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Bart Impact Studies: A Disaggregated Comparison of the Cost Overrun of the San Francisco Bay Area Rapid Transit District

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This study is one in a series directed at understanding the impacts of the Bay Area Rapid Transit (BART) system on transportation and related activities in the San Francisco Bay region. No financial or other support for these studies is derived from the BART district; the ideas expressed herein are those of the authors and are not necessarily in conformance with views of the District or its management.

BART IMPACT STUDIES  
A Disaggregated **Comparison**  
Of the Cost Overrun of the San Francisco  
Bay Area Rapid Transit District  
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and  
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May 10, 1971  
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## INTRODUCTION

Cost overruns on public works projects are very common. Military procurement is notorious for this problem, but nonmilitary projects are not immune. There is much reporting about cost overruns, but what really is newsworthy is a project which is done at costs approximating those predicted at the outset. This, not the other, is the rare event.

The San Francisco Bay Area Rapid Transit (BART) project is no different. Journalists savored its cost overruns for they made good copy. Yet were they really large compared with others in their population? The overrun on BART costs is of the order of 40% to date. Costs escalated from about \$1.0 billion to \$1.4 billion between 1962 and 1971.

A paper by Robert Summers<sup>1</sup> summarizes cost experience for 68 major hardware components of 22 military weapons systems. This is the standard reference on military cost overruns, although more experience has accumulated since Summers wrote in 1962. He found that 75% of the estimates were low, at least a quarter by a factor of two or more. On the average, actual cost was 3.25 times estimated cost. When gross adjustments were made for changes in quantity procured and inflation, the mean ratio of actual to estimated costs was 1.79. A

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<sup>1</sup>R. Summers, "Cost Estimates as Predictors of Actual Costs: A Statistical Study of Military Developments" in T. Marschak, T.K. Glennan, Jr. and R. Summers, Strategy for R & D: Studies in the Microeconomics of Development. A RAND Corporation research study. Springer-Verlag New York, Inc., 1967.

recent General Accounting Office report predicts costs of \$41 million per aircraft for the B-1 bomber, up from 1969 estimates of \$35 million. The Office of Management and Budget has suggested costs per plane including armaments could run as high as \$80 million.<sup>2</sup> The C-5A cargo transport was supposed in 1965 to cost \$3.4 billion for 120 aircraft or about \$283 million per plane. By 1969, the cost estimate was up to \$433 million each, and the order was cut to 81 airplanes. At the beginning of this year the cost was estimated at \$4.6 billion or some \$533 million per airplane, 1.9 times the 1965 estimate, and the manufacturer is taking a loss at that.<sup>3</sup> In all fairness, military development projects are often at the fringe of technology. Preparedness demands gaining a superiority over the supposed enemy by having the very latest capabilities. Public works are often much more pedestrian. Dams, bridges, buildings and even underground rapid transits have been built many times before. They do not depend on uncertain scientific development projects.

The project of the City of Long Beach to convert the Queen Mary to a floating convention center was estimated to cost \$8.5 million at the time the decision to go ahead with the project was taken. It is now up to \$53 million and still climbing.<sup>4</sup> Rockefeller's Mall in Albany, New York is another example. The state estimate in 1964 for the construction of this complex of public buildings was \$400 million. Now, already years overdue and not to be finished

<sup>2</sup>The Wall Street Journal, June 3, 1971, p. 1.

<sup>3</sup>The New York Times, December 13, 1970, p. 1.

<sup>4</sup>San Francisco Chronicle, August 11, 1971, p.11.

before 1975, the estimate stands at \$850 million but will possibly reach \$1 billion before the end is seen.<sup>5</sup>

There may be a special problem when a project has access to the public fisc. Legislatures rarely leave a hole in the ground as monuments to their poor decisions or lack of financial control. Public projects can continue to go back for more funds. But one wonders if the cost experience in the private sector is much better. As usual, their performance is protected by the paucity of data. The phenomenon of the "courtroom contractor" is well known, however. He bids low, but always seems to find something not in the contract that only he can conveniently do and for which he wants an exorbitant price. One suspects that although they are doing work on which much experience is accumulated, there are frequent and extensive cost overruns in the private sector.

