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An Assessment of the Use of Part-Time Operators at the Massachusetts Bay Transportation Authority

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ABSTRACT

The impact of introducing part-time bus operators at the Massachusetts Bay Transportation Authority (MBTA) in Boston is evaluated and the likely impact of various future scenarios regarding the size and utilization of a part-time labor force at MBTA is analyzed. In January 1982 MBTA had no part-time operators; there are now 280, representing almost 19 percent of the surface-operator classification. Introduction of this number of part-time operators to provide the current level of service has resulted in an annual saving of more than $5 million through reduction in unproductive paid hours, spread penalties, and fringe benefits. However, three factors mitigate this financial benefit: higher accident rates, absenteeism, and turnover among the part-time operators compared with that among the full-time operators. Although there are clear opportunities to obtain further financial benefits from the introduction of more part-time operators, the high accident rate to date suggests that caution is appropriate in expanding their role. Strategies to improve productivity by using the existing complement of part-time operators are also discussed.

In January 1982 the Massachusetts Bay Transportation Authority (MBTA) introduced part-time operators (PTOs) on surface bus lines with the assignment of 20 PTOs to the Quincy bus garage. This was the result of enactment by the Massachusetts Legislature in 1980 of a bill that gave MBTA management, among other things, the right to hire and assign part-time employees as they thought appropriate, notwithstanding previous collective bargaining agreements and past labor practices. This right to use part-time employees, when applied to the typical bus-scheduling requirements of MBTA, provided an opportunity to make substantial savings by reductions in 8-hr work day guarantees and long working hours (called spread penalties).

The first 1 1/2 years of MBTA experience with PTOs is assessed and alternative uses of part-time employees in the Transportation Department are examined. An attempt has been made to evaluate all impacts of the use of PTOs, although the effort was limited by the relatively short period of experience to date and, in some instances, a lack of primary data on the particular issue at hand. Where possible, the impacts of the current and projected use of PTOs have been quantified.

BACKGROUND

The introduction of PTOs at MBTA has clearly been accomplished in an accelerated manner over the past year and a half. The initial 20 PTOs who were assigned to the Quincy garage in January 1982 were primarily from the ranks of former full-time operators (FTOs) who had been laid off in April 1981. In each quarterly timetable through March 1983, an increasing number of PTOs were trained and assigned a daily run of up to 6 working hr per day. Today, 280 PTOs are assigned throughout the bus system.

Throughout late 1981 and 1982, MBTA negotiated with the Boston Carmen's Union (Local 589 of the Amalgamated Transit Union) to set conditions for hiring and utilizing PTOs. These discussions did not result in an agreement, and so, while MBTA management pressed ahead with the hiring and assignment of part-time drivers, the Carmen's Union brought the matter to interest arbitration. Although MBTA maintained that the right to hire PTOs was not subject to collective bargaining or arbitration under Chapter 581 of the 1980 Acts and Resolves of Massachusetts, it presented a proposal that called for unrestricted use of PTOs under the following conditions:

1. A maximum of 30 hr of work per week;
2. A guarantee of 2 hr pay for each scheduled work day;
3. A schedule of work on a 7-day basis;
4. A 6-month probationary period after instruction;

5. A pay rate of 58 percent of the top operator's hourly rate;
6. Eligibility for the following benefits: standard uniform allotment, free transportation, other benefits mandated by federal or state law, and pension plan as amended for part-time employees;
7. No requirement to join the union but requirement of agency fee equal to the dues paid by members of Division 589, less the international portion, as a condition of employment; and
8. The same qualifying standards as those for regular operators.

The Carmen's Union maintained that part-time employees were different from full-time employees only in guaranteed hours of work per day and should otherwise be accorded the same wages, rights, and benefits. The Carmen's Union also contended that there should be an agreed limit to the number of part-time employees working in any MBTA job classification.

On January 15, 1983, the arbitrator made an award covering salary and working conditions for both FTOs and PTOs. Concerning PTOs, the arbitrator ruled that they should indeed be represented by the Carmen's Union and that they should be paid at the same rate as FTOs, subject to the new-hire progression. Benefits for PTOs were set as previously stipulated by MBTA. Although MBTA management immediately put into place the pay and benefits aspects of the award, it objects to, and has refused to comply with, several elements on the basis that they are in violation of Chapter 581. Specifically, MBTA refused to

1. Place an upper limit on the number of part-time employees at 15 percent of the number of full-time employees in each classification (e.g., surface operator, rapid transit motorman),
2. Preclude the layoff of full-time employees while part-time employees remain on the payroll in the same classification,
3. Prohibit PTOs from working on Saturday or Sunday, or
4. Prohibit PTOs from substituting for absent FTOs.

