

# First-Year Impact of Reduced Transit Fares on Southern California Rapid Transit District

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## ABSTRACT

In 1980 voters in Los Angeles County passed a referendum designed to support public transit development through a dedicated sales tax. One feature of this referendum, the reduced-fare program, substantially lowered the bus fares at the Southern California Rapid Transit District (SCRTD) and provided a subsidy to maintain adequate service levels. The lower fares precipitated a surge in patronage on SCRTD lines. This growth in system boardings made it necessary to accelerate monitoring of the bus lines and to increase service levels in many cases. The attempts made by SCRTD to deal with the patronage growth and the impacts on patronage, service levels, and operating productivity are described.

Voter approval of the Transit Development Program referendum in 1980 ushered in a new era for public transportation in Los Angeles County. Through this referendum, the voters mandated the development of a regional rail rapid transit system. The referendum, known as Proposition A, is one of the largest dedicated taxes for public transportation ever voted by a county electorate in the United States. An opportunity has thus been presented to accomplish major transportation improvements in Los Angeles County.

The Los Angeles County Transportation Commission (LACTC) placed Proposition A on the ballot at the November 4, 1980, general election. The measure was approved by 54.2 percent of the county voters. After a legal challenge, the measure was validated by the California Supreme Court on April 30, 1982. The new Transit Development Program started on July 1, 1982.

Proposition A provided funding for three specific programs: lower bus fares (reduced-fare program), local transit improvements, and construction of a rail rapid transit system. Proposition A increased the sales tax in Los Angeles County by 0.5 percent and raised almost \$300 million in the first year. This revenue was combined with state and federal funds, fares, and other revenues to provide a comprehensive public transit program in Los Angeles County.

Every incorporated city in Los Angeles County will receive a direct allocation of sales tax revenues for local transit improvements. Each year, 25 percent of the sales tax revenue will be set aside in a special fund and then divided among the 82 cities and the county unincorporated areas, according to the population of each jurisdiction. Each city (or the county in the case of unincorporated areas) will decide how to provide better local public transportation services for their community. They may spend the funds themselves or contract with other service providers, such as the Southern California Rapid Transit District (SCRTD). This 25

percent allocation of the sales tax funds to cities is permanent.

For the first 3 years--July 1, 1982, through June 30, 1985--the first claim on the balance of the funds is for fare reductions. The district's base fare was reduced from 85 to 50 cents with concurrent reductions in the balance of the district's fare structure. Funds are provided for the additional service necessary to relieve overcrowding from increased ridership induced by the lower fare. Funds will also be allocated to the municipal bus operators as necessary, to keep their base fare at the 50-cent level. During the first 3 years, funds not required for the fare-reduction program are available for rapid transit development programs.

The fare-reduction program of Proposition A ends in July 1985. At that time funds will be reallocated as follows: 25 percent for the cities, a minimum of 35 percent for transit guideway development (Metro Rail and light rail projects), and the balance of 40 percent for discretionary public transit improvements as defined by LACTC. These programs could include fare-relief subsidy, maintenance of bus service, or acceleration of rail rapid transit construction.

One feature of the Transit Development Program is the focus of this paper: the first-year impact of the Proposition A reduced-fare program on SCRTD. The reduced-fare program caused significant changes in ridership and service levels. Initially, ridership surged, then continued at a slower growth rate throughout the first year. Growth in ridership affected the service levels required to maintain adequate capacity. In the first half of the paper the attempt made by SCRTD to deal effectively with the surge in ridership is described. The actual impacts of the reduced-fare program on patronage, service level, pass sales, and operating productivity are documented in the second half of the paper.