The point of all this is not to say that overruns are good things to have but to show that BART is not atypical. This does not ease the problem, of course, but the purpose of this paper is not to solve the problem. Hopefully, however, the data can help explain where the estimation went wrong, and perhaps prevent recurrence in future projects.

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<sup>5</sup>Fortune, June 1971, p. 94.

## I

## A BRIEF HISTORY

Following a short organizational period after the formation by the California State Legislature of the San Francisco Bay Area Rapid Transit District in 1957, the staff retained as consulting engineers a consortium of three firms which has become known as the Joint Venture. Parsons Brinckerhoff-Tudor-Bechtel is formed from Parsons, Brinckerhoff, Quade and Douglas; Tudor Engineering Company; and Bechtel Corporation. These consultants produced a plan for a modern, exclusive right-of-way, rail rapid transit system for the five counties comprising the District, which were Alameda, Contra Costa, Marin, San Francisco, and San Mateo Counties. The consultants furnished estimated cost data, and after considering this data, the Boards of Supervisors of Marin and San Mateo Counties exercised their rights as provided in the Enabling Act and withdrew their counties from the District.

The Joint Venture engineers and the staff of the District scaled the system down and submitted it for approval to the voters of the three remaining counties on November 6, 1962. A sixty per cent positive vote was required for passage, and this was barely achieved, with populous San Francisco County turning out almost a two-thirds majority which was nearly negated by the only fifty-four per cent "yes" vote in much less densely populated Contra Costa County. But the margin was adequate, and the District staff prepared to issue the

bonds authorized by the voters. However, in a foretaste of controversy to come, a suit was filed in Contra Costa County charging the District and the Joint Venture with several improprieties. An injunction was granted against the District on December 10, 1962, and not lifted until June 10, 1963. This alone was enough to guarantee that the system would cost more than expected, but it was only one of a long series of cost-increasing actions.

The District staff, in an effort to minimize pre-operating expenditures, decided to leave cost control to the Joint Venture, which was building the system. It requires no editorializing to suggest that this was an unsound practice. At any rate, operations appeared to be proceeding smoothly with periodic bland public statements that the system would function as promised. An interim report presented by the Joint Venture in 1965 acknowledged that there would be some delay, but no problems of cost were mentioned. By the summer of 1965, however, the possibility of a substantial deficit in funding had been acknowledged, and by the end of the year, cost control had been shifted from the Joint Venture to the BART staff. Up to this point, the maneuvers had been conducted quietly and the press and the public had not noticed what was happening.

In December of 1965, bids were opened for the Oakland subway segment and the Transbay Tube. The low bids submitted exceeded estimates by some \$65 million, or over 75 per cent, and the secret was out. Newspapers ran critical stories and editorials, the Joint Venture and the BART Board of Directors traded accusations, and the Joint Legislative Budget Committee requested a report. For all the tumult and shouting, however, noticeable results consisted mainly of

noise. It was obvious that the supply of money was inadequate, but the search for more was hampered by acrimonious political debate and personal power plays. Three years and a considerable amount of political logrolling were required before a solution was found. It was not an unusual one: tax the public more. In April, 1969, a bill was signed into law which added an additional half of one per cent to the sales tax in the three counties comprising the district. This supposedly is supplying sufficient additional funding to complete the system, and the public can only hope that it will be successful. The current official prediction of the date for the first trains to begin running is early 1972, six months after the originally planned date for total completion of the system. This does not mean, of course, that the trains will begin to run or that the funding problems are completely over. There are still problems with the propulsion systems of the rapid transit cars which have not responded well to the efforts of engineers to track them down and correct them. In addition, the February earthquake in Southern California collapsed a building in which brakes for the cars were being built, so those vital components are being delayed.