MBTA is in violation of the first of these provisions because PTOs make up almost 19 percent of the full-time surface operators. Because MBTA did not reduce the number of PTOs but rather maintained their number at 280, the Carmen's Union sought injunctive relief from the courts. A preliminary injunction was denied and the case (for a permanent injunction) is still pending. Thus far, MBTA has elected not to increase the number of PTOs further, pending disposition of the court case. Thirty-five new PTOs were hired in April and May 1983 to replace the same number, who were promoted to full-time status when the summer timetable began in June.

CURRENT USE OF PTOs

The difficulty of scheduling transit service to meet the demands for morning and afternoon school and commuter travel is well known in the industry. MBTA must schedule in the peak travel hours, on average, 2.5 times the number of vehicles scheduled during midday. To meet such uneven daily demands for service with only full-time employees, MBTA has historically scheduled many operators to work split shifts to provide service in both peaks (e.g., 6:00 to 9:00 a.m. and 2:00 to 7:00 p.m.). Because this results in long work days with an unpaid break in the middle, labor has successfully bargained over the years for compensating work rules that provide higher pay for split runs, guarantee a minimum of 8 hr of pay, and restrict the number and manner in which split runs are designed.

Three of the most restrictive and costly rules that MBTA faced before hiring PTOs included

1. A requirement that all scheduled pieces of work be included in 8-hr driver runs (which forced some unnecessary and unproductive cover time to be scheduled);
2. A requirement that 70 percent of all runs in a rating station (an organizational unit that corresponds in general to a garage) be less than 11 hr in total length, including breaks (which also forced the scheduling of unproductive cover time in so-called additional runs); and
3. The requirements for spread penalties for all runs that exceed a total elapsed time of 10 hr (time worked in the 11th hour is paid at the rate of time and a half; time worked in the 12th and 13th hours is paid at the rate of double time).

Just before the introduction of PTOs, MBTA's distribution of weekday surface operator runs was as follows:

Type of Run	No.	Percent
Weekday $\leq$ 10 hr	427	40
Weekday between 10 and 11 hr	309	29
Weekday between 11 and 13 hr	335	31
Additional that included an average of >1.5 hr of cover time (included in the previous figures)	92	9

Extra pay for the spread penalties and unnecessary cover time added about 900 daily pay hours to the schedule or about 10.5 percent to the total cost of the schedule.

In scheduling PTOs, MBTA has been, thus far, successful in eliminating the longer spread penalties and unnecessary cover time. It is impressive that so many scheduling changes have been accomplished in so short a time through a completely manual process. Nearly every PTO used thus far has replaced an FTO who had unnecessary paid cover time or who had received large spread-pay penalties. This has been accomplished, however, through scheduling the majority of the PTOs over a 12- to 13-hr work day during which they have, on average, a 6- to 7-hr unpaid break in the middle of the day. Thus far the peak-period work has not been split into two pieces to be assigned to two different PTOs because of the difficulty of recruiting and training new operators and the perception that the overall objective was to maximize cost savings for a given number of PTOs.

Each PTO is assigned and trained for a single run from a particular garage on Monday through Friday each week. The assignment of a specific number of PTOs to a garage is based on an informal analysis of existing spread penalties and additional runs. However, the allocation by the Plans and Schedules Department has at times been altered based on the Transportation Department's limited ability to reassign and retrain PTOs and FTOs. Thus, the current allocation of PTOs among garages does not maximize spread-penalty savings. No PTOs are currently used on the weekends because the spread-penalty savings are much greater during the week. As mentioned earlier, 23 of the 280 PTOs are not assigned to scheduled runs but fill in as substitute personnel for absent PTOs. Finally, no PTOs have yet been assigned to any rail operations because of the special training required.

FINANCIAL IMPACT OF PTOs

There is no doubt that the use of 280 PTOs is saving

MBTA substantial operating resources. Assuming that the spring (March 1983) timetable is carried forward during the next year and the level of part-time use (280) remains constant, MBTA will save approximately $5.6 million over the next year. These savings come primarily from three sources:

1. Wage savings because of reduction of unnecessary scheduled driver time (i.e., 6 productive hr of a PTO have been substituted for a guaranteed 8-hr day, which included extensive unnecessary cover) and because a quicker turnover of PTOs keeps their wage rate somewhat below the average rate of a comparable number of FTOs;
2. The elimination of costly FTO spread penalties for runs that were scheduled more than 10 hr to cover both the morning and evening peak travel requirements; and
3. Fringe benefit savings, because PTOs receive only the benefits required by statute (social security, worker's compensation), a scaled-down retirement fund contribution, free transportation, and a uniform allowance, whereas FTOs receive holiday, vacation, and sick pay and health, dental, life, and accident insurance as well.

