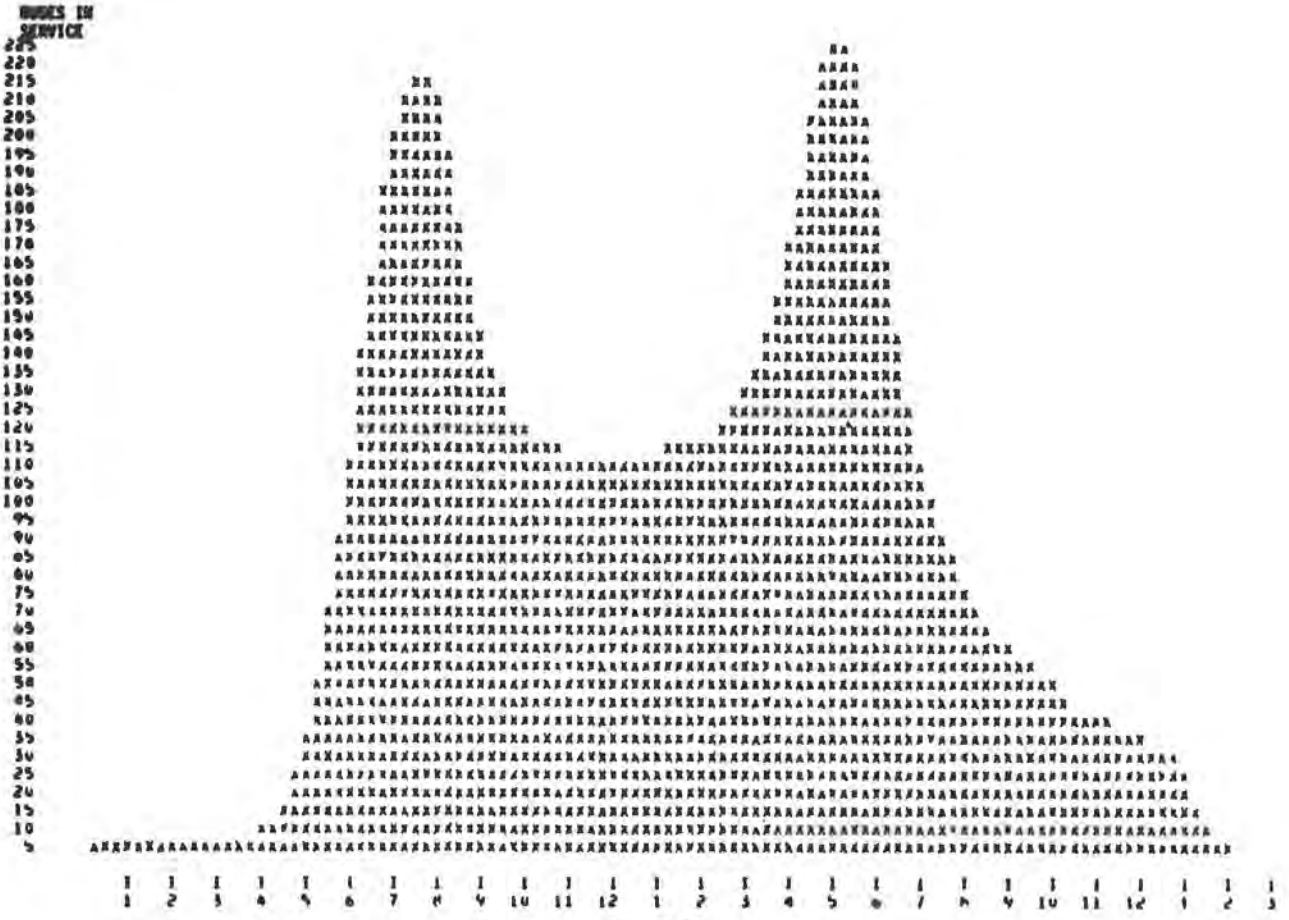

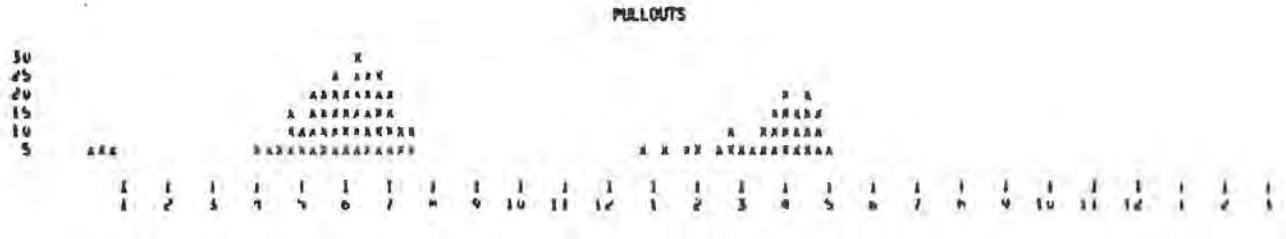

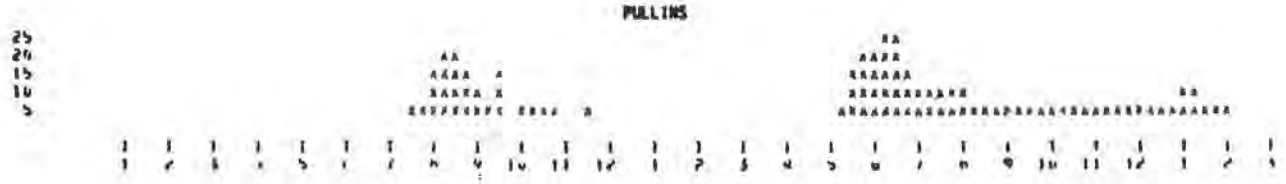

