Livermore/Amador Valley Rail Alternatives Study

Final Report

Prepared for

Livermore-Amador Valley Transit Authority
and
Bay Area Rapid Transit District

December 1987

PROJECT PARTICIPANTS

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Draft Environmental Impact Report

BAY AREA RAPID TRANSIT DISTRICT

Dublin/Pleasanton Extension Project

September 1989

<u>Comments on the Draft EIR</u>

Written comments should be sent
by October 23, 1989 to:

Marianne A. Payne
Dublin/Pleasanton Extension Project
Bay Area Rapid Transit District
P.O. Box 12688
Oakland, California 94604–2688

State Clearinghouse Number 89011009

8810156-tb CON-1

TABLE 2-1 PROJECTED RIDERSHIP A.M. PEAK PERIOD (2 HOURS) AND TOTAL DAILY RIDERS FOR PROPOSED PROJECT

Station Activity	Year 1995	2000	2005
Castro Valley			
A.M. Peak Period Ons	1,000	1,130	1,330
A.M. Peak Period Offs	190	210	250
Total A.M. Peak Period	1,190	1,340	1,580
Daily Ons and Offs	4,740	5,370	6,320
West Dublin/Pleasanton			
A.M. Peak Period Ons	3,380	3,830	4,510
A.M. Peak Period Offs	450	510	600
Total A.M. Peak Period	3,830	4,340	5,110
Daily Ons and Offs	13,570	15,380	18,090
Total All Stations			
A.M. Peak Period Ons	4,380	4,960	5,840
A.M. Peak Period Offs	640	720	850
Total A.M. Peak Period	5,020	5,680	6,690
Daily Ons and Offs	18,310	20,750	24,410
Daily Passengers			
Trips to/from DPX	17,230	19,530	22,970
Intra-DPX	540	610	720
Total	17,770	20,140	23,690

Sources:
(1) Livermore/Amador Valley Rail Alternative Study (1987).
(2) 1995 and 2000 ridership estimated by Manuel Padron & Associates.

in 1989 dollars for fixed facilities are estimated to be $307.1 million. Final project costs will include inflation and escalation to midpoint of expenditures (Bechtel Civil, Inc.). This estimate does not include vehicles which have been estimated at approximately $54.3 million (Livermore/Amador Valley Rail Alternatives Study, 1987).

2.7.2 OPERATING COSTS AND REVENUES

Electrical power, maintenance of vehicles, ways and structures, and subsystems, operation of all equipment associated with the system, labor and administrative expenses are all included in operating costs. The total annual incremental operating costs for the proposed project in 1989 dollars are estimated to be $15.8 million. Total annual incremental revenue is projected to be $13.06 million. The incremental fare recovery is estimated to be 64 percent.

BART EXTENSION PROGRAM

- **In the past several years BART has funded and delivered a program of three new extensions, including 5 new stations, within budget: Pittsburg/Bay Point, Colma. and Dublin/Pleasanton.**
  - Bay Point - 7.8 mile extension running north of the existing Concord Station. Two new stations, the North Concord / Martinez Station, and the Pittsburg/Bay Point Station. Additionally, improvements were made to the existing Concord Yard.
  - Colma - 0.9 miles extension running south of the existing Daly City Station. One new station, the Colma Station adjacent to the Daly City Yard.
  - Dublin-Pleasanton - 13.8 mile extension running east of the existing Bay Fair Station in San Leandro. Two new stations, the Castro Valley Station, and the East Dublin/Pleasanton Station.

- **Through a regional rail expansion program resolution adopted by the Metropolitan Transportation Commission (MTC), funding for these extensions has been predominantly state and local sources. The total budget of $1.2 billion for these three extensions is composed of approximately 8% BART, 10% federal, 36% state, and 46% local sources.**

	Fund Source Percentages (%)			
Extension	District	Local	State	Federal
PAX	8.4	57.4	34.2	0.0
CSX	4.1	13.2	11.8	70.9
DPX	7.9	46.4	45.7	0.0

Status of expenditures relative to budget as of November 1997: Over ninety percent expended.

Extension	Budget ($M)	Expended ($M)	% of Budget
PAX	505,742	457,000	90.4
CSX	179,907	176,724	98.2
DPX	543,050	520,731	95.9
Total	1,228,699	1,154,455	93.9

- **BART has two more extensions in the planning stage:**
  - **The Warm Springs and the Oakland Airport Connector are both included in the expenditure plan for funding from an Alameda County sales tax reauthorization to go on the ballot later this year.**

BART EXTENSIONS - PROJECTED V. ACTUAL RIDERSHIP

	Daly City	Colma	total	net gain
1997	12,918	11,892	24,810	4,694
96	14,420	9,398	23,818	
95	20,116			

Projected ridership, 2000: Colma, 15200; net gain, 8200
actual ridership is 78% of projected
actual net gain is 55% of projected

	Concord	NC	Pitts	Total ext	net gain
1997	10,702	3,082	6,960	10,042	5,098 (15,646-10,042)
96	11,324	6,290	5,874	12,164	
95	15,646				

