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Capital Costs of Candidate Alignments

Technical Report
for the
CORE STUDY

Draft Subsequent Environmental Impact Report

Prepared by

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Southern California Rapid Transit District

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Table of Contents

	<u>Page</u>
I. INTRODUCTION	1
II. COST ESTIMATING METHODOLOGY	3
III. SUMMARY OF COST ESTIMATES	9
A. Alignment 1	10
B. Alignment 2	14
C. Alignment 3	18
D. Alignment 4	22
E. Alignment 5	26

I. INTRODUCTION

This technical report details the cost estimates for the five candidate alignments evaluated in the Draft Subsequent Environmental Impact Report (SEIR) for the Los Angeles Rail Rapid Transit Project, Metro Rail, published in February 1987.

The purpose of this report is to explain the methodology, the basic assumptions, and the break-down of the items that were the basis for the cost estimates contained in the Draft SEIR.

Background

In December, 1983, the U.S. Department of Transportation/Urban Mass Transportation Administration (UMTA) and the Southern California Rapid Transit District (SCRTD) published a Final Environmental Impact Statement (FEIS) on the Los Angeles Rail Rapid Transit Project, Metro Rail. In compliance with California Environmental Quality Act (CEQA) requirements, a Final Environmental Impact Report (FEIR) was published in November 1983. These documents provide detailed analysis of the Metro Rail Locally Preferred Alternative (LPA). The LPA is a major component of a 150-mile regional rapid transit system to be developed in Los Angeles County in accordance with Proposition A. Proposition A was a referendum approved by a majority of the voters of Los Angeles County in November 1980, which authorized the collection of a one-half of one percent retail sales tax to fund the improvement of public transit in the County.

The LPA is an 18.6-mile subway adopted for construction and for which a capital grant application was submitted to UMTA. UMTA determined that it was unable to commit to funding the full 18.6-mile system or a shorter 8.8-mile segment identified in the FEIS due to budget constraints and a legislative prohibition on the commitment of federal funds beyond Fiscal Year 1986. In response, SCRTD proposed a 4.4-mile, five-station Minimum Operable Segment (MOS-1), extending from a yard and shop facility south of Union Station to the Wilshire/Alvarado Station, as an initial segment for funding purposes. In August 1984, UMTA and SCRTD completed an Environmental Assessment (EA) for MOS-1. On December 19, 1985, the President signed legislation requiring that the Secretary of Transportation enter into a full funding contract with SCRTD for the construction of MOS-1. That full funding contract was signed on August 27, 1986; construction of MOS-1 is underway.

In March 1985, a fire occurred at the Ross Dress-for-Less Store near Wilshire Boulevard at Third and Ogden Streets. Subsequent investigation of this event by a special City of Los Angeles "Task Force" resulted in the conclusion that the source of the fire was naturally-occurring methane gas. The "Task Force Report on the March 24, 1985, Methane Gas Explosion and Fire in Fairfax Area, June 10, 1985," identified specific zones where subsurface conditions indicated a "potential risk" or "potential high-risk" of encountering methane gas during subsurface excavations. As a result of concerns associated with the subsurface presence of methane gas, the U.S. Congress attached to the Agriculture, Rural Development, and Related Agencies Appropriations Act (H.R. 3037), which provides funds for Metro Rail, the stipulation that the SCRTD should not tunnel in any of the risk zones identified in the City Task Force Report. The U.S. Congress also stipulated that the SCRTD should identify and study candidate alignments that would avoid these risk zones.

In compliance with the Congressional mandate, the SCRTD initiated the Congressionally Ordered Re-Engineering (CORE) Study. The CORE Study includes the identification and evaluation of candidate alignments, the investigation of subsurface conditions, and the assessment of environmental impacts. The goal of the CORE Study is to identify an appropriate alignment to link the San Fernando Valley, the Wilshire Corridor, and MOS-1 segments of the LPA. This alignment should provide service to the Los Angeles Regional Core comparable to the service that would have been provided by the 18.6-mile LPA, while avoiding tunneling through any portion of the risk zones identified in the Task Force Report. A Draft Subsequent Environmental Impact Report (SEIR) was prepared and circulated in February 1987. It contains a discussion of the anticipated impacts of five candidate alignments identified by the SCRTD for detailed analysis.

Capital Cost estimates to construct any one of the five candidate alignments are also included in the Draft SEIR. This technical report provides the back-up details of the cost figures and the methodology and assumptions used in developing the cost figures contained in the Draft SEIR.

II. COST ESTIMATING METHODOLOGY

The CORE Study estimates are divided into two elements: Facilities, and Systems. District Engineering departments have final responsibility for the design of the Metro Rail Project and work closely with the Program Control Department, which prepares the capital cost estimates for the respective design elements. Transit Facilities is responsible for the design of all tunnels and aerial trainways. This responsibility includes design of the station shell, architecture, finishes, and ingress/egress. Systems Design and Analysis is responsible for the operational components of the Project, such as propulsion, power communications, train control systems, and vehicle design.

Capital Costs

Capital costs include all costs associated with the actual contracts for procurement, installation, and/or construction, including all direct and indirect cost and contractor mark-up or profit. Appropriate contingency allowances and other items such as design and engineering, insurance, right-of-way acquisition, construction management, and agency costs to manage the design and construction are added to these estimates to produce a total estimate of Project cost. Capital cost estimates have been prepared for each of the five CORE alignments and have been summarized to present total Project cost for each alignment.

Estimating Construction/Procurement

- o Plans prepared by the General Consultant, MRTC, were used in this study. These plans provided plan and profile sheets, with stationing, which enabled the estimator to compile tunnel, cut and cover, and aerial lengths.
- o Cost for operable segment OS-A and OS-B were generated using the following costs:
 - \$6600/RF is the average cost, using segmented liners, for awarded tunnel contracts in MOS-1.
 - \$3200/RF for aerial guideway is based on an estimate prepared by the Construction Manager, PDCD. This conceptual estimate was based on sketches furnished by MRTC. Tudor Engineering Company conducted an independent evaluation of the estimates prepared on aerial structures and found them to be acceptable.

- \$13,000/RF for cut and cover structure on the Wilshire portion is based on an estimate prepared by the District estimating staff. The take-off was based on Standard Drawing No. SS-011A. Pricing was based on historical data derived from contracts in MOS-1.
- Subway station costs are based on comparable stations in MOS-1 on the original 18 mile alignment. An average station cost is \$36,000,000. This cost was derived by averaging all 85% estimates for the stations from Wilshire/Vermont to Hollywood/Cahuenga, (Stages I & II). The costs for utility relocation and membrane were added for an average cost of \$34,280,000. Additional cost for station growth from 85% design completion to final design was then added to bring the average total to \$36,000,000 (rounded).
- North Hollywood and Universal City Station costs were arrived at by using 85% estimates and adding Stage II estimates. The configuration of these two stations varies from the average station in width and length.
- The over and under station at Wilshire/Vermont was based on the 85% estimate for Wilshire/Fairfax Station, the only similar station in the original Project alignment, and is priced at \$75,000,000.
- Costs of \$9,000,000 for aerial stations in the street are based on estimates prepared by PDCD and the District. This conceptual estimate is based on sketches furnished by MRTC.
- Systems cost are based on historical data obtained from MOS-1.

Trackwork	400.00/LF
Signs/Graphic	255000.00/STA
Escalators/Elevators	2,285,000.00/STA
Fans/Air Handling/UPS	1,710,000.00/STA

- Train Control - Based on a preliminary estimate prepared for each alignment. Estimates are available on request.
- Traction Power - Based on a preliminary estimate prepared for each alignment. Estimates are available on request.
- Passenger Vehicles - 1,203,000.00/ea. for OS-A, 1,147,000.00/ea. for OS-B. OS-B slightly cheaper due to a learning curve.
- Communications - Based on a preliminary estimate prepared for each alignment. Estimates are available on request.
- Fare Collection - 1,390,000.00/STA

Contingency Costs

The contingency cost is an add-on and is an unallocated allowance to cover design and construction uncertainties stated in terms of percent of total estimated capital cost. The design contingency recognizes uncertainties of design during the earlier stages of design. The need for this allowance disappears as the design progresses toward the 100 percent level. The construction contingency is an allowance added to the estimated total capital cost of each contract to cover adjustments in quantities, changes in field conditions, extra work, or acts of God such as earthquakes or storms. Included in this estimate is a combined design and construction contingency of 15 percent for facilities and 10 percent for systems elements.

Design and Construction Management

These are also add-on costs to provide for Project design and for procurement and management during the construction phase. These costs have been estimated as a percentage of total capital cost. In this estimate, design and construction management costs are included at 13 percent for facilities and 10 percent for systems elements.