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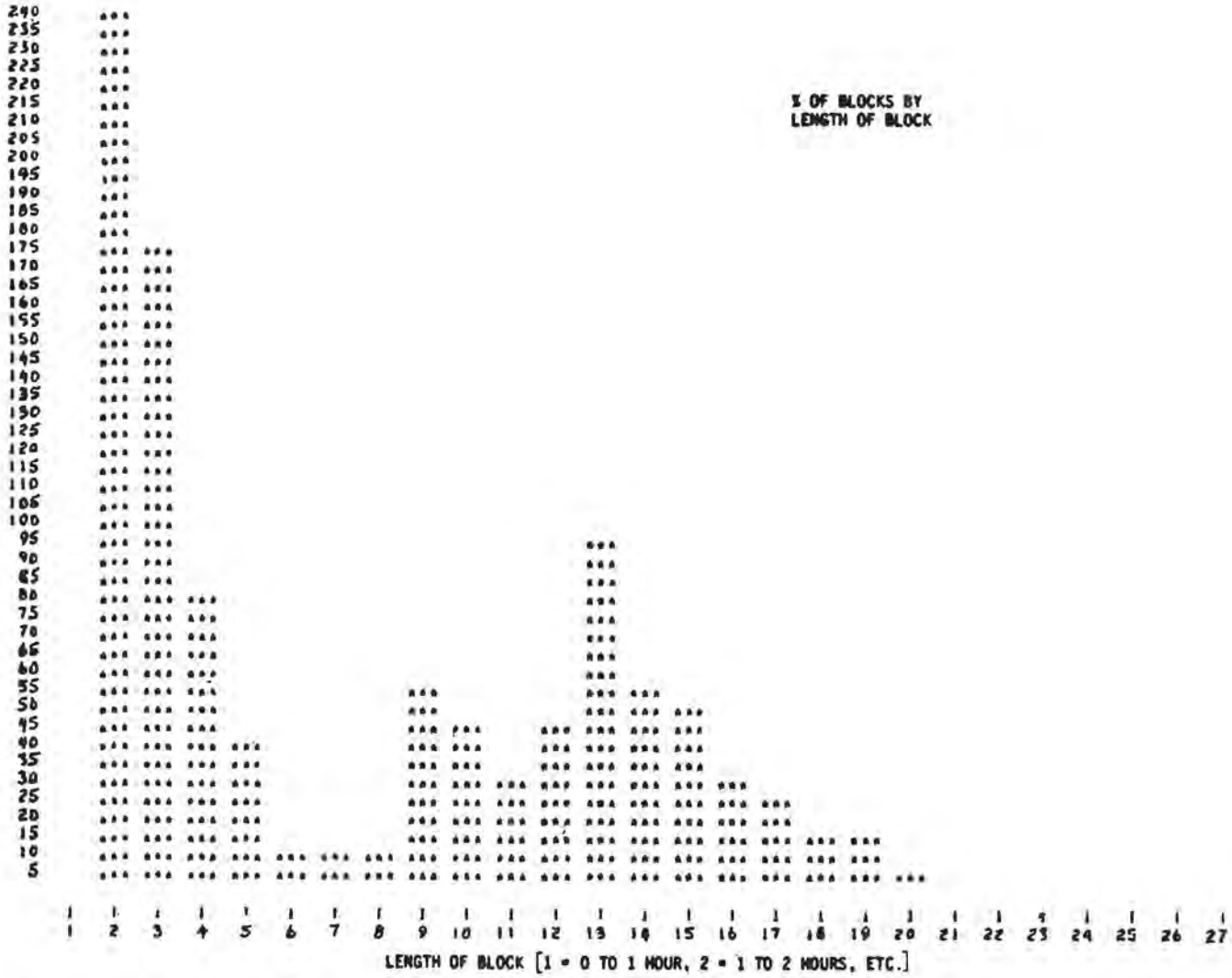

