FILE NUMBER **00003**

SUBJECT **30-Year Bus vs. Blue Line Costs**

ORIGINAL DATE **August 21, 1990**

COMMENTS **Retrospective Alternatives Analysis of Blue Line and comparison of costs of building and operating Blue Line for 30 years and using same amount of money and using it for bus.**

ORIGINAL FILE NAME **30YRLIFE**

INTEROFFICE MEMORANDUM
SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
OFFICE OF THE CONTROLLER-TREASURER

****

DATE: **August 21, 1990**

TO: **Alan Pegg**
Art Leahy
Al Perdon
John Richeson
Gary Spivack

FROM: **Tom Rubin**

SUBJECT: Bus vs. Rail Costs

****

I was interested in comparing the life-cycle costs of providing transit services by light rail versus bus. Based on the construction costs of the Blue Line and our budgeted operating costs for FY91, I made a few estimates that may be of interest. I am interested in your comments on this quick and dirty "alternatives analysis."

Conclusion

The methodology leads to a conclusion that for the same level of

funding, we can either afford to build and operate the Blue Line for 30 years or operate 430 buses for 33 years (including the cost of building the operating divisions to support these new buses). For the same cost, however, the buses would produce over four and one-half times as many passenger miles and over nine times as many passengers. This result is reached even though the assumptions utilized tend to favor the Blue Line on several important issues.

General Methodology

I decided to use a thirty-five year period for comparability. This was basically a product of five years to construct the Blue Line from the date of approval plus a thirty year operating life. A comparable thirty-five year period was used for bus, except that it was assumed that it would take two years from the date of approval to build new bus operating garages and put them into operation from the date of approval for construction of bus facilities and purchase of buses. Therefore, we are comparing 33 years of bus operations vs. 30 years of rail operations. Although this produces 10% more passengers and passenger miles for bus, it actually hurts bus on the cost comparisons. Bus is much less capital intensive than rail and this methodology shifts more bus costs into the early years, so this assumption does not favor bus because of the discounting methodology used.
I did a rather simple model, doing all figures in constant dollars and assuming that cost and revenue relationships would remain stable over time. This is obviously a simplistic assumption, but all other methodologies are at least equally subject to question, so basically, I went with the status quo.

All cash flows were assumed to fall on the first day of each year. All cash flows were discounted at a rate of 3% per year, which approximates the average, long-term, rate of return on high rated debt securities after discounting for inflation. (Since I'm using constant dollars, the discount rate must be adjusted for inflation.)

The key performance indicators are tied to unlinked passenger trips and passenger miles consumed. These are not discounted -- a trip in year seven is "worth" exactly as much as a trip in year thirty five. If the trips were discounted, the analysis would be much more favorable to bus.

No consideration is given to the source of funding in this analysis. Therefore, for example, the Blue Line capital costs, which were 100% locally funded, were treated in exactly the same manner as buying buses or building bus operating divisions, which

are generally 75% to 80% funded by Federal grants. The full costs are shown in both cases.

Light Rail

I used the following as the capital costs of the Blue Line:

Year 1	$100 million
Year 2	200 million
Year 3	300 million
Year 4	200 million
Year 5	100 million
Total	$900 million

The reported costs are only slightly higher than this, as measured in current year dollars. However, I believe that $900 in current year dollars is pretty close because:

. Not all the costs of original construction are in yet. In particular, the Compton work for rerouting the Southern Pacific track is yet to be finalized and done.

. There will be additional capital costs for items not in the original budget, such as protective fences at elevated stations

. It appears that not all of the Blue Line costs were charged to the Blue Line

Nothing was put in for capital renewal and replacement, which is, of course, not a possible condition in the real world. At the end of the thirty-five year period, the trackwork and Division 11 will have useful life left. The rail cars may reach thirty years of useful life, with proper care, but any use beyond that is highly questionable without complete remanufacture. As a practical matter, they will almost certainly need major rebuild work to reach thirty years.

