Evidence on Time-of-Day Pricing in the United States

Volume 2: Appendices and Case Studies

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Forward

This is the companion volume to the research report on Evidence on Time-of-Day Transit Pricing in the United States. This volume serves as an expanded appendix to the Volume 1 report, principally providing detailed case-by-case summaries on experiences with time-of-day transit pricing to date. It provides the interested reader with more in-depth background information on the reasons for adopting time-of-day pricing, the impacts recorded to date, implementation issues, a national survey of transit officials, along with a theoretical summary of the time-of-day pricing concept.

Appendix I presents thirty-two individual case study summaries on time-of-day transit pricing experiences. Attention focuses on each rationale for adopting time-of-day pricing, trends and impacts associated with the fare programs, and assorted implementation issues. Performance data and statistics are generally provided for each case study.

Appendix II presents the theory of peak-load and time-of-day pricing, in particular as it bears on the American transit industry. Efficiency and equity arguments in favor of time-of-day pricing are charted in the second appendix. Some of the classical literature on this topic are also discussed.

Appendix III briefly summarizes a national survey conducted whereby a range of questions associated with time-of-day fares were asked. Background information on respondents and their agencies is included in Appendix III.

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Appendix I

Case Studies

Thirty-two individual case studies on the full array of issues surrounding time-of-day pricing are presented in this appendix. For each case, the following information is presented:

1. System Description
2. Fare Structure
3. Reasons for Adopting Time-of-Day Pricing
4. Trends and Impacts Associated with Time-of-Day Pricing
5. Implementation Issues
6. Summary and Prospects

For the ten areas which subsequently abandoned time-of-day pricing, reasons for doing so are presented.

The information presented in this section was obtained from a number of sources, including agency reports, telephone interviews, site visits, UMTA Section 15 summaries, and APTA documents. The scope of available information varied from property to property. However, an effort was made to present findings as consistently as possible. Case studies are presented alphabetically, first for the 22 areas which still have time-of-day pricing, and then for the 10 which subsequently discontinued their fare programs. The 32 case studies are:

Areas Which Have Retained Time-of-Day Pricing

1. Akron
2. Allentown
3. Binghamton
4. Burlington
5. Chapel Hill
6. Chico
7. Cincinnati
8. Columbus
9. Denver
10. Erie
11. Louisville
12. Minneapolis-St. Paul
13. Orange County
14. Sacramento
15. Salt Lake City
16. Seattle
17. Spartanburg/Anderson
18. Tacoma
19. Washington
20. Wichita
21. Wilmington
22. Youngstown

Areas Which Have Discontinued Time-of-Day Pricing

23. Albuquerque
24. Baltimore
25. Boston
26. Duluth
27. Kansas City
28. Palm Springs
29. Rochester
30. San Francisco-Oakland
31. St. Louis
32. Walnut Creek

1. Akron, Ohio -- Metro Regional Transit Authority

1.1 System Description

Metro Regional Transit Authority took over transit operations for the Akron area in 1972, when voters approved a one mill dedicated property tax. This measure put the Akron region's transit service on a sound financial footing for the first time since 1969, when the Akron Transportation Company folded in the midst of a strike by transit workers.

Metro runs fixed route buses, along with demand-responsive vehicles for the elderly and physically handicapped, serving an area of 95 square miles and a 1980 population of about 340,000. The fixed route system, almost entirely radial, covers 28 routes and carried 6 million passengers in 1981. An 11-member Board of Trustees appointed by the mayors of the communities within the service district directs Metro's policies.

1.2 Fare Structure

Time-of-day pricing was first instituted in Akron in 1972 when the flat 40 cents fare was lowered to 35 cents during most times and 25 cents for the midday (Monday-Friday, 10 a.m.-2 p.m.) period. All fares were increased by 5 cents in 1979, and in 1981 the fare was increased to 50 cents for all time periods in anticipation of cuts in federal operating subsidies. A time-of-day differential was reinstituted in 1982 when the basic fare was increased to 55 cents while the midday fare was left unchanged. Thus, various renditions of time-of-day pricing have been used in Akron over the past decade. The current fare structure is shown in Table 1.1.

Table 1.1

Akron Metro Fare Structure (as of January, 1983)

Type of Fare	Base Fare	Midday[1] Fare
Adult Cash	.60	.50
Student	.40	.40
Elderly	.30	.30
Handicapped	.30	.30
Tickets[2]	.60	.60
Monthly Pass	24.00	24.00

[1] Weekdays 10 a.m.-2 p.m.

[2] Ten ride tickets for $6.00.

1.3 Reasons for Adopting Time-of-Day Pricing

The decision to institute time-of-day pricing in 1972 was prompted by a desire to increase off-peak ridership. Such an increase was considered desirable both in order to increase overall system ridership and to fill empty midday seats. The original idea for peak/off-peak pricing came from Metro's General Manager, who was encouraged to convert to the scheme by the general manager of the Erie, Pennsylvania transit system.

Metro's return to flat fares in 1981 was a response to anticipated cuts in federal operating assistance. Metro reinstated the time-of-day differential in 1982 because of management's belief that uniform fares had resulted in a substantial decline in ridership.

1.4 Trends and Impacts Associated with Time-of-Day Pricing

Initial Implementation

Table 1.2 shows selected operating and financial data for Akron for the years 1971 to 1973. The midday discount was implemented in late September, 1972, so a comparison of the 1972 and 1973 figures is of primary interest.*

Metro's systemwide ridership increased 16.7% between 1972-73. The degree to which this increase can be attributed to the fare structure changes in difficult to assess, mainly because over 20% more bus miles of service were provided in 1973. This is illustrated in Table 1.3, which presents three estimates of the average fare line elasticity calculated from the 1972 and 1973 data and based on different assumed values of the vehicle miles elasticity. The results indicate that no conclusions concerning the ridership impacts of time-of-day pricing can be drawn because of the pronounced change in level of service which occurred at about the same time. A best guess of the effect of the pricing change is that it caused ridership to increase between 5% and 6%, equivalent to an average fare elasticity of about -0.4.

In considering the increase in Akron Metro ridership between 1972 and 1973, it is necessary to point out that the 1971 ridership level exceeded those in both 1972 and 1973. This suggests that many of the 'new' riders in 1973 were actually returning to a mode of travel which they were previously accustomed to using.

No fiscal impacts of time-of-day pricing in Akron are apparent from the data in Table 1.2. While ridership increases did bring about a slight increase in revenues, this increase cannot be attributed solely to the fare change for the reasons just discussed. Moreover, the large increase in operating expense and consequent deterioration in recovery ratio suggest that time-of-day pricing was not effective as a means of stemming the tide of increasing costs which beset the entire transit

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* The comparison is thus between a year in which the fare differential was in effect for 12 months and a year when it was in effect for only two months.

industry during the early '70s.

Akron Metro experienced a significant improvement in operating performance during the year following the adoption of time-of-day pricing. Costs per vehicle mile and per vehicle hour registered absolute decreases in 1973, and the 3% increase in costs per passenger is slight considering the inflation of the time. Moreover, vehicle hours per employee increased significantly. As in the case of ridership, it is not possible to separate the time-of-day pricing effects on operating performance from those of the increased vehicle mileage. Nonetheless, these trends are consistent with a leveling of transit service demand such as would be expected from the implementation of a time-of-day differential.

Return to Flat Fares and Re-Implementation

Between 1980 and 1983, Akron Metro's fare structure underwent three changes. Prior to February, 1981, adult fares stood at 40 cents base and 30 cents midday. The adult fare was then increased to 50 cents with no midday discount. The flat fare was maintained until January, 1982, when the base fare was increased to 55 cents while the midday fare remained 50 cents. In January, 1983, the base fare was again raised by 5 cents, bringing the fare structure to 60 cents base and 50 cents midday.

Two sources of ridership data covering this period are available. During the springs of 1980, 1981, and 1982, on-board counts were taken on a "typical" weekday, with results disaggregated by time-of-day. Estimates of monthly ridership, computed by dividing monthly farebox revenue by an assumed average fare value obtained from periodic surveys, were also made. These data may be used to give some indication of the ridership impacts associated with the changes in Metro's fare structure over this three year period.

Results of the on-board ridership counts are summarized in Table 1.4. These data do not suggest strong trends or impacts which can readily be attributed to the pricing changes. Overall ridership appears to have gone up slightly in 1981, despite a substantial fare increase. On the other hand, a significant decline in ridership is suggested by the 1982 data, even though a much smaller fare increase took place in that year. The distribution of ridership by time period seems to remain roughly constant, with the possible exceptions of a slight decline in the evening share and a slight increase in the peak period share.

There are a number of possible explanations for these results. The fact that the counts were taken on one day only in each of the three years casts some doubt upon their reliability as indicators of long term trends. Also, the counts are not disaggregated by rider category, leaving the possibility that the impacts of the fare changes on adult ridership are canceled out by countervailing trends in ridership by senior citizens or students. Third, other exogenous factors may have influenced patronage. Finally, the circumstances surrounding the fare

Table 1.2

Selected Akron Metro Performance Data, 1971-1973

Indicator	1971	1972*	1973	% Change 1972-73
Annual Revenue Passengers (000)	3,219	2,503	2,920	16.7
Passenger Revenue ($000)	1,019	866	880	1.6
Average Fare ($)	31.7	34.6	30.1	-13.0
Operating Revenue ($000)	1,158	1,057	1,115	5.5
Operating Expense ($000)	1,340	1,571	1,888	20.2
Revenue/Expense	.86	.67	.59	-11.9
Peak/Base Buses	N/A	53/37	53/37	0.0
Active Buses Owned	N/A	64	63	-1.6
Employees	114	127	130	2.3
Vehicle Miles (000)	1,664	1,643	2,004	21.9
Vehicle Hours (000)	131	138	170	23.2
Vehicle Miles/ Employee	14,597	12,937	15,415	19.2
Vehicle Hours/ Employee	1,149	1,087	1,308	20.3
Expense/Passenger	41.6	62.8	64.7	3.0
Passenger/Mile	1.93	1.52	1.46	-3.9
Passenger Revenue/ Mile ($)	.61	.53	.44	-27.9
Passenger Revenue/ Hour ($)	7.78	6.72	5.18	-33.4
Expense/Mile ($)	80.5	95.6	94.3	-1.4
Expense/Hour ($)	10.23	11.38	11.11	-2.4

* Time-of-day implemented September, 1972.

N/A Not Available

changes may have influenced ridership behavior. For example, it is possible that the 1982 fare increase was resisted more strongly because it came so soon after the larger 1981 increase.

The monthly ridership data tell roughly the same story. The data were used to estimate several models of monthly ridership. The model which appears to be the most satisfactory is:

Table 1.3.

Average Fare Line Elasticities Based on Different Assumed Values of Vehicle-Miles Elasticity

Assumed Vehicle Miles Elasticity	% Change in Ridership 1972-73			Average Fare Elasticity
	Total	Vehicle Miles Induced[1]	Average Fare Induced[2]	
0.0	16.7	0.0	16.7	-1.28
0.5	16.7	11.0	5.7	-0.44
1.0	16.7	21.9	-5.2	+0.40

[1] The change in ridership which would result from a 21.9% increase in vehicle miles based on the assumed vehicle miles elasticity.

[2] The difference between the observed 1972-73 ridership change and the vehicle-miles-induced ridership change.

Table 1.4

Akron Ridership Counts: 1980-82

Year	Base Fare	Midday Fare	Peak Riders	Evening Riders	Total Base Riders	Midday Riders	Grand Total Riders
1980	.40	.30	15906 (63)	3545 (14)	19451 (77)	5678 (23)	25129 (100)
1981	.50	.50	16912 (66)	2981 (12)	19893 (78)	5721 (22)	25614 (100)
1982	.55	.50	15986 (65)	3164 (13)	19150 (78)	5327 (22)	24477 (100)

Note: Numbers in parentheses are percentages of total ridership for given year.

$$\hat{P}_t = \underset{(.00)}{488} - \underset{(.00)}{62S_t} + \underset{(.00)}{1.0M_t} - \underset{(.00)}{7.5F_t} - \underset{(.00)}{25TD_t} \qquad (1.1)$$

where $\hat{P}$ = Predicted monthly revenue passengers (thousands)

S = Summed dummy variable (= 1 for July and August and 0 otherwisework)

M = Monthly vehicle miles (thousands)

F = Average fare (cents)

TD = Time-of-day fares dummy (= 1 before February, 1981 and from January, 1981 onward; = 0 otherwise)

t indicates time series observations.

R^2 = .86, Durban-Watson Statistic = 1.68, N = 36 observations

The most surprising result of this model is that the coefficient of TD, the midday discount dummy variable, is negative and highly significant. This implies that, ceterus paribus, the time-of-day differential produces ridership losses.* In effect, this is another indication that the January, 1981 fare increase, which eliminated the midday discount, had a minimal impact on overall ridership, while the 1982 fare increase, in which the discount was reestablished, coincided with a significant ridership loss.

One possible explanation for these results is that the midday discount coincided with some other exogenous influence which actually caused the ridership decline. Two factors which could have such an effect are the price of gasoline, which was declining at the time the discount was reintroduced, and the economy, which was in a period of deepening recession at the time. To investigate the possibility that these factors, and not the midday differential, produced the ridership decline, models in which the local gasoline price and the regional unemployment rate were independent variables were estimated. These variables were found not to be significant, indicating that they cannot account for the observed ridership changes.

Thus, while it remains intuitively implausible that Metro's midday discount costs the system riders, there is no obvious explanation for the significant negative TD coefficient in equation (1.1). Moreover, the monthly results are quite consistent with those of the one-day ridership counts. Based on these analyses, it is quite apparent that over the 1980-83 period, the midday discount has not increased Metro's overall ridership levels, or had the expected effects on temporal distribution.

1.5 Implementation Issues

Time-of-day pricing faced very little resistance in Akron. Members of the Metro Board accepted the arguments for such pricing as a means to increase ridership and enhance the Authority's public image. The board reaction was in keeping with its general belief that Metro staff are transit professionals and should therefore be responsible for the development of innovative management strategies.

Labor reaction to peak/off-peak pricing included some concern about the difficulties in policing the scheme. This concern occurred more at the level of the individual drivers, however, and did not result in any collective stand against the fare change.

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* Of course, the midday discount also causes a decrease in the average fare, which would stimulate ridership.

Metro riders generally accepted the first institution of time-of-day fares with few complaints. The public's receptivity was likely due to the lowering of both peak and midday fares when the differential was first implemented.

Metro uses clock time to determine which fare period is in effect. Bus yard clocks are set each day according to Greenwhich Mean Time, and drivers in turn adjust their watches according to the bus yard clocks.

The marketing of time-of-day pricing in Akron consisted largely of newspaper advertisements, brochures, and notices. Information on fares is also included in Akron Metro's bus schedules. The bus schedule fare information is the only marketing measure which has been ongoing since the initiation of the time-of-day differential.

1.6 Summary and Prospects

Akron Metro's midday discount, dating from 1972, is on of the longest standing time-of-day fare programs in the country. There was very little difficulty in implementing the program, and the limited data available suggest that it was initially successful in filling empty midday seats. Akron Metro management strongly believes that the midday discount attracts off-peak riders to the system. The fact that the discount was reestablished just one year after it was removed in 1981 indicates that management has come to view the discount as an integral feature of the system's price structure.

On the other hand, analysis of ridership data for 1980-83 suggest that the midday differential did not cause any overall patronage increase during that period, but rather appears to have cost the system some riders. While this may in fact be the case, it is more likely that the results are caused by some confounding factors, which have not been accounted for. Like a number of other systems discussed in this report, Akron Metro is a case in which time-of-day pricing has produced results which are subjectively favorable, but for which hard data to document these results are generally not available.

2. Allentown, Pennsylvania -- LANTA

2.1 System Description

The urbanized area of Allentown-Bethlehem-Easton Pennsylvania-New Jersey is served by the Lehigh and Northhampton Transit Authority (LANTA). LANTA was organized in 1972 in order to replace the privately owned Lehigh Valley Transit Company, which was beset with the familiar problems of declining ridership and increasing costs.

LANTA provides fixed route bus service to an area which in 1970 had a population of 326,000. Thirty routes served slightly over 5 million passengers in FY 82.

LANTA was formed by the counties of Lehigh and Northhampton with the objective to "maintain and improve public transportation in the Lehigh Valley." The agency is governed by a ten member board, with five members members representing each county. The members are appointed by their respective county governments.

2.2 Fare Structure

Time-of-day pricing was first implemented by LANTA in October, 1972, when the regular 40 cent fare was lowered to 25 cents during the hours of 10 a.m. to 3 p.m. on weekdays and all day on Saturday. The time-of-day differential has remained in effect ever since, although its size has shrunk since the 1972 introduction. The current fare structure is shown in Table 2.1.

Table 2.1

LANTA Fare Structure

Fare Type	Base Fare	Off-Peak Fare[1]
Adult	.50	.40
Student	.25	.25
Senior Citizens	.50	.00
Handicapped	.50	.25
10-ride Ticket	4.50	4.50
40-ride Ticket	17.00	17.00
Monthly Pass	17.00	17.00

[1] Off-peak period is 9 a.m.-3:30 p.m. and after 6:30 p.m. weekdays and all day Saturdays.

2.3 Reasons for Adopting Time-of-Day Pricing

LANTA's decision to adopt time-of-day pricing was prompted primarily by a desire to increase ridership during the off-peak period. It was believed that off-peak riders would be quite sensitive to fare

changes, and therefore that a decrease in the off-peak fare would produce the patronage increase.

Time-of-day pricing was instituted by LANTA when it first began transit operations. Members of the LANTA board paid a visit to Erie, Pennsylvania, which had adopted time-of-day pricing in 1970, and were impressed with the success of the pricing scheme there. Additionally, the change was in the spirit of one of the primary goals of the new Authority, that of increasing accessibility of the transit dependent population.

2.4 Impacts and Trends Associated with Time-of-Day Pricing

To assess the ridership impacts of LANTA's time-of-day fare structure, monthly ridership data between 1971 and 1982 were used to develop overall and peak/off-peak ridership models. The resulting model, estimated using a first order autogressive technique, is presented in Equation 2.1.

$$\hat{P}_t = \underset{(.00)}{288} + \underset{(.00)}{0.74G_t} + \underset{(.10)}{5.0W_t} - \underset{(.00)}{14.4S_t} + \underset{(.00)}{4.1DC_t} + \underset{(.00)}{0.61T_t} + \underset{(.02)}{0.30M_t}$$

$$- \underset{(.00)}{6.2F_t} + \underset{(.04)}{13.7ZD_t} - \underset{(.00)}{15.6SD_t} - \underset{(.00)}{49.7M_t} \qquad (2.1)$$

where $\hat{P}$ = Predicted monthly adult passengers (thousands)

G = Gasoline price (cents per gallon)

W = Winter dummy variable (= 1 for Jan., Feb., March and 0 otherwise)

S = Summer dummy variable (= 1 for June, July, and August)

DC = Day composition variable (weekdays - Sundays - holidays)

T = Secular trend variable (= 1 for Jan., 1971, = 2 for Feb. 1971, etc.)

M = Monthly vehicle miles (thousands)

F = Average fare (cents)

ZD = Zonal fares dummy (= 1 for period when zonal surcharges were in effect and 0 otherwise)

SD = Senior citizen exclusion dummy (= 0 before June, 1973, when senior citizens began to be counted seperately from other passengers, and 1 thereafter)

TD = Time-of-day fares dummy (= 0 before August, 1973, when time-of-day fares were initiated, and 1 thereafter)

t indicates time series observations

R^2 = 0.83 N = 140 observations

Numbers in parentheses are probabilities that coefficients are zero.

This model suggests that the time of day differential actually decreased ridership, if its effect on average fares is controlled for. It should be noted, however, that flat fares were in effect for only the first sixteen months of the twelve year time series, so that the apparent negative impact of the fare differential could be the result of some other, unobserved factor which increased ridership during the initial flat fare period relative to the ridership since then.

If peak/off-peak fares really did cause a ridership decrease, this would suggest that LANTA's peak users are more price sensitive than off-peak users. Some confirmations of this hypothesis is given by the models of peak period and off-peak period adult ridership, again estimated using first order autogression, are shown in equations 2.2 and 2.3.

$$\hat{P}^p_t = \underset{}{166} - \underset{(.00)}{0.70G_t} + \underset{(.07)}{5.0W_t} - \underset{(.00)}{15.5S_t} + \underset{(.00)}{3.8DC_t} - \underset{(.00)}{3.31F^p_t} \qquad (2.2)$$

R^2 = 0.78

$$\hat{P}^o_t = \underset{}{26.6} + \underset{(.00)}{4.97W_t} + \underset{(.00)}{5.25SP_t} + \underset{(.00)}{0.91DC2_t} + \underset{(.02)}{0.47T_t} + \underset{(.00)}{0.29M_t} - \underset{(.00)}{1.70F^o_t} \qquad (2.3)$$

R^2 = 0.64

where, in addition to the variables defined in Equation 4.5,

$\hat{P}^p$ = Predicted monthly adult peak passengers (thousands)

$\hat{P}^p$ = Predicted monthly adult off-peak passengers (thousands)

F^p = Peak fare* (cents)

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* Peak fare is defined as total revenue collected from peak period users (including ticket and pass sales as well as cash fares) divided by total users.

F^O = Off-peak fare (cents)

SP = Spring dummy variable (= 1 for March, April, May and 0 otherwise)

DC_2 = Off-peak day composition variable (Saturdays + Sundays + holidays)

t indicates time series observations

N = 140 observations

The fare coefficients of equations 2.2 and 2.3 can be used along with the mean fare and ridership values to estimate fare elasticities of demand for the peak and off-peak periods. The calculated elasticity for the peak is -0.85, while that for the off-peak is -0.66. Thus, the models suggest that LANTA's peak ridership actually is more fare elastic than its off-peak ridership. Thus, although the results of both the overall ridership model and the peak/off-peak models differ from theoretical expectation, they are consistent with one another.

Trends in performance and operations during the periods when time-of-day pricing was implemented are shown in Table 2.2. Although no causal inferences can be made, Table 2.2 indicates that increasing operating costs, fluctuating operating revenues, and decreasing levels of service characterize LANTA's operations during this period. The impressive increase in ridership between 1972 and 1974 may, according to the model, be explained by higher gas prices and a secular trend, as well as by the initiation of special senior citizen fares.

2.5 Implementation Issues

The key support for LANTA's peak/off-peak pricing program came from the board. The board's support has continued as evidenced by its rejection of various proposals to reinstate flat fares. Among drivers, there was some feeling that the time of day differential would be a nuisance to enforce. This was not, however, viewed as a major issue either by labor or by management. Users and other citizen groups showed no particular reaction to the new fare structure. Neither has LANTA experienced significant complaints regarding the changeover from one fare period to another, which is governed by clock time and does not necessarily coincide with the beginning of a run.

None of LANTA's prepayment options, including a monthly pass, a 10-trip punch ticket, and a 40-trip punch ticket, make allowance for the less expensive off-peak fares. Hence, only those users who pay cash fares are able to take advantage of the off-peak discount.

LANTA's marketing efforts have not focused specifically on the time of day differential. LANTA has attempted to promote off-peak ridership, however, by gearing its marketing effort toward shopping. Some employers in the Allentown-Bethlehem area have supported LANTA's attempts to encourage ridership by subsidizing employee's purchase of

Table 2.2

Selected LANTA Performance Data, FY 72-74

	FY 72	FY 73*	FY 74	% Change '72-'74
Revenue Passengers (000)	2796	2692	3686	31.8
Passenger revenue ($000)	953	872	1227	28.8
Average Fare ($)	.341	.324	.333	-2.3
Operating Revenue ($000)	1573	1045	1248	-20.7
Operating Expense ($000)	1712	1764	1792	4.7
Revenue/Expense Ratio	.92	.59	.70	-23.9
Vehicle miles (000)	2073	1849	1781	-14.1
Vehicle hours (000)	176	169	158	-10.2
Expense/Passenger	.61	.69	.49	-19.7
Passengers/Mile	1.35	1.46	2.07	53.3
Passenger Revenue/ Mile ($)	.46	.47	.69	50
Passenger Revenue/ Hour ($)	5.41	5.16	7.77	43.6
Expense/mile ($)	.83	.95	1.01	21.7
Expense/hour ($)	9.73	10.44	11.34	16.5
Revenue/Expense Ratio	.92	.59	.70	-23.9

* Time-of-day pricing implemented September, 1972.

monthly transit passes. Also, schools in the area have designed schedules so that students' trips to school occur during the off-peak period.

2.6 Summary and Prospects

Time-of-day pricing is well established at LANTA, and is likely to be continued there into the indefinite future. The fact that the time-of-day differential has been maintained over a ten year time period, and

through several fare increases, indicates that the concept has considerable support. Moreover, there appear to have been few difficulties in implementing time-of-day areas, and little resistance to it from any of LANTA's constituencies.

The ridership impacts of LANTA's time-of-day pricing program appear to have been unfavorable. When average fare and other significant variables are controlled for, it appears that the differential resulted in a ridership loss. One possible explanation for this is that LANTA's peak period ridership is more price sensitive than its off-peak ridership, and this possibility is given some credence by the models of peak and off-peak ridership which were developed. It is also possible, however, that the analysis fails to control for one or more unobserved variables which are the true causes of the decline in ridership levels.

3. Binghamton, New York -- Broome County Transit Authority

3.1 System Description

Residents of Broome County, New York, located just north of the PA/NY border and including the city of Binghamton, has been served by the Broome County (B.C.) Transit Authority since 1970. B.C. Transit offers fixed route transit service on a system which includes 465 route miles, focussed radially around downtown Binghamton. In 1981, B.C. Transit's fleet of 36 buses accommodated some 3.6 million unlinked passenger trips. B.C. Transit is run under the auspices of the Broome County Department of Transportation, which in turn reports to the County Executive and the County Legislature.

3.2 Fare Structure

B.C. Transit's current fare structure is summarized in Table 3.1. The time of day differential was instituted in July, 1982, prior to which a flat 40 cent adult fare was in effect.

Table 3.1:B.C. Transit Fare Structure (as of July 1, 1982)

Type of Fare	Peak Fare	Base[1] Fare
Adult Cash	.50	.40
Commuter	.75	N/A
Park and Ride	.75	.75
Express	.75	.75
Senior Citizens	.50	.20
Handicapped	.50	.20
Students	.35	.35
Tokens[2]	.45	.45
Monthly Pass	18.00	18.00
Commuter Pass	27.00	27.00
Family Pass[3]	N/A	35.00

[1] Weekdays before 9:15 a.m. and 3:15-6:15 p.m.

[2] Available in lots of 20 for $9.00.

[3] Monthly pass which may be used by any family member (up to five at one time) during the off-peak period.

N/A = Not Applicable

3.3 Reasons for Adopting Time-of-Day Pricing

B.C. Transit adopted peak/off-peak pricing in order to enhance farebox revenue, with the specific objective of attaining a 50% farebox recovery ratio by 1986. Such a rate, some 60% greater than that achieved in 1982, was targeted in anticipation of the cuts in federal operating subsidies.

Given the overriding need to raise fares, the decision to do so in the peak period only stemmed from B.C. Transit's understanding of the system's various market segments. A 1976 New York State Department of Transportation study had produced a very high estimate (-1.15) for the overall fare elasticity of Broome County, suggesting that a flat fare increase would be counterproductive. It was believed, however, that certain segments of the Broome County ridership population, particularly peak period and premium service users, would be far less sensitive to a fare increase. Thus, the latest fare increase was limited to the peak period.

There were two other reasons for the adoption of time-of-day fares. First, it was hoped that the differential would redistribute ridership from the peak to the off-peak. Also, the change facilitated the policy of providing higher quality service during the peak period (e.g., closer headways), but insisting that such service achieve the same farebox recovery ratio as regular service.

3.4 Trends and Impacts Associated with Time-of-Day Pricing

Because time-of-day pricing is such a recent innovation at B.C. transit, no before-and-after operating data are available. The Commissioner estimates that revenue has risen about 10% since the fare increase, and believes that some elderly are shifting their usage times to the off-peak period. There has also been a reduction in the sale of tokens, suggesting many of those who purchased tokens in the past were off-peak riders, for whom the cash fare is now less expensive.

3.5 Implementation Issues

The major backers of time of day pricing in Broome County were the B.C. Transit Commissioner, the County Executive, and the County Legislature's Transportation Committee. The Commissioner, who had been recently hired and was expected to recommend and implement a wide variety of system changes, initiated the proposal.

The County Legislature, bus operators, riders, and B.C. Transit staff all had some concerns about time-of-day pricing. Some legislators thought that differentiated fares would be too complex and would not achieve their stated objectives. The limited interest of the legislators for the proposal discouraged any attempt to adopt a wider differential. Drivers had some concern about how to resolve the border problem, but were generally supportive of the idea to raise fares. The objections of drivers may have been diffused somewhat by a broad management initiative aimed at improving labor relations which began at roughly the same time. Among users, dissent came primarily from the elderly and the

handicapped, whose fare discounts had previously been in effect during both the peak and off-peak periods. The opposition of groups may have eroded some support for time-of-day pricing in the County Legislature. Finally, some B.C. Transit staff members objected to the proposal because they thought it unfair to penalize the system's "bread and butter" users, i.e. its regular commuters. Post-implementation reaction from policy makers cannot yet be assessed, pending analysis and presentation of the results of the fare change by B.C. Transit management and staff.

B.C. Transit collects its passenger revenues through the farebox, tokens, and monthly passes. Of the prepayment options, only the family off-peak pass is designed to encourage use of off-peak service. While this pass may be a good transportation value for some families, its price of $35.00 is $8.00 more than the price of an individual pass good for service at all times of day. Thus, for most riders paying cash fares is the only way to take advantage of the time-of-day differential.

B.C. Transit resolves the border problem by taking advantage of the system's "pulse" scheduling method. Under this schedule, most buses begin their route runs from downtown Binghamton at the same time in order to facilitate passenger transfers. Changes from one fare period to another are made at the beginning of one of the pulses. In the case of certain bus routes which are not included in the pulse system, drivers are permitted some discretion in enforcing the differential. There is also a contingency plan for broadcasting a control tone over the all-call radio system at the beginning of the peak and off-peak periods, although so far it has not been necessary to implement this plan.

3.6 Summary and Prospects

While it's too early to evaluate the impacts of B.C. Transit's time-of-day differential, it is clear that the implementation has gone smoothly. At this time, the political support for time-of-day fares is somewhat fragile, with elderly and handicapped users, along with some members of the county legislature, the primary opposition. As time goes on, and the effects of the program become more clear, this opposition may either dissipate or gain strength. Despite these uncertainties, B.C. Transit's experience demonstrates the operational feasibility of time-of-day pricing for a small transit property.

4. Burlington, Vermont -- Chittendon County Transit Authority

4.1 System Description

The Chittendon County Transit Authority (CCTA) provides transit service to the city of Burlington and neighboring communities along the eastern shore of Lake Champlain in northern Vermont. CCTA operates nine predominantly radial routes which converge on downtown Burlington. In 1982, CCTA served approximately 1.6 million passengers.

CCTA is a public authority of the County of Chittendon. Local operating subsidies are provided by each community which is served by the system, and assessed on the basis of the amount of service provided. The authority is overseen by a Board of Commissioners, which includes two appointed representatives of each community served by CCTA.

4.2 Fare Structure

Time-of-day pricing was initiated in Chittendon County in 1976, when off-peak fares were lowered from 35 cents to 25 cents. The fare differential has been widened or maintained in each of the three subsequent fare increases. CCTA's current fare structure is shown in Table 4.1.

Table 4.1

CCTA Fare Structure (as of July, 1982)

Type of Fare	Peak Fare	Off-Peak Fare[1]
Adult Cash	.75	.50
Elderly/Disabled	.75	.35
Students	.50	.50
Tokens/Ten Token Tickets	.70	.35
Monthly Pass	22.00	22.00

[1] Weekdays, 9 a.m.-3 p.m., and Saturdays, 7 p.m.-10:30 p.m.

4.3 Reasons for Adopting Time-of-Day Pricing

CCTA adopted time-of-day pricing for two basic reasons. First, it was hoped that lowering off-peak fares would increase ridership during the off-peak and overall. (CCTA management expected that the extra riders would make up for the loss in passenger revenue incurred by cutting off-peak fares.) Second, the Authority sought to entice peak period users to shift their travel to the off-peak hours, thus easing some of the pressure to expand the limited peak period capacity.

4.4 Trends and Impacts Associated with Time-of-Day Pricing

Time-of-day pricing appears to have had favorable ridership impacts. Some reports indicate that off-peak ridership increased 300% in the months following the lowering of off-peak fares, although data to confirm this are not available. The data which are available, presented in Table 4.2, indicate a 16% increase in overall ridership levels for the year following the fare increase. This growth is probably the result of both the fare change and the increased vehicle miles provided by CCTA in 1976. Table 4.3 shows the ridership increase attributable to each of these factors under different assumed values of the vehicle miles elasticity. The few investigations of rider response to level of service changes have yielded vehicle miles elasticity estimates in the .5 - .7 range, suggesting that the fare increase alone caused a ridership increase of about 10%.

A recent passenger survey suggests that the time-of-day differential influences users' riding habits. 94% of adult users are aware of the existence of the differential, and 45% of those who are aware reported that they plan their trips with the differential in mind. Moreover, 88% of off-peak riders said that they planned their trips to take advantage of the off-peak discount. These results strongly suggest that peaking of demand is significantly damped by time-of-day pricing.

Table 4.2

Changes in CCTA Ridership, Vehicle Miles, and Fares in 1975-76

	FY75	FY76*	% Change 75-76
Ridership (000)	919.8	1077.7	16.0
Vehicle miles (000)	652	723	10.9
Peak fare	$.35	$.35	0
Off-peak fare	$.35	$.25	-28.6

* Time-of-day pricing implemented July, 1975.

No data documenting the financial or operating trends during 1975 and 1976 were available. Farebox recovery rates in recent years have consistently exceeded 50%, however, indicating that time-of-day pricing is at least compatible with maintaining a reasonably cost-effective small transit operation.

4.5 Implementation Issues

CCTA's time-of-day pricing program was spearheaded by the General Manager, and received strong support from the Authority's Board of

Table 4.3

Ridership Increase Attributable to Fare Change
Under Different Assumed Values
of Vehicle-Miles Elasticity

Assumed Vehicle Miles Elasticity	% Change in Ridership FY76-77			Average Fare Elasticity
	Total	Vehicle Miles Induced[1]	Fare Change Induced[2]	
0	16.0	0.0	16.0	-1.12
0	16.0	5.4	10.6	-0.74
0	16.0	10.9	5.1	-0.37

[1] The change in ridership which would result from a 10.9% increase in vehicle miles based on the assumed vehicle miles elasticity.

[2] The difference between the observed FY76-77 ridership change and the vehicle-miles-induced ridership change.

Commissioners. CCTA drivers did not resist the new fare structure, but have since suggested a return to flat fares as a result of enforcement problems. CCTA users were generally very receptive to the differential, although some regular commuters and elderly have complained that the fare structure is unfair.

Commuters feel that the are being unfairly penalized for their regular patronage of the system. The elderly dislike the restriction of their special fares to the off-peak, which means that they face a larger time-of-day differential than regular users.