## PREPARING FOR IMPLEMENTATION OF THE REDUCED-FARE PROGRAM

### Actions by the Board of Directors

Subsequent to the April 30 validation of Proposition A by the California State Supreme Court, the policy bodies of SCRTD and LACTC approved a master agreement, also called the Memorandum of Understanding (MOU). Intended to prevent system productivity from worsening, the MOU outlined actions and constraints under which the district was to implement the Proposition A reduced-fare program. The MOU, revised in February 1983, will remain in effect through the end of the mandated reduced-fare program, June 30, 1985. Key features of the MOU include the following:

1. The district will lower its fare structure to designated levels on July 1, 1983,
2. The district will provide enhanced service on existing lines to accommodate the increased ridership demand resulting from the lowered fare structure,
3. The district will redeploy its services

wherever possible so that capacity is shifted to meet additional demand,

4. The district will maintain its productivity as measured by designated standards and not allow conditions to become worse on lines where excessive crowding exists,

5. The district will prepare brief statistical reports at regular intervals covering specified performance indicators, and

6. LACTC will reimburse the district for these actions up to a set dollar limit per month for up to a set limit of vehicle service hours per year.

The SCRTD Board of Directors affirmed the master agreement by approving the revision of the district's fare structure. As required, the base fare was lowered from 85 to 50 cents, a 41 percent decrease. There were corresponding reductions in all fare categories. Student and college or vocational school fares experienced the greatest reductions: cash fares were reduced more than 70 percent and their respective pass prices were reduced more than 80 percent. In Table 1 the bus fares before and after Proposition A are presented.

TABLE 1 Bus Fares Before and After Proposition A

Type of Fare	Price (\$)	
	Before July 1	After July 1
Cash		
Regular	0.85	0.50
Senior citizens and handicapped	0.40	0.20
Students (under 19)	0.65	0.20
College and vocational	0.85	0.20
Pass		
Regular	34.00	20.00
Senior citizen and handicapped	7.50	4.00
Student (under 19)	22.00	4.00
College and vocational	26.00	4.00

To prepare for the expected patronage increases due to reduced fares, the Board of Directors authorized the general manager to proceed with necessary personnel hiring, bus preparation, and additional data collection.

#### Actions by District Staff

The district developed internal guidelines for making service additions (1). In order to stay within the previously mentioned constraints of the master agreement and comply with its spirit and objectives, exceeding of the standards in any of the following five respects was deemed sufficient justification to recommend additional service:

1. A 140 percent loading standard exceeded on four consecutive trips each day,

2. Pass-ups caused by crowding reported at the same location or along the same route segment for at least three consecutive days (or on weekends) (pass-ups cannot be eliminated by schedule adjustment),

3. An average maximum load (AML) for the 3-hr peak period of more than 55 passengers (the maximum load is the highest load occurring on a single trip and is generally a little higher than the load measured at the peak point),

4. A 100 percent loading standard exceeded for local services during the off-peak period and on Saturdays and Sundays (three consecutive trips must exceed the standard each day), and

5. A 100 percent loading standard exceeded on express lines for three consecutive trips each day.

Although these guidelines did not state what level of crowding was acceptable, they were intended to identify and alleviate the most overcrowded services.

The district's preparatory activities were coordinated by the Interdepartmental Proposition A Implementation Task Force, which had representation from each of the affected departments. The district obtained additional bus operators, as customary, by converting part-time drivers to full-time status and by hiring additional part-timers. By performing a costly overhaul and upgrading of the retired fleet, the district obtained the necessary additional equipment. All SCRTD departments made expeditious preparations for the implementation of the fare-reduction program based on an expected surge in ridership.

#### MONITORING OVERCROWDED CONDITIONS

The district's major concern regarding the reduced-fare program was that the initial patronage increase might be very large and might more than fill available capacity on many lines. Some excess capacity existed before July 1 due to steady patronage declines during FY 1982. However, it was believed that capacity would quickly be exhausted on many lines. Accurately predicting the size and location of the expected patronage overloads was not possible, especially because the fare decrease was so significant. The primary goal of the district in responding to this uncertainty was to make plans that would allow overloading problems to be quickly identified and corrected, thus avoiding prolonged hardship to patrons.