Real Estate Costs

These are direct Project costs to acquire needed real estate for construction of stations, parking, storage yards, and other facilities. This cost has been determined by the District based on right-of-way requirements developed by MRTC.

Insurance Costs

In addition to insurance costs included in a contract's overhead or indirect cost, the District also incurs indirect insurance costs that must be added. These costs cover insuring the facilities and contractors during construction for worker's compensation, general liability, and builder's risk. This insurance, often referred to as wrap-up insurance, adds 7.5 percent to the total capital cost of the Project.

Operating and Maintenance Costs

Operating and maintenance (O/M) costs are incurred in the day-to-day operation of the transit system and are estimated on a total annual cost basis. They include labor, material, and other expenses required to operate, maintain, and manage the system. Several operating and maintenance activities are required to ensure that Metro Rail provides a high level of service and operates in a safe and reliable manner. Examples include train operation, vehicle inspection, station cleaning, police supervision, and track maintenance. These activities became the framework for derivation of the O/M costs. Labor, materials, and other expenses were estimated for each activity.

Basis and Assumptions

Aerial Structure Study Estimate

Assumptions For Aerial Guideway

- This estimate is based on a prototypical aerial guideway as specified in the "Draft Report of Aerial Structure Study". The total route footage for the guideway is 20,310 Ft.
- The major streets on this alignment are Vermont Street and Sunset Boulevard.
- The pier foundation consists of prestressed concrete piles (50' long, 12" square). Typical number of piles per foundation is 30. The cast-in-place pile cap dimensions are 17' x 28' x 5' deep.
- The reinforced concrete column to support the box girders is 7' in diameter. The height of the pier is set to provide a minimum vertical clearance of 16'-6" to the underside of the girder at all locations.
- The girder spans range from 84' to 132' (along intersections), with a typical span of 108' along most of the alignment.
- The prestressed concrete box girders have an out-of-out width of 28', a depth of 7' and a 12' long section.
- The precast box girders are positioned on a truss the full span. After all segments are in place, the longitudinal post-tensioning is stressed and grouted.
- The major utilities assumed to be encroaching on the pier foundations to be relocated are water (30"/main), gas (4"/main), and sewer.
- The final street reconstruction of restoration requirements are: 15' sidewalk on each side, 2' concrete curb and gutter on both sides, AC pavement 29' wide on each side, and 2" AC pavement on the 12' median.

Assumptions for Aerial Station

- This estimate is based on a prototypical aerial station design on Vermont Avenue area.
- This estimate considers station shell and finishes. In addition, total station length is limited to total platform length (450').
- The reinforced concrete columns to support the box girders are 7' in diameter and flare out to 9' in diameter just below the pier cap. The columns are spaced at 75' apart.

- The prestressed concrete box girder will be supported by the cast-in-place reinforced concrete pier cap spaced at 75' apart. The dimensions for the girder segments are identical to the guideway girders. After all segments are in place, the longitudinal post-tensioning is stressed and grouted.
- The platform canopies will be precast and the 18" diameter columns are spaced at 25' apart.
- The major utilities shown to be encroaching on the pier foundations to be relocated are water (30" and 6" main), telephone and sewer. The final street reconstruction or restoration requirement will be identical to the items mentioned in these guideway assumptions.

III. SUMMARY OF COST ESTIMATES

The cost estimates for each of the Alignments I through V are based on the segment length and the number of stations in each alignment for OS-A and OS-B. They consist of capital and non-capital costs.

Capital costs are those relating to the construction of facilities (stations and guideways) and to the procurement or installation of systems.

Non-capital costs are those relating to contingency, design and construction management, right-of-way, agency, and owner's insurance.

The cost estimates for Alignments I to V are summarized on page 9.

METRO RAIL PROJECT - CORE STUDY
PROJECT COST SUMMARY

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

	OS-A			OS-B			SUB TOTALS			TOTALS **INCLUDING MOS-1		
	\$	LENGTH (MILES)	NO. OF STATIONS	\$	LENGTH (MILES)	NO. OF STATIONS	\$	LENGTH (MILES)	NO. OF STATIONS	\$	LENGTH MILES	NO. OF STATION
ALIGNMENT I	731,595	4.55	6	1,308,166	11.37	7	2,039,761	15.92	13*	3,124,864	20.4	18*
ALIGNMENT II	794,112	6.95	8	799,028	8.96	5	1,593,140	15.91	13*	2,678,243	20.4	18*
ALIGNMENT III	794,112	6.95	8	914,718	8.41	5	1,708,830	15.36	13	2,793,933	19.9	18
ALIGNMENT IV	763,472	6.81	8	871,466	9.23	6	1,634,938	16.04	14*	2,720,041	20.5	19*
ALIGNMENT V	818,386	5.80	6	812,700	9.23	5	1,631,086	15.03	11*	2,716,189	19.7	16*

* Does not include Hollywood Bowl

** MOS-1 Cost \$1,085,103

METRO RAIL COST ESTIMATE - CORE STUDY

DATE: 16-Jan-87

ALIGNMENT I

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

SEGMENT	OS-A	OS-B	TOTAL
LENGTH (MILES)	4.55	11.37	15.92
NO. OF STATIONS	6.00	7.00	13.00
FACILITIES			
GUIDEWAY	128,132	428,054	556,166
STATIONS	265,800	291,400	557,200
TOTAL FACILITIES	393,932	719,454	1,113,366
SYSTEMS			
TRACKWORK	10,920	25,856	36,776
ESCALATOR/ELEVATOR	16,045	15,995	32,040
SIGNS/GRAPHICS	1,530	1,785	3,315
FANS/AIR HANDLING/UPS	10,260	11,970	22,230
TRAIN CONTROL	12,611	21,209	33,820
TRACTION POWER	11,670	22,245	33,915
PASSENGER VEHICLES	40,897	59,661	100,558
COMMUNICATIONS	6,929	14,132	21,061
FARE COLLECTION	8,340	6,973	15,313
AUXILIARY VEHICLES			0
MISC EQUIPMENT	1,500	1,500	3,000
TOTAL SYSTEMS	120,702	181,326	302,028
TOTAL CAPITAL COST	514,634	900,760	1,415,394
CONTINGENCY:			
15% FACILITIES/10% SYSTEMS	71,160	126,048	197,208
DESIGN/CONSTRUCTION MGMT:			
13% FACILITIES/10% SYSTEMS	63,281	111,659	174,940
RIGHT OF WAY	18,190	57,104	75,294
AGENCY COST, 5%	25,732	45,038	70,770
OWNERS INSURANCE, 7.5%	38,598	67,557	106,155
TOTAL DECEMBER 85 COST	731,595	1,308,166	2,039,761
MOS-1 DECEMBER 85 COST			1,085,103
TOTAL PROJECT			3,124,864
OPERATING COST			39,400 PER YEAR

20.40 MILES--INCLUDES 4.45 MILES AND 5 STATIONS IN MOS-1
 18 STATIONS--DOES NOT INCLUDE HOLLYWOOD BOWL

ALIGNMENT I

OS-A

GUIDEWAYS

WILSHIRE/ALVARADO TO WILSHIRE/VERMONT			
264 + 50 TO 310 + 30 = 4,580 RF TUNNEL	@ 6,600 =	30,228,000	
WILSHIRE/VERMONT TO WILSHIRE/NORMANDIE			
3 + 20 TO 31 + 50 = 2,830 RF TUNNEL	@ 6,600 =	18,678,000	
WILSHIRE/NORMANDIE TO WILSHIRE/WESTERN			
37 + 30 TO 50 + 70 = 1,340 RF TUNNEL	@ 6,600 =	8,844,000	
WILSHIRE/VERMONT TO VERMONT/BEVERLY			
319 + 66 TO 364 + 60 = 4,494 RF TUNNEL	@ 6,600 =	29,660,000	
VERMONT/BEVERLY TO VERMONT/SANTA MONICA			
370 + 0 TO 414 + 50 = 4,450 RF TUNNEL	@ 6,600 =	29,370,000	
VERMONT/SANTA MONICA TO VERMONT/SUNSET			
419 + 50 TO 436 + 70 = 1,720 RF TUNNEL	@ 6,600 =	11,352,000	
TOTALS	19,414 RF	128,132,000	

STATIONS (INCLUDING UTILITIES)

WILSHIRE/VERMONT	(OVER & UNDER)	936 FT	75,000,000
WILSHIRE/NORMANDIE		580 FT	36,000,000
WILSHIRE/WESTERN	(WITH CROSSOVER)	970 FT	41,400,000
VERMONT/BEVERLY		540 FT	36,000,000
VERMONT/SANTA MONICA		500 FT	36,000,000
VERMONT/SUNSET	(WITH CROSSOVER)	1,100 FT	41,400,000
TOTALS		4,626 FT	265,800,000
TOTAL TUNNEL & CUT & COVER		24,040 FT	

