San Diego Trolley: Performance Trends

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Revenue service on the San Diego light rail transit project was inaugurated on July 26, 1981. From the project's inception, planning for the San Diego Trolley placed primary emphasis on cost-effective operations. The intent was to create a system that attracted the maximum number of riders while minimizing operating cost. The San Diego trolley was, in a sense, a pioneer in light rail operations. Although off-the-shelf technology was used and light rail systems are not new to most of the world, the San Diego trolley was a first in the automobile-oriented environment of Southern California. Since the 1981 opening, the system has more than doubled in size, both in terms of route miles and ridership. After 10 years of operation, it is now time to review the performance of the trolley and look to the future.

"Please Hold Tight" is written inside all San Diego trolley vehicles to remind passengers that they are riding in a high-performance vehicle. Indeed, the same advice could be given to decision makers, as the trolley has been a high-performance addition to San Diego's regional transit system. The trolley has taken single-occupant vehicles off the road, while increasing transit ridership in its corridors. Its high level of performance is reflected in its cost-effectiveness—the lowest farebox recovery ratio for any fiscal year has been more than 70 percent; the highest has been over 95 percent.

The Metropolitan Transit Development Board (MTDB) was created in 1976 to plan and construct transit guideway facilities in the southern urbanized portion of San Diego County. With the use of existing rights-of-way in well-developed areas and strong support from the California legislature and the local community, MTDB has built a successful light rail transit (LRT) system. It is operated by San Diego Trolley, Inc., a wholly owned subsidiary of MTDB.

The first trolley line was the South Line. Opened on July 26, 1981, it runs 15.9 mi (25.6 km) from downtown San Diego to the international border with Mexico. It was constructed in one of the region's fastest growing employment areas where, according to census statistics, jobs have grown by 54 percent and population has risen by 29 percent between 1980 and 1990. The line currently carries approximately 32,000 riders per day.

The second line to be built was the East Line, which opened in phases to El Cajon between March 1986 and June 1989. In June 1990 the Bayside extension of the East Line was opened in Centre City, connecting the core of the downtown with the new convention center and other developments along the harbor. The East Line is now 19 m (30.4 km) long and connects eastern suburbs to downtown. Ridership has exceeded expectations and the line currently carries approximately 18,000 daily riders. The South and East lines together include 34.9 route miles (56.0 km) and 33 stations.

Numerous extensions are in various stages of development, ranging from alignment studies to construction (see Figure 1). As the trolley rolls into the next century, extensions will be taking on a new form. Most of the usable, existing railroad right-of-way, which allowed in the past for low-cost construction with relatively little impact on communities, has already been tapped. As a result, more new rights-of-way will be established, including running on, above, or below existing streets.

One future trend in San Diego will be to incorporate the trolley into existing and new developments whenever possible. MTDB's efforts in existing communities will be not to intrude, but to serve. Developers are beginning to incorporate trolley right-of-way into their plans. Many of them hope to use proposed trolley lines as a selling point for their property. Development has increased near existing trolley lines and people are moving to areas where they can use the trolley. A substantial amount of undeveloped land still remains in San Diego that affords MTDB the opportunity to work with developers. Some are even planning transit-oriented developments that incorporate transit stations as a major focus of the project. The aim is to design areas that do not rely solely on the automobile because they have a viable transit alternative, the trolley.

RIDERSHIP PERFORMANCE

Across the board, the trolley's numbers are positive. Ridership figures indicate continuous growth, farebox recovery rates that are among the highest of any transit system, passengers riding by choice (i.e., they have a car available for the trip) and 70 percent of them highly satisfied with the service.

The annual number of boarding passengers on the trolley has increased continuously since the first day of operation (see Figure 2 and Table 1). Not only has trolley ridership grown, but so has the ridership on the transit system as a whole, dispelling the notion that the trolley serves only passengers who would have ridden the bus anyway (see Figure 3).

Many of the suburban bus operators have rerouted their service specifically to connect with the trolley. They have cited this integration of service as a reason for the increase in transit passengers in the region and on their systems (see Figures 4 and 5). The increase in ridership for the smaller operators since the trolley began operation has been dramatic. In the South Line corridor, Chula Vista Transit has had a 158 percent increase in total passengers between FY 81 and FY 91, while miles of service increased 42 percent. National City Transit, in the same corridor, had a ridership increase of 179 percent