Initially, the most severe crowding problems were expected to occur during the peak periods when capacity was least. Bus line patronage is not generally tracked at the peak period independently. Therefore, to track peak patronage growth and assess remaining capacity, a system was developed to follow 72 bus lines. These 72 lines included 80 percent of the service and represented a spectrum of service types. To track peak-period patronage on these lines, peak-period data from before the reduced-fare program were gathered, creating a base line. A method was established to estimate total peak-period ridership on a line from the number of passengers on board at the peak stop. Past experience has shown that the ratio of total passengers to passengers on board at the peak stop is not affected by a change in ridership level. This ratio is especially stable when the time period under consideration has a consistent pattern of ridership, such as the a.m. or p.m. peak period. The base-line data for each of the 72 lines determined the ratio. SCRTD then collected subsequent patronage data at a line's peak stop and estimated the total ridership for the period using the ratio. This estimation method allowed a savings in manpower and made it possible to monitor the 72 lines more frequently after the July 1 fare reduction.

Patronage data on individual lines can vary as much as 10 percent on a typical day, but summing the peak-period patronage for the 72 lines gave a more reliable estimate of the growth in peak-period ridership. In addition, the individual line estimates were used to determine possible overloading problems as defined in the internal guidelines discussed previously. Where overloading was indicated, the line would be rechecked to assess the regularity of the occurrence.

By early planning, SCRTD hoped to identify and address the worst overcrowding problems promptly.

TABLE 2 Average Daily Boardings Since July 1, 1982

Date	Weekday			Saturday			Sunday		
	Avg Daily Last Boardings (000s)	Percent Change		Avg Last Boardings (000s)	Percent Change		Avg Last Boardings (000s)	Percent Change	
		Last Month	Daily per Year		Daily per Month	Last Year		Month	Year
1982									
July	1,116	3.5	-4.7	673	1.8	-3.7	475	9.3	-2.0
August	1,220	9.3	4.8	736	9.5	8.9	576	21.2	21.1
September	1,256	3.0	3.8	718	-2.6	5.5	538	-6.6	18.5
October	1,374	9.4	12.5	700	-2.5	1.8	544	1.2	22.5
November	1,360	-1.1	13.2	706	0.9	6.1	498	-8.5	13.7
December	1,351	-0.7	17.8	724	2.6	9.3	503	1.0	12.0
1983									
January	1,391	3.0	23.8	667	-8.0	9.0	493	-2.1	16.0
February	1,402	0.8	24.9	702	5.3	0.2	495	0.5	7.0
March	1,422	1.5	25.5	739	5.3	1.4	521	5.3	22.3
April	1,442	1.4	30.2	756	2.3	16.9	525	0.8	23.7
May	1,471	2.0	33.4	773	2.2	19.9	536	2.1	27.7
June	1,476	0.3	36.9	755	-2.3	14.2	587	9.5	35

Because of the size and diversity of the SCRTD bus system, not all capacity problems could be anticipated. For these, SCRTD relied on complaints. Complaints came from several sources, including the public, bus operators, dispatchers, and road supervisors. All complaints were evaluated, usually by point check, and then service was augmented if necessary. In September when school resumed and student patronage surged, the use of complaints to detect crowding was necessary.

#### FIRST-YEAR IMPACTS OF THE REDUCED-FARE PROGRAM

##### Patronage Growth

In the initial 2 months of the fare-reduction program there was a 12 percent surge in average weekday patronage. However, few demand capacity problems were experienced. Spare capacity existed in the system as a result of steady patronage losses over the previous two fiscal years, so initial increases could be absorbed.

Checks of ridership in the initial weeks suggested that the majority of the patronage increase was taking place during the midday period and on weekends; the smallest increase was in activity oriented to the central business district (CBD) during the peak periods. This explained how a 0.7 percent increase in service level was able to accommodate a 12 percent growth in patronage during the first 2 months of the program.

Table 2 shows average daily boardings for the calendar months from July 1982, the start of the reduced-fare program, through June 1983. As can be seen, the weekday boardings have steadily increased each month except for the November and December seasonal patronage loss, which nevertheless represented a ridership level more than 13 percent higher than that of the 1981 holiday season. Saturday and Sunday ridership levels, though more erratic month to month, have also experienced an overall gain since July. Weekend patronage levels have been consistently higher than those of the previous year, displaying larger increases on Sundays than on Saturdays.