There is currently in the works a move to take \$22.5 million which was to be used to build a subway for the Municipal Railway connector service on the West side of the Twin Peaks tunnel and use it in the downtown San Francisco area. Both City of San Francisco and BART officials approve of the action, but no one is perfectly sure that it is legal. Final action must await the outcome of formal court proceedings to protect the District from future legal liabilities if the shift is actually made. Another potentially ominous development is an increase of \$40 million in the total estimated cost of the

system reported between March and April. This increase is expected to be taken care of with available funding, but reserves are running low. A few more increases will mean that the District finds itself without sufficient funds for completion again, and the public and political outcry in that event is not pleasant to anticipate.

## II

## THE BASIS FOR COMPARISON

When the vote to authorize construction of the BART system was taken in 1962, the public had gained whatever knowledge of the proposal it had from a document called the Composite Report.<sup>6</sup> This was a compilation of four reports submitted to the District by its four consulting firms. These were the Joint Venture, the engineering consultants; Smith, Barney & Co., the financial consultant who developed the mechanisms by which BART would be funded; Stone and Youngberg, the financial advisor who conducted studies of the financial impact of the transit plan on taxpayers and public agencies within the district; and Van Buren Stanbery, the economic consultant. The reports were published in May of 1962 in a single volume of 88 pages, and described the proposed system in considerable detail. The system was justified on the basis of need, the financing required and the mechanics of obtaining the money were laid out, and the Joint Venture described the system physically and provided estimates of its cost. It is this last item with which we are concerned here.

The Parsons Brinckerhoff-Tudor-Bechtel estimates disaggregated the system into ten geographical segments to be constructed plus a category for the central maintenance facility, which included for convenience the cost of constructing the central administration

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<sup>6</sup>Parsons Brinckerhoff-Tudor-Bechtel, et. al., The Composite Report, May 1962. 88 pp.

building. For each of these segments, cost estimates were made for different parts of the construction costs, such as trackwork, train control, engineering charges, and so on. Included were allowances for contingencies plus allowances for inflation. It was assumed that these allowances would cover increases in the cost of labor and materials and also any unforeseen circumstances. Obviously, everything did not work out as planned. Nonetheless, the Composite Report is the basic document with which any comparisons of current or currently estimated costs must be made.

When the responsibility for cost control was shifted from the Joint Venture to the BART staff in 1965, there were orders issued to keep the data as current as possible. Among the many reports that resulted was a monthly summary called the Comparative Data Report. This report summarizes all work costs incurred or to be incurred. Included are all the separate accounts through which the District obtains its funds, including Federal grants, agreements with other public agencies, and such items as the Berkeley subway fund. It seems obvious that this Report should be the source of data to be compared with that contained in the Composite Report. The Comparative Data Report gives breakdowns of estimates at several points in time by several sources. A complete project cost re-evaluation was made in July of 1966 during the initial outcry concerning the overrun, and this is contained in the Report. It also contains figures for a working budget submitted in April of 1969. The figures of interest to us are neither of these, however, but another set which are current forecasts based on actual progress in the field. It is these figures which we will attempt to compare with the Composite Report.

## III

## THE DATA AND CONSIDERATIONS

The table contained in this section comparing the Composite Report and the Comparative Data Report figures presented a challenge. The main problem is that the categories used at the present time by the District to tabulate the costs bear little relationship to the categories in the Composite Report. This is not unreasonable, since the Comparative Data Report is designed basically as an accounting document while the Composite Report was more of a preliminary working paper. Contracts for construction and the furnishing of materials simply are not let by the neat categories listed in the table. A meaningful comparison, however, requires that cost figures be related to the same items. Thus, the definitions of the categories as given in the Composite Report (see Notes to Table, A,B) were used here and the figures in the Comparative Data Report were disaggregated and allocated to match those definitions insofar as possible.