The annual financial impact of using 280 PTOs is summarized as follows:

	Annual Financial Impact ($000,000)		
	Operating Cost		PTO
Type of Impact	FTO	PTO	Savings
Wages	6.1	4.3	1.8
Spread penalties	1.4	-	1.4
Fringe benefits	3.4	1.0	2.4
Total	10.9	5.3	5.6

The wage impacts reflect an average PTO rate of $9.76/hr (81 percent of top scale) and an average FTO rate of $10.45/hr (87 percent of top scale), which reflects the different turnover rates among PTOs and FTOs and the 8 months that it takes for a PTO to earn a 5 percent progression step increase working 6 hr a day as compared with 6 months for an FTO working 8 hr a day. The wage difference was computed by adding 2 hr per day to each part-time run and applying the respective wage rates to the total hours worked. The spread-penalty savings were computed directly based on the spread hours currently worked by part-time operators and applying the top wage rate ($12.065/hr) because more senior FTOs would generally pick these lucrative runs. The savings in benefits were computed directly on a per-operator basis by using the respective average wage rates for PTOs and FTOs and other unit cost data supplied by the MBTA Budget Office.

There are also some second-order financial benefits (which are not accounted for here), including up to 15 min of overtime and make-up time, which would have to be paid to FTOs and for which PTOs do not qualify. (For example, although the goal for scheduling PTO runs is 6 hr a day, the average PTO run is only 5 hr and 48 min. The additional 12 min a day for each PTO is saved, whereas all FTOs must be paid for a full 8-hr day.)

The average total annual savings is about $20,000 for each PTO currently assigned. As shown in the foregoing tabulation, the PTO savings are split relatively evenly among the three types of expenses. Although the fringe-benefit category is approximately linear with the number of PTOs, it should be noted that the other two categories will vary significantly at different levels of PTO use. After a certain point, the assumption of substituting one PTO run directly for one FTO run (and thus automatically saving 2 hr of pay per day) will not apply; rather, four PTO runs will be needed to replace three FTO runs and the only difference will be the difference in wage rates between the two classifications. The threshold point at which the dramatic wage savings are eliminated is about 310 PTOs for the bus system and 335 PTOs for the entire bus and light rail system. Similarly, the spread-penalty savings per operator are reduced as the number of PTOs increases, because the largest spread penalties are eliminated first as PTO runs are developed. For weekday service, it has been estimated that each PTO hired for the surface system beyond a total of 335 will save MBTA about $6,300 annually, that being the difference in fringe benefits for a PTO and an FTO.

ACCIDENT RATES

A critical concern is the effect on the accident rate of introducing PTOs. In this section, the accident rates for PTOs and FTOs are compared and the role that the difference in experience and working hours between these two groups plays in accident rates is investigated.

Table 1 shows the numbers of operators employed and accidents by month for PTOs and FTOs. It is clear that the accident rates for part-time employees are significantly higher than those for full-time employees. For example, in July 1982 the accident rate for part-time employees was fully three times that for FTOs. Although the accident rate for part-time employees had decreased considerably by the first quarter of 1983, it was still 75 percent higher than that for full-time employees. Clearly, as PTOs acquire experience their accident rate is declining, but it remains to be seen how far and how quickly this decline will proceed.

Furthermore, if the accident rate is computed on the basis of hours worked rather than number of op-

TABLE 1 Accident Rates for PTOs and FTOs

	FTO			PTO		
Date	No. of Operators	No. of Accidents	Annual Rate[a]	No. of Operators	No. of Accidents	Annual Rate[a]
July 1982	1,367	151	1.33	67	24	4.30
Aug. 1982	1,367	133	1.17	101	38	4.51
Sept. 1982	1,367	140	1.23	177	44	2.98
Oct. 1982	1,367	165	1.45	203	49	2.90
Nov. 1982	1,379	150	1.31	227	61	3.22
Dec. 1982[b]	1,379	107	1.44	281	44	2.91
Jan.-March 1983	1,370	449	1.33	280	161	2.33
Total		1,295	1.31		421	2.83

[a]Accidents per operator per year.
[b]Up to December 20th only.

erators, the discrepancy between PTOs and FTOs is much more marked; the accident rate for PTOs in the first quarter is 133 percent above the accident rate for FTOs. This is, in fact, a fairer way of looking at the accident rate because the exposure increases with hours worked.

In June 1981 the MBTA Safety and Training Department analyzed the relationship between accidents and driver experience. For 9 months of accident records the accident rate was computed by the number of years of MBTA service by the driver. The results summarized in Table 2 show that accident rates indeed decline with experience, being twice as high in the first 2 years as rates for those with more than 5 years' experience.