Figure 1 gives the quarterly growth in patronage on weekdays, Saturdays, and Sundays for FY 1983. During this period, two pronounced increases in patronage occurred. One happened in July with the advent of reduced fares and one in September concurrent with the opening of the schools. The latter is a seasonal shift that was significantly inflated by

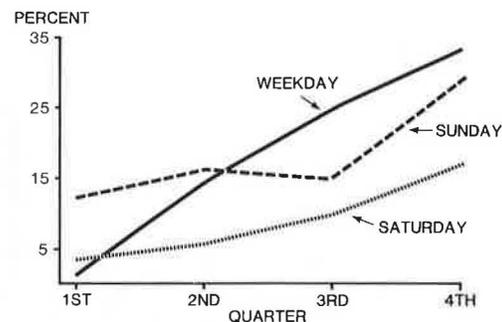


FIGURE 1 Change in daily patronage, FY 1983.

the lower student fare. As is evident, patronage continued steady growth through FY 1983. Original predictions, drawn from past experiences with fare reductions, had stated that system patronage would probably level off during the second quarter (October to December 1982). This pattern of continuing growth was unexpected.

##### Service Hours and Equipment

As the patronage increase strained the capacity of many lines, service was augmented. In Table 3 the annualized system revenue vehicle hours in effect for six representative months from April 1982 to April 1983 are reported. The drop in service hours that occurs between April and June 1982 reflects the

TABLE 3 Change in Revenue Vehicle Hours

Date	Annualized Revenue Hours <sup>a</sup>	Percent Change
1982		
April	6,650,353	—
June	6,599,144	-0.77
September	6,673,098	+1.12
December	6,767,312	+1.41
1983		
January	6,860,569	+1.38
February	6,874,360	+0.20
April	6,928,705	+0.79

<sup>a</sup> For months coinciding with significant changes in the bus system.

seasonal service decrease caused by the recessing of school. Revenue vehicle service hours increased again in September and continued steady growth thereafter. The district made a concerted effort during this period to abide by the master agreement when service was augmented. As a result, although patronage increased more than 27 percent by February 1983, revenue service hours had increased only 2.7

percent. However, as FY 1983 approached its end, the annualized revenue service hours being operated by the district had surpassed, by an estimated 60,000 to 80,000 hr, the 6,883,000-hr cap agreed on in the MOU.

Another aspect of increasing service is the additional bus requirements. Figures 2, 3, and 4 show the number of additional buses added per month

