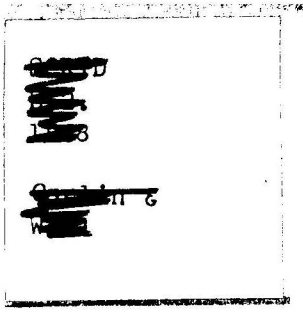

AN ECONOMIC RE-EVALUATION OF THE PROPOSED LOS ANGELES RAPID TRANSIT SYSTEM

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An issue of immediate importance to Los Angeles residents is whether a rail rapid transit system should be built and heavily subsidized out of a proposed sales tax. Although such projects seem to be currently fashionable in the larger North American cities without such facilities, we believe that the economic feasibility of this project deserves more careful scrutiny than it has thus far received. After some summary comments of more general interest, this paper will examine in some detail the economic justification recently presented for the project by the Southern California Rapid Transit District in their Final Report.[1]

SUMMARY AND MORE GENERAL COMMENTS

In forming an opinion about the desirability of such a rapid transit system for Los Angeles, it is important to carefully consider how it will serve the community, not only in the late 1970's when the system will be fully operational, but in the years to follow. Although no one single statistic, or set of statistics, can fully indicate how the populace in general will be served by the proposed LA rail transit system, it will be helpful to note that the Los Angeles region is presently served by 29,000 miles of local and collector streets, major arterials, freeways and expressways (almost 500 miles of which are freeways and expressways), that the region in 1946 was served by

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1100 miles of inter-urban electric railways, and that the SCRTD (Southern California Rapid Transit District) is proposing the constructure of a new, small-scale 90 route-mile rail transit system. At the outset, then, it is obvious that only a relatively few points of interest, employment, and residence would be linked together and thus served by the proposed transit system.

For the services provided by this system, the Los Angeles voter is being asked to approve up to one-half of 1 percent sales tax (in addition to the fares that will have to be paid for use of the system if and when operating) extending at least to the year 2017. However, this assumes that the SCRTD's cost and revenue estimates are correct; if they are not (and as pointed out below we seriously question whether the traffic and, therefore, revenue will be as high as SCRTD's consultants' estimate), the SCRTD would be forced to impose even higher taxes. But assuming that the one-half percent turned out to be the final rate, each family would be forced to pay the following amounts per year for almost fifty years according to their expenditures on items subject to sales tax, regardless of whether any member used the system:

Annual taxable expenditures	$5,000	7,500	10,000	15,000	25,000
Annual SCRTD tax	25	38	50	75	125
Present value of tax[1]	394	591	788	1,182	1,970

As shown, this is equivalent to an immediate expenditure of $400 to $2,000 for families with yearly taxable expenditures ranging from $5,000 to $25,000.

It is also important to consider the extent to which this small fixed-rail system would actually be used. Of course, no one can be sure what the eventual ridership would be unless the rail system is actually built, but it would probably fall somewhere between 1 and 2 percent of the daily tripmaking made in the Los Angeles region. To those few percent who would use the system frequently, the additional taxes may seem worthwhile, but to the many who would never or only

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[1] Taxes paid over a 50-year period at a discount rate of 6 percent.

occasionally use it, they may not. Furthermore, when it is pointed out that the users of North American suburban commuter railroad (and similar) facilities (a description which can fairly be applied to the proposed LA system) tend to be considerably wealthier than other travelers and residents of a region, one must be concerned with the high chance that well-to-do rail transit users will be subsidized by less well-to-do non-users.

After carefully analyzing the economic justification for the project presented by the SCRTD, it is our conclusion that there will not only be many citizens (if not a majority) who will find the costs to exceed the benefits, but also that on balance the costs to the community as a whole will exceed the benefits. In other words, the project does not appear to be economically justified and would make the community worse off economically than if it were not built. Our reasons for this strong conclusion are three in number and will be documented in turn in the following pages.

(I) There are compelling reasons for believing that the Final Report's traffic estimates, on which all the economic calculations are based, are grossly optimistic;

(II) The Final Report uses at least four economically unjustified procedures in computing the net benefits and costs for the project. The net effect is to overstate annual benefits relative to costs by over $80 million;

(III) The "community benefits" claimed are excessive. No adequate justification is given for at least $49 million of the annual benefits claimed.