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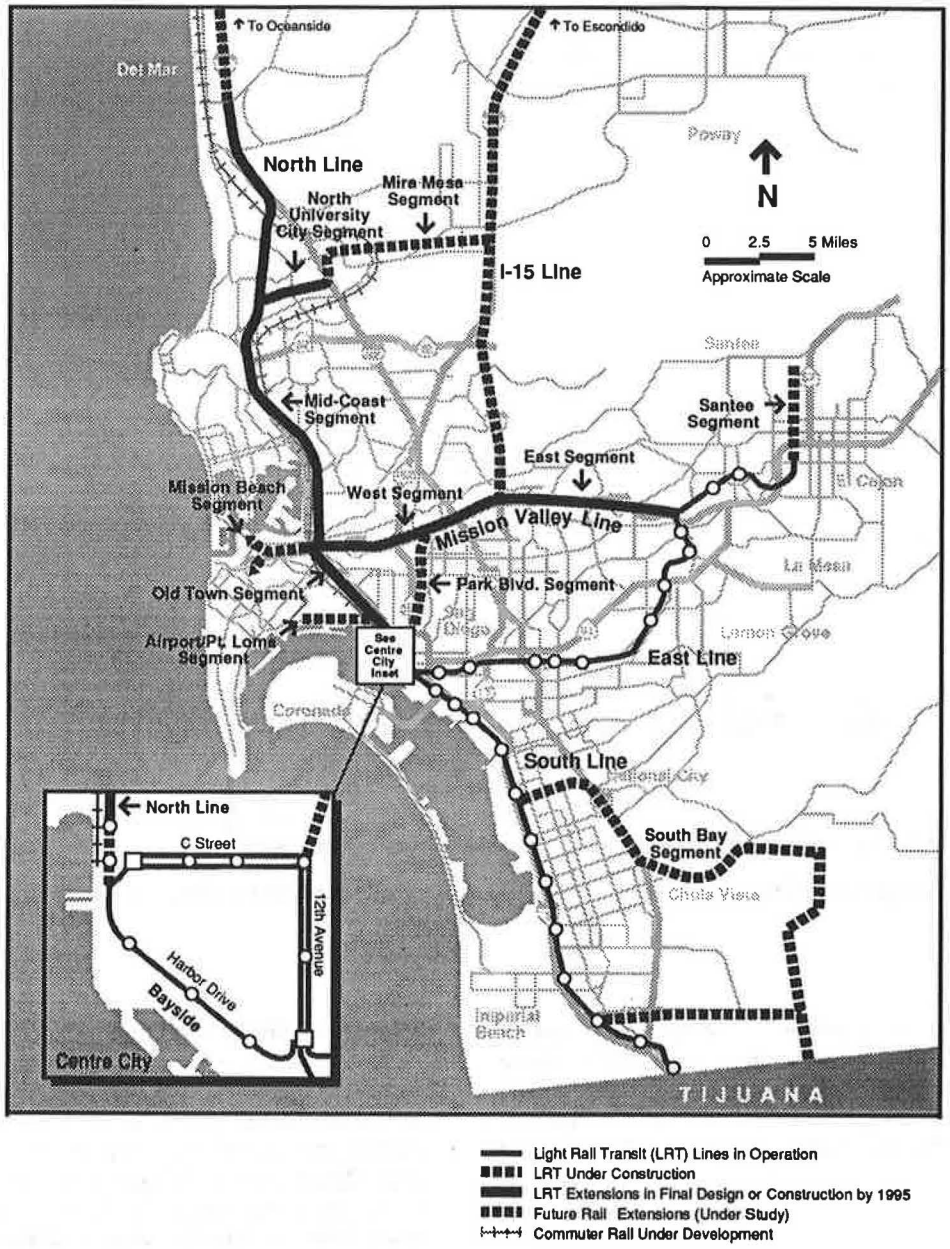


FIGURE 1 San Diego's regional rail transit plan.

in the same period, with miles of service up only 25 percent. In the East Line corridor, San Diego County Transit System has experienced an 161 percent increase in ridership between FY 89 and FY 91, while miles of service went up 89 percent.

The growth in LRT ridership can be related to certain key events as depicted in Figure 6. The two most significant factors were improving frequency from 20 to 15 min on the double-tracked South Line in FY 83 and completing the East Line to El Cajon in FY 89.

The trolley is in fact luring people who would have otherwise made their trips by car. Figure 7 indicates that 41 percent of trolley passengers ride by choice, compared to only 26 percent for all transit users. Figure 7 also indicates that the number of passengers who have an automobile available has increased significantly from 1985 to 1990. Figure 8 indicates that 37 percent of trolley passengers previously made the trip by driving alone. San Diego Transit Corporation, the largest bus operator in the region, has not shown as great an increase in choice riders as the systemwide average. This may be in part because of a diversion of riders from bus to LRT, but the data seem to indicate that the boost in choice riders for the region depends heavily on LRT service.

As indicated in Table 2, most riders walk or transfer from a bus to access the trolley. Between 1985 and 1990, the primary change in mode of access has been a small increase in transfers and a small decrease in walking. This may be because of the increase in feeder bus service and more auto access on the East Line.