3.68 MILES TUNNEL 6 STATIONS ALL SUBWAY
 4.55 MILES WITH STATIONS

ALIGNMENT I

OS-B

GUIDEWAYS

VERMONT/SUNSET TO HOLLYWOOD/WESTERN			
447 + 70 TO	504 + 50 =	5,680 RF TUNNEL @ 6,600 =	37,488,000
HOLLYWOOD/WESTERN TO HOLLYWOOD/VINE			
510 + 40 TO	559 + 0 =	4,860 RF TUNNEL @ 6,600 =	32,076,000
HOLLYWOOD/VINE TO UNIVERSAL CITY			
574 + 50 TO	644 + 50 +		
821 + 0 TO	950 + 90 =	17,990 RF TUNNEL @ 6,600 =	118,734,000
VENT SHAFT - 2 EACH			2,000,000
UNIVERSAL CITY TO NORTH HOLLYWOOD			
936 + 40 TO	957 + 4 +		
958 + 8 TO	1,043 + 30 =	10,586 RF TUNNEL @ 6,600 =	69,868,000
VENT SHAFT - 1 EACH			1,000,000
WILSHIRE/WESTERN TO WILSHIRE/CRENSHAW			
59 + 70 TO	87 + 0 =	2,730 RF TUNNEL @ 6,600 =	18,018,000
WILSHIRE/CRENSHAW TO WILSHIRE/LA BREA			
92 + 50 TO	160 + 20 =	6,770 CUT & COVER @ 13,000 =	88,010,000
WILSHIRE/LA BREA TO WILSHIRE/FAIRFAX			
165 + 70 TO	212 + 50 =	4,680 CUT & COVER @ 13,000 =	60,840,000
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		53,296 RF	428,034,000

STATIONS (INCLUDING UTILITIES)

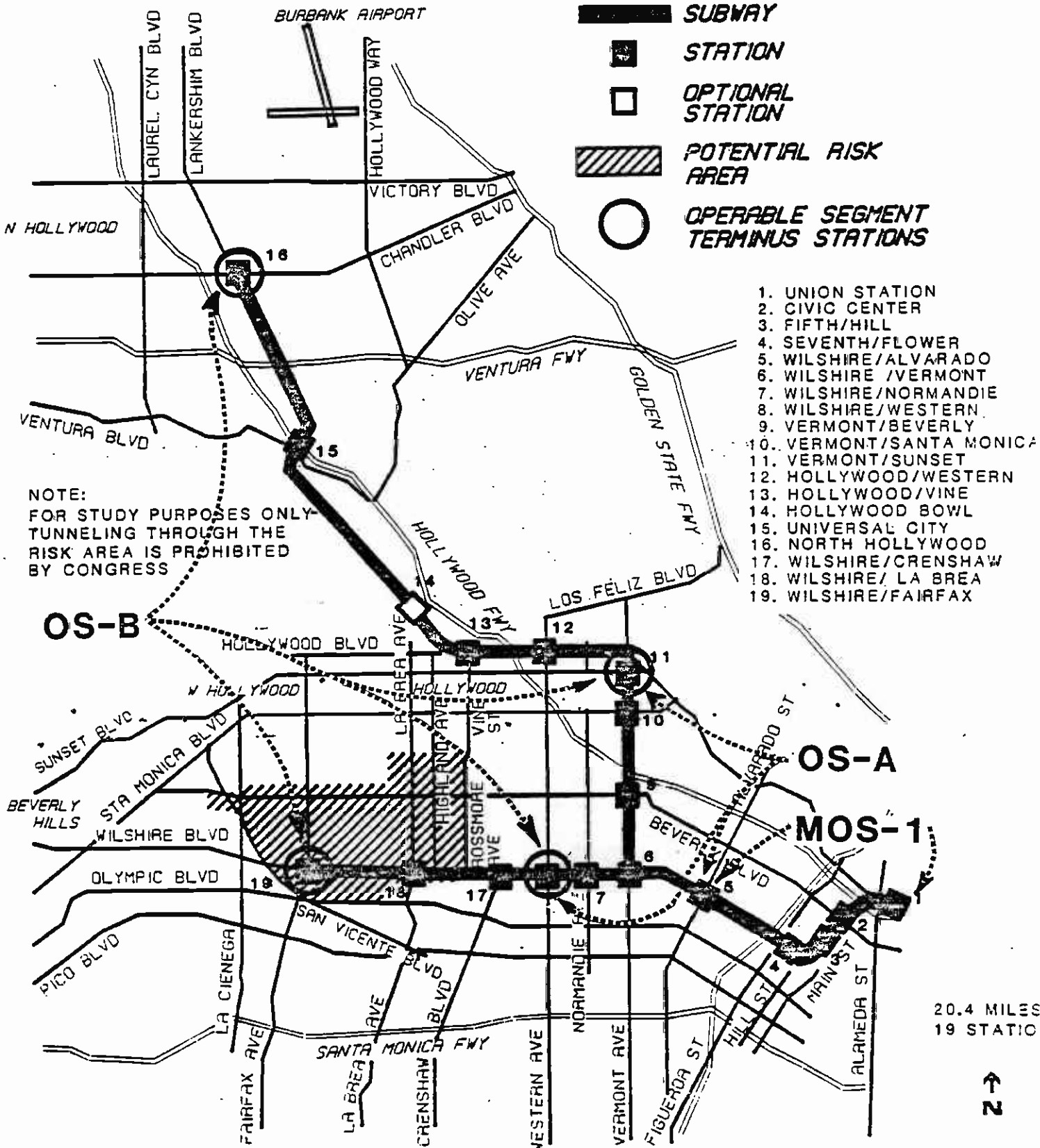
HOLLYWOOD/WESTERN		590 FT	38,000,000
HOLLYWOOD/VINE	(WITH POCKET TRACK)	1,550 FT	39,000,000
UNIVERSAL CITY		550 FT	38,000,000
NORTH HOLLYWOOD	(WITH CROSSOVER)		45,000,000
TAILTRACK		1,435 FT	10,000,000
WILSHIRE/CRENSHAW		550 FT	36,000,000
WILSHIRE/LA BREA		550 FT	36,000,000
WILSHIRE/FAIRFAX	(WITH CROSSOVER)	1,500 FT	41,400,000
TAILTRACK	(IN ABOVE)		10,000,000
		-----	-----
TOTALS		6,725 FT	291,400,000
TOTAL TUNNEL & CUT & COVER		60,021 FT	

10.09 MILES TUNNEL 7 STATIONS ALL SUBWAY
 11.37 MILES WITH STATIONS

CORE STUDY AREA

CANDIDATE ALIGNMENT 1

VERMONT/HOLLYWOOD BLVD./WILSHIRE SUBWAY



METRO RAIL COST ESTIMATE - CORE STUDY
ALIGNMENT II

HOLLYD BLVD

DATE: 16-Jan-87
REVISED ROW OS-A:

16-Jan-87
12-Feb-87

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

SEGMENT	OS-A	OS-B	TOTAL
LENGTH (MILES)	6.95	8.96	15.91
NO. OF STATIONS	8.00	5.00	13.00
FACILITIES			
GUIDEWAY	140,966	244,702	385,668
STATIONS	229,400	132,000	361,400
TOTAL FACILITIES	370,366	376,702	747,068
SYSTEMS			
TRACKWORK	16,314	20,594	36,908
ESCALATOR/ELEVATOR	20,615	11,425	32,040
SIGNS/GRAPHICS	2,040	1,275	3,315
FANS/AIR HANDLING/UPS	9,507	5,420	14,927
TRAIN CONTROL	18,118	18,826	36,944
TRACTION POWER	16,524	16,850	33,374
PASSENGER VEHICLES	49,389	51,540	100,929
COMMUNICATIONS	8,231	9,095	17,326
FARE COLLECTION	10,274	5,039	15,313
AUXILIARY VEHICLES			0
MISC EQUIPMENT	1,500	1,500	3,000
TOTAL SYSTEMS	152,512	141,344	293,856
TOTAL CAPITAL COST	522,878	518,046	1,040,924
CONTINGENCY:			
15% FACILITIES/10% SYSTEMS	70,606	70,639	141,445
DESIGN/CONSTRUCTION MGMT:			
13% FACILITIES/10% SYSTEMS	63,399	63,105	126,504
RIGHT OF WAY	71,669	82,483	154,152
AGENCY COST, 5%	26,144	25,902	52,046
OWNERS INSURANCE, 7.5%	39,216	38,853	78,069
TOTAL DECEMBER 85 COST	794,112	799,028	1,593,140
MOS-1 DECEMBER 85 COST			1,085,103
TOTAL PROJECT			2,678,243
OPERATING COST			39,400 PER YEAR