The increased off-peak ridership believed to be stimulated by time-of-day pricing has been welcomed by the communities which subsidize CCTA operations. Since the subsidy obligation of each community is determined on the basis of the number of vehicle miles which CCTA provides in that community, increased load factors mean that a greater amount of passenger service is obtained for each subsidy dollar.

CCTA collects it fares through the farebox, token sales, and monthly pass sales. Patrons who pay either with cash fares or with tokens can take advantage of the off-peak discount. For token users who pay two tokens per ride in the peak and one per ride in the off-peak, the differential is somewhat greater than for cash fare patrons (see Table 4.1).

CCTA defines the borders between peak and off-peak fare periods according to the actual time on the clock. Any fare disputes are generally resolved in favor of the customer. Although CCTA uses a pulse scheduling system, with most buses arriving in downtown Burlington at the same time, the pulse times do not coincide with the fare period

border times.

Most of CCTA's marketing efforts have been directed at promoting the entire system rather than the off-peak discount in particular. The General Manager does frequently stress the advantages of riding in the off-peak when speaking before user groups such as senior citizens.

Burlington's business community has traditionally provided strong support for transit, and CCTA management believes that such support may have increased as the result of peak/off-peak fares. Examples of business community involvement include free printing of CCTA schedules by a local bank, and local stores offering free bus tokens to customers who make minimum purchases.

4.6 Summary and Prospects

Time-of-day pricing is well established at CCTA, and is expected to remain in effect indefinitely. The fare differential has caused no significant problems, and there is some evidence that it has stimulated ridership increases. Above all, CCTA stands out as a small transit operation which has managed to differentiate its fares by time-of-day while also maintaining a cost recovery ratio in excess of 50%.

5. Chapel Hill, North Carolina -- Chapel Hill Transit

5.1 System Description

Chapel Hill's bus system began operations in 1974, serving nine square miles around the University of North Carolina and neighboring communities. Thirty coaches operate over 12 routes -- eight arterial routes, two campus shuttles, one park-and-ride lot express route, and one combined arterial evening route. Weekday services operate on all routes. Vehicles operate at headways of thirty minutes or less during the morning (6:30-9:30 a.m.) and evening (3:00-6:00 p.m.) peak periods (weekdays only). Because university students and faculty are major patrons of the system, service hours are further modified when classes are not in session. An elected Citizen Transportation Board reviews and recommends staff policy proposals to the Town Council, which retains final decision making responsibility.

5.2 Fare Structure

The peak surcharge of $.10 was adopted in August, 1982, and applies to the eight arterial routes. Adult cash fares are 50 cents peak, and 40 cents off-peak; seniors, youth, and handicapped patrons pay 25 cents during the peak and 20 cents during the off-peak. All-use and limited-use passes are available on a 12-, 9-, 6-, or 3-month basis, with the largest discount going to one year passes. Forty-ride ticket packages are also available, reflecting a 20% discount over cash fare prices. The peak/off-peak differential is also reflected by formula in the pass prices, such that passes are usable during both peak and off-peak periods. Transfers from an arterial route to any other route are free. Transfers from the campus shuttle routes to an arterial route are an additional 25 cents during peak hours and 20 cents during the off-peak. Table 5.1 summarizes the CHT fare structure.

Table 5.1

CHT Fare Structure (as of July, 1982)

Fare Type	Peak	Off-Peak
Adult	$.50	$.40
Youth	.25	.20
Sr. Citizen/Handicapped	.25	.20
Campus Routes (all rides)	.25	.20
Passes (3 month only)		
all use	39.50	39.50
limited use	19.75	19.75
40-ride tickets	16.00	16.00

5.3 Reasons for Adopting Time-of-Day Pricing

CHT's primary reason for implementing time-of-day pricing was to increase revenue. Because there had been significant fare increases between 1980 and 1982, the Transportation Board did not want to see another general fare hike. Nevertheless, something had to be done to address rising costs. Since ridership levels were highest during peak hours, increasing only peak fares was a viable alternative.

A secondary consideration was to encourage riders to shift from the peak to the off-peak, thereby utilizing resources more efficiently. Major shifts to underutilized off-peak service could reduce costs if extra tripper buses could be eliminated.

5.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 5.2 presents CHT ridership, revenue, and cost data for the five years prior to the initiation of peak/off-peak pricing.

Table 5.2

Chapel Hill Transit: Ridership, Revenue, and Cost Trends

Fiscal Year	Total Ridership	Passenger Revenue($)	Operating Cost($)	Farebox Recovery
1977-78	1,807,298	257,639	994,348	.273
1978-79	1,750,378	226,973	960,078	.236
1979-80	2,002,936	289,635	1,039,016	.279
1980-81	2,076,883	368,154	1,293,415	.285
1981-82	2,031,125	484,800	1,716,311	.282
% change FY 77-81	+12.38	+145.09	+61.17	+88.17

* Passenger Revenue equals cash plus pass sales revenue.

Ridership increased 12.4%, from 1,807,298 (1977-78) to 2,031,125 (1981-82). However, system costs rose rapidly during the same period, 80.7%. Increases in both pass prices and cash fares in 1980-81 kept the five year revenue increase of 88.2% in line with that of operating costs. As a result, farebox recovery rate rose slightly, 7.2% for the five year period.

Ridership data was only available for five months after peak/off-peak pricing became effective, and is presented in Table 5.3. Total patronage from August through December 1982 decreased 3.2% compared to the total ridership for the same period in 1981. This decrease is not, however, attributable solely to peak/off-peak pricing. A 20% increase in pass prices and an 8% decrease in service implemented during the same period probably contributed more to the patronage decline.

Table 5.3

CHT Ridership Trends: Before and After Peak/Off-Peak Pricing

Month	1981 (before)	1982 (after)
August*	129,877	142,441
September	258,158	244,833
October	241,658	224,051
November	216,653	218,505
December	132,791	117,984
5-month Total	979,137	947,814
% change 1981-82	-3.2	

* Time-of-day pricing adopted August 1, 1981.

Based on ridership counts conducted in September, 1982, approximately 54% of total weekday ridership travels during the morning and evening peak periods. The CHT staff indicated that approximately 67% of riders travelled in the peak before time-of-day pricing, although this shift hasn't been sufficient to warrant elimination of tripper buses. Again, it is difficult to assign this apparent shift solely to peak/off-peak pricing because of simultaneous cut-backs in service and increased pass prices.

5.5 Implementation Issues

Peak/off-peak pricing was initiated by CHT staff. The Transportation Board and City Council agreed with staff recommendations to implement time-of-day pricing. Driver reactions were better than expected, although some complained about the administrative and reporting requirements of different fares. Users experienced initial difficulty with the program; however, delineation of peak versus off-peak runs on pocket schedules reduced most of the confusion. The printed schedules superceded rigid peak period time boundaries, avoiding time-border problems.

The only complication from the management's point of view concerns the definition of the true evening peak. Unlike most other transit systems, students rather than commuters are the most frequent patrons of the system. The afternoon peak on some routes therefore occurs between 12:20 to 2:00 p.m. instead of the 4:00 to 6:00 p.m., typical of commuter travel. Although staff debated changing the afternoon peak period on these particular routes, they decided to retain the existing definitions to avoid any confusion.

Peak/off-peak pricing was incorporated into the general marketing

program which included radio and newspaper advertising, and descriptions in passenger schedules. The riding public seems fairly familiar with the current program, and further marketing efforts targeted to peak/off-peak pricing are not considered necessary.

5.6 Summary and Prospects

Overall, the management of Chapel Hill Transit considers time-of-day pricing a successful revenue raising strategy. Implementation has been relatively straightforward, and although revenue gains and ridership shifts may not be direct results of peak/off-peak pricing, the new fare structure is nonetheless being well-received in Chapel Hill.

6. Chico, California -- Butte County Transit

6.1 System Description

Butte County Transit is a small urban and inter-city bus company. Established in June, 1981, the system operates three routes in Chico and between the surrounding communities of Oroville, Paradise, and Gridgeley. A total of 18 round trip runs are conducted daily, with four buses and a van operating during the peak and three at all other times. The County owns the buses and sets fare policy, and contracts with an outside manager to operate the system.

6.2 Fare Structure

Differentiated fares have been in effect since June, 1981 when service was first established. Originally set at $.75 for the peak and $.50 for the off-peak, the fares were increased in July, 1983 to $.85 and $.60 respectively. Peak hour runs only operate between Chico and Paradise approximately 6:30 to 7:45 a.m. and 5:30 to 6:30 p.m.; and between Chico and Oroville approximately 7:15 to 8:00 a.m. and 5:00 to 5:45 p.m.

6.3 Reasons for Adopting Time-of-Day Pricing

The original intent behind the adoption of a commuter surcharge was to increase revenues without discouraging off-peak usage.

6.4 Trends and Impacts Associated with Time-of-Day Pricing

No data were available on ridership, fiscal, and performance trends for Butte County Transit for its three year experience with time-of-day fares. However, interviews with staff members provided the following information.

As of July, 1983, about 400 people were riding the system daily. The fare increase that year, however, has apparently resulted in a significant drop in ridership, about a 50% decrease during the peak hours. Whereas farebox recovery was about 35% last year, staff anticipates that it will drop to a level between 20-30% in 1983 as a result of ridership losses.

6.5 Implementation Issues

Commuters have been unhappy with time-of-day pricing since its inception, and were quite upset when the fares were raised recently. In general, peak hour users felt that the surcharge was unfair given the generally poor quality of peak hour service in terms of crowding and promptness. Staff has noticed an increase in voluntary carpooling commensurate with the drop in bus ridership, as users have turned to other

modes to avoid paying higher fares.

6.6 Summary and Prospects

Although limited information on Butte County's experience with differentiated fares makes suppositions difficult, it appears that time-of-day pricing at best faces an uncertain future, given the public's opposition to the program, and the rather dubious financial outlook of the system at this time.

7. Cincinnati, Ohio -- Southwest Ohio Regional Transit Authority

7.1 System Description

The Southwest Ohio Regional Transit Authority (SORTA) was formed in 1968 for the purpose of acquiring the Cincinnati Transit company and establishing a publicly owned and operated system. One of the first actions by SORTA was to secure alternative funding to the farebox. In 1971, Cincinnati's base fare was 55 cents (with finely graduated concentric zones), the highest in the country at the time. A 0.3% earnings tax was passed in 1972 by a substantial margin under the promise that fares would be lowered. Area residents enjoyed not only lower fares over much of the seventies, but vastly expanded and improved services as well. As a result, ridership nearly doubled to over 30 million passengers annually between 1973, the first year of public ownership, and 1979. This brought Cincinnati national praise as one of the most efficiently run and successful public transit operations in the country.

Today, SORTA offers predominantly fixed route bus services for Hamilton County, along with curb-to-curb lift-equipped van services for elderly and handicapped residents and special express runs. Moreover, a downtown circulator service is provided. Over 400 buses are used by Queen City Metro (SORTA's operating division) to provide services on 41 local and express bus routes. SORTA's board members are appointed by the Hamilton County Board of Commissioners, with the City of Cincinnati selecting four of the nine members.

7.2 Fare Structure

SORTA inaugurated time-of-day pricing in 1978 when adult base fares were raised from a quarter to 35 cents during the peak (6-9 am and 3-6 pm) and 30 cents during all other hours. This differential augmented the eight concentric zonal surcharges around the city proper. In 1981, the time-of-day differential was widened to 10 cents, with respective peak and off-peak charges of 50 and 40 cents. One year latter, fares in all periods were raised by a dime, resulting in the current price structure summarized in Table 7.1. In that Cincinnati had the highest base fare in the country under private ownership (55 cents, in addition to finely graduated zones), in some respects the current fare structure has represented a relative bargain and simplification of previous practices.

7.3 Reasons for Adopting Time-of-Day Pricing

SORTA launched time-of-day pricing in 1978 primarily to attract riders to the off-peak at "bargain" rates in hopes that once they tried transit they would continue to patronize it. The differential was part of a larger effort to project SORTA in a positive public relations light. Initially, the differential was purposely held at a nickel to prevent major revenue losses, though management's intention from the very beginning was to gradually widen it. SORTA officials also sought to assist elderly and lower income residents by holding down off-peak fares. Additional objectives were to encourage ridership shifts to the

Table 7.1

Cincinnati's Fare Structure (as of 7/1/83)1

Type of Fare	Peak-Hour Fare2	Off-Peak Fare3
Adult Cash	$.60	$.50
Elderly and Handicapped	.30	.30
Students	.15	.15
Zonal Surcharge4	.10/zone	.10/zone
Downtown Circulator	.10	.10
Monthly Pass	24.00	24.00

1 Fares shown for zone 1 which consists of the City of Cincinnati. Other zones have higher fares than shown in this table.
2 Weekdays, 6-9 a.m. and 3-6 p.m.
3 All other hours
4 SORTA has eight zonal surcharges for all trips outside of the City of Cincinnati.

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lower priced periods and to design fares so as to more closely recapture costs. Most recently, the time-of-day differential has been retained as part of an overall effort to achieve a farebox recovery target of 45%.

According to SORTA management, a political motivation for raising commute period fares was to cover a higher proportion of the system's costs from suburban area residents. The City Council of Cincinnati owns all of the assets of SORTA and therefore has the final vote on all regional fare policy matters. Their philosophy has historically been to maintain low fares in Cincinnati and more closely cover the costs of services in outlying areas. Thus, in addition to the dedication of tax receipts on wages earned within the city, the Council adopted both zonal and peak period pricing as a means of generating relatively high levels of financial support from residents of other jurisdictions.

7.4 Trends and Impacts Associated with Time-of-Day Pricing

SORTA experienced a tremendous increase in ridership and significant improvements in productivity throughout the seventies. These trends were already in place prior to the implementation of time-of-day fares, although the differential possibly played some role in reinforcing ridership and performance improvements. Table 7.2 presents selected annual data which reveals performance trends for the years 1977 to 1979 (encompassing the before-and-after period around the initial differential) as well as 1982 (corresponding to SORTA's latest fare increase). System ridership initially rose 7% following the 1978 time differentiation of fares, but has since fallen over the past few years, in all likelihood due to local recessionary factors. Much of this loss has been from the ranks of off-peak users. Although off-peak ridership rose slightly following the 1978 fare change, subsequent increases in fares have resulted in substantial losses in off-peak patronage. From

Table 7.2.

Selected Performance Data for Cincinnati's SORTA, 1977-82

Indicator	19771	1978*	1979	% Change 1977-79	1982	% Change 1979-82
Revenue Passengers (millions)	30.565	32.679	32.173	5.3	27.610	-15.5
Passenger Revenue (millions)	7.756	9.605	10.037	29.4	11.518	19.9
Average Fare ($)	.25	.29	.31	24.4	.42	44.8
Operating Revenue ($millions)	8.430	10.371	11.035	30.9	12.522	20.7
Operating Expense ($mill.)	21.605	24.765	27.557	27.6	35.820	49.0
Revenue/Expense	.390	.419	.401	2.8	.350	-16.5
Peak/Base Buses	369/127	367/122	351/121	0.2	350/120	0.0
Employees	939	936	937	-0.2	937	0.0
Vehicle Miles (millions)	11.973	12.758	12.344	3.1	12.348	-3.2
Vehicle Hours (000)	948.900	972.900	930.400	-1.9	882.460	-9.3
Vehicle Miles/ Employee	12,750	13,630	13,174	3.3	13,178	3.3
Passenger Revenue/Mile	.65	.75	.81	25.0	.93	24.0
Expense/Mile Passenger	1.80	1.94	2.23	23.9	2.90	49.5
Revenue/Hour	8.17	9.87	10.79	32.1	14.19	43.8
Expense/Hour	22.76	25.45	29.62	30.1	40.59	59.5

* Time-of-day pricing initiated February 26, 1978
1 November teacher's strike and December operator's strike

several on-board surveys, moreover, no discernable shifts in usage from the peak to the lower-priced off-peak have been measured over the past five years. SORTA planners generally believe that the absence of significant ridership impacts can be attributable to the relatively small

size of the differential.

Table 7.2 also shows that SORTA's revenues increased slightly faster than costs over the 1977-1979 period such that the system's cost recovery ratio rose to over 40 percent. By 1982, however, the ratio dipped below the pre-differential level. The table also reveals that the differential was not associated with any discernable impacts on the size of SORTA's labor force or peak-to-base ratio of buses. Although vehicle miles per employee rose by 3.3% during 1977- 79, this productivity gain was offset by even relatively greater increases in unit costs (e.g., expense per hour). Overall, then, few noticeable efficiency gains appear associated with the introduction of time-of-day pricing in Cincinnati, and SORTA's general performance has slipped in recent years, obstensibly due to non-fare related factors.

The availability of a fairly rich monthly time series of ridership, fare, and service data over the past decade enabled a more rigorous evaluation of SORTA's fare programs. Two sets of time series regression models were estimated, for the periods 1971-83 and 1980-83, to further probe the relationship between ridership and fare differentials. Equations 7.1 through 7.3 summarize the results.

Overall Ridership Model: 1971-1983

$$P = -3253 + 0.316M + 150W - 343S - 9.8Fp + 5.32E \qquad (7.1)$$
$$\qquad\qquad (.00) \quad (.00) \quad (.00) \quad (.00) \quad (.00)$$

where P = Monthly revenue passengers (000s)
M = Monthly vehicle miles (000s)
W = Winter dummy variable (=1 for January, February, and March)
S = Summer dummy variable (=1 for July and August)
E = Total regional employment (000s)
Fp = Peak fares (cents)
(.00) = Probabilities coefficients equal 0
R2 = .89, Durban-Watson = 1.60
Peak Fare Elasticity = -.13

Peak/Off-Peak Ridership Model: 1980-1983

$$Pp = 156 + 0.087M + 59.2S - 5.12Fp \qquad (7.2)$$
$$\qquad\qquad (.00) \quad (.00) \quad (.00)$$

where, in addition to above:

Pp = Monthly adult peak passengers (000)
Fp = Adult peak fare (cents)

R2 = .83, Durban-Watson = 1.83
Peak Fare Elasticity = -.31

$$Po = 484 + 0.05M + 4.00G - 70.1W - 15.4Po \qquad (7.3)$$
$$\qquad\qquad (.00) \quad (.00) \quad (.00) \quad (.00)$$

where, in addition to above:

Po = Monthly adult off-peak passengers (000)
Fo = Adult off-peak fare (cents)
G = Average gasoline price (cents/gallon)
R2 = .88, Durban-Watson = 1.77
Off-Peak Fare Elasticity = -.69

From equation 7.1, a peak period fare elasticity of -0.13 was computed for the period encompassing the past twelve years. The vehicle mile elasticity for the same period, by contrast, was 1.23, suggesting that peak usage was generally quite insensitive to fare levels yet heavily influenced by service features. The elasticities seemed intuitively reasonable and suggest that SORTA's peak period surcharges had a negligible impact on ridership, though they helped to bring about increased revenues.

Of equal interest are the respective peak and off-peak fare

elasticities of -.31 and -.69 estimated from equations 7.2 and 7.3. Over the past three years when both off-peak and peak fare rates were increased (yet the 10 cents differential was retained), off-peak users seemed to be more than twice as likely to cease riding as their peak hour counterparts. Fare levels, in fact, seemed to be the most important factor behind midday ridership losses, with the off-peak period vehicle miles elasticity being 0.56 and gasoline price elasticity being 0.59. These findings suggest that SORTA probably could have curbed recent ridership losses by raising only peak period fares in recent times and that serious consideration should perhaps be given to widening the time-of-day differential (if increasing systemwide patronage remains a priority concern). The analysis in Chapter 3 suggests that a 30 cents differential, with 70 cents peak fares and 40 cents off-peak fares, would be optimal. Current costing models suggest that the peak is continuing to return a smaller share of its costs (27%) than other time periods, so a widening of the differential remains a realistic possibility.

7.5 Implementation Issues

There have been very few implementation problems associated with time-of-day pricing in Cincinnati to date. Users have become accustomed to differentiated pricing and have accepted it with few complaints, principally because the vast majority make the same trip and pay the same fare regularly. Drivers report few fare disputes over the time differential and generally experience greater problems related to collecting transfers, zonal charges, and exact fares. The biggest implementation headache, according to drivers, has been the collection of express service zonal surcharges for passengers alighting the bus. The collection of peak fares has been eased by the shading of individual route schedules to indicate at what point on a line the differential will be in effect. Radio dispatchers inform drivers as to when the peak period is effective. In addition, drivers' manuals explain enforcement responsibilities for collecting peak surcharges, however drivers are urged to exercise discretion when passengers complain over paying higher fare rates, particularly if a bus has been late. To reduce possible confrontations, visible signs are placed aboard buses which designate whether or not peak fares are required.

SORTA launched a major marketing and educational campaign at the time peak/off-peak pricing was introduced which unquestionably facilitated implementation. In 1978, newspaper ads were placed and brochures were circulated to inform the riding public of the new fare program. Marketing efforts focused heavily on encouraging discretionary travellers to switch over to off-peak periods, using radio spots, advertisements, posters, and newsletters to inform the public about the advantages of doing so. SORTA's marketing office no longer directly promotes the time-of-day fare program per se, though marketing efforts continue to focus on encouraging off-peak usage.

SORTA's Board of Trustees has proven to be a staunch supporter of the fare program. Staff attribute this to the ties of many board members to local corporate interests where emphasis is placed on efficient pricing and management. Another possible factor which has worked

in the favor of time-of-day pricing has been the relatively large number of flex-time work programs which exist in the community. Although the time-of-day fare differential did not spawn the creation of flex-time arrangements, the decision of several large corporations to allow employees to commute at off-peak periods has probably encouraged some to take advantage of SORTA's lower priced off-peak fares. SORTA also works closely with the Downtown Council, a group of organized retail merchants, to promote off-peak travel. The Council has initiated a program to pay for free return-rides during downtown "sales days" held twice a year.

7.6 Summary and Prospects

Cincinnati has managed to introduce time-of-day pricing along with zonal fares with very little resistance, few implementation problems, and moderately successful results. The strong communitywide support of public transportation in Cincinnati, evidenced by such statistics as SORTA's relatively low fare evasion rate, probably helps account for this. Although the ridership and financial impacts of recent fares changes have been mixed, SORTA management feels a strong commitment to time-of-day pricing and is seriously contemplating widening the differential. Even though few shifts in ridership between time periods have been demonstrated, management nonetheless feels that the differential is the right way to go -- it presents the image of efficiency, regardless if data can document such improvements. SORTA's management believes that all transit systems should attempt to implement time-of-day pricing, with the priviso that the initial differential be small. The initial five cents differential probably failed to have much of an impact in Cincinnati's case. However, this analysis suggests that managements' desire to eventually widen the differential could augur well for SORTA's future.

8. Columbus, Ohio -- Central Ohio Transit Authority

8.1 System Description

Ownership of Columbus's private bus company transferred over to the Central Ohio Transit Authority (COTA) in 1974. By introducing a number of service improvements, COTA succeeded in reversing a downward ridership spiral -- turning it around from a low of 13 million annual passengers in 1973 to 16.5 million by the end of the decade. A 0.8 mill dedicated property tax allowed COTA to stabilize fares, eliminate zone charges, liberalize transfer policies, and expand its fleet size by one-third during the seventies.

Rising costs forced COTA to go before Columbus area voters with a dedicated sales tax proposal in 1979. It was narrowly defeated. COTA's only recourse was to increase fares from 50 cents to 60 cents, to exact a 15 cents surcharge from express service users, and to trim services. Following an aggressive marketing campaign and political manuveuring among community leaders to gain their support, Franklin County voters approved a 0.5% sales tax initiative one year latter. Included among the list of promises made to the public for their tax support was a lowering of midday fares to 25 cents.

Today, COTA operates more than 250 motor buses over 17 local, 19 express, and 14 cross-town routes. Buses logged nearly 9 million miles in 1983 in serving an urban area population of over 1.1 million. COTA is guided by a Board of Trustees, whose thirteen members are appointed by elected officials from communities within Franklin County. A General Manager directs day-to-day operations.

8.2 Fare Structure

COTA initiated time-of-day pricing in June, 1981 as part of an overall "Incentive Fare Program". During the hours of 9:30 a.m. and 3:00 p.m., COTA provides free services within a two square mile downtown area enclosed by a freeway innerbelt and charges 25 cents for rides outside of this zone. During all other hours, the previous local service adult fare of 60 cents and the express service fare of 75 cents are collected. (See Figure 8.1.) In addition to this substantial midday discount, COTA offers a 50 cents unlimited ride ticket and a $10 unlimited ride monthly pass for the midday hours (at half the cost of the regular pass). As much as any system in the nation, COTA offers tremendous incentives for midday customers to opt for transit travel.

Table 8.1
Columbus's Fare Structure (as of 7/1/83)

Type of Fare	Midday Fare[1]	Peak and Base Fare[2]
Adult Cash -- Local	$.25	$.60
Adult Cash -- Express	N/A	.75
Elderly and Handicapped	.25	.25
Children[3]	.25	.25
Midday Transfer[4]	.50	N/A
Downtown[5]	free	.60
Monthly Local Pass	10.00	20.00
Monthly Express Pass	N/A	25.00

1 9:30 a.m. to 3:00 p.m.
2 All other hours
3 Ages 7-12; under 7 free.
4 Unlimited rides outside of the CBD.
5 Free For All zone

8.3 Reasons for Adopting Time-of-Day Pricing

According to COTA's General Manager, the major supporter of the Incentive Fare Program from its inception, the primary reasons for initiating midday discounts were 1) to increase ridership during the midday period of underutilized capacity and 2) to strengthen the downtown core and business community. In that many peak hour services were already at capacity and above, COTA felt that a substantial lowering of midday fares, along with the downtown free zone, would be the most effective way to increase systemwide patronage. Staff generally felt that lower midday fares would lure some residents out of their cars and into buses for the first time, demonstrating to significant numbers that public transit is a worthy travel alternative. At the urging of some business merchants and civic leaders, the fare program was also launched as a central element of a larger downtown revitalization effort.

From interviews with a number of COTA staff members and Board officials, it was clear that the Incentive Fare Program was also initiated as a marketing strategy to give the riding public a break at the farebox and promote good will among areawide residents. Realizing that the fiscal well-being of COTA is dependent upon continued local taxpayer support, COTA's management and Board has placed considerable emphasis on casting the agency in a positive light. Reduced fares have been a major part of this effort. Besides all of the reasons cited above, the midday discount program was also an important political bargaining chip -- a promise made to Columbus area voters and civic leaders in order to win their support for the dedicated sales tax and to pave the way for its renewal, scheduled to go before voters in 1985.

8.4 Trends and Impacts Associated with Time-of-Day Pricing

Columbus's Incentive Fare Program has produced fairly dramatic results to date. Table 8.2 highlights this -- presenting annual

ridership, financial, and productivity data for a three year period surrounding the introduction of time-of-day fares. It should be kept in mind when interpretting this table that a 17 day strike served to suppress some of the figures shown for 1982.

Ridership Trends and Impacts

Table 8.2 reveals that COTA's total ridership, consisting of both paid and free-ride customers, grew by nearly 27% between 1980 and 1982 -- i.e., between the year prior to and after the fare change. The 11% jump in ridership between 1980 and 1981 led the nation for systems of COTA's size. Revenue paying patronage, however, dropped in 1982, following a sharp rise the previous year when the midday discount was introduced. According to COTA's management, this ridership loss was attributable to the December, 1982 worker strike as well as local recessionary factors and lower gasoline prices. Thus, COTA has enjoyed significantly higher levels of usage since introducing time-of-day pricing, though the number of fare-paying customers actually dropped off slightly, in all probability due to exogenous factors.

The most impressive ridership impacts occurred immediately after the June 1, 1981 introduction of the incentive fare program. Daily ridership to downtown Columbus rose by one-third between May and July, 1981 -- from 14,200 to 19,100 trips per day. Downtown business merchants immediately heralded the new fare program as a tremendous traffic builder and boon to the central city. Outside of the CBD, midday usage increased 102% for the same period, from 7,400 to 15,000 daily trips. Overall, midday ridership rose 62% during this two month period. Moreover, midday patronage has risen from 36% to 48% of total daily ridership within the past two years. And on a majority of local routes, midday ridership exceeds the sum of both morning and evening peak usage. COTA officials also note that recent ridership losses have come solely from the ranks of peak hour users, with midday ridership holding its own. Although COTA has not collected statistics on the incidence of ridership shifts between time periods, the general impression of management is that it has probably been in the 10 percent range.

The availability of monthly data between January, 1980 and December, 1982 enabled a more rigorous analysis of COTA's time-of- day fare program to be conducted. Using least-squares estimation, the regression expression shown in equation 8.1 was obtained.

$$P = 2707.7 - 28.6F + 25.0W - 4.46T \qquad (8.1)$$

where P = Monthly non-express passengers (000s)
F = Average fare (cents)
W = Working day variation (equals workdays-Sundays-holidays)
T = Secular trend variable (January, 1980 = 1, etc.)
R2 = .99, Durban-Watson = 1.64

An extremely good fit was obtained from the equation, explaining over 99% of the variation in non-express fares during the three year time series. At the mean value of passengers (P) and fares (F), the

Table 8.2.

Selected Performance Data for Columbus's COTA, 1980-82

Indicator	1980	1981*	% Change 1980-81	19821	% Change 1980-82
Total Passengers (millions)	19.031	22.340	17.4	24.149	26.9
Revenue Passengers (millions)	16.546	18.356	10.9	16.218	-2.0
Passenger Revenue ($ millions)	8.531	8.257	-3.2	7.553	-11.5
Average Fare ($)	.52	.45	-13.5	.47	-9.6
Operating Revenue ($ millions)	9.327	9.701	4.0	9.391	0.7
Operating Expenses ($ mill.)	18.412	22.436	21.9	23.790	29.2
Revenue/Expense	.534	.433	-19.0	.395	-26.0
Peak/Base Buses	227/103	224/101	-0.6	255/110	-4.9
Employees	642	677	5.5	697	8.6
Revenue Vehicle Miles (millions)	7.478	8.364	11.8	8.705	16.4
Revenue Vehicle Hours	609,832	688,258	12.9	675,460	10.8
Vehicle Miles/ Employee	11,648	12,354	6.1	12,489	7.2
Passenger Revenue/Mile	1.14	.99	-13.2	.87	-23.9
Expense/Mile Passenger	2.46	2.68	8.9	2.73	11.1
Revenue/Hour	13.99	12.00	-14.2	11.18	-20.0
Expense/Hour	30.19	32.60	8.0	35.22	16.7

* Midday discount introduced June, 1981
1 17 day strike in December, 1982

price elasticity of demand estimated from this equation is -0.94, quite high by transit fare standards. This suggests that Columbus area transit users were quite sensitive to the midday discounts offerred. As discussed in Chapter 3, however, further midday fare reductions would likely have far less spectacular effects on ridership.

It should also be noted that COTA experimented with extending the 25 cents discount to evening periods (after 6:30 p.m.) during December, 1981. Response from the public was favorable. COTA witnessed a 154% increase in night time ri ders during this experiment, with late-night and low-income patronage rising dramatically.

Financial Trends and Impacts

Table 8.2 suggests that COTA's Incentive Fare Program had a deleterious effect on the agency's fiscal health, with the cost recovery ratio declining 26% between 1980 and 1982 -- from .534 to .395. The share of expenses recovered directly from passenger fares plummetted even faster, to a low of .318 in 1982. COTA well expected farebox revenues to decline following the introduction of the discount fare program, hoping that sales tax income would compensate for the losses. They have done so and more, to the point where the agency is relatively less reliant on state and federal aid than previously. COTA budgetted a $ 1 million revenue loss for the first fiscal year of the fare program, yet received far greater returns from its sales tax revenues than were anticipated, resulting in a surplus of $622,000 above that budgetted. Overall, nearly $2 million in sales tax revenue above that expected was received during the first year -- translating into $400 million in regional retail sales above than estimated. In a span of three years, COTA's sales tax receipts have grown 14% to $22.3 million in 1983, despite a period of recessionary economic conditions.

The unexpected boom in COTA's sales tax receipts is especially noteworthy in that the agency has become less dependent on state and federal assistance since the midday discount program was initiated, a period of threatened subsidy cutbacks. Yet this growth is also perplexing because of the economic situation of the period. COTA's management believes the Incentive Fare Program was partly responsible for the boom in retail sales due to the multiplier effect of stimulating downtown business activities through free midday bus rides. (Over 57% of downtown shoppers reach their destination by bus.) As anecdotal evidence, COTA staff notes that sales tax revenues rose 13.7% from May 1 to June 30, 1981, while for the same period during the previous year they decreased 9.5%.

One would expect, however, any sales tax gains to be more related to larger regional economic forces. That is, in the absence of a growing economy, any increases in downtown business sales would be purely redistributive -- taking away retail transactions from non-CBD areas. This could not be substantiated because sales tax revenues are only accounted for at the county level. Nevertheless, the fact remains that COTA is now in a financially more viable po sition than several years earlier, and the contention that the midday discount program has been responsible for this may very well hold some truth.

Productivity Trends

Table 8.2 also suggests that the redistribution of trip- making to the midday has also had positive efficiency impacts. For instance, revenue vehicle miles per employee, a commonly used index of labor productivity, rose 13% during the first year of the fare program. Moreover, the peak-to-base ratio of buses declined slightly, suggesting a more efficient allocation of COTA's capital resources. Currently, ridership is 63% of seating capacity, on during the midday, compared with only about 59% for peak periods. As a result, COTA has transferred ten driver assignments and added ten spare buses to the midday.

On the negative side, unit expenses (e.g., per mile and per hour) have continued to rise while revenues have declined over the 1980-82 period. Moreover, there are signs that COTA's effectiveness at maintaining schedules has sufferred under the midday discount program. The number of trips running 1-5 minutes late, for example, increase from 21% to 25.6% during the first month of the fare program. Despite these trends, COTA's management believes that over the long run service quality will improve and some cost savings will be experienced.

Ridership Composition and Equity Trends

Ridership surveys conducted one month before and after the June 1, 1981 introduction of midday discounts revealed that COTA's share of black, low-income, and male passengers had increased slightly. Similarly, the December, 1981 evening discount experiment witnessed a significant increase in low-income patrons. COTA's management cite these statistics in noting the positive, though admittedly modest, distributional consequences of off-peak fare discounts.

8.5 Implementation Issues

Perhaps the most noteworthy aspect of COTA's midday discount and Incentive Fare Program have been the impressive strides made toward implementation. COTA stands out as an exemplary agency with regards to collecting, marketing, and building a political base of support for time-of-day fares.

Fare Collection

COTA adopted 25 cents as the midday fare because it involves only one coin. Management felt that a quarter would expedite the boarding process along heavily patronized routes. COTA has gotten around the boundary problem by defining time breaks on the basis of individual bus runs. Any run which arrives or departs downtown between 9:30 a.m. and 3:00 p.m. has a reduced fare. This eliminates fare disputes since varying fare rates are not collected midway along a route but rather only when a new group of passengers board. Each route's schedule is also clearly shaded to indicate exactly when and where the change in fare rate will occur. Moreover, fareboxes have clearly visible flip markers which designate which fare is in effect. Columbus's scheduling of buses on a pulse-timed arrangement, where buses are generally downtown or at a peripheral terminus at the same time, has also facilitated

the collection of differentiated fares.

