Cost Increases, Cost Differences, and Productivity of Transit Operations in New York State

William C. Holthoff,* Polytechnic Institute of New York
Robert G. Knighton, Planning and Research Bureau, New York State Department of Transportation

Public transit operations in New York State were analyzed to explore transit costs and operational productivity. Three transit systems were examined over time to determine what cost component are causing the rapid increases in operating costs that have occurred in the past 7 years. Twelve bus operations were analyzed to explore why some transit operations cost more to operate than others, and whether similar transit operations are equally productive. The results showed that employee costs (wages and salaries, pensions, and other employee-related costs) constitute 70 to 90 percent of all operating costs, and that increases in employee costs are almost entirely responsible for past increases in operating costs. Increases in fuel, power, and other non-employee-related costs were found to have little effect on operating cost increases. Differences in operating cost per vehicle-kilometer among operations are accounted for by differences in average vehicle speeds, employee average earnings, and, in some cases, productivity. Cost savings of between 5 and 12 percent could be obtained by increasing the average vehicle speed of a bus operation by 1 km/h (0.6 mph). The difficulties of obtaining an increase in average vehicle speed are also discussed.

This paper extends a previously reported analysis of transit operating costs that was performed during the New York State study of transit operating assistance. The previous analysis (1, 2) showed that transit costs were increasing at a rate that was about 5 percent faster than the consumer price index (CPI), and that there are significant differences in operating costs per vehicle-kilometer among different transit operations in the state. This paper explores several key areas in transit costs.

1. What particular cost component(s) are responsible for past cost increases?
2. Why are some transit operations' operating costs per vehicle-kilometer increasing faster than others?
3. Why do similar transit operations have different operating costs per vehicle-kilometer?
4. What, if anything, can be done to reduce these differences?

The paper also examines transit productivity and investigates whether similar operations have the same productivities and then explores the relations between productivity, total operating costs, and employee compensation.

HISTORY OF TRANSIT COST INCREASES

Three transit operations, which had sufficient data available for the years 1967 through 1973, were chosen for this analysis. They are

1. Regional Transit Service (RTS), the primary transit operator in Rochester, New York;
2. New York City Transit Authority (NYCTA), a subsidiary of Metropolitan Transit Authority (MTA), a bus and subway operation; and
3. Manhattan and Bronx Surface Transit Operating Authority (MABSTOA), a subsidiary of NYCTA, a bus operation.

The data obtained for each operation include

1. Number of employees (including transit police for New York City operations);
2. Revenue vehicle-kilometers;
3. Employee costs: (a) wage and salary costs, (b) pension costs, and (c) other benefit costs (which include health and welfare benefits, Social Security taxes, cost of workmen's compensation, and any other related employee benefits that are paid by the employer);
4. Cost for fuel for buses;
5. Power cost (subway only);
6. Material and supplies cost (except for RTS for which data were not available); and
7. Total operating costs (excluding depreciation and including transit police costs).

Transit police were included in most of the analysis since their employee costs were not separated from transit-worker employee costs. Where possible transit police have been excluded and these places have been indicated.

Component Cost Percentages

Each cost variable as a percent of total operating cost is shown in Figure 1.

Employee Costs (Wages and Salaries, Pensions, and Other Benefits)

This component is 80 to 90 percent of the total operating costs, making it the prime determinant of operating costs. Wages and salary costs as a percentage of operating costs have declined somewhat (although still the largest single component), but pension costs have increased. The percentage costs of other benefits have increased for two operations and decreased only slightly for the other.

Other Costs

Fuel for buses, power, and material and supply costs each represent less than 10 percent of the operating costs for each of these transit operations. Both MABSTOA and NYCTA experienced drastic increases in fuel prices during the energy crisis: During 1973-1974 the cost of fuel for buses increased by about 100 percent and the cost of power increased by about 40 percent. At the same time, however, the percentage of the operating costs represented by the fuel cost increased only 1 percent and that by the power cost less than 1.5 percent. Even drastic increases in the costs of power, fuel, and materials and supplies have little effect on the percentage that other costs represent of the total operating costs.