Figure 9 indicates that the primary trip purpose of people using the trolley is to commute to work, approximately 52

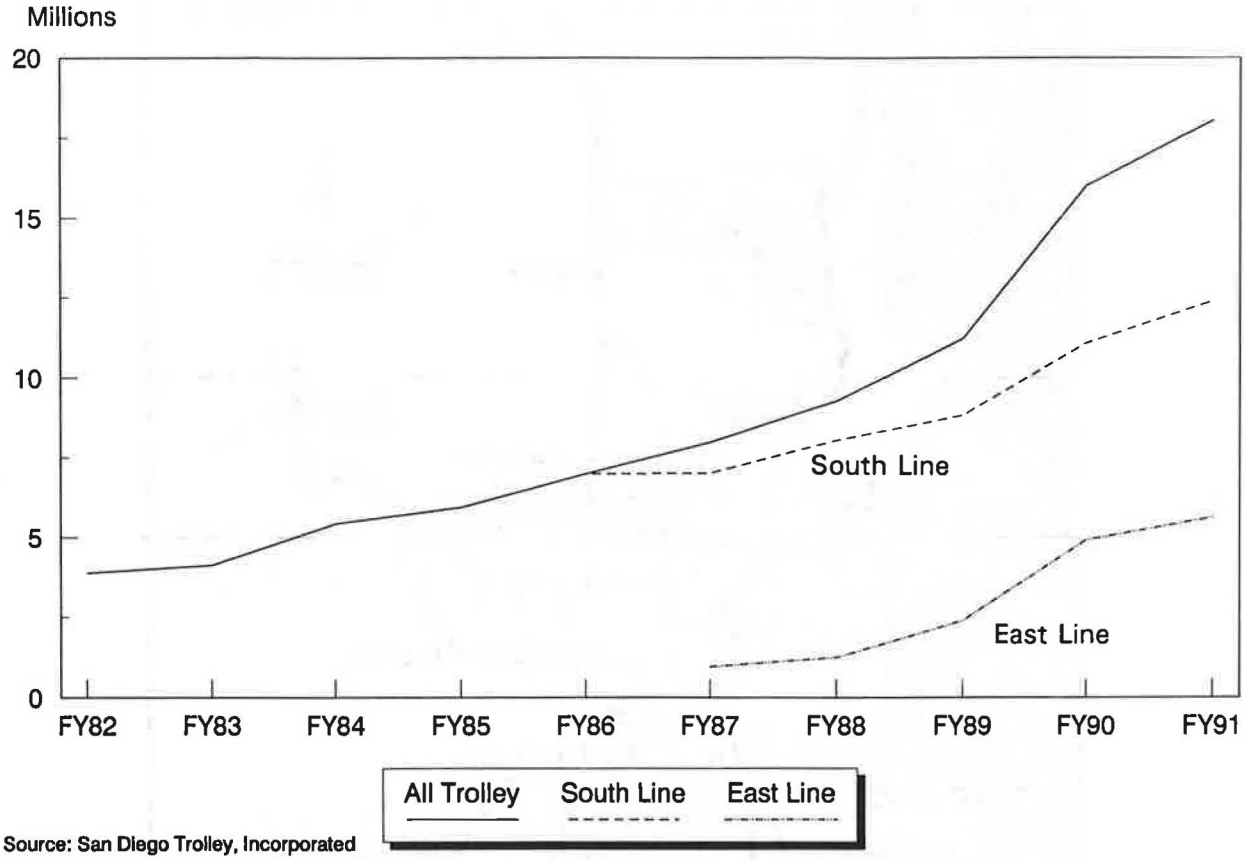


FIGURE 2 Passenger comparisons between the South and East lines and the trolley service as a whole.

percent. Table 3, in its demographic information, indicates that a higher proportion of trolley riders earn $30,000 or more than the riders of transit system as a whole. Taken together, these data seem to indicate that the trolley attracts middle- and upper-middle-income workers, even though they could drive to work.

TABLE 1 San Diego Trolley: Total Passengers

	Total	South Line	East Line
FY82	3,885,703	3,885,703	
FY83	4,137,928	4,137,928	
FY84	5,437,091	5,437,091	
FY85	5,942,858	5,942,858	
FY86	7,003,283	7,003,283 (includes East line)	Information for FY 86 not available
FY87	7,974,058	7,013,035	960,782
FY88	9,280,612	8,033,660	1,246,952
FY89	11,216,631	8,816,736	2,399,695
FY90	16,005,726	11,088,328	4,917,398
FY91	18,029,669	12,401,549	5,628,120

Source: San Diego Trolley, Incorporated

FINANCIAL PERFORMANCE

Passenger fares provided 36.7 percent of the total operating revenue for transit systems in the United States in 1990. By contrast, the farebox recovery rate for the trolley has exceeded 70 percent since it began operations. Figure 10 displays revenue and operating costs since FY 82. The closest the trolley came to breaking even overall was in FY 89 when the recovery ratio reached 95.31 percent (see Figure 11). In FY 89, 90, and 91, the South Line actually ran at a profit, with farebox revenues higher than operating costs. The farebox recovery rate has declined since its high in FY 89 for two primary reasons: the recent extensions are not yet as productive as the South Line and power consumption has increased considerably with the entire fleet now air-conditioned. (The South Line opened without air-conditioned vehicles.)

To accommodate the ridership growth of the past 10 years, the trolley has more than doubled its route miles, from 15.9 (25.6 km) to 38.3 (61.4 km). The light rail vehicle (LRV) fleet has grown from 14 to 71. This growth has been accompanied by service frequency increases, train size changes, and all of the other operational measures associated with service improvements. Operating costs have, of course, increased accordingly.

