Distribution of Public Transit Subsidies in Los Angeles County

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Public transit today is faced with the challenge of serving its clientele while subsidies are failing to keep pace with increasing operating costs. In Los Angeles County, there are service distribution inequalities—overcrowding and unmet demand in some areas and, at the same time, surplus capacity in other areas. To use subsidy resources efficiently requires that the effects of present subsidy allocation practices be understood—that is, how subsidies are translated into consumed service, both by type of service and by geographic sector within the urban area. An attempt is made to provide a preliminary understanding of that distribution in Los Angeles County. It is postulated that significantly more passengers are carried per dollar of subsidy in the central Los Angeles area than in other areas and that local services require a lower subsidy per passenger than do express services. A number of policy issues are raised, the most important being the very purpose of public transit subsidies.

Today's public transit industry serves a variety of transportation needs. In recent years, ridership has increased but operating costs have increased at a rate exceeding the increase in operating subsidies. Indeed, the industry has entered a period of declining public subsidies. In view of this situation, the mobility of American urban areas requires greater efforts to improve the return on public subsidy resources.

In order to obtain such a return, a complete understanding of the present transit situation must be obtained, including an understanding of the current distribution of public transit subsidies. Very little research has been devoted to this subject.

It is the purpose of this paper to present findings on the distribution of public transit subsidies, in terms of consumed service, in one urban area, Los Angeles County. This analysis includes the distribution of subsidies both by service type and by geographic sector within the County. A number of policy issues emerge.

This paper represents a preliminary analysis, and further research should follow. Improved urban transportation must be based on a comprehensive understanding of the existing system, and such an understanding must include the distributional effects of public transit subsidies.

PUBLIC TRANSIT IN LOS ANGELES COUNTY

The 7 million residents of urbanized Los Angeles County are served by nine fixed-route transit operators and more than 2200 buses during peak hours. The largest operator is the Southern California Rapid Transit District (SCRTD), which provides more than 85 percent of the service. The other 15 percent is provided by municipally owned operators (most operate both within and beyond their municipal boundaries), two of which, Long Beach and Santa Monica, have fleets of more than 100 buses.

Public transit ridership has increased markedly in recent years. For some time, many local services, primarily in the central area, have been overcrowded and waiting riders are often passed by at bus stops by buses with crush loads. This is well illustrated by the fact that about 40 percent of evening peak-hour, peak-direction buses in the central Los Angeles area achieve maximum loads of 70 or more (40-70 percent above seating capacity). Some express services also have standees, a situation that has developed since the May 1979 gasoline crisis. Conversely, many bus lines are operating at levels far below seated capacity; outside the central area, maximum loads of more than 60 are rare and the median peak load in the evening rush hour is fewer than 30.

Federal operating assistance (Section 5 of the Urban Mass Transportation Act of 1964, as amended) and state subsidies (from the Transportation Development Act) are administered and distributed by the Los Angeles County Transportation Commission.

METHODOLOGY

This study required three major elements (see Figure 1):

1. The definition of the geographic sectors to be studied,
2. The definition of the service categories, and
3. The development of financial data (costs and revenues) to be arrayed in the desired classification and geographic framework.

Classification of Services

A simplified transit line service classification was used, based on the percentage of bus hours in express (limited-stop) service:

Service Classification	Express Freeway Service Hours (%)
Local	0-9
Hybrid	10-29
Express	30-100

Peak-only services are generally found in the "express" classification. Such services are characterized by limited stops and boarding or alighting restrictions throughout the length of the line.

A number of lines operate in express service for a portion of the run and then operate as local services with frequent stops, without either boarding or alighting restrictions. These lines are included in the "hybrid" category.

Some local lines have relatively short limited-stop segments. These lines, and lines without limited stop segments, are found in the "local" classification.