There are many mechanical problems involved in this sort of enterprise. For example, the Comparative Data Report includes data on the transit rail cars in several places. The Composite Report contains estimates of the cost of the vehicles, and we will consider them, but they are not contained in the table. Possibly the greatest difficulty arises from the fact that many contracts for both construction and materials were let on a large-scale basis, covering many or all of the line segments delineated in the Composite Report. Allocation

## COMPARISON TABLE

This table is similar to the one in the Composite Report which summarizes estimated costs. Here, all entries are in pairs, with the upper one being that found in the Composite Report and the lower one being the current estimate calculated from the Comparative Data Report. Definitions of the headings and the boundaries of each line segment will be found in the Notes to Table A and B.

As stated in the text, the label "non-allocable" has been added to accommodate costs that could not otherwise appear without being wildly arbitrary.

SUMMARY OF ESTIMATED CONSTRUCTION COST AND PRE-OPERATING EXPENSE  
(all figures in thousands of dollars)

LINES	TRACK & STRUCTURES	STATIONS	YARDS & SHOPS	ELECTRIFICATION	TRAIN CONTROL	UTILITY RELOCATION	ENGINEERING & CHARGES	RIGHT OF WAY	CONTINGENCIES	INFLATION	NON-ALLOCABLE	TOTAL
<b>A. CONSTRUCTION COST</b>												
San Francisco Downtown	50,883 92,464	31,558 89,270	-	1,215 1,915	251 1,997	11,781 12,465	9,569 2,909	2,994 1,929	10,825 3,757	23,816		142,892 206,706
Mission Line	37,673 56,589	15,527 32,049	-	3,699 3,589	910 3,073	7,808 3,153	6,561	4,427 11,129	7,661	16,853		101,119 109,582
Twin Peaks Line	7,659 23,303	2,376 448	-	156 628	- 429	284 462	1,046	- 36	1,150	2,550		15,181 25,306
Oakland Downtown	26,729 40,671	15,677 50,954	-	1,633 2,475	610 1,675	6,549 2,659	5,120	12,585 10,452	6,890	15,158		90,951 108,886
Berkeley-Richmond Line	32,947 52,469	13,989 34,524	1,478	8,583 6,095	2,286 6,339	2,727 2,943	6,201 1,729	27,365 29,345	9,558	21,028	8,219	126,162 141,863
Central Contra Costa Line	68,170 156,916	10,696 11,549	958 3,374	12,201 8,472	3,146 9,403	2,075 9,314	9,724	10,220 12,055	11,719	25,781		154,690 211,063
Southern Alameda County Line	42,114 58,113	11,590 18,101	1,504 5,136	15,270 11,110	3,620 11,449	2,712 2,853	7,681	13,739 29,857	9,823	21,610		129,663 136,599
Central Yard & Shops and Administration Building	-	-	6,861 13,121	809 496	5,817 3,796	-	1,348	2,464 1,097	1,730	3,806		22,835 18,510
Nonallocable							101,632		12,149		23,121	136,902
<b>CONSTRUCTION COST</b>												
	266,155 480,325	101,413 236,895	10,801 21,631	43,566 34,780	16,640 38,361	33,936 33,849	47,250 106,270	73,794 95,860	59,356 15,906	130,582		783,493 1,095,417
<b>PRE-OPERATING EXPENSE</b>												
<b>TOTAL</b>												
	16,996 29,975	-	-	845 149	76 202	720 670	1,863	- 224	2,050	4,510		27,060 31,220
San Francisco Approach												
Subaqueous Tube	57,284 106,322	-	-	4,087 1,649	564 2,232	1,470 6,202	6,341	47 220	6,979	15,354		92,126 116,625
Oakland Approach	6,787 12,436	-	-	1,016 676	259 914	370 385	843	977 498	1,026	2,256		13,534 14,909
Nonallocable							11,478		4,248			15,726
<b>TOTAL</b>												
	81,067 148,733	-	-	5,948 2,474	899 3,348	2,560 7,257	9,047 11,478	1,024 942	10,055 4,248	22,120		132,720 178,480
<b>C. ROLLING STOCK</b>												
<b>GRAFD TOTAL</b>												
												71,200 86,716
												994,413 1,390,766

## NOTES TO TABLE

## PART A

The following are the definitions from the Composite Report for the expenditure categories in the table:

## TRACK AND STRUCTURES

Costs to construct the transit structures between stations, including all related costs, such as track work, site preparation, street widening and restoration, fencing, traffic maintenance during the construction period, grade separation structures, and protection of existing buildings.