If benefits and costs are recomputed to take into account adjustments for (II) and (III), the result is that quantifiable costs exceed benefits by more than $15 million in 1980. Although there are other non-quantified benefits claimed in the Report, these are more than offset, in our judgment, by the effects of the unduly optimistic traffic estimates.

Finally, and on a more positive note, we would argue that this proposed rail transit system should be viewed and analyzed alongside other possible urban transport system improvements. Particularly, it would seem desirable to consider more carefully -- and as part of the SCRTD study program -- those alternatives that would offer broader

coverage, that would stand a reasonable chance of enjoying high usage, or that would afford better levels of transport service and be readily adaptable to our mobile and ever-changing urban society of today and tomorrow. Without attempting to be complete about listing such possibilities or to assert their feasibility, we would mention the following: (1) bus rapid transit, perhaps to operate express service over private, grade-separated expressways and to provide a direct-connection residential feeder service; (2) construction of additional loop, cross-town and/or through-downtown freeways; and (3) the substitution of "free-entry" taxi services (similar to the Washington, D. C. situation) for the franchise type taxi service now available in the LA area.

I. QUESTIONABLE TRAFFIC ESTIMATES

As in the case of other consultant-prepared ridership and revenue estimates for proposed rapid transit systems, which almost without exception have proved higher than the actual figures once the systems were built, it is appropriate to question the estimates presented in the Final Report for the proposed LA system. The experience of Cleveland's postwar rapid transit system is a typical case in point Although the consultants "conservatively estimated" annual ridership to be 32 million at the outset, the actual ridership during the best year since the 1955 opening has been only 18.3 million. More importantly, since that best year -- the fifth full year of operation -- the ridership has steadily fallen and now is scarcely 16 million annually.

The highly heralded rapid transit system in Toronto can also be examined to gain further insight. There, ridership on the postwar rapid transit lines began to fall only three years following the first full year of operation and continued to decline for five years until the rapid transit lines were extended and subsidized; since that time the system has been expanded twice and ridership is still increasing. Even so, it is important to record that the total transit system ridership in Toronto in 1967 -- after the construction and subsidization of the 15-mile rapid transit lines to supplement the surface transit system -- was only one-half of 1 percent higher than that which was experienced on the surface transit system prior to the construction of the rapid transit portion. In short, the rapid transit construction and extensions have as a practical matter merely shifted people from one transit mode to another (and at the expense of a general subsidy).

The ridership patterns and trends on the other North American rapid transit systems are no more encouraging (see Appendix Table 1). On the New York, Chicago, Philadelphia and Boston rapid transit systems, all of which have been extended and which have experienced service improvements and subsidies, ridership has declined at least 25 percent since 1946 and at best has dropped only 1 percent since 1956.

To compare present ridership patterns and other circumstances in those North American cities having rapid transit to those that might be expected in Los Angeles -- should the proposed LA rapid transit system be built as planned -- is of course a shaky proposition and of questionable value. Nevertheless, some perspective can be gained by summarizing data on particular land use and transport system characteristics.

The Final Report anticipates higher rail transit usage in Los Angeles (138,000,000 passengers a year in 1980) than is now experienced in Chicago (about 115,000,000). Is this a reasonable expectation?

First, rail rapid transit facilities in Chicago -- consisting of five lines spread over 68 route miles (for an average line length of 14 miles, compared with an average length of 18 miles for the five lines proposed for Los Angeles) -- have less miles of coverage than the system planned for LA (see Appendix Table 2). That is, the LA lines would extend farther into the suburbs. But do the downtown workers live way out in the suburbs? Not in Chicago. For instance, 88 percent of Chicago central business district (CBD) workers live within 14 miles of the CBD and 91 percent within 16 miles and 96 percent within 20 miles. Of more relevance for Los Angeles, the results of the Los Angeles Regional Transportation Study (LARTS) show that the great bulk of the LA Central Business District person trips originate or terminate at areas lying within 5 to 10 miles of the CBD; virtually no trips have origins or destinations outside a 10 mile ring and only a negligible number farther out.[1] Thus, the extended suburban coverage in Los Angeles -- as in Chicago -- seems to be aimed at a non-existent ridership potential.