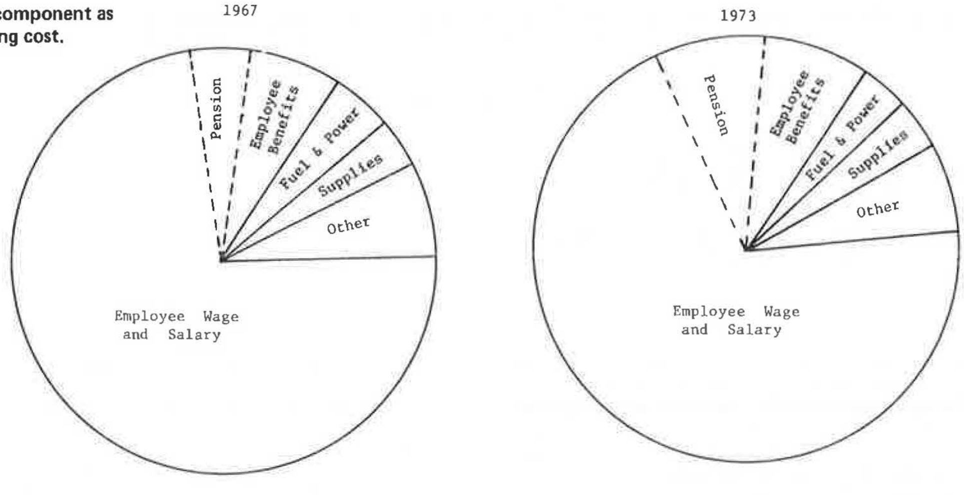


Figure 1. Transit cost component as percent of total operating cost.

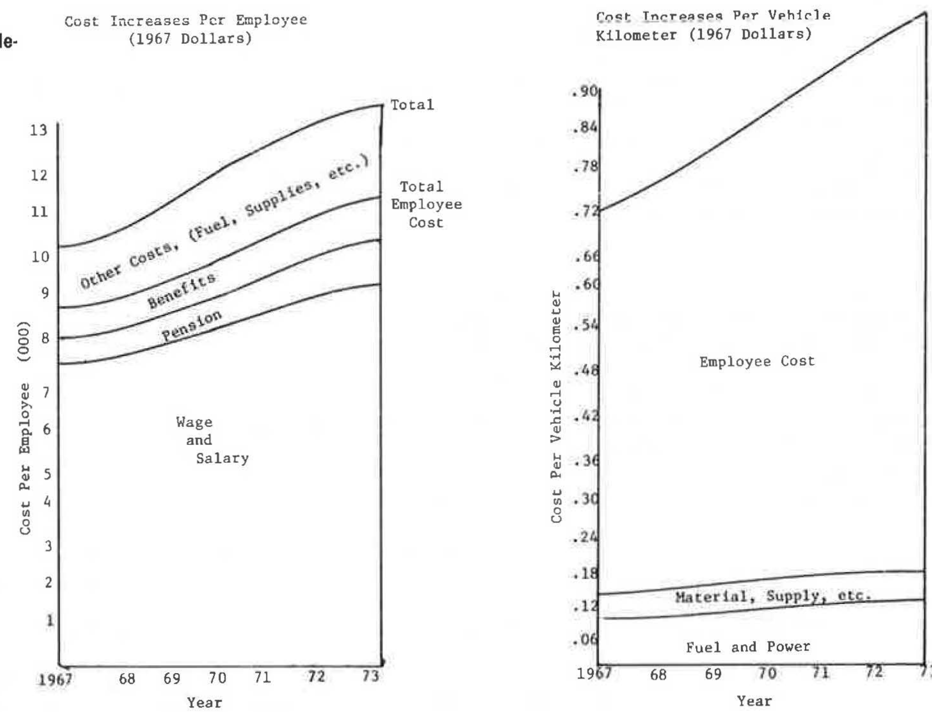


Figure 2. Transit cost component changes per employee and per vehicle-kilometer in 1967 dollars.

Cost Increases

The cost increases occurring from 1967 to 1973 were adjusted in the following ways.

1. The cost per employee and per vehicle-kilometer was calculated for each cost component.
2. An average cost for the three systems was calculated.
3. The costs were converted to 1967 dollars by using the CPI to analyze the real cost increases without regard to inflation.

Figure 2 shows the components of the total operating costs on both a per employee and a per vehicle-kilometer basis. Employee costs, particularly wages and salaries, are responsible for most of the transit cost increase; while wage and salary costs have grown at a lower rate since 1972, pension and benefits have grown more rapidly so that the growth in employee costs has continued at approximately the same rate.

Differing Rates of Cost Increase per Vehicle-Kilometer

Figure 3A shows the operating costs per vehicle-kilometer of each of the systems examined. The operating costs per vehicle-kilometer of MABSTOA are increasing faster than those of NYCTA, whose costs (since mid-1971) have been increasing faster than those of RTS.