## STATIONS

Costs of all station construction as well as the track structure within the station, the parking and access area construction, and the fare collection system. Related costs are identical with those listed under "Track and Structures."

## YARDS AND SHOPS

Costs for transit yard facilities; service, inspection, and routine maintenance buildings and equipment; track work within the yard limits and lead tracks; and other components incident to the storage, maintenance and repair of transit rolling stock and equipment. The cost of the administration and operations center is included in this item.

## ELECTRIFICATION

Costs of the electrical system to furnish power for train propulsion and control, including such items as utility connections, sub-stations, the third rail for train power, and incidental electrical facilities.

## TRAIN CONTROL

All costs of the automatic train control system.

#### UTILITY RELOCATION

All costs incidental to the relocation and maintenance of utility installations necessitated by construction of the transit system. Electric power distribution, communication, gas, water, steam, sewage and storm drainage are affected.

#### ENGINEERING AND CHARGES

These costs include fees for architectural and engineering services as well as construction management costs during the construction period. Interest during construction, operating expenses, financing charges, and District administrative expenses are not included.

#### RIGHT OF WAY

All costs relative to the acquisition of property required for the construction of the transit system as well as for the demolition of existing improvements, the cost of title investigations, appraisals and negotiating and legal expenses incident to the right of way acquisition.

#### CONTINGENCIES

A contingency is included amounting to ten per cent of the sum of all construction costs including engineering and charges and right of way.

#### INFLATION

This cost is an allowance to cover realized and anticipated increases in construction costs over the first quarter 1960 price levels used in preparing the estimate.

#### PRE-OPERATING EXPENSES

Before formal revenue operation can begin over any completed segment of the rapid transit system, it will be necessary to plan operations, recruit and train personnel, and perform other preparatory functions. These pre-operating expenses are in addition to the capital cost of construction of the system, and they are estimated at a cost of \$7,000,000. The total of the capital cost of construction and the pre-operating expense is \$790,493,000, and it is this amount that must be provided from the issuance of general obligation bonds by the District.

## NOTES TO TABLE

## PART B

The following are line segment boundaries as defined in the Composite Report:

SAN FRANCISCO DOWNTOWN<sup>1</sup>

This segment extends from the East end of the Montgomery Street station to the existing Twin Peaks tunnel.

## MISSION LINE

This segment extends from the San Francisco downtown segment at 14th Street to the end of the line in Daly City.

## TWIN PEAKS LINE

This segment is a part of the Muni Rapid Line and consists of the area West of the Twin Peaks tunnel.

## TRANS-BAY LINE

The San Francisco Approach portion of this line extends from the Montgomery Street station to the West ventilation building. The Trans-Bay Tube begins with the ventilation building and extends across the Bay and includes the East ventilation building. The Oakland Approach extends from the East ventilation building to the West Oakland station.

## OAKLAND DOWNTOWN

This segment begins with the West Oakland station and extends to just South of the Lake Merritt station and North and East to a portal at West Grand Avenue and 23rd Street.

<sup>1</sup>The Embarcadero Station has been added since the Composite Report was published. Station costs have been placed under "San Francisco Downtown," but most other costs remain as originally defined under "San Francisco Approach."

**BERKELEY-RICHMOND LINE**

This segment extends from the North portal of the Oakland subway to the end of the line in Richmond.

**CENTRAL CONTRA COSTA LINE**

This segment begins just North of the MacArthur station where it leaves the Berkeley-Richmond Line and extends to the end of the line in Concord.