Geographic Sectors

The geographic sectors used are combinations of SCRTD planning areas. Because of the complexity of allocating costs and revenues by geographic sectors for transit lines that serve more than one sector, the geographic analysis is limited to single-sector local services (most hybrid and express lines serve more than one sector). The geographic sectors and their populations are as follows:

Sector	Population
Central	2 900 000
San Fernando Valley	1 050 000
San Gabriel Valley	1 250 000
South Bay	650 000
South East	1 050 000
Total	6 900 000

The central sector includes the downtown Los Angeles, Wilshire Corridor, Hollywood, and Westwood business districts. This sector also includes the County's largest low-income and transit-dependent areas, south central Los Angeles and east Los Angeles. The southeast sector includes the Long Beach business district. The geographic sectors are shown in Figure 2.

Development of Financial Data

Once the geographic sectors and service classifications were identified, total system costs, boardings, and subsidy statistics were developed by using FY 1979.

Municipal Operator Data

All of the municipal operator services were either local or express, and the data were available in the required format (having just been developed for the Los Angeles County Transportation Commission by Simpson and Curtin). This analysis is limited to those subsidies that are generally available for use on all services within the urbanized portion of Los Angeles County, and thus municipal subsidies are not included in the distribution analysis. Municipal subsidies are either very small or nonexistent; however, this approach does overstate some operating ratios.

Figure 1. Methodology.

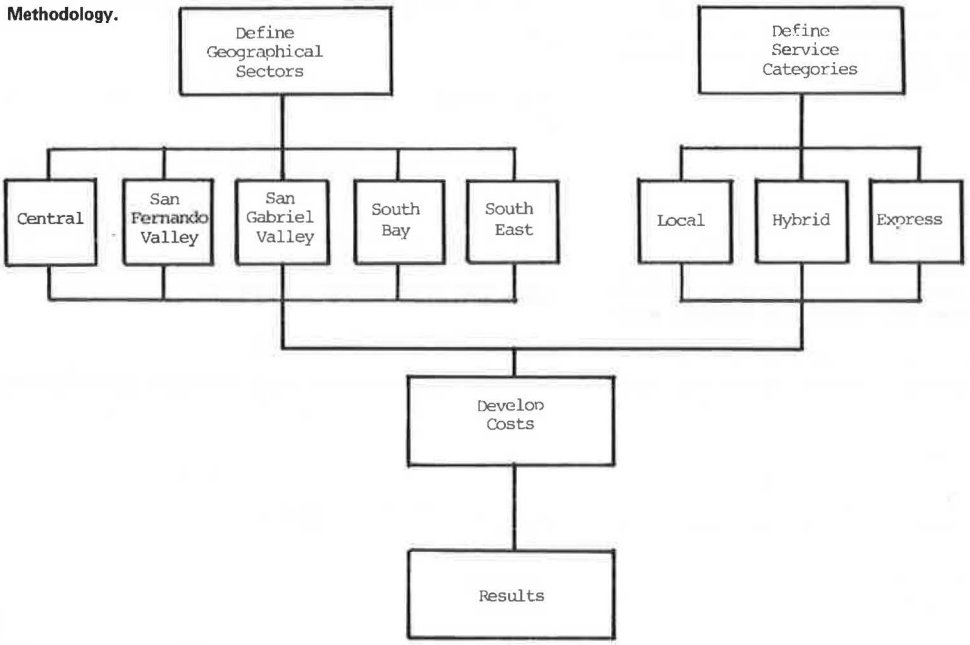
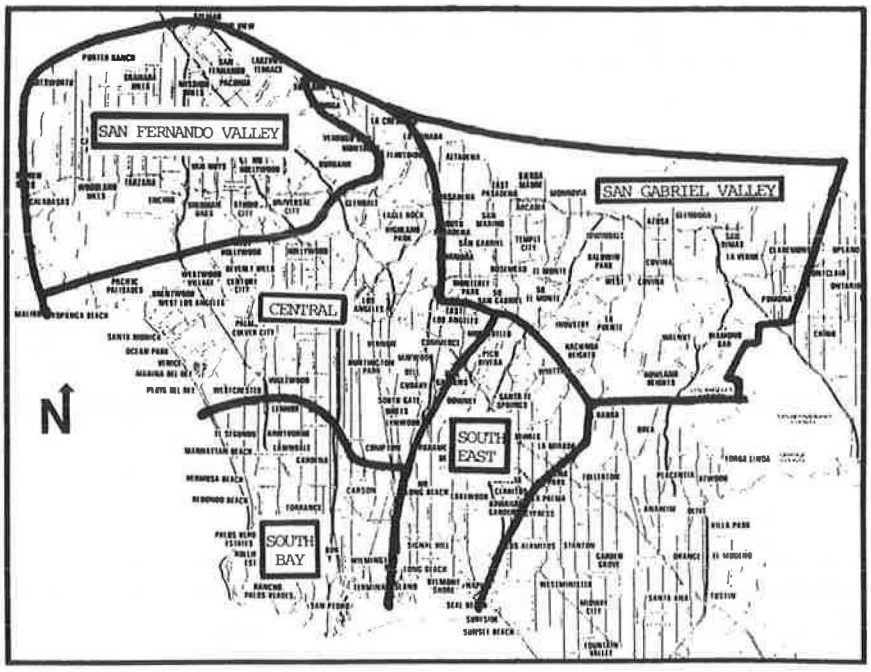