But while the LA rapid transit system -- if built as proposed -- will have about 90 route miles compared with Chicago's 68 route miles, the LA system proposal includes only 67 stations, a figure about half as large as Chicago's 136 rapid transit stations. Consequently, on this score one would expect LA's system to have considerably lower ridership than that experienced in Chicago.

Second, in wondering about the reasonableness of the LA ridership estimates, it is of obvious importance to ask whether Los Angeles has the residential density and concentration of employment to engender high

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[1] LARTS Volume 1, Base Year Report, December 1963, p. 56.

usage of a fixed rail system which, as a practical matter, should be viewed as a commuter system for CBD workers. On this point, Los Angeles occupies a much less than optimistic position. Chicago, for example, has a residential density which averages 16,000 persons per square mile over a land area of 225 square miles; Los Angeles, by contrast, has a much lower residential density which averages about 9,000 persons per square mile over its densest 200 square miles. (Even the density in Los Angeles' densest 80 square mile area is only 11,000.) With a residential density only one-half as large as Chicago's, and with a station spacing over twice that of Chicago's, one hardly can anticipate ridership in Los Angeles to even approach Chicago's, much less surpass it as the SCRTD consultants expect. Of perhaps greater importance, the concentration of employment in downtown Los Angeles is far below that in Chicago in all terms. Specifically, the absolute employment in Chicago's 1.1 square mile CBD is about three times that in Los Angeles' 0.6 square mile CBD. Thus, the employment density in the Chicago core area -- the area served most appropriately by rail transit -- is over 75 percent higher than that in Los Angeles' CBD.

Couple these facts with the important ones that highway transport is less congested and faster and more flexible (in terms of route choices) in Los Angeles than in Chicago and that the populace in Los Angeles is more affluent than that in Chicago, and even more pessimism must be expressed about the high transit ridership estimates, even now and more particularly so in the years ahead.

II. INVALID PROCEDURES

The Final Report follows at least four unjustified procedures in computing the net equivalent annual benefits for the project; three of these have the effect of inflating the net benefits. Specifically, these include the following:

(A) Computation of benefits and costs in terms of price levels of different years;

(B) Incomplete accounting of annual capital costs;

(C) Inclusion of irrelevant alleged benefits not resulting from the construction of the project;

(D) Use of fares and fees expected to be paid on the rapid transit system rather than the operating costs of the system in computing benefits and costs.

(A) DIFFERENT PRICE LEVELS

The Final Report (p. SRI-5) adds $58.5 million in annual benefits as an "adjustment for inflation." The effect is to value benefits in terms of (necessarily hypothetical) 1980 dollars while construction costs are estimated in terms of hypothetical costs at the time of expenditure. Since most of the construction expenditures occur in the early 1970's, the result is to inflate the benefits relative to capital costs and to compare numbers that cannot validly be compared.

Since operating costs are estimated only in March 1968 prices and should be included in any estimate of costs, and since there is little basis for estimating future rates of inflation in construction costs or benefits, the simplest way to handle the problem is by computing all benefits and costs in terms of 1968 prices. In order to do so, it is only necessary to deflate the estimated construction costs. Since the Report states that a 7 percent annual inflation has been assumed in deriving its costs,[1] it is relatively simple to do this (see columns 3 to 5 of Table 1).

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[1] Page JV-43.

Table 1

CAPITAL COSTS OF PROPOSED LA RAPID TRANSIT SYSTEM IN 1968 PRICES AS OF DECEMBER 1976

Fiscal Year Incurred	Expenditure Shown by SCRTD ($ millions)	Derivation of Escalation Factor	Assumed Escalation Factor	Expenditure in 1968 Prices ($ millions)	Derivation of 1976 Value Factor	1976 Value Factor	Expenditure as of December 1976 ($ millions)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
1968-69	17.6	1.07	1.070	16.5	$(1.045)(1.06)^7$	1.571	25.9
1969-70	72.5	$(1.0525)(1.07)$	1.126	64.4	$(1.06)^7$	1.504	96.9
1970-71	214.1	$(1.0525)(1.07)^2$	1.205	177.7	$(1.06)^6$	1.419	252.1
1971-72	395.1	$(1.0525)(1.07)^3$	1.289	306.4	$(1.06)^5$	1.338	410.1
1972-73	555.7	$(1.0525)(1.07)^4$	1.380	402.8	$(1.06)^4$	1.262	508.5
1973-74	568.1	$(1.0525)(1.07)^5$	1.476	384.8	$(1.06)^3$	1.191	458.3
1974-75	405.5	$(1.0525)(1.07)^6$	1.579	256.7	$(1.06)^2$	1.124	288.4
1975-76	210.7	$(1.0525)(1.07)^7$	1.690	124.7	(1.06)	1.060	132.2
1976-77	44.1	$(1.0525)(1.07)^8$	1.808	24.4	(1.015)	1.015	24.7
	2,483.4			1,758.4			2,197.1