The FY91 budget for Blue Line operating expenses, with modifications for conditions that have changed from the June budget approval, is estimated at approximately $36,000,000 at this time. I have assumed that operating costs will stabilize at $35 million, reflecting such future changes as reduction in security costs when LASD is replaced by out transit police and increases in P/L-P/D

costs when SCRTD, rather than LACTC, will be picking up the self-insured reserve expenditures. Also, the revenue estimates are based on a 67% increase in daily ridership over the approximately 18,000 current passengers, which will of course require an increase in the level of transit operations, and therefore maintenance, and other passenger-driven expenditures, such as P/L-P/D.

I assumed $5 million/year operating revenues, calculated:

Average Weekday Passengers		30,000
Weekdays to Annual Conversion Factor	x	302
Average Fare/Passenger	x	$.55
Annual Fare Revenues		$4,983,000

Calculation of annual passengers and passenger miles is as follows:

Average Weekday Passengers		30,000
Weekdays to Annual Conversion Factor	x	302
Annual Passengers		9,060,000
Average Trip Length	x	8.1
Annual Passenger Miles		73,386,000

The 30,000 passenger forecast is one of many that have been thrown around from time to time. The 8.1 mile average trip length is from the latest UTPS models we ran for "mature" full system, pre-Green/ Blue operations (Fall 1991 - this model forecast 17,000 daily riders).

Bus

I assumed that one new bus operating division would be required for each 200 new buses. The cost of a new, 200-bus operating division is as follows:

Year 1	$ 6.5 million
Year 2	6.5 million
Total	$13.0 million

The operating divisions are assumed to require no renewal and replacement over the period and are assumed to have a thirty year life. These assumptions are obviously simplistic, but the renewal and replacement capital costs are not a big factor and they tend to occur in later years where the discount factor has a big impact.

Buses are new, standard, 40 foot, 102" diesels at a cost of $185,000 each, which is what we were paying for a fully equipped bus three years ago. Buses are assumed to have a twelve year life, last the entire twelve years, not require a major rebuild during the twelve years, and are retired exactly at the end of the twelve years. New buses are delivered; paid for in full on the first day of years 3, 15, and 27; and put into full operations on the day that they are delivered. Again, these assumptions are somewhat simplistic, but the deviations from reality do not have much of an impact on the analysis. The buses purchased in year 27 will have three years of useful life left at the end of the thirty-five year analysis period. No adjustment is made for the value of this extra useful life.

Operating cost per bus was computed from the FY91 budget:

FY91 Bus Operating Costs	$582,430,000
Divided By: Active Fleet	2,480
Annual Operating Cost/Bus	$ 234,851

Operating revenue was assumed to be 42% of operating costs, as per FY91 budget. As a practical matter, the $582 million figure above includes a lot of "fixed" costs, so that the marginal operating cost of an additional bus are probably significantly lower. On the other hand, the marginal bus may not carry as many riders, which would reduce marginal revenue, although our recent experience tends to show that there is a huge unmet demand for bus service out there. The population of the Los Angeles area continues to increase at a high rate, creating a larger demand for transit services. Therefore, these factors are assumed to cancel each other out.

1988 Section 15 report data was used to compute passengers and passenger miles:

Average Passenger Miles Per Active Bus	710,000
Divided by: Average Trip Length	4.0

Average Passengers Per Active Bus	177,500

The FY88 figure was nearer to the bottom than the top of the range of recent years, although FY89 was slightly lower. There may be some question if a marginal bus can produce this many passengers and passenger miles. My feeling is that it will probably be pretty close.