20.40 MILES--INCLUDES 4.45 AND 5 STATIONS IN MOS-1
18 STATIONS--DOES NOT INCLUDE HOLLYWOOD BOWL

ALIGNMENT II OS-A

GUIDEWAYS

WILSHIRE/ALVARADO TO WILSHIRE/VERMONT			
264 + 50 TO	310 + 30 =	4,580 RF TUNNEL @ 6,600 =	50,228,000
WILSHIRE/VERMONT TO WILSHIRE/NORMANDIE			
3 + 20 TO	31 + 50 =	2,830 RF TUNNEL @ 6,600 =	18,678,000
WILSHIRE/NORMANDIE TO WILSHIRE/WESTERN			
37 + 30 TO	50 + 70 =	1,340 RF TUNNEL @ 6,600 =	8,844,000
WILSHIRE/VERMONT TO TRANSITION			
319 + 66 TO	338 + 0 =	1,834 RF TUNNEL @ 6,600 =	12,104,000
TRANSITION			
338 + 0 TO	352 + 90 =	1,490 RF @ 5,000 =	7,450,000
TRANSITION TO VERMONT/BEVERLY			
352 + 90 TO	365 + 30 =	1,240 RF AERIAL @ 3,200 =	3,968,000
VERMONT/BEVERLY TO VERMONT/SANTA MONICA			
369 + 80 TO	414 + 50 =	4,470 RF AERIAL @ 3,200 =	14,304,000
VERMONT/SANTA MONICA TO VERMONT/SUNSET			
419 + 0 TO	433 + 80 =	1,480 RF AERIAL @ 3,200 =	4,736,000
VERMONT/SUNSET TO HOLLYWOOD/WESTERN			
442 + 30 TO	508 + 0 =	6,570 RF AERIAL @ 3,200 =	21,024,000
HOLLYWOOD/WESTERN TO TRANSITION			
512 + 50 TO	534 + 0 =	2,150 RF AERIAL @ 3,200 =	6,880,000
TRANSITION TO HOLLYWOOD/VINE			
534 + 0 TO	559 + 50 =	2,550 RF AERIAL @ 5,000 =	12,750,000
TOTALS		30,534 RF	140,966,000

STATIONS (INCLUDING UTILITIES)

WILSHIRE/VERMONT	(OVER & UNDER)	936 LF	75,000,000
WILSHIRE/NORMANDIE		580 LF	36,000,000
WILSHIRE/WESTERN	(WITH CROSSOVER)	970 LF	41,400,000
VERMONT/BEVERLY		450 LF AERIAL	9,000,000
VERMONT/SANTA MONICA		450 LF AERIAL	9,000,000
VERMONT/SUNSET	(WITH CROSSOVER)	850 LF AERIAL	11,000,000
HOLLYWOOD/WESTERN		450 LF AERIAL	9,000,000
HOLLYWOOD/VINE	(WITH POCKET TRACK)	1,500 LF SUBWAY	39,000,000
TOTALS		6,186 FT	229,400,000
		1.17 MILES	

GUIDEWAYS: TUNNEL 12,074 RF 2.29 MILES
 AERIAL 18,460 RF 3.49 MILES

STATIONS: TUNNEL 4
 AERIAL 4

ALIGNMENT II

OS-6

GUIDEWAYS

WILSHIRE/WESTERN TO TRANSITION			
60 + 0 TO	74 + 30 =	1,430 RF TUNNEL @ 6,600 =	9,438,000
TRANSITION			
74 + 30 TO	87 + 0 =	1,270 RF @ 5,000 =	6,350,000
TRANSITION TO WILSHIRE/CRENSHAW			
87 + 0 TO	89 + 70 =	270 RF AERIAL @ 3,200 =	864,000
WILSHIRE/CRENSHAW TO WILSHIRE/LA BREA			
94 + 20 TO	163 + 70 =	6,950 RF AERIAL @ 3,200 =	22,240,000
WILSHIRE/LA BREA TO WILSHIRE/FAIRFAX			
168 + 20 TO	212 + 60 =	4,440 RF AERIAL @ 3,200 =	14,208,000
HOLLYWOOD/VINE TO UNIVERSAL CITY			
574 + 50 TO	644 + 50 +	=	
821 + 0 TO	930 + 90 =	17,990 RF TUNNEL @ 6,600 =	118,734,000
VENT SHAFT - 2 EACH			2,000,000
UNIVERSAL CITY TO NORTH HOLLYWOOD			
936 + 40 TO	957 + 4 +		
958 + 8 TO	1,043 + 30 =	10,586 RF TUNNEL @ 6,600 =	69,868,000
VENT SHAFT - 1 EACH			1,000,000

TOTAL	31,276 RF	TUNNEL	244,702,000
	11,660 RF	AERIAL	

STATIONS (INCLUDING UTILITIES)

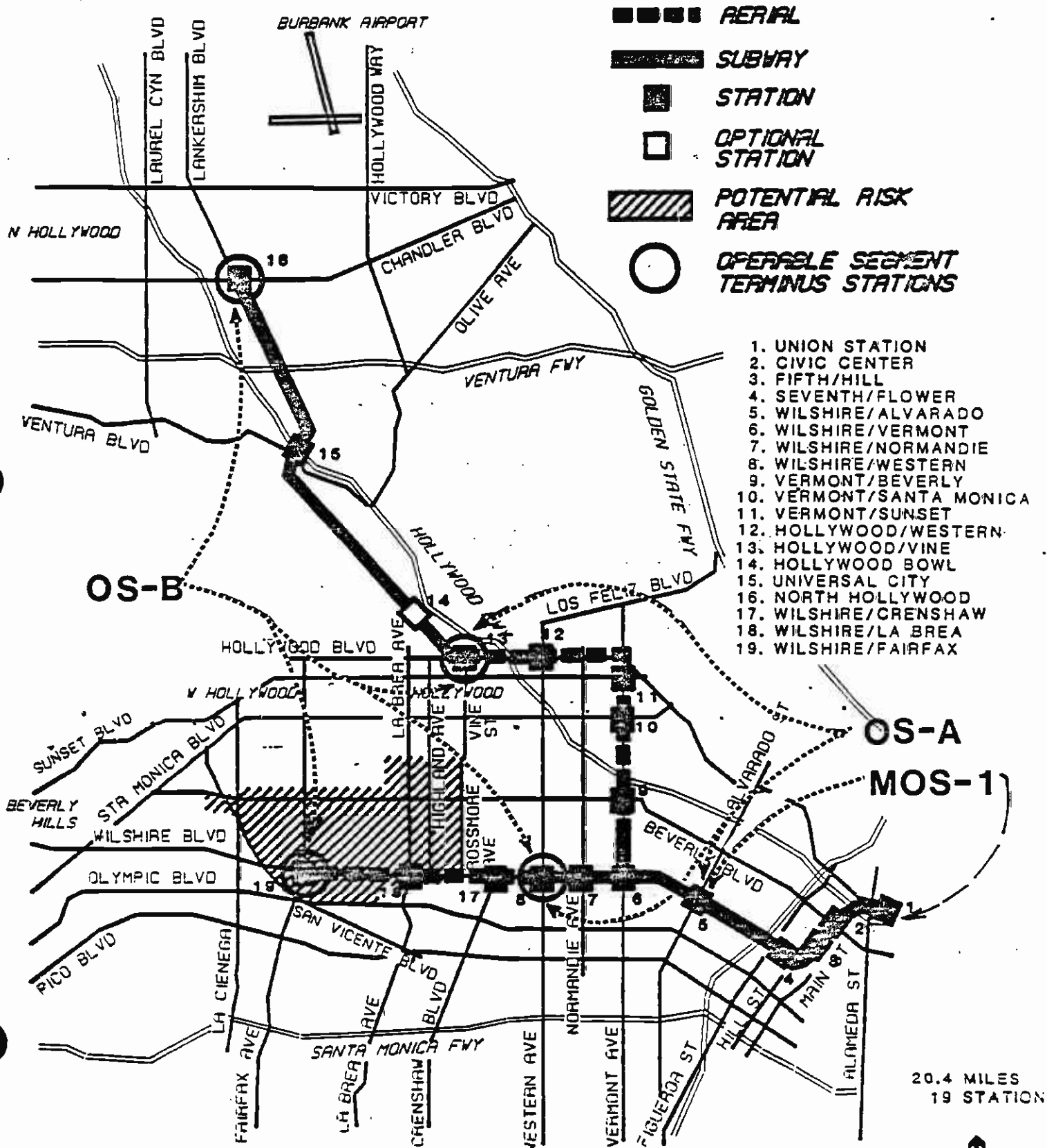
WILSHIRE/CRENSHAW		450 LF AERIAL	9,000,000
WILSHIRE/LA BREA		450 LF AERIAL	9,000,000
WILSHIRE/FAIRFAX	(WITH CROSSOVER)	1,500 LF AERIAL	11,000,000
TAILTRACK			10,000,000
UNIVERSAL CITY		550 LF	38,000,000
NORTH HOLLYWOOD	(WITH CROSSOVER)	1,435 LF	45,000,000
TAILTRACK			10,000,000