Notes on column:

(1): Southern California Rapid Transit District (SCRTD) Fiscal Year, July to June.

(2): As shown in SCRTD Final Report, May 1968, p. SY-3, except that $31.5 million representing the cost of refunding outstanding SCRTD revenue bonds has been subtracted from the 1968-69 expenditure.

(3): Assumes that the 7 percent inflation assumed in the Final Report (ibid., p. JV-43) has been calculated from March 1968 prices, as have other costs in the Report. The purpose of column (3) is to reconstruct the escalation factors by which the March 1968 costs were originally multiplied to obtain column (2). A rough check that these are approximately the escalation factors used in the Report is provided by the fact that the difference between the column totals in columns (2) and (5) is $724.6 million, compared with $622.7 million escalation on construction (out of $2,013.6 million as shown on p. JV-43) and an unknown amount on the remaining.

(4): Product of factors shown in column (3).

(5): Column (2) divided by column (4).

(6): Factors by which column (5) must be multiplied to account for interest at 6 percent from the time the expenditure was incurred to December, 1976.

(7): Product of factors shown in column (6).

(8): Column (5) multiplied by column (7).

(B) INCOMPLETE ACCOUNTING OF ANNUAL CAPITAL COSTS

The Final Report derives annual equivalent capital costs by making some inadequately explained "adjustments to convert debt service payment schedule to average annual cost over 40 years."[1] Since we have been unable to reconstruct the Report's figures from the information provided, and since the debt service payment schedule bears no necessary relation to annual capital costs suitable for use in a benefit-cost analysis,[2] we have computed our own estimate of equivalent annual capital costs.

The most convenient approach is to start by valuing all expenditures in terms of their value in a single year. Since the Report suggests that the end of 1976 would mark the termination of construction and start of full operations, December 1976 has been selected.[3] Table 1 shows how the value of all construction expenditures as of December 1976 can be derived at the Report's recommended 6 percent rate of interest. After construction costs have been deflated to 1968 prices, the easiest way to derive annual costs is by first valuing these investment expenditures as of the end of the construction period (still in 1968 prices) -- December 1976 -- by

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[1] Op. cit., p. SRI-5.

[2] The debt service payments schedule differs from what is needed here in at least three important respects:

(1) Debt service payments do not reflect those capital costs that would be met directly at time of construction out of receipts from the proposed one-half percent sales tax.

(2) The debt service figures are based on an interest rate of 4½ percent rather than the 6 percent advocated by the Report (p. SRI-5) as a basis for economic comparisons.

(3) The debt service payments during the "period of level payments" has the effect of excluding interest during the construction period.

[3] Although the Report claims that some operations would commence earlier, it would appear to be a reasonable simplifying assumption (in the absence of any relevant data in the Report) that benefits would begin to be realized in January, 1977.

adding the interest suggested by the Report[1] to the deflated expenditures.

As shown in the Table, this total comes to about $2.2 billion. It then follows that the equivalent annual capital costs are $146 million,[2] a slightly larger number than the $140 million shown in the Report despite the presumably much lower expenditure levels ($1.76 billion) used (column 5 compared to column 2) in our computation. Application of similar methods to the expenditure levels shown in column 2 would lead to much higher annual capital costs.

(C) INCLUSION OF IRRELEVANT BENEFITS

The Final Report includes $14.9 million in benefits from an alleged surplus in revenue over operating costs resulting from construction of project. If realized, this would be purely a financial "benefit" since it does not result from any investment now contemplated as part of the proposed rapid transit project. For reasons presented in Section I above, this operating surplus itself seems unlikely. But even if it should be realized, it does not belong in an economic analysis intended to assess the economic justification for a project. A more realistic assessment of this amount would seem to be that it represents a minimal cushion to cover operating costs if (as seems likely) traffic should fall short of the Report's estimates.