Has operating cost-effectiveness been sacrificed as a result of growth? This question can be answered by examining op-

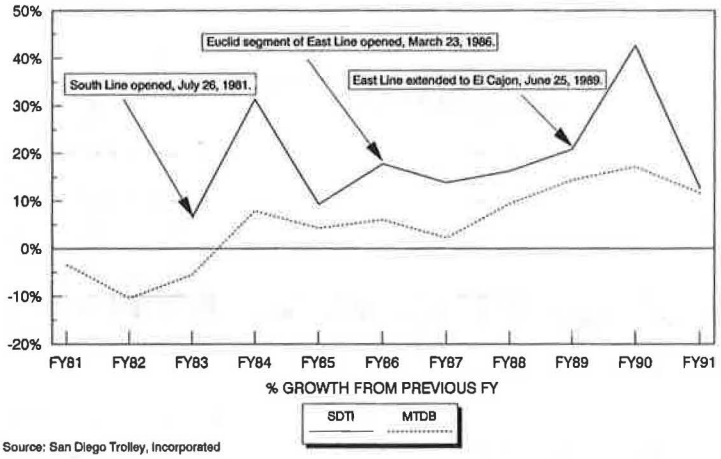


FIGURE 3 Ridership growth comparisons between the trolley and the MTDB area fixed route.

erating costs through the 10-year period compared to the amount of service (defined as number of riders) provided to passengers. When the audited operating cost for each fiscal year is divided by the number of passengers carried each year, a cost per trip is calculated for each trip provided during that year. Without considering revenue collected and capital cost, it can be seen whether the trolley has remained cost-effective even during a period of major growth.

Current year and 1982 base-year figures are displayed in Table 4. It is evident that the actual cost per passenger has remained about the same (average $0.91) over the 10 years of operation. However, when the figures are converted to 1982 dollars, the real cost per passenger has actually decreased to $0.56. The San Diego Consumer Price Index (CPI) for all consumer goods for the FY 82–91 period averaged 4.68 percent per year, one of the highest in the country. If costs had increased at the same rate as the San Diego CPI, then a cost of $1.28 per passenger trip could have been expected in FY 91.

The same kind of cost-efficiency test can be applied to cost per train mile and cost per car mile, as displayed in Table 4. Once again, if costs had increased at the rate of 4.68 percent per year, the FY 91 cost per train mile would have been $9.57, and the cost per car mile would have been $4.87.

Therefore, when examined from the perspective of three factors, cost per passenger trip, cost per train mile, and cost per car mile, it can be seen that the trolley has shown a distinct

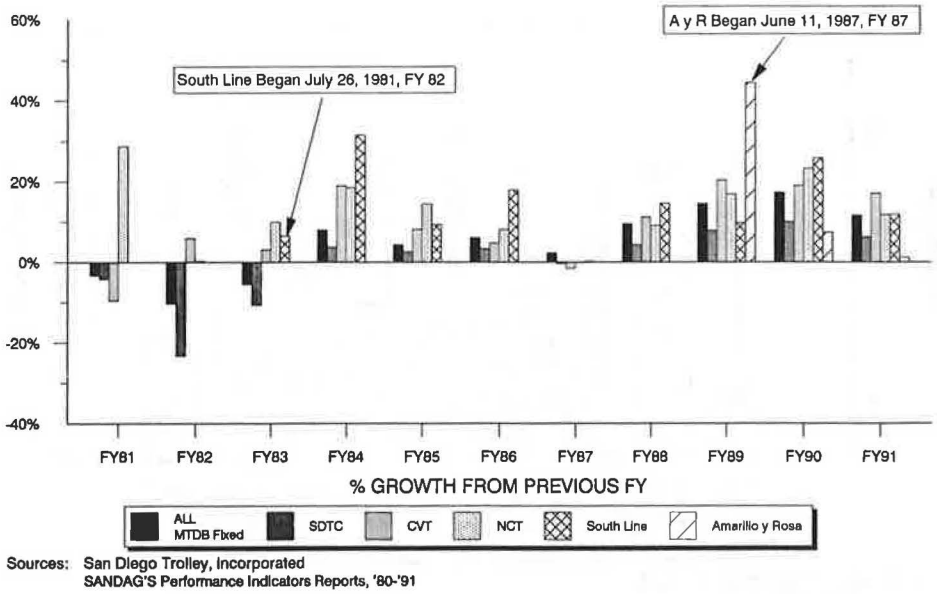


FIGURE 4 South Line corridor ridership growth comparisons.