Figure 2. Geographic sectors: urbanized Los Angeles County.



SCRTD Data

Each of the SCRTD lines was categorized according to service type and, within the local classification, by geographic sector. SCRTD lines were found in all service categories and geographic sectors, and some local lines were found to serve substantially more than one geographic sector. Because of this, a "multiple-sector" local service category was established.

Because the SCRTD data did not exist in the required format, a sample was taken. In each geographic and service category, the sample included lines with more than 45 percent of the category patronage, which resulted in a level of confidence above 99 percent.

The development of the financial data required the determination of costs and revenues for each of the lines in the sample. The costs were obtained by using a "peak-base" cost allocation model, which was developed for the Los Angeles County Transportation Commission by Simpson and Curtin. This formula assigns costs to one of three variables: vehicle hours, vehicle miles, or peak vehicles. The formula reflects the higher unit costs of peak-hour services as opposed to off-peak unit costs, as given below:

Variable	Percentage of Costs	Calculated Value ($)
Vehicle miles	32.40	0.79
Peak vehicle hours	25.22	20.64
Base vehicle hours	28.33	15.86
Peak vehicles	14.05	68.92/weekday

It was assumed that each bus accounts for 5.5 peak-h (except in the case of peak-only services, where actual hours were used). The validity of this estimate is supported by an analysis of recent research, which yields a peak-hour figure of 5.47 h/bus for SCRTD (1).

Revenues were taken from SCRTD revenue allocations for each line. The subsidy per passenger was calculated, for each line, by subtracting the line's revenue per passenger from the cost per passenger (using the costs developed from the peak-base cost allocation model).

The individual line data were then combined into the appropriate classifications and geographic sectors and expanded to simulate the total financial data in the desired format. The data derived are of sufficient reliability to be used in broad policy considerations.

Formatting of Data

The data from SCRTD and the municipal operators were combined, with the results given in Table 1.

RESULTS

A review of the data in Table 1 yields various results, which are discussed below.

Distribution by Geographic Sector

Limiting the geographic analysis to single-sector local services overstates the percentage of subsidies used in the central sector, for at least two reasons. The first is that express lines tend to bring patrons from outer sectors into the central sector and the exclusion of these lines results in an understatement of the subsidies expended in the outer sectors. The second is that, if the multi-sector local and hybrid services had been allocated to the individual sectors, a great disparity could have been expected between the central sector and other sector per-boarding subsidies because the ridership on such lines is higher in the central sector than in the other sectors.