West Pittsburg opening, projected average daily passengers of 12,000
current ridership is 83% of projections, 100% last year
Projected ridership, 2000: 24,850
actual ridership is 40% of projected in 2000
net gain is low compared to total projected riders

	BF	Hay	CV	DPX	Total Ext	net gain
1997	9,300	8,986	2,810	7,826	10,636	8,750
1996	10,466	9,706				

Projected ridership, 1995: 17,770 ?
actual ridership is 59% of projected for 1995
Projected ridership, 200: 20,140
actual ridership is 52% of projected

Source: BART and EIRs
(doubled 1997, 96, 95 exits)
to compare to EIR projections

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BAY AREA RAPID TRANSIT DISTRICT
Dublin/Pleasanton Extension Project

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P.O. Box 12688
Oakland, California 94604–2688

State Clearinghouse Number 89011009

Mike, 2-27

The numbers are from the Draft EIR but they never changed in the Final.

Cam
X4834

OCITY Q4. CITY COMING FROM (ORIG)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
		402	.3	.3	.3
	ALAMEDA	2946	2.4	2.4	2.8
	ALAMO	209	.2	.2	2.9
	ALBANY	904	.7	.7	3.7
	AMERICAN	18	.0	.0	3.7
	ANTIOCH	947	.8	.8	4.5
	B	4	.0	.0	4.5
	BELMONT	69	.1	.1	4.6
	BELVEDER	9	.0	.0	4.6
	BENICIA	417	.3	.3	4.9
	BERK	21	.0	.0	4.9
	BERKELEY	6886	5.7	5.7	10.6
	BERKLEY	5	.0	.0	10.6
	BETHEL I	10	.0	.0	10.7
	BLACK HA	15	.0	.0	10.7
	BOULDER	2	.0	.0	10.7
	BRENTWOO	45	.0	.0	10.7
	BRISBANE	12	.0	.0	10.7
	BURLINGA	157	.1	.1	10.8
	BYRON	27	.0	.0	10.9
	CAMERON	6	.0	.0	10.9
	CAMPBELL	23	.0	.0	10.9
	CAPITOLA	2	.0	.0	10.9
	CARMICHA	3	.0	.0	10.9
	CASTRO V	1151	1.0	1.0	11.8
	CASTROVI	5	.0	.0	11.8
	CLAYTON	391	.3	.3	12.2
	CLYDE	8	.0	.0	12.2
	COLMA	48	.0	.0	12.2
	CONCORD	4800	4.0	4.0	16.2
	CORTE MA	32	.0	.0	16.2
	COTATI	2	.0	.0	16.2
	CROCKETT	88	.1	.1	16.3
	CUPERTIN	31	.0	.0	16.3
	DALI CIT	3	.0	.0	16.3
	DALY CIT	4878	4.0	4.0	20.4
	DAMASCUS	9	.0	.0	20.4
	DANVILLE	805	.7	.7	21.0
	DAVIS	36	.0	.0	21.1
	DC	11	.0	.0	21.1
	DIABLO	2	.0	.0	21.1
	DILY CIT	16	.0	.0	21.1
	DIXON	23	.0	.0	21.1
	DUBLIN	277	.2	.2	21.4
	E	11	.0	.0	21.4
	E OAKLAN	4	.0	.0	21.4
	EL CERRI	2173	1.8	1.8	23.2
	EL CERRT	10	.0	.0	23.2
	EL GRANA	11	.0	.0	23.2
	EL SOBRA	682	.6	.6	23.7
	ELCERRIT	8	.0	.0	23.8
	ELK GROV	6	.0	.0	23.8
	EMERVILL	5	.0	.0	23.8

OCITY Q4. CITY COMING FROM (ORIG)

EMERYVIL	216	.2	.2	23.9
FAIRFAX	30	.0	.0	24.0
FAIRFIEL	210	.2	.2	24.1
FORESTVI	5	.0	.0	24.1
FOSTER C	101	.1	.1	24.2
FREMONT	3894	3.2	3.2	27.5
FREMONTT	5	.0	.0	27.5
FRESNO	3	.0	.0	27.5
GILROY	5	.0	.0	27.5
GLEN PAR	10	.0	.0	27.5
GRATON	7	.0	.0	27.5
GREENBRA	3	.0	.0	27.5
H	8	.0	.0	27.5
HALF MOO	93	.1	.1	27.6
HARTFORD	5	.0	.0	27.6
HAYWARD	4745	3.9	3.9	31.5
HERCULES	752	.6	.6	32.1
HILLSBOR	35	.0	.0	32.2
HOLLISTE	5	.0	.0	32.2
HONOLULU	8	.0	.0	32.2
IRVINE	10	.0	.0	32.2
KELSEYVI	11	.0	.0	32.2
KENSINGT	233	.2	.2	32.4
LA HONDA	11	.0	.0	32.4
LAFAYETT	1363	1.1	1.1	33.5
LARKSPUR	7	.0	.0	33.5
LIVERMOR	400	.3	.3	33.9
LODI	14	.0	.0	33.9
LOS ALTO	20	.0	.0	33.9
LOS ANGE	6	.0	.0	33.9
LOS GATO	29	.0	.0	33.9
MANTECA	6	.0	.0	33.9
MARTINEZ	1085	.9	.9	34.8
MENLO PA	36	.0	.0	34.8
MENLO PK	5	.0	.0	34.8
MERIDIAN	3	.0	.0	34.9
MILL VAL	25	.0	.0	34.9
MILLBRAE	211	.2	.2	35.0
MILPITAS	162	.1	.1	35.2
MISSION	18	.0	.0	35.2
MODESTO	60	.0	.0	35.2
MONTARA	20	.0	.0	35.3
MONTCLAI	13	.0	.0	35.3
MONTEREY	3	.0	.0	35.3
MORAGA	637	.5	.5	35.8
MORGAN H	30	.0	.0	35.8
MOSS BEA	47	.0	.0	35.9
MOUNT HO	3	.0	.0	35.9
MOUNTAIN	23	.0	.0	35.9
NAPA	54	.0	.0	35.9
NEWARD	9	.0	.0	35.9
NEWARK	616	.5	.5	36.5
NEWMAN	8	.0	.0	36.5
NO BERKE	11	.0	.0	36.5
NORTH BE	17	.0	.0	36.5
NORTH OA	8	.0	.0	36.5
NOVATO	83	.1	.1	36.6