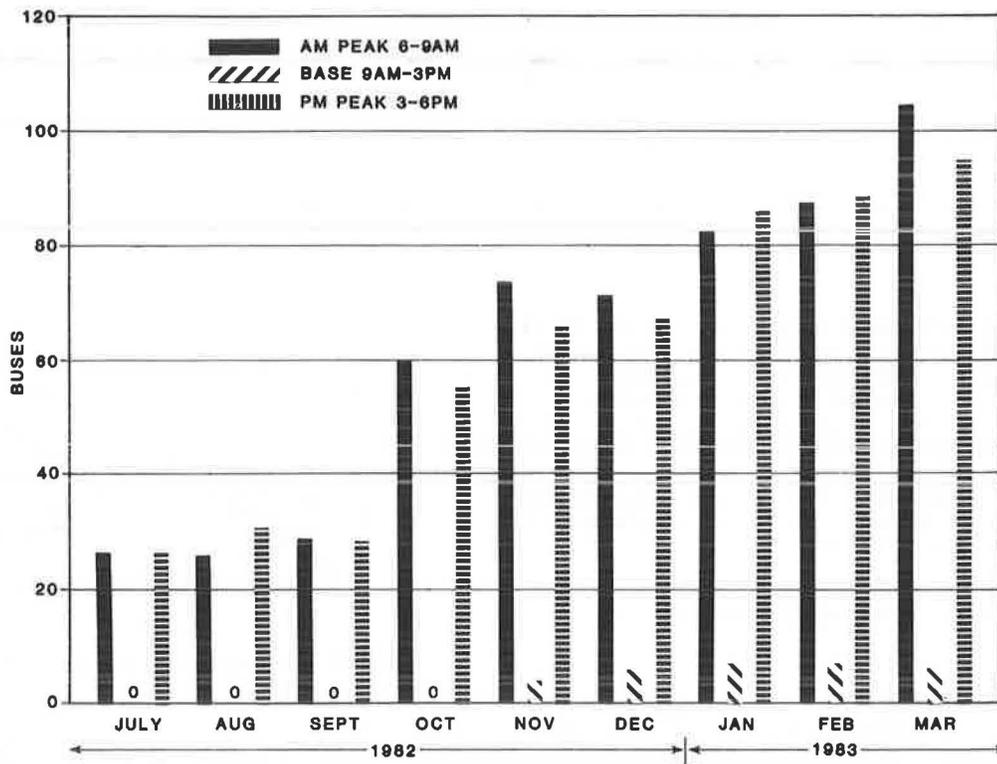


FIGURE 2 Cumulative monthly bus additions for weekdays.

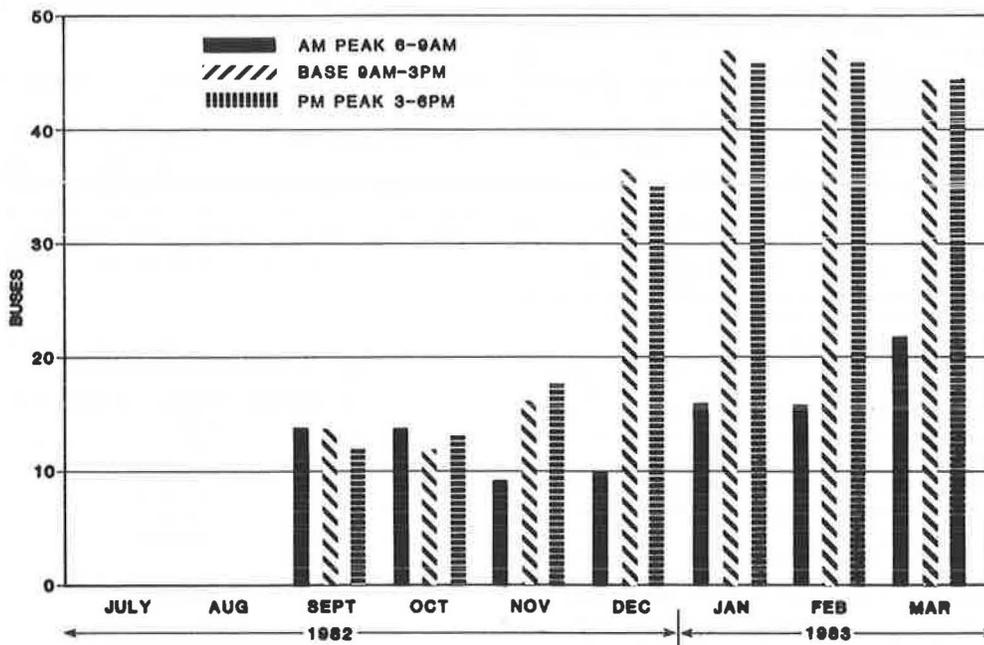


FIGURE 3 Cumulative monthly bus additions for Saturdays.