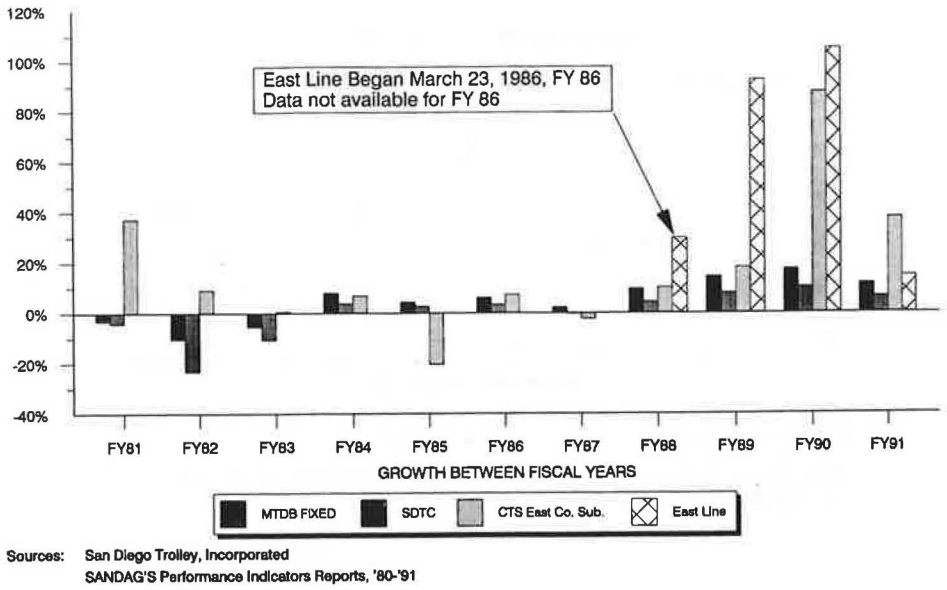


FIGURE 5 East Line corridor ridership growth comparisons.

pattern of improvement in operating cost-efficiency over the first 10 years of operation.

Two other financial items of interest include the change from a flat fare to a distance-based fare structure and the capital depreciation account. When the South Line opened, the basic fare was $1.00, with a $0.25 fare for trips within Centre City. In an effort to increase passenger revenue and match the fare more closely to distance traveled, a distance-based system was implemented in July 1984 for the trolley. (A similar system for bus fares was initiated in July 1989.) Modest increases in both ridership and revenue were achieved with the change.

When the South Line opened, MTDB established a capital depreciation account for the future replacement of system components. MTDB Policy No. 16 covered the amount to be paid to the account and the use of funds. A formula based on asset value, depreciation period, and the Consumer Price Index is used to calculate the annual payment with a minimum payment of $500,000. A reduced payment can be made when actual farebox recovery falls below the budgeted amount.

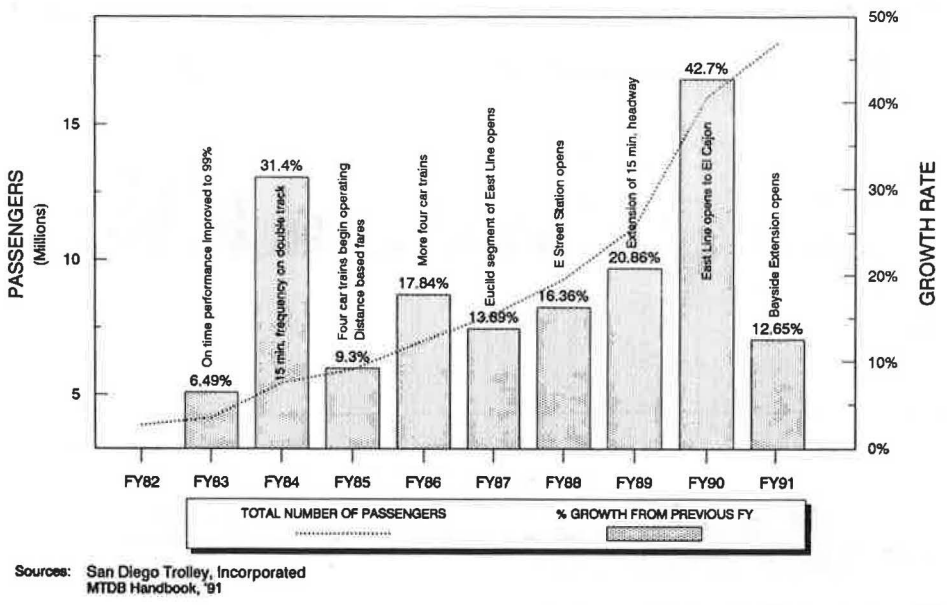
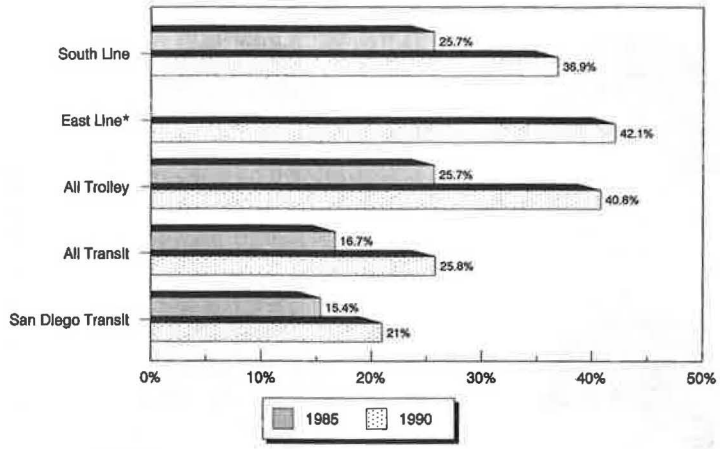
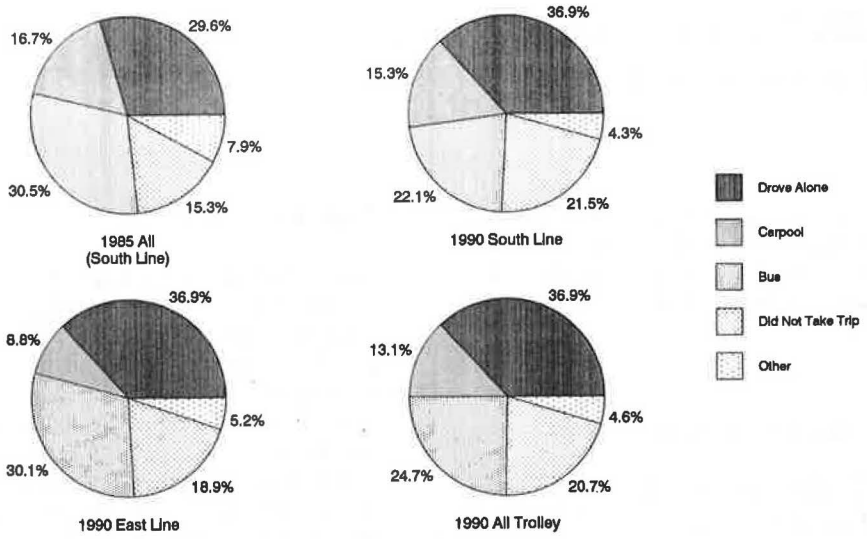