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[1]The Report (p. SRI-5) advocates use of a 6 percent rate of discount. Although we strongly favor the use of a higher rate of interest, we have used 6 percent in these calculations to avoid argument about this controversial subject. Since the annual costs of the project are quite sensitive to the interest rate assumed, use of a higher interest rate would greatly reduce net equivalent annual benefits and hence weaken the economic case for the project. The presence of substantial economic risks in the project would make the use of a much higher interest rate particularly appropriate in this case. Our argument for a higher rate runs along similar lines to that presented by Jack Hirshleifer, James DeHaven, and Jerome Milliman for the water supply industry in their book, Water Supply: Economics, Technology and Policy (University of Chicago Press, 1960), pp. 144-148.

[2]The equivalent annual cost (assuming for the moment that the project has no salvage value at the end of n years)

$$c = \frac{C_o i(1+i)^n}{(1+i)^n - 1} = \$146.0,$$

(D) USE OF FARES AND FEES RATHER THAN OPERATING COSTS

The Final Report made one conceptual error that decreased the computed net annual benefits of the project. When computing the social benefits from substituting one mode of transport for another, the correct procedure is to measure the difference in avoidable costs between the two modes.[1] In calculating variable costs, however, the Report measures the difference between the reduction in traveler (mainly automobile) costs to those who switch to rapid transit and the expected fares and fees to be paid by rapid transit patrons. Since fares and fees do not necessarily bear any relationship to rapid transit operating costs, the correct procedure is to measure the difference between the reduction in traveler costs and the increase in total SCRTD system operating costs with the rapid transit project over what it would be without the project. In this case the numbers are very similar, namely, $49.2 million for increased operating costs[2] compared to $49.5 million for fares and fees.

(see Hirshleifer, et al., ibid., p. 155) where

C_o = value of capital expenditures as of December 1976 = $2,197.7 million,

i = assumed interest rate = 0.06, and

n = life of project in years = 40.

[1] Hans A. Adler, "Economic Evaluation of Transport Projects," in Gary Fromm, ed., Transport Investment and Economic Development, Brookings Institution, Washington, 1965, p. 184. This assumes that the travel service and ridership volume are identical for the two.

[2] Although the total increase in operating costs is not derived in the Report, it presents figures implying that the total is $49.2 million. Specifically, it states (p. SRI-10) that the costs (in millions) are:

Operating expenses for rapid transit and feeder bus operations	$48.6
Equivalent annual cost of replacements	6.0
Gross operating expenses	54.6
Reduction in bus system costs	-5.4
Net operating expenses	$49.2

III. INFLATED COMMUNITY BENEFITS

The Final Report quantifies $109 million in annual benefits to the community. Under the best of circumstances, such benefits are even more difficult to accurately quantify than the "traveler benefits." Three of the Report's benefits involving $64 million annually appear particularly questionable, namely, construction employment benefits, "improvements in life style," and business productivity increases.

Of these three items, the first is the most clearly invalid. In order to find $24 million in annual benefits, the Report assumes that "a reduction in construction unemployment will occur equal to 50 percent of the average magnitude of the SCRTD construction work force."[1] Although it is difficult to predict the future unemployment in the construction trades, such high levels among the particular trades required for this project seem most improbable. But regardless of what the percentage may be, we believe that none of the construction labor costs should be charged off to unemployment relief in a cost-benefit analysis except during a severe depression that can be expected to last for some time.[2]

Although there may be some community benefits resulting from "improvements in life style," the Report makes no adequate case for assigning $25 million in annual benefits from this source. There may indeed be some benefits to the non-driver above what he would pay in fares. It should be noted, however, that in general those who do not have access to or "first call" on a car are also those to whom such access would be least valuable to the economy. The "improvements in life style" alleged for the other District residents are even more difficult to quantify or even define. The choice of $2.75 per inhabitant (including both small children and adults with first claim on an automobile)

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[1] Final Report, op. cit., p. SRI-13.

[2] See Hirshleifer, et al., op. cit., pp. 130-131.

appears to be quite arbitrary and without substantive basis. We do not believe that the Report has presented an adequate basis for quantifying such benefits.