Figure 3B shows the index of the operating costs per employee based on the year ending December 31, 1967: All three operations have had similar cost increases per employee. Thus, the differing rates of cost increase per vehicle-kilometer are probably due to changes in the number of vehicle-kilometers of operation without similar changes in the number of employees. Figure 4 shows the changes in vehicle-kilometers and in the number of employees for each of the systems (transit police have been excluded from the number of employees for NYCTA). RTS, since mid-1968, has changed the number of employees and the number of vehicle-kilometers at the same rate. NYCTA did almost the same until 1971,

Figure 3. Comparisons of total operating cost per vehicle-kilometer and per employee for three operations.

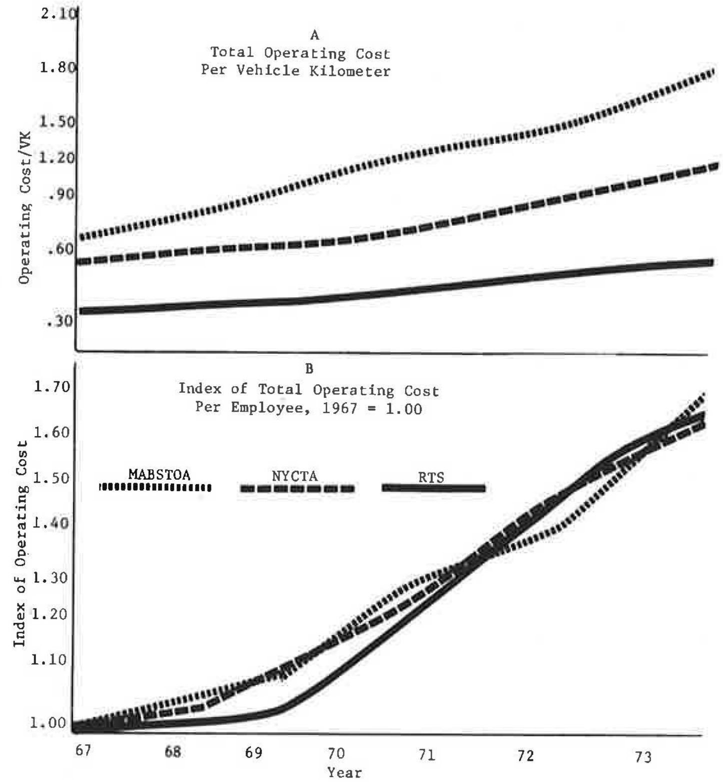
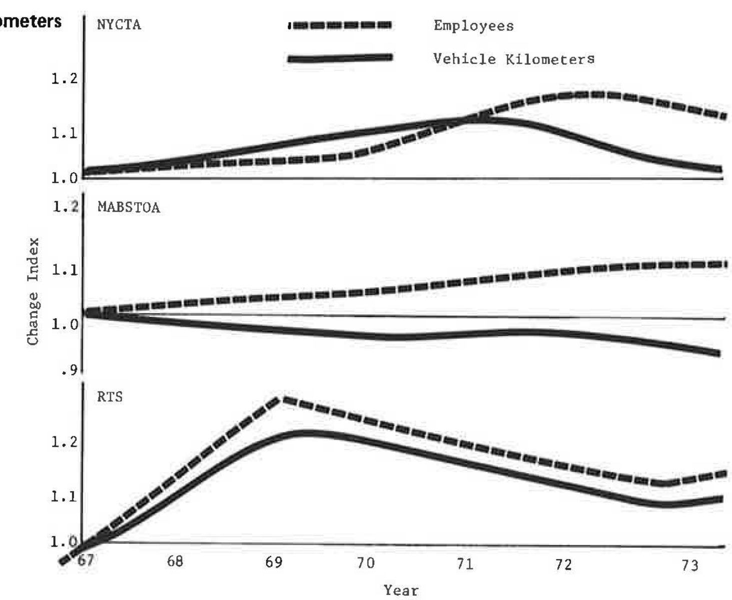


Figure 4. Comparison of changes in employees and vehicle-kilometers for three operations.



after which employment remained about constant while the number of vehicle-kilometers decreased. This explains why the increases in operating costs per vehicle-kilometer for NYCTA and RTS were almost the same from 1967 to 1971, while after that RTS costs increased at a slower rate than those of NYCTA. MABSTOA, which has had the fastest increase in operating costs per vehicle-kilometer, has since 1967 increased its employment but decreased the number of vehicle-kilometers. Thus the different rates of increase in operating costs per vehicle-kilometer have been due to changes in the number of vehicle-kilometers operated without corresponding changes in the number of employees.