The major fare collection problem in COTA's case has been the tendency of many who leave the free downtown zone not to pay the 25 cents fare upon exiting. Though drivers are instructed to collect these fares from disembarking passengers (by announcing, when they leave the free zone, that 25 cents must be paid), the incidence of fare evasion is considered to be quite high. This arrangement has disenfranchised some passengers who end up paying a 50 cents fare when riding a midday bus which passes through the downtown free zone -- a quarter both upon boarding and exiting. COTA experimented with a program whereby midday customers paid 50 cents at one time (on all inbound runs, with midday outbound runs being free); however the program was quickly abandoned because of users complaints over inequities. The creation of a free downtown zone has clearly complicated the collection of midday fares in COTA's case.

Marketing COTA launched an ambitious marketing campaign at the onset in support of the midday fare program. An impressive $40,000 promo tional effort and media blitz was undertaken through television, radio, and newspaper advertisements. COTA's General Manager also appeared on local television in the spring of 1981 to inform the public about the impending fare program. A massive mailing and brochure campaign was also launched to educate the riding public. Moreover, merchants gave a total of 267,000 store prizes and free ride coupons during the opening week of the fare program as a good will gesture. A weekend retreat at a posh downtown hotel was also donated as the grand prize during promotional week.

It is noteworthy that as a conscientous marketing strategy, COTA advertised the program as a midday discount, not a peak/off- peak differential, in order to present the fare system in a more positive light. COTA's management was sensitive to the possibility that regular commuters, the system's bread and butter, would react negatively if any mention was made of higher peak versus midday fares. Thus, the entire promotional campaign was geared around presenting the program as a bargain to those who have a chance to ride in the midday.

Reactions

COTA's midday fare program has been well-received by almost everyone in the Columbus area, perhaps with the exception of bus operators. Although initially there were roughly 25 complaints made per week against the fare program, over time both the riding and non-riding public have become receptive to the idea of midday discounts. Several newspaper accounts during the summer of 1981, for example, recorded some public resentment to the fare program at the onset, typified by one commuter's reaction that "it won't help the working people any". A random opinion poll of 1,000 area residents, conducted one year after the introduction of the midday fare program, found that over three-quarters of all respondents felt that COTA's services are reasonably priced. The survey also revealed that the program has enjoyed high visibility -- 72% were aware of the midday discount arrangement.

Although interviews with COTA's management and board members as well as community leaders revealed a resounding base of support for the fare program, COTA's drivers and rank-and-file union representatives painted a far different picture. From discussions with two driver representatives, it was clear that most operators found the enforcement of the fare program a tremendous bother. There seemed to be less difficulty in collecting the higher rates at time breaks than collecting the 25 cents fare from riders leaving the midday free zone. According to the interviewees, the word spread quickly amongst riders that COTA management instructed drivers not to challenge anyone over a midday fare dispute, thus the incidence of abuse skyrocketed. The driver representatives volunteered that well over one-half of COTA's drivers don't enforce the midday fare policy. Drivers also noted that buses have become so crowded in the downtown area during the midday that regular fare-paying customers who attempt to board for travel to the suburbs sometimes cannot get on. They intimated that service levels on some routes have deteriorated to the point that previous midday COTA customers have begun to drive rather than fight the noon-time "madness".

8.6 Summary and Prospects

On the whole, COTA's experiences with midday discounts to date have been quite impressive. Total ridership has risen markedly, and although less money is being generated from the farebox, COTA officials feel financially more secure than before the program's implementation because of healthy sales tax returns. COTA's management contends that the fare program helped to bring this about by stimulating downtown retail sales activities. Though there is no way to substantiate this, the fare program has proven to be a tremendous inducement to midday downtown travel. Much of COTA's success can be attributed to positive and aggres- sive marketing, a visionary management team, and a carefully designed collection process which has reduced fare disputes. Al though drivers have voiced some displeasure over the midday program, COTA's experience nonetheless stands out as a worthy exemplar for other transit agencies who are considering innovative transit pricing.

9. Denver, Colorado -- Regional Transit District

9.1 System Description

Denver's Regional Transportation District (RTD) was one of the first transit properties in the U.S. to implement time-of-day pricing and now has the most liberal incentive for riding during off-peak hours in the country. RTD was created by the Colorado General Assembly in 1969 to develop, maintain, and operate public transportation over an area encompassing all or parts of six counties and 35 jurisdictions, including Denver itself. An elected Board of Directors, comprised of one representative from 15 individual districts, governs the system. (When time-of-day fares were initially implemented, however, the Board consisted of 21 appointed members.)

RTD became an operating agency in 1973, and by 1975 had acquired 324 buses and remaining assets from six different private bus companies, including the 85 year old Denver Tramway Company. From this foundation, RTD has grown to an active fleet of 671 buses which serve a population of 1.6 million over an area of 2,304 square miles, one of the largest in the country. The District currently operates 128 routes over 2,850 fixed miles, broken down as follows: 43 local routes in Denver and Boulder; 20 circulator routes operating within neighborhoods; 51 limited stop express routes focussing on downtown Denver; 12 regional routes connecting seven cities with major activity centers (e.g., airport); and 2 contracted paratransit routes. An assortment of other services are also offerred including door-to-door subscription services for the elderly and handicapped, midday shopper runs, sixteen park and ride lots, vanpools to remote employment sites, a free downtown shuttle, and limited charter service.

Denver has recently embarked upon an ambitious transit improvements program as part of a larger comprehensive effort to reduce congestion, revitalize downtown, and improve regional air quality. The 16th Street transit mall was opened in 1982 with 19 free shuttle vehicles operating over a one mile stretch every 1 to 2 minutes during the peak. The aesthetically landscaped mall is flanked by two major terminal and transfer facilities at the north and south ends. A number of major service improvements, such as the massive restructuring of routes to a grid network and the acquisition of 89 articulated buses, have also been made.

9.2 Fare Structure

RTD introduced time-of-day pricing in 1973 during its first year of operations. The program actually involved a midday discount, whereby the regular adult cash fare of 35 cents was lowered to 25 cents during the hours of 9:30 a.m. and 2:30 p.m. A 15 cents per zone surcharge was also collected as was a 10 cents express charge. Students, senior citizens, and handicapped riders received a discount at all times. In 1975, zones were eliminated and the fare program was transformed to an off-peak discount arrangement whereby the 25 cents fare applied to all hours of operation, except from the first morning runs to 9:00 a.m. and

4:00-7:00 p.m. during weekdays. February, 1978 witnessed the introduction of a free off-peak fare demonstration which proved so successful that the federal government underwrote the continuation of the demonstration through the remaining 10 months of the year. Peak hour adult cash fares were raised to 50 cents the following year while the quarter off-peak fare was retained. In order to keep off-peak ridership levels high following the discontinuation of free fares, RTD narrowed the peak period intervals to 6:00-8:00 a.m. and 4:00-6:00 p.m.

In response to RTD's worsening financial situation and the threatened withdrawal of federal operating assistance, fares were raised across the board in June, 1981. Local adult fares during peak hours were raised to 70 cents and the peak hour intervals were again changed, this time widened to 6:00-9:00 a.m. and 3:00- 6:00 p.m. as a revenue-generating measure. Local off-peak adult fares were increased at the same percentage rate to 35 cents, while express fares were increased to $1.05 and regional fares to $1.75. In Boulder, the time-of-day differential was smaller, with peak fares set at 50 cents and off-peak ones at 35 cents. Off-peak elderly and handicapped fares were set at 5 cents and a free transfer arrangement was instituted. An assortment of passes and tokens were also offerred, with circulator passes requiring a 35 cents add-on fare if used during peak periods. This fare structure, which remains in effect today, is summarized in Table 9.1.

RTD's choice of the specific fare rates for certain services and at certain times of the day was based on the desire to encourage the use of prepaid tokens. RTD instituted a token program in 1979 whereby tokens valued at 35 cents each could be purchased from over 100 areawide stores at a 20% discount. RTD management sought to encourage token usage at the time of the 1981 fare change, so fares were set up to be multiples of the 35 cents tokens: off-peak -- 1 token; peak -- 2 tokens; express -- 3 tokens; and regional -- 5 tokens.

Looking over RTD's decade of fare changes, tremendous incentives have been designed to encourage Denver area travellers to ride during off-peak periods. Unlike other properties which have introduced time-of-day pricing, RTD has actually widened the differential over time rather than letting it erode by inflation. As a result, Denver area residents now enjoy the largest time-of- day differential in the country.

9.3 Reason for Adopting Time-of-Day Pricing

RTD's primary reason for initiating and continuing time-of- day pricing all throughout the past decade, including during 1978 free off-peak fare program, has been to spur ridership increases and shifts to the off-peak period. This was not only an efficiency move, but also part of a larger comprehensive effort to improve regional air quality and reduce highway congestion. More recently, the Denver Regional Council of Governments has identified the 70 cents peak/35 cents off-peak program as important strategy to attain over 200,000 average daily trips by December, 1984, a target set forth in the State Air Quality Implementation Plan.

Table 9.1

Denver RTD's Fare Structure (as of 6/1/83)

Type of Fare	Peak	Off-Peak	Elderly and Handicapped Off-Peak[1]
Circulator	.35	.35	.05
Local	.70	.35	.05
Express	1.05	1.05	.05
Regional	1.75[2]	1.75[2]	.05
Downtown Shuttle	free	free	free
Local Pass	24.00	24.00	16.00
Express Pass	36.00	36.00	24.00
Regional Pass	60.00	60.00	40.00
Circulator	12.00[3]	12.00	8.00
Boulder City	17.00	17.00	11.00

1 Reduced pass rates also apply to students 6 to 19 years old.
2 Or less
3 Plus a 35 cents surcharge during peak hours

A secondary objective for originally introducing (and subsequently retaining) time-of-day pricing was to promote equity objectives. RTD's Board has continued to take the position that patrons who commute during rush hours can most afford higher bus fares.

9.4. Trends and Impacts Associated with Time-of-Day Pricing

Over the past decade, the Denver area has experienced a steady increase in ridership and, in recent years, a more financially viable transit operations. RTD's time-of-day fare program, in its various carnations, likely contributed to these trends in a significant way. This is suggested in Table 9.2, where performance and financial data for 1974 (the first full year of public operations) and the span of 1978 through 1982 are presented. Four significant changes in time-of-day pricing occurred over this period, as discussed in section 2. 1978, the year of the free off-peak fare demonstration, stands out as somewhat of an anomaly. It is difficult to attribute changes in ridership and performance patterns during and after 1978 to the off-peak fare incentive because of the massive service changes which took place concurrently. RTD totally restructured its routes to a grid system in 1978, changing headways and introducing a number of new cross-town services. Similarly, various service improvements, such as the construction of five major transportation centers, were introduced after 1978 which confound any analysis of the 1979 and 1981 time-of-day fare changes. Still, the significant trends revealed in Table 9.2 are noteworthy in that they occurred concomitantly with RTD's fare revisions.

Transit ridership in the Denver region has increased markedly from a low of 14.2 million annual trips in 1972 to 24.4 million trips just two years latter and to over 45 million trips in 1982. The 1978 free

Table 9.2

Selected Performance Data for Denver's RTD,
1974 and 1978-1982

Indicator	19741	19782	1979	19803	19814	1982	% Change 1978-82
Total Passengers (millions)	24.347	43.097	38.127	42.750	44.980	45.100	5.5
Passenger Revenue (millions)	6.367	5.636	10.709	13.176	17.239	17.508	32.9
Average Fares ($)	.26	.13	.28	.31	.38	.39	25.8
Operating Revenues (millions)	7.981	6.094	11.144	13.756	17.786	17.508	30.2
Operating Expenses (millions)	16.688	34.852	51.289	62.195	70.116	66.314	6.6
Revenue/ Expense	.478	.175	.217	.221	.254	.270	22.9
Peak/Base Buses	356/220	440/250	504/315	506/305	510/300	526/271	-14.5
Employees	744	1582	1730	1720	1699	1650	-4.1
Vehicle Miles (Millions)	10.443	21.860	23.808	24.940	23.666	23.400	-6.2
Vehicle Miles/ Employee	14,023	13,818	13,762	14,500	13,929	14,181	-2.2
Passenger Revenue/Mile	.61	.26	.45	.52	.73	.75	44.2
Expense/Mile	.76	1.59	2.15	2.49	2.96	2.83	13.8

1 Peak local fare = 35 cents, midday local fare = 25 cents
2 Peak local fare = 35 cents, off-peak fare suspended for 11 months
3 Peak local fare increased to 50 cents, off-peak local fare set at 25 cents
4 Peak local fare raised to 70 cents, off-peak local fare raised to 35 cents

fare program witnessed a particularly large increase in transit usage. Average fares have also grown steadily over time, except again for during the period of free off-peak fares. With the fare changes in 1979 and 1981, RTD's cost recovery rate has also grown noticeably, though it still lags behind the rates of comparable size properties. Table 9.2 also shows that passenger revenues per mile increased at a far faster rate than unit expenses during the 1978-82 period. By comparison, vehicle miles per employee, an oft-used indicator of labor productivity, remained fairly stable over this period. One surprising statistic is the increase in RTD's peak-to-base ratio of buses during the period when the time-of-day differential was widened the most. This generally reflects the expansion of peak services along several express routes and on the downtown transit mall, however.

Perhaps the most extensive available information on RTD's time-of-day pricing is from the 1978 free off-peak fare demonstration. Ridership rose 41.9% during February, the initial month of implementation. On February 6, 1978, when fares were eliminated for the entire day, patronage increased 80%. In the months following the initial free off-peak program, ridership generally levelled off.

Surveys conducted during 1978 revealed some important insights about who the new off-peak patrons were. About one- quarter of off-peak free riders were new users. Most of the new users tended to be of a younger age and with slightly higher incomes than previous off-peak users. Over 80% of these previously drove or travelled by automobiles. Moreover, one-third of the new off-peak bus riders previously made their trip during peak hours. Six percent of all off-peak users indicated that they had altered their time of work to take advantage of the free service. Overall, RTD planners estimated that off-peak ridership rose 70% above what it would have been without the free fare program.

Planners cited increased downtown retail sales as the most significant non-ridership impact of the program. The effect on air quality and traffic congestion, however, was thought to have been inconsequential. On the negative side, numerous complaints were aired during the free fare program regarding overcrowding, poor schedule adherence, and rowdy passengers. The total cost of the demonstration was set at $5 million, including over $4 million in lost revenue. Although the free off-peak program was discontinued, RTD has remained committed to the lowering of off-peak travel costs of Denver area residents.

The availability of monthly data during 1980 and 1981 enabled a more rigorous analysms of the ridership impacts of RTD's latest, and perhaps most significant, peak/off-peak fare change. Equation 9.1 was derived:

$$P = 159 - 2.2F + 28W - 13S + 3.1T + 7.4D \qquad (9.1)$$
$$\qquad\quad (.00)\ \ (.00)\ (.00)\ (.00)\ \ (.00)$$

where P = Total monthly passengers (000s)
F = Average fare (cents)
W = Winter dummy variable (equals 1 for January, February, and March)
S = Summer dummy variable (equals 1 for July, August, and September)
T = Secular trend variable (January, 1980 = 1, etc.)
D = Day composition variable (equals workdays - Sundays - holidays)
(.00) = Probabilities that coefficients equal 0.
R2 = .92

The R2 of .92 indicates a good fit. Equation coefficients were estimated using a first-order autoregressive technique, as significant negative serial correlation of error terms was found when ordinary least squares was used. The fare elasticity measured from equation 9.1 (at the mean values) was -0.22. The relatively low value suggests Denver area riders, on the whole, were fairly insensitive to the 70 cents peak/35 ents off-peak differential.

No data have been collected for investigating the effects of the 1981 fare change on temporal shifts in usage. The widening of the designated peak period by two hours, however, suggests that the degree of shifting was probably modest.

9.5 Implementation Issues

Time-of-day pricing has been implemented in the Denver area over the past decade with relatively few problems and complaints. Regarding collection, drivers are encouraged to exercise judgement and discretion when confronted by passengers about what the proper fare is, usually giving the benefit of the doubt to the customer. All schedules are shaded to inform passengers when and where along a route they can expect to pay peak fares. Although there is no official designation on buses indicating which fare category is in effect, RTD management noted during interviews that some drivers place their own signs on the bus with the message "Fare is now 70 cents". RTD is now seriously considering self-service are collection for the future which would, in the view of management, facilitate the collection of fare differentials. Overall, drivers have accepted the peak/off-peak fare program with very few complaints, largely because it has become so institutionalized. Moreover, senior drivers welcome time-of-day pricing as an improvement over the far more complicated zone fare system which existed during the early seventies.

RTD's Marketing Division has continually promoted the benefits of off-peak travel during the past decade of fare changes. Flyers, pocket-sized cards, posters, and media advertisements have been used to inform the riding public about all fare changes as well as to inform them of the savings which off-peak travel offers. RTD has also worked closely with private employers to promote staggerred work hours and

flex-time programs, emphasizing the savings which workers can enjoy by travelling during the off-peak. A significant number of flex-time programs have been put into place in recent years, some aimed at promoting regional air quality objectives.

The general reaction of RTD's Board as well as the riding public to the time-of-day differential has been favorable. Perhaps the major complaint in recent years has been in regards to the widening of the designated peak hours to 6:00-9:00 a.m. and 3:00-6:00 p.m. Some riders who could take advantage of the off-peak hours under the previous narrower time band have more recently been forced to pay substantially higher peak fares. This is evident from the testimony of several citizens at the April 7, 1981 public hearing on RTD's fare change:

> The purpose of the peak-hour differential is to encourage people to shift away from the peak hour and allow better distribution of your customer load. This change will be the third change in the peak hour in six years. How often do you expect people to shift their work hours for the small savings in bus fare? I predict that this change will lead to some shift out of the 8 to 9 a.m. and out of the 3 to 4 p.m. hours into the already high current peak hours. The shift will intensify the problem of peak-hour service and thereby increase the cost of the entire system. . . . Keep the peak hours as they are and commit to doing so for at least five years. Then people can plan around your hours with some sense of permanence. . . . Peak and off-peak fares have been one of the great inventions of the system. But the original purpose was to encourage people to spread out their ridership. By making a peak fare narrow, you allow people to make moderate changes in their schedule and ride the shoulders. Now you make it absolutely impossible for the vast majority oe people, even the vast majority of employers, to change their hours.

Still, the overwhelming sentiment at the April, 1981 public hearing was in favor of time-of-day pricing. Only those riding the shoulders of the peak who now pay higher fares have voice any dissatisfaction.

9.6 Summary and Prospects

According to RTD management, time-of-day pricing in the Denver area has been a "qualified success". The qualification seems to be that some fare should be charged during the off-peak to cope with the free-rider problem and that careful attention needs to be given to defining the peak hours. Denver's RTD has managed to increase ridership and improve the agency's financial position over the past several years while increasing the time-of-day differential at the same time. It's evident that the pricing program, along with various service enhancements, is partly responsible for these recent improvements. Management takes pride in the recent accomplishments made, including the peak/off-peak differential's standing as the largest in the country. Because of the past successes and the general popularity of the fare program, RTD management anticipates that time-of-day pricing will be around for a long time.

10. Erie, Pennsylvania -- Erie Metropolitan Transit Authority

10.1 System Description

The Erie Metropolitan Transit Authority (EMTA) began operations in 1967 after taking over the Erie Coach Company. Under public ownership, a long standing trend of declining ridership was reversed. A variety of capital improvements and marketing efforts helped bring about a 9% increase in ridership during EMTA's first two years of operation. From that time until the present, EMTA has been one of Pennsylvania's more successful transit systems, combining high levels of ridership with relatively low per passenger operating costs.

EMTA's service network consists of ten routes which cover about 250 miles. The system has a radial crisscross configuration which converges on downtown Erie. During FY81, some 6.4 million passengers boarded EMTA's 77 buses. This level of ridership makes EMTA the most heavily used transit system in Pennsylvania outside of those in Philadelphia and Pittsburgh, a distinction made more impressive by the fact that EMTA's service population of 212,000 is surpassed by seven other systems in the the state.

EMTA is a regional authority in which both Erie City and Erie County participate. The authority is governed by a nine member board. Day-to-day operations are the responsibility of the General Manager, who reports directly to the board.

10.2 Fare Structure

EMTA's current fare structure is shown in Table 10.1. EMTA became the first public bus agency in the U.S. to implement time-of-day pricing when, in January, 1970, the 30-cent flat fare was decreased to 20 cents during the off-peak periods and marketed to the public as a "bargain fare". These fares remained in effect until 1976, when each was raised a nickel. Since then, repeated increases have brought the fares to their present levels. In relative terms, the midday differential has eroded from a 33% to a 17% discount.

10.3 Reasons for Adopting Time-of-Day Pricing

EMTA's time-of-day fare structure was instituted to attract discretionary riders, particularly shoppers, to the off-peak period. The goal of increasing off-peak ridership was based both on a desire to maintain off-peak service levels and to familiarize more people with EMTA's service and its viability as a transportation alternative.

When EMTA first implemented time-of-day pricing in 1970, it was in the form of a six month experiment, the objective of which was to help establish an optimum fare structure for the system. The initial trial period was extended first for six additional months, and then indefinitely, as a result of increasing passenger volumes.

Table 10.1

Current Fare Structure for EMTA (as of January, 1982)

Fare Type	Peak Fare	Off-Peak[1] Fare
Adult Cash	.60	.50
Student Cash	.50	.50
Student Token[2]	.45	.45
Senior Citizen	.10	.00
Handicapped	.30	.05

[1] Monday-Saturday 10 a.m.-2 p.m. and all day Sunday and holidays.

[2] Adults may also use student tokens during the off-peak.

The increased ridership which apparently resulted from EMTA's mid-day discount made the scheme an exemplar for a number of other systems in the early '70s. The transit systems in both Allentown and Akron adopted time-of-day fare structures partly in response to EMTA's success. EMTA's general manager also promoted the idea through his active involvement with the American Transit Association.

10.4 Trends and Impacts Associated with Time-of Day Pricing

Table 10.2 shows revenue, operating, and ridership data for the year before and the year after EMTA's adoption of peak/off-peak pricing, as well as for the most recent year for which data were available. These data indicate a significant ridership increase along with some slippage in financial performance in the year following the fare change.

EMTA's ridership increase could be attributed to the fare change, the increase in service levels, or from other factors not shown in Table 10.2. Considering only the first two possibilities, it is possible to estimate the average fare elasticity under different assumed values for the vehicle miles elasticity. The calculations are shown in Table 10.3. They suggest that the average fare elasticity is within the range -0.5 to -0.9. The average fare elasticity is thus almost certainly greater than the rule of thumb value of -0.3. This higher value most probably reflects the fact that off-peak demand is more elastic than peak demand, although the fact that Erie is a relatively small city may also be a contributing factor.

Because time-of-day fares have been in effect for such a long time, it is not possible to assess the current effect of the fare differential. It should be noted, however, that the relative size of the differential has decreased with each fare increase, probably resulting in a lessening of ridership impact.

Table 10.2

EMTA Financial and Performance Indicators 1969-70

Indicator	1969	1970	% Change 1969-70
Revenue Passengers (000)	3540	3835	8.3
Passenger Revenue ($000)	795	784	-1.4
Average Fare ($)	.224	.204	-8.9
Operating Revenue ($000)	864	871	-0.8
Operating Expense ($000)	1,166	1,258	7.9
Revenue/Expense	0.74	0.69	-6.8
Vehicle Miles ($000)	1,407	1,460	3.8
Expense/Passenger ($)	.329	.328	-0.3
Passengers/Miles	2.52	2.63	4.4
Passengers Revenue/Mile ($)	.565	.537	-5.0
Expense/Mile ($)	.829	.862	4.0

* Fare differential adopted January, 1970.

Source: EMTA Annual Reports, 1969 and 1970.

Table 10.3

1969-70 Average Fare Line Elasticity Estimates
Under Different Assumed Vehicle Miles Elasticities

Assumed Vehicle Mile Elasticity	% Change in Ridership 1969-70			Average Fare Elasticity
	Total	Vehicle Mile Induced[1]	Average Fare Induced[2]	
0.0	8.3	0.0	8.3	-0.93
0.5	8.3	1.9	6.4	-0.72
1.0	8.3	3.8	4.5	-0.51

[1] The change in ridership which would result from a 3.8% increase in vehicle miles based on the assumed vehicle miles elasticity.

[2] The difference between the observed 1969-70 ridership change and the vehicle-miles-induced ridership change.

Despite the increased ridership, the financial position of EMTA in 1970 was somewhat weaker than that in 1969, when flat fares were still in effect. There was a slight decrease in passenger service revenue, a 16% increase in operating costs, and a resulting 15% decrease in the farebox recovery ratio. The increasing costs cannot be attributed to time-of-day pricing, but indicate that any savings in operating costs which the scheme may have brought about were not significant in terms of EMTA's overall balance sheet. These increasing costs were only partially offset by the higher load factors resulting from increased ridership, the net result being an 7% increase in operating expense per rider.

In summary, time-of-day pricing in Erie appears to have brought about a significant increase in ridership with only a marginal loss in passenger service revenue, and was thus an efficient means of stimulating patronage from a fiscal point of view. Insofar as these gains in ridership increased load factors, peak/off-peak pricing may have also had a positive effect on per passenger operating costs. There is no evidence, however, that time-of-day pricing had any direct effect on operating costs.

10.5 Implementation Issues

EMTA's time-of-day pricing proposal was initiated by the Authority's General Manager, and received support from both staff and policymakers. At the staff level, the idea was backed strongly by the marketing department, who saw it as an opportunity to further promote the system. This support has, to date, not waivered. In 1977, in fact, the board rejected a consultant's recommendation to decrease the differential from 10 cents to five cents.

EMTA riders have also generally supported time-of-day pricing. The only complaints about the change occurred when users were charged the higher fare either just before or just after the off-peak period.

EMTA collects its fares through the farebox and through token sales. The 10 for $4.50 student tokens are accepted from all riders in the off-peak period. The border problem is resolved by changing the fares in effect at the beginning of a route run. Drivers are also given some leeway in the enforcement of the peak/off-peak differential.

EMTA's marketing of the midday discount was viewed as part of a large scale effort to promote the new system. Among the marketing approaches used were television interviews, newspaper and radio advertisements, a promotional film, and an open house at the bus yard. It should be stressed that these efforts were all intended at promoting the system as a whole, and that time-of-day pricing was considered as much a means of boosting the public's image of the system as an object of promotion. In referring to peak/off-peak pricing, EMTA marketers coined the term "bargain fares," thereby promoting EMTA as a good transportation value and at the same time associating the system with the activity of shopping.

Downtown Erie businesses were important participants in EMTA's promotional efforts. One form of cooperation was the joint sponsorship of free inbound bus rides at various times during the morning off-peak period. These experiments both encouraged off-peak ridership and assisted EMTA in understanding the public's response to different types of price structures. Businesses also assisted in the promotion by including in their advertising messages a reminder to use EMTA for shopping trips.

10.6 Summary and Prospects

As the first American public bus transit agency to implement time-of-day fares, EMTA holds an important place in the history of transit fare innovation. The success of its program, at least in its early years, is apparent from available data and from first hand accounts. Moreover, the fact that EMTA has maintained the differential through several fare changes indicates the agency's ongoing commitment to time-of-day pricing. Maintaining the same numerical differential, however, has meant an erosion of the relative differential. Thus, it may be that the ridership impacts of the program have dissipated over time. Nonetheless, there can be no question that EMTA has strengthened its operation through its willingness to experiment with differentiated fares.

11. Louisville, Kentucky -- Transit Authority of River City

11.1 System Description

Prior to 1974, several private transit companies served the Louisville area. The largest, the Louisville Transit Company (LTC), carried 90% of the transit patrons in the region. However, after operating at a loss since 1970, LTC announced in 1972 that it would cease operations in two years. Fearful that the company would fold, city and county officials provided a $750,000 subsidy to keep LTC afloat.

In September 1974, LTC was purchased, and the Transit Authority of River City (TARC) established. Given the problems of the former transit operation, securing a stable source of permanent funding became a top priority. In November, 1974, the voters of Jefferson County and the city of Louisville approved a 1/5 of 1 percent occupational license tax applicable to all wages, salaries, and profits earned within those jurisdictions. These tax revenues can be used by TARC for operating and capital matching funds.

Under public ownership, TARC pursued a vigorous service expansion program. Vehicle miles increased by 61.5% between 1974 and 1981. Currently, 27,069 daily miles are scheduled over 534.2 total route miles. The system includes 16 radial routes, 21 express routes, 4 feeder routes, 2 circulator routes, and 5 crosstown routes. TARC's fixed route service concentrates on the Louisville Metropolitan area of Jefferson County, a jurisdiction of 395 square miles with a population of 761,000.

TARC system policy is guided by a Board of Directors. The eight members are appointed for terms of four years, with four representatives from Jefferson County, and four from the city of Louisville.

11.2 Fare Structure

The adult cash fare was $.50 peak, and $.25 off-peak from November 6, 1974 to August 31, 1980 (except for a period between July 5, 1977 and March 20, 1978 when the peak fare was lowered to $.35 as part of a clean air promotion program). Discounted commuter tickets were also provided which effectively reduced the peak fare per ride to $.35.

On September 1, 1980, TARC raised peak fares to $.60 and off-peak fares to $.35, and commuter tickets to $.50 per trip. Table 11.1 presents the current fare structure.

11.3 Reasons for Adopting Time-of-Day Pricing

TARC inherited its peak/off-peak fare structure from the private Louisville Transit Company. LTC had decreased off-peak fares during its

Table 11.1

Louisville TARC's Fare Structure[1]

(as of July, 1983)

Fare Type	Peak	Off-Peak
Adult Cash	$.60	$.35
Adult Ticket	.50	N/A
Elderly, Handicapped and Students	.25	.25
Zone charge	.15-.25	.15-.25
Downtown shuttle	.20	.20
Transfers	free	free

[1] Peak hours: 6:30 - 8:30 a.m. and 3:30 - 5:30 p.m., weekdays

N/A - Not Applicable

last year of operation as part of the subsidy "bail-out" program sponsored by the Louisville Board of Alderman. An ad hoc public transportation committee appointed by the Board had identified the community's priority issues through a series of public hearings. Among these, the need for lower fares was most frequently expressed, mainly to benefit students, elderly, and other transit dependent riders in the region. Consequently, local authorities provided LTC with a $750,000 subsidy to allow a lowering of fares. In 1974, responding to these community concerns, LTC deferred further service cut-backs, reduced the off-peak (including weekend) fares from $.50 to $.25, reduced student fares, and eliminated transfer charges.

Peak/off-peak pricing has been retained throughout public ownership. TARC management believes it increases off-peak ridership, resulting in better utilization of base period capacity.

11.4 Trends And Impacts Associated With Time-of-Day Pricing

Ridership Trends

Table 11.2 presents ridership data for several years before and after the peak/off-peak differential was implemented in Louisville. Under the private LTC, ridership levels declined 54.2% between 1964 and 1973, falling most rapidly over the latter five years.

The decline reversed itself in 1974, rising 8.8% from 1973 levels. TARC assumed transit system ownership during that year, and retained the $.50/.25 peak and off-peak differential during the first six fiscal

Table 11.2

TARC Ridership, Revenue, and Cost Trends

	Revenue Passengers (millions)	Passenger Revenue (millions $)	Operating Expenses (millions $)	Farebox Recovery[1] (%)
Before Fare Change				
1972	10.316	4.557	4.487	101.6
After Fare Change				
1973*	9.740	4.365	4.399	99.2
1974*	10.593	3.162	5.082	62.2
TARC ownership				
1974-75	11.150	3.172	6.547	48.4
1975-76	11.151	2.984	8.739	34.1
1976-77	12.418	3.120	10.386	30.0
1977-78	13.151	3.164	11.354	27.9
1978-79	14.737	3.512	13.499	26.0
1979-80	16.140	3.934	16.799	23.4
1980-81	14.775	5.360	20.356	26.3
1981-82	13.752	5.378	21.605	24.9

* Time-of-Day pricing implemented in 1974; TARC assumes ownership in September

1 Farebox recovery = % of costs recovered by passenger revenue -- presented only for years under public (TARC) ownership.

years of public operation. Ridership increased 44.7% between 1974 and 1979. However, this is most likely a result of greatly improved levels of service under public ownership, rather than riders' attraction to the midday discount.

Fares increased for the first time under TARC in September, 1980. Ridership declined 14.8% from 1981-82. Off-peak ridership as a percentage of total ridership decreased from 62% in 1976-77 to 51% in 1979-80, though it climbed somewhat to 55% in 1982-83.

Fiscal and Performance Trends

Table 11.2 also presents revenue and cost data for the eight years of TARC operation. Although ridership increased almost 50% between fiscal years 1975 and 1980, revenues remained fairly constant over this period. They grew slightly in 1979-80, then rose noticeably in 1980-81

following the fare increase, with the sharpest rise occurring in 1981-82.

Costs on the other hand increased 230% between 1975-76 and 1982-83, far outpacing any revenue gains. As a result, farebox recovery ratios declined steadily from 48.4% in 1975-76 to 23.4% in 1980-81. The fare increase of September effectuated a small ratio increase in 1981-82, but farebox recovery fell again slightly in 1982-83.

Performance data were not available for the period before and after TARC's initial implementation of time-of-day pricing. However, information on TARC's most recent (September, 1980) fare change, whereby the differential was widened more than at any other time in the system's history, was available.

As expected, revenues in both absolute and unit terms (e.g., per vehicle mile and vehicle hour) increased in response to the fare increase. However, expenses also increased, and at a faster rate. Other performance measures showed that the agency's productivity declined slightly after the fare increase, though probably not as a direct result of it. Peak to base vehicle ratios increased by 2.1%, suggesting vehicles were deployed less efficiently throughout the day. The 2.0% decrease in ratio of vehicle miles per employee suggests a slight decline in labor productivity as well.

Ridership Composition and Equity

Table 11.4 presents ridership profiles obtained from on-board surveys taken four months before peak/off-peak pricing was implemented; fifteen months after the program became effective; and again after approximately five years under the $.50/.25 differential. Interpretation of the results, however, is hampered by:

1) a common failure to differentiate peak and off-peak riders within specific socio-economic categories; and

2) the fact that public takeover of Louisville transit operations occurred within a year of adopting time-of-day pricing.

The effects that new management had on the level and nature of ridership is impossible to distinguish from the effects due to differentiated fares alone.

The data presented in Table 11.4 indicates little change in the age distribution of riders between 1973 and 1974, when roughly 66% of all riders were under 50 years of age. In 1979, after peak/off-peak pricing was well established, the majority of riders were still within this age range, although there was a decrease in proportion of the youngest riders (under 18 years old). The distribution of males and females changed more substantially. Little shift occurred between 1973 and 1974; however, male ridership rose from 29.8% in 1974 to 41.0% in 1979, with female ridership dropping from 70.4% to 59.0%. Minority ridership also increased during that time from 36.6% to 49.0%.