Finally, although a rapid transit system might result in some of the minor improvements in business productivity claimed in the Report, the Report does not present any particular basis for believing that the increase would amount to 0.05 percent of gross business activity as opposed to any other percentage of any other measure of business activity. It may well be that the support accorded the rapid transit proposal by the Los Angeles Chamber of Commerce is based more on the stimulus that the system may give to the central business district at the expense of outlying business districts than to the alleged increase in business productivity. Without a better basis for estimating the benefits to business productivity, we believe it would be better not to attempt to quantify them at all.

Even giving the benefit of the doubt to the remaining alleged community benefits, we cannot accept either the $24 million for "construction employment benefits" or the $25 million for "improvements in life style." No adequate basis is presented for the $15 million alleged "business productivity" benefits either, but even including this last item, the total quantified "community benefits" comes to no more than $60 million annually.

COSTS AND BENEFITS RECOMPUTED

With the adjustments suggested in this and the preceding section in mind, it is possible to recompute the quantifiable benefits and costs from the project, still assuming the highly dubious traffic estimates presented in the Report. As shown in Table 2, the quantifiable net equivalent annual costs, as recomputed, exceed the benefits by at least $15 million annually.

Although the Report identifies a number of non-quantified benefits, it appears to omit at least one major non-quantifiable cost, namely, the added inconvenience and discomfort of taking public transportation. Even if travel time is equal or smaller and the costs higher, many

Table 2

NET EQUIVALENT ANNUAL BENEFITS OF PROPOSED LA RAPID TRANSIT SYSTEM ASSUMING SCRTD TRAFFIC ESTIMATES (millions of 1968 dollars)

		SCRTD Final Report	Carlin-Wohl
		(1)	(2)
1.1	Traveler benefits	$ 85.3	$ 119.9
1.2	Community benefits	109.0	60.0
1.3	Adjustment for inflation	58.5	--
1.4	Equivalent annual benefits	252.8	179.9
2.1	Annual operating costs	--	49.2
2.2	Equivalent annual capital costs	140.2	146.0
2.3	Less equivalent value of $700 million salvage value of ROW and structures received in 2017	-4.5	-4.5
2.4	Equivalent annual costs	135.7	195.2
3.1	Net equivalent annual benefits	117.1	-15.3

Notes on line:

1.1. Column (1): From Southern California Rapid Transit District, Final Report, May 1968, p. SRI-6. Column (2): Reduction in traveler costs (ibid.) minus $14.9 million in "service improvements or fare reductions."

1.2. Column (1): Ibid., p. SRI-11. Column (2): As derived on pp. 13-14 of this paper. Includes $15 million of inadequately documented alleged benefits to "business productivity." Excluding these, line 3.1 would be -$30.3 million.

2.1. As derived on p. 12 of this paper.

2.2. Column (1): Final Report, p. SRI-11. Column (2): As derived on pp. 10-12 of this paper.

2.3. As shown in the Final Report, p. SRI-11.

people would prefer to drive their own cars to work rather than to take public transportation.[1] Many are willing to pay a penalty in terms of time and money to avoid walking at one or both ends of their trips, to avoid possibly crowded conditions, to listen to the radio on their way to work, not to have to wait for transit vehicles, and not to have to meet possibly inconvenient and inflexible schedules so as to minimize delays. Among those who do switch in spite of these costs, the benefits will not be as large as their monetary savings.[2]

Nevertheless, even if the non-quantifiable benefits do exceed the non-quantifiable costs, we believe that the excess is more than offset by the grossly optimistic traffic estimates assumed in both the Report and our Table 2. We further do not necessarily accept the judgment that net benefits will increase in the years after 1980. As pointed out in Section I above, most North American rapid transit systems have experienced falling rather than rising patronage.

On balance, then, it is our judgment that the proposed rapid transit system for Los Angeles is not economically justified.

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[1] Hans A. Adler, op. cit., the author of one article on the economic evaluation of transportation projects, singles out the case of passenger trips previously made by bus but now made by private car for the comment that "The higher relative operating costs of a private car are evidently outweighed by its advantages, especially the greater convenience and comfort; it is usually not possible to measure this difference in monetary terms." Although Adler's remarks are directed particularly at automobile versus bus transportation (which many potential users of the proposed LA rapid transit system would have to use in order to reach the system), they would seem to apply in somewhat reduced measure to rapid transit as well.