OCITY Q4. CITY COMING FROM (ORIG)

O	9	.0	.0	36.6
OAK	33	.0	.0	36.6
OAK MUSE	2	.0	.0	36.6
OAK PARK	1	.0	.0	36.6
OAKLAND	17431	14.5	14.5	51.0
OAKLEY	175	.1	.1	51.2
ORANGEVA	14	.0	.0	51.2
ORINDA	921	.8	.8	52.0
PACHECO	105	.1	.1	52.1
PACIFICA	1200	1.0	1.0	53.0
PALO ALT	159	.1	.1	53.2
PATTERSO	8	.0	.0	53.2
PETALUMA	43	.0	.0	53.2
PHOENIX	8	.0	.0	53.2
PIEDMONT	299	.2	.2	53.5
PINOLE	526	.4	.4	53.9
PINOLR	11	.0	.0	53.9
PITTS	8	.0	.0	53.9
PITTSBUR	1391	1.2	1.2	55.1
PLACERVI	12	.0	.0	55.1
PLEASANT	2045	1.7	1.7	56.8
POINT RI	26	.0	.0	56.8
PORT COS	10	.0	.0	56.8
PORTLAND	22	.0	.0	56.8
PORTOLA	18	.0	.0	56.8
PRINCETO	3	.0	.0	56.9
PT RICHM	16	.0	.0	56.9
RANCHO C	8	.0	.0	56.9
REDDING	10	.0	.0	56.9
REDWOOD	124	.1	.1	57.0
RENO	13	.0	.0	57.0
RICHMOND	3898	3.2	3.2	60.2
RIO LIND	8	.0	.0	60.2
RIO VIST	5	.0	.0	60.2
ROCKLIN	2	.0	.0	60.2
RODEO	101	.1	.1	60.3
ROHNERT	28	.0	.0	60.3
ROSEVILL	6	.0	.0	60.3
ROSSMORE	7	.0	.0	60.4
S F	58	.0	.0	60.4
S HAYWAR	1	.0	.0	60.4
S P	10	.0	.0	60.4
SACRAMEN	133	.1	.1	60.5
SALINAS	2	.0	.0	60.5
SAN ANSE	26	.0	.0	60.5
SAN BERN	9	.0	.0	60.6
SAN BRUN	767	.6	.6	61.2
SAN CARL	31	.0	.0	61.2
SAN FRAN	30292	25.1	25.1	86.3
SAN JOSE	638	.5	.5	86.9
SAN LEAN	3288	2.7	2.7	89.6
SAN LORE	710	.6	.6	90.2
SAN MATE	361	.3	.3	90.5
SAN PABL	959	.8	.8	91.3
SAN RAFA	74	.1	.1	91.3
SAN RAMO	504	.4	.4	91.7
SANLEAND	3	.0	.0	91.7

OCITY Q4. CITY COMING FROM (ORIG)