TABLE 2 Accident Rate as a Function of Experience Level

Accidents per Operator per Year	Years of Service
2.1	0-1
2.2	1-2
2.0	2-3
1.7	3-4
1.8	4-5
1.1	5-10
0.8	10-20
0.9	20-30
0.8	30-40+

A comparison of the PTO accident rate with the FTO accident rate for operators with comparable experience (0 to 2 years of service) indicates that PTOs have a 30 percent higher gross annual accident rate, or 73 percent higher hourly accident rate. These findings indicate that the higher PTO accident rate is related to their lower level of driving experience.

It has also been suggested that the higher PTO accident rate may be related to the use of PTOs during peak periods. This issue was addressed by examining the relationship between accidents and time of day. March 1983 accident data for FTOs were studied to see whether accident rates varied between time periods. This analysis showed that there was no statistically significant difference between peak-period and off-peak accident rates; in fact, the peak-period rate was marginally lower.

In addition to the impact on public safety, the higher accident rate exhibited by PTOs will clearly increase MBTA costs for settling accident claims and repairing damaged vehicles. A comparative analysis with 1983 data on the use of PTOs and FTOs indicates that the use of PTOs incurs an additional $0.9 million, representing a 20 percent increase, in annual costs for accident claims. (Note that this analysis did not include any increase in the cost to MBTA for repairing vehicles damaged in accidents.) This analysis compared current 1983 operations using 1,370 FTOs and 280 PTOs with a scenario of operations using no PTOs and 1,650 FTOs. For each scenario the number of accidents per year was estimated by applying the annual accident rate per driver (FTO or PTO), based on data from July 1982 through March 1983. Annual costs for accident claims and suits were estimated by assuming that each accident cost MBTA $2,000, based on data from recent years. The scenario with no PTOs resulted in an annual total of 2,162 accidents at a cost of $4.3 million. On the other hand, current operations (with 280 PTOs) are estimated to yield 2,587 accidents at an annual cost of $5.2 million. Applying the more recent lower 1983 PTO accident rate (annualized to 2.33 accidents per year) to the scenario of 1,320 FTOs and 280 PTOs results in an annual total of 2,447 accidents and an annual cost of $4.9 million. This represents a 13 percent increase in annual accident cost over similar operations without the use of PTOs.

It should be noted that this analysis uses average (inflated) claims and suit settlement data from the past several years, which excluded several large settlements. It is impossible to predict how the higher PTO accident rate will translate into a probability of encountering a number of extremely costly claims that could quickly erase the savings realized from introducing PTOs. (In 1981 one suit, now on appeal, was decided at a cost of $1.5 million, and in 1982 another suit was decided at a cost of $1.8 million.) Already one PTO has been involved in a fatal bus-pedestrian accident.

The high PTO accident rates at the MBTA are clearly disturbing. Individual safety is of utmost importance in a public transit operation and MBTA should continue to monitor this situation closely in the coming months. Perhaps it should be required that stricter standards and disciplinary actions accompany any PTO vehicle violations or that any PTO involved in an accident undergo remedial training during the midday breaks. Data from three other agencies using PTOs suggest that the PTO accident rates should continue to decline to the level of FTO rates; both Los Angeles and Baltimore report about the same accident rate for PTOs and FTOs, and Seattle reports a slightly lower PTO accident rate.

One other possible explanation for the difference between PTO and FTO rates should be recognized. It may be that PTOs are reporting a larger number of minor accidents that would go unreported by FTOs. With the data available, it has not been possible to test this hypothesis, but it is a possibility and if it is true, this would eliminate safety as a major factor in the analysis.

ABSENTEEISM

Another potential effect of the introduction of part-time employees is a lower rate of absenteeism. If this is the case, service performance should be improved or the cover list can be reduced, resulting in cost savings.

In Table 3 absence hours are given as a percentage of total scheduled hours for full-time surface operators, rapid transit operators, and PTOs for each year. The data indicate that the absence rates for PTOs are in fact significantly higher than those for FTOs, primarily because of more sick time, terminations, suspensions, and unauthorized leave. On the other hand, the absences of full-time surface and rapid transit operators are attributable primarily to sick time and industrial accidents.

Figure 1 shows the annual absenteeism data by employee class over time. The graph of total hours absent clearly indicates the higher rate for PTOs and also that the absence rates for all employee classes declined in 1983. (Because the 1983 data represent only the first 4 months of the year, the lower absenteeism rate may be a result of seasonal fluctuation.) Note that FTO absenteeism increased significantly for a period in 1982, which is related to the introduction of PTOs. The graph of absences due to sick leave and industrial accidents shows the higher rates for FTOs and rapid transit motormen. The PTO rate increased substantially from 1982 to 1983, almost entirely because of an increase in hours of sick leave. The 1982 increase for FTOs was entirely attributable to a dramatic rise in industrial accidents. The graph of terminations, suspen-