Table 11.3

TARC Selected Performance Data, Fiscal Years 1980-81 and 1981-82

	1980-81	1981-82	% Change FY 81-82
Total Passengers (millions)	14.775	13.752	-6.9
Passenger Revenue (millions of $)	5.360	5.378	0.3
Average Fare ($)	.36	.39	8.3
Operating Expense (millions of $)	20.356	21.605	6.1
Peak/Base Buses	219/95	226/96	2.1
Employees	674	662	-1.7
Vehicle Miles (millions)	8.469	8.150	-3.8
Vehicle Hours (millions)	.633	.611	-3.5
Vehicle Miles/ Employee	12,565	12,311	-2.0
Passenger Revenue/ Mile ($)	.633	.660	4.3
Expense/Mile ($)	2.40	2.65	10.4
Passenger Revenue/ Hour ($)	8.47	8.80	3.9
Expense/Hour ($)	32.16	35.36	9.9

* Fares increased $.10 in the peak and off-peak

Distributions of income exhibited the most marked shifts between survey periods. From 1973 to 1974, there was a small but decided shift to higher income groups. Riders making less than $5,000 annually comprised 48.8% of those surveyed in 1973, but dropped to 40.6% in 1974. Representation in the remaining income categories increased anywhere from 0.5% to 4.0%. This shift continued through 1979, when riders in the lowest income category made up only 18.0% of TARC patronage, while those making $15-25,000 rose from 10.5% in 1974 to 22.0% in 1979; and

Table 11.4

Changes in TARC Ridership Composition, 1973, 1974, and 1979

	Percent of Survey Respondents		
	1973	1974	1979
AGE (years)			
under 20	33.4	33.6	24.2*
20-39	22.3	24.2	41.4
40-59	27.5	26.2	34.3
60+	16.8	16.1	9.1
	100.0	100.0	100.0
SEX			
male	30.5	29.8	41.0
female	69.5	70.2	59.0
	100.0	100.0	100.0
INCOME($) (annual family)			
under 5,000	48.8	40.6	18.0
5-15,000	42.6	45.8	54.0
15-25,000	6.5	10.5	22.0
25,000+	2.1	3.1	6.0
	100.0	100.0	100.0
TRANSIT DEPENDENCY			
captive	87.5	61.7	59.0
choice	12.5	38.3	41.0
	100.0	100.0	100.0
RACE			
minority	35.8	36.6	49.0
white	64.2	63.4	51.0
	100.0	100.0	100.0

* Age for 1979 equals under 18, 18-34, 35-64 and 65+.

Sources: Transit Implementation Program, 1973 Louisville Metropolitan Area Study of Transit Riders, 1976 Draft Report, "Summary of Findings, TARC Passenger Survey", ZML/Consensus, 1979

those making over $25,000 from 3.1% to 6.0%.

Transit captive ridership dropped from 87.5% to 61.7% between 1973 and 1974, while choice ridership rose from 12.5% to 38.3%. No significant changes in these percentages were evident in 1979.

Apparently, TARC has attracted more affluent, "choice" riders since 1973, a trend contrary to the conventional image of the low-income, "captive" transit market. On the other hand, senior citizen and

minority representation has also increased, the latter attaining virtual parity with the percentage of whites by 1979. Nevertheless, the degree to which these trends are a result of differentiated fares versus other factors is difficult to determine.

11.5 Implementation Issues

Because the fare differential was in effect when TARC assumed ownership and operations of the Louisville metropolitan area transit, implementation of the midday discount has not been an issue. The public is so long accustomed to it that time-border problems are rare, and when they do occur, drivers are expected to use their discretion in dealing with the problem. No marketing efforts have been designed around time-of-day pricing particularly.

11.6 Summary and Prospects

The TARC midday discount is a tradition of good standing. Generally, management feels that the midday discount has worked reasonably well for them. It is believed to have stabilized off-peak ridership levels over the years. No thoughts of discontinuing the program are presently being entertained.

12. Minneapolis-St. Paul, Minnesota -- Metropolitan Transit Commission

12.1 System Description

The Metropolitan Transit Commission (MTC) was created in 1967 to develop public transit in the seven-county metropolitan area surrounding the twin cities of Minneapolis and St. Paul. In September, 1970, MTC commenced public transit services by taking over Twin City Lines, a private company.

MTC currently operates about one thousand vehicles, over 1,300 fixed route miles. Of the 123 total routes, 57 are local, 49 are express, and 17 are special services (e.g., a University of Minnesota intercampus bus service, and a subscription service to outlying companies). In addition, MTC operates a door-to-door service for handicapped riders and a $.10 downtown shuttle service. MTC also manages a vanpool and carpool program, which together served roughly 16,500 passengers in 1982.

In the early 1970's, MTC received most of its funding from the farebox and a dedicated property tax. In 1975, however, the State Legislature limited MTC's taxing power by reducing the maximum tax levy and the size of the tax district. The resultant revenue losses were made up primarily by state block grants. Three years later these block grants were replaced by "performance" funding, wherein the State began paying MTC a set subsidy for each passenger carried.

The MTC consists of one chairman and eight commissioners, representing seven counties and the twin cities of Minneapolis and St. Paul. Members are appointed by the Metropolitan Council, a regional planning agency. The Commission in turn appoints the general manager of system operations.

12.2 Fare Structure

Between 1970 and 1979, MTC's base fare remained at $.30. Faced with declining rates of cost recovery, MTC increased the base fare by $.10 in July 1979. Gasoline shortages and fuel price increases, however, sparked increases in patronage and pressures for service expansions. As costs continued to rise, MTC was forced to quickly raise fares again, contrary to its prior policy of stable fare rates. In April, 1980, base fares rose to $.50, largely in response to a new policy objective aimed at recovering 40-50% of operating costs through bus revenues.

Continued cost escalations forced another base fare increase to $.60 in July, 1981. At this point, the Minnesota Legislature statutorily set a ceiling on base fare increases, although a peak hour surcharge was allowed. The need for greater farebox returns persisted, and time-of-day pricing was thus formalized in June, 1982 when MTC raised peak hour fares to $.75. The legislature effectively limited MTC's fare options to the peak periods.

MTC's current fare structure is relatively complex, involving both distance and time components. Table 12.1 presents the current fare schedule for the first zone closest to the downtown center. Passes are provided in the form of monthly "all you can ride" cards, prorated to different zones, and contain time-of-day surcharges.

Table 12.1

Current MTC Fare Structure, (as of July, 1983)
(first zone only)[1]

Fare Type:	Peak[2]	Off-Peak
Adult	$.75	$.60
Youth	.75	.20
Sr. Citizen	.75	.10
Handicapped	.75	.30
Dime Zone (Minneapolis/St. Paul Downtown Centers)	.10	.10
Pass Cards	24.00	24.00-50.00

1 Fares prorated upwards for travel from zones 1 to 2,3,4 and outside city limits.

2 Peak hours in effect 6:00 to 9:00 a.m. and 3:30 to 6:30 p.m. during weekdays.

12.3 Reasons for Adopting Time-of-Day Pricing

MTC staff and management opposed the peak/off-peak pricing, preferring an across-the-board increase instead. However, time-of-day pricing was the only option open to the Commission since the Legislature statutorily froze the off-peak fare at $.60 in 1981.

The State's underlying rationale for setting a ceiling on off-peak fares appeared to be based on efficiency as well as equity considerations. Section 473.408, subdivision 2 of the governing transit fare policy states:

> Fare and fare collection systems shall be established and administered to accomplish the following purposes:
>
> a) To encourage and increase transit and paratransit ridership with an emphasis on regular ridership;

b) To restrain increases in the average operating subsidy per passenger;

c) To ensure that no riders on any route pay more in fares than the average cost of providing the service on that route;

d) To ensure that operating revenues are proportioned to the cost of providing the service so as to reduce any disparity in the subsidy per passenger on routes in the transit system; and

e) To implement the social fares as set forth in subdivision 3 which dictates a $.20 base fare for students, 50% of full fare for handicapped, and a $.10 fare for all elderly persons 65 years or older.*

Given these legislative constraints, MCT's fare response was reactionary rather than initiative in nature. Nevertheless, all affected agency departments -- training, labor, operations, research, planning and scheduling, finance and revenues -- were included in implementation policy discussions to ensure relatively smooth program implementation.

Still, MTC management continues to oppose time-of day pricing, and would like to discontinue it as soon as the legislature enables them to do so. This will unlikely occur before 1985, since the base fare will statutorily remain at the June 30, 1983 level of $.60 through the fiscal biennium ending June 30, 1985.

12.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 12.2 presents annual ridership, revenue, cost, and performance data for a period two years prior to the fare increase and the year of its implementation.

Ridership Trends

Ridership had risen steadily in the mid-1970's, reaching a high of 93.8 million in 1979. The base fare was increased from $.30 to $.40 in July 1979; ridership declined annually thereafter, decreasing 12.4% from 1980 to 1982, and is projected to further decline during 1983. Although many factors likely influenced this drop-off, the yearly fare increases beginning in 1979 certainly contributed. The sharpest twelve month ridership drop during this period occurred between 1981 to 1982, when peak/off-peak pricing was effective for six months.

Specific peak versus off-peak ridership counts for a period before the fare change were not available. However, a system survey taken in January, 1983, about eighteen months after the change, showed that 54.8% of sampled riders rode during the peak, and 45.2% during the off-peak.

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* This level is only 16.7% lower than the full base fare; however, a social fare reimbursement grant from the State effectively increases this percentage to 50% from MTC's standpoint.

Table 12.2

MTC Selected Performance Data, 1980-1982

	1980	1981	1982*	Percent Change 1980-81	
Total Passengers (millions)	92.700	90.700	82.200	-2.2	-9.4
Passenger Revenue (millions of $)	26.695	29.515	32.408	10.6	9.8
Average Fare ($)	.29	.33	.39	13.8	18.2
Operating Revenue (millions of $)	28.502	31.397	34.400	10.2	9.6
Operating Expense (millions of $)	85.730	87.364	87.000	1.9	-0.4
Revenue/Expense	.322	.359	.395	8.1	10.0
Farebox Recovery Rate	.311	.338	.373	8.7	10.4
Peak/Base Buses	855/281	850/276	816/289	1.2	-8.3
Employees	2459	2375	2316	-3.4	-.2.5
Vehicle Miles (millions)	24.630	24.490	23.916	-0.6	-2.3
Vehicle Hours (millions)	1.810	1.796	1.759	-0.8	-2.1
Vehicle Miles/ Employee	10.106	10.312	10,326	2.9	0.1
Passenger Revenue/ Mile ($)	1.08	1.21	1.36	12.0	12.4
Expense/Mile ($)	3.48	3.57	3.64	2.6	2.0
Passenger Revenue/ Hour ($)	14.75	16.43	18.42	11.4	12.1
Expense/Hour ($)	47.36	48.64	49.46	2.7	1.7

* Time-of-day pricing introduced June, 1982.

The survey also queried riders about their time-of-day travel since the program became's inception. Survey results indicated that most users are riding less frequently and shifting trips from the peak to off-peak periods. Persons making non-working trips, as well as traditionally transportation handicapped groups, showed the greatest shifts between time periods.

Fiscal and Performance Trends

As anticipated, MTC's operating revenue rose in response to fare increases. Whereas ridership decreased more than 12% from 1979 to 1982, annual operating revenue rose 54.9% from 22.2 million to 34.4 million over the same period. However, this rise was accompanied by a 37.7% increase in costs over the same period. Table 12.2 shows that passenger revenue and operating in unit terms (e.g., per vehicle mile and hour) demonstrated the same patterns. Both cost and farebox recovery rates had been in a steady decline throughout the 1970's, but began to climb in 1980 in response to the fare increases.

Other performance measures derived from these data indicate that prior to the adoption of peak/off-peak pricing in June, 1982, MTC operations demonstrated fluctuating levels of effectiveness. Vehicle miles per employee showed a jump in 1980, a dip in 1981 and another jump in 1982. Thus, though it appears that resources (vehicles and employees) were generating increasing levels of outputs (vehicle miles and vehicle hours) from 1981 to 1982, the previous year does not suggest that this trend would continue into 1983. Peak to base vehicle ratios fluctuated over the period, increasing from 1979 through 1981, then dropping slightly in 1982. The decrease in peak to base ratio suggests that vehicles are being distributed more evenly between time periods.

Ridership Composition and Equity

From a systemwide survey administered January 22-24, 1983 (six months following the introduction of time-of-day pricing), MTC passengers were asked whether their trips had decreased in number, remained the same, or shifted to off-peak hours since the fare change (see Table 12.4). Responses were disaggregated by various socio-demographic characteristics. One must be careful about assigning changes in trip making behavior solely to peak/off-peak pricing, since the crosstabulations do not control for other potential factors.

Regarding the users' age, the young and the old seemed most affected by time-of-day pricing. Among youth riders under 18 years old (3.1% of the sample), 21.3% said they were riding less, while another 31.2% said they shifted their trips to the off-peak period. Riders aged 65 and over (9.8% of the sample) also tended to shift their trips to the off-peak -- 30.5% of elderly respondents indicated greater off-peak travel since the fare change.

No major differences were evident between male and female riders as a result of the fare change. With regard to income groups, the only significant difference appeared among those earning less than $10,000

Table 12.4

Perceived Impacts of MTC's Peak/Off-Peak Fares on Travel Behavior

	Percent of Riders Which:			
	Rode less	Shifted	No Change	
Age (Years)				
Under 18	21.3	31.2	47.5	100.0
18-34	12.5	19.6	67.9	100.0
35-64	9.5	11.2	79.3	100.0
65+	15.9	30.5	63.5	100.0
Sex				
Male	13.4	68.4	18.2	100.0
Female	10.0	72.3	17.3	100.0
Income ($) (Annual Family)				
Under 10,000	13.0	31.7	55.3	100.0
10-20,000	10.7	15.0	74.3	
20-40,000	9.4	10.5	80.1	100.0
40,000+	11.9	9.9	78.2	100.0
Transit Dependency				
Captive	11.9	24.2	63.9	100.0
Choice	10.6	12.0	77.4	100.0

Source: MTC Systemwide Passenger Survey, 1983

annually. Of these riders, 31.7% indicated a greater shift to off-peak travel, double the percentage of any other income group. Interestingly, higher income riders, in addition to lower income ones, revealed the greatest tendency to reduce the number of trips taken. Finally, respondents who indicated that they didn't drive or own a car tended to shift their travel to the off-peak far more so than other user groups.

12.5 Implementation Issues

In addition to strong program opposition by MTC policy-makers and staff, drivers opposed time-of-day fare because of the anticipated longer boarding times and the resultant schedule maintenance problems. From interviews with staff, there's also the perception that users have generally become disgruntled with higher peak charges. MTC staff feels that the increase in fares from $.30 to $.75 in just four years was too rapid, and the public fears that fares will continue climbing on an

annual basis. However, a rider survey taken in February 1982 prior to June implementation indicated that most riders preferred a fare increase to a decrease in service levels.

Major adjustments in MTC's fare collection policy had to be made in order to identify peak riders. Previously MTC utilized a mixed pay-out/pay-enter procedure to facilitate the collection on zonal fares -- i.e., zone fares were collected upon leaving the bus on outbound routes, and upon boarding on in-bound routes. However, with the introduction of the p.m. peak period, outbound patrons had to pay the basic fare plus peak surcharge on entering and later pay any zonal charges upon exit. Drivers opposed this practice, and riders have complained about the inconvenience of paying twice. MTC dealt with the time-border problem by identifying which runs are considered peak and off-peak on all schedules. Drivers have been instructed to use their discretion in handling individual passenger disputes.

MTC's pass program has become more complex with peak/off-peak pricing. Having the form of a punch-card, passes had to be redesigned to accommodate peak as well as zonal charge denominations. Drivers have also complained that passes are now far more cumbersome to handle.

Staff resistance to the peak/off-peak policy was reflected by the lukewarm promotion of the program, despite the existence of a strong and aggressive marketing department. Newspaper coverage, on-board flyers , and new schedules comprised MTC's limited advertizing effort prior to implementation, and nothing has been pursued on an on-going basis. The business community has not been involved in any way with promotion of the fare differential.

12.6 Summary and Prospects

In summary, peak/off-peak pricing has not been the preferred revenue raising device at MTC, and without the support of staff and the policy commission, it faces an uncertain future. The share of MTC's operating costs recovered by operating revenues has been quite erratic, reflecting perhaps financial difficulties that time-of-day pricing, by design, is unable to redress. Overall, management feels that the co-existence of time-of-day and zonal pricing is redundant and overly complicates the fare structure, and would therefore prefer to bring base period fares up to the peak level.

13. Orange County, California -- Orange County Transit District

13.1 System Description

The Orange County Transit District (OCTD) is a publicly operated transit system formed in 1972 from several private bus companies. The system has grown rapidly over the past decade, from just under 1 million passengers during its first year of operation to over 28 million passengers in 1982. Yet only about 2% of all trips within Orange County are made by public transportation, owing to the multi-centered pattern of urban development and the historical auto-orientation of the region. In all, OCTD operates 600 buses over sixty routes covering 2,900 miles, with services focussing on the cities of Santa Ana, Anaheim, Costa Mesa, Hunington Beach, Garden Grove, Fullerton, Irvine, and Newport Beach. Orange County is one of the fastest growing areas in the country, with employment increasing at the rate of 2.6% annually.

The District offers a diverse range of services to Orange County residents. Over 97% of all trips are made on the fifty local routes, most of which operate on thirty minute headways, or less, during rush hours. In addition, eight express routes with park-and-ride lots, several regional bus connections to Los Angeles, and over eighty contracted dial-a-ride buses (21 with wheelchair lifts) serve County residents. OCTD also sponsors a carpool matching program. This rich mix of services is well tailored to the County's diverse ridership markets and generally low density layout.

OCTD's Board is comprised of two members from the County Board of Supervisors, two members from alternating cities within the County, and one public representative elected at-large. Two of the Board members also serve on the Orange County Transportation Commission, the agency responsible for distributing all state and federal transportation assistance. Day-to-day operations are directed by a General Manager.

13.2 Fare Structure

OCTD introduced time-of-day pricing on both local fixed route and dial-a-ride services on July 1, 1981. From OCTD's inception until the fall of 1978, the system's basic fare was a quarter. The next four years, however, witnessed a rapid succession of fare changes. In response to steadily rising deficits, local adult fares rose to 35 cents in late 1978, 50 cents in late 1979, and 75 cents during peak versus 60 cents during the off-peak in mid-1981. Thus, within less than two years, the predominant fare had increased by over 100%. OCTD actually initiated time-of-day pricing in September, 1980 when elderly and handicapped fare discounts were eliminated during peak hours, though it was ten months later when the program was expanded systemwide.

OCTD's fare structure as of fall, 1983 is summarized in Table 13.1. From 6:00-9:00 a.m. and 3:00-6:00 p.m. during weekdays, the fare is 75 cents, while for all other hours, including weekends, it is 60 cents. For dial-a-ride, peak fares are $1.50 versus $1.25 during off-peak hours. Dial-a-ride services, available to the public at-large, operate

within limited areas, and charge extra for transfers between zones. (Vans with lifts, however, are restricted to handicapped persons.) Thus, a fairly refined time-of-day and distance-based fare structure has been designed for demand-responsive services in Orange County, perhaps more so than anywhere in the country.

Fares for senior citizens are 35 cents during the peak and free at all other times. (The County reimburses OCTD for the difference between discounted senior fares and regular fares.) For handicapped passengers, off-peak travel costs 35 cents. OCTD's express fares are $1.50. An assortment of discounted monthly passes and multi-ride tickets are also offerred to the public. Senior citizens' passes require a 40 cents surcharge if used during peak hours. Also, all transfers, except on dial-a- ride vehicles, are free.

Table 13.1

Orange County's Fare Structure (as of 7/1/83)

Type of Fare	Peak Hour Fare1	Off-Peak Fare2
Local Adult Cash	$ .75	$ .60
Senior Citizen Cash	.35	free
Handicapped Cash	.75	.35
Express Cash	1.50	N/A
Regular Dial-a-Ride	1.50	1.25
Senior and Handicapped Dial-a-Ride	.50	.50
Local Pass3	25.50	25.50
Local Student/ Handicapped Pass3	22.50	22.50
Senior Pass3	14.504	14.00
Express Pass3	60.00	60.00
Regional Pass5	67.00	67.00
Local Tickets (40)	27.00	27.00
Express Tickets (20)	27.00	27.00
Dial-a-Ride Tickets (40)	17.00	17.00

1 Weekdays, 6-9 a.m. and 3-6 p.m.
2 All other hours
3 Passes are good for unlimited monthly use
4 Plus a 40 cents surcharge
5 Good for unlimited usage on OCTD and the Southern California Rapid Transit District (RTD) in Los Angeles
N/A Not Applicable

13.3 Reasons for Adopting Time-of-Day Pricing

OCTD adopted time-of-day pricing for two primary reasons: 1) to make fares reflect variations in costs; and 2) to increase revenue in order to attain a 20% farebox recovery target. OCTD management became increasingly convinced that the incremental cost of peak services was

somewhat above the average base period cost; thus, a higher peak period fare was considered to be an efficient alternative to uniform pricing. In that there is no dominant CBD in Orange County, and commute trips tend to be scattered throughout the region, management felt that a relatively small differential was appropriate. Although planners had no costing models for closely estimating the true incremental cost of peak period services, the fact that OCTD operates with one of the lowest peak-to-base ratio of buses (1.24) in the country for a major transit property suggested that a small differential was in order. From interviews, OCTD planners did indicate that a significantly larger differential would have been put into place if the route structure followed more of a radial layout and the peak-to-base ratio was higher.

OCTD's farebox recovery. target. was prompted by state legislation* which set 20% as a minimum for receiving state transit assistance. The time-of-day fare structure is considered to be just one element of a larger program to improve OCTD's financial position and increase productivity. The system currently covers 22% of all costs, though on a number of specialized services, such as dial-a-ride, the figure is below 10%. Thus, pressures to increase farebox returns helped to bring about OCTD's fare differential, although the influence of state law was not as direct as in the case of Minneapolis/St. Paul. (See Appendix I.12). The overriding reason, rather, was to design a cost-based fare structure.

13.4 Trends and Impacts Associated with Time-of-Day Fares

OCTD's operating and financial performance has improved over the past several years due to a host of factors, perhaps including the 1981 time-of-day differentiation of fares. This is suggested in Table 13.2 which shows patronage, financial, and productivity trends spanning fiscal years (July 1 to June 30) 1980 through 1982. In that OCTD's fare differential was introduced on July 1, 1981, a comparison of fiscal years 1981 (covering one year before) and 1982 (covering one year after) is most revealing. It should be noted that a 22-day work stoppage in February, 1981 had a major effect on ridership and all other statistics for that fiscal year. To remove the effects of the strike, fiscal year 1981 data were adjusted by OCTD by extrapolating trends from the 11-month non-strike period.

OCTD's systemwide ridership had been increasing steadily since the early seventies, but has levelled off in recent years, despite expanded services. Management attributes this not only to the work stoppage (which broke the transit habit of some users), but also to declining fuel prices and the slowdown of the economy. Higher average fares have also probably had a hand in the levelling off of ridership, though management believes the effect of the differential it self has been negligible. This was confirmed by the analysis in Chapter 3 which found a fare elasticity associated with OCTD's 1981 time-of-day differential of -0.31 compared to an elasticity of -0.28 for the 1980 15 cents uniform fare increase. This suggests that average fare rates, not the

* California Sentat Bill 620

time-of-day structure itself, have had depressing affects on OCTD's ridership.

On-board surveys conducted a year before and after the 1981 fare change (see Chapter Five) reveal that ridership losses have come mainly from choice users -- down 3% as a share of total patronage. Age and income distributions remained relatively constant from before and after the 1981 differential. In that lower income riders tend to patronize the off-peak more often (e.g., persons with annual incomes of $5,000 or less make up 22% of off-peak compared to 14% of peak usage), OCTD planners feel that compared to a uniform fare hike, the differential was less onerous to lower income passengers.

Ridership has declined most sharply on express services, which prior to 1981 had been increasing steadily. This suggests that OCTD's fare elasticities, even for rush hour work trips, are quite high at the upper range of fare levels. Regarding shifts in ridership following the differential, OCTD planners feel that the incidence was fairly modest and consisted primarily of elderly patrons changing their period of discretionary travel to the free off-peak hours. As a share of total ridership, peak usage currently makes up 54%, only slightly down from the pre- differential level.

Table 13.2 does indicate that OCTD's financial position has improved markedly since implementing the differential, although planners attribute this as much to various in-house measures (e.g., reducing extraboard drivers, incentives to reduce absenteeism) as anything. Between 1980 and 1982, passenger revenues, in both absolute and unit terms, increased at a far faster rate than expenses, resulting in a significant increase in OCTD's cost recovery. Costs per hour have been particularly stabilized, increasing slower than the consumer price index since 1981. The table also shows that the peak-to-base ratio of buses declined by nearly 10% one year after the fare differential was introduced. Moreover, labor productivity (e.g., vehicle miles of service per employee) rose noticeably. Other productivity indicators have dropped some, although the declines have been reflected throughout the day. For instance, between May, 1981 and May, 1982, passengers per vehicle hour dropped from 27.9 to 26.1 during the peak and from 27.0 to 25.6 during the off-peak. Overall, then, OCTD's time-of-day differential has been associated with positive financial gains and negligible patronage and productivity impacts.

13.5 Implementation Issues

The implementation of time-of-day pricing in Orange County has gone fairly smoothly, with few complaints or obstacles. Fares change on a "designated route policy" rather than adhering to rigid time borders. Fares rise to peak rates only at major collection/discharge points on each route, and not necessarily by any one direction of a run (i.e., either inbound or outbound from an urban center). This arrangement was considered to be the most practical one for Orange County because of the multi-centered, modified grid layout of routes as well as the fact that buses run on a pulse schedule. Thus, major connection points, not exact time on the clock, generally determine when a fare change is to occur.

Table 13.2

Selected Performance Data for OCTD, 1980-821

Indicator	1980	19812	1982*	%Change 1980-81	%Change 1981-82
Total Passengers (millions)	26.088	31.848	31.592	21.1	-0.8
Passenger Revenue (millions)	6.477	9.921	14.984	131.1	51.0
Average Fare ($)	.25	.31	.47	88.0	51.6
Operating Revenue (millions)	7.606	10.712	21.380	181.1	99.6
Operating Expense (millions)	35.566	54.821	67.639	90.2	23.4
Revenue/Expense	.214	.195	.316	47.6	62.1
Farebox Recovery Rate3	.182	.181	.221	21.4	22.1
Peak/Base Buses	204/190	352/258	362/298	13.1	-9.6
Employees	854	1199	1199	13.9	0.0
Vehicle Miles (millions)	15.451	19.484	22.110	43.1	13.5
Vehicle Hours (millions)	1.088	1.263	1.491	37.0	18.1
Vehicle Miles/ Employee	18,093	16,250	18,440	1.9	13.5
Passenger Revenue/ Mile ($)	.42	.50	.68	61.9	36.0
Expense/Mile ($)	2.30	2.81	3.06	33.0	9.3
Passenger Revenue/ Hour ($)	5.95	7.86	10.05	68.9	27.9
Expense/Hour ($)	32.69	43.40	45.37	38.8	4.5

* Time-of-day fare differential introduced on July 1, 1982
1 Data are for fiscal years (July 1 to June 30)
2 Adjusted for 22-day work stoppage in February, 1981
3 Farebox recovery rate equals passenger revenues/expenses

Collection is facilitated by bold-faced entries on individual bus schedule, each designating where and when the rate change will occur. Overall, drivers have been suportive of the fare program.

Although some initial hesitancy was expressed by OCTD's Board towards time-of-day pricing, members now support the program fully. Prior to implementing differential pricing, however, OCTD staff felt there was a prevailing belief among Board members and some management personnel that the peak period was a money-maker. A prolonged and carefully designed educational process took place to dispell this myth, involving various workshops and staff presentations on OCTD's cost structure. In that there are no standing loads during peak periods in Orange County, concern over charging rush hour users a premium fare for often inferior quality services was not an issue.

The riding public has also generally accepted time-of-day pricing. There was some initial confusion about the fare program -- about 100 formal complaints were filed regarding fares during the three months surrounding the 1981 change, compared to a usual rate of about 20.* The majority of the complaints were related to the OCTD's indecisiveness in designating the peak hours. For the first two weeks the differential was introduced, the peak was defined as the five hour period from 6:30-9:00 a.m. and 3:30-6:00 p.m., the same span used for senior citizens time-of-day pricing the previous year. Realizing that revenues were not increasing as much as had been hoped for, OCTD management quickly stretched the period to six hours on June 14, 1981. This caused a fair amount of disgruntlement among passengers who found themselves missing out on a cheaper fare. OCTD was also criticized for discouraging commuters from shifting their travel to the off-peak by this move. Some confusion also seems to persist over the fare program. Notably, drivers continue to report substantial numbers of non- English speaking patrons, primarily southeast Asians and Latinos, who pay the full fare during off-peak hours because they simply don't understand the differential and are fearful of being accused of underpayment. Despite some of these problems, OCTD management believes most patrons have accepted peak/off-peak pricing as a necessary part of running an efficient bus system.

13.6. Summary and Prospects

OCTD's initiation of time-of-day pricing, along with various service and cost-savings improvements, have helped the system financially. Overall, however, the program appears to have had no significant impacts on ridership. The limited amount of ridership shifting between time periods can probably be attributed to the relative small size of the differential, combined with the wide time span designated for peak hours. Planners set a small fare differential because of Orange County's unique multi-nucleated layout and the small ratio of peak-to-base buses, realizing that any patronage impacts would probably be modest as a result. No immediate changes to the fare structure are

* The number of fare related complaints filed are monitored and recorded on a quarterly basis in the General Manager's Executive Summary.

currently being considered, although OCTD management acknowledges that the peak/off-peak program could be modified in the future depending upon fiscal needs. Overall, time-of-day pricing seems to be paying off in Orange County.

14. Sacramento, California -- Regional Transit

14.1 System Description

Sacramento Regional Transit (RT) was formed in 1971. The system serves an area of 343.4 square miles and a population of 780,000. Currently, the 230 vehicle fleet operates over 89 routes and 1,026 directional route miles.

RT's Board of Directors is elected by the activated jurisdictions of the District. Activation requires the jurisdiction to pass a resolution whereby its Transit Development Funds are turned over directly to the District. Currently only the city and county of Sacramento are active members. Thus the Board consists of four city and three county appointees, the remaining cities foregoing Board representation in favor of retaining direct control over their Transit Development Fund allocations.

14.2 Fare Structure

RT's current base fare is $.50; elderly and handicapped pay a half fare of $.25. A surcharge of $.10 is levied during weekday a.m. and p.m. peak periods, which are designated as 6:30-9:00 a.m. and 3:30-6:00 p.m. respectively. Regular monthly passes are available for $24.00, based on 40 peak-period rides. Discounted passes are offered to students and elderly and handicapped patrons at $16.00 and $10.00 respectively. Table 14.1 presents the current fare structures.

Table 14.1

RT Fare Structure (as of July, 1981)

Fare Type	Peak	Off-Peak
Adult	$.60	$.50
Youth	.50	.40
Sr. Citizen/Handicapped	.25	.25
Handicapped Zone Charge	.50	.50
Daily Passes		
Adult	24.00	24.00
Youth	12.00	12.00
Sr. Citizen/Handicapped	12.00	8.00

14.3 Reasons for Adopting Time-of-Day Pricings

RT management realized that its system costs were much higher during the peak than the off-peak, due to several factors:

1. Fixed costs were geared to its peak level of operations rather than to a uniform level of demand over the entire day;

2. Contract provisions which govern the daily spread of hours a driver could work resulted in substantial over-time payments;

3. Peak period riders tended to travel longer distances; consequently, passenger turnover per service mile was lower in the peak than in the off-peak, resulting in higher costs per passenger per service mile.

Recognition of these peak period cost factors was the primary motivation for implementing a peak period surcharge in July 1981. System planners estimated that 1981-82 peak hour costs were approximately 50% higher during the peak compared to the off-peak: $30.00 per hour versus $20.00 per hour.

A secondary reason for time-of-day was to encourage non-commuters, especially the elderly, handicapped, and student patrons, to travel during the off-peak hours, thereby making additional capacity available in the peak.

14.4 Trends and Impacts Associated with Time-of-Day Pricing

Ridership Trends

Table 14.2 presents ridership trends for three years before and one year after Sacramento Regional Transit implemented time-of-day pricing.

Table 14.2

RT Ridership Trends:
Distributions by Peak and Off-Peak Period

Fiscal Year	Total Passengers (millions)	Percentage of Estimated Ridership in:[1]	
		Peak	Off-Peak
1978-79	16.477	34.9	65.1
1979-80	18.791	35.1	64.9
1980-81	21.122	36.1	63.9
1981-82*	18.043	44.4	55.6

* Time-of-day fares initiated July, 1981.

1 Peak/off-peak distributions estimated from samples of daily ridership.

Prior to the new fare program, ridership had risen steadily from 1978-79 to 1980-81. Ridership declined to 18.0 million in 1981-82 following the inception of peak/off-peak pricing, an -14.6% decline from the previous year.

Based on a sample of average weekday ridership, RT found that the percent of peak period travel actually rose following the introduction of time-of-day fares. Beginning in 1978-79 with 34.9%, the proportion of peak riders rose to 44.4% in 1981-82 one year after the fare change. The 23% growth in the proportion of peak riders between 1980-81 and 1981-82 came during a time when overall ridership had decreased by 14.6%, suggesting that the largest part of this decline occurred among off-peak riders.

However, it is highly unlikely that RT's ridership changes were due solely to the peak surcharge. RT staff believes the overall decrease in ridership in 1981-82 was influenced more by lower gas prices and a general economic downturn, rather then to the higher transit fares.

Staff also observed very few ridership shifts from the peak to the off-peak periods. This was attributed mostly to the relatively small $.10 differential. Consequently, RT staff is proposing a significantly larger surcharge of $.25. A survey was taken to determine riders' sensitivity to the potential peak hour increase, with respondents indicating that they would continue to patronize the system. This further supports the continuation that RT riders are more sensitive to factors other than the fare change.

Fiscal Trends

Table 14.3 shows operating revenue, cost, and performance data for fiscal years 1979-80 to 1981-82. Passenger revenues increased steadily over this three years period. Revenues increased 24.4% the year before implementation of peak/off-peak pricing, from $4.9 million in 1979-80 to $6.1 million in 1980-81. Following the fare change, revenues grew 11.8% to 6.9 million in 1981-82.

Operating costs increased at a slower rate over the same period, although they were considerably higher than revenues. In the year prior to peak/off-peak pricing, costs rose 19.1%. After the fare change, costs remined essentially constant. During this time RT introduced major service modifications. About 150 runs were deleted on various routes, and the workforce was reduced wherever possible. Contract service reductions, discontinuation of bus leases, an improved maintenance program, and the hiring of part-time drivers all served to keep costs down. As a result of these trends, RT's cost and farebox recovery rate increased annually. Revenue and costs in unit terms followed the same patterns.