Comparison of Cost Component Increases

Wage and salary costs per employee have increased for all three operations at approximately the same rate, to almost 1.6 times higher in 1973 than they were in 1967. Pension costs per employee have increased at approximately the same rate for NYCTA and RTS and were about 2.5 times higher in 1973 than they were in 1967. MABSTOA has had a much higher increase in pension cost per employee (5.7 times as much in 1973 as in 1967). However, its increase in other benefits per employee has been lower than those of NYCTA or RTS (MABSTOA, 1.8 times; RTS, 2.1 times; and NYCTA, 2.5 times higher in 1973 than other benefit costs per employee in 1967).

Costs per vehicle-kilometer for fuel for buses have increased at approximately the same rate for each operation. Power costs per vehicle-kilometer have steadily increased since mid-1969 and were 2.26 times greater in mid-1974 than in 1969. Increases in material and supply costs per vehicle-kilometer have varied. Those of MABSTOA have increased 3.7 times over 1967 levels while those of NYCTA have increased only 1.8 times.

DIFFERENCES IN TRANSIT COSTS (BUS ONLY)

The first section of this report has examined rates of cost increases but has not explained differences in magnitudes of costs. Previous work (3, 4) had shown that the operating cost per vehicle-kilometer between two transit operations varies by as much as $3.20/vehicle-kilometer for the same year. This section and the following one investigate these differences.

Data for the year 1973 were obtained for 12 bus operations in New York State. All of these operations have the following characteristics: (a) a high percentage of fixed-route, multistop service; (b) mainly interurban operations; and (c) little charter service. The companies, the areas they serve, the types of operations, and their average operating speeds are summarized below (1 km/h = 0.6 mph).

Company	Area Served	Type of Operation	Avg Operating Speed (km/h)
NYCTA (bus only)	New York City	Public	12.6
MABSTOA	New York City	Public	9.6
Niagara Frontier Transit	Buffalo	Private	17.3
Regional Transit Service	Rochester	Public	18.7
Queens Transit	New York City	Private	16.3
CDTA	Albany-Schenectady-Troy	Public	17.6
Triboro Coach	New York City	Private	13.6
Steinway Transit	New York City	Private	16.3
Westchester Street	Westchester County	Private	16.5
Club Transportation	Westchester County	Private	19.8
Liberty Coaches	Westchester County	Private	17.9
Avenue B and East Broadway	New York City	Private	10.6

The variations in percent of operating costs for each of the cost components are employee costs = 72 to 91; wages and salaries = 62 to 85; pension costs = 3 to 11; other benefits = 7 to 11; and fuel, oil, and power costs = 2 to 5 percent respectively.

The average speed (obtained by dividing the number of revenue vehicle-kilometers by the number of revenue vehicle-hours) of these operations also varies significantly. The slowest company operates at an average speed of 9.6 km/h (6 mph) while the fastest operates at an average speed of 19.8 km/h (12 mph). There was no correlation between the average vehicle speed and the size of the transit operation.

Total Costs per Vehicle-Kilometer

Figure 5A shows the total operating costs (excluding depreciation) per vehicle-kilometer. The operating costs per vehicle-kilometer varied from $0.65 to $1.81/vehicle-km ($1.04 to $2.90/vehicle-mile). The operations are ranked by order of size, and since the operating cost per vehicle-kilometer still varies, operation size does not explain the differences in operating cost per vehicle-kilometer.

Effect of Vehicle Speeds

Transit operations can have significantly different operating costs per vehicle-kilometer and yet have similar operating costs per vehicle-hour so that the apparent difference in operating costs per vehicle-kilometer may be due to differences in average vehicle speed. To test this, the vehicle-kilometers for each operation were adjusted to reflect a 9.6-km/h (6-mph) average speed by multiplying the number of vehicle-hours by 9.6 km/h (6 mph). (Since the number of vehicle-hours does not change, the number of employee-hours and therefore the employee costs will not change.) Figure 5B shows the effect on the operating cost per vehicle-kilometer due to reducing the average vehicle speed to 9.6 km/h (6 mph). Significant increases in the cost per vehicle-kilometer would occur for most of the faster operations, but the operating cost per vehicle-kilometer, and thus the differences in the system per-kilometer operating costs, are partially, but not entirely, a function of the differences in average speed.