FIGURE 6 Total trolley passenger growth.



* East Line began March 23, 1988.
Source: 1990 SAN DIEGO REGIONAL TRANSIT SURVEY, VOLUME 2, SANDAG, 1991.

FIGURE 7 Automobile availability of transit passengers.



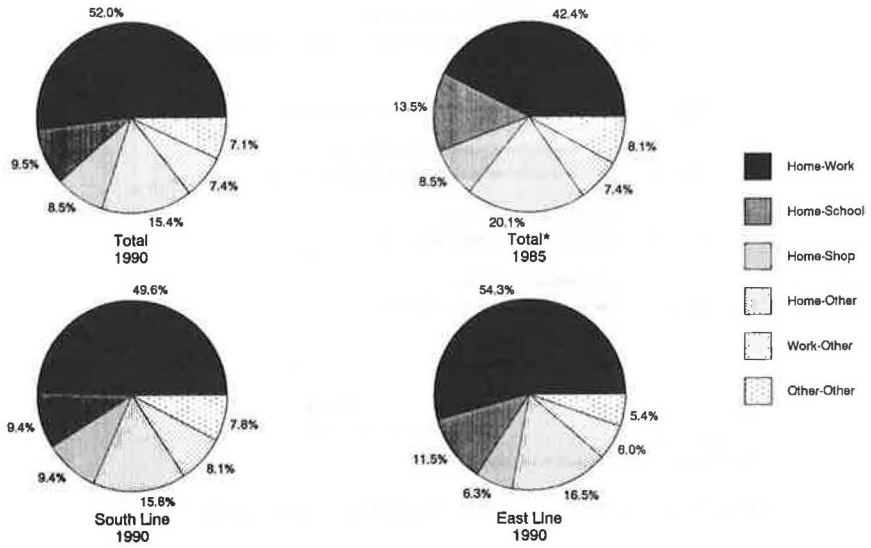
Source: 1990 SAN DIEGO REGIONAL TRANSIT SURVEY, VOLUME 2, SANDAG, 1991.

FIGURE 8 Mode of travel prior to trolley service.

TABLE 2 Mode of Access to Transit Stops in Percentage of Boardings by Operator

	TRANSFER		WALK		AUTO		OTHER	
OPERATOR	1985	1990	1985	1990	1985	1990	1985	1990
SAN DIEGO TROLLEY	17.0%	21.6%	59.7%	56.5%	20.1%	20.7%	3.2%	1.2%
SAN DIEGO TRANSIT	25.5	26.2	70.4	69.4	3.3	3.7	0.8	0.7
NATIONAL CITY TRANSIT	33.8	40.3	63.2	56.0	2.3	2.7	0.7	1.0
CHULA VISTA TRANSIT	33.6	37.9	62.9	59.0	2.5	2.8	1.0	0.5
SD COUNTY TRANSIT	19.5	25.4	69.9	62.4	10.2	11.5	0.3	0.8
MTDB CONTRACT ROUTES	28.9	25.6	59.8	68.7	5.9	5.0	5.4	0.6
NORTH COUNTY TRANSIT	22.8	26.9	70.0	66.4	5.5	5.5	1.8	1.2
TOTAL	24.4	25.8	68.3	65.1	5.9	8.3	1.4	1.0

SOURCE: 1990 SANDAG REGIONAL ONBOARD SURVEY



* East Line Began 3/23/86
Source: 1990 SAN DIEGO REGIONAL TRANSIT SURVEY, VOLUME 2, SANDAG, 1991.