Other performance measures indicate that RT's productivity has improved somewhat from 1979-80 to 1981-81. Vehicle miles per employee had increased prior to the fare change, then stabilized. Peak to base vehicles did decrease in the year that time-of-day pricing was introduced, demonstrating the agency's efforts to utilize its resources more

Table 14.3

Sacramento RT's Revenue and Cost Trends,
Fiscal Years 1978-79 to 1981-82

	1979-80	1980-81	1981-82*	% Change 80-81	% Change 81-82
Total Passengers (millions)	18.791	21.122	18.043	12.4	-14.6
Passenger Revenue (millions of $)	4.945	6.150	6.874	24.4	11.8
Average fare ($)	.26	.29	.38	11.5	31.0
Operating Revenue (millions of $)	5.062	6.194	6.881	22.4	11.1
Operating Expense (millions of $)	19.721	23.488	23.725	19.1	1.0
Revenue/Expense	.257	.264	.290	2.7	9.8
Farebox Recovery Rate	.251	.262	.290	4.4	10.7
Peak/Base Buses	172/130	175/134	157/129	-1.3	-6.8
Employees	625	577	573	-7.7	-0.7
Vehicle Miles (millions)	7.910	7.535	7.403	-4.7	-1.7
Vehicle Hours (millions)	.482	.496	.488	2.9	-1.6
Vehicle Miles/ Employee	12,656	13,059	12,920	3.2	-1.0
Passenger Revenue/ Mile ($)	.62	.82	.93	32.2	13.4
Expense/Mile ($)	2.49	3.12	3.20	25.3	2.6
Passenger Revenue/ Hour ($)	10.23	12.40	14.09	21.2	13.6
Expense/Hour ($)	40.91	47.35	48.62	15.7	2.7

* Time-of-day pricing introduced July, 1981.

efficiently.

14.5 Implementation Issues

The planning staff at RT actively supported the concept of time-of-day pricing. In-house studies had revealed that it cost substantially more to provide incremental peak service above base levels. Consequently, peak/off-peak pricing was recommended as a viable method to recover some of these costs. Neither the General Manager or the Board of Directors opposed the new program, and the fare differential was included as part of the adopted 1981-82 five-year plan.

Drivers were apprehensive about possible confrontations with patrons during the enforcement of peak/off-peak pricing. To help allay their concerns, a strict adherence to time boundaries was avoided. Instead, schedules were redesigned to indicate the beginning and end of peak period runs on each route, thus clarifying when the surcharge was in effect. The peak surcharge was then considered effective over the entire length of the run.

In general, users did not object when peak/off-peak pricing was implemented. There were only a few complaints from elderly and handicapped patrons because their special pass did not include the peak surcharge. Staff hoped this omission would encourage off-peak travel. However, concessions were made to the elderly and handicapped who did not wish to pay a cash surcharge: since the higher priced student pass permitted peak hour travel, elderly and handicapped patrons were given the option of purchasing student stickers to cover peak travel.

Outside of RT's redesign of schedules, little else was done to facilitate time-of-day pricing directly. Several service cuts and other operational changes were made, but these were unrelated to the pricing program. Marketing efforts aimed at informing the public about the new program included notices, signs and flyers, and news spots; however, these promotional efforts were discontinued shortly after time-of-day fares were in place.

14.6 Summary and Prospects

Sacramento RT management has generally been pleased with time-of-day pricing. The differential has achieved its objective of raising more revenue by tapping the resources of riders who can generally most afford higher fares -- the daily commuter. Staff would like to see even better results, and plan to explore the full potential of time-of-day pricing by raising the peak surcharge from $.10 to $.25 in the near future.

15. Salt Lake City, Utah -- Utah Transit Authority

15.1 System Description

The Utah Transit Authority (UTA) was formed in 1969 to serve Salt Lake County. Weber and Davis counties also joined the district by the mid-seventies. In 1975, all three counties earmarked a .25% local option sales tax to help finance transit expansions in their jurisdictions.

UTA's tri-county service area covers approximately 1,500 square miles and serves an urban population of 900,000 along the Wasatch Front between Salt Lake City and Ogden at the northern end. The UTA system, developed on a modified grid system, operates 350 vehicles over fixed route covering 2,652 total miles. Inter-city services connect Ogden and Salt Lake, and all other jurisdictions along the corridor.

Special services include ski runs and dial-a-ride for elderly and handicapped customers. The agency also helps coordinate a commuter ride-sharing program along with the Utah State Energy Office and the Utah Department of Transportation.

In 1982, fares covered only 18% of total operating assistance, with the majority of revenue coming from the local dedicated sales tax. UTA's Board of Directors consists of six members from Salt Lake County and two each from Davis and Weber Counties. Members are appointed by locally elected county commissioners.

15.2 Fare Structure

UTA has a history of low fares. During most of the 1970's, the base fare was $.15. In 1979 it was raised to $.30. Two years later, in July, 1981, the off-peak fare was raised to $.40 and the peak fare to $.50.

The current fare structure is presented in Table 15.1.

15.3 Reasons for Adopting Time-of-Day Pricing

The primary motive for UTA's implementation of a peak surcharge appears to have been political. UTA had been recovering only an 18-22% of its costs through the farebox. Facing the possible loss of Federal Section 5 operating assistance, UTA initially sought an across-the-board fare increase from $.40 to $.50. In addition, UTA management wanted to reduce the abuses of the existing pass program, particularly among students.

This proposal met with strong and organized opposition at public hearings, particularly from senior citizens and student groups. In particular, the suggested redefinition of the student pass to limit its applicability to those 17 and under was challenged, prompting protest letters from the associated students of the University of Utah, Salt Lake City's Mayor and the City Council.

Table 15.1

UTA's Fare Structure (as of July, 1981)

Fare Type	Peak*	Off-Peak*
Adults and Students	$.50	$.40
Zone Fare	.50	.40
Senior Citizens/ Handicapped	.25	.20
Zone Fare	.25	.20
Children	free	free
Transfers	free	free
Commuter/Express all passengers	.60	N/A
Zone Fare	.50	N/A
Passes:		
Adult (2-4 zones)	$18.00-54.00	$18.00-54.00
Student (2-4 zones)	13.00-39.00	13.00-39.00
Senior Citizen/Handicapped (2-4 zones)	9.00-27.00	9.00-27.00
Commuter Express (2-4 zones)	2.00-40.00	22.00-40.00

* Peak Hours: 1st Bus to 8:30 a.m. and 3:30 p.m. to 5:30 p.m.

* Off-Peak Hours: 8:30 a.m. to 3:30 p.m. and 5:30 p.m. to Last Bus; all Day Saturday and Sunday.

N/A Not Applicable

In a written statement to the UTA general manager, the associated students maintained that "the proposed discontinuance (sic) of the student pass to college students could provide temporary easement of the administration and budget problems of the Utah Transit Authority, but the overall effects would only increase tensions and problems between (the students and the agency)." However, they did suggest a reduced fare in the off-peak as an alternative to abolition of the college level pass. In a public statement, the Utah State Coalition of Senior Citizens also recommended off-peak and other "ridership incentives" in lieu of fare increases.

Limiting higher fares only during peak hours, then, was largely a concession to highly vocalized interest groups. In a memorandum to the Board of Directors, UTA's staff planners acknowledged that rush hour

commuters would more likely tolerate a fare increase. UTA staff also felt that time-of-day pricing would be more equitable, since persons making shorter trips tend to ride more in the off-peak, while many longer trips are concentrated in the peak. A distance-based fare structure was actually recommended, though time-of-day fares were eventually opted for primarily because they are easily implemented.

15.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 15.2 presents ridership revenue, cost, and performance data for calender years 1980 through 1982, a period covering both the adoption of time-of-day pricing in July 1981, and earlier fare changes.

Ridership Trends

UTA's Ridership totaled 19.443 million passengers at the end of 1980. Though seasonal downturns in the summer had been characteristic of UTA ridership in the past, patronage declined somewhat noticeably after the January 1, 1981 fare increase, and dropped markedly after peak/off-peak pricing went into effect in July. By the end of 1981, ridership was down 15.2% from the previous year. In 1982, ridership appeared to stabilize, the annual total dropping only 2.9% from the previous year.

Undoubtably, other factors influenced the fluctuations in UTA patronage, including declining gas prices, but the timing of the declines in 1981 suggests that the fare changes themselves had a significant effect. A fare line elasticity for a period of 12 months before and after time-of-day pricing was implemented is estimated to be -.385.*

In additions, since the introduction of the fare differential, the share of UTA's adult ridership during the peak hours seems to have declined slightly -- from an estimated pre-differential 56% to 54.2% in January, 1982. Shifts seem to have been even more distinct among elderly and handicapped patrons -- from about 62% off-peak (before) to 66.4% off-peak (after).

Fiscal and Performance Trends

UTA's passenger revenue rose, as expected, with increases in fares, between 1980 and 1981. Since expenses rose more slowly, the system's financial position improved markedly in 1981. For the year following the initiation of time-of-day fares, however, UTA's farebox recovery rate declined 6%.

Performance measures shown in Table 5.2 are generally inconclusive. Ratios of vehicle miles to employees remained relatively stable from 1980 to 1981. The peak to base vehicle ratio rose slightly from 1980 to 1981 when differentiated fares were adopted, but decreased considerably

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* A line elasticity is the proportional change in ridership to the proportional change in average fares, where change is measured relative to a before point in time, in this case 1980.

the following year, demonstrating a more even distribution of resources through the day (although more vehicles were in operation overall). Unit revenues and costs, on average, seemed to remain unchanged (though on a per mile basis there seemed to be a slight deterioration in financial performance.)

Ridership Composition and Equity

Table 15.3 presents profiles of UTA's ridership both before and after the implementation of peak/off-peak pricing. Data were obtained from on-board ridership surveys taken roughly two years before and four months after implementation.

It is improbable that any changes in ridership demographics would be attributable solely to the introduction of peak/off-peak pricing, particularly since two other flat fare increases were implemented during this same time. Nonetheless, some shifts in ridership composition are suggested by the data. The policy affected some groups more than others.

In the age category, the most noticeable change was a shift in ridership towards older persons. This perhaps reflects UTA's targetting of many service improvements to senior citizens. Females seemed to make up the majority of 1981 riders, compared to a male majority in 1979, thus the change in percentage could be within the tolerance of sample error.

It is among income categories that the shifts are most apparent. Lower income patrons appear to have comprised a much smaller percentage of total system rider ship in 1981 than in 1979. Riders making between $5,000 and $9,999 annually also rode substantially less, falling from 34.1% to 24.0% of total ridership between 1979 and 1981. On the other hand, persons with incomes of $15,000 or more went from the least represented income group to the most highly represented one. It should be noted, however, that everyone's income generally rose during this period, so the use of unadjusted income figures could be deceptive.

Ethnic composition of UTA riders remained relatively constant, perhaps the only real change being a decline in Hispanic riders from 8.3% in 1979 to 4.0% in 1981. The level of transit captive riders on the system was difficult to determine precisely between surveys because comparable questions on car availability were not asked. However, it appears that the proportion of users not having a car option for making the trip did not change appreciably.

15.5 Implementation Issues

UTA's policy-makers, including board members and UTA management and staff, were initially supportive of time-of-day pricing, but have been somewhat disappointed with results to date. Short-run revenue gains were not as high as expected, and no major ridership shifts were seen between the peak and off-peak. Some drivers did complain, though most were indifferent to the program overall. Users have been generally quite receptive.

Table 15.2

UTA Select Performance Data, Calender Years 1980-82

	1980[1]	1981[2]	1982	% Change 80-81	% Change 81-82
Total Passengers (millions)	19.443	16.482	16.010	-15.2	-2.9
Passenger Revenue (millions of $)	3.662	4.657	4.867	27.2	4.5
Average Fare ($)	.19	.28	.30	47.4	7.1
Operating Expense (millions of $)	19.898	21.421	23.808	7.6	11.1
Farebox Recovery Rate[3]	.184	.217	.204	17.9	-6.0
Employees	786	763	N/A	-2.9	N/A
Vehicle Miles (millions)	10.428	9.983	11.510	-4.3	15.3
Vehicle Hours (millions)	.670	.699	.715	4.3	2.3
Vehicle Miles/ Employee	13.267	13,084	N/A	-1.4	N/A
Passenger Revenue/ Mile ($)	.35	.47	.43	34.3	-8.5
Expense/Mile ($)	1.91	2.15	2.07	12.6	-3.7
Passenger Revenue/ Hour ($)	5.46	6.66	6.81	22.0	2.2
Expense/Hour ($)	29.70	30.65	33.30	3.2	8.6

[1] Fare increase in February, 1980.

[2] Fare increase in January, 1981; time-of-day pricing adopted in July, 1981.

[3] Farebox recovery rate equals passenger revenue/operating expense

N/A Not Applicable

Table 15.3

Profiles of UTA's Ridership, Percent of Survey Respondents, 1979-81

	1979	1981	% Change in Relative Composition*
Age (Years)			
Under 21	28.7	26.0	-9.4
21-39	45.6	40.0	-12.3
39-59	16.0	22.0	37.5
60+	9.7	13.0	34.0
	100.0	100.0	
Sex			
Male	50.6	48.0	-5.1
Female	49.4	52.0	5.3
	100.0	100.0	
Income ($) (Annual Family)			
Under 5,000	31.5	24.0	-23.8
5-15,000	55.1	39.0	-29.2
15,000+	13.4	37.0	176.1
	100.0	100.0	
Race			
Minority	16.4	16.0	-2.4
White	83.6	84.0	0.5
	100.0	100.0	

* Equals percent change in the percentage of total ridership each group comprised between 1979 and 1981.

Sources: 1980 Transit Supply and Demand Characteristics Technical Memorandum, No. 33, Oct. 1982.

User support for time-of-day fares has probably been facilitated by UTA's policy regarding the time-border issue. To avoid confrontations between drivers and riders over the applicability of peak surcharge fares when a bus is running behind schedule, UTA adopted the position that an off-peak fare would be charged whenever a late-running bus forced a passenger boarding a scheduled off-peak trip into the peak hours, or from a scheduled peak trip into off-peak hours.

No operational changes were made to facilitate peak/off-peak pricing, and the differential fares were collected in the same manner as fares previously. Marketing efforts were limited to posters on bus boards and news paper advertisements.

15.6 Summary and Prospects

Notwithstanding a minimum of administrative problems, UTA is seriously considering the discontinuation of the time-of-day program by increasing all fares to $.50. UTA's overriding concern is generating more revenues, and time-of-day pricing has proven to be fairly impotent in this regard. There appears to be growing interest in differentiating fares on the basis of distance, thus a different version of cost-based pricing may be in store for Salt Lake City area residents.

16. Seattle, Washington - Municipality of Metropolitan Seattle

16.1 System Description

The Municipality of Metropolitan Seattle, or Metro, provides transit service to residents of Seattle and surrounding King County. The system includes some 7,000 miles of routes, over 900 buses, and over 100 trolley cars, with a area population of 1.3 million. In addition to regular transit service, a free fare zone in the downtown CBD is featured. In 1982, Metro carried 64 million revenue passengers.

Metro is a cooperative venture of the City of Seattle and King County. Policy is made by the 37-member, elected, Metro council, with day-to-day management in the hands of the Manager of Transit.

16.2 Fare Structure

Metro's current fare structure is shown in Table 16.1. Time-of-day pricing was introduced with the adoption of this structure in February, 1982. The prior fares were set at the same level as the current base (off-peak) fares. The cash time-of-day fare differential is 10 cents for trips within one zone, and 15 cents for trips between two zones. Eight different pass options, varying according to time of day, number of zones, and length of time, are available. Passes for peak period usage cost around 21% more than base period passes.

Table 16.1

Seattle Metro Fare Structure (as of July, 1983)

Type of Fare	Peak[1] Fare ($)	Base Fare ($)
One zone[2]	.60	.50
Two zones - cash	.90	.75
One zone - monthly pass	23.00	19.00
Two zones - monthly pass	34.50	28.50
One zone - annual pass	253.00	209.00
Two zones - annual pass	379.50	313.50
Youth - One or Two zones	.60	.50
Elderly/Handicapped	.15	.15

[1] Inbound 6-9 a.m., 3:30-6 p.m.; outbound 6-8:30 a.m., 3-6 p.m. weekdays only.

[2] Zone boundary coincides with municipal boundary.

16.3 Reasons for Adopting Time-of-Day Pricing

The purpose of the time-of-day differential was to enhance revenue, with the objective to raise an additional $3 million annually, thereby maintaining the farebox recovery ratio at 30%. Several alternatives, including an express surcharge, an increase in the number of fare zones, and the elimination of the fare zones accompanied with a higher flat fare, were also considered as means of generating the additional funds. The time-of-day differential was preferred for the following reasons:

1. Small anticipated ridership impact - Relying upon Lago et al.'s (1980) work on average fare elasticities, Metro staff calculated that a peak fare increase would result in a ridership loss of less than 1.5 million annually. By comparison, it was projected that the flat fare alternative would cost the system over 3.5 million riders per year.

2. Operational Simplicity - The time-of-day differential was not expected to pose significant adjustment problems for passengers or for drivers. The multiple zone alternatives were believed to have much greater potential for confusing both riders and operators, and the express surcharge alternative was thought to pose problems in distinguishing service types.

3. Jurisdictional Equity - A Washington state law requires that Metro's deficits be apportioned between the City of Seattle and King County according to the system's tax receipts from each jurisdiction. Based on the predicted ridership levels of the peak/off-peak fare structure and the established formula for allocating operating costs between city and county, it was believed that the time-of-day differential would produce an acceptable deficit distribution. In contrast, the single zone alternative would have reduced Seattle's deficit share by 2.4 %.

4. Effect on Low Income Population - The time-of-day differential was felt to favor low income riders, because they tend to ride less frequently in the peak periods.

16.4 Trends and Impacts Associated with Time-of-Day Pricing

In order to investigate the impacts of time-of-day pricing on trip-making behavior, Metro staff administered a before-and-after ridership survey. The first questionnaire was administered on-board one week before the fare change. Respondents to the first survey who furnished their names and addresses were mailed a second survey in May, three months after the increase. In all, about 31 percent of those people originally offered an on-board survey in January completed both the questionnaires.

The survey results indicate that the average (two-time) respondent made 8.2% fewer transit trips in May. The reasons cited for changes in transit use (both increases and decreases) include changes in schedule or in locational or employment circumstances (44.1%), changes in modal

preference (23.6%), and the fare increase (15.9%). When these percentages are combined with average change in trips for each category, it appears that the fare increase alone caused a 1.2% decline in ridership. Of this decrease, 0.92% represents lower peak period ridership, with the remaining 0.27% corresponding to changes in base period ridership. The change in peak period ridership represents an unusually low average fare elasticity of -0.1. Despite the apparent slight decrease in base period ridership, a net 4% shift in discretionary trips from the peak to the base period was also reported. Also, survey results suggest that disproportionally fewer trips employing cash fares were being made after the fare change, a shift for which there is no apparent explanation.

In order to further investigate the ridership of Seattle Metro's peak fare surcharge, a model of monthly ridership was developed. Ridership, revenue, and operating data from 1979 through 1983 were used to calibrate the model. Two fare changes took place during this period: a flat fare increase of 40 cents to 50 cents in 1980, and the imposition of the peak period surcharge in 1982. The model obtained is:

$$\hat{P}_t = \underset{}{358} + \underset{(.04)}{148W_t} - \underset{(.00)}{176S_t} + \underset{(.00)}{2.05M_t} - \underset{(.00)}{672D1_t} - \underset{(.00)}{258D2_t} \qquad (16.1)$$

where $\hat{P}$ = Predicted total monthly revenue passengers (thousands)

W = Winter dummy variable (= 1 for January, February, March and 0 otherwise)

S = Summer dummy variable (= 1 for July, August, September and 0 otherwise)

M = Monthly vehicle miles (thousands)

D1 = Dummy variable for first fare increase (= 0 before the first fare increase in June, 1980 and 1 thereafter)

D2 = Dummy variable for second fare increase (= 0 before the peak surcharge in February, 1982 and 1 thereafter)

t indicates time series observations

R^2 = .72, Durban-Watson Statistic = 2.58, N = 24 observations

Numbers in parentheses are probabilities that coefficients are zero.

The model coefficients suggest that the system lost about 672,000 riders a month as a result of the flat fare increase, as compared with 258,000 due to the adoption of the peak surcharge. In order to properly interpret these estimates, it is necessary to consider them in conjunction with the average fare increases which resulted from the fare changes. Table 16.2 shows that the 1980 flat fare hike increased average fares (i.e., total revenue divided by total revenue passengers) by

about 10 cents, while the peak surcharge added less than 4 cents to the average fare. Thus, the smaller ridership losses which occurred as a result of the 1983 fare change may be attributed to the fact that the change had much less of an effect upon the average fare. This is evident from the roughly equal elasticity estimates presented in Table 16.3. Thus, it does not appear that Seattle Metro prevented any ridership loss by imposing a peak surcharge rather than a (smaller) flat fare increase.

Table 16.2

Metro Average Fare and Ridership, 6/79 - 4/83

Time Period	Average Fare	Average Ridership (thousands)
6/79-5/80	0.37	5,351
7/80-1/82	0.47	5,462
2/82-4/83	0.51	5,247

Table 16.3

Metro Average Fare Elasticity Calculations

Fare Increase	Average Fare Change (%)	Ridership Change (%)[1]	Average Fare Elasticity
6/80	27.0	-12.6	-0.47
2/82	8.5	-4.7	-0.55

[1] Computed by dividing coefficient of appropriate fare dummy variable by average ridership before the fare change.

These findings differ significantly from those of the before-and-after ridership survey. Although the survey results indicate that ridership did decrease significantly after the peak surcharge was implemented, they also suggest that most of the decrease resulted from factors other than the fare change. The model, on the other hand, suggests that the change was the critical factor. When exogenous factors such as unemployment rate and gasoline price were introduced into the equation, they were found to be statistically insignificant.

Financial and performance data for the year before and the year after the fare increase are shown in Table 16.4. The data indicate that farebox revenues increased, but the farebox recovery ratio declined

slightly because of increased operating costs. Nonetheless, the ratio was well above the targeted level of 0.30. There also appears to be some decrease in operating efficiency, as measured by vehicle miles and vehicle hours per employee. This stems from a 6.3% increase in the number of employees while service levels were virtually unchanged.

Table 16.4

Selected Seattle Metro Performance Data, 1981-82

Indicator	1981	1982*	% Change 1981-82
Ridership (millions)	65.982	63.574	-3.6
Farebox Revenue ($ millions)	26.390	27.590	4.6
Average Fare	0.40	0.43	8.5
Operating Revenue ($ millions)	31.000	32.280	4.1
Operating Expense ($ millions)	88.130	95.880	8.8
Revenue/Expense	0.352	0.337	-4.3
Total Active Fleet	961	N/A	N/A
Total Employees	2.802	2.978	6.3
Vehicle Miles (millions)	34.261	34.123	-0.4
Vehicle Hours (millions)	2.427	2.417	-0.4
Vehicle Hours/Employee (000)	866	812	-6.2
Vehicle Miles/Employee	12.227	11.458	-6.3
Expense/Passenger	1.34	1.51	12.7
Passengers/Mile	1.92	1.86	-3.1
Farebox Revenue/Mile	0.77	0.81	5.2
Farebox Revenue/Hour	10.90	11.40	4.6
Expense/Mile	2.57	2.81	9.3
Expense/Hour	36.30	39.70	9.4

N/A = Not Available

* Time-of-day pricing implemented February, 1982.

16.5 Implementation Issues

Metro staff developed the time-of-day differential concept in response to the Metro Council's request for revenue enhancement options. As discussed above, the time-of-day differential was one of several options which staff presented to the council. The express surcharge proposal was the first preference of the Council, but it was determined that this alternative, which would have required the use of tickets to distinguish express from local passengers, could not be implemented in the two- to three- month time frame necessary to raise sufficient revenue. The time-of-day differential therefore received Council support as the most desirable option which could be implemented within an

acceptable time period.

There has been little documented reaction to time-of-day pricing from operators or users. Drivers have had 25 to 30 additional fare questions per day for the system's transit coordinator, but this has not proven difficult to handle. While customer complaints relating to fares and transfers have increased 85% over 1981 levels, only a few of the complaints have concerned the time-of-day differential. Most of those complaints which do pertain to peak/off-peak fares have come from shoppers during the early portion of the afternoon peak who believe that the mid-afternoon (3 p.m.) peak starting time makes the higher fares too difficult to avoid.

Metro collects its fares through both the farebox and a variety of pre-paid passes. One unique aspect of its passes in that a specific pass is available for each fare period and for both one- and two-zone trips. The marketing department believes that this flexibility is also confusing and makes the marketing of passes more difficult. Outbound passengers who pay cash fares do so as they exit from the bus.

Peak and off-peak periods are distinguished by the schedule, according to the time the run leaves from or arrives in downtown Seattle. Each bus carries a sign on the farebox specifying the fare period, and the fare period of each run is given in Metro's printed schedules. There have been a few instances in which run cards, timetables, and schedules has been inconsistent in the designation of a run, a problem which is expected to be eliminated when the timetables are computerized.

Efforts to promote the new fare structure were restricted to an initial public information campaign, which included "Ridership Alert" posters. Also, Metro has attempted to present the differential as an off-peak discount rather than a peak surcharge. A much more intensive overall marketing program has existed for some time and is ongoing. Business involvement with Metro promotions has focussed on it free CBD zone, which it already had when time-of-day fares were introduced.

16.6 Summary and Prospects

Seattle Metro's time-of-day pricing program has proven successful in raising desired revenues and has been implemented with very little difficulty. Most notably, the differentiated fare structure was adopted after an unusually thorough study of available options, suggesting that time differentiated fares have intrinsic appeal to local policy makers when they are adequately informed of the issues involved.

The ridership impacts of Metro's time-of-day fare structure to date are unclear. While ridership levels decreased after adoption, the evidence concerning the relation of this decrease to the fare change is ambiguous. On the other hand, it appears that implementation of the time-of-day differential was trouble free. Thus, while there can be no conclusive assessment of the net benefits of time-of-day pricing in Seattle, the program is certainly successful in terms of meeting revenue objectives and avoiding any significant disruption to the system.

17. Spartanburg and Anderson, South Carolina -- Duke Power Transit

17.1 System Description

Duke Power Transit is a joint franchise operation under the ownership and management of the Duke Power Company, a private utilities corporation serving parts of North and South Carolina. The Transit company provides service to Spartanburg and Anderson in South Carolina, and Durham and Greensboro in North Carolina.

Because it is a private company, routes, schedules, and fares in Spartanburg and Anderson must be approved by the Public Service Commission. The Spartanburg service area is approximately 57 square miles, serving a population of 87,936. Anderson is somewhat smaller. Spartanburg's weekday service is over 13 routes, roughly between the hours of 6:00 a.m. and 6:15 p.m. There is limited service on Saturdays, and no service on Sundays or in the evenings. In Anderson weekday services are provided from approximately 7:00 a.m. to 6:00 p.m. over 7 designated routes, reduced to 4 routes on Saturday.

17.2 Fare Structure

The off-peak pass concept was initiated by transit operating staff in both communities. The proposed policy was presented to South Carolina's Public Service Commission and adopted in 1978. The actual fare structure, including the off-peak fare design, was developed by the Corporate Rate Department of Duke Power Company.

The current fare structure for the Spartanburg Division is presented in Table 17.1. The fare schedule for Anderson is identical to Spartanburg's, except there are no adult transfer or zone charges.

For both localities, off-peak discounts between the hours of 9:00 a.m. and 3:00 p.m. are available by using one of two passes. A 30-day off-peak pass of unlimited rides costs $12.00. A 16 ride off-peak pass costs $15.00. Thus, time-of-day pricing in both Spartanburg and Anderson is implemented by restricting pass usage to non-peak periods.

17.3 Reasons for Adopting Time-of-Day Pricing

The primary motivation for adopting the off-peak discount pass was one of equity. The Duke Power Company was seeking a way to provide fares to senior citizens in the area. However, a lower fare targeted for those two groups only was not a satisfactory approach. Duke Power management felt that special transit fare privileges for senior citizens would invite their demands for similar discounts in the other utilities it provided. By allowing the discount to apply to all riders, Duke Power felt it would avoid the perception of a special senior citizen program. In addition, management felt other predominately midday riders, especially the poor, could benefit from the discount as well. Management hoped that midday usage would also increase as a result of

Table 17.1

Spartanburg's Current Fare Structure (as of July, 1983)

Fare Type	Peak	Off-Peak
Adult		
base	$ .50	$ .50
zone	.10	.10
transfer	.10	.10
Student		
base	.30	.30
zone	free	free
transfer	free	free
10-ride ticket	5.00	5.00
Passes (all riders)		
16-ride[1]	N/A	5.00
30-day[2]	N/A	12.00

[1] Valid for 60 days

[2] Good for unlimited rides in midday

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the discount pass program.

17.4 Trends and Impacts Associated with Time-of-Day Pricing

Limited background data were available on Duke Power Company's transit operations in Spartanburg and Anderson. Table 17.2 presents some performance data for Spartanburg for 1978, the year the off-peak pass program was adopted, and one year after. Although service levels did not change appreciably, ridership overall dropped somewhat while costs increased.* However, there is some indication that Spartanburg's midday ridership increased in response to the new fare program. Staff indicated that over the three years following adoption of the off-peak pass, pass sales rose more than 100%, even though total ridership dropped slightly over the same period. Nevertheless, affects of the pass program on cost recovery rates likely have been fairly negligible, since pass receipts make up a relatively small proportion of total revenue.

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* Similar annual operating revenue data was not available.

Table 17.2

Duke Power Transit, Spartanburg; Selected Performance Data, Calender Years 1978-1979

	1978*	1979	% Change 78-79
Total Passengers (thousands)	862	723	-16.1
Operating Expense (thousands of $)	565	625	10.6
Peak/Base Buses	24/12	24/12	0.0
Vehicle Miles (thousands)	422	422	0.0
Vehicle Hours (thousands)	37	37	0.0
Expense/Mile ($)	1.33	1.48	11.3
Expense/Hour ($)	15.11	16.77	11.0

* Time-of-day pricing adopted September 1978.

17.5 Implementation Issues

Duke Power Company experienced few problems with implementation. The only complaints were from drivers regarding the increased accounting responsibilities associated with a pass as well as cash payments. Riders, however, liked the program very much, and are quite supportive

17.6 Summary and Prospects

Overall, Duke Power transit management feels that the program has been moderately successful in both Spartanburg and Anderson. The potential for attracting even more midday riders in the future is considered good.

18. Tacoma, Washington -- Pierce Transit

18.1 System Description

Pierce Transit began operating services in November, 1979, following the approval of a 3/10 of one cent sales tax levy by the general electorate. The district's service area covers 275 square miles, encompassing 24 local jurisdictions and a service population of 422,000. The fleet of 179 buses operates over 39 bus routes spanning 683 miles. A special regional shuttle service operates an additional 19 vehicles. Operating hours are 4:00 a.m. to 1:00 a.m. on weekdays with peak hour periods of 5:00 a.m. to 9:00 a.m., and 4:00 p.m. weekdays to 6:00 p.m.

The Pierce Transit Board of Commissioners consists of seven members elected from all sections of the service district. The Board works closely with system staff in policy development, and contributed directly to the formulation of the time-of-day fare program.

18.2 Fare Structure

In January, 1982, Pierce Transit instituted the current differential fare structure of $.50 during the peak and $.25 during the off-peak. The $.25 increase over the base period represents the first fare increase in 25 years. Monthly passes are also available, at the following schedule:

Table 18.1

Pierce Transit Fare Structure
(as of January, 1982)

Fare Type	Peak	Off-Peak
Cash Fares		
Adult	$.50	$.25
Student	.50	.25
Elderly/Handicapped	.50	.25
Monthly Passes		
General	20.00	20.00
Student	15.00	15.00
Elderly/Handicapped	10.00	10.00

The general monthly pass incorporates the peak hour surcharge, based on 40 rides at $.50 each.

18.3 Reasons for Adopting Time-of-Day Pricing

Time-of-day pricing was implemented by Pierce Transit primarily for equity reasons. It was felt that peak hour riders commuting to full-time jobs were in a better position to pay higher fares. In addition, management believed a significantly higher level of service was being offered during the peak periods (e.g., shorter headways and greater route coverage). Hence, a higher peak fare was considered appropriate to finance the increased costs of producing better service.

18.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 18.2 presents ridership, revenue, and performance data for one year before and after the implementation of time-of-day pricing. (Cost information was not available for the latter year.) There was only a slight drop-off in ridership following the introduction of time-of-day fares. Operating revenue for the year prior to peak/off-peak pricing was $1.36 million. One year after the program began, total revenue rose to $1.93 million, a 42.5% increase. However, lack of information precludes a similar comparison of costs and farebox recovery.

Pierce Transit management implemented peak/off-peak pricing as part of an overall effort to increase the system's cost recovery ratio to 33-35%. However, the cost recovery rate was well below that in 1981.

Other performance measures suggest that productivity has not improved since time-of-day fares were adopted. The peak to base vehicle ration increased, suggesting that vehicles are deployed less evenly throughout the day. However, unit measures of passenger revenue indicates that, on average, each vehicle mile and hour of operation generated more revenue in 1982 than in 1981.

18.5 Implementation Issues

The Pierce Transit Board of Commissioners have reacted quite favorably to time-of-day pricing, due largely to their considerable input in the program's development. Likewise, drivers have been very supportive. Moreover, users have accepted the fare differential, acknowledging that after 25 years, a price adjustment seemed in order.

The only operational change made to facilitate time-of-day pricing was the installation of flip-signs on buses to indicate when peak hours became effective. Pierce does not have a specific policy to deal with the time-of-day border problem. If confrontations with patrons arise, drivers are encouraged to use their discretion in dealing with the problem.

The fare differential received some media coverage, particularly in local newspapers. However, the public was quite cognizant of the need and "overdue" nature of the fare increase, and an on-going marketing effort was not seen as necessary.

Table 18.2

Pierce Transit Selected Performance Data, Calender Years 1981-82

	1981	1982*	% Change 1981-1982
Total Passengers (millions)	12.300	12.237	-0.5
Passenger Revenue (millions of $)	1.153	1.539	33.5
Average Fare	9.4	12.6	34.0
Operating Revenue (millions of $)	2.912	3.786	30.0
Operating Expense (millions of $)	14.498	N/A	N/A
Revenue/Expense	.201	N/A	N/A
Farebox Recovery Rate[1]	7.9	N/A	N/A
Peak/Base Buses	132/75	142/77	4.8
Employees	396	N/A	N/A
Vehicle Miles (millions)	5.438	5.697	4.8
Vehicle Hours (millions)	.351	.417	18.8
Vehicle Miles/ Employee	13.732	N/A	N/A
Passenger Revenue/ Mile ($)	.21	.27	28.6
Expense/Mile ($)	2.67	N/A	N/A
Passenger Revenue/ Hour ($)	3.28	3.69	12.5
Expense/Hour ($)	41.30	N/A	N/A

* Time-of-day pricing adopted January, 1982

[1] Equals Passenger Revenue/Operating Expense

N/A - Not Available

18.6 Summary and Prospects

Overall, staff has found time-of-day pricing easy to implement and readily accepted by the riding public. This is attributed largely to a supportive riding public and a cooperative, interested Board of Directors. Farebox revenues have not increased as much as was anticipated. However, management feels that low ridership and consequently low revenue levels are reflective of a depressed local economy as much as anything else. They expect both ridership and revenue to climb as the regional economy improves. In general, time-of-day pricing is openly accepted in the Tacoma area, and therefore appears to have a promising future.