Comparative Analysis

I used a rather simple spreadsheet that produced a thirty-five year discounted net cash outflow of 430 buses that was almost identical to that of the Blue Line over the period, as summarized as follows:

	.....Millions.....	
Cash Flows (Undiscounted)	Blue Line	Bus
Capital		
System Total	$ 900	
2.15 Bus Operating Divisions @ $13 Million Each		$ 28
430 Buses @ $185,000 Each Times Three Generations		226
Total Capital	900	254
Operating		
Annual System Operating Costs	35	
Less: Operating Revenue	5	
Additional Buses		430
Operating Cost/Bus/Year		.235

Operating Cost/Year		101*
Less: Operating Revenue		42*
Net Operating Cost Per Year	30	59*
Times: Years of Service	30	33
Total Net Operating Cost	900	1,947
Total Net Cash Flow (Undiscounted)	$1,800	$2,201
Total Net Cash Flow (Discounted @ 3%)	$1,371	$1,373

* Rounded

Note: The Net Discounted Cash Flows are almost identical, even though the Bus Net (Undiscounted) Cash Flows are approximately 22.3% higher, because a large portion of the Blue Line cash flows are for capital outlays in the early years. Because the Bus cash flows are more heavily annual operating costs, the "interest earnings" on the unspent cash allow higher total expenditures.

	.....Thousands.....	
	Blue Line	Bus
Passengers/Year	9,060	76,325
Times: Years in Operation	30	33
Total Passengers Carried	271,800	2,518,725
Average Trip Length	8.1	4
Total Passenger Miles	2,201,580	10,074,900
Thirty-Five Year Discounted Cash Flow	$1,371 M	$1,373 M
Average "Cost"/Passenger	$5.04	$ .55
Average Cost/Passenger Mile	$.627	$.136

Note: Do not attempt to compare the above statistics to our current budgeted or actual cost per passenger or cost per passenger mile. Because the costs are discounted, but the passengers and passenger miles aren't, the above statistics are much lower than our actual or budgeted statistics. The above statistics are only useful for comparing Blue Line to Bus costs on a more-or-less apples-to-apples basis.

I freely admit that there are gross simplifications in my methodology. However, I maintain that these short-cuts are relatively minor in impact upon the numbers that should be used to make decisions and that the above results are reasonably close to reality, as we expect it to occur at this day and time. The numbers are overwhelmingly in favor of bus over light rail (rail is over nine times as expensive on a per passenger basis and over four times as expensive on a per passenger mile basis), so perhaps there is not a whole lot of need to perform a more detailed, sophisticated analysis.

Also, some of the most important assumptions significantly favor the Blue Line, including:

. I used a 30,000 passenger per day ridership for the entire period. To say the least, this may prove to be quite optimistic, especially in the early years. There is considerable question whether the Blue Line will ever reach 30,000 per day. For a reality check, here are the average daily ridership statistics (1988) for the nations's light rail operators:

Operator/Location	Daily Ridership
GCRTA/Cleveland	13,008
MBTA/Boston	65,876
METRO/Seattle	756
MUNI/San Francisco	130,746
NJTC/Newark	12,737
NFTA/Buffalo	24,577
NORTA/New Orleans	27,024
PAT/Pittsburgh	26,770
SCCTD/San Jose	647
SDTI/San Diego	30,730
SEPTA/Philadelphia	141,586
SRTD/Sacramento	11,860
TRI-MET/Portland	18,495

Blue Line (forecast) 30,000

In FY88, only four light rail operators reached the 30,000 passengers a day mark. Three of these four (MUNI, MBTA, and SEPTA) are long-established, extensive systems with much greater track milage and more vehicles than the Blue Line, and all three tie into extensive heavy rail systems. It is possible for the Blue Line to hit this mark, but far from certain.

. I used an 8.1 mile average trip length for the Blue Line, which amounts to the average trip being over 35% of the length of the line. This number was obtained from a UTPS model and has yet to be verified by actual experience. The average trip length for all light rail systems, as per the UMTA 1988 Section 15 Annual Report, was 3.1 miles, which could lead to some questioning of this assumption. Cleveland reported 7.6, which gave them first place in this statistic by a wide margin. However, our operating characteristics are different from most of the other large light rail operators in the country, so this may be possible. However, if my life depended upon it, and I had to guess if the actual would be higher or lower than 8.1, I'll take the low pool.