SANTA CL	71	.1	.1	91.8
SANTA CR	14	.0	.0	91.8
SANTA RO	33	.0	.0	91.8
SARATOGA	20	.0	.0	91.9
SAUSALIT	61	.1	.1	91.9
SCOTTS V	3	.0	.0	91.9
SEBASTOP	28	.0	.0	91.9
SF	192	.2	.2	92.1
SF UCSF	28	.0	.0	92.1
SO SAN F	19	.0	.0	92.1
SONOMA	7	.0	.0	92.1
SONORA	11	.0	.0	92.2
SOUTH HA	42	.0	.0	92.2
SOUTH SA	1411	1.2	1.2	93.4
STANFORD	4	.0	.0	93.4
STOCKTON	79	.1	.1	93.4
SUISUN C	103	.1	.1	93.5
SUNNYVAL	106	.1	.1	93.6
SUNOL	10	.0	.0	93.6
TARAVAL	4	.0	.0	93.6
THOUSAND	2	.0	.0	93.6
TRACY	150	.1	.1	93.7
UNION CI	1732	1.4	1.4	95.2
VACAVILL	44	.0	.0	95.2
VALLEJO	1269	1.1	1.1	96.3
VALY	16	.0	.0	96.3
W PITTSB	18	.0	.0	96.3
WALNUT C	4394	3.6	3.6	99.9
WALNUTR	8	.0	.0	99.9
WATSONVI	3	.0	.0	99.9
WEST BER	3	.0	.0	99.9
WEST PIT	34	.0	.0	100.0
WHEATLAN	8	.0	.0	100.0
WINTERS	10	.0	.0	100.0
WLANUT C	1	.0	.0	100.0
WOODSIDE	4	.0	.0	100.0
YERBA BU	4	.0	.0	100.0
YOUNTVIL	5	.0	.0	100.0
ZEPHYR C	5	.0	.0	100.0
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TOTAL	120621	100.0	100.0	

Valid Cases 120621 Missing Cases 0

OSTANO Q1. ORIGIN STATION

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
RICHMOND	1	2098	1.7	1.7	1.7
EL CERRITO DEL NORTE	2	5690	4.7	4.7	6.5
EL CERRITO PLAZA	3	3174	2.6	2.6	9.1
NORTH BERKELEY	4	2342	1.9	1.9	11.0
BERKELEY	5	2568	2.1	2.1	13.2
ASHBY	6	2380	2.0	2.0	15.1
MACARTHUR	7	3008	2.5	2.5	17.6
19TH STREET	8	2124	1.8	1.8	19.4
12TH STREET	9	2923	2.4	2.4	21.8
LAKE MERRITT	10	1580	1.3	1.3	23.1
FRUITVALE	11	4556	3.8	3.8	26.9
COLISEUM	12	2324	1.9	1.9	28.8
SAN LEANDRO	13	2752	2.3	2.3	31.1
BAY FAIR	14	4007	3.3	3.3	34.4
HAYWARD	15	2977	2.5	2.5	36.9
SOUTH HAYWARD	16	2470	2.0	2.0	38.9
UNION CITY	17	3073	2.5	2.5	41.5
FREMONT	18	3707	3.1	3.1	44.6
CONCORD	19	5738	4.8	4.8	49.3
PLEASANT HILL	20	5896	4.9	4.9	54.2
WALNUT CREEK	21	3086	2.6	2.6	56.8
LAFAYETTE	22	2498	2.1	2.1	58.8
ORINDA	23	1980	1.6	1.6	60.5
ROCKRIDGE	24	2815	2.3	2.3	62.8
WEST OAKLAND	25	2703	2.2	2.2	65.1
EMBARCADERO	26	1722	1.4	1.4	66.5
MONTGOMERY	27	2254	1.9	1.9	68.3
POWELL	28	3189	2.6	2.6	71.0
CIVIC CENTER	29	3778	3.1	3.1	74.1
16TH STREET	30	3507	2.9	2.9	77.0
24TH STREET	31	7277	6.0	6.0	83.1
GLEN PARK	32	5101	4.2	4.2	87.3
BALBOA PARK	33	7570	6.3	6.3	93.6
DALY CITY	34	7755	6.4	6.4	100.0
	TOTAL	120621	100.0	100.0	

Mean	19.499	Std Dev	10.385	Minimum	1.000
Maximum	34.000				

Valid Cases 120621 Missing Cases 0

DSTANO Q5. DESTINATION STATION

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
RICHMOND	1	679	.6	.6	.6
EL CERRITO DEL NORTE	2	627	.5	.5	1.1
EL CERRITO PLAZA	3	403	.3	.3	1.4
NORTH BERKELEY	4	361	.3	.3	1.7
BERKELEY	5	7699	6.4	6.4	8.1
ASHBY	6	662	.5	.6	8.7
MACARTHUR	7	1437	1.2	1.2	9.9
19TH STREET	8	6279	5.2	5.2	15.1
12TH STREET	9	5377	4.5	4.5	19.6
LAKE MERRITT	10	1626	1.3	1.4	20.9
FRUITVALE	11	995	.8	.8	21.8
COLISEUM	12	1874	1.6	1.6	23.3
SAN LEANDRO	13	966	.8	.8	24.1
BAY FAIR	14	831	.7	.7	24.8
HAYWARD	15	1709	1.4	1.4	26.3
SOUTH HAYWARD	16	384	.3	.3	26.6
UNION CITY	17	613	.5	.5	27.1
FREMONT	18	1712	1.4	1.4	28.5
CONCORD	19	1564	1.3	1.3	29.8
PLEASANT HILL	20	1020	.8	.8	30.7
WALNUT CREEK	21	1147	1.0	1.0	31.6
LAFAYETTE	22	272	.2	.2	31.8
ORINDA	23	307	.3	.3	32.1
ROCKRIDGE	24	1063	.9	.9	33.0
WEST OAKLAND	25	939	.8	.8	33.8
EMBARCADERO	26	24893	20.6	20.7	54.5
MONTGOMERY	27	24707	20.5	20.6	75.1
POWELL	28	10778	8.9	9.0	84.1
CIVIC CENTER	29	10789	8.9	9.0	93.0
16TH STREET	30	1760	1.5	1.5	94.5
24TH STREET	31	1499	1.2	1.2	95.8
GLEN PARK	32	627	.5	.5	96.3
BALBOA PARK	33	2201	1.8	1.8	98.1
DALY CITY	34	2110	1.7	1.8	99.9
EL CERRITO ?	35	159	.1	.1	100.0
NONE GIVEN	0	554	.5	MISSING	
	TOTAL	120621	100.0	100.0	