19. Washington, D.C. -- Washington Metropolitan Area Transit Authority

19.1 System Description

The Washington, D.C. area has seen a wide variety of time-of- day fare programs over the past decade -- over ten different versions of peak/off-peak pricing have been implemented. This is partly because of the unique political arrangement which has evolved for making fare policy decisions and governing transit policy in the nation's capital. Washington, D.C., northern Virginia, and suburban Maryland are represented by two directors and two alternates on the Board of the Washington Metropolitan Area Transit Authority (WMATA). Formed through a Congressionally- approved interstate compact in 1966 to plan, finance, and operate public transit in the Washington area, WMATA has become a forum whereby each jurisdiction pursues its own philosophy of transit pricing. In a sense, each jurisdiction "buys" its transit services from WMATA, as much or as little as it is willing to subsidize. Thus, fare structures in each jurisdiction have evolved almost autonomously of one another as different pricing policies have been adopted.

WMATA formally began operating public transit services when four different private bus companies were acquired in late 1973. Annual ridership has grown from 116 million to over 180 million since public acquisition and the expansion of services. Today, about 1,450 buses operate on nearly 400 basic bus routes with about 800 route variations. WMATA also began rapid rail services in 1976 following seven years of construction. Over 40 miles of the planned 101 mile system have been opened to date. The system currently serves nearly 300,000 passenger trips per day. The two operations go by the names Metrobus and Metrorail, which together provide Washington area residents an integrated network of public transportation.

19.2 Fare Structure

Fare History

WMATA has a fairly unique history of time-of-day pricing which is chronicled in Table 19.1. The evolution of time-of-day fares reflects changing political priorities among the three jurisdictions, each pursuing, in the words of one longtime observer, "its own narrow, parochial interest".

The first time-of-day fare differential was introduced in September, 1975 when peak fares of 50 cents were collected for trips in Virginia and Maryland, marking the first fare change since 1970. The off-peak fare was held to 40 cents, as was the fare for all times of the day in Washington, D.C. As with all subsequent differentials, higher zonal and interstate fare rates were also collected during the peak in comparison to the off-peak.

Table 19.1
History of WMATA's Time-of-Day Fare Programs

Date	Description
September, 1975	First regional Metro fare change since public takeover. Time-of-day fare differential: 50 cents peak and 40 cents off-peak in Maryland and Virginia, plus higher interstate fares in peak than base periods. District's fares are set at 40 cents for all periods of the day. For the first time, sharp division within WMATA evident along geographic lines, with D.C. arguing against increase and Virginia representatives threatening to withhold subsidy support unless fare increase passed. At earlier public hearings, commuters presented anti-increase petition. Planners expect a 1% revenue loss and decrease in ridership, especially in suburban areas, from the fare change.
March, 1976	Metrorail opens with 55 cents peak and 40 cents off-peak fares, until automated collection equipment can be installed.
June, 1976	In response to the need to increase revenues on both rail and bus operations, peak period extended by two hours -- from 6:30-9:00 a.m. and 3:30-6:00 p.m. to 6:00-9:30 a.m. and 3:00-6:30 p.m.
August, 1976	Rush hour fares increase 5 cents per zone in Maryland and 10 cents per zone in Virginia.
October, 1976	The 94th Congress cuts $2.4 million from Washington's budget, instructing the District to increase rush hour fares to 50 cents as in other jurisdictions to make up the difference. Mayor and City Council protest vehemently. Newspaper editorial appears that area's fares are the "highest and most complex in the world". Editors note there are six potential fares between Springfield, Va. and Washington.
February-March, 1977	Prince George County Council approves 5 cents fare increase during peak while rejecting a 10 cents off-peak increase. WMATA proposes 10 cents peak hour fare increase for the District, in keeping with Congress's recommendation. Suburban zone fares increase 10 cents in Virginia during peak, 5 cents in Maryland during peak, and 5 cents in Virginia during off-peak. Ends policy of equal fares in Virginia and Maryland. Elderly and handicapped discounts extended to all times of day. WMATA is observed by local press as being increasingly indecisive, the result of deficits becoming a politically sensitive issue.

Board decisions are based on instructions from political jurisdictions they represent.

July, 1977 — With automated fare collection, Metrorail lowers peak fares for the first 3 miles to 40 cents, the same as the off-peak. Additional mileage charges are higher in peak than off-peak -- 7.5 cents versus 3.75 cents. Peak bus fares in Washington raised to 50 cents.

July, 1978 — Virginia raises off-peak base fare to equal peak fare of 50 cents. Maryland lowers fares for longest trips while Virginia raises surcharges. Rail system inaugurates a flat 50 cents fare during off-peak. Rush hour rail fares increase 5 cents for longest trip.

July, 1979 — Maryland raises peak fare to 55 cents, retaining 40 cents off-peak rate. Virginia reintroduces differential by also raising peak fares to 55 cents, retaining off-peak rate of 50 cents. Zone charges increase. Initial three mile rail fare is increased to 45 cents in the peak and 50 cents in the off-peak. Thus, for short trips, rail becomes cheaper during rush hours. Beyond three miles, though, graduated fare rises to 9.5 cents per mile during peak. No surcharges for off-peak, thus for longer trips off-peak remains cheaper.

January, 1980 — In response to inflationary pressures, WMATA proposes major fare increases for bus and rail. For bus, proposal calls for increasing off-peak fares substantially more than peak ones. For rail, only higher peak fares considered. All jurisdictions support the Board's proposal because of precarious financial situations. Board assigns WMATA staff the task of simplifying the fare structure. Board formally acknowledges that simplicity would result in a different distribution of subsidy support among jurisdictions.

June, 1980 — Washington increases bus fare to 55 cents in peak and 50 cents in off-peak, narrowing differential. Virginia again eliminates differential by increasing all base fares to 60 cents, increasing zone charges the most during off-peak. Maryland increases peak fare to 60 cents and off-peak to 45 cents. Metrorail increases peak initial fare to 55 cents and retains off-peak fare of 50 cents, again making short rush hour trips more expensive. Peak distance fares increased, while off-peak flat fare retained.

January, 1981	In response to study recommendations, for the first time a uniform boarding fare (60 cents) applies to all jurisdictions, all times of day, and on both bus and rail. Amounts to largest increase in the District. Interstate and zonal fares increased for both time periods, though with higher peak rates retained. Except for the difference in distance surcharges between time periods, for the first time WMATA has an identical flat initial fare for peak and off-peak periods alike.
December, 1981	Bus and rail boarding fare rises to 65 cents in all jurisdiction at all times except the District during off-peak hours, which retains 60 cents fares. Thus, time-of-day differential reinstated in Washington. Distance surcharges on rail and bus also increase.
April, 1983	Boarding fares increase to 75 cents in all jurisdictions at all times for both modes. Exception again is Washington which increases off-peak fares only to 70 cents. Higher zonal and interstate fares during peak are retained. Rail distance charges increase to 14 cents per mile during peak, while flat 75 cents fare still applies in off-peak.

The hours of the peak were shortly thereafter defined to be 6:00- 9:30 a.m. and 3:00-6:30 p.m., a fairly wide time span. A year latter, Metrorail based its fare structure on Metrobus's, collecting 55 cents for peak trips and 40 cents for off-peak ones.

In 1977, the 94th Congress forced Washington, D.C. to join the other two jurisdictions in charging more for peak trips by cutting $2.4 million from the District's budget. From the 1976 appropriation hearings, the D.C. Budget Conference Committee recommended:

> Columbia for the Metrobus system during the peak hour periods...As the primary ridership during the peak period is working people, the result of these deliberations was that a fare increase would not work as an economic hardship on the citizens of the District and is greatly needed and long overdue as a fiscal measure.

The District reluctantly introduced a 10 cents peak surcharge in July, 1977 under protest, with the mayor introducing a resolution to the City Council proclaiming the fare to be "an imposition by the U.S. Congress of suburban (auto-oriented) values into D.C. transportation systems". In that same month, following the installation of automated fare collection at all stations, Metrorail lowered peak period fares from 55 cents to 40 cents, and initiated graduated fares with peak mileage rates set twice as high as those in the off-peak. One year latter, Metrorail abandoned all mileage surcharges during the off-peak.

Following several subsequent variations on time-of-day fares, WMATA embarked on a formal effort to simplify regional fares by promoting a

uniform minimum boarding price. In January, 1981, a base fare of 60 cents was initiated for all jurisdictions and both modes, supplemented by interstate and graduated surcharges which were higher during the peak than off-peak period. By the end of 1981, however, Washington, D.C. decided to retain the 60 cents off-peak fare while all basic jurisdictional fares as well as the District's peak fare, were raised by 5 cents.

Current Structure

WMATA's current fare structure, as of the fall, 1983, is summarized in Table 19.2. For bus trips and within jurisdictions, peak boarding fares are 75 cents, except in Washington where the off-peak boarding price is 70 cents. Between jurisdictions, zonal surcharges are higher during peak than non-peak hours. The time differentials are as small as a quarter (between Washington and Maryland's inner zone) and as large as $1.30 between Maryland's and Virginia's outer zones -- $1.85 if the trip is made during the off-peak compared to $3.15 if it is made during peak hours. Fares are considerably cheaper for elderly and handicapped citizens, varying from 25 cents to 60 cents depending on the zones crossed and remaining constant by time-of-day. Another layer of complexity added onto WMATA's fare structure is the availability of unlimited ride "flashpasses" which range in cost from $14 to $31 and are good for the designated two-week period. Flashpasses can be used systemwide during off-peak periods. During the peak, however, one has to add a surcharge ranging from 25 cents to $1.50 for trips crossing zonal boundaries or other jurisdictions.

Metrorail's current boarding fare for all periods is also 75 cents, with a 14 cents per composite mile* surcharge collected only during the peak periods. In 1982, the average peak rail fare paid was 94 cents, compared to the average off-peak fare of 65 cents. Thus, a time-of-day differential is achieved on the rail system by collecting distance steps only during peak hours. Transfer fees between rail and bus are free in Washington, 50 cents in Maryland, from 50 cents to $1.30 between Virginia's zones, and from 60 cents to $2.05 between jurisdictions.

In sum, a highly complex and atomistic fare structure and approach to time-of-day pricing has evolved in the Washington, D.C. region. The fare system is an artifact of a unique political situation whereby two different states and the Congressionally- supported District respond to individual pricing based on changing political philosophies and mandates. In WMATA's early years, Maryland and Virginia had time-of-day differential, while the District maintained a lower flat fare. Most recently, Washington has retained a fairly small differential, while both states have opted for a uniform base fare rate. It is noteworth, however, that all jurisdictions effectively have time-of-day fare differentials in that higher surcharges are collected for crossing state lines in the peak than the off-peak and zonal fares only apply during rush hours. Similarly, Metrorail has an implicit time-of-day fare by

* A composite mile is defined as the average between airline and surface mileage.

Table 19.2
Current WMATA Fare Structure (as of 8/1/83)

Type of Fare	Peak	Off-Peak
Washington, D.C. Bus Adult Cash Fare	$ .75	$ .70
Maryland and Virginia Bus Adult Cash Fare	.75	.75
Within Virginia Zonal Adult Cash Fares (range)	1.00-1.55	.75
Interstate Adult Cash Fares (range)	1.35-3.15	1.10-1.85
Elderly and Handicapped Cash Fare within Maryland and Washington, D.C.	.25	.25
Elderly and Handicapped Cash Fare in Virginia	.35	.35
Elderly and Handicapped Interstate Fare (range)	.50-.60	.50-.60
Two-week Unlimited Ride Flash Passes (range)	14.00-31.00	14.00-31.00
Distance Surcharges on Flash Passes (range)	0-1.55	0
Metrorail Cash Fare (under 3 miles)	.75	.75
Metrorail per Mile Distance Surcharge (after 3 miles)	.14	0
Bus/Rail Transfer (range)	0-2.05	0-1.25

collecting distance rates only during the peak.

There is probably a considerable amount of redundancy in WMATA's differentiation of fares by both distance and time-of-day. This redundancy is the product of different fare components and concessions which have been layered onto the base structure during political negotiations over the past decade. District representatives have generally sought low base fares for their constituents on social equity grounds while arguing that higher distance surcharges should be collected outside of

the District to maintain WMATA's fiscal viability. The District, however, has lowered the base fare for three rail stations to offset the high charges incurred by lower income, working class residents who pay both distance and peak surcharges. Virginia and Maryland representatives, on the other hand, have argued for higher base fares and reducing or even eliminating distance steps. Realizing that their residents will generally have to pay their fair share, however, Virginia has opted to institute the most refined (4 zones) fares because the state has to cover the costs of long-haul trips. Maryland has a less defined (2 zone) structure largely because of heavy state subsidization through a dedicated gas tax. In that WMATA policy is to adjust fares annually by indexing them to the inflation rate, a highly politicized and differentiated structure can probably be expected to continue into the future.

19.3 Reasons for Adopting Time-of-Day Pricing

The rationales for adopting time-of-day pricing in the Washington, D.C. area over the past decade are almost as varied as the number of renditions which have emerged over time. Overlooking the political motivations behind each fare change, perhaps the primary reason for peak/off-peak pricing throughout was a desire to structure fares so as to reflect cost differences. The competitive nature of political activities at WMATA's Board level gave rise to a "cost consciousness". Thus, time-of-day differentials, along with distance surcharges, represent the most practicable ways of capturing cost differences. The political alignments have predictably pitted suburban versus inner city interests -- with inner jurisdictions generally arguing for lower base fares and higher surcharges and outer ones arguing the exact opposite.

The initial 1975 introduction of time-of-day pricing in Washington was based principally on efficient pricing arguments. Planners argued that peak services were the most costly, with over 60% of all trips to Washington occurring during rush hours. Thus a higher peak rate targetted at Maryland and Virginia residents who bus-commute to the District was initiated. Planners also argued that since those commuting to work are less sensitive to price increases, overall system ridership would increase by 1.3 million annually as a result. Another major reason given for the time-of-day differential was to encourage shifts to the off-peak so that available capacity could be more fully utilized. Finally, some planners also noted that off-peak users should be given a break because buses generally operate under longer headways, producing inferior quality services.

Subsequent incarnations of time-of-day pricing reflected other rationales. The District's eventual capitulation to introduce time-of-day fares in 1977 was prompted by the U.S. Congress's insistence that Washington residents pay a higher share of the transit bill. Metrorail's initial introduction of time-of- day fares followed on the heals of the bus system's experiences and was essentially an interim measure until automated fare collection equipment could be installed at stations.

Interviews with WMATA Board members revealed several different reasons for the latest round (post-1980) of fare differentials. Though

reluctant to charge peak users more in the mid-seventies, Washington, D.C. is now the only jurisdiction which differentiates basic fares by time-of-day. The reason given for the District's reintroduction of higher peak fares in December, 1981 was to capture cost differences. However, the differential was set at only a nickel, almost a token amount, because of officials' fears that working class peak users would be hurt by a higher increment. Social equity objectives were also cited for a slightly lower off-peak fare. Overall, the District's policy has been to differentiate costs by the time-of-day factor since travel distances within the city are generally comparable. By comparison, distance is the most important factor for differentiating between costs in Maryland and Virginia, so zonal surcharges have been retained and time-of-day fares abandoned.

19.4 Trends and Impacts Associated with Time-of-Day Pricing

Attributing ridership and financial trends to WMATA's time- of-day fare programs is complicated by the numerous fare differentials implemented, along with a number of major service improvements (e.g., new rail openings) which took place concurrently. Table 19.3 presents summary ridership, financial, and related data for fhe 1979-82 period for all jurisdictions and modes combined. WMATA's total ridership has risen from 116 million annual users in 1974 to over 175 million in 1982. Much of the patronage gain has been on Metrorail. System ridership has actually fallen 6.6% since 1980, the result of reduced reliability, cuts in bus services (in response to rail openings), cheaper gas prices, and the economic downturn. The system's cost recovery ratio grew slightly over the 1979-82 period, with a much higher rate of return on rail than bus operations. The share of expenses recovered by passenger revenues has also remained fairly steady over this period, owing to WMATA's inflation-indexing of fares. Another statistic which stands out is the 6.6% decrease in the ratio of peak-to-base buses from 1979-82, perhaps again owing to the expansion of Metrorail services into new commuter markets. It bears repeating, however, that these trends cannot be directly associated with the various time-of-day pricing programs implemented between 1979 and 1982 due to a host of confounding influences. In that the size of the peak/off-peak differentials were generally small over this period, any direct impacts would very likely have been extremely modest.

The relative composition of Metrorail and Metrobus ridership by time period did not appear to change much over the past six years either. This is revealed in Table 19.4, whereby the percent of average weekday ridership for each mode is broken down into peak and off-peak categories. On the rail mode, the percent of off-peak ridership actually dropped by over 3% between 1977 and 1978 when non-peak distance surcharges were eliminated. The next year, off-peak usage rose again, despite the introduction of higher short distance charges for non-peak periods. Both of these trends seem counterintuitive, and perhaps cast doubt on whether fare policy had any material effects on Metrorail's ridership over this period. Metrobus's share of off-peak ridership has hovered around the one-third mark during this time, although there was a conspicuous 3.5% gain in relative off-peak usage in 1982. This is the period when the uniform base fare was slightly modified by the

Table 19.3

Selected Performance Data for WMATA, 1979-82, All Jurisdictions and All Modes Combined, Fiscal Years

Indicator	1979	1980	1981	1982	% Change 1979-82
Total Passengers (millions)	174.9	187.4	182.8	175.8	.5
Passenger Revenues ($ millions)	82.98	101.44	118.93	130.27	57.0
Average Fare ($)	.47	.54	.65	.74	57.7
Operating Revenues ($ millions)	87.46	113.21	133.01	142.54	63.0
Operating Expense ($ millions)	194.07	242.90	275.27	298.71	73.9
Revenue/Expense	.451	.466	.483	.477	5.8
Peak/Base Buses	1573/591	1573/530	1545/526	1260/507	-6.6
Employees	6450	6099	6903	7100	10.1

District's 5 cents reduction of off-peak fares. Overall, the computation of midpoint fare elasticities for 1979-82 period revealed that peak users were on the order of four times more sensitive to fare changes than their off-peak counterparts. This probably reflected the fact that significant distance surcharges targetted at rush hour commuters were introduced during this period.

The figures in Table 19.4 also suggest that the shifts in ridership from peak to off-peak periods which were hoped for never materialized. This was confirmed through interviews with WMATA staff. Particularly in terms of the initial 1975 introduction of time-of-day pricing, system planners noted, anecdotally, there was very little evidence of many shifts occurring. Lower off-peak fares were considered effective at stimulating latent demand but fairly ineffective in bringing about inter-temporal shifts. WMATA planners surmise that the wide time span defined as the peak (i.e., 6-9:30 a.m. and 3-3:30 p.m.) precluded most commuters from taking advantage of lower off-peak fares. Even with the introduction of staggerred work hour and flex-time programs for federal employees during this period, the lengthiness of the peak hour period discouraged many from exercising the flex-time perogative. WMATA staff felt that these flexible working arrangements led to a more even distribution of ridership during peak hours (e.g., less sub-peaking), though commuters were not able to benefit at the farebox.

Table 19.4

Percent of WMATA Ridership Between Peak and Off-Peak Periods, By Mode (Survey of Typical Weekday Ridership)

	1977	1978	1979	1980	1981	1982
Percent of Rail Trips in:						
Peak	68.7	72.1	68.0	66.8	67.1	N/A
Off-Peak	31.3	27.9	32.0	33.2	32.9	N/A
Percent of Bus Trips in:						
Peak	66.2	67.5	65.5	67.5	66.7	63.2
Off-Peak	33.8	32.5	34.5	32.5	33.3	36.8

N/A = Not Available

WMATA planners noted during interviews that the peak hours were expanded in 1976 because the narrower band was also not proving effective at diverting trips to the off-peak. Too much money was being lost, particularly from long-haul commuter trips which were commencing before 6:30 a.m., many involving relatively affluent suburbanites who were paying less than inner-city trip- makers. Planners also felt that diverting trips away from the shoulders of the peak would not lower the level of peak surging any and would therefore offer few cost savings.

19.5 Implementation Issues

Fare Collection

Bus drivers are responsible for collecting all WMATA time-of- day differentials. WMATA's union contract requires all drivers to own a watch and to set the correct time-of-day according to the garage clock after signing in for their assignments. Drivers' watches are considered the official time. No special markers are placed on buses to designate peak or off-peak fare periods. Drivers are to collect all appropriate differentials, but are instructed not to confront passengers over fare disputes. Rather, they are to activate silent alarms aboard all buses to notify WMATA transit police if someone refuses to pay their correct fare. However, discretion is also encouraged in these cases. For the Metrorail system, station attendants are responsible for monitoring time-of-day differentials by modifying automated fare machines diurnally.

Interviews disclosed that most Metrobus drivers generally supported WMATA's initial 1975 introduction of peak/off-peak pricing because the

fare program actually represented a simplification of previous practices. The 1975 fare program supplanted a complex zonal arrangement with a dozen distance categories in Montgomery County, Maryland and even more in Fairfax County, Virginia. The most recent 5 cents time-of-day differential in Washington, D.C. is viewed as a nuisance by most drivers, however. Even WMATA management considers Washington's nickel differential "ridiculous" and "more trouble than it's worth". Most driver complaints have been over enforcing the flashpass, which allows unlimited off-peak rides yet requires different surcharges during the peak for different jurisdictions and zones. WMATA management also indicated that the frequent fare changes over the past decade have involved a tremendous driver retraining effort, particularly with the variety of passes. Also, management speculated that the incidence of fare abuse is rampant because of the complexity of the fare system.

Marketing

WMATA launched an aggressive marketing campaign in 1975 to promote the new fare system. The campaign involved newspaper announcements, brochures aboard buses, and numerous radio and television advertisements. The Marketing Division publicized the fare program as an off-peak discount, stressing the potential benefits of riding during off-hours. An ongoing marketing effort has been in place to promote the idea of differential pricing under the theme "Fair Fares". WMATA's Marketing Division has continued to promote reduced off-peak fares, particularly on Metrorail, emphasizing the wealth of historical and cultural places which can be reached for only 75 cents.

Reactions

Reactions to WMATA's fare structure in general and time-of- day pricing specifically varies depending upon who one talks to. Most jurisdictions have supported time-of-day pricing, with few complaints being lodged against peak period surcharges per se. Most citizens complain about the complexity of the fare structure. Others note, however, that close to 90% of all people end up paying the same fare rates all of the time, primarily for work trips, so for most the complexity is not an issue. Rather, complexity seems to be more of a problem with visitors. There does seem to be a consensus among most observers that there's less support for time-of-day pricing now than in previous years. Some loath time differentials as just one more layer of complexity, while a significant number of others have never been convinced that peak services are more costly to WMATA.

Some of the most outspoken critics of WMATA's time-of-day pricing program have testified at public hearings. A review of the January, 1983 transcripts of WMATA's fare change hearings disclosed considerable discontent over certain aspects of the time-of-day differential. Some chastized the fare system for introducing unnecessary inequities:

> The systemwide flat off-peak rail fare of 75 cents is unfair. Short and long trips pay the same, thus per mile payments are the same. Why are off-peak discounts offerred only to long distance riders? Why were millions of dollars spent on a fare

collection system that is not used for the great majority of the time? Off-peak fares should be discounted at the same percent for all riders, long- haul and short-haul, bus and rail. Short-haul riders will respond to the same inducement as more affluent long-haul passengers.

Still others complained about the inordinate complexity and perceived arbitrariness of the fare system:

> The fare structure for the bus system is a mess. The vast number of different fares, flashpasses, zones, and transfer charges doesn't make sense....The 5 cents differential found on city buses is ridiculous. Does the Board really believe that it provides a sufficient inducement to travel off-peak? It is not worth the complexity it introduces.

Finally, several testified against WMATA's designation of peak hours:

> Please define the peak as rush hour -- 7:30-9:00 a.m. You are penalizing the people who try to be smart and get out early and get to their destination early.....But the word "peak". The peak of a mountain is not at the base, it's not half-way up, it's at the tip-top. So when is your peak fare? When is your peak ridership? It's not at 6 o'clock in the morning. It's not at 7 o'clock and it's not at 9:30.

19.6 Summary and Prospects

Perhaps the most complex fare structure in the nation has evolved in the Washington, D.C. area, with time-of-day pricing representing just one component. Interviews with some WMATA managers revealed that many feel the fare structure is the biggest single impediment to the expansion and the success of the Metro system. Although the vast majority of users pay the same fare regularly, it has probably prevented some from initially trying Metro and discouraged a lot of occassional, discretionary trips. One WMATA official volunteered that the unique political setting in Washington area will discourage fare reform, but "someday the fare system will become so complex that there will be no choice but to radically revise it". From interviews, most WMATA Board members felt that time-of-day pricing will continue to be an integral part of pricing in the nation's capital, though the emphasis will change from year to year. Nearly everyone was in agreement that a stable regional tax source would be the best solution to financing Metro and simplifying fares. They were also in agreement, however, that the collectivity of two states, a District, and federal government, each with different legislative mandates and priorities, would continue to thwart such a program from ever emerging.

20.1 System Description

Wichita Transit was established as a public bus system in 1966. It is a fairly small system serving a 105 square mile area. Forty-five peak and 23 off-peak buses operate along 18 routes, carrying approximately 8,500 passengers per weekday. The system has operated on a "pulse" program for some time, wherein all inbound buses are scheduled to meet at a central downtown terminus simultaneously in order to facilitate transfers.

20.2 Fare Structure

With Wichita Transit's latest fare increase in January, 1983, time-of-day pricing was introduced by raising the previous flat fare from $.50 to $.60 between 9:45 a.m. and 3:45 p.m., and to $.75 during the rest of the day. Table 20.1 presents the current fare structure.

Table 20.1

Wichita Transit Fare Structure (as of January 1983)

Fare Type	Peak	Off-Peak
Adult	$.75	$.60*
Student	.50	.50
Elderly/Handicapped	.35	.35
Transfers	.15	.15
Punch Passes		
20-ride (all day)	14.00	14.00
20-ride (midday only)	N/A	12.00
Student	10.00	10.00
Elderly/Handicapped	7.00	7.00

* Midday discount is effective between 9:45 am and 3:45 pm

20.3 Reasons for Adopting Time-of Day Pricing

Wichita transit had been criticized publically for not "paying its own way". Consequently, Board and staff formally adopted a 30% farebox recovery goal. The main reason for implementing time-of-day pricing was to increase revenues to accomplish this objective, while minimizing ridership losses during the more price elastic off-peak period. It was also hoped that a lower midday fare would improve productivity by shifting ridership from the crowded peak to the underutilized off-peak. Finally, it was perceived that those least able to pay higher fares rode during the midday, and the lower fare would lessen the impacts on these

groups.

20.4 Trends and Impacts Associated with Time-of Day Pricing

Because time-of-day pricing is relatively new to Wichita, determining the effects of the new fare structure on ridership and performance is difficult. Farebox recovery in the last two years has been climbing, actually surpassing the 30% target in late 1982 (32%) and the early months of 1983 (32-34%). However, local planners estimated that ridership will decrease 6-7% during 1983 because of higher fares.

It had been hoped that the midday discount would attract enough off-peak ridership to off-set a steady patronage decline which began at the end of 1982. Although time has not permitted a detailed investigation yet, preliminary observations suggest that midday ridership did not increase to levels sufficient to avert the downturn, which continued through the summer of 1983. However, the ridership decline did appear to level off beginning in September of that year, and staff hopes to see growth in the future.

20.5 Implementation Issues

Previously unsuccessful fare collection experiments prompted comprehensive staff analysis of fare alternatives. Time-of-day pricing was believed to be simpler and thus more easily implemented than distance-based fares. This was an important consideration, since very little road supervision and support was available to operators to assist them with more complicated fare structures. Even so, some inaccuracies in fare collection procedures have been noted, and more attention had been directed to this area.

Policymakers were supportive of the program once it had been carefully explained to them. Drivers were initially unhappy because they felt the fare increase had compromised recent contract settlements, but they have been generally indifferent. Some riders complained about the inconvenience of a two-tiered fare structure, though most have adapted more quickly than expected. Time border conflicts were avoided by adjusting the pulse system so that all buses were at one or the other end of a line at 9:45 a.m. and 3:45 p.m.; therefore, the change over from peak to off-peak was uniform for all buses leaving in-bound or out-bound.

Marketing consisted of placing rider bulletins and brochures aboard all buses. Fareboxes decals explained the fare structure. Wichita expects to receive an UMTA Section 4 grant to develop a midday marketing strategy to promote off-peak usage. An existing weekly midday punch card marketed the second month of implementation seemed to be well received, and staff are also considering a monthly off-peak pass. Presently, a peak hour punch card is also available, representing a $.05/trip discount.

20.6 Summary and Prospects

Overall, Wichita Transit's staff feels the transition to time-of-day fares has gone smoothly, supporting their contention that time-of-day pricing is a relatively simple method of fare differentiation. Staff are optimistic about the future of time-of-day pricing in Wichita, and hope to retain the differential. Support for the differential is also suggested by current efforts to integrate it into Wichita Transit's pre-paid pass program.

21. Wilmington, Delaware -- Delaware Administration for Regional Transit

21.1 System Description

The Delaware Administration for Regional Transit (DART) serves the northern half of Delaware's New Castle County, which includes the urban center of Wilmington and its suburbs. The system has been under public ownership since 1969, and DART has existed as a subsidiary corporation of the Delaware Transportation Authority (DTA) since 1979.

DART offers regular fixed route and express rush hour bus service to an area of about 400,000 persons. All but one of DART's 22 routes are radial, with convergence around Wilmington's CBD. The route covers about 200 miles and carried 7.4 million passengers in 1980.

DART is headed by an Administrator, who reports to the Director of the DTA. A five member Advisory Board of Commissioners provides public representation to both DART and the DTA. The 113 DART operators and maintenance personnel are represented by local 842 of the Amalgamated Transit Union.

21.2 Fare Structure

DART's fare structure is based both on distance and time of day. Distance-based fares, which currently involve four zones, have existed for over a decade. Time-of-day fares were initiated in 1981, when the standard fare was increased from 50 cents to 60 cents for a single zone trip, while the midday (9:00 a.m.-3:00 p.m.) and Saturday fares were left at 50 cents. Both the peak and midday fares were increased by 10 cents in 1982, and 5 cent annual increases though FY 86 are proposed. The largest time-of-day differential is for trips made over four zones, which cost $1.75 during the peak and .85 during the off-peak -- a discount of over 50%. DART'S complete fare structure is shown in Table 21.1.

Of DART's various prepayment options, only its strip tickets have been differentiated by time of day. This is done by selling both 70 cent and 60 cent single zone tickets, along with 25 cent multi-zone tickets. DART's monthly passes and 20 ride punch tickets are priced according to peak period fare rates only.

21.3 Reasons for Adopting Time-of-Day Pricing

DART introduced time-of-day pricing with three basic objectives in mind. First, it was felt that peak period services cost more to provide, and therefore higher peak charges would be more equitable. Second, there was a desire to increase midday ridership, as plenty of seats were available between peak periods. Third, the differential was expected to draw discretionary peak period riders to the off-peak, thus providing a less crowded and more comfortable ride for rush hour commuters.

Table 21.1

Current DART Fare Structure

Type of Fare	Peak Charge ($)	Off-peak[1] Charge ($)
Regular	.70	.60
Zone Charge[2]	.25	.25
Express Surcharge	.25	.25
Monthly Pass[3]	14.70-35.70	14.70-35.70
Tickets[4]	.70-1.70	.60-.85
Elderly	.25	.25
Handicapped	.25	.25

[1] Weekdays 9 a.m.-3 p.m. and all day Saturdays.

[2] In peak, for each zone crossed; in off-peak, for up to four zones.

[3] Price is based on 21 round trips during peak period and includes zonal charges.

[4] Strips of ten peak single zone, off-peak single zone, and multi-zone tickets are available at prices equal to cash fare equivalents.

The introduction of time-of-day pricing coincided with a complete overhaul of DART's route and fare structures. The overhaul was a response to spiraling operating costs and many perceived inequities of the previous system. New routes and schedules, a revised zone system, and higher surcharges for express commuter service were all introduced. It was hoped that these measures would increase the farebox recovery ratio from around 40% to 50%, and that the new fare structure would be markedly more equitable than its predecessor. Moreover, these changes were expected to establish a groundwork for the system which was efficient and equitable, and which in turn could be modified more gradually in response to changing costs and patterns of demand.

21.4 Trends and Impacts Associated with Time-of-Day Pricing

Performance data describing the last three years of DART's operation are presented in Table 21.2. These statistics reveal that DART's route, zone, and fare changes, including the institution of peak/off-peak pricing, at the beginning of FY 82 were accompanied by a substantial gain in passenger revenue and average fare, a modest gain in farebox recovery ratio, some decline in level of service (as measured by vehicle miles and vehicle hours), and a substantial decrease in ridership. Very slight decreases in operating efficiency, as measured by vehicle miles and vehicle hours per employee and per vehicle, also occurred between FY 81 and FY 82.

Table 21.2

Selected DART Performance Indicators, FY81-83

Indicator	FY 81	FY 82*	FY 83[1]	% Change FY 81-82
Passengers (000)	7,304	5,410	5,048	-25.9
Passenger Revenue ($000)	2,708	3,112	3,045	-25.9
Average Fare ($)	0.37	0.58	0.60	56.8
Operating Revenue ($000)		3,171	3,161	
Operating Expense ($000)	7,046	7,432	7,577	5.5
Revenue/Expense	.38	.43	.42	13.2
Peak/Base Buses	90/44	87/44	84/37	-3.3
Total Buses		100	100	
Employees	178	N/A	180	N/A
Vehicle Hours (000)	203	193	179	-4.9
Vehicle Miles/Employee (000's)	14,022	N/A	12,967	N/A
Vehicle Hours/Employee (000's)	1,140	N/A	994	N/A
Expense/Passenger ($)	0.96	1.37	1.50	42.7
Passengers/Mile	2.93	2.27	2.16	-22.5
Passenger Revenue/Mile ($)	1.08	1.30	1.30	20.4
Passenger Revenue/Hour ($)	13.34	16.12	17.01	20.8
Expense/Mile ($)	2.82	3.11	3.25	10.3
Expense/Hour ($)	34.71	38.51	42.33	10.9

* Time-of-day pricing implemented July, 1981

[1] Projected from 9 months data, July through March.

N/A Not Available

Both the increased passenger fares and the decline in level of service probably contributed to DART's lower ridership in FY 82. If the level of service factor is neglected, it is possible to calculate the line elasticity for system ridership with respect to average fare. The value obtained is -.47, which is higher than, but within one standard deviation of, the mean value of average fare elasticities for cities with populations less than 500,000 (Mayworm et al, 1980). The higher value may result from the above average incomes of Wilmington area residents, as income and transit ridership elasticities have been found to be positively correlated.