Effect of Employee Costs

The actual employee costs (wages and salaries plus pensions plus other benefits) per employee range from $9774 to $18 744/year. Employee costs constitute 72 to 91 percent of operating costs; hence even a small difference in employee average earning between operations will make a significant difference in the operating costs per vehicle-kilometer. The effects of these different employee costs were determined by adjusting the operating costs so that all employees in each operation received an average wage and salary, pension, and fringe benefits total of $18 744/employee. Figure 5C shows the results of the employee cost adjustment on the operating costs per vehicle-kilometer at a 9.6-km/h (6-mph) speed. Except for three operations, the operating costs per vehicle-kilometer after adjustments for speed and employee costs are all approximately equal.

Employee costs for the three remaining operations represent 72 to 78 percent of their operating costs. Other cost components constitute too small a percentage of operating costs to account for the difference in magnitude of operating costs per vehicle-kilometer among these three operations and the other nine. One possible reason for these three operations having significantly different costs could be that the vehicle-kilometers (after adjustment) per employee are significantly different from those of the other nine operations. This is explored in the next section.

PRODUCTIVITY

Vehicle-Kilometers per Employee

Figure 6 shows the actual productivity in terms of actual vehicle-kilometers and adjusted vehicle-kilometers operated at 9.6 km/h (6 mph). Even after adjustments have been made to average speed, there are significant differences in the productivity of different transit operations. This difference in productivity does not appear to be due to the number of hours an employee works per day. Figure 6 also shows that, with two exceptions, private transit operations are more productive than public transit operations.

However, Niagara Frontier Transit, one of the two low-productivity private operations, became a public

Figure 5. Effects on total operating cost per vehicle-kilometer if all operations operated at the same vehicle speed and all employees received the same compensation.

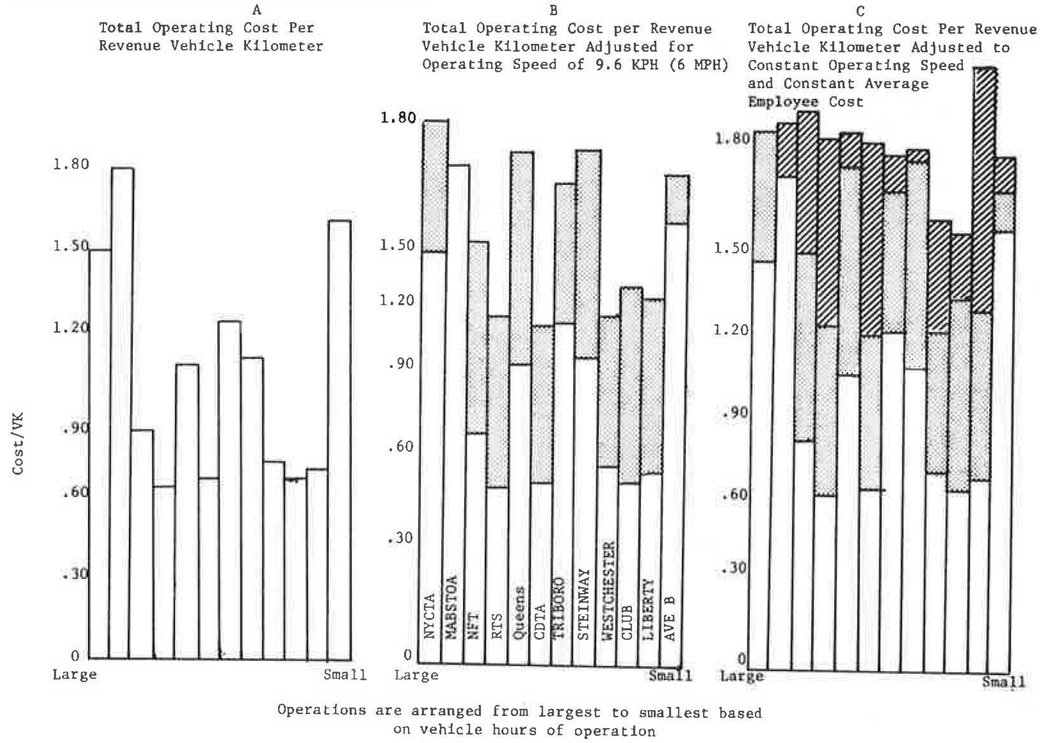
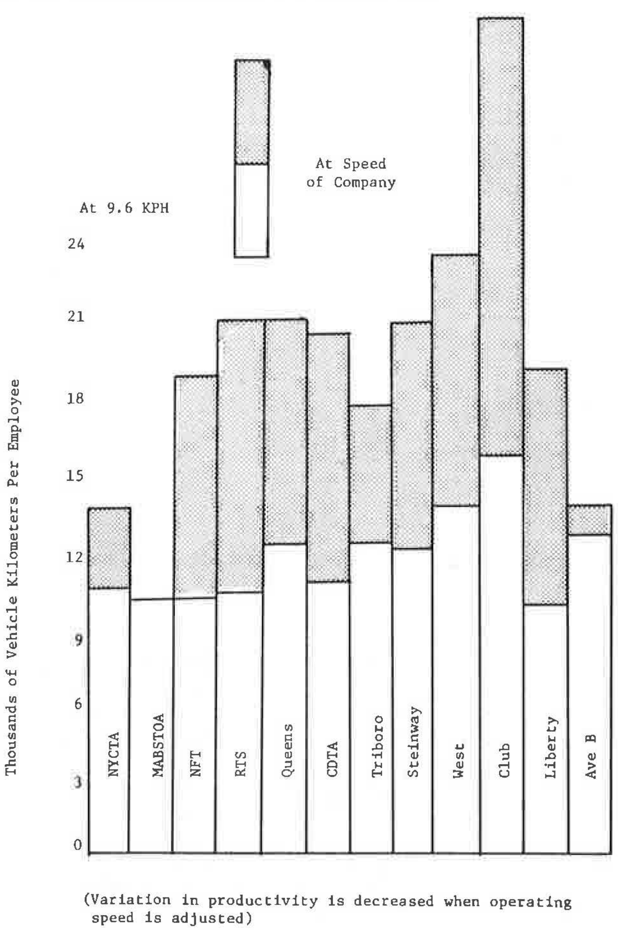