. I did not specifically put anything away for capital renewal and replacement for either the Blue Line or Bus fixed facilities. For the Blue Line, this is a major distortion of true long-term spending. For Bus, it does not have much impact. We assume that buses are replaced every twelve years and the annual bus operating costs are based on our FY91 budgeted bus costs, which include the mid-life rebuild program. The only thing of any importance that is ignored in Bus capital renewal and replacement is the operating division costs. Therefore, since bus renewal and replacement is included and nothing is included for the Blue Line, this set of assumptions favors the Blue Line.

. The ignoring of the source of capital funding significantly favors the Blue Line in regard to what this region can afford. As a practical matter, it is likely that we can get some outside funding, particularly Federal Section 3, to assist in the capital costs of expansion of bus service. It is unlikely that we can get any additional outside funding (that we didn't have already and could use for other purposes) to assist in building light rail lines. LACTC may be able to get Glendale or Pasadena to kick in a few millions, for example, but that will probably be about it.

. This simplistic model assumes that light rail exists in a vacuum, which it does not. According to our early models, approximately one-half to three-fourths of the light rail riders will get to the Blue Line via bus. The assumptions in the simplistic model used are such that rail is not charged for these bus costs. While it is true that some bus lines will be modified or discontinued due to the Blue Line start up, the loss of revenue and the changes in other bus lines to serve the Blue Line makes this pretty close to a wash. If we really want to get Blue Line ridership as high as possible, we will have to add significant feeder bus service, and this should be shown as a Blue Line, not Bus, cost.

Further, one of the usual arguments for rail vs. bus is that rail may be more expensive as far as capital goes, but that rail operating costs are much lower. The above analysis does not support this argument. There is no doubt that the first part, rail capital requirements being higher, is correct. The Blue Line capital cost is approximately $900 million, all in the early years, while bus capital is $254 million, with much of it in the later years (and this is for a capital system that will produce many times the transit usage of rail). However, the operating costs of bus are much lower than those of light rail when measured on a cost per unit of consumption basis. It is true that the annual net operating costs of bus are almost twice as high as rail, approximately $59 million vs. $30 million. However, bus carries approximately 8.42 times as many passengers and produces about 3.79 times as many passenger miles per year (even ignoring the extra three years of service that we get with bus).

In short, rail has capital costs that are well over four times higher than bus (when the time value of money is considered) and produces operating costs per passenger mile that are almost twice as high.

INTEROFFICE MEMORANDUM
SOUTHERN CALIFORNIA RAPID TRANSIT DISTRICT
OFFICE OF THE CONTROLLER-TREASURER

****
***

DATE: **September 4, 1991**

TO: **Alan Pegg**
Art Leahy
Al Perdon
John Richeson
Gary Spivack

FROM: **Tom Rubin**

SUBJECT: Bus vs. Rail Costs

****
***

This is a revision of my memo of August 21, 1990, updated using actual FY91 data for Bus and Blue Line operating finance and operating statistics and capital costs.

I was interested in comparing the life-cycle costs of providing transit services by light rail versus bus. Based on the construction costs of the Blue Line and our budgeted operating costs for FY91, I made a few estimates that may be of interest. I am interested in your comments on this quick and dirty "alternatives analysis."

Conclusion

The methodology leads to a conclusion that for the same level of funding, we can either afford to build and operate the Blue Line for 30 years or operate 470 buses for 33 years (including the cost of building the operating divisions to support these new buses). For the same cost, however, the buses would produce almost four as many passenger miles and almost nine times as many passengers. This result is reached even though the assumptions utilized tend to favor the Blue Line on several important issues.

General Methodology

I decided to use a thirty-five year period for comparability.

This was basically a product of five years to construct the Blue Line from the date of approval plus a thirty year operating life. A comparable thirty-five year period was used for bus, except that it was assumed that it would take two years from the date of approval to build new bus operating garages and put them into operation from the date of approval for construction of bus facilities and purchase of buses. Therefore, we are comparing 33 years of bus operations vs. 30 years of rail operations. Although this produces 10% more passengers and passenger miles for bus, it actually hurts bus on the cost comparisons. Bus is much less capital intensive than rail and this methodology shifts more bus costs into the early years, so this assumption does not favor bus because of the discounting methodology used.