**SOUTHERN ALAMEDA COUNTY LINE**

This segment begins just South of the Lake Merritt station and extends to the end of the line in Fremont.

of these costs requires consideration of the nature of the construction of each segment of the system, as well as the number and size of stations on the line, and so on. Federal grants presented another problem. Some of the grants were demonstration or developmental grants, designed to benefit not only BART but future rapid transit systems which might gain from the experience of BART in its development programs. After some thought, it was decided to allocate all the costs as if BART had gained all the benefit and not to try to measure the benefit to an as yet unknown beneficiary or beneficiaries. This problem was not critical in all cases, of course; the benefits of a landscaping grant obviously accrue entirely within the District.

One other major difficulty deserves mention. The "contingencies" and "inflation" categories lose their meaning almost as soon as they are created. The whole idea is to provide an excess in the budget for cost overruns. If the overruns occur, these funds naturally diminish, in some cases quite literally to the vanishing point. A future accounting which shows the balance of such funds to be zero really means little, and there is no rational basis for comparison. The categories do appear in the table, however, just as they did in the Composite Report. A related problem is that which occurs with a change in the scope of the project. For example, part of the cost overrun in the "track and structures" category is due to the construction of the Berkeley subway (discussed later), which was not contemplated in the original cost estimates. Finally, there are some costs which simply cannot be allocated intelligently without a great deal more information. Some of these can be assigned to a line segment but not to a specific category, while others cannot even be located that

closely. For these costs, there appears in the table the only heading which was not contained in the Composite Report, that of "nonallocable."

#### The Transit Vehicles

The Composite Report envisioned a fleet of rolling stock comprising 450 modern, lightweight transit cars. The total estimated cost for the fleet was \$71,200,000, with the cost per car varying from \$153,000 to \$160,000, depending on the date of their delivery. The funding for the cars comes from revenue bonds issued in anticipation of fare-box revenues, and there has been considerable help in the form of Federal grant money. At any rate, the current total cost of the transit fleet, including grants and design costs, is \$86,716,000. In terms of the rest of the system, this would appear to be a fairly modest increase, except for the fact that this figure is to finance only 250 cars, a number the District decided it could operate with when the costs began to climb. This is nearly \$347,000 per car, over twice what they were predicted to cost.

## IV

## ATTEMPTS TO EXPLAIN THE OVERRUN

It is obvious from the table that the overrun is large in both relative and absolute terms. Every segment of the system except the Central Yard and the Administration Building exceeded estimates. The total for construction including the transbay tube and the rolling stock is \$1,390,766,000. This is 40 per cent and \$400 million higher than the original estimates. Some parts are much worse viewed alone; the cost per car is going to be around 120 per cent above the original estimates. A look at the table provides interesting insight into the relative costs of construction methods. The Southern Alameda Line, which is mainly elevated, is only slightly above its estimates. This is because it turned out to be relatively inexpensive to "mass produce" standardized components for the elevated structure. The Contra Costa Line, on the other hand, incurred an overrun of over \$50 million, due in part to much higher than expected costs incurred in tunneling under the Oakland Hills. It is obvious, however, that one tunnel and some expensive transit cars did not cause the whole \$400 million overrun. But if they are only part of the reason, what is the rest of it?

The favorite explanation of the BART staff is that inflation and delay in construction caused the problem, and these two factors are no doubt the most important. In an earlier paper, Bruce Richard<sup>7</sup>

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<sup>7</sup>Bruce Richard, The Cost Overrun of the San Francisco Bay Area Rapid Transit District, 1970. (Thesis, Master of Business Administration, University of California, Berkeley) pp. 37-46.

attempted to quantify the costs of inflation and delay. He estimated that unanticipated inflation caused an overrun of \$46.1 million, delay caused an overrun of \$145.1 million, and a combination of the two which could not be disaggregated was responsible for another \$107 million. These factors worked in combination to increase cost far more than either one alone could have. The planners made what appear to have been reasonable estimates about the rate of anticipated inflation. Unfortunately, the economy heated up and the price indices rose much faster than they had foreseen. Delays exacerbated the problem by causing outlays to be made after the prices had risen even higher than they would have been at the expected rate of inflation, let alone at the real rate. Richard's figures indicate a total overrun due to inflation and delay of just under \$300 million. The estimates were made in the Spring of 1970 when the total anticipated overrun was of the order of \$360 million, but it is clear that inflation and delay are still far and away the most significant factors.