TABLE 3 Absenteeism

	Hours Absent[a] (%)									
	FTO				Rapid Transit Operator				PTO	
Type of Absence	1980	1981	1982	1983	1980	1981	1982	1983	1982	1983
Sickness	3.4	3.7	3.7	3.1	4.5	4.3	4.2	3.5	2.4	4.0
Industrial accident	1.2	1.9	3.3	2.8	1.5	1.8	1.8	2.0	0.2	0.5
Excused	0.3	0.3	0.2	0.2	0.3	0.3	0.4	0.3	0.6	0.4
Absent without leave	0.1	0.1	0.3	0.1	0.1	0.1	0.3	0.0	0.3	0.1
DIF	0.1	0.1	0.1	0.1	0.1	0.1	0.0	0.0	0.1	0.0
Jury duty	0.1	0.1	0.1	0.1	0.2	0.1	0.2	0.0	0.0	0.0
Termination	0.1	0.1	0.1	0.0	0.0	0.2	0.1	0.0	2.5	1.6
Military duty	0.1	0.1	0.2	0.1	0.1	0.1	0.1	0.2	0.1	0.3
Suspension	0.3	0.5	0.6	0.6	0.3	0.5	0.5	0.3	2.6	2.1
Union	0.0	0.2	0.0	0.1	0.0	0.0	0.0	0.0	0.0	0.0
Unauthorized	0.1	0.0	0.0	0.2	0.0	0.0	0.1	0.1	1.9	0.9
Total	5.9	7.1	8.9	7.3	7.0	7.5	7.7	6.4	10.7	9.8

[a]Hours absent expressed as a percentage of total scheduled hours.

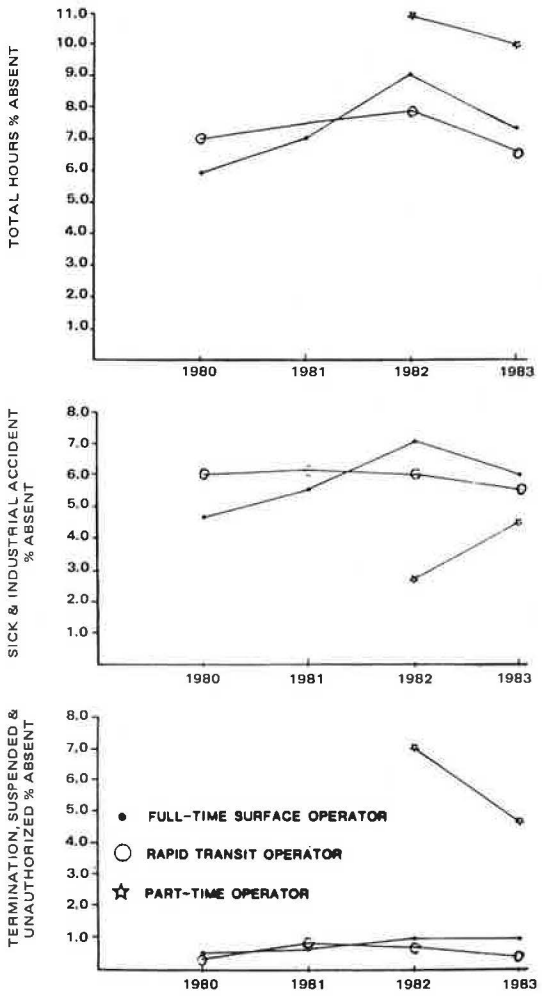

FIGURE 1 Distribution of absenteeism by category.

sions, and unauthorized absences shows the high rate for PTOs. It is also clear that the PTO rate decreased significantly from 1982 to 1983; the decrease is primarily attributable to a lower rate of terminations and unauthorized absences. Three of the four other agencies contacted (Washington, D.C.; Los Angeles; and Seattle) reported lower absenteeism for PTOs; the fourth (Baltimore) reported a significantly higher PTO absence rate.

TURNOVER RATE

The turnover rate is important because it affects the amount of hiring and training required and also reveals the amount of experience that PTOs acquire before leaving. There is no reason a priori to expect similar turnover rates for PTOs and FTOs because the working conditions, pay, and benefits are quite different.

Annual FTO turnover rates were computed based on the number of annual terminations and total number of FTO employees, shown as follows for 1980 through 1982:

Year	Total No. of FTOs	No. of Terminations	Turnover Rate (%)
1980	1,930	103	5.3
1981	1,785	225	12.6
1982	1,468	114	7.3

Note that in 1981 a substantial number of drivers were laid off. As a result, the analysis is based on the 1982 data; that is, an annual rate of 7.3 percent, or a little more than 100 FTOs laid off each year.

Two major components of PTO turnover are examined: the promotion of PTOs to full-time status, and PTO terminations (discharge or resignation).

Promotion to FTO Status

The estimated annual rate of PTO promotions over the next few years is 36 percent (100/280). Estimation of this rate assumes that a PTO staff size of 280 employees is maintained and that approximately 100 FTOs terminate and must be replaced annually.