FIGURE 9 Passenger trip purpose.

Items with short life spans (e.g., trucks and communication equipment) have already drawn on the account for replacement. The trolley continues to pay into the account each year and will thus be able to replace more expensive items when necessary.

TABLE 3 1990 MTS Bus and Trolley Rider Profile and Performance Trends

HIGHLIGHT	SAN DIEGO REGION	SAN DIEGO TROLLEY ONLY
Weekday Ridership	200,000	53,000
Commuter Weekday ridership	86,000	31,000
Trip Type		
Work	49.0%	58.3%
Visitor/Recreation	14.0%	17.9%
Shopping	14.0%	12.5%
School	18.9%	12.3%
Other	11.1%	6.8%
Riders who had car available	25.9%	41.8%
Persons/Household (p/h)		
1 p/h	16.5%	13.5%
2 p/h	23.4%	19.7%
3 p/h	19.0%	20.3%
4 p/h	18.3%	21.0%
5 p/h	22.7%	25.4%
Rider Type		
Male	50.4%	55.0%
Female	49.6%	45.0%
12–18 Years of Age	12.3%	7.6%
19–24 Years of Age	42.1%	22.9%
25–44 Years of Age	22.6%	49.9%
45–59 Years of Age	11.2%	13.7%
60+ Years of Age	9.2%	5.9%
Earn $30,000+	28.9%	34.7%
Earn Up to $19,000	54.4%	49.6%
Military	5.5%	7.9%
Visitor	8.3%	13.9%

Based on 1990 SANDAG REGIONAL ONBOARD SURVEY
December, 1991

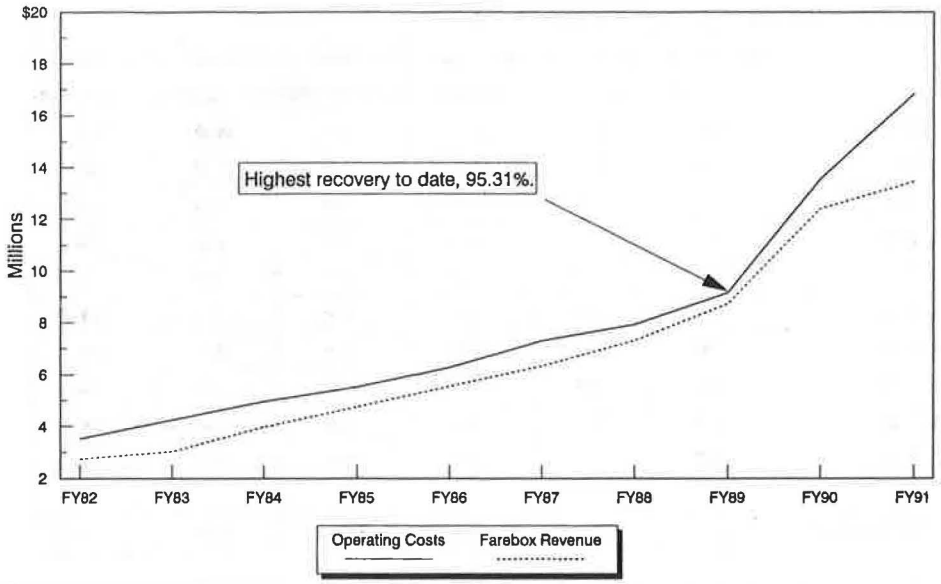
LESSONS LEARNED

Several lessons can be learned from the first 10 years of operation. Some of the effects of LRT service have already been discussed. The trolley clearly attracts people from their cars, it induces new trips, and all transit systems gain ridership because of its presence. In addition, several other observations are worth mentioning that may help guide future LRT development.

The low-cost design aspects, such as self-service fare collection and simple stations, have paid off in long-term operating cost savings. Although, for example, some of the future stations may be more elaborate when part of a joint development project, the basic concepts employed in building the South and East lines will continue to be followed.

The trolley has been fortunate to have two strong trip generators to serve, downtown San Diego and the international border with Mexico. These two areas have helped ensure strong ridership even when other factors have dampened ridership growth. Future lines will attempt to serve activity centers as witnessed by plans for the Mission Valley Line to serve San Diego Jack Murphy Stadium and San Diego State University.

The trolley has spawned several joint developments including the MTS Tower (which houses MTDB and San Diego Trolley, Inc. offices), American Plaza (across from the Santa Fe Depot), the Trolley 8 Cinemas at the Grossmont Center Station, and a housing/day care project at the 47th Street Station. Discussions are under way with numerous developers on the Mission Valley and Mid-Coast lines for even more joint developments. Thanks to the trolley's proven benefits and supportive local jurisdictions, more of these projects are expected in the future. In this way, the trolley may help shape urban development in much the same way Toronto's system has.