The only other element of the overrun which might explain a large amount is the charge of inadequate planning and consultation by the BART designers. The District encountered great community resistance to many parts of its plan, as exemplified by the tangle with the City of Berkeley. In March 1964, Mayor Wallace Johnson of Berkeley suggested that the entire BART line in Berkeley should be in a subway, rather than only the planned 3600 feet in the CBD. Johnson suggested that the change would cost about \$6.25 million more than the Composite Report plan. The District's response was critical and discouraging, and it remained so throughout the next two years. On April 10, 1964, the District estimated that Johnson's proposal

would cost an additional \$24.6 to \$32.3 million. Both Johnson and the District claimed they were using as a basis for calculation recent subway construction in Toronto and Montreal, but someone was obviously not using the numbers very carefully. On May 5, 1964, a consultant to the City of Berkeley submitted a figure for Johnson's plan for \$7 million in incremental costs. On May 22, the Berkeley City Council heard a proposal for subway and a redevelopment project above it, to cost \$18 million. In June, BART amended its figure for the original proposal downward to \$22.5 million over the Composite Report plan. After a noisy but unenlightening summer, the BART Board voted on September 10, 1964, not to accept Johnson's proposal, but it left the door open to any improvements which the City of Berkeley was willing to finance for itself.

On October 20, 1964, the City Council voted to spend no more than \$150,000 to prepare alternate designs for consideration. The route was determined, but the structure to be constructed was still a point of contention. For the next year and a half, planning took place relatively quietly. Then on February 9, 1966, BART announced that its estimates of the cost of the three Berkeley stations in the Composite Report plan had tripled. Whether by coincidence or design, Wallace Johnson suggested the next day that the structure of the BART Board of Directors should be changed, with the Directors to be elected, among other things. This, of course, did not endear him to the Board. One member called Johnson a fool. Debate for the next couple of months was about as constructive. In the late spring, however, proposals began to be made specific, and a \$3.5 million Federal grant to aid the subway construction became available in June.

On July 7, bids on five separate segments with options totalling 30 combinations were let, and the bids were opened on July 27. They were well below the District's estimates but somewhat above the City's, and indicated that subway could be constructed from Ward Street to McGee for about an additional \$13 million. Further changes were made in the plans during the summer, and in October 1966, the voters of Berkeley approved a \$20.5 million bond issue, of which only the necessary amount was to be sold. This permitted complete subway construction within the City of Berkeley except near the city limits where the track had to be elevated to meet the elevated structures in Oakland and Albany. To date only \$12 million of the authorized amount has been sold, and this, coupled with a larger \$4,733,000 Federal grant and \$810,000 earned under unexpectedly high interest rates, is expected to be adequate to pay the incremental costs.

The point of all this is that the episode demonstrates more forcefully than most the fact that the initial planning did not include adequate community participation, and costly design changes were requested and contested relatively late in the project all over the District. The fault is not entirely that of the Joint Venture or the BART staff, of course. No one was prevented from making proposals before the Composite Report was issued. Solicitation of community participation, however, could have been and probably should have been more vigorous.

There have been charges of excessive profits by the Joint Venture and of inadequate competition on some bids. No evidence of a substantial nature indicates any gross profiteering by the companies, and even if the charge were true, it seems unlikely that it could account for more than a small portion of the overrun.

The problem with bidding is that there are few firms able to take on a job of this magnitude, even in concert with other companies. It is clear that there is a massive overrun, and that inflation and delay have been the primary causes. The inflation problem was simply a result of circumstances and probably could not have been prevented. A substantial portion, but certainly not all, of the increase due to delay could probably have been prevented by better planning. Lawsuits, earthquakes and Asian wars, however, are not items which can be anticipated except under the inexact heading of "contingency." All things considered, the overrun is unpleasant but not unusual for such a project. Compare it with the successful Lindenwold Line in Philadelphia and New Jersey which finally cost \$94 million after an estimate of \$54 million when it was begun, or with the Skokie-Swift project in Chicago which had to increase its budget five times, with construction and rental costs increasing 73%. Hopefully the BART experience will help others to make more realistic estimates in the future.