PTO Terminations

Experience to date has indicated a 21 percent turnover rate because of PTO discharges or resignations based on 13 discharges and 30 resignations. Most of these terminations involved PTOs hired in the summer and fall of 1982, relatively early in the MBTA experience with PTOs. Evidence suggests that many of these early terminations were a result of confusion regarding the implementation of new procedures and a new work force. In fact, the early 1983 termination rate is 16 percent, lower than the 21 percent overall rate to date. Therefore, it appears likely that the part-time operation is stabilizing and that the number of discharges and resignations can be reduced over time. However, the current termination rate for PTOs is still twice as high as that for FTOs.

Experience from other agencies (Seattle and Los Angeles) suggests that although turnover rates are still significantly higher for PTOs than FTOs, the turnover rates did decrease as more experience was gained in screening, hiring, and monitoring PTOs.

One implication of the high PTO turnover rate concerns the impact on costs of training operators. By incorporating the estimated 57 percent annual PTO turnover and any additional training requirements for PTOs, it is estimated that the introduction of PTOs has increased annual costs for training by almost $206,000, approximately 113 percent.

ALTERNATIVE SCENARIOS

An analysis was conducted of various MBTA options under three future scenarios:

1. Keeping the number of PTOs constant;
2. Complying with the recent arbitrator's ruling of a 15 percent limit (per classification) for part-time employees, and
3. Increasing the use of PTOs without restrictions.

Options for the future were analyzed separately for the three scenarios related to the overall number of PTOs that might be available. In the first scenario, the potential for improving the utilization of PTOs was explored under the assumption that the total number remains at 280. This scenario is strictly a short-term one assuming a continuation of the MBTA policy of neither increasing nor decreasing the number of PTOs until the litigation resulting from the arbitration award is resolved. The second scenario focuses on the implications of the arbitration award's being upheld in the courts, requiring the number of PTOs to be reduced to 15 percent of FTOs. Finally, the third scenario is that the courts remove the arbitration award restrictions on the number of PTOs and MBTA continues with its initial plan to expand to 350 to 400 PTOs.

Keeping the Number of PTOs Constant

Under the first scenario, a detailed analysis of the current FTO and PTO runs for three bus rating stations suggested two ways to improve the utilization and productivity of PTO assignments:

1. Schedule PTOs to cover all pullouts (beginning of run) before 5:00 a.m., thereby eliminating all paid meal breaks, and
2. Adjust most of the FTO runs to bring the spread times to just under 10 hr in all (i.e., increase those now about 9 hr).

These two improvements together would eliminate most spread-time penalties.

Currently there are about 80 weekday straight runs on the MBTA surface bus system, each of which by contractual agreement includes a paid break of at least 20 min. An analysis of these straight runs shows that the average weekday paid break is approximately 30 min, yielding 40 paid hr per day without work. Most of these straight runs have pullouts before 5:00 a.m. because by contractual agreement all such runs must be straight if assigned to an FTO.

Currently all pullouts before 5:00 a.m. are served by FTOs who cannot participate in the afternoon peak because of the restriction that they must work a straight 8 hr (they will all be out of service by 1:00 p.m.). By structuring all pullouts before 5:00 a.m. as PTO runs, two benefits are obtained:

1. The paid breaks are eliminated, and
2. By scheduling runs with spreads of approximately 13 hr, these drivers can also participate in the afternoon peak.

It is estimated that the annual savings from the elimination of all weekday straight shifts and the associated paid breaks would be approximately $145,000. This is based on the observation that one driver run could be eliminated when the runs were recut in each of the Charlestown, Cabot, Somerville, and Arborway rating stations.

By eliminating all straight shifts and by lengthening the spread time for many evening runs from the current level of about 9 hr to close to 10 hr, many of the runs that currently have spreads requiring premium pay can be reduced to about 10 hr in total spread. In general, this will involve increasing the average spread time for PTOs slightly, but few (if any) would be required to work spreads of more than 13 hr, which is the policy maximum currently used by MBTA schedulers. In most garages, PTOs would be divided into two groups. One group would serve the earliest pullouts (including all of those before 5:00 a.m.) and work 3.5 to 4 hr in the morning and 2 to 2.5 hr in the afternoon peak. The other group would serve the 6:30-7:00 a.m. pullouts and work 2 to 2.5 hr in the morning and 3.5 to 4 hr in the afternoon peak. This pattern of assigning PTO runs in two groups could be consistently applied systemwide, because our analysis showed it to significantly reduce spread penalties in each of the Cabot, Quincy, and Somerville garages. An additional annual savings of approximately $350,000 is projected from this restructuring of existing part-time runs to reduce spread penalties. If implemented along with the elimination of FTO runs with paid meal breaks, a total of about $0.5 million in transportation costs would be saved annually.