The FY 82 fare structure overhaul produced a fare increase greater for peak users than for off-peak users. Because peak demand is generally considered to be less elastic than off-peak demand, the above average elasticity suggested by the ridership decreases is somewhat

surprising. On the other hand, the decline in ridership which which accompanied the flat fare increase in FY 83 suggests a much greater elasticity of -1.28. Although the ridership decline during FY 83 is probably also the result of a number of factors other than the fare increase, it is consistent with the expectation that flat fare increases will impact ridership more severely than increases which are directed at the the peak period market segment.

The slight improvement in the FY 82 farebox recovery ratio over that in FY 81 is primarily the result of the greater farebox revenues collected in FY 82. The changes in efficiency indicators and operating expenses between FY 81 and FY 82 do not suggest that significant savings resulted from the fare and operational changes made at the beginning of FY 82. It does not appear that the 50 per cent farebox recovery ratio which these changes were intended to bring about will be met in the near future.

The statistical trends suggested by Table 21.2 are the result of a package of changes of which peak/off-peak pricing has been only a single element. It is therefore impossible to isolate the effect of peak/off-peak pricing on these trends. Nonetheless, the table reveals that, with the exception of decreasing ridership and increasing average fares, the entire package of changes has had only marginal effects of DART's performance. The same inference probably also applies for time-of-day pricing in and of itself.

21.5 Implementation Issues

From DART's inception, policymakers at DTA and members of the Citizen's Advisory Committee have generally supported the idea of time-of-day pricing. According to DART'S management, many of these individuals have business backgrounds and could therefore easily understand the principle of peak/off-peak pricing. Also, because the proposal for time-of-day pricing came at a time of massive system changes, it benefitted from a general spirit of innovation.

The apparent failure of time-of-day pricing to produce dramatic changes in DART's financial picture has prompted some policymakers to requestion its rationale. The added complexity which the time-of-day differential lends to the fare structure, and the resulting inconvenience which users are believed to experience, suggest to some that the true costs of time-of-day pricing exceed its benefits. On the whole, however, the policy consensus is that more time is needed before the impacts of time-of-day pricing can be fully assessed, and therefore that the differentiated fare structure should be maintained at least for the immediate future.

DART's operators and other personnel have expressed no strong reaction to the differentiated fare structure. There was some concern that it would be difficult to implement, both because of its complexity and because of the boundary problem. DART management attempted to allay these concerns by giving each driver thorough training in the new fare structure, and by using a simple procedure to deal with the fringe

periods.

Since adopting time-of-day pricing, drivers have aired few, if any, complaints about it. The problem of collecting zonal fares has been found to be more bothersome than that of enforcing proper time payments. DART management does concede, however, that some non-enforcement of the time-of-day differential probably exists.

The DART management and staff played the central role in the institution of time-of-day pricing. DART's administrator at the time, an employee of a private management firm, was the major initiator of the idea. Other members of the staff played a critical role in selling the idea to the general public. Several formal public hearings, along with other smaller gatherings, were held. DART staff sought to use these forums to educate the public about why peak period service costs more to provide and should thus have higher fares.

In addition to undertaking activities directed specifically at promoting peak/off-peak pricing, DART's management paved the way for public acceptance of the new fare program by also instituting a variety of system improvements. These improvements, which included cleaning, painting, and air-conditioning buses, as well as installing bus stop signs and shelters, contributed to the public's perception that DART was really trying to improve its service, and thus lent credibility to its fare proposals.

DART's users needed to be convinced that all of the proposed fare and service changes were justified. The four public hearings held in different parts of New Castle County to explain the proposals were therefore very well attended. While some peak period users did object to the increased peak period fares, the major area of concern was the change in fare zones, which meant substantially higher fares for many users.

Since adoption of time-of-day pricing, user reaction has been subdued. DART riders pay all cash fares when they board the bus. Riders who are traveling in more than one fare zone are also expected to pay extra zonal charges at the time of boarding. DART relies on an honor system to encourage payment of the correct fare, although drivers can effectively monitor payment in the case of regular passengers.

Monitoring of cash fare payments is facilitated by the specific zonal surcharge and differential used in DART's fare structure. Because the time-of-day differential is less than the zonal surcharge, there is no overlap in the possible fares which may be paid in the peak and off-peak periods. Drivers can therefore enforce the peak/off-peak differential without knowing the passengers' destinations.

Outside of the public meetings discussed above, DART's efforts to promote time-of-day pricing included advertisements on the television and radio and in the newspapers. These advertisements presented the time-of-day differential as a midday discount rather than a peak period surcharge. In addition, DART circulated pamphlets which explained the new fare structure and explained justifications for revamping the fares.

These promotional measures represented a one time effort, although DART maintains an ongoing advertising campaign to attract riders.

Business community involvement in the promotion of peak/off-peak pricing has been restricted to the adoption of flextime by a few large employers. DART is presently trying to expand this involvement by having employers sell monthly passes and tickets.

21.6 Summary and Prospects

DART's combined zonal and time-of-day fare structure represents a strong commitment to cost-based pricing principles. The short time since time-of-day fares have been in effect, combined with the variety of changes which were implemented simultaneously, prevents any definitive assessment of the peak surcharge. The data available suggest that DART has yet to realize significant benefits from its new pricing policy and this has led some to question whether the complexity of the fare structure is worthwhile. Thus, time-of-day pricing's future in Wilmington remains uncertain.

22. Youngstown, Ohio -- Western Reserve Transit Authority

22.1 System Description

The Western Reserve Transit Authority (WRTA) serves the urbanized area of Youngstown (1980 population: 383,000), in northeastern Ohio. The system includes 75 buses and fourteen, primarily radial, routes. In 1981, WRTA carried slightly over 3 million passengers.

WRTA took over transit operations from the Youngstown Transit Company in 1971, making it the oldest publicly held transit company in the State of Ohio. The system is currently recovering from severe financial difficulties which forced it to shut down temporarily in 1981. The several years prior to the shutdown witnessed severe management upheaval and rapid turnover of personnel, significantly limiting the availability of information about the system before the 1981 shutdown.

22.2 Fare Structure

WRTA initiated time-of-day fares in 1979, when midday fares were cut from 50 cents to 10 cents. The promotional midday fare was continued until August, 1980, when flat fares were reinstated. An off-peak discount was again introduced in 1982, and remains in effect. The current fare structure in summarized in Table 22.1.

Table 22.1

WRTA Fare Structure (Effective December, 1981)

Type of Fare	Peak ($)	Midday[1] ($)
Adult	.60	.45
Children	.25	.25
Elderly	.30	.30
Handicapped	.25	.25
Coupons, Tickets, and Tokens	.55	.55
Monthly Pass	22.00	22.00

[1] Weekdays, 9:30 a.m.-2:30 p.m., and all day Saturday.

22.3 Reasons for Adopting Time-of-Day Pricing

The midday discount was originally introduced in order to promote downtown shopping. WRTA and local merchants split the costs of the discount program initially, but merchant support ceased after the first year. The current time-of-day differential is intended both to attract

shoppers, and to provide some relief to the Youngstown area's large unemployed population.

22.4 Trends and Impacts Associated with Time-of-Day Pricing

No reliable data concerning the impacts of WRTA's time-of-day pricing program are available. WRTA management believes that operating data collected before the 1981 are inaccurate, and the current time-of-day differential has been in effect over the entire period since then.

22.5 Implementation Issues

No information concerning the original implementation of the peak period discount at WRTA is available. The fact that the program was resumed by current management suggests that the initial fare structure did not encounter any overwhelming obstacles. Accounts of why the initial program was discontinued are very sketchy, but it appears that one reason was the cessation of financial support from downtown merchants. Merchant subsidies are now in the process of being re-established, this time for a 10 cent CBD circulator service instead of the midday discount.

The current time-of-day differential is enforced by clock time. Although WRTA maintains a very active promotional campaign, the off-peak discount is not mentioned specifically because it is believed that the public is generally aware of its existence.

22.6 Summary and Prospects

WRTA intends to retain a time-of-day differential indefinitely, although its size may be reduced with the next fare increase. This suggests that the differential in perceived as a positive contributor to WRTA's operations. Beyond this, lack of information prevents an assessment of how well the program has worked. While there is no evidence of significant problems in the implementation of Youngstown's time-of-day fare program, neither is there any way of measuring the benefits which have resulted.

23. Albuquerque, New Mexico -- SUNTRAN

23.1 System Description

SunTran operates transit service throughout the Albuquerque metropolitan area. In 1983, SunTran's fleet consisted of 107 buses, with 83 operating during the peak and 77 during the off-peak. Approximately 17,500 passengers ride the system on an average weekday.

23.2 Fare Structure

In 1980, Albuquerque's city council decided to reduce the $.40 basic adult fare to $.20 between the hours of 9:00 a.m. and 3:00 p.m., Monday through Friday. However, implementation problems prompted a return to flat in July, 1981.

23.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

In 1980, Albuquerque's city council decided to reduce the $.40 basic fare to $.20 between the hours of 9:00 a.m. and 3:00 p.m. Monday through Friday. The Council felt that this fare reduction would bring about ridership increases during the midday. SunTran staff, however, was less optimistic. SunTran staff noted that thirty-five percent of total system trips were work-related, most of which were restricted to the peak hours. Another 30% was related to high-school and university trips, both of which tended to be made during peak hours with limited ability to shift to the off-peak. The remaining 35% of trips tended to be elderly and young people who generally travelled in the off-peak, but already enjoyed a half fare discount. Though unsupportive, the staff proceeded to implement the off-peak reduction on July 1, 1980 at the direction of the city council.

The major reason for discontinuing the off-peak discount was an accounting one. The fareboxes were not designed to register half-fare payments separately, and drivers could not accurately maintain ridership counts. Therefore, it was impossible to estimate how many riders were being carried during the respective periods.

23.4 Trends and Impacts Associated with the Adoption of Time-of-Day Pricing

Table 23.1 presents revenue and expense information for the year SunTran's midday discount was in effect, and the year after. The fact that farebox recovery rate remained unchanged probably reflects the staff's suspicion that most off-peak riders already were receiving discounts -- the elderly and students. However, the decrease in revenues overall suggests that system ridership dropped dramatically, although reliable ridership data was not available to substantiate this.

During the period that the midday discount was in effect, a rough allocation had been used to divide revenues between the peak and off-

Table 23.1

SunTran Revenue and Cost Data, Fiscal Years 1980-81 and 1981-82

	1980-81*	1981-82	% Change 81-82
Passenger Revenue (millions of $)	2.570	1.714	-33.3
Operating Expense (millions of $)	11.140	7.489	-33.1
Farebox Recovery Rate	.231	.229	-0.9

* Time-of-day pricing effective July, 1980 to June, 1981

peak. Ridership figures derived by this method indicated some overall increases. However, SunTran staff attributed this growth less to the fare increase and more to other exogenous factors, like the rising gasoline prices and spot shortages. Moreover, SunTran staff were suspect of the accuracy of the ridership counts themselves.

23.5 Implementation and Abandonment Issues

Since the original intent of the policy was to increase ridership in the off-peak, and it was impossible to determine with certainty that the program was having a positive effect, the SunTran staff recommended that the fare differential be abandoned. By this time, City council support for time-of-day pricing was beginning to waiver and there really were no strong advocates for retaining the differential. Users were indifferent to the off-peak fare rising again -- no one showed up for the public hearing, and no formal complaints were aired to the agency. SunTran's drivers and management never really endorsed the differential pricing idea, and the city council opted not to press the issue further. No major marketing promotions had been implemented in concert with the fare differential, reflecting the SunTran staff's general disinterest and reservations about the program.

23.6 Summary and Prospects

A general lack of interest in time-of-day pricing, coupled with staff's inability to substantiate any shifting of ridership between time periods, led to the discontinuation of time-of-day pricing in Albuquerque. Consequently, SunTran staff doubts that such fares would ever be reinstated.

24. Baltimore, Maryland -- Mass Transit Administration

24.1 System Description

The Baltimore Mass Transit Administration (MTA) is part of the Maryland State Department of Transportation. As a result, MTA has no independent sources of revenue; rather, farebox receipts and other operational income become part of general department funds, with MTA's budget being appropriated annually. Between 1969, when the state assumed operation of local transit in Baltimore, and 1975, the base fare was $.30, supplemented by zone surcharges.

24.2 Fare Structure

From 1971 to 1975, MTA's farebox recovery ratio fell from 104.2% to 68.3%. Facing this deteriorating situation, the agency set a minimum acceptable recovery rate of 50%. To obtain this, MTA decided to increase base fares and introduce a $.05 peak surcharge in 1976. The surcharge was in effect from 6:00 to 9:00 a.m. and 3:00 to 6:00 p.m. However, difficulties in maintaining this cost recovery level prompted MTA to discontinue the $.35/.40 differential in 1980 and increase fares to $.50 across the board. The fare was raised again in July, 1981 to .60.

24.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

Equity was the primary reason for adopting time-of-day pricing. In 1976, major service changes were implemented, the most critical being a reduction of the inner city base zone, shortened from a seven to a five mile radius. It was felt that poorer, predominantly minority riders of the inner city would bear the brunt of generally higher fares, since their trips would most likely include a zone fare where previously one hadn't existed. Policymakers felt that if some relief was given to these riders in the form of a lower off-peak fare, there would be less resistance to fare increases. Consequently, the base fare was set at $.35, a nickel increase, whereas the peak was raised to $.40, a dime increase.

The secondary reason for implementing a time-of-day differential was to minimize overall ridership losses while achieving the 50% farebox recovery target. MTA staff felt that off-peak users were more price-sensitive than peak ones. Therefore, a relatively lower base fare would help retain off-peak ridership with most of the needed revenues generated by peak patronage. Indeed, the most significant impact MTA staff attributed to peak/off-peak pricing was a stabilization of off-peak ridership levels. Some losses did accompany the five cent increase, but staff felt losses would have been much greater with an across-the-board ten cent fare increase.

However, the time-of-day differential failed to generate adequate

revenues. Cost recovery rates continued to plummet (albeit at a slower rate), falling from 63.9% in 1976, to 47.4% in 1980, the date when time-of-day pricing was discontinued. A fare increase that year brought all fares up to $.50. In 1981, the cost recovery ratio had climbed to 49.5% and by 1982 was 49.9%, on the threshold of the now legislatively mandated 50% level.

Besides inadequate revenue generation, implementation problems prompted the abandonment of time-of-day fares. Drivers were instructed to adhere strictly to time boundaries. This created problems when a bus was late and patrons were required to pay a peak instead of an anticipated off-peak fare. The result was driver/passenger confrontations, and increased complaints to MTA management.

24.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 24.1 presents revenue, cost, and ridership figures for a period spanning five years before the fare change, five years of implementation, and two years after the policy was discontinued. The table reveals that between 1971 and 1975, both revenues and ridership rose, but expenses outpaced both. After time-of-day pricing was implemented, revenues rose 20.5% between 1976 and 1980, an improvement over the previous five years, but still well below the increase in costs. For that period, ridership dropped slightly (-2.8%).

In response to both the discontinuance of time-of-day pricing in 1980 and the additional fare increase in 1981, revenues rose faster than costs between 1981 and 1982. Overall ridership declined more quickly since abandoning the peak surcharge and raising fares across the board. However, MTA's financial position has improved, as reflected by the increasing cost recovery rate.

24.5 Implementation Issues

The peak/off-peak program was designed by an MTA "policy group" composed of the system administrator, the resident manager, the deputy administrator, and the director of finance. There is no formal MTA policy board, the agency being part of the State Department of Transportation. Therefore, the proposed differential fare structure was included as part of the budget proposal and adopted by the Maryland State Legislature.

Drivers were not happy with the new program because they had to take the brunt of user complaints. Users were disenchanted not so much with the program's nickel and dime fare increases as with the strict adherence to time boundaries, even when buses were late.

Several operational changes were made at the same time the peak/off-peak program was initiated in 1976. Although not direct complements to the pricing program, the zone changes were major and influenced the decision to implement time-of-day pricing. A monthly pass

Table 24.1

Baltimore MTA Ridership and Revenue Trends, 1971 to 1982

Year	Operating Revenues (millions $)	Operating Expenses (millions $)	Average Fare ($)	Revenue Passengers (millions $)	Revenue/ Expenses
Prior to differential:					
1971	26.40	25.33	.27	97.18	1.042
1972	26.98	27.31	.27	99.68	.988
1973	26.74	29.52	.27	100.03	.906
1974	28.23	34.88	.27	104.18	.810
1975	28.64	41.94	.27	106.78	.683
% change 1971-1975	8.5%	65.6%	0.0%	9.9%	-65.5%
Period of differential:					
1976*	28.56	44.67	.29	97.25	.639
1977	31.28	50.22	.34	91.72	.623
1978	31.57	53.56	.34	93.93	.589
1979	32.06	61.61	.34	94.55	.520
1980[1]	34.40	72.49	.34	101.93	.475
% change 1976-1980	20.8%	62.3%	17.2%	-2.8%	-25.7%
After differential:					
1981[2]	40.79	82.38	.43	94.10	.495
1982	42.51	85.16	.54	78.05	.499
% change 1981-1982	4.2%	3.4%	25.6%	-17.1%	0.8%

Source: Mass Transit Administration, State of Maryland Dept. of Transportation

* Time-of-day pricing introduced

[1] Time-of-day pricing abandoned

[2] Base fare raised from $.50 to $.60

program was implemented as part of the peak/off-peak policy, offering a 12% discount over peak prices. This monthly pass was retained after time-of-day pricing was discontinued, and currently makes up 30% of farebox recovery. Marketing efforts were limited to traditional radio and newspaper spots.

24.6 Summary and Prospects

Overall, staff felt that peak/off-peak pricing served its purpose at the time of implementation by minimizing adverse impacts on those users least able to afford transit fare increases. However, the controlling criterion was the required 50% farebox recovery ratio, and an across-the-board fare increase better accomplished that goal with fewer administrative hassles. MTA does acknowledge, however, that it is not inconceivable that peak/off-peak pricing would be tried again under different circumstances or objectives.

25. Boston, Massachusetts -- Massachusetts Bay Transit Authority

25.1 System Description

The Massachusetts Bay Transit Authority (MBTA), which provides rapid rail, streetcar, and bus service throughout the Boston metropolitan area, experimented with time-of-day pricing between 1973-75. Its integrated rapid rail and streetcar network includes over 150 miles, nearly 700 vehicles, and 42 subway stations. In 1981, the rail/streetcar system served some 130 million unlinked passenger trips, making it the fourth most heavily used urban rail system in the country.

25.2 Fare Structure

MBTA is one of the largest urban transit systems in the U.S. to attempt time-of-day pricing to date. On April 2, 1973, the regular 25 cent fare was reduced to 10 cents during the weekday hours between 10 a.m. and 1 p.m. at most rail stations, and the 50 cent fare on the Quincy line was reduced to 25 cents. Beginning in May, 1974, the discount fare hours, called Dime Time, were extended until 2 p.m. on weekdays, and Sundays were included in the program. Dime Time was suspended indefinitely on April 1, 1975.

25.3 Reasons for Adopting and for Discontinuing Time of Day Pricing

The primary rationales for adopting time-of-day pricing were to increase ridership and to flatten peak period demand. The program was based on a theory of "marginal congestion pricing", under which riders are charged according to the increment of congestion which they add to the system at the time when they ride.

MBTA dropped Dime Time because it did not appear to be having the desired impacts on ridership. MBTA estimated that the discount resulted in some $2.2 million in lost passenger revenue per year.

25.4 Impacts and Trends Associated with Time-of-Day Pricing

In assessing the impacts of Dime Time on ridership, MBTA used both passenger counts and ridership surveys. The passenger surveys were taken one week before and in each of five weeks subsequent to implementation in the Spring of 1973. The results of the counts are summarized in Table 25.1. The data suggest that Dime Time did not increase overall ridership levels, but may have caused some intertemporal shifting of demand. Another possible interpretation of the data is that the ridership levels observed in the base week are atypically high for the period prior to Dime Time, and that the higher proportion of midday riders observed after implementation actually reflects additional demand generated by the lower fares.

Table 25.1: MBTA Subway Ridership Before and After Dime Time Implementation

Time Period	Daily Passengers	Dime Time Passengers	Dime Time as % of Total Passengers
Base	286,333	35,726	12.4
Week I	291,962	39,973	13.6
Week II	281,148	38,372	13.6
Week III	278,269	35,446	12.7
Week IV	284,190	37,153	13.0
Week V	277,108	37,819	13.6

Passenger surveys were conducted at five outlying stations during Dime Time hours in June, 1973 and June, 1974. Inbound passengers were surveyed and asked a variety of questions intended to determine how Dime Time had affected their transit riding habits. In the first survey, 11% of the respondents stated that they were using the subway more frequently as a result of Dime Time. Among this group, the reported increase in individual ridership averaged 81%, implying an overall Dime Time ridership gain of about 9%. From the second survey, 11% of respondents also reported an increase in subway usage because of Dime Time. When combined with this group's average reported ridership increase of 42%, this suggests an overall increase of about 5%. These estimates are roughly consistent with the passenger count data presented in Table 25.1. If the actual midday ridership increase associated with lowering midday fares was in the range of 5-9%, the off-peak fare elasticity would be between -0.08 and -0.15, unusually low values compared with those generally cited in the literature.

In summary, it appears that Dime Time did result in measurable, albeit small, increases in ridership during the time in which it was in effect. Its impacts on overall ridership cannot be assessed from available data, but even if none of the additional Dime Time period rides were the result of intertemporal shifts, the overall impact would still be quite marginal.

25.5 Implementation Issues

Dime Time did not elicit strong reaction from either MTA employees or from users of the system. There is some evidence that station attendants were not entirely forthcoming in advising users of the lower Dime Time fares, but there is no indication of active resistance to the program among this group. MTA patrons seemed to accept the revised fare system with little resistance.

Dime Time fares were collected at the entrance to each station and, for passengers exiting on the Quincy Line, also at the station exit. Coin operated turnstyles served as the means of collection, and were adjusted at the beginning of the Dime Time period to accept lower fares. This procedure caused some problems during the border between the morning peak and Dime Time, when patrons waited by the turnstyles for the

lower fares to go into effect.

Marketing for Dime Time included an extensive advertising campaign, including radio, television, newspapers, and billboards, as well as signs in the MBTA stations. Results of the passenger survey indicate that, at the beginning of the program, over 80% of passengers riding during Dime Time demonstrated their familiarity with the program by paying the lower fare, and that the proportion had reached 98% one year later. The decision to suspend Dime Time also necessitated a campaign to inform the public, an archive of which is shown in Exhibit 7.2, Chapter Seven.

25.6 Summary and Prospects

MBTA staff believe that Dime Time was unsuccessful because of the limited hours during which the lower fares were in effect and the lack of an accompanying staggered work hours program. There is some interest in developing a time-of-day pricing program which avoids these obstacles, perhaps involving a directional time-of-day fares (for example, higher fares for morning inbound riders). The Massachusetts Legislature, however, has mandated that simplicity be a major objective of MBTA fare policy. It thus appears that, at least for the immediate future, MBTA will not have the opportunity to put into practice the lessons learned from Dime Time.

26. Duluth, Minnesota -- Duluth Transit Authority

26.1 System Description

Duluth, Minnesota, population 93,000, lies on the western edge of Lake Superior. Since 1970, the area has received transit service from the Duluth Transit Authority, which took over from the financially troubled Duluth-Superior Transit Company. DTA is a public authority of the City of Duluth. By contractual agreement, it also provides service to the neighboring city of Superior, Wisconsin.

DTA has a fleet of about 100 buses, which provide fixed route and commuter service along a 200 mile route system. In 1981, the system was used for about 5.2 million unlinked passenger trips, which covered some 16.8 million passenger miles.

26.2 Fare Structure

The recent history of DTA's fare structure is shown in Table 26.1. The system's experience with time-of-day pricing began in August, 1980, when it began offering two monthly passes. One of the passes, referred to as the Discount Pass, was offered at a price $3.00 less than the regular pass, with the single restriction that it could not be used during the morning peak half-hour of 7:30-8:00. From the inception of the program until July, 1981, the pass was available only through employers which had less than 70% of their employees begin work between 7:45 and 8:00, and who agreed to participate. From August, 1981 until the Discount Pass was discontinued one year later, the pass was also sold directly to the general public.

Throughout this period, cash and token fares continued to be undifferentiated by time-of-day. These fares were increased in January, 1981, while the monthly pass price was left unchanged. In August, 1981, token fares and pass prices were increased, and one year later the Discount Pass was discontinued.

26.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

DTA experimented with peak/off-peak pricing as part of a UMTA service and management demonstration project. The purpose of the project was to eliminate sharp peaks in travel demand though a coordinated program which encouraged flexible work hours while making available a fare prepayment plan which included discount off-peak passes. The elimination of sharp peaking in travel demand was expected to result in operating cost savings and improved seat availability. DTA eliminated the Discount Pass at the end of the UMTA project period because it did not appear to be accomplishing its objectives.

Table 26.1

DTA Fare Structure from 8/80 to 8/82

Time Period	Form of Payment	Peak* Fare	Off-Peak Fare
8/80-12/80	cash fare (per trip)	.40	.40
	token fare (per trip)	.35	.35
	pass (per month)	14.00	11.00
1/81-7/81	cash fare (per trip)	.50	.50
	token fare (per trip)	.40	.40
	pass (per month)	14.00	11.00
8/81-8/82	cash fare (per trip)	.50	.50
	token fare (per trip)	.50	.50
	pass (per month)	17.00	20.00
8/82-present	cash fare (per trip)	.50	.50
	token fare (per trip)	.50	.50
	pass (per month)	20.00	20.00

* Peak defined as 7:30-8:00 a.m.

26.4 Trends and Impacts Associated with Time-of-Day Pricing

The effects of time-of-day pricing in Duluth are obscured by the fare increases and by a sharp decline in Duluth's economy over the period in which the pricing scheme was in effect. These trends resulted in a 25 per cent decrease in DTA ridership between the 12 months ending in May, 1980, and the 12 months ending May, 1982. As a result of these aggregate changes, attempts to isolate the effects of the demonstration project innovations on ridership must focus on the results of ridership surveys and on changes in the temporal patterns of travel demand. Even when these are considered, however, there is little indication of significant ridership impact. Ridership surveys indicate that during the morning peak two-hour period, no more than 1% of the trips were generated by the pass program. The morning peak half-hour shares of total ridership and of peak two hour ridership also showed no significant change as the result of the program.

Transit operations of DTA were not significantly changed as a result of either the program or the decline in overall ridership which accompanied it. The two-hour peak schedules remained the same although peak period ridership declined by roughly 20 per cent. Of course, this did result in a decrease in peak period vehicle occupancy over the course of the project. Although the revenue/expense ratio declined from .54 to .49 between FY81 and FY82, this reflects increasing operating costs and declines in ridership as opposed to time-of-day pricing.

26.5 Implementation Issues

Duluth's demonstration project attempted to integrate three elements: flexible work hours, fare pre-payment, and time-of-day pricing. The multi-faceted nature of the project, combined with the fact that time-of-day pricing took the form of an off-peak half hour discount for pass buyers only, substantially conditioned the implementation issues faced by DTA.

In DTA's early attempts to sell the project to employers in the Duluth community, the main controversy surrounding the discount pass was when to introduce it. Originally, only the full price pass was to be available in the first phase of the program. The employers felt, however, that unless they were allowed to sell the discount pass, there would be no incentive for them to adopt flexible work hours. A decision was therefore made to alter the plan so that both types of passes would be available from the start.

Even with this incentive, virtually no employers felt that the benefits of flexible work hours justified the costs of introducing them. Even the Duluth city government, which had been counted on as a major backer of the program, decided against doing so. In fact, the only employer which did adopt flex-time was the firm which was acting as the data collection subcontractor for the project. This led to another modification in the original protocol: instead of requiring an employer to actually develop a flex time program in order to be eligible to sell passes, the revised program insisted only that the employer have less than 70% of its workforce arrive at work between 7:45 and 8:00 a.m. With this minimal restriction, the program was able to gain the participation of about 135, or 10% of the employers in the Duluth area.

Reaction of riders to the program consisted mainly of buying passes. Monthly sales peaked in March, 1982, when 404 All-Day and 792 Discount Passes were sold. Some users also supported the program by encouraging their employers to participate, or by taking responsibility for selling the passes at their firms.

The ability of bus drivers to enforce the program was hampered by misunderstandings concerning the restrictions on the discount pass and inability to distinguish the two types of passes. Attempts were made to make the passes as distinctive as possible, and project staff provided the drivers with free coffee at the beginning of each month to remind them that a new pass was in effect. These measures did not, however, completely solve the enforcement difficulties.

Marketing efforts for the project included a newsletter directed at DTA riders, press releases, an advertising campaign featuring busboards, and, probably most importantly, word-of-mouth publicity generated by those riders familiar with the new program.

26.6 Summary and Prospects

The Duluth project did not succeed in reducing the sharp peaks in travel demand as it was designed to do. Incentives to ride at times other than the peak half-hour were restricted to pass holders, who never constituted a very significant portion of the overall ridership. Also, the flex-time programs, which were expected to serve a vital function in encouraging off-peak ridership, did not materialize. Given the ineffectiveness of the Discount Pass program in accomplishing it objectives, it is not surprising that the DTA decided to abandon time-of-day pricing.

27. Kansas City Missouri -- Kansas City Area Transit Authority

27.1 System Description

The Kansas City Area Transportation Authority (KCATA) serves a population of 1.1 million persons. The current bus fleet of 343 vehicles operates over approximately 600 route miles.

27.2 Fare Structure

Resolutions by the transit policy board and city council demonstrated support for a peak surcharge program, which was adopted January, 1982. KCATA's adult base fare was raised from $.50 to $.60 between the hours of 6:00 to 9:00 a.m. and 3:00 to 9:00 p.m. weekdays. Several major implementation problems, however, later contributed to the eventual discontinuation of the policy in January, 1983.

27.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

The primary impetus for the differentiation of fares was equity. During much of the seventies, KCATA maintained low flat fares. A 1981 planning study recommended annual fare increases in anticipation of future federal aid cutbacks. System staff, aware of the inequities associated with flat fares, began looking for ways to cushion the impacts of higher fares on disadvantaged groups. Time-of-day pricing seemed a viable option. It was also felt that differential pricing would be more palatable to the public, based largely on the belief that peak riders were less price-sensitive than off-peak riders.

27.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 27.1 presents data for calender year 1981, one year prior to the adoption of time-of-day fares and 1982, the year the program was effective. Revenues did increase, as would be expected with the implementation of the peak surcharge, and expenses decreased as well. Consequently, farebox recovery rose 9%.

Ridership data were not available for 1982, precluding before and after comparisons. However, staff noted a general decline in overall patronage, without any evidence of a shift from the peak to the off-peak. Overall, KCATA officials believed the $.10 differential was too small to effectuate major changes in the riding behavior of regular commuters.

27.5 Implementation Issues

A major complication with the peak surcharge was the simultaneous introduction of distance-based pricing along with the time-of-day program. Staff discovered numerous over-payments in the off-peak, suggesting that neither drivers or patrons understood the change. Operators in

Table 27.1

KCATA Performance Data, Calender Years 1981-82

	1981	1982*	% Change 1981-82
Total Passenger (millions)	25.379	N/A	N/A
Passenger Revenue (millions)	6.463	6.992	8.2
Average Fare	.25	N/A	N/A
Operating Expense (millions of $)	27.886	27.690	-0.7
Farebox Recovery Rate	.231	.252	9.0

* Time-of-day pricing in effect from January through December, 1982.

particular were opposed to the system, on the grounds it complicated their job. Driver complaints culminated in a filed grievance by the union to the board, although the issue never became a contractual dispute between the union and management. Some users seemed confused by the peak surcharge, although regular commuters had fewer problems determining proper fare.

To minimize problems at the time-border, trips were identified as peak or off-peak for the entire length of the run, peak trips being shaded on time-tables. Several monthly passes were designed to accommodate various zone denominations, although no special passes were designated for use in the peak or off-peak periods.

27.6 Summary and Prospects

According to KCATA's management, time-of-day pricing was dropped in response to union pressures and public confusion. Staff feels perhaps they "tried to do too much" by implementing time-of-day and distance-based pricing simultaneously. The peak differential was discontinued by increasing the off-peak base fare up to the $.60 level in January 1983. The $.10 per zone pricing was retained. Kansas City Transit staff doubts that time-of-day pricing will be introduced again. However, if they were to do it over, efforts would concentrate on marketing the program more effectively, both internally to gain workforce support, and externally to educate the public and ease program administration.

28. Palm Springs, California -- Sunline Transit

28.1 System Description

Sunline Transit provides local bus services to the desert community of Palm Springs, California. Several surrounding jurisdictions are served by inter-jurisdictional routes as well. The Transit Board consists of locally elected officials appointed by the city councils of Palm Springs and adjacent communities. Because of its setting, Palm Springs has a large retirement age population and enjoys seasonal influxes of tourists, many of whom use the transit system.

28.2 Fare Structure

Time-of-day pricing was established in October 1981 when the local fares were reduced from $.60 to $.25 between the hours of 10:00 a.m. and 2:00 p.m., for both weekdays and weekends. Intercity route fares of $.75 were also dropped to $.25 during the midday. An off-peak pass was also designed to incorporate the midday discount. However, subsequent revenue losses led the Board to discontinue time-of-day pricing in September 1982.

28.3 Reason for Adopting and Discontinuing Time-of-Day Pricing

The major reason for implementing the differential was to see if new riders could be attracted to the off-peak, under the belief that off-peak users were more price-sensitive than peak ones. Sunline officials also hoped to encourage better utilization of off-peak capacity. Sunline discontinued time-of-day pricing in September, 1982 as a result of subsequent revenue losses.

28.4 Trends and Impacts Associated with Time-of-Day Pricing

No data on ridership and fiscal trends were available for the Sunline system. However, staff did indicate that no significant increases in midday ridership occurred as a result of the off-peak fare reduction. This was most likely due to the fact that senior citizens, a major proportion of midday patrons, already enjoyed a 50% discount fare. Revenue, on the other hand, did drop noticably, prompting the return to flat fares.

28.5 Implementation Issues

The initiator and major supporter of the differentiated fare program was the Sunline staff. The Board had adopted time-of-day pricing as part of a large fare restructuring program undertaken in October, 1981. Drivers showed little reaction to the discount program. Users seemed indifferent as well, although some complaints were lodged when the plan was discontinued.

Sunline implemented the midday discount program without restructuring services, operating practices, or collection procedures. Different

fare rates were collected according to scheduled arrival times. Regardless of the time a bus actually arrived at a stop, passengers would pay whatever rate was indicated in the schedule. Thus, if a bus arriving at 2:01 should have arrived earlier, a discounted $.25 fare would still be collected.

Given the small size of the Sunline system, a rather extensive marketing program was undertaken, including newspaper, radio, and television advertizing. An off-peak pass was also designed to incorporate the midday discount. The inability to attract greater numbers of off-peak riders suggests that these efforts had little real pay-off.

28.6 Summary and Prospects

In general, Sunline staff concluded that time-of-day pricing was not viable for their particular jurisdiction. In that the Palm Springs community has a large retirement population, a significant number of the potential off-peak riders they attempted to attract to the midday already enjoyed a substantial discount under UMTA's Section 16(6) 2 provisions. Moreover, the area's generally hot noon weather during much of the year might also have limited the ability of any discount arrangement to encourage midday usage. Overall, the lowering of midday fares was not a sufficient incentive to attract enough new patrons to off-set revenue losses.