Even so, the subsidies in the central sector are considerably lower than those in the other sectors, as illustrated in Table 2. It should be noted that at least part of the per-boarding subsidy difference between sectors is related to the comparatively low municipal operator unit costs of operation. The figures in the southeast and South Bay sectors particularly reflect these lower costs.

Another illustration of subsidy differences is the number of passengers carried per subsidy dollar (Table 2). This is a measure of resource allocation effectiveness in terms of consumed service. These figures indicate that, on the aggregate, from more than two to more than six times as many passengers are carried per subsidy dollar in the central sector than in the other sectors. Among local services, differences of as much as 44 times were observed in the sample (comparison of line 3 at $0.07/passenger with line 447 at $3.13/passenger). Even greater differences were observed in comparing local services with express services, as discussed below.

Distribution by Service Classification

The results from all services were used in comparing the subsidies by service classification. Local services were found to be subsidized significantly less than hybrid and express services (see Table 3). Subsidies per passenger in the hybrid services are about 2.5 times that of the local services, whereas express boardings are subsidized at a rate nearly 3.5 times that of local boardings.

SCRTD express subsidies are more than four times the average local subsidy and nearly seven times greater than the subsidy for local services in the central sector (most SCRTD express lines are so long that it is not possible to obtain more than one trip

Table 1. Operating and financial data by geographic sector and service classification.

Service Classification	Sector	No. of Daily Boardings (000s)	Daily Operating Cost ($000s)	Daily Subsidy ($000s)	Subsidy per Boarding ($)	Operating Ratio	Sample Size
Local		1190.7	698.8	424.2	0.356	0.39	0.55
	Single	1018.2	531.5	302.4	0.297	0.43	0.56
	Central	881.6	384.4	193.0	0.219	0.50	0.53
	San Fernando Valley	49.6	58.7	43.6	0.879	0.26	0.48
	San Gabriel Valley	20.1	32.2	25.9	1.295	0.20	0.48
	South Bay	12.5	16.1	11.3	0.904	0.30	1.00
	South East	54.4	40.1	28.6	0.526	0.29	1.00
	Multiple	172.5	167.3	121.8	0.706	0.27	0.46
Hybrid		88.1	109.0	76.9	0.873	0.29	0.50
Express		41.5	72.0	49.2	1.186	0.31	0.62
Total		1320.3	879.8	550.3	0.417	0.38	0.55

out of a peak-period bus, which has an unfavorable effect on costs). Although the local passengers were found to be subsidized at a level below that of hybrid service passengers (Table 2), this only occurs in the central and southeast sectors. On one line, the per-boarding subsidy exceeded by more than 55 times the subsidy of a local line (line 3 at $0.07 compared with line 605 at $3.89). Table 3 illustrates the boardings per subsidy dollar by service categories.

The boardings per subsidy dollar are shown in Figure 3.

POLICY ISSUES

The situation in many other large urban areas is similar to that of Los Angeles: There are great disparities in ridership and in subsidy per passenger as transit authorities address the often conflicting goals of serving the entire urban area while also serving the very high demand in some parts of the urban area. This task is made more complicated by the reduction in transit subsidies.

Table 2. Local service subsidies by geographic sector.

Sector	Subsidy per Boarding ($)	Percentage of Boardings	Percentage of Subsidies	Boardings per Subsidy Dollar
Central	0.219	86.6	63.8	4.56
San Fernando Valley	0.879	4.9	14.4	1.14
San Gabriel Valley	1.295	2.0	8.6	0.77
South Bay	0.904	1.2	3.7	1.11
Southeast	0.526	5.3	9.5	1.90
Multisector	0.706			1.42
Aggregate	0.356			2.81

Table 3. Subsidies by service classification.