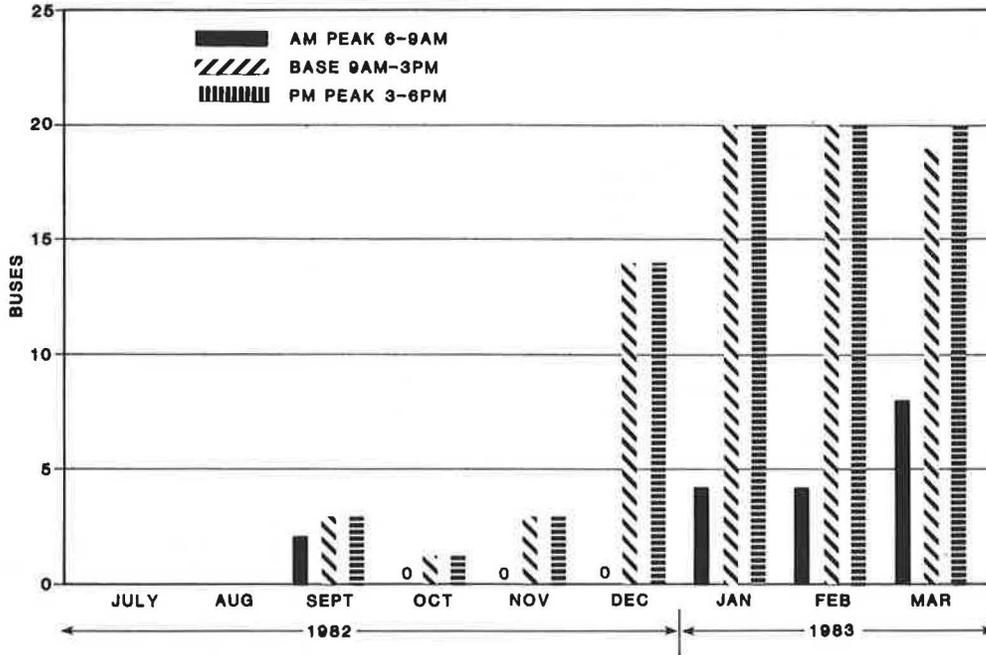


FIGURE 4 Cumulative monthly bus additions for Sundays.

from July 1982 to March 1983. As can be seen in Figure 2, weekday bus additions hovered around 30 buses from July through September and then rose sharply to around 60 buses in October. Weekday equipment requirements increased in the a.m. and p.m. peak periods, whereas weekends required additional equipment during the midday and p.m. peak periods. Since October, bus patronage has continued a less dramatic but steady rise, and bus additions have grown consistent with this demand.

Pass Sales

Pass sales have escalated in volume as expected; however, the various categories of bus passes ex-

hibited dissimilar patterns of growth. Figure 5 shows growth in sales by type of pass purchased. Although pass sales for all types are higher since the bus fares were reduced, the student and college and vocational pass categories demonstrated the most dramatic rise; student pass sales escalated to surpass those of senior citizen and regular passes. The disproportionate growth in student pass sales is attributable to the 80 percent reduction in the student pass price on July 1 versus a 41 percent reduction in the regular pass price. For this reason, some Los Angeles County school systems are considering cutting costs by reducing or terminating their school bus contracts with private carriers and purchasing student passes from SCR TD (1). Even with

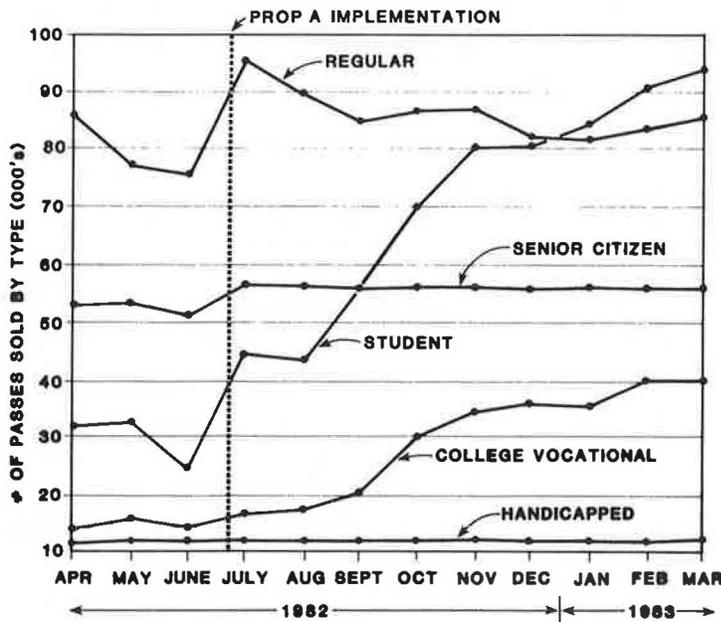


FIGURE 5 Pass sales by type per month.

staggered school hours and efficient scheduling, providing school bus service exerts a heavy load on the district, because students travel in patterns requiring extra bus assignments and excessive non-revenue miles.