Mean 21.964 Std Dev 8.821 Minimum 1.000
Maximum 35.000

Valid Cases 120068 Missing Cases 554

OPURP Q3. WHERE DID YOU COME FROM (ORIG)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
HOME	1	120621	100.0	100.0	100.0
	TOTAL	120621	100.0	100.0	

Mean 1.000 Std Dev .000 Minimum 1.000
Maximum 1.000

Valid Cases 120621 Missing Cases 0

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DPURP Q7. WHERE ARE YOU GOING (DEST)

Value Label	Value	Frequency	Percent	Valid Percent	Cum Percent
HOME	1	4359	3.6	3.7	3.7
WORK	2	88144	73.1	74.1	77.8
SCHOOL	3	9900	8.2	8.3	86.1
SHOPPING	4	1949	1.6	1.6	87.8
MEDICAL, DENTAL	5	1660	1.4	1.4	89.2
SOCIAL, RECREATION	6	4547	3.8	3.8	93.0
PERSONAL BUSINESS	7	4418	3.7	3.7	96.7
INTEROP	8	1051	.9	.9	97.6
HOTEL	9	293	.2	.2	97.8
OTHER	10	2568	2.1	2.2	100.0
NONE	0	1733	1.4	MISSING	
	TOTAL	120621	100.0	100.0	

Mean 2.703 Std Dev 1.783 Minimum 1.000
Maximum 10.000

Valid Cases 118889 Missing Cases 1733

BART

EXECUTIVE DECISION DOCUMENT

Pay Phones

GENERAL MANAGER APPROVAL:	GENERAL MANAGER ACTION REQ'D:
DATE:	BOARD INITIATED ITEM ☐

NARRATIVE: PUBLIC ACCESS TELECOMMUNICATIONS/PAY TELEPHONE SERVICE CONCESSION PERMIT

PURPOSE: To obtain Board approval to authorize the General Manager or designee to issue a Concession Permit to Pacific Bell for three years, and to exercise two separate options to extend the Permit for one year each, in order to operate Public Access Telecommunications/Pay Telephone Services (PATS)on BART premises.

DISCUSSION: Currently PATS/Pay Telephone Service is provided on BART premises by Phone Tel Technologies, Inc. under a Concession Permit issued in 1994. The current permit provides BART with a guaranteed annual minimum income payment of one million dollars ($1,000,000) or 40% of gross revenues, whichever is greater.

On October 10, 1997, BART issued a Request For Proposals (RFP) to provide Public Access Telecommunications/Pay Telephone Services (PATS) on BART premises under a new three-year Concession Permit, with two one-year options. The PATS RFP called for the provision of public access telecommunications/pay telephone equipment (including equipment to meet BART's ADA/Key Station Plan requirements),and "state of the art" enhanced features. BART sent out forty-five RFP's, the issuance of the RFP resulted in the submission of five proposals on November 7, 1997.

Prior to the review and evaluation of the proposals, a four-member BART Pay Telephone Evaluation Committee (Committee) was established to evaluate and select a proposal for submission to the General Manager for approval and recommendation to the Board. Three of the members were empowered to score and select a proposal for recommendation to proceed. The panel consisted of staff from Customer Services, Telecommunications, and Real Estate. The fourth non-voting member represented Contract Management who acted as an administrative advisor/consultant to the Committee.

Prior to receiving proposals, the committee established fifteen minimum technical requirements that needed to be met by a proposer to be consider further, those proposers who met the requirements would be further evaluated based on the amount of money to be paid annually to BART for the permit. The proposers were asked to submit pertinent information on their Business/Financial, Service, and Technical/Equipment capabilities. The proposers were also asked to submit proposals for a guaranteed minimum annual income figure or a percentage of annual gross revenue from all call revenues. The permit would be awarded to the proposer who offered the highest revenue to BART.

On November 20, 1997, the Committee completed the evaluation scoring process. The results of the evaluation are portrayed in Attachment A. The proposal ranking and staff's recommendation are based on the proposals received and subsequent information requested and received to clarify some information in the original proposals.

All five proposers met the minimum technical requirements. Since all five proposers met the technical aspects, staff recommends that the proposer who offered BART the greatest guaranteed revenue be awarded the Concession Permit.

Pacific Bell offered the highest amount of revenue - one million, nine-hundred thousand dollars ($1,900,000) as the minimum annual guarantee.