I did a rather simple model, doing all figures in constant dollars and assuming that cost and revenue relationships would remain stable over time. This is obviously a simplistic assumption, but all other methodologies are at least equally subject to question, so basically, I went with the status quo.

All cash flows were assumed to fall on the first day of each year. All cash flows were discounted at a rate of 3% per year, which approximates the average, long-term, rate of return on high rated debt securities after discounting for inflation. (Since I'm using constant dollars, the discount rate must be adjusted for inflation.)

The key performance indicators are tied to unlinked passenger trips and passenger miles consumed. These are <u>not</u> discounted -- a trip in year seven is "worth" exactly as much as a trip in year thirty five. If the trips <u>were</u> discounted, the analysis would be much more favorable to bus.

No consideration is given to the source of funding in this analysis. Therefore, for example, the Blue Line capital costs, which were 100% locally funded, were treated in exactly the same manner as buying buses or building bus operating divisions, which are generally 75% to 80% funded by Federal grants. The <u>full</u> costs are shown in both cases.

<u>Light Rail</u>

I used the following as the capital costs of the Blue Line:

Year 1	$105 million
Year 2	210 million
Year 3	315 million

Year 4	210 million
Year 5	105 million
Total	$935 million

The costs reported by the Commission are somewhat lower slightly higher than this, as measured in current year dollars. However, I believe that $945 in current year dollars is pretty close because:

. The latest announced budget that I know of was $877 million, released over two years ago. Since then, there have been significant scope changes, such as the early opening of the Seventh and Flower Station. Also, for several months during FY90 and FY91, the Commission approved three to five million dollars worth of change orders per month. While some of these change orders may have been included in the budget, it is very unusual, in my experience, for a project of this type to have this quantity of large change orders so late in the construction cycle. Finally, I have reason to believe that certain Blue Line construction costs were charged to projects other than the Blue Line.

. Not all the costs of original construction are in yet -- the Compton work for rerouting the Southern Pacific track is yet to be finalized and done.

. There will be additional capital costs for items not in the original budget, such as protective fences at elevated stations

. It appears that not all of the Blue Line costs were charged to the Blue Line

I put nothing was put in for Blue Line capital renewal and replacement, which is, of course, not a possible condition in the real world.

At the end of the thirty-five year period, the trackwork and Division 11 will have useful life left. The rail cars may reach thirty years of useful life, with proper care, but any use beyond that is highly questionable without complete remanufacture. As a practical matter, they will almost certainly need major rebuild work to reach thirty years.

The FY91 actual cost of Blue Line operating expenses was $37,872,000 at this time. To this, I added $672,000 for on-going

costs that were not paid in FY91. This amount approximates the savings from not paying General Farebox, Inc. for ticket vending machine maintenance (TVM) for most of the year while the TVMs were being brought up to a minimum acceptable level of performance. This produces an annual operating expense of $38,500,000 and I have assumed that operating costs will stabilize at this level.

Revenue estimates are based on 30,000 riders per average weekday and a average weekday to annual multiple of 320, producing annual ridership of 9,600,000. It appears that Blue Line ridership has stabilized in the mid to high 20,000's at this time. It is, of course, possible that Blue Line ridership will continue to increase. If it does so, it will be necessary to add additional service to carry these riders (we have already increased service once for FY92 and are likely to have further increases in the near future). This will result in a larger operating loss for the Blue Line. However, the cost per passenger and per passenger mile will decrease. A larger expenditure for Blue Line would, by my model, result in putting more buses on the street, thereby also increasing bus ridership and passenger miles. The net result would be a slight improvement in the rail:bus comparison ratios.