When average pass use per day by type of pass is examined, another result of the reduced fares can readily be seen. In Table 4 bus pass sales are compared with the average pass use per day by type of pass for the months of February 1982 and February 1983. It is interesting to note that actual sales of regular passes rose 2 percent and their average use increased 5 percent from February 1982 to February 1983, whereas the percentage of average daily boardings by regular pass fell 2.8 percent. Concurrently, the sale of student passes rose 162 percent and their average pass use fell 21 percent, whereas the percentage of average daily boardings by student pass gained 6.3 percent. Student pass sales surpassed the sale of regular passes for the first time in SCRTD history in January 1983.

TABLE 4 Comparison of Pass Sales and Average Pass Use per Day by Pass Type

Pass Type	February 1982		February 1983		Percent Change	
	No. Sold	Avg Pass Use per Day	No. Sold	Avg Pass Use per Day	No. Sold	Avg Pass Use per Day
Regular	82,198	3.49	83,766	3.65	+2	+5
Senior citizen and handicapped	64,084	2.23	67,351	2.52	+5	+13
College and vocational	14,237	2.82	40,373	2.56	184	-9
Student	34,781	2.98	91,296	2.36	162	-21

#### Operating Productivity

The district makes an ongoing effort to maintain and increase the productivity of its bus operations. Productive bus operations are marked by good utilization of bus capacity and a high proportion of operating time spent in revenue service. In the case of SCRTD, the need to offer service to a wide service area such as Los Angeles County limits the efficiency that can be obtained. However, the rise in patronage caused by the lower fares has favorably affected productivity by increasing bus utilization in the midday period when excess capacity is available on most lines.

Bus service productivity is measured by a variety of indicators. Some common measures are passengers carried per hour or per mile of service, nonrevenue bus hours as a percentage of total bus hours, and rate of return from passenger fares (farebox operating ratio). Table 5 shows these performance measures for intervals from April 1982 through April 1983. All productivity measures in Table 5 experienced improvement concurrent with the patronage growth except, as expected, the last one, farebox recovery.

Some of the added efficiency demonstrated in Table 5 occurred due to the increases in off-peak patronage. The remainder resulted from productive scheduling measures that contained peak vehicle requirements in spite of the significant patronage increase. Between June and December 1982, a 21 percent increase in total monthly boardings occurred. Approximately 15 percent of this increase occurred during the peak periods, supplemented by a 3.5 percent increase in peak buses.

The rate of growth of the district's operating

TABLE 5 Operating Productivity Measures

Date	Passengers per Revenue Hour	Passengers per Revenue Mile	Nonrevenue Hours per Total Hours (%)	Farebox Operating Ratio (%)
1982				
April	53.0	4.0	7.39	42
June <sup>a</sup>	52.1	3.9	6.75	38
		Fare Reduction		
September	59.9	4.5	6.92	24
December	63.4	4.7	6.91	23
1983				
January	65.1	4.8	6.60	23
February	66.0	4.9	6.67	24
April	66.1	4.9	6.45	24

Note: Performance measures are for months coinciding with significant changes in the bus system.

<sup>a</sup>School recess.

costs declined between FYs 1982 and 1983. Farebox revenue fell dramatically in July, and, interestingly enough, it has maintained a fairly uniform level since then, in spite of the continuing growth in patronage. The even farebox revenue levels combined with significant patronage growth during the weekday base and weekend time periods tend to indicate a notable increase in discretionary bus travel and not solely the attraction of new patrons. Pass sales data would indicate that regular pass buyers are making these discretionary trips. However, the true proportion of discretionary trips contained in the increase is as yet unsubstantiated.

#### CONCLUSION

Perceiving the need to improve their public transportation, the voters of Los Angeles County mandated development of rail and light rail transit systems by approving the Transit Development Program referendum in 1980. The sales tax referendum also called for reduced bus fares during the first 3 years and compensated the affected bus companies by providing a subsidy derived from the sales tax. This local funding allowed the district to avoid major service cutbacks that had been planned to begin in July 1983. The Transportation Development Program was a real boon to the district, because it demonstrated local support for a rail system and obviated the need to cut bus service in FY 1983.