TOTALS		4,385 LF	132,000,000
GUIDEWAYS:	TUNNEL	31,276 RF	5.92 MILES
	AERIAL	11,660 RF	2.21 MILES
STATIONS:	TUNNEL	2	
	AERIAL	3	

CORE STUDY AREA

CANDIDATE ALIGNMENT 2

VERMONT/HOLLYWOOD BLVD./WILSHIRE AERIAL



METRO RAIL COST ESTIMATE - CORE STUDY

ALIGNMENT III

HOLLYD BLVD

DATE: 16-Jan-87
 REVISED ROW OS-B: 02-Feb-87
 REVISED ROW OS-A: 12-Feb-87

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

SEGMENT	OS-A	OS-B	TOTAL
-----	-----	-----	-----
LENGTH (MILES)	6.95	8.41	15.36
NO. OF STATIONS	8.00	5.00	13.00
FACILITIES			
-----	-----	-----	-----
GUIDEWAY	140,966	261,678	402,644
STATIONS	229,400	216,400	445,800
TOTAL FACILITIES	370,366	478,078	848,444
SYSTEMS			
-----	-----	-----	-----
TRACKWORK	16,314	19,464	35,778
ESCALATOR/ELEVATOR	20,615	11,425	32,040
SIGNS/GRAPHICS	2,040	1,275	3,315
FANS/AIR HANDLING/UPS	9,507	8,550	18,057
TRAIN CONTROL	18,118	18,410	36,528
TRACTION POWER	16,524	15,395	31,919
PASSENGER VEHICLES	49,389	51,340	100,729
COMMUNICATIONS	8,251	10,356	18,607
FARE COLLECTION	10,274	5,039	15,313
AUXILIARY VEHICLES			0
MISC EQUIPMENT	1,500	1,500	3,000
TOTAL SYSTEMS	152,512	142,754	295,266
TOTAL CAPITAL COST	522,878	620,832	1,143,710
CONTINGENCY:			
15% FACILITIES/10% SYSTEMS	70,806	85,987	156,793
DESIGN/CONSTRUCTION MGMT:			
13% FACILITIES/10% SYSTEMS	63,399	76,426	139,825
RIGHT OF WAY	71,669	53,869	125,538
AGENCY COST, 5%	26,144	31,042	57,186
OWNERS INSURANCE, 7.5%	39,216	46,562	85,778
TOTAL DECEMBER 85 COST	794,112	914,718	1,708,830
MOS-1 DECEMBER 85 COST			1,085,103
TOTAL PROJECT			2,793,933
OPERATING COST			39,000 PER YEAR

19.90 MILES--INCLUDES 4.45 MILES AND 5 STATIONS IN MOS-1
 18 STATIONS

GUIDEWAYS

WILSHIRE/ALVARADO TO WILSHIRE/VERMONT		
264 + 50 TO 310 + 50 =	4,580 RF TUNNEL @ 6,600 =	30,228,000
WILSHIRE/VERMONT TO WILSHIRE/NORMANDIE		
3 + 20 TO 31 + 50 =	2,830 RF TUNNEL @ 6,600 =	18,678,000
WILSHIRE/NORMANDIE TO WILSHIRE/WESTERN		
37 + 30 TO 50 + 70 =	1,340 RF TUNNEL @ 6,600 =	8,844,000
WILSHIRE/VERMONT TO TRANSITION		
319 + 66 TO 338 + 0 =	1,834 RF TUNNEL @ 6,600 =	12,104,000
TRANSITION		
338 + 0 TO 352 + 90 =	1,490 RF @ 5,000 =	7,450,000
TRANSITION TO VERMONT/BEVERLY		
352 + 90 TO 365 + 30 =	1,240 RF AERIAL @ 3,200 =	3,968,000
VERMONT/BEVERLY TO VERMONT/SANTA MONICA		
369 + 80 TO 414 + 50 =	4,470 RF AERIAL @ 3,200 =	14,304,000
VERMONT/SANTA MONICA TO VERMONT/SUNSET		
419 + 0 TO 433 + 80 =	1,480 RF AERIAL @ 3,200 =	4,736,000
VERMONT/SUNSET TO HOLLYWOOD/WESTERN		
442 + 30 TO 508 + 0 =	6,570 RF AERIAL @ 3,200 =	21,024,000
HOLLYWOOD/WESTERN TO TRANSITION		
512 + 50 TO 534 + 0 =	2,150 RF AERIAL @ 3,200 =	6,880,000
TRANSITION TO HOLLYWOOD/VINE		
534 + 0 TO 559 + 50 =	2,550 RF AERIAL @ 5,000 =	12,750,000
TOTALS	30,534 RF	140,966,000

STATIONS (INCLUDING UTILITIES)

WILSHIRE/VERMONT	(OVER & UNDER)	936 LF	75,000,000
WILSHIRE/NORMANDIE		580 LF	36,000,000
WILSHIRE/WESTERN	(WITH CROSSOVER)	970 LF	41,400,000
VERMONT/BEVERLY		450 LF AERIAL	9,000,000
VERMONT/SANTA MONICA		450 LF AERIAL	9,000,000
VERMONT/SUNSET	(WITH CROSSOVER)	850 LF AERIAL	11,000,000
HOLLYWOOD/WESTERN		450 LF AERIAL	9,000,000
HOLLYWOOD/VINE	(WITH POCKET TRACK)	1,500 LF SUBWAY	39,000,000
TOTALS		6,186 FT	229,400,000
		1.17 MILES	
GUIDEWAYS:	TUNNEL	12,074 RF	2.29 MILES
	AERIAL	18,460 RF	3.49 MILES
STATIONS:	TUNNEL	4	
	AERIAL	4	

ALIGNMENT III
OS-B

GUIDEWAYS

WILSHIRE/WESTERN TO CRENSHAW/OLYMPIC			
59 + 70 TO 113 + 70 = 5,400 RF TUNNEL @ 6,600 =			35,640,000
CRENSHAW/OLYMPIC TO SAN VICENTE/PICO			
119 + 40 TO 167 + 60 = 4,820 RF TUNNEL @ 6,600 =			31,812,000
VENT SHAFT			1,000,000
HOLLYWOOD/VINE TO HOLLYWOOD/HIGHLAND			
574 + 50 TO 593 + 50 = 1,900 RF TUNNEL @ 6,600 =			12,540,000
HOLLYWOOD/HIGHLAND TO UNIVERSAL CITY			
599 + 30 TO 753 + 76 +			
922 + 0 TO 930 + 90 = 16,336 RF TUNNEL @ 6,600 =			107,819,000
VENT SHAFT			2,000,000
UNIVERSAL CITY TO NORTH HOLLYWOOD			
936 + 40 TO 957 + 4 +			
958 + 8 TO 1,043 + 30 = 10,586 RF TUNNEL @ 6,600 =			69,868,000
VENT SHAFT			1,000,000
		-----	-----
TOTAL	39,042 RF	TUNNEL	261,678,000