Limiting PTOs to 15 Percent

One possible outcome of the court's review of the arbitration award is that the award will be upheld with respect to the terms of MBTA use of PTOs. The particular implications of such a finding would arise from one clause that MBTA is not now honoring: The maximum number of part-time employees should be 15 percent of the number of full-time employees in the same classification.

The 15 percent limit would imply a reduction from about 280 PTOs to 224 PTOs in the surface-operator classification. In order to estimate the increased cost of service, again assuming that the amount of service provided does not change, it is assumed that the following process is used:

1. Select those part-time runs with the minimum spread time;
2. Convert each run to a full-time run by adding sufficient cover time to bring the run up to 8 hr paid time; and
3. Compute the additional cost of the full-time runs by costing the additional time worked, the spread-time penalties, and the increased benefits accruing to FTOs.

The total cost of the additional 56 FTOs rather than PTOs is estimated to be about $870,000 annually. Some additional economies might be realized by using fewer FTOs to replace the 56 PTOs and in-

creasing the number of FTO runs with large spread penalties, but these additional savings (mainly from lower FTO fringe benefits) would probably not amount to more than 10 percent of the total estimated additional cost.

Although the $0.9 million annual cost is significant, it appears that it can be at least partly offset by the use of PTOs in other MBTA classifications. There are two other classifications in which PTOs could be valuable in reducing premium pay components: rapid transit motorman and rapid transit doorman (guard). In each of these classifications, approximately 20 part-time employees could be hired within the 15 percent limit ruling. After allowing for part-time cover, this implies that the 18 most expensive full-time runs in each classification may be converted to part-time runs, eliminating spread-time penalties and unnecessary cover time for these runs. The estimated savings for these new part-time employees total $0.75 million, as shown in the following:

Saving	Amount ($000s)
Reduced cover hours (20 hr/day)	63
Spread penalties (45 hr/day)	142
Reduced benefits, 20 PTOs	165
Total	370

If this use of part-time employees is adopted, it would require careful prior review of required training to ensure that accidents are prevented. Certainly the increase in accident rates observed for part-time surface operators must be avoided in the rail system. For this reason, it would be much easier to start the part-time employees in the doorman classification than the motorman classification. Nonetheless, in all likelihood, the length of training and consequently its cost would increase, erasing some of the hypothesized savings.

A final element in increasing the savings under the 15 percent limit is the use of some of the 280 part-time surface operators on the streetcar system. Specifically, if use of part-time employees for streetcar operation is sanctioned, with the same safety proviso given earlier for rail transit, a total of 20 PTOs could be shifted to streetcar operation to eliminate all spreads of more than 11 hr and 30 min. This would produce a net additional annual savings of about $63,000.

In sum, it appears that if the arbitration award is upheld, the immediate net impact on annual MBTA operating cost would be almost $0.9 million. However, these costs could be partly recovered by introducing part-time employees into the classifications of rapid transit motorman and doorman (an annual savings of about $0.43 million can be achieved by using 20 part-time doormen and shifting 20 part-time bus operators to streetcars) and by the better use of existing part-time bus operators as discussed under the first scenario.

Increasing Use of PTOs

The final scenario is based on the overturn of the arbitration award as it affects part-time employees, which would allow MBTA to increase the number of part-time employees in any classification without limit. MBTA would have the greatest number of options available under this scenario and the following additional PTO uses were identified with their projected transportation cost savings:

1. Thirty additional PTOs to eliminate all remaining bus system spread penalties, $650,000;
2. Twenty-five more PTOs if midday service adjustments on heavy bus routes are made according to the MBTA Service Policy, $465,000;
3. Twenty-five PTOs to eliminate spread penalties and unproductive cover time on the Green line, $537,000;
4. Thirty PTOs to eliminate spread penalties and cover time for the rapid transit doorman classification, $500,000;
5. Thirty PTOs to eliminate spread penalties and cover time for the rapid transit motorman classification, $500,000;
6. Fifty PTOs to provide all Sunday bus service and eliminate paid meal breaks on Sundays, $750,000; and
7. Any additional PTOs beyond those just shown, $6,300 per PTO.

In considering this third scenario, however, the safety issue becomes paramount. Before there is any expansion of PTO participation in the MBTA work force, the exact causes of the high accident rate must be investigated and identified, and strategies to combat it must be developed and implemented. One possible exception to this generalization, however, is the potential to introduce part-time rapid transit doormen, which should not have any significant safety impact and can further reduce operating costs by about $0.5 million annually.