However, the reduced bus fare imposed by the program severely underpriced the cost of a bus ride for all riders. The extremely low cost of the student pass has led to tremendous growth in student patronage. The resultant need to add service for this relatively low revenue-producing segment of the transit market has been especially costly for the district in terms of bus requirements, high nonrevenue service hours, and lowered operating ratio. In addition, the district's patrons who have been misled by the low subsidized fares will be distressed when the mandated subsidy ends in July 1985 and fares return to a more reasonable level.

Patronage levels had been expected to stabilize within the first 6 months of the reduced-fare program. However, this has not occurred, and patronage is continuing to rise. The district is working with LACTC to restrain the growth of service hours as much as possible, because the district could potentially exceed the maximum hours agreed on for FY 1984 (1). It is necessary to contain the service hours of the bus system at this time, because in FY 1985 the guaranteed subsidy for bus transit will

end. Unguarded growth now would assure major service withdrawals in 1985 and the loss of the goodwill of district patrons.

#### ACKNOWLEDGMENT

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#### REFERENCE

1. Proposed Measures to Relieve Overcrowding. Board of Directors, Southern California Rapid Transit District, Los Angeles, July 22, 1983.

Publication of this paper sponsored by Committee on Public Transportation Planning and Development.

# Using the 1980 Census to Evaluate the Equity of Transit Service in Northern New Jersey

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#### ABSTRACT

A computer-based method is developed to evaluate the compliance of New Jersey Transit with Title VI of the 1964 Civil Rights Act regarding a fair and adequate distribution of transit service to all persons. The method involves a combining of transit-service and census data so minority areas and the level of service to these areas can be identified. One county (Union County) was selected as a test case to examine the four main problems encountered. The first involved geographical matching of transit routes and census tracts. Second, transit service had to be measured and apportioned to the tracts. Third, minority classifications were defined and assigned to the tracts. Finally, a means was necessary to present the results in an easily interpreted format.

At the request of New Jersey Transit (NJ Transit), the newly formed state organization responsible for owning and operating most of the public transportation services in New Jersey, a procedure was developed at Princeton University for evaluating the equity of transit service to the various minority groups residing in northern New Jersey's urbanized areas. This was prompted by NJ Transit's need to report to UMTA the compliance or noncompliance with Title VI of the 1964 Civil Rights Act regarding a fair and adequate distribution of federally assisted transit service among all persons.

The two main data requirements for this study were the transit operations and the census information. The route locations and frequencies for approximately 150 bus routes, 9 commuter rail lines,

and 1 subway (Newark) were provided by NJ Transit. Also provided were similar data for privately owned, state-subsidized bus services. The census data concerning the various minority groups were obtained from the 1980 census at the tract level. The study region in northern New Jersey contained 1,280 tracts in the following 10 counties: Bergen, Essex, Hudson, Middlesex, Monmouth, Morris, Ocean, Passaic, Somerset, and Union (see Figure 1).

Union County was used as a test case to focus on the four main problems that had to be resolved in order to permit a rational, rapid, and objective display of the facts. The first problem concerned the geographical matching of transit routes and census tracts. Second, transit service had to be measured and apportioned to each tract. The third problem involved defining the minority classifications and assigning those properties to the tracts. Finally, a method was needed to present the results so that all pertinent information could be displayed for easy interpretation and assessment by UMTA's evaluators.

#### GEOGRAPHIC MATCHING OF ROUTES AND TRACTS

The transit routes were provided by NJ Transit as a series of bold lines traced over streets on Hagstrom maps. A digitizer was used to code these routes for computer storage as a series of line plots with X-Y coordinates. [Digitizing routes involves tracing the route on a sensitive table with a special pen that automatically records the location of a point (node) when it is depressed.] From the X-Y coordinates of the nodes, routes were pieced together as a series, or chain, of links (see Figure 2).

The tract boundaries were available in a digitized form from the Princeton University Computer Center. This file, as with the route file, consisted of a set of X-Y coordinates, but these coordinates were in latitude and longitude (Figure 3). Therefore, a method to combine the two data sets into a