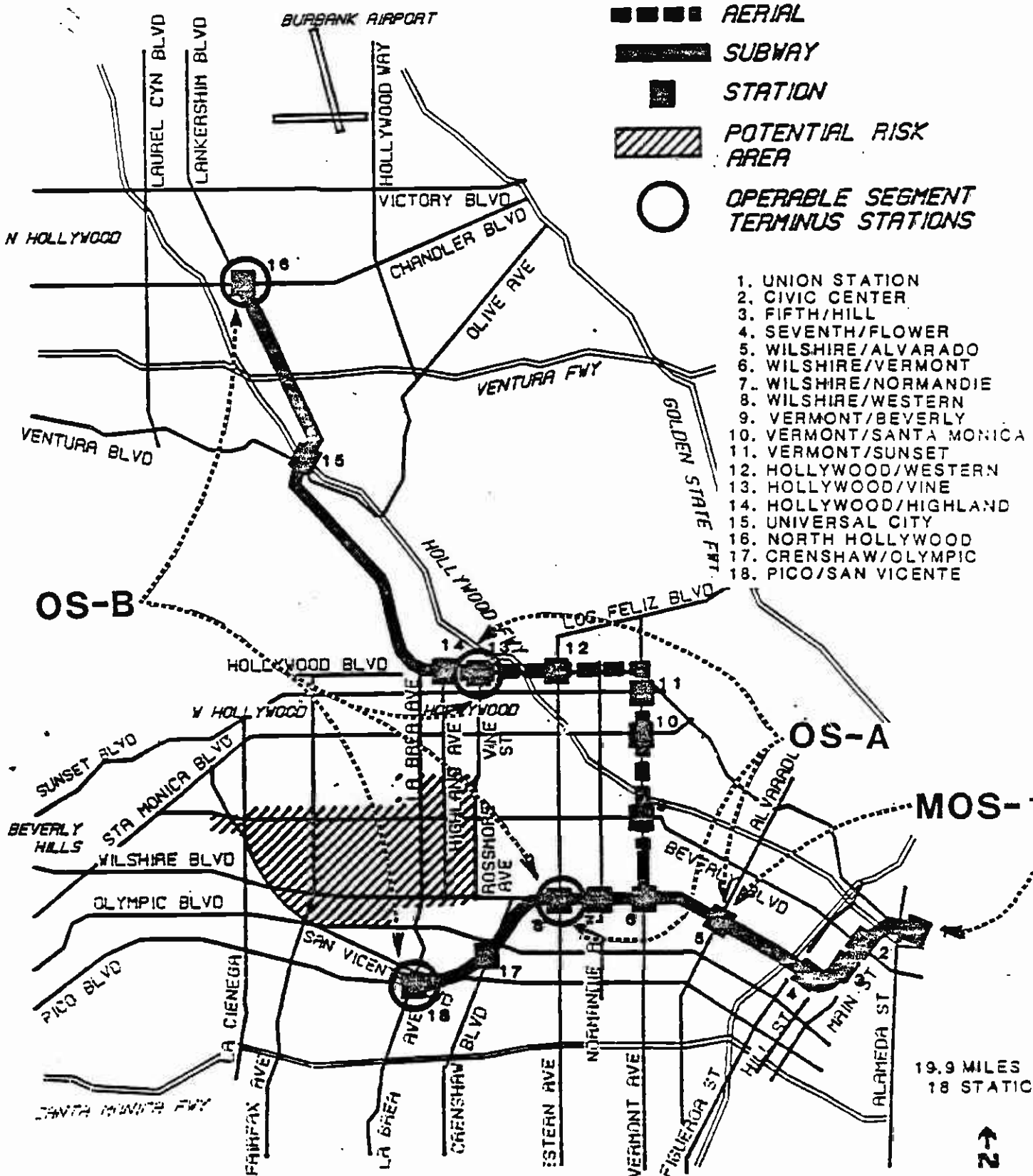
STATIONS (INCLUDING UTILITIES)

CRENSHAW/OLYMPIC		570 LF	36,000,000
SAN VICENTE/PICO	(WITH CROSSOVER)		41,400,000
TAILTRACK		2,240 LF	10,000,000
HOLLYWOOD/HIGHLAND		580 LF	36,000,000
UNIVERSAL CITY		550 LF	38,000,000
NORTH HOLLYWOOD	(WITH CROSSOVER)	1,435 LF	45,000,000
TAILTRACK			10,000,000
		-----	-----
TOTALS		5,375 LF	216,400,000
GUIDEWAYS:	39,042 RF	7.39 MILES	
STATIONS:	5 ALL TUNNEL		

CORE STUDY AREA

CANDIDATE ALIGNMENT 3

VERMONT/HOLLYWOOD. AERIAL, PICO/SAN VICENTE SUBWAY



19.9 MILES
18 STATIC



METRO RAIL COST ESTIMATE - CORE STUDY
ALIGNMENT IV

DATE: 16-Jan-87

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

SEGMENT	OS-A	OS-B	TOTAL
LENGTH (MILES)	6.81	9.23	16.04
NO. OF STATIONS	8.00	6.00	14.00
FACILITIES			
GUIDEWAY	137,262	250,246	387,508
STATIONS	227,400	168,000	395,400
TOTAL FACILITIES	364,662	418,246	782,908
SYSTEMS			
TRACKWORK	15,827	21,134	36,961
ESCALATOR/ELEVATOR	20,615	13,710	34,325
STGNS/GRAPHICS	2,040	1,530	3,570
FANS/AIR HANDLING/UPS	9,507	7,130	16,637
TRAIN CONTROL	18,015	18,940	36,955
TRACTION POWER	16,391	18,185	34,576
PASSENGER VEHICLES	49,389	51,370	100,759
COMMUNICATIONS	8,120	9,967	18,087
FARE COLLECTION	10,274	6,140	16,414
AUXILIARY VEHICLES			0
MISC EQUIPMENT	1,500	1,500	3,000
TOTAL SYSTEMS	151,678	149,606	301,284
TOTAL CAPITAL COST	516,340	567,852	1,084,192
CONTINGENCY:			
15% FACILITIES/10% SYSTEMS	69,867	77,698	147,565
DESIGN/CONSTRUCTION MGMT:			
13% FACILITIES/10% SYSTEMS	62,574	69,333	131,907
RIGHT OF WAY	50,148	85,601	135,749
AGENCY COST, 5%	25,817	28,393	54,210
OWNERS INSURANCE, 7.5%	38,726	42,589	81,315
TOTAL DECEMBER 85 COST	763,472	871,466	1,634,938
MOS-1 DECEMBER 85 COST			1,085,103
TOTAL PROJECT			2,720,041
OPERATING COST			40,200 PER YEAR

20.50 MILES--INCLUDES 4.45 MILES AND 5 STATIONS IN MOS-1
19 STATIONS--DOES NOT INCLUDE HOLLYWOOD BOWL

ALIGNMENT IV OS-A

GUIDEWAYS

WILSHIRE/ALVARADO TO WILSHIRE/VERMONT			
264 + 50 TO 310 + 30 =	4,580 RF TUNNEL	@ 6,600 =	30,228,000
WILSHIRE/VERMONT TO WILSHIRE/NORMANDIE			
3 + 20 TO 31 + 50 =	2,830 RF TUNNEL	@ 6,600 =	18,678,000
WILSHIRE/NORMANDIE TO WILSHIRE/WESTERN			
37 + 30 TO 50 + 70 =	1,340 RF TUNNEL	@ 6,600 =	8,844,000
WILSHIRE/VERMONT TO TRANSITION			
319 + 66 TO 338 + 0 =	1,834 RF TUNNEL	@ 6,600 =	12,104,000
TRANSITION			
338 + 0 TO 352 + 90 =	1,490 RF	@ 5,000 =	7,450,000
TRANSITION TO VERMONT/BEVERLY			
352 + 90 TO 365 + 30 =	1,240 RF AERIAL	@ 3,200 =	3,968,000
VERMONT/BEVERLY TO VERMONT/SANTA MONICA			
369 + 80 TO 414 + 50 =	4,470 RF AERIAL	@ 3,200 =	14,304,000
VERMONT/SANTA MONICA TO SUNSET/EDGEHONT			
419 + 0 TO 455 + 30 =	3,630 RF AERIAL	@ 3,200 =	11,616,000
SUNSET/EDGEHONT TO SUNSET/WESTERN			
459 + 80 TO 495 + 30 =	3,550 RF AERIAL	@ 3,200 =	11,360,000
SUNSET/WESTERN TO TRANSITION			
499 + 80 TO 530 + 0 +			
510 + 20 TO 521 + 50 =	3,550 RF AERIAL	@ 3,200 =	11,360,000
TRANSITION TO SUNSET/VINE			
521 + 50 TO 536 + 20 =	1,470 RF AERIAL	@ 5,000 =	7,350,000

TOTALS	29,984 RF		137,262,000

STATIONS (INCLUDING UTILITIES)

WILSHIRE/VERMONT	(OVER & UNDER)	936 LF	75,000,000
WILSHIRE/NORMANDIE		580 LF	36,000,000
WILSHIRE/WESTERN	(WITH CROSSOVER)	970 LF	41,400,000
VERMONT/BEVERLY		450 LF AERIAL	9,000,000
VERMONT/SANTA MONICA		450 LF AERIAL	9,000,000
SUNSET/EDGEHONT		450 LF AERIAL	9,000,000
SUNSET/WESTERN		450 LF AERIAL	9,000,000
SUNSET/VINE	(WITH POCKET TRACK)	1,680 LF SUBWAY	39,000,000