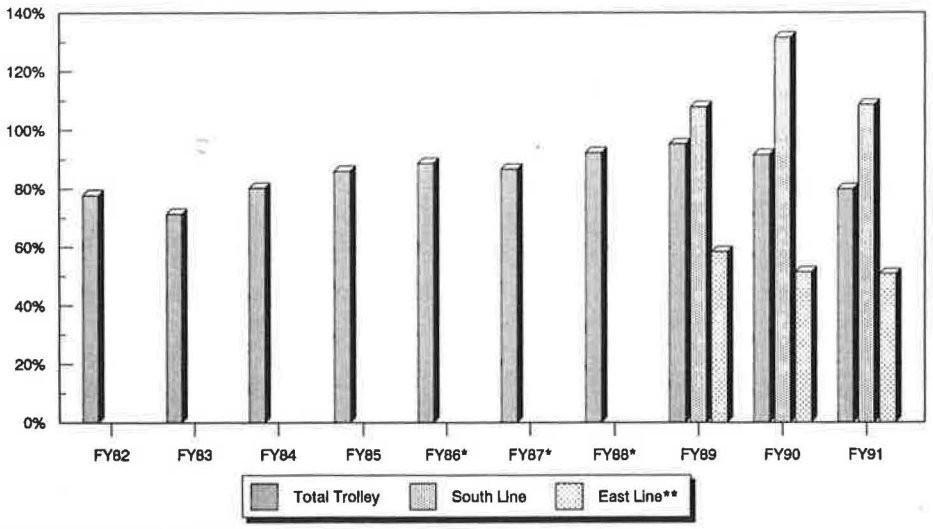
Source: San Diego Trolley, Incorporated

FIGURE 10 Trolley operating costs versus farebox revenue.

On the operational side, double-tracking was found to be essential to on-time operations. The South Line opened as a single-track line and on-time service could not be provided at 15-min frequency. As a result, 20-min service was operated until double-tracking could be completed. Double-tracking is now our design standard. Only in a few special situations, such as at the suburban end of a line, is single-tracking considered. All planning and environmental work assumes a double-tracked right-of-way.

Also, immediate graffiti cleanup has been effective in keeping the problem under control. Marked-up vehicles are cleaned when they come in before they return to service. Wayside facilities are cleaned as soon as possible. Vehicles have even been cleaned while in service, with a crew waiting for them at a station. As a result, the San Diego trolley has remained virtually graffiti free.

Looking toward the future, MTDB and San Diego Trolley, Inc., will have to try harder to maintain the success they have enjoyed in the first 10 years. New lines will be built in more suburban areas where major trip generators like downtown or the border crossing are harder to find. Planning for the expansions is becoming more difficult as new rights-of-way must be found. The system is aging, requiring a higher level of maintenance and, thus, greater expense to keep things in



Source: San Diego Trolley, Incorporated
* Breakdown of East and South Lines not available.
** East Line began 3/23/86, FY 86.

FIGURE 11 Trolley farebox recovery ratio.

TABLE 4 San Diego Trolley Financial Indicators

	Operating Cost/ Passenger	Operating Cost/ Train Mile	Operating Cost/ Car Mile	Operating Cost/ Passenger (1982$)	Operating Cost/ Train Mile (1982$)	Operating Cost/ Car Mile (1982$)
FY82	$0.91	$6.82	$3.47	$0.91	$6.82	$3.47
FY83	1.03	8.16	3.32	1.00	7.92	3.22
FY84	0.91	6.40	3.01	0.84	5.89	2.77
FY85	0.93	7.16	3.38	0.81	6.21	2.93
FY86	0.90	7.45	3.42	0.75	6.21	2.85
FY87	0.92	7.35	3.50	0.74	5.88	2.80
FY88	0.85	7.52	3.70	0.64	5.68	2.79
FY89	0.82	8.01	3.79	0.57	5.59	2.65
FY90	0.85	7.91	3.31	0.54	5.05	2.12
FY91	0.93	9.38	3.74	0.56	5.60	2.23
10-YEAR AVERAGE	$0.91	$7.62	$3.46	$0.74	$6.09	$2.78

Sources: San Diego Trolley, Incorporated
Bureau of Labor Statistics

a like-new condition. San Diego Trolley, Inc., itself will grow to operate the expanded system, presenting the challenge of maintaining its high standards within a larger organization. Marketing efforts will probably have to increase to keep ridership growing in the existing corridors.

Fortunately, trip making restrictions emanating from air quality efforts will likely be helpful in boosting ridership.

Yes, the future will be challenging, but the experience of operating the system for over a decade, the support of the community, and the continued commitment of MTDB and San Diego Trolley, Inc., to high standards should enable this LRT success story to keep growing.

ACKNOWLEDGMENT

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