Figure 6. Productivity of transit bus operations in terms of revenue vehicle-kilometers per employee at operating speed of company and at adjusted operating speed of 9.6 km/h (6 mph).



operation in 1974. Thus, if the analysis had been done a year later, it would show five public operations, all of which are less productive than the private operations with only one exception. This suggests that the lower productivity of public operations may be explained by the fact that the least productive (often the least profitable) private operations tend to become public operations. It is not because operations are public that they are unproductive, but the reverse: Unproductive operations tend to become public.

Vehicle-Hours per Day per Employee

Figure 7A shows the productivity of operations in terms of vehicle-hours per day per employee, and Figure 7B shows the adjusted employee costs plus operating costs per vehicle-kilometer at 9.6 km/h (6 mph). As productivity increases, the adjusted costs per adjusted vehicle-kilometer tend to decrease. This is particularly true for the three transit operations that had significantly different costs per kilometer after all adjustments had been made. Westchester Street Transportation Company and Club Transportation Corporation have significantly lower costs per kilometer after adjustments have been made and have the highest productivity. Liberty Coaches, Inc., had the highest cost per kilometer and the lowest productivity. Thus, different average vehicle speeds, different employee costs per employee, and in some cases, different productivities per employee are the reasons why transit operations have different costs per vehicle-kilometer.

Figure 7A shows (in parentheses) the actual employee costs per employee for each of these operations. There seems to be little relation between employee costs per employee and productivity. Employee costs per employee (or employee average earnings) do not seem to be related to productivity.

Employee costs may possibly be related to passengers per employee. Figure 8 shows the employee costs per

Figure 7. Comparison of employee productivity in terms of vehicle-hours per employee per day and total adjusted operating costs per adjusted vehicle-kilometer.