ROUTING NO.	PERSON	DUE DATE	INITIAL	DATE
1.	Desha Hill		DH	1/26/98
2.	George Lythcott		BL	2/5/98
3.	Mike O'Connor		M	2/6/98
4.	Matt Burrows		MB	2/2/98
5.	Jim Dunn		JD	2/2
6.	Roberta Collier		RC	1/29
7.	Joseph D. Evans		JE	2/6
8.				
9.				
10.				

PROPOSAL AFFECTS (CHECK ALL THAT APPLY):

___ OPERATING BUDGET	X OPERATIONS
___ CAPITAL BUDGET	___ MAINTENANCE
___ CAPITAL PROGRAMS	___ ENGINEERING
___ GOVERNMENT RELATIONS	___ PUBLIC INFO
___ LABOR RELATIONS	X PROCUREMENT
___ CIVIL RIGHTS	___ STAFFING
___ SAFETY	___ CONSULTANTS
___ LEGAL	___ OTHER

COORDINATION TO COMPLETE ACTION ('X' IF APPROVALS REQUIRED):

☒ AGM OPERATIONS JB 2/2	☐ WEST BAY EXTENSIONS	☒ GENERAL COUNSEL
☐ TRANSIT SYSTEM DEVELOPMENT	☐ EXTERNAL AFFAIRS	☒ CONTROLLER/TREASURER
☒ AGM ADMINISTRATION 1/26/98	☒ BUDGET & BUSINESS MANAGEMENT 2/4/98	☐ DISTRICT SECRETARY

PREPARED BY: Laura King

INITIALS: LK DATE:

FORM NO. 1163 (REV 3, 10/95)

BART

EXECUTIVE DECISION DOCUMENT
NARRATIVE CONTINUED:

FISCAL IMPACT: The issuance of the Concession Permit will provide an annual non-transportation revenue income stream to BART of $1,900,000 (guaranteed minimum annual income) or 42% of all gross annual revenue, whichever is greater. Payments to BART under this three year agreement will begin July 1, 1998 and will be included in the FY99, FY00 and FY01 operating budgets.

ALTERNATIVES: 1. Reject all proposals and readvertise the RFP. 2. Discontinue PATS on BART property.

RECOMMENDATIONS: It is recommended that the Board adopt the following motion.

MOTION: The General Manager or his designee is authorized to issue a Concession Permit to Pacific Bell for three years, and to exercise two separate options to extend the Permit for one year each, to provide Public Access Telephone Services/Pay Telephone Services on BART premises with a guaranteed annual minimum income payment of $1,900,000, subject to compliance with BART's protest procedure.

Post-it® Fax Note 7671		Date 2/10/98	# of pages ▶ 3
To	Mike Healy	From	Laura King
Co./Dept.		Co.	
Phone #		Phone #	7582
Fax #	7103	Fax #	

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ATTACHMENT A

PUBLIC ACCESS TELECOMMUNICATIONS/PAY TELEPHONE SERVICE
CONCESSION PERMIT
RFP NO. 6G5533

PROPOSED REVENUE

RANK	PROPOSERS*	Proposed Minimum Guaranteed Annual Revenue
1	Pacific Bell	$1,900,000
2	GTE	$1,100,000
3	PhoneTel	$1,000,000
4	NSC	$700,000
5	MCI	$151,440

Notes:

1) * All proposers met minimum requirements.

2) Proposers ranked in descending order based on Proposed Guaranteed Minimum Annual Revenue.

LIVERMORE/AMADOR VALLEY

RAIL ALTERNATIVES STUDY

FINAL REPORT

Prepared for

Livermore/Amador Valley Transit Authority

and

Bay Area Rapid Transit District

by

DKS ASSOCIATES

In Association With

Heller & Leake Architects
Parker-Leflufy Ltd.
Strategic Transit Consulting, Ltd.
TPTC, Ltd.

December, 1987

DKS Associates

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December 4, 1987

Mr. Victor Sood
General Manager
Livermore/Amador Valley Transit Authority
6500 Dublin Boulevard, Suite 203
Dublin, CA 94568

Mr. Richard Wenzel
Supervisor of Extension Planning
Bay Area Rapid Transit District
800 Madison Street
Oakland, CA 94606

Subject: Livermore/Amador Valley Rail Alternatives Study P86270x0

Dear Sirs:

We are pleased to submit the attached Final Report presenting the results of the Livermore/Amador Valley Rail Alternatives Study. This study evaluates alternatives for a proposed rail line extending from the Bay Fair BART station in San Leandro to the Dublin/Pleasanton area via Dublin Canyon.

The report describes the design requirements, patronage potential, costs and operating characteristics of two candidate light rail alternatives and compares these attributes to those of the BART alternative previously studied in 1983. Conclusions and recommendations are made regarding the feasibility and impacts of constructing rail transit in the corridor, the technically preferred rail mode, and a schedule for implementation. These conclusions and recommendations are intended as input to the BART and LAVTA Boards who will ultimately select the appropriate rail mode for implementation. This is a prerequisite for proceeding with Preliminary Engineering, Environmental Analysis, and Final Design of the rail line.