[2] The inconvenience and discomfort factors need to be taken into account both in deriving the traffic estimates and as non-quantifiable costs of those who switch from automobiles to rapid transit. Although the Report mentions inconvenience and discomfort (p. CC-4) as factors affecting passenger choice of mode, it does not make precisely clear whether or to what extent they were used in estimating the number of passengers expected to be diverted to rapid transit. The Report's discussion suggests that the primary factor used in differentiating between diverted and non-diverted trips was total trip time. It is possible that it was failure to take these factors into account that resulted in the rather optimistic traffic forecasts in the Report.

Appendix Table 1

ANNUAL REVENUE-PASSENGER TRENDS ON NORTH AMERICAN RAPID TRANSIT SYSTEMS
(Index: 1956 = 100.0)

Year	Cleveland	Toronto	New York	Chicago	Philadelphia	Boston[a]
1946			151.8	136.8	177.8	185.1
1950			121.9	95.2	137.3	140.2
1951			117.5	97.1[b]	126.2	132.3
1952			114.1	97.0	123.0	127.0
1953			114.0	96.1	114.8	122.8
1954			103.9	95.8	109.2	112.1
1955		97.0[c]	101.0	97.2	102.8[d]	103.6
1956	100.0[c]	100.0	100.0[e]	100.0	100.0	100.0
1957	107.0	101.0	99.5	97.2	95.6	96.6
1958	105.7[f]	99.1	96.7	92.8[g]	92.0	94.1
1959	121.0	99.1	97.2	98.1	89.5	92.4[h]
1960	124.7	95.7	98.7	97.6[i]	90.1	91.2
1961	120.9	91.0[j]	100.0	95.2	92.9	88.5
1962	117.5	91.0[m]	100.5	98.9	89.4	(81.6)[k]
1963	115.1	100.8	100.0	96.1	NA	(79.1)
1964	113.8	105.1	100.3	96.2	81.7	(80.5)
1965	113.1	109.8	98.6	99.1	80.3	(78.8)

Notes on following page.

Appendix Table 1 (Continued):

Notes:

[a]Two extensions of existing lines have been made since 1947.

[b]Milwaukee Avenue and Dearborn Line opened in 1951.

[c]First full year of operation.

[d]Woodland Avenue extension opened in 1955.

[e]Rockaway Line opened during 1956.

[f]CTS Westside extension opened during 1958.

[g]Congress Street Line opened during 1958.

[h]Highland Branch Line extension opened during 1959.

[i]Congress Street Line extension opened during 1960.

[j]Estimate by Toronto Transit Commission, based on 11 months actual data (letter to authors of The Urban Transportation Problem).

[k]Parentheses indicate that indexes were computed on the basis of "revenue fares collected." (Fares are collected more than once from passengers.)

[m]Original system extended 2 miles (or about 50 percent) within downtown Toronto during 1963.

[n]Data requested but not yet received.

[NA]Data not available.

Source:

J. Meyer, J. Kain, and M. Wohl, The Urban Transportation Problem, Harvard University Press, Cambridge, 1965.

Appendix Table 2

COMPARATIVE STATISTICS INFLUENCING RAPID TRANSIT USE IN LOS ANGELES (PROPOSED), CHICAGO, AND BOSTON

	Estimates for Five-corridor LA Plan		Actual 1965 Figures for: Chicago	Boston
1. Annual passenger ridership on rapid transit system (millions)	138.0[a]		114.6	100.9
2. Route miles of rapid transit	89.1		68.2	43.0
3. Average distance between rapid transit stations (miles)	1.33		0.50	0.62
4. No. of rapid transit stations	67		136	62
5. Daily person trips ending in CBD (thousands)	158		466	370
6. CBD land area (sq. miles)	0.6		1.1	1.1
7. Daily person trip density to CBD (thousands)	250		439	336
8. SMSA[b] population (millions)	6.743		6.220	2.589
9. Residential density in densest area shown in line 10 (thousands of persons per sq. mile)	9.3	11.0	16.0	12.6
10. Densest land area (sq. miles)	200	79	225	83

Note:

[a] 1980 estimate.

[b] Standard Metropolitan Statistical Area.