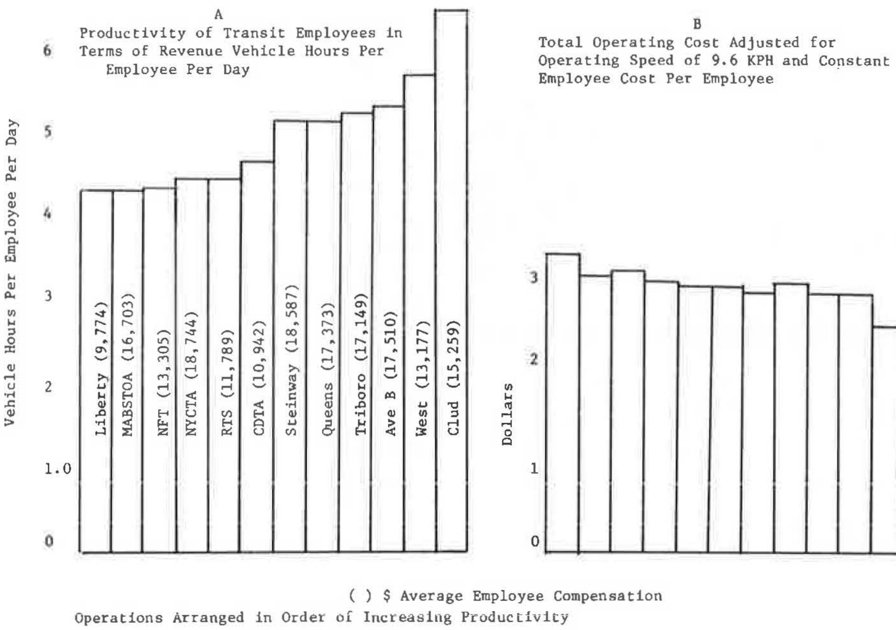
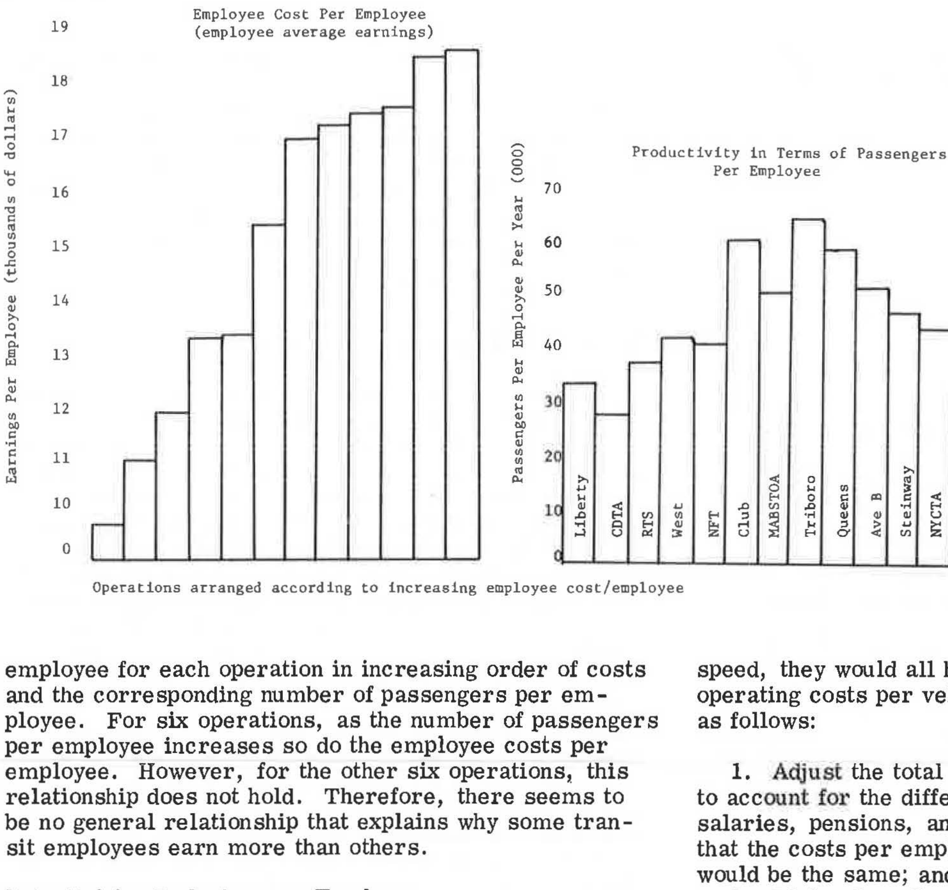


Figure 8. Comparison of employee costs per employee and employee productivity in terms of passengers per employee.



employee for each operation in increasing order of costs and the corresponding number of passengers per employee. For six operations, as the number of passengers per employee increases so do the employee costs per employee. However, for the other six operations, this relationship does not hold. Therefore, there seems to be no general relationship that explains why some transit employees earn more than others.