## REFERENCES

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Bay Area Rapid Transit District, a large variety of general  
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## INTERVIEWS

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- Jenevein, Richard G., Chief Accountant, San Francisco Bay Area  
Rapid Transit District, May 3, 1971.
- Quinby, H. D., Transportation Engineer, Parson, Brinkerhoff, Quade  
and Douglas, April 16, 1971.

SUMMARY OF ESTIMATED CONSTRUCTION COST AND PRE-OPERATING EXPENSE  
(all figures in thousands of dollars)

LINES	TRACK & STRUCTURES	STATIONS	YARDS & SHOPS	ELECTRIFICATION	TRAIN CONTROL	UTILITY RELOCATION	ENGINEERING & CHARGES	RIGHT OF WAY	CONTINGENCIES	INFLATION	NON-ALLOCABLE	TOTAL
A. CONSTRUCTION COST												
San Francisco Downtown	50,883 92,464	31,558 89,270	-	1,215 1,915	251 1,997	11,781 12,465	9,569 2,909	2,994 1,929	10,825 3,757	23,816		142,892 206,706
Mission Line	37,673 56,589	15,527 32,049	-	3,699 3,589	910 3,073	7,808 3,153	6,561	4,427 11,129	7,661	16,833		101,119 109,582
Twin Peaks Line	7,639 23,303	2,376 448	-	156 628	- 429	284 462	1,046	- 36	1,150	2,530		15,181 25,506
Oakland Downtown	26,729 40,671	15,677 50,954	-	1,633 2,475	610 1,675	6,549 2,659	5,120	12,585 10,452	6,890	15,158		90,921 108,886
Berkeley-Richmond Line	32,947 52,469	13,989 34,524	1,478	8,583 6,095	2,286 6,539	2,727 2,943	6,201 1,729	27,365 29,345	9,558	21,028	8,219	126,162 141,865
Central Contra Costa Line	68,170 156,916	10,696 11,549	958 3,374	12,201 8,472	3,146 9,403	2,075 9,314	9,724	10,220 12,035	11,719	25,781		154,690 211,063
Southern Alameda County Line	42,114 58,113	11,590 18,101	1,504 5,136	15,270 11,110	3,620 11,449	2,712 2,853	7,681	13,739 29,837	9,823	21,610		129,663 136,599
Central Yard & Shops and Administration Building	-	-	6,861 13,121	809 496	5,817 3,796	-	1,348	2,464 1,097	1,730	3,806		28,895 18,510
Nonallocable							101,632		12,149		23,121	136,902
CONSTRUCTION COST												
	266,155 480,525	101,413 236,895	10,801 21,631	43,566 34,780	16,640 38,361	33,936 33,849	47,250 106,270	73,794 95,860	59,356 15,906	130,582		783,493 1,095,417
PRE-OPERATING EXPENSE												
TOTAL												7,000 30,153
B. TRANS-BAY LINE												
San Francisco Approach	16,996 29,975	-	-	845 149	76 202	720 670	1,863	- 224	2,050	4,510		27,060 31,220
Subaqueous Tube	57,284 106,322	-	-	4,087 1,649	564 2,232	1,470 6,202	6,341	47 220	6,979	15,354		92,126 116,625
Oakland Approach	6,787 12,436	-	-	1,016 676	259 914	370 385	843	977 498	1,026	2,256		13,534 14,909
Nonallocable							11,478		4,248			15,726
TOTAL												
	81,067 148,733	-	-	5,948 2,474	899 3,348	2,560 7,257	9,047 11,478	1,024 942	10,055 4,248	22,120		132,720 178,480
C. ROLLING STOCK												
GRAND TOTAL												71,200 86,716
												994,413 1,390,766