TOTALS		5,966 LF	227,400,000
		1.13 MILES	

GUIDEWAYS: TUNNEL 12,074 RF 2.29 MILES
 AERIAL 17,910 RF 3.49 MILES

STATIONS: TUNNEL 4
 AERIAL 4

ALIGNMENT IV

05-B

GUIDEWAYS

SUNSET/VINE TO HIGHLAND/HOLLYWOOD

553 + 0 TO 577 + 50 = 2,450 RF TUNNEL @ 6,600 = 16,170,000

HIGHLAND/HOLLYWOOD TO UNIVERSAL CITY

583 + 10 TO 622 + 50 +
630 + 0 TO 644 + 50 +
821 + 0 TO 930 + 90 = 16,380 RF TUNNEL @ 6,600 = 108,108,000

VENT SHAFT 2 EACH 2,000,000

UNIVERSAL CITY TO NORTH HOLLYWOOD

936 + 40 TO 957 + 4 +
958 + 8 TO 1,043 + 30 = 10,586 RF TUNNEL @ 6,600 = 69,868,000

VENT SHAFT 1 EACH 1,000,000

WILSHIRE/WESTERN TO TRANSITION

60 + 0 TO 74 + 30 = 1,430 RF TUNNEL @ 6,600 = 9,438,000

TRANSITION

74 + 30 TO 87 + 0 = 1,270 RF @ 5,000 = 6,350,000

TRANSITION TO WILSHIRE/CRENSHAW

87 + 0 TO 89 + 70 = 270 RF AERIAL @ 3,200 = 864,000

WILSHIRE/CRENSHAW TO WILSHIRE/LA BREA

94 + 20 TO 163 + 70 = 6,950 RF AERIAL @ 3,200 = 22,240,000

WILSHIRE/LA BREA TO WILSHIRE/FAIRFAX

168 + 20 TO 212 + 60 = 4,440 RF AERIAL @ 3,200 = 14,208,000

TOTAL 43,776 RF TUNNEL 250,246,000

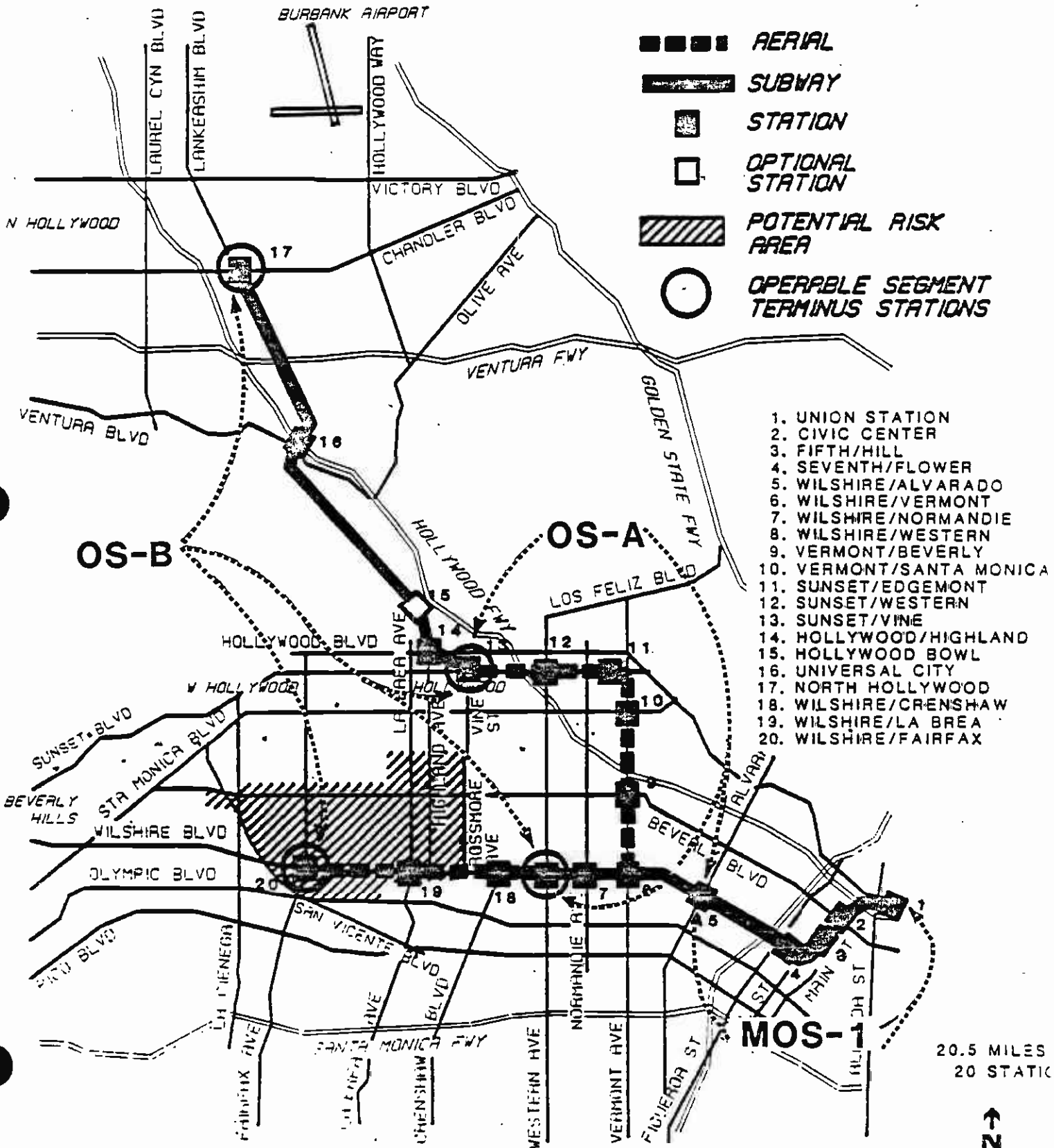
STATIONS (INCLUDING UTILITIES)

HIGHLAND/HOLLYWOOD	560 LF	36,000,000
UNIVERSAL CITY	550 LF	38,000,000
NORTH HOLLYWOOD (WITH CROSSOVER)	1,435 LF	45,000,000
TAILTRACK		10,000,000
WILSHIRE/CRENSHAW	450 LF AERIAL	9,000,000
WILSHIRE/LA BREA	450 LF AERIAL	9,000,000
WILSHIRE/FAIRFAX (WITH CROSSOVER)	1,500 LF AERIAL	11,000,000
TAILTRACK		10,000,000
TOTALS	4,945 LF	168,000,000

GUIDEWAYS: TUNNEL 32,116 RF 6.08 MILES
AERIAL 11,660 RF 2.21 MILES

STATIONS: TUNNEL 3
AERIAL 3

CORE STUDY AREA CANDIDATE ALIGNMENT 4 VERMONT/SUNSET/WILSHIRE AERIAL



METRO RAIL COST ESTIMATE - CORE STUDY
ALIGNMENT V

DATE: 16-Jan-87

ALL COSTS IN THOUSANDS, DECEMBER 1985 DOLLARS, UNESCALATED

SEGMENT	OS-A	OS-B	TOTAL
LENGTH (MILES)	5.80	9.23	15.03
NO. OF STATIONS	6.00	5.00	11.00
FACILITIES			
GUIDEWAY	172,676	254,074	426,750
STATIONS	268,800	132,000	400,800
TOTAL FACILITIES	441,476	386,074	827,550
SYSTEMS			
TRACKWORK	13,098	21,138	34,236
ESCALATOR/ELEVATOR	16,045	11,425	27,470
SIGNS/GRAPHICS	1,530	1,275	2,805
FANS/AIR HANDLING/UPS	10,260	5,420	15,680
TRAIN CONTROL	16,629	18,941	35,570
TRACTION POWER	12,627	16,978	29,605
PASSENGER VEHICLES	49,329	51,340	100,669
COMMUNICATIONS	7,750	9,267	17,017
FARE COLLECTION	8,340	4,771	13,111
AUXILIARY VEHICLES			0
MISC EQUIPMENT	1,500	1,500	3,000
TOTAL SYSTEMS	137,108	142,055	279,163
TOTAL CAPITAL COST	578,584	528,129	1,106,713
CONTINGENCY:			
15% FACILITIES/10% SYSTEMS	79,952	72,117	152,049
DESIGN/CONSTRUCTION MGMT:			
13% FACILITIES/10% SYSTEMS	71,103	64,395	135,498
RIGHT OF WAY	16,444	82,043	98,487
AGENCY COST, 5%	28,929	26,406	55,335
OWNERS INSURANCE, 7.5%	43,394	39,610	83,004
TOTAL DECEMBER 85 COST	818,386	812,700	1,631,086
MOS-1 DECEMBER 85 COST			1,085,103
TOTAL PROJECT			2,716,189
OPERATING COST			37,600 PER YEAR