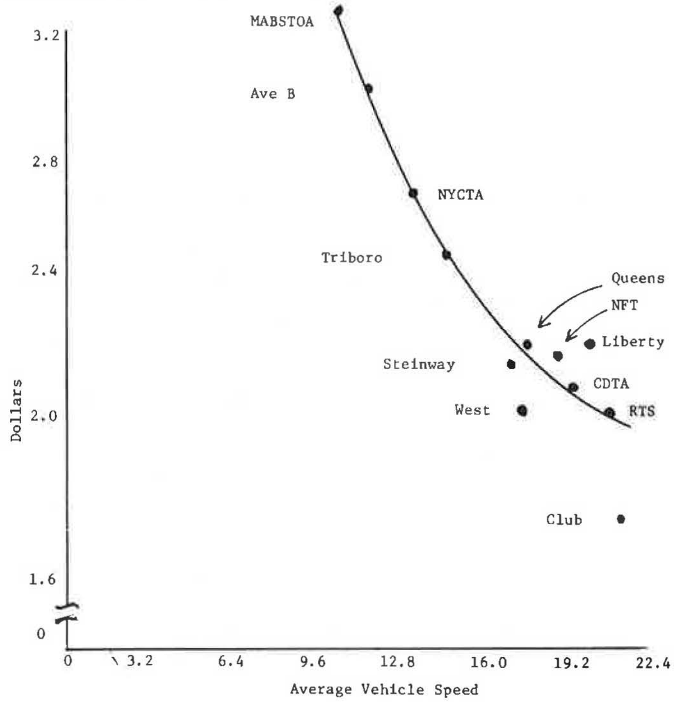
Potential for Reducing per-Employee Costs by Increasing Speeds

To further investigate the effect of average vehicle speed on operating costs, adjustments were made so that, if each of these systems had operated at the same average speed, they would all have had approximately the same operating costs per vehicle-kilometer. This was done as follows:

1. Adjust the total operating costs for each system to account for the different employee costs (wages and salaries, pensions, and benefits) among the systems so that the costs per employee for each of these systems would be the same; and
2. Divide the adjusted operating costs by the number of actual vehicle-kilometers of operation.

The total adjusted operating cost per revenue vehicle-kilometer is plotted against the average operating speed in Figure 9, which shows a dramatic decrease in operat-

Figure 9. Total operating costs plus adjusted employee costs per revenue vehicle-kilometer versus average vehicle speed.



ing costs per vehicle-kilometer as the operating speed increases from 9.6 to 19.2 km/h (6 to 12 mph). The table below shows the approximate percent decrease in operating costs to be expected for each kilometer-per-hour increase in operating speed (1 km/h = 0.6 mph).

Increase (km/h)	Decrease (%)	Increase (km/h)	Decrease (%)
10 to 11	12	14 to 15	6
11 to 12	9	15 to 16	5
12 to 13	8	16 to 17	5
13 to 14	7	17 to 18	5

(As the speed increases toward 19.2 km/h (12 mph) the additional saving from further speed increases becomes less.)

As the average vehicle speed increases, the same number of vehicle-kilometers can be achieved with fewer vehicle-hours. This allows the operator to reduce the number of employee hours, thus decreasing the employee costs, which represent 72 to 91 percent of the operating costs, or, by operating the same number of vehicle-hours with increased vehicle speed, more vehicle-kilometers of service could be provided without greatly increasing the operating costs. Thus, by increasing vehicle speed, the operator has three options:

1. To reduce his operating costs, while maintaining the same amount of service,
2. To maintain the same operating costs and increase the service provided, or
3. A combination of both.

But increases in average vehicle speed will not be easy to attain. Some operations operate at significantly slower speeds because of the on-street traffic environment, particularly during rush hours when congestion on the streets is extremely high and when the large portion of bus service is provided. It may be possible to increase the average vehicle speed by the elimination of on-street parking and better traffic enforcement.

Further increases in average vehicle speed would probably be attainable only by restricting automobile traffic or by implementation of exclusive bus lanes or rights-of-way. All of these alternatives are beyond the powers of the transit operator, and would have to be implemented by other government agencies. To produce a cost savings in the short run, if a higher average vehicle speed were achieved, the number of employee hours would have to be reduced, and with a strong transit union that may be difficult.

Even if the free flow of transit vehicles were possible, the average vehicle speed would not be increased by more than a few kilometers per hour because the distance between bus stops, the number of signalized intersections, and the number of people boarding at a bus stop all affect the average speed and set an upper limit on how fast a bus can operate without changes in service.

There are other advantages to increasing the average vehicle speed. If the prime determinants of mode choice (choosing the bus over any other mode for a trip) are frequency of service, travel time, and cost, then increasing the transit vehicle speed will shorten the travel time by bus, which will increase the number of passengers using transit. Shorter headways could also be obtained if service were increased, which should also increase ridership. Either of these options increases the number of passengers carried, thus increasing the operating revenue, which will help to reduce the operating deficit. In summary, the obstacles to obtaining a higher average vehicle speed for a bus operation are numerous, but the benefits are high. Increasing the average vehicle speed by 1 km/h (0.6 mph), particularly for lower speed operations, could reduce the operating costs between 5 and 12 percent without reductions in service. Increasing speed would also help increase revenue because shorter travel time by transit would increase the number of revenue-paying passengers.

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