Mr. Victor Sood
Livermore/Amador Valley Transit Authority

Mr. Richard Wenzel
Bay Area Rapid Transit District

We have been guided in this study by a Policy Liaison Committee consisting of three members each of the Boards of Directors of the Livermore/Amador Valley Transit Authority and the Bay Area Rapid Transit District. We have also received inputs from a Technical Advisory Committee whose members represent various affected agencies. We would like to thank the members of both committees for their valuable inputs and comments. We would also like to thank Susan Bruestle and Marianne Payne of LAVTA and BART, respectively, for their guidance and review in the process.

We hope that this report will provide the two transit agencies the necessary information for selecting an appropriate rail transit mode in the corridor and for proceeding rapidly with the next steps of Preliminary Engineering and Environmental Analysis for the selected alternative.

Sincerely,

DKS ASSOCIATES

Michael A. Kennedy

Michael A. Kennedy
Principal

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SUMMARY

The Livermore-Amador Valley Rail Alternatives Study presents a conceptual design for a light rail transit line extending from the existing Bay Fair BART station to the Dublin/Pleasanton area. The report then compares the light rail alternative with previously proposed extensions of BART in the same corridor. The study is being conducted by a consultant team under the joint direction of BART and LAVTA. The objective of the study, in accordance with the conditions of Alameda County Measure "B", is to help local decision makers select the mode of transit service (BART or light rail) to be constructed for the Dublin/Pleasanton Extension (DPX).

Recent planning studies by BART led to adoption by the Board of Directors of the rail alignment shown in Figure 1. It starts at the existing Bay Fair BART station, travels south to Interstate 238, follows I-238 to its junction with Interstate 580, and then travels in the median of I-580 through Dublin Canyon to the Dublin/Pleasanton area. East of Pleasanton, the route would continue in the median of I-580 to a terminus in East Livermore. Five new stations are proposed: one in Castro Valley, two in the Dublin/Pleasanton area and two in Livermore.

Previous policy decisions by BART determined that the initial phase of the BART extension would extend from the Bay Fair BART station to Dublin/Pleasanton, including the Castro Valley and West Dublin/Pleasanton stations. This study examines only this initial phase. The light rail alignment utilizes the adopted BART alignment and station sites.

This summary section highlights light rail design/operating characteristics, describes possible light rail options for the corridor, and compares features of the light rail and BART alternatives. It also provides consultant recommendations for the choice of mode, and outlines a possible implementation schedule for the Extension.

LIGHT RAIL CHARACTERISTICS

Light rail differs from heavy rail transit such as BART in that the vehicles are derived from streetcars and can run on-street in mixed traffic or in partially protected rights-of-way. The light rail vehicles (LRV's) are designed with the ability to accelerate and brake rapidly and to traverse very sharp curves and steep grades. Single track sections are possible where space is tight. This allows greater alignment flexibility than heavy rail systems, which can result in lower cost and less disruption. Typical LRV's are designed for maximum speeds of 40 to 50 miles per hour, although conventional LRV's can be equipped for higher speeds, and high performance light rail vehicles have been built with speeds and performance characteristics similar to BART.