19.70 MILES--INCLUDES 4.45 MILES AND 5 STATIONS IN MOS-1
16 STATIONS--DOES NOT INCLUDE HOLLYWOOD BOWL

ALIGNMENT V OS-A

GUIDEWAYS

WILSHIRE/ALVARADO TO WILSHIRE/VERMONT		
264 + 50 TO 315 + 50 = 4,900 RF TUNNEL	@ 6,600 =	32,340,000
WILSHIRE/VERMONT TO WILSHIRE/NORMANDIE		
319 + 10 TO 345 + 20 = 2,610 RF TUNNEL	@ 6,600 =	17,226,000
WILSHIRE/NORMANDIE TO WILSHIRE/WESTERN		
41 + 10 TO 54 + 60 = 1,350 RF CUT & COVER	@ 13,000 =	17,550,000
WILSHIRE/NORMANDIE TO WESTERN/BEVERLY		
355 + 56 TO 407 + 0 = 5,144 RF TUNNEL	@ 6,600 =	33,950,000
WESTERN/BEVERLY TO WESTERN/SANTA MONICA		
416 + 30 TO 461 + 80 = 4,500 RF TUNNEL	@ 6,600 =	29,700,000
WESTERN/SANTA MONICA TO SUNSET/VINE		
467 + 40 TO 530 + 90 = 6,350 RF TUNNEL	@ 6,600 =	41,910,000

TOTALS	24,854 RF	172,676,000

STATIONS (INCLUDING UTILITIES)

WILSHIRE/VERMONT	560 LF	36,000,000
WILSHIRE/NORMANDIE	OVER & UNDER 936 LF	75,000,000
WILSHIRE/WESTERN	WITH CROSSOVER 1,020 LF	41,400,000
WESTERN/BEVERLY	WITH CROSSOVER 980 LF	41,400,000
WESTERN/SANTA MONICA	560 LF	36,000,000
SUNSET/VINE	1,710 LF	39,000,000
	-----	-----
TOTALS	5,766 LF	268,800,000
	1.09 MILES	

GUIDEWAYS: ALL TUNNEL 24,854 RF 4.71 MILES

STATIONS: ALL TUNNEL 6

ALIGNMENT V
OS-B

GUIDEWAYS

WILSHIRE/WESTERN TO TRANSITION				
64 + 80 TO	74 + 30 =	950 RF TUNNEL	@ 6,600 =	6,270,000
TRANSITION				
74 + 30 TO	87 + 0 =	1,270 RF	@ 5,000 =	6,350,000
TRANSITION TO WILSHIRE/CRENSHAW				
87 + 0 TO	89 + 70 =	270 RF AERIAL	@ 3,200 =	864,000
WILSHIRE/CRENSHAW TO WILSHIRE/LA BREA				
94 + 20 TO	163 + 70 =	6,950 RF AERIAL	@ 3,200 =	22,240,000
WILSHIRE/LA BREA TO WILSHIRE/FAIRFAX				
168 + 20 TO	212 + 60 =	4,440 RF AERIAL	@ 3,200 =	14,208,000
SUNSET/VINE TO UNIVERSAL CITY				
548 + 0 TO	622 + 50 +			
630 + 0 TO	644 + 50 +			
821 + 0 TO	930 + 90 =	19,890 RF TUNNEL	@ 6,600 =	131,274,000
VENT SHAFT 2 EACH				2,000,000
UNIVERSAL CITY TO NORTH HOLLYWOOD				
936 + 40 TO	957 + 4 +			
958 + 8 TO	1,043 + 30 =	10,586 RF TUNNEL	@ 6,600 =	69,868,000
VENT SHAFT 1 EACH				1,000,000
TOTAL				254,074,000

STATIONS (INCLUDING UTILITIES)

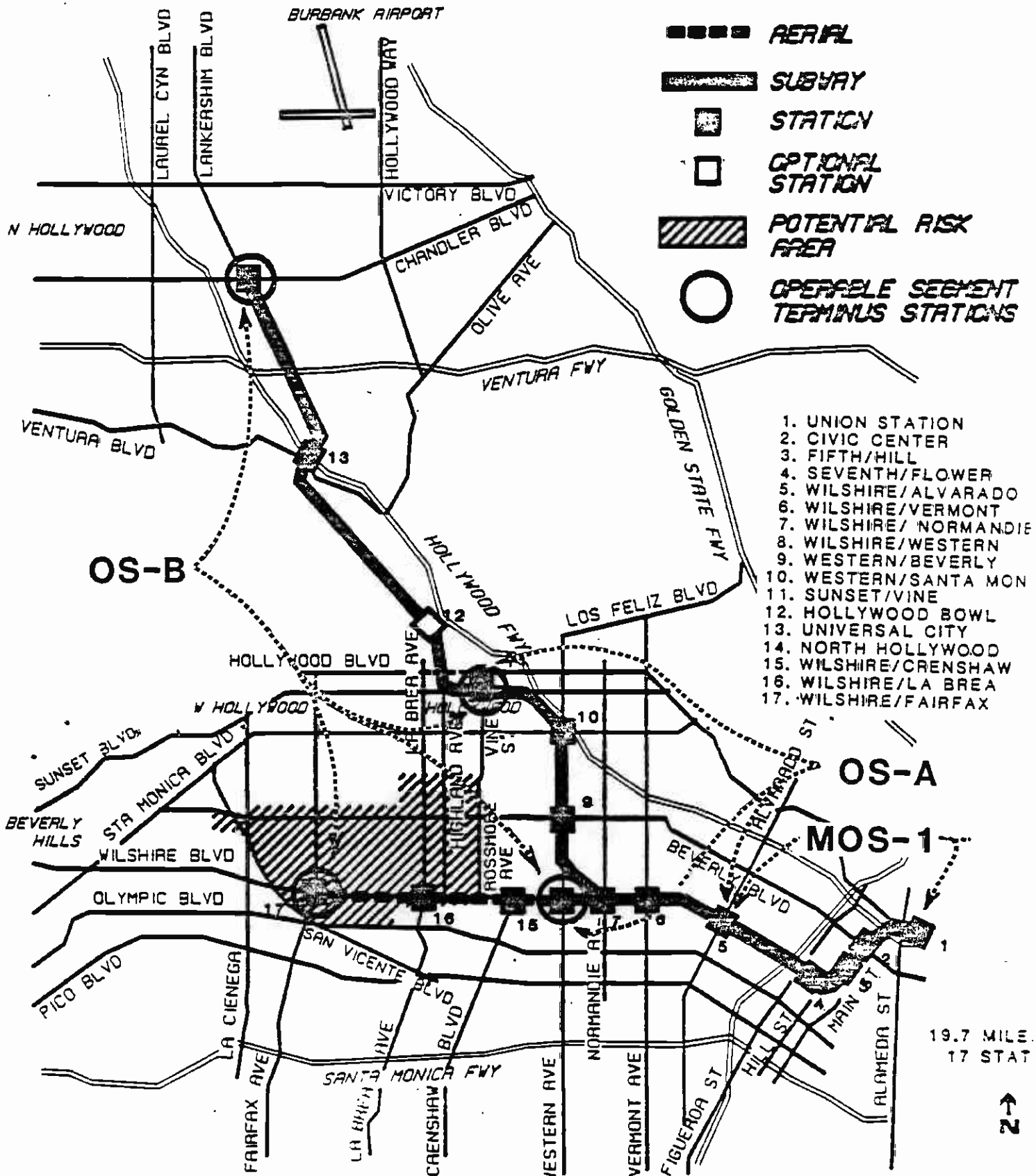
WILSHIRE/CRENSHAW		450 LF AERIAL	9,000,000
WILSHIRE/LA BREA		450 LF AERIAL	9,000,000
WILSHIRE/FAIRFAX	(WITH CROSSOVER)	1,500 LF AERIAL	11,000,000
TAILTRACK			10,000,000
UNIVERSAL CITY		550 LF	38,000,000
NORTH HOLLYWOOD	(WITH CROSSOVER)	1,435 LF	45,000,000
TAILTRACK			10,000,000
TOTALS		4,385 LF	132,000,000

GUIDEWAYS:	TUNNEL	32,696 RF	6.19 MILES
	AERIAL	11,660 RF	2.21 MILES
STATIONS:	TUNNEL	2	
	AERIAL	3	

CORE STUDY AREA

CANDIDATE ALIGNMENT 5

WESTERN/SUNSET SUBWAY, WILSHIRE AERIAL



19.7 MILE.
17 STAT