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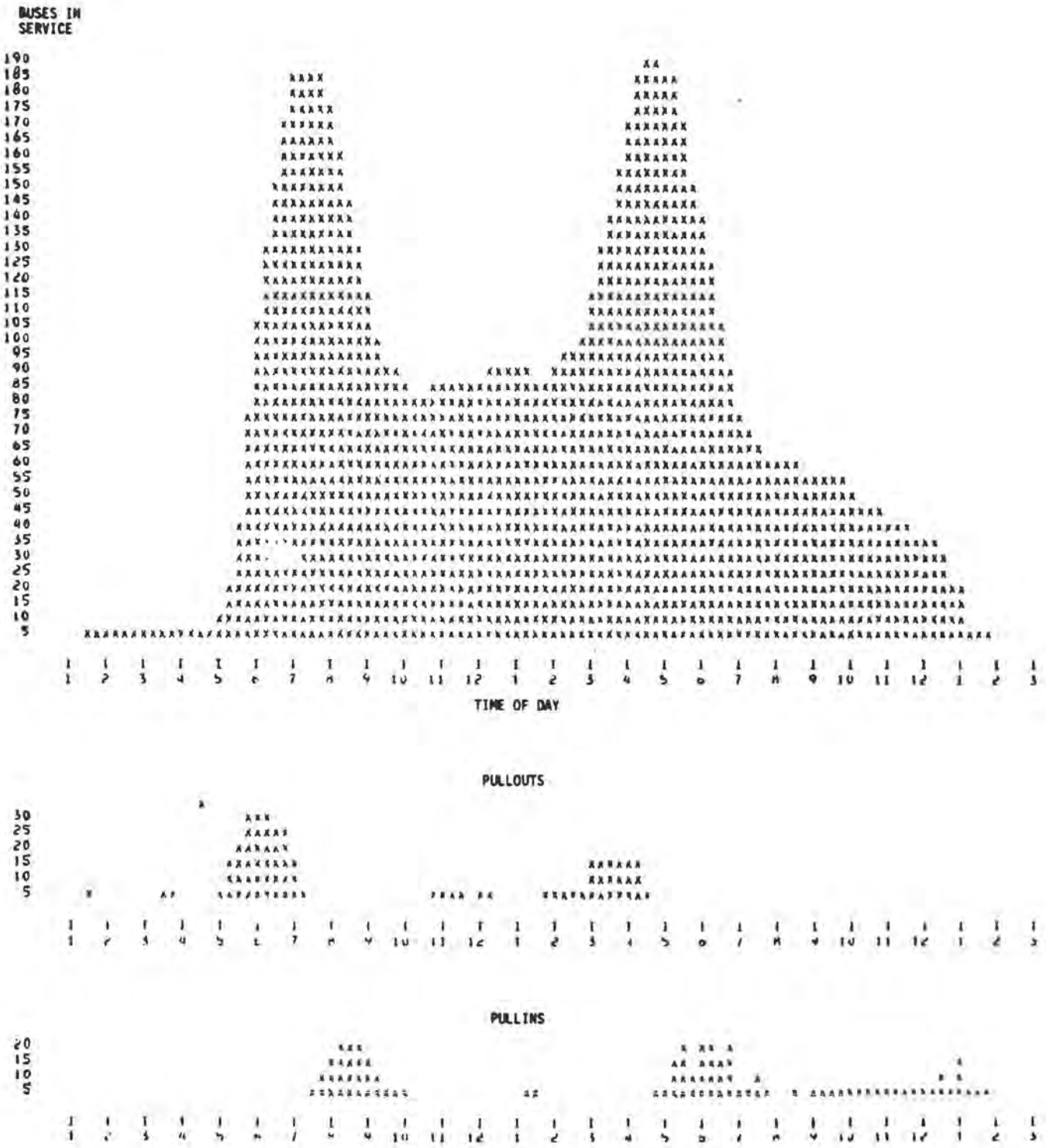