DKS Associates

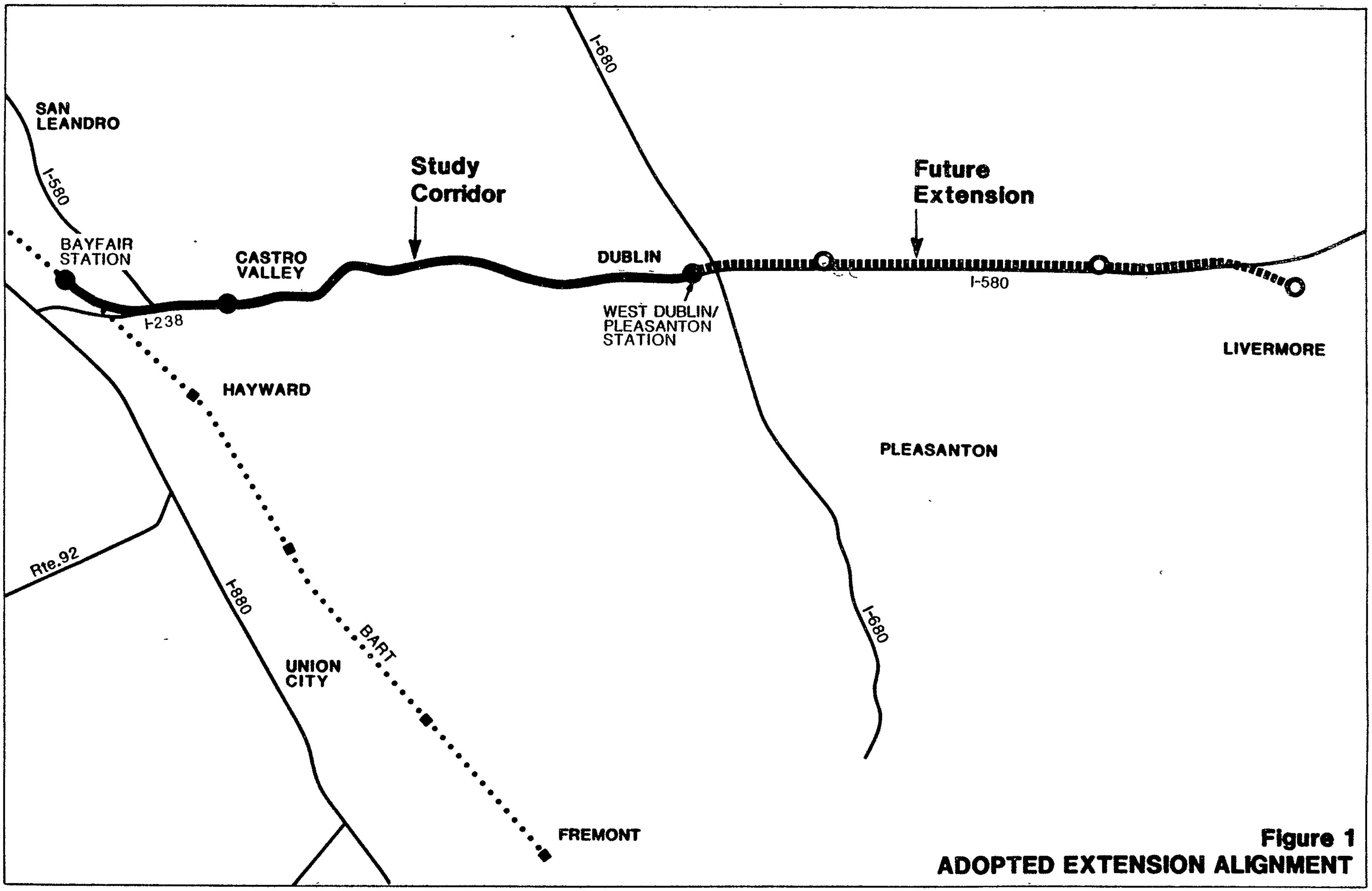


Figure 1
ADOPTED EXTENSION ALIGNMENT

Light rail is typically less costly and easier to implement than heavy rail in situations which take advantage of light rail's ability to run on streets and cross streets at grade. This is not necessarily the case on the DPX alignment, where the proposed alignment is completely grade separated and primarily uses an existing freeway median. Light rail can provide faster travel times than buses in situations where a separate rail corridor is used to bypass congested roads. Also, light rail can carry more passengers per operator than buses, resulting in cost savings on heavily patronized transit corridors.

LIGHT RAIL TRANSIT SYSTEM DESIGN

The first step in this study was to define a preferred light rail alternative for comparison to BART. What resulted from the first phase of work was a decision to carry forward several variations of a light rail alternative. These variations included the following:

- Two light rail vehicle options: High speed conventional and high performance.
- Two alignment options for approach to Bay Fair Station: West side and shared alignment with BART.
- Two fare system options: Barrier-free fare system at DPX stations and BART fare system at all stations.

Comparison of Light Rail Vehicle Options

Below is a summary of the key differences between high speed conventional and high performance LRV's for use on the extension.

	HSC	HP
Travel time, West Dublin/Pleasanton to Bay Fair (mins.)	18.8	13.5
Daily Riders, Year 2005 Unconstrained Demand	18,800	22,550
Fleet size, including spares	39	44
Capital Cost of Fleet ($Millions, 1987 dollars)	$50.3	$81.4-90.2
Annual Operating Cost ($Millions, 1987 dollars)	$6.7	$6.2

The high speed conventional LRV's would be less expensive to purchase than high performance LRV's, and perhaps easier to procure. The main drawback to the high speed conventional LRV's is a projected 16 percent loss in ridership as a result of the slower travel time through the Dublin Canyon. The trade-off between ridership and fleet cost is the main issue in terms of selecting a vehicle type for the light rail alternative. For this reason, both vehicle alternatives were retained for comparison to the BART alternative.

Comparison of Fare Systems

Two types of fare collection systems were considered for the Dublin/Pleasanton Extension:

- An independent self-service system similar to those used in almost all newer light rail operations

- BART-type system involving use of fare gates

Some trade-offs are involved due to the nature of the DPX and its connection with BART. Self-service fares would reduce equipment costs and improve operations at the DPX stations, but would require entire trainloads of passengers to enter the BART faregates all at once at the Bay Fair station and would increase operating costs on the DPX. The fare concourse at Bay Fair would contain considerable equipment and would be congested. This, together with the dual fare transaction, would cause delays and add substantially to the inconvenience of the transfer.

A BART-type fare system would improve the transfer to BART at Bay Fair and would reduce operating costs on the DPX, but would add to equipment requirements. These cost increases would be largely offset by the reduced requirements for new equipment at the Bay Fair station.

The BART fare system would cost about $300,000 more than the self-service fare system (0.2 percent of total system cost). Station operating costs of the self-service system would be lower, but this would be largely offset by the costs of roving inspectors on the trains. Passenger convenience would be better with the BART fare system being extended to both DPX stations. Considering all these factors, use of the BART fare system is recommended for the DPX.

Comparison of Bay Fair Alignments

For the segment approaching Bay Fair Station, four alignment variations