I assumed $5.491 million/year operating revenues, calculated:

Average Weekday Passengers		30,000
Weekdays to Annual Conversion Factor	x	320
Average Fare/Passenger	x	$.572
Annual Fare Revenues		$5,491,000

Calculation of annual passengers and passenger miles is as follows:

Average Weekday Passengers		30,000
Weekdays to Annual Conversion Factor	x	320
Annual Passengers		9,600,000
Average Trip Length	x	9.2
Annual Passenger Miles		88,320,000

The average fare/passenger and the 9.2 mile average trip length are FY91 actual results.

Bus

I assumed that one new bus operating division would be required for each 200 new buses. The cost of a new, 200-bus operating division is as follows:

Year 1	$10 million
Year 2	10 million
Total	$20 million

The operating divisions are assumed to require no renewal and replacement over the period and are assumed to have a thirty year life. These assumptions are obviously simplistic, but the renewal and replacement capital costs are not a big factor and they tend to occur in later years where the discount factor has a big impact.

Buses are new, standard, 40 foot, 102" diesels at a cost of $185,000 each, which is what we were paying for a fully equipped bus three years ago. Buses are assumed to have a twelve year life, last the entire twelve years, not require a major rebuild during the twelve years, and are retired exactly at the end of the twelve years. New buses are delivered; paid for in full on the first day of years 3, 15, and 27; and put into full operations on the day that they are delivered. Again, these assumptions are somewhat simplistic, but the deviations from reality do not have much of an impact on the analysis. The buses purchased in year 27 will have three years of useful life left at the end of the thirty-five year analysis period. No adjustment is made for the value of this extra useful life. Since the FY91 actual costs, which are used for the computations of average cost per bus, include the costs of our bus rebuild program, the cost of bus rebuilds are included in the bus cost per year figure.

Operating cost per bus was computed from the FY91 budget:

FY91 Bus Operating Costs	$572,360,790
Divided By: Active Fleet	2,519
Annual Operating Cost/Bus	$ 227,217

The operating ratio percentage used was FY91 actual, slightly over 42% of operating costs. As a practical matter, the $572 million figure above includes a lot of "fixed" costs, so that the marginal operating cost of an additional bus are probably significantly lower, most likely approximately 80%, based on recent studies used for other purposes. On the other hand, the marginal bus may not carry as many riders, which would reduce marginal revenue, although our recent experience tends to show that there is a huge unmet

demand for bus service out there. The population of the Los Angeles area continues to increase at a high rate, creating a larger demand for transit services. Therefore, these factors are assumed to cancel each other out.

1991 Section 15 actual data was used to compute passengers and passenger miles:

Total Bus Passengers	416,170,000
Divided By: Active Bus Fleet	2,519
Average Passengers Per Bus	165,212

Average bus trip length was 4.0 miles in FY91.

Comparative Analysis

I used a rather simple spreadsheet that produced a thirty-five year discounted net cash outflow of 470 buses that was almost identical to that of the Blue Line over the period, as summarized as follows:

	.....Millions.....	
Cash Flows (Undiscounted)	Blue Line	Bus
Capital		
System Total	$ 945	
2.15 Bus Operating Divisions @ $13 Million Each		$ 47
430 Buses @ $185,000 Each Times Three Generations		261
Total Capital	945	308
Operating		
Annual System Operating Costs	38.5	
Less: Operating Revenue	5.5	
Additional Buses		470

Operating Cost/Bus/Year		.227
Operating Cost/Year		107
Less: Operating Revenue		45
Net Operating Cost Per Year	33	62
Times: Years of Service	30	33
Total Net Operating Cost	990	2,028
Total Net Cash Flow (Undiscounted)	$1,935	$2,335
Total Net Cash Flow (Discounted @ 3%)	$1,466	$1,465

(Schedule does not add due to rounding)

Note: The Net Discounted Cash Flows are almost identical, even though the Bus Net (Undiscounted) Cash Flows are approximately 20.7% higher, because a large portion of the Blue Line cash flows are for capital outlays in the early years. Because the Bus cash flows are more heavily annual operating costs, the "interest earnings" on the unspent cash allow higher total expenditures.