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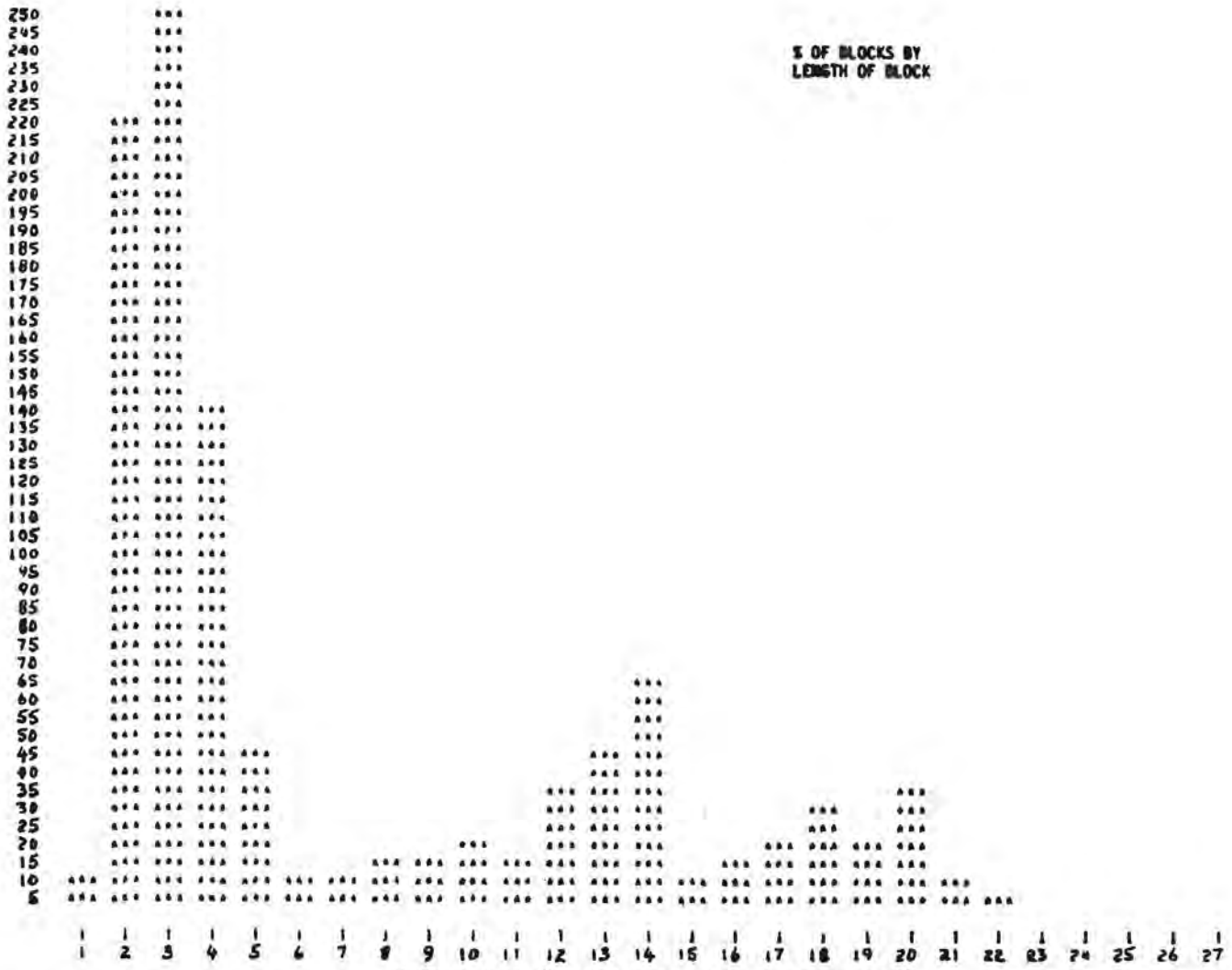