It is important to recognize the potential long-range implications of a policy of aggressively increasing the proportion of part-time employees at MBTA. Because PTOs are now represented by the Carmen's Union, it must be anticipated that as the number of PTOs increases, their impact on the contract negotiation and bargaining process will also increase. In the next round of bargaining, negotiation might focus on possible limitations and pay penalties on spread time for PTOs as well as FTOs and the incorporation of more fringe benefits into the part-time employee package.

Although it is impossible to predict what the outcome of such negotiations might be, it is important to recognize the potential for a narrowing of the cost differential between part-time and full-time MBTA employees. This again suggests that a policy of slow expansion of part-time employee participation is the most appropriate policy.

SUMMARY

MBTA has made significant progress in the last year and a half in improving productivity through the use of PTOs, and further productivity improvements appear possible. The high rate of accidents, however, suggests caution in expansion of the PTO labor force (except perhaps for the rapid transit doorman classification). MBTA management should develop careful monitoring and remedial training strategies to deal with the PTO accident problem.

Several other possibilities exist to increase the productivity of PTOs:

1. MBTA should experiment (especially under scenario 3) with hiring and assigning PTOs to work only 2 to 5 hr a day for one peak period. The performance of these one-piece PTOs should be compared with that of the existing PTOs.
2. MBTA should consider making the selection

process for promotion (to FTO) more formally structured and weighted more toward a merit rather than seniority basis.

3. A programmed hiring approach should be put into place to ensure that all newly hired and reassigned PTOs have adequate training time and reassignment of both PTOs and FTOs can be made more often to correspond to productivity changes identified by the scheduling department.

4. A range of short-term improvements should be made in planning and scheduling to more easily and quickly respond to changing work-force requirements and to allow a fine-tuning of MBTA service to better meet the region's travel demands.

Using Section 15 Data: Adapting and Evaluating the Magnetic Tape Version for Statistical Analysis

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ABSTRACT

Data reported as required by Section 15 of the Urban Mass Transportation Act of 1964 have already proved useful in transit decision making. Yet wider use of these data has been inhibited by the difficulty of access to it electronically. A set of strategies for extracting, reorganizing, and evaluating data originating in the electronic data files disseminated by Transportation Systems Center on magnetic tape is described. The current organization of information within the files is unsuitable for most statistical software packages. Therefore, it is necessary to extract information from the Section 15 files and rearrange it in a form suitable for analysis. Different classes of missing data are also defined and remedies for the problem are addressed. In addition the cross-validation of values and the computation of basic transit variables are considered. Many statistical models make assumptions about the distributional characteristics of variables. Differences of scale among transit systems on such measures as size of fleet often result in variables the distributions of which violate these assumptions. Transformations that remedy the problem are recommended.

Since its first release for FY 1979, the reporting system outlined in Section 15 of the Urban Mass Transportation Act of 1964 has proved itself a powerful tool in transit decision making. It has provided standardized definitions of transit activities and recording procedures (1); replaced burdensome and nonuniform data-collection efforts by local operators (2); allowed local, regional, and nationwide comparison of transit performance (3); and facilitated management, performance evaluation, and the allocation of financial assistance at all jurisdictional levels (4-7). In short, analysis of Section 15 data offers greater leverage for understanding transit performance than has hitherto been possible.

The most complete version of Section 15 available for analysis is distributed by the Transportation Systems Center (TSC), Cambridge, Massachusetts, in the form of 62 electronic data files stored on magnetic tape. Although this version promises to be the most useful in the long run, current use of the tape is inhibited by the difficulty associated with reading it and adapting the information to a form suitable for statistical analysis. Considerable time and effort must be allocated to the development of a system for accomplishing the adaptation.

As TSC adopts a new operating system and develops new software for Section 15 data, a wider variety of data tape formats may become available. However, the first 4 years of Section 15 data (FY 1979-1982) share the same organization described in this paper.

An alternative to the magnetic tape is the National Urban Mass Transportation Statistics, UMTA's annual report (8), which provides tabular summaries of Section 15 data. But there are two drawbacks to substituting the printed annual report for the tape version. First, the tape is a comprehensive set of data including far more information than the printed annual report. All levels of reporting are included in the tape, whereas only the required level of information is given in the printed annual report. Entire classes of data such as operating schedules and peak loads are available only on the tape. This additional information permits the cross-validation of values, a critical step in assessing the accuracy of these data. Second, for users who wish to analyze transit systems on a nationwide level or use many variables, the cost of making the printed annual report machine readable could rival or exceed that involved in adapting the tape. For example, the data to be used require keypunching. Then a number of preliminary computational steps, such as converting percentages back to raw values, must be carried out before actual analysis commences. Therefore, it would be useful if a set of strategies could be outlined that would facilitate the use of Section 15 data as it originates on magnetic tape.

This paper describes such a set of strategies. A conceptual scheme underlying the conversion of the magnetic tape data to a conventional statistical format is first described. This is followed by a