	.....Thousands.....	
	Blue Line	Bus
Passengers/Year	9,600	77,650
Times: Years in Operation	30	33
Total Passengers Carried	288,800	2,562,444
Average Trip Length	9.2	4
Total Passenger Miles	2,649,600	10,249,776
Thirty-Five Year Discounted Cash Flow	$1,466,000	$1,465,000
Average Subsidy/Passenger	$5.09	$.57
Average Subsidy/Passenger Mile	$.553	$.143

Note: Do not attempt to compare the above statistics to our current budgeted or actual cost per passenger or cost per passenger mile. Because the costs are discounted, but the passengers and passenger miles aren't, the above statistics are much lower than our actual or budgeted statistics. The above statistics are only useful for comparing Blue Line to Bus costs on a more-or-less apples-to-apples basis.

I freely admit that there are gross simplifications in my methodology. However, I maintain that these short-cuts are relatively minor in impact upon the numbers that should be used to make decisions and that the above results are reasonably close to reality, as we expect it to occur at this day and time. The numbers are overwhelmingly in favor of bus over light rail (rail is almost nine times as expensive on a per passenger basis and almost four times as expensive on a per passenger mile basis), so perhaps there is not a whole lot of need to perform a more detailed, sophisticated analysis.

Also, some of the most important assumptions significantly favor the Blue Line, including:

. I did not specifically put anything away for capital renewal and replacement for either the Blue Line or Bus fixed facilities. For the Blue Line, this is a major distortion of true long-term spending. For Bus, it does not have much impact. The model assumes that buses are replaced every twelve years and the annual bus operating costs are based on our FY91 budgeted bus costs, which include the mid-life rebuild program. As a practical matter, we are using our buses for well beyond twelve years because we do not have the funds to replace them. The only thing of any importance that is ignored in Bus capital renewal and replacement is the operating division costs. Therefore, since bus renewal and replacement is included and nothing is included for the Blue Line, this set of assumptions favors the Blue Line, especially since it is likely that buses will be used beyond the twelve years assumed in the model.

. The ignoring of the source of capital funding significantly favors the Blue Line in regard to what this region can afford. As a practical matter, it is likely that we can get some outside funding, particularly Federal Section 3, to assist in the capital costs of expansion of bus service. It is unlikely that we can get any additional outside funding (that we didn't have already and could use for other purposes) to assist in

building light rail lines. LACTC has proposed that "new" light rail cities will have to pay 20% of the capital costs, but, at this time, this is far from certain to happen.

. This simplistic model assumes that light rail exists in a vacuum, which it does not. According to our passenger surveys, approximately 75% of the light rail riders get to and.or from the Blue Line via bus. The assumptions in the simplistic model used are such that rail is not charged for these bus costs. While it is true that some bus lines will be modified or discontinued due to the Blue Line start up, the loss of revenue and the changes in other bus lines to serve the Blue Line makes this pretty close to a wash. If we really want to get Blue Line ridership as high as possible, we will have to add significant feeder bus service, and this should be shown as a Blue Line, not Bus, cost. Such an action would, of course, be an unwise use of scarce transit financial resources as it is far cheaper to carry these riders all the way to their destination via bus.

Further, one of the usual arguments for rail vs. bus is that rail may be more expensive as far as capital goes, but that rail operating costs are much lower. The above analysis does not support this argument. There is no doubt that the first part, rail capital requirements being higher, is correct. The Blue Line capital cost is approximately $945 million, all in the early years, while bus capital is $308 million, with much of it in the later years (and this is for a capital system that will produce many times the transit usage of rail). However, the operating costs of bus are much lower than those of light rail when measured on a cost per unit of consumption basis. It is true that the annual net operating (subsidy) costs of bus are almost twice as high as rail, approximately $62 million vs. $33 million. However, bus carries approximately 8.08 times as many passengers and produces about 3.87 times as many passenger miles per year (even ignoring the extra three years of service that we get with bus).

In short, rail has capital costs that are well almost four times higher than bus (when the time value of money is considered) in total and over thirty times as high per passenger and produces operating costs per passenger mile that are almost twice as high.