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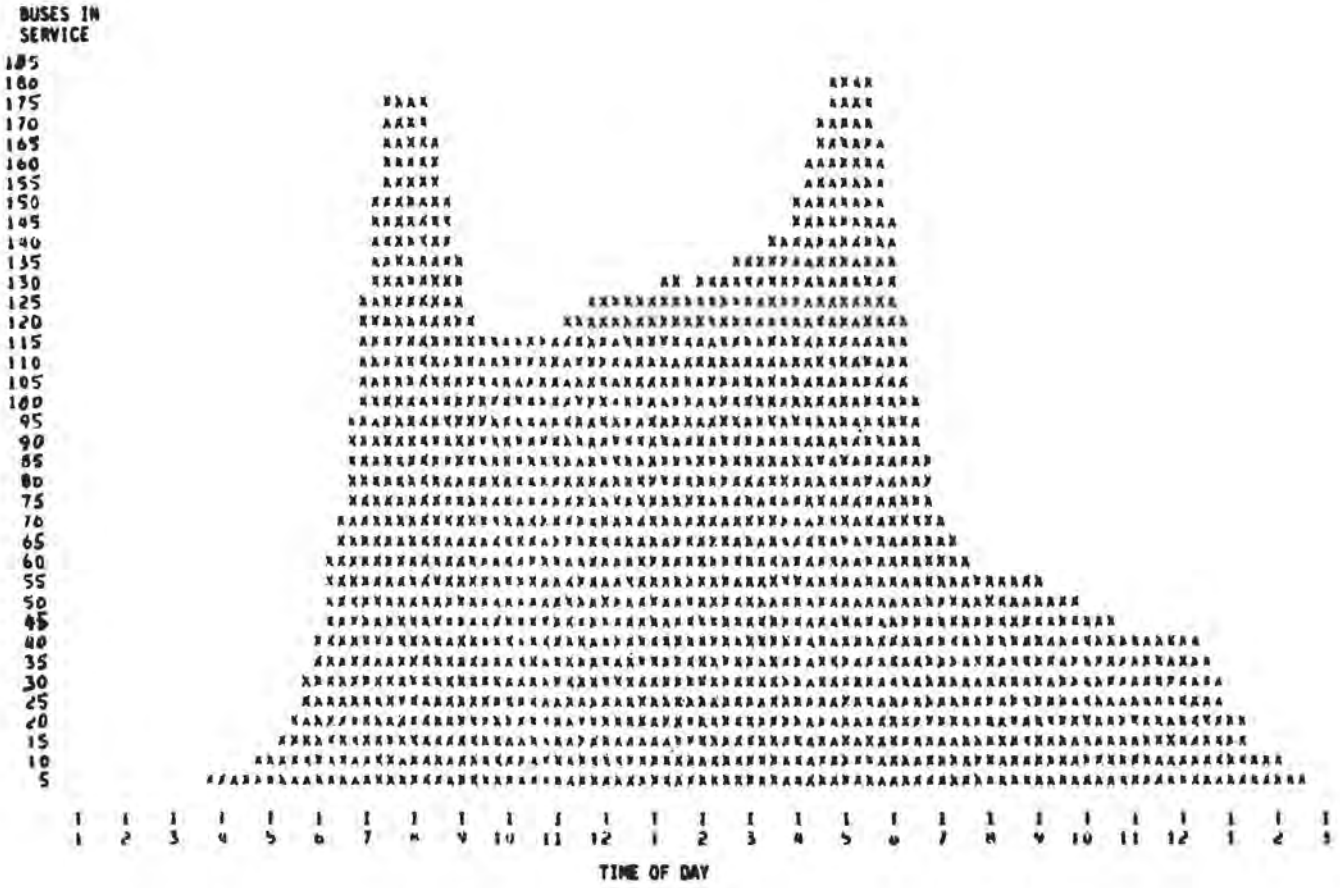
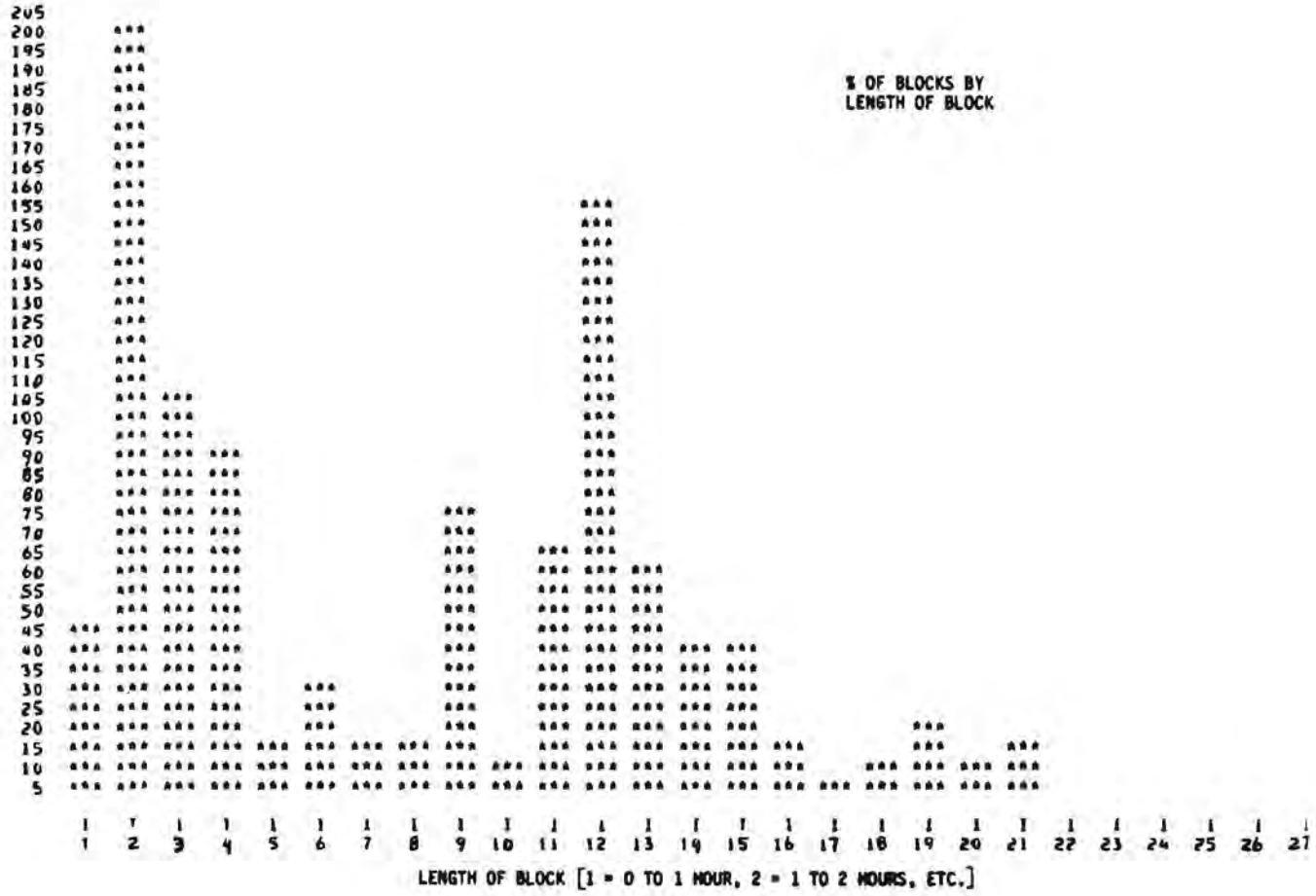
PLATFORM HOURS:	1848
NUMBER OF BLOCKS:	291
PEAK TO PEAK TIME:	9:30
SHOULDER TO SHOULDER TIME:	12:45
ORIGINAL CONTRACT PROVISION --	
MAXIMUM SPREAD TIME:	NONE
SPREAD PENALTY TIME:	12:00

THERE ARE PROVISIONS FOR SPECIAL RUNS
WITH LOW PLATFORM BUT NO SPREAD PREMIUM

CITY "E" SERVICE PROFILE



CITY "E" SERVICE PROFILE (Cont'd.)



STATISTICS

PEAK/BASE RATIO:	1.5
PLATFORM HOURS:	1930
NUMBER OF BLOCKS:	265
PEAK TO PEAK TIME:	9:15
SHOULDER TO SHOULDER TIME:	11:00
ORIGINAL CONTRACT PROVISIONS --	
MAXIMUM SPREAD TIME:	NO CURRENT PROVISION: DE FACTO 12:00
SPREAD PENALTY TIME:	10:00