Service Classification	Subsidy per Boarding ($)	Percentage of Boardings	Percentage of Subsidies	Boardings per Subsidy Dollar
Local	0.356	0.2	77.1	2.81
Hybrid	0.873	6.7	14.0	1.15
Express	1.186	3.1	8.9	0.84
Aggregate	0.416			2.40

In Los Angeles County, current subsidy allocation practices result in retarded mobility in high-demand areas. Subsidies are relatively low, and potential ridership exceeds the supply of service. In these same areas are concentrated the largest percentage of low-income transit-dependent citizens, and their much higher farebox percentage contribution, in effect, results in cross subsidization of less intensively used transit services in more affluent areas. More detailed research might well document what appears to be an inverse relation between personal income and the level of transit subsidies.

At the same time that the transit system fails to supply sufficient capacity in the high-demand areas, comparatively large subsidies are directed toward lower-demand services. As a result, many empty seats are moved around these areas while not even standing room is available to some patrons in the higher-demand areas.

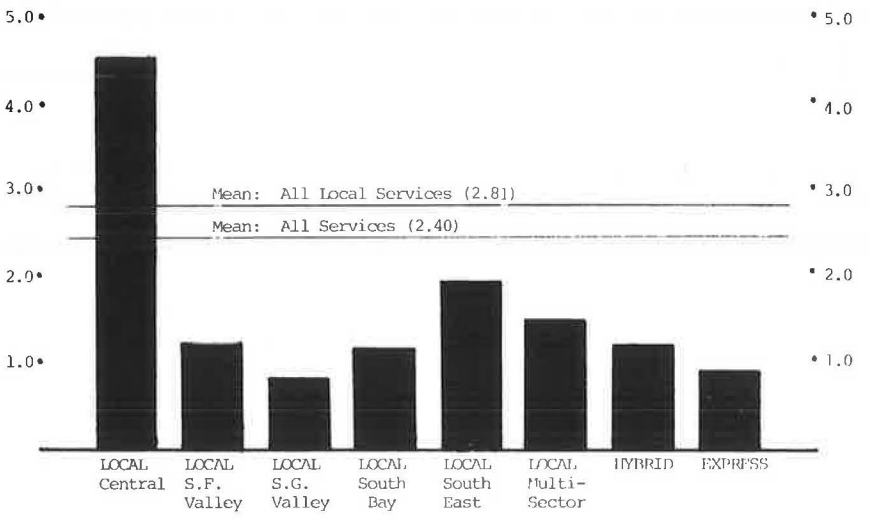
The well-patronized peak-only express services require such a comparatively high subsidy per passenger that service cannot be expanded to meet the demand. At the same time, however, the private sector is providing more than 100 daily express bus round trips in the area, charging fares at or below public-sector fares, and without either capital or operating subsidy. Thus, public transit, by providing express service, may be providing a service that it need not provide and that, if not provided, would free resources to meet the excess demand without retarding the mobility of the express passengers.

In the years of more plentiful subsidies, the conventional transit services, which had served well the older, densely populated central cities, were expanded into newer and less densely populated areas. The result has been a less-than-optimum match of suburban mobility needs with the transit service provided, as demand remained low and costs were high. The great amount of unused capacity of these services, combined with the shortage of service in higher demand areas, poses a serious dilemma for transit.

As subsidies become more scarce, transit authorities must become more aware of the relative performance of the services that are being provided and should seek innovative approaches that provide mobility to lower-density areas at a reasonable cost to the public.

In all of the above issues, resource allocation emerges as the critical element. Traditional transit operational strategies, such as short-lining, may provide a better level of mobility by moving excess capacity from lower-demand line sections to the

Figure 3. Boardings per subsidy dollar by category of service.



high-demand sections. Other, less traditional approaches may be appropriate, such as timed transfer or pulse systems, private-sector service contracting, or substitution of paratransit services for fixed-route services in areas of very low demand. To the extent that the public transit system seeks to assist the low-income person dependent on transit, the feasibility of user-side subsidies should be reviewed.

Finally, a better match between demand and service is necessary if urban mobility is to be improved and if public transit is to remain viable within urban areas. To achieve this match requires a clear definition of the purpose of public transit subsidies. In order to define that purpose and to measure the extent to which the purpose is being addressed, public transit authorities must be aware of existing subsidy disparities between areas and types of services within the urban area.