29. Rochester, New York -- Regional Transit Service

29.1 System Description

Regional Transit Service (RTS) is an operational division of the Rochester-Genesee Regional Transportation Authority whose member counties include Monroe, Wayne, Genesee, and Livingston as well as the City of Rochester. The Authority began public operations after purchasing the private Rochester Transit Corporation in 1970.

The present system has a fleet of 254 vehicles and carries approximately 24 million passengers a year. Service concentrates in the City of Rochester, with extensions to surrounding Monroe County suburbs. A network of Park and Ride express commuter routes links jurisdictions in the other three counties to the Rochester core.

29.2 Fare Structure

Time-of-day pricing was implemented in 1975 when the then existing $.40 local fare was reduced to $.25 between 10:00 a.m. and 2:30 p.m. The fare differential was retained in the system's next fare increase, when the base fare was raised to $.50 and the off-peak to $.30. Subsequent implementation problems led RTS to discontinue time-of-day pricing in April, 1982, when all fares were raised to $.70.

29.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

In 1975, RTS was faced with increasing demands for rush hour services, and consequently, major capital investments to accommodate them. RTS's staff was looking for ways to avoid such an investment, and proposed an off-peak differential as a viable alternative. By lowering the midday fare it was anticipated that riders would shift to the cheaper midday period and better utilize excess capacity.

In succeeding years, the original objective of increased efficiency became overshadowed by a larger need to generate more revenues. Rising costs had necessitated increases in fares, as well as local and state support. The New York Department of Transportation had become critical of the special fare discounts of RTS, including the fare differential and the downtown "free fare zone". The public had also expressed disenchantment with the free-fare zone, perceiving that the major beneficiaries were not regular transit riders, but commuting professionals who took advantage of the free service during the lunch hour. The Authority Commissioners responded to these charges by calling for a flattening of fares and elimination of the downtown free zone. RTS was in favor of the latter recommendation, although they preferred to retain the off-peak differential, fearing a "reverse" shift in demand to the peak under flat fares. However, the Commissioners voted for a major fare revision consisting of an across-the-board fare increase to $.75 which became effective April 1, 1982.

29.4 Trends and Impacts Associated with Time-of-Day Pricing

RTA's objective of increased efficiency was initially realized as staff observed a dramatic increase in off-peak ridership matched by a significant drop in peak patronage. This redistribution of ridership to the midday relieved some of the pressure for increasing peak period services; in fact, RTS was able to eliminate ten peak hour trips, and reduce peak vehicles from 204 buses to 190 buses. The fare differential was retained in the system's next fare increase, when the base fare was raised to $.50 and the off-peak to $.30 in June, 1976.

The most significant effect of the fare program was an induced shift to the off-peak. This was most evident in the stabilization of revenue after implementation of the lower midday fare -- the loss of peak period revenue was balanced by the large revenue gains due to increased off-peak ridership. However, staff were unable to determine how much of this patronage increase was attributable to shifts of former peak users, and how much due to new riders.

Table 29.1 presents select ridership and revenue performance data for the year RTS implemented the midday discount, and for the year after. Note the ridership did increase somewhat, however overall revenues declined, perhaps reflecting major shifts to the cheaper midday. In spite of decreasing revenues (-2.7%), RTS's farebox recovery dropped only slightly (-1.6%)

Table 29.1

Rochester's Regional Transit Service Select Performance Data, Fiscal Years 1975-76 to 1976-77

	1975-76*	1976-77	% Change 1976-77
Total Passengers (millions)	20.255	20.330	0.4
Passenger Revenue (millions of $)	5.854	5.697	-2.7
Average Fare	.29	.28	-3.4
Operating Expense (millions of $)	11.467	11.345	-1.0
Farebox Recovery Rate	.510	.502	-1.16

* Time-of-day pricing implemented June, 1975.

Following the discontinuation of the program, staff did not witness a reverse demand shift. There had been concern that such a shift would result in a need for expanded service in the rush hours. This was not necessary, and in fact RTS has reduced service as stabilized fuel prices, in addition to other factors, brought about an overall reduction in ridership.

29.5 Implementation Issues

RTS did not introduce any operational changes to facilitate time-of-day pricing, although bus deployment changed as a result of the ridership shifts. Fare collection procedures also remained the same. To address the time-border problem, the fare differential was effective for the entire length of the run -- any in-bound trip leaving points of departure to the downtown after 9:30 a.m. was discounted, as was any out-bound trip leaving the downtown prior to 2:30 p.m.

Marketing the program was limited to newspaper advertisements. RTS had a pass program, but it was not adjusted to the off-peak differential, under the assumption most pass users were rush hour commuters.

29.6 Summary and Prospects

The staff's general impression of the time-of-day program was favorable. It had accomplished its original objective of shifting peak demand and averting a major capital investment. It was not discontinued because of an internal lack of support; rather due to a need to respond to public and political pressures to simplify fare structures and reduce subsidies to noon-time downtown professionals. Staff feels there is a definite possibility it would be reconsidering time-of-day fares under different circumstances.

30. San Francisco, California -- Bay Area Rapid Transit District (BART)

30.1 System Description

The Bay Area Rapid Transit District (BART) provides rail rapid transit service in the central San Francisco Bay region. BART has 71 miles of track and 34 stations, opened in stages between 1972 and 1976.

30.2 Fare Structure

Fares are collected by automatic fare gates which read the value stored on magnetically-encoded tickets, compute the station-to-station fare upon exit, deduct the fare from the stored value, and print the remaining value on the ticket. BART's fare structure is based principally on a minimum fare good for trips up to 6 miles and a mileage charge, which declines with distance in four steps:

Trips up to 6 miles	60 cents
Trips from 6 to 14 miles	$0.71 + 5.5 cents/mile
Trips from 14 to 20 miles	$1.15 + 2.4 cents/mile
Trips over 20 miles	$1.29 + 2.1 cents/mile

Other fare structure components include a speed component (which adjusts for differences in speed of travel between pairs of stations), a transbay surcharge (for trips which cross San Francisco Bay), and a surcharge on trips to and from the one station (Daly City) which lies outside BART's taxing district. BART's current fares, adopted in September, 1982, range from 60 cents to $2.15.

BART experimented with a midday discount during the month of February, 1982 when fares were reduced 20% on all twenty weekdays between 10 a.m. and 3 p.m. At the time of the experiment, BART's normal fares ranged from 50 cents to $1.75.

30.3 Reason for Adopting Time-of-Day Pricing

The intent of the experiment was to promote off-peak riding. Substantial midday capacity existed so that no increase in operating costs would result from higher of-peak patronage.

30.4 Trends and Impacts Associated with Time-of-Day Pricing

A full report evaluating the experiment was to be prepared by the end of 1983, but it has yet to be released. Preliminary information indicated that about 3,000 to 4,000 additional weekday trips were added due to the discounted fare. Initial staff analysis indicated that the discount did not attract enough new patrons to offset the revenue loss, so the experiment was terminated.

Summary information on BART's average weekday patronage between January, 1981 and August, 1982 is presented in Table 30.1 The table suggests that BART's total patronage rose to February, 1982 from the previous year relative to other month pairs, but that the one-year growth rate for the non-experiment months of December, 1981 and January, 1982 was even higher. The table also reveals that BART recorded a noticeably higher midday ridership count during February 1982, though generally no more than 5 percent above other months.

30.5 Implementation Issues

Implementing the differential posed few problems since automated fare collection is used. Ticket readers were timed to permit 20 percent lower fares during midday hours. Changes in fare rates were made precisely according to the clock. Incidences of patrons queuing outside the fare gates until lower fare rates became effective occurred, but posed few problems. The level of marketing associated with the program was modest, consisting principally of brochures available at stations promoting midday travel.

30.6 Summary and Prospects

BART staff believes that the short trial period and the low level of marketing associated with the discount moderated impacts. In adopting its last fare increase (September, 1982), the BART Board asked staff to report back on the prospects for an extended trial program of off-peak fare reductions. The staff recommended to the Board in October 1983 that no further work be done until future deliberations on general fare structure modifications. The principal argument was that instituting off-peak discounts without offsetting increases in peak fares would result in a revenue loss of $1.7 million. Future prospects for reinstituting the program are uncertain.

Table 30.1

Summary BART Patronage and Fare Data

Month:	Average Weekday Patronage	% Increase From Month in Previous Year	Average Weekday Midday Patronage	Average Weekday Fare
Jan. '81	156,706	10.34	N/A	1.036
Feb.[1]	165,568	10.77	N/A	1.034
Mar.	166,803	7.63	57,703	1.037
Apr.	173,696	8.09	N/A	1.040
May	173,592	7.51	N/A	1.039
June	173,792	5.61	64,656	1.045
July[2]	173,420	10.85	65,472	1.049
Aug.	175,968	11.37	67,816	1.055
Sep.	177,524	14.95	62,167	1.047
Oct.	181,574	15.12	61,983	1.042
Nov.	180,277	15.10	64,875	1.046
Dec.	181,930	20.92	66,404	1.047
Jan. '82	186,094	18.75	N/A	1.050
Feb.*	191,883	15.90	70,141	1.009
Mar.	187,943	12.67	65,359	1.047
Apr.	192,443	10.08	69,446	1.046
May	190,920	9.98	68,154	1.043
June	189,275	8.91	67,429	1.048
July	190,545	9.87	67,816	1.054
Aug.	191,159	8.63	69,779	1.060

[1] BART staff believe that Federal decontrol of gasoline prices at the end of January, 1981 contributed to a sharp increase in patronage.

[2] A BART fare increase effective June 30, 1980 depressed patronage for several months. The year-to-year comparisons for the second half of 1981 are therefore probably overstated.

* Time-of-day experiment

N/A Not Available

31. St. Louis, Missouri - Bi-State Development Agency

31.1 System Description

The Bi-State Development Agency (BSDA) was formed in 1949 through a congressionally approved compact between Missouri and Illinois, to plan, develop, and operate regional multi-modal transportation services. In 1963, Bi-State bought out 15 private carriers and established a single regional transit system.

The BSDA service area is approximately 3600 square miles, encompassing the Missouri counties of St. Louis, St. Charles, and Jefferson, and the Illinois counties of St. Clair, Madison and Monroe. Services focus on St. Louis, with extensions to outlying suburbs. Most of the 131 routes operate along radial corridors, although several major cross-town runs also exist. During 1982, Bi-State transit operated 888 buses over 24 million vehicle miles.

31.2 Fare Structure

Prior to public takeover, the basic fare in St. Louis was $.45. Under Bi-State ownership, the fare was lowered to $.25 in 1973. With the aid of federal operating subsidies, basic fares remained at a quarter for seven years. Increasing costs, however, prompted an increase in base fares to $.50 in July 1980, accompanied by service reductions and the furlough of some employees.

Time-of-day pricing was implemented in October, 1981 when a $.10 surcharge was levied on weekdays between 6:00-9:00 a.m. and 3:00-6:00 p.m. (see Table 31.1). Express fares were also raised, from $.75 to $.80, during those hours. The differential was discontinued in April, 1982, when Bi-State raised all fares to a flat $.75. This was the shortest time that time-of-day pricing was retained among all the properties which had implemented one.

31.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

BSDA's major reason for implementing peak/off-peak pricing was to raise additional revenues. Escalating costs and the impending losses of federal operating subsidies necessitated a higher farebox recovery rate than the 18% experienced during fiscal year 1980. The doubling of basic fares to $.50 in 1980 was met with strong public protests at formal fare hearings. Bi-State officials needed to increase fares again in 1981, though by this time they were sensitive to the political repercussions of increasing base-level fares too quickly. The $.10 peak-only surcharge seemed a reasonable alternative, and once adopted, generated very few complaints.

Unfortunately, peak/off-peak pricing failed to generate substantial new revenues either. Both peak and off-peak ridership declined steadly

Table 31.1

BSDA Time-of-Day Fare Structure,
(Effective October, 1981 - April, 1982)

	Peak	Off-Peak
Adult		
Local	$.60	$.50
Commuter	.80	N/A
Children		
Local	.25	.25
Commuter	.50	.50
Elderly/Handicapped		
Local	.25	.25
Commuter	.25	.25
Passes		
Weekly Adult	$8.00	
Student	$3.00[1]	

[1] Valid 6:00 a.m. - 6:00 p.m. weekdays only

N/A Not Applicable

after the program was initiated.

hours; however, there was very little evidence of this. Bi-State's new management company recommended that a farebox recovery ratio of 33% be attained by raising the $.75 basic fare across-the-board. In April, 1982, this was implemented, and time period surcharges were discontinued.

31.4 Trends and Impacts Associated with Time-of-Day Pricing

Table 31.2 presents monthly ridership broken down by peak and off-peak periods for May, 1981 (five months prior to the inception of the program), November, 1981 (one month after implementation), and April, 1982 (one month after discontinuation). The results suggest that time-of-day pricing had little impact on riding patterns, insofar as there were no observable changes in the distribution of riders among time periods.

Table 31.3 presents annual ridership, passenger revenue, and operating cost data for fiscal years 1980-81 and 1981-82. The period of the fare differential, from October, 1981 to April, 1982 falls in the

Table 31.2

BSDA Peak/Off-Peak Ridership Distributions

	Total Ridership	Peak Ridership	Peak as % of Total	Off-Peak Ridership	Off-Peak as % of Total
Weekday-5/81 *	229,733	130,116	56.7	99,617	43.3
Weekday-11/81 *	223,309	125,600	56.2	97,709	43.8
Weekday-4/82	196,661	111,873	56.9	84,788	43.1

* One month after time-of-day pricing introduced

Table 31.3

BSDA Selected Performance Data; Fiscal Years 1980-81 to 1981-81

	1980-81	1981-82*	% Change 81-82
Total Passengers (millions)	72.997	68.315	-6.4
Passenger Revenue (millions of $)	21.552	21.757	1.0
Average Fare	.29	.31	6.9
Operating Expense (millions of $)	91.072	88.308	-3.0
Farebox Recovery Rate	.237	.246	3.8

* Time-of-day pricing effective from October, 1981 to April, 1982.

middle of the latter fiscal year. Thus, it is difficult to say much about the probable revenue impacts time-of-day pricing had, since the effects of raising fares back up to a flat $.75 are also captured in the annual figures. The improvement in BSDA's financial position as reflected by the increase in farebox recovery rate, is likely the result of a return to uniform pricing rather than the peak surcharge.

31.5 Implementation Issues

Bi-State did not experience any major implementation problems during the six months of differential pricing. The July, 1980 flat fare increase had sparked a great public outcry, but staff indicated "extenuating circumstances" had taken much of the political heat off the fare differential. Nevertheless, it failed to generate a sufficient amount of much needed revenue, and the program was abandoned rather quickly.

31.6 Summary and Prospects

BSDA was facing a severe financial crisis when time-of-day pricing was adopted. Although the increased revenue generated via the peak hour surcharge was a step in the right direction, it fell short of BSDA's farebox recovery rate objective. Management, however, has not abandoned the concept of time-of-day pricing entirely. Under conditions of greater financial stability, differentiated fares may again hold a place in BSDA pricing policy.

32. Walnut Creek, California -- Central Contra Costa Transit Authority

32.1 System Description

Walnut Creek is a suburban community of 55,000 about 20 miles east of San Francisco. The city initiated transit services in 1974 by running a shuttle service around the central business district. By 1979, Walnut Creek was operating ten minibuses on seven routes that reached into outlying areas. In 1980, a new agency, the Central Contra Costa Transit Authority (CCCTA), was formed to take over the services in Walnut Creek and in five other neighboring suburban jurisdictions in Contra Costa County. The takeover of services by CCCTA was completed in 1982, with a major route restructuring and a uniform fare structure.

Prior to the formation of CCCTA, Walnut Creek's service was carrying 2,800 riders on an average weekday, with the primary focus of routes on the Walnut Creek BART station near downtown. BART (Bay Area Rapid Transit District) provides rapid transit service between CCCTA service area and the more heavily urbanized areas of San Francisco and the East Bay (Oakland, Berkeley and nearby communities).

32.2 Fare Structure

Shortly after it began service, Walnut Creek adopted a two-tiered fare structure: 25 cents basic adult fare, 50 cents peak hour commuter fare. The peak was defined as 6 to 9 a.m. and 4:30 to 8 p.m.

32.3 Reasons for Adopting and Discontinuing Time-of-Day Pricing

There were several reasons given for introducing the time-of-day differential. First, there was the desire to generate as much fare revenue as necessary to avoid the need for subsidy from the city's general fund. The higher peak fares, along with a dedicated surcharge on the city's business license tax, achieved that goal. Second, there was a desire to keep the midday fare low to attract new riders. Third, there was a general perception that peak period users were both imposing higher costs on the system and gaining greater value from the service than were off-peak users. Fourth, with limited parking at the BART station, the BART commuters were something of a captive market. Finally, there was agreement that the BART commuters were an affluent group, well able to pay the additional fare.

The program was also designed to partly offset fare revenue lost by a transfer agreement with BART. Walnut Creek had adopted the same bus-BART transfer agreement that was used originally between BART and AC Transit, the major bus operator in the urbanized East Bay. Under that system, patrons pay their normal fares to ride local buses to BART stations, but receive a free transfer from machines in BART stations upon exiting. The transfers were then accepted as full local bus fares for trips away from BART stations. As expected, more patrons were taking advantage of the free ride from BART than were riding the city bus to

BART. For instance, on the downtown shuttle loop, the BART station accounted for 58 percent of boarding, but only 30% of alightings. Evidently, commuters were being dropped off at the station in the mornings and taking the free bus home in the evening.

When CCCTA took over services in July 1982, a uniform fare structure of 60 cents was adopted for all services, with no time-of-day differentials. Free bus transfers from BART were retained. CCCTA abandoned the fare differential to simplify the system. The availability of a broader base of financial support under CCCTA enabled this change in pricing policy.

32.4 Trends and Impacts Associated With Time-of-Day Pricing

No data exists to retrace the impacts of Walnut Creek's peak surcharge. The fact that the fare structure was retained for seven years until new management took over suggest that the ridership and financial effects of the program on the whole were perceived to be favorable.

32.5 Implementation Issues

No critical implementation issues were apparent from discussions with Walnut Creek City officials who recall the program.

32.6 Summary and Prospects

Walnut Creek's 100% time-of-day fare differential was fairly pioneering for a system of its size. Regarding prospects, CCCTA staff indicate that time-of-day differentials may be reconsidered in the future, but that board sentiment is still for keeping the fare structure as simple as possible.

Appendix II

Time-of-Day Transit Pricing Theory

Many pricing principles from the public utilities field offer a theoretical framework for differentiating transit fares by time-of-day. Arguments for pricing transit services along the lines of public utilities are usually grounded in the belief that the transit industry enjoys inherent increasing returns to scale. Evidence to support this, however, remains inconclusive. Using national data from 1960-69, Wells et al. (1972) suggested tendencies toward scale economies by noting that cost per mile declined with increases in the total number of vehicle miles for ten of eleven transit systems studied. Lee and Steedman (1970) revealed similar decreasing unit cost characteristics among larger British transit systems during the same approximate time period. Wabe and Coles (1975), however, have challenged these studies based on 1973 findings that most British bus systems exhibit proportionally higher costs as fleet size increases. Since larger bus systems tend to operate under conditions of greater surface street congestion and stronger union pressures on driver wages, incidences of diseconomies of scale are perhaps becoming more commonplace within the transit industry. Several more recent studies seem to confirm this (Fravel, 1978; Berechman, 1982).

To the extent that scale economies exist in the transit industry, the two primary functions of pricing are in direct conflict with one another. One major function, revenue generation, calls for prices which produce returns sufficient to recoup the costs of providing services. Another important function of pricing, however, is efficient resources allocation. Efficiency criteria require that prices be set at marginal (or in the case of transit, incremental) costs to reflect the value of real opportunities foregone in producing services. Since the incremental cost of expanding services falls below average cost under conditions of scale economies, adherence to the marginal cost pricing rule implies deficit-spending. Given the existence of scale economies, then, the transit industry faces the perverse task of achieving two conflicting objectives: cost recovery and efficiency.

Public utility theorists have long argued for price differentiation as a means of combatting this dilemma in the pricing of electricity and quasi-public services (Boiteux, 1949; Steiner, 1957; Williamson, 1966). Their arguments are straightforward: in order to maximize social welfare, peak users should pay the variable costs of their service plus the full cost of capacity, while off-peak customers should be levied a charge only for their corresponding marginal costs. The roots of this principle perhaps extend back to Hotelling's (1938, p. 260) historic example of why a non-congested bridge should be free of charge:

> The efficient way to operate a bridge is to make it free to the public, so long as the use of it does not increase the state of overcrowding. A free bridge costs no more to construct than a toll bridge, and costs less to operate; but

society, which must pay the cost some way or other, gets far more benefit from the bridge if it is free, since it will be used more. Charging a toll only causes some people to waste time and money in going around by a longer way and prevents others from crossing.

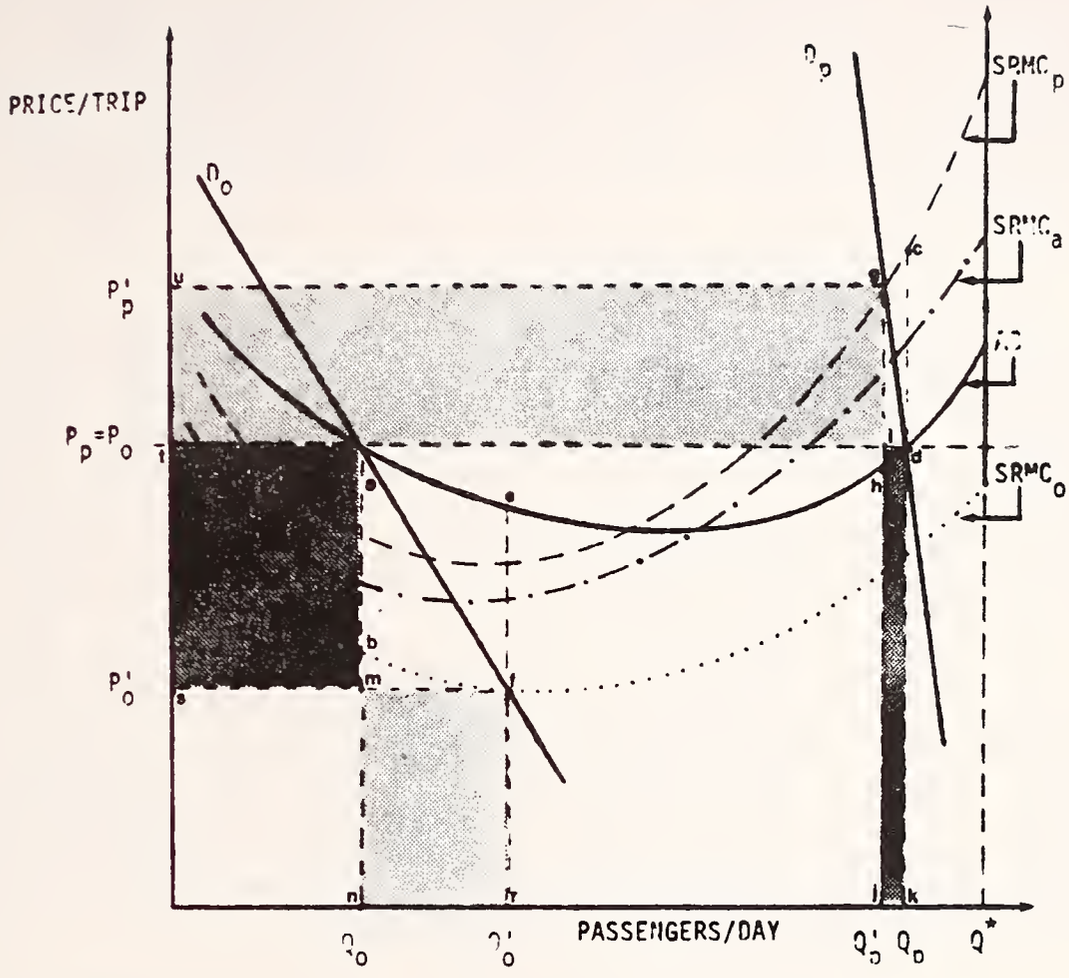
It can be argued that Hotelling's maxim is equally applicable to public transit: the extra fixed cost of accommodating bus patrons during the off-peak is virtually zero; system capacity would still be there whether or not off-peak users placed demands on it. The inference to be drawn from the arguments of Hotelling and others is that the marginal cost of the tax dollar which society pays to subsidize the capital component of off-peak transit services is less than the marginal cost to society of non-peak customers either transferring to the auto mode or foregoing their trip.

The efficiency and revenue implications of differential pricing under conditions of scale economies are best demonstrated through graphic analysis. Figure II.1 compares flat and differential fare systems. Off-peak use is identified by the downward-sloping demand curve D_o while peak use is reflected by the curve D_p. To simplify things, a linear demand relationship is assumed. The off-peak demand is considerably more elastic than peak demand, indicating a greater sensitivity to price changes.

The three marginal cost curves ($SRMC_a$, $SRMC_p$, $SRMC_o$) and the average cost curve (AC) are drawn to reflect the simplified expense situations most managers face. $SRMC_a$ represents the combined peak and off-peak short run marginal cost averaged for a 24 hour period. At low levels of demand, $SRMC_a$ lies below AC, reflecting increasing returns to scale. However, at certain threshold demand levels where system capacity is being approached, $SRMC_a$ begins to exceed AC, indicating diminishing returns.

The true marginal costs imposed by peak and non-peak users are expressed in $SRMC_p$ and $SRMC_o$ respectively. The $SRMC_p$ curve lies above the averaged daily marginal cost curve ($SRMC_a$) while the $SRMC_o$ falls below both. $SRMC_p$ exceeds $SRMC_o$ due primarily to the higher ratio of payhours to vehicle hours in the peak as well as the assignment of annual capital depreciation (and debt service) expenses soley to peak use. Therefore, at high levels of demand, each additional passenger imposes relatively high incremental costs involving inflated wages (due to increased driver spreadtime and overtime duties), increased capacity expenses for extra vehicles, and greater passenger discomfort. In a short run context, system capacity is assumed constrained by a maximum ridership level of Q*. Thus, all cost curves rise infinitely at Q*.

Under the uniform transit pricing approach, the average cost function is employed to set fare levels and to determine the number of passengers/day for each period. An equal flat fare of (P_p=P_o) would be levied among peak and off-peak customers alike, resulting in ridership levels of Q_p and Q_o respectively. Since off-peak patrons pay a higher fare than their marginal costs ($SRMC_o$) while peak users' marginal costs ($SRMC_p$) exceed their fares, uniform pricing inevitably results in



where:

D	=	Passenger Demand
$SRMC$	=	Short Run Marginal Cost
AC	=	Average Cost
P	=	Price/Trip Under Flat Fare System
P'	=	Price/Trip Under Differential Fare System
Q	=	Passengers/Day Under Flat Fare System
Q'	=	Passengers/Day Under Differential Fare System
Q^*	=	System Capacity
o	=	Off-Peak Period Subscript
p	=	Peak Period Subscript
a	=	Daily Average SRMC Subscript

Figure II.1. Comparison of Flat and Differential Fare Systems

considerable resource misallocation and fare cross-subsidization. Misallocation occurs since off-peak riders' fares incorporate shares of capital costs and expensive increments of operating wages. Conversely, peak users draw upon excessive capacity resources which could have provided greater economic satisfaction if used elsewhere. The actual level of cross-subsidization is measured in Figure II.1 by (ab) and (cd); the intramarginal surplus (ab) is used to offset the intramarginal deficit of (cd). Effectively, off-peak passengers transfer fare payments to peak users under uniform pricing.

To mitigate the regressivity of uniform pricing, some advocate lowering fares unilaterally. As can be inferred from Figure II.1, reducing average fares for the benefit of off-peak users actually increases the subsidy levels of peak users, undercharging higher income persons who are often willing to pay more for rush hour commuter services. Consequently, any reduction in flat fares would result in peak users extracting a relatively larger portion of the consumer surplus gains, placing an even greater cost burden on off-peak riders.

A system of differential transit pricing is also presented in Figure II.1 as an alternative to uniform pricing. Under this approach, fares are set at the peak and off-peak according to their respective SRMC functions. Thus, peak users would pay a fare of P_p while off-peak patrons would enjoy a relatively low fare of P_o. The corresponding ridership levels would be Q_p and Q_o. With this arrangement, off-peak users would be producing a deficit (ef) which would be offset by the intramarginal surplus (gh) extracted from peak users.

Peak load transit pricing could generally be expected to yield the following: (1) gains in consumer surplus for off-peak users (tafs) due to the additional ridership captured from latent demand ($Q_o - Q_o$); (2) a loss in consumer surplus for peak users (ugdt) due to a small drop in ridership ($Q_p - Q_p$) and a sizable increase in price ($P_p - P_p$); and (3) secondary benefits (such as reduced highway congestion and fuel savings) enjoyed by society as a whole. The additional revenue which could accrue from differential fares is measured by the producer's surplus: [(ugit) - (idkj)] during peak periods (representing a surplus) and [(mfrn) - (tams)] during off-peak periods (representing a revenue shortfall). From the transit operator's viewpoint, there would be a net increase in welfare since the aggregate revenue gains [(ugit) + (mfrn)] (lighter shaded area) exceed the total losses [(idkj) + (tams)] (darker shaded area). That is, $\{[(ugit) + (mfrn)] - [(idkj) + (tams)]\} > 0$. Since the shaded areas of Figure II.1 actually represent transfers between consumers and producers, the net social welfare gains produced by differential fare systems are measured by the "transactive surplus" -- the difference between the triangular areas (afm) and (gdi). In that (afm) > (gdi), it can be inferred that differential pricing would lead to a net increase in social welfare. Expressed another way, differential price structures improve overall efficiency since the marginal gains in off-peak users' consumer surplus exceed the marginal losses in peak users' consumer surplus.

It's apparent that benefits would accrue under differential pricing largely because peak users tend to be less price sensitive than their

off-peak counterparts. Given the existence of cost functions similar to those is the figure, then, time-of-day pricing could be expected to improve overall efficiency, reduce the incidence of cross-subsidization, and generate higher farebox returns. Other benefits might include net increases in ridership (particularly among off-peak patrons who couldn't justify travelling under uniform pricing), as well as the diversion of some trips to the "shoulders of the peak" and to periods of excess capacity.

Appendix III

National Transit Fare Policy Survey

A self-completion questionnaire eliciting attitudinal responses on time-of-day pricing was mailed to 265 transit professionals from 69 U.S. transit agencies during the summer of 1983. 176 usable surveys were returned (66.4%), representing all 69 agencies. The 69 agencies included all of those which have implemented time-of-day pricing. In addition, all agencies with more than 250 revenue vehicles in active use were included. Such large agencies are only half of the total of systems with experience with time-of-day fares, however, they dominate transit in the U.S. Fully three-quartes of all U.S. revenue vehicles and vehicle-miles are provided by such large systems and over 85% of all passenger transit trips are made on them. Respondents from the smaller systems were selected based on attendance records from federally-sponsored transit fare workshops. The small-system sample cannot, therefore, be considered statistically representative. The sample distribution by size class is shown below:

Table III.1

Survey Sample

System Size	Number of Systems Which: Currently Have Time-of-Day Fares	Discontinued Time-of-Day Fares	Never Had Time-of-Day Fares	Sample Total	U.S. Total
1000+ Vehicles	3	3	10	16	16
500-999	2		9	11	11
250-499	4	3	10	17	17
100-249	4	1	5	10	42
Under 100	9	1	5	15	232
Total	22	8	39	69	318

The survey was sent to a broad cross-section of individuals in the agencies to ensure that a range of opinions was obtained, especially from the largest agencies where several departments might be involved with fare policy discussions. The distribution of respondents by agency size and time-of-day/non-time-of-day experience was as follows:

* Urban Mass Transportation Administration "Pricing Teleconference," attendance lists from the Seattle, San Francisco, Kansas City, Dallas, Chicago and Philadelphiaa workshops provided by the conference coordinator, Public Technology, Inc., Washington, D.C.

Table III.2

Survey Respondents

System Size	Time-of-Day Experience	No Time-of-Day Experience	Total
1000+ vehicles	16	53	69
500-999	6	23	29
250-499	12	29	41
100-249	8	9	17
Under 100	12	8	20
Total	54	122	176

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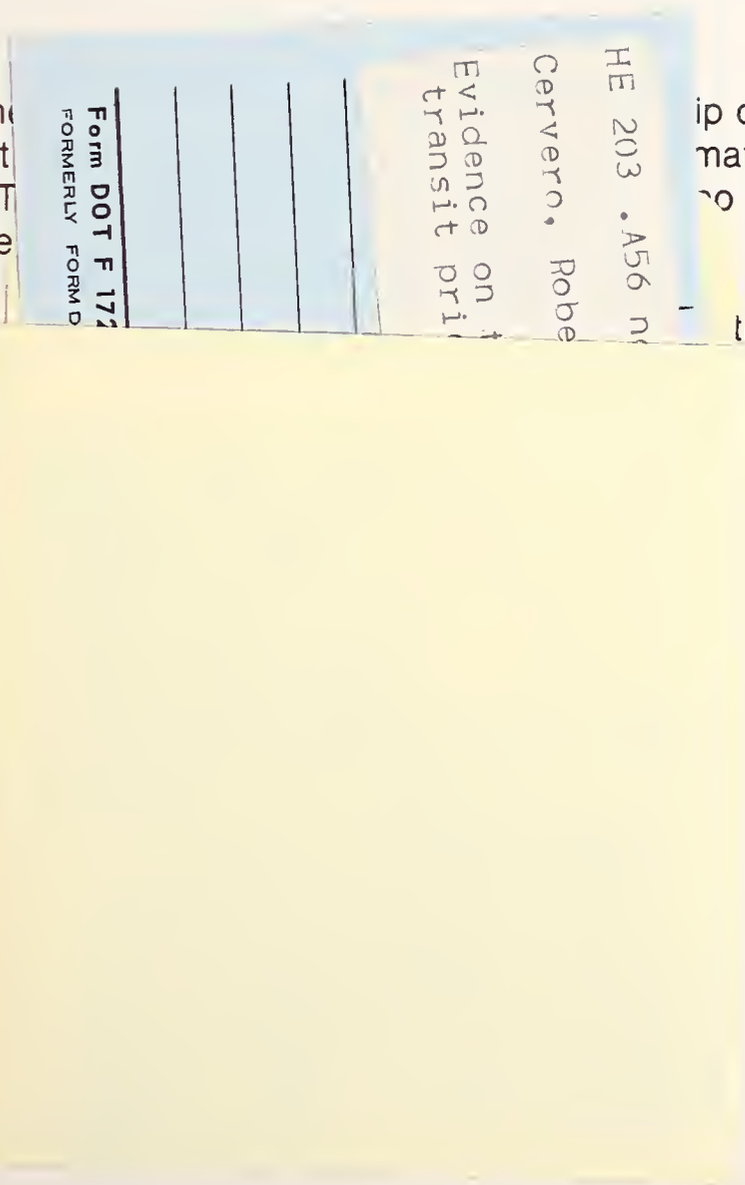

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TECHNOLOGY SHARING

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