REFERENCES

1. R. Cervero, M. Wachs, R. Berlin, and R. Gephart. Efficiency and Equity Implications of Alternative Transit Fare Policies. Univ. of California, Los Angeles, 1980.
2. R. Johnson. Park and Ride Survey. SCRTD Marketing Research, Los Angeles, Feb. 1981.

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Formula for Allocation of WMATA Metrorail Subsidy Requirement

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Many major U.S. metropolitan areas struggle with the problem of how to distribute the cost of providing government services among participating political jurisdictions. Because transit service is provided by local or state governments, quasipublic authorities, and private operators, it has increasingly required direct financial assistance in order to meet its operating costs in the past decade. This subsidy requirement has given rise to the same sharing problem that characterizes other regional activities. An obvious way to determine a jurisdiction's share of total transit subsidy is to examine the difference between the passenger revenue collected in that jurisdiction and the operating cost incurred in the same jurisdiction. Experience indicates, however, that this approach, while equitable, is fraught with practical problems. An alternative approach, adopted by the Washington Metropolitan Area Transit Authority for application to the Metrorail system, has combined simplicity and stability with ease of administration to produce a formula that distributes only the system subsidy, not costs and revenues. This formula relies on measurements of relative benefits derived from operation of the rail transit system, focusing on jurisdictional population and density, number of stations in each jurisdiction, and number of riders from each jurisdiction. The technique has been successfully applied in each of the past four years, a noteworthy accomplishment given the widely divergent fiscal policies of the District of Columbia, the two states, the four counties, and the three municipalities that constitute the Washington, D.C., transit zone. The technique is transferable to other locations and may be applicable to other government activities.

The legislation that created the interstate compact organization known as the Washington Metropolitan Area Transit Authority (WMATA) was signed into law by President Johnson in 1966. The original purpose of the Authority was to construct the Washington, D.C., regional rail rapid transit system known as Metrorail. Since that time, some 37 miles of heavy rail lines have been built and placed in operation, including 40 stations and two large storage and maintenance facilities. The system is scheduled for completion in 1990 and will include 101 service miles and 82 stations.

Following the 1972 acquisition by WMATA of the region's private bus companies, it became apparent that the Authority would not only construct the Metro system but would also operate it. The area's local governing bodies were soon to discover that this new transit operating responsibility would carry with it some very difficult problems of inter-jurisdictional coordination and agreement. One of the greatest of these has been the policy and process for handling the steadily mounting operating deficits of the transit system.

It is the purpose of this paper to explain the method selected by the WMATA Board of Directors for determining the financial responsibility of each local political jurisdiction with respect to the Metrorail operating deficit.

METRORAIL OPERATING ASSISTANCE REQUIREMENT

The WMATA transit zone is composed of eight local political jurisdictions: Montgomery and Prince Georges Counties in Maryland; Arlington County, Fairfax County, the City of Alexandria, the City of Falls Church, and Fairfax City in Virginia; and the District of Columbia. Figure 1 shows these jurisdictions, along with the adopted 101-mile Metrorail system.

Since the beginning of WMATA transit operations in 1972, the Board of Directors has attempted to keep passenger fares as low as possible subject to local fiscal constraints. The fare structures that have been instituted on Metrorail since its inception have provided enough revenue to cover only about half the cost of operating the system. The remaining half has been provided by subsidies--financial contributions received from sources other than passenger fares--the responsibility for which has been shared by the local political jurisdictions and the federal government. Table 1 gives this "operating assistance" requirement for each of three consecutive fiscal years, FY 1978 to FY 1980. This paper focuses on the jurisdictional distribution of the Metrorail subsidy requirement (line 3 in Table 1) only.

METRORAIL SUBSIDY ALLOCATION PROBLEM

Given the above stated operating assistance requirements, one is led logically to the question of the extent to which each local jurisdiction is obligated to support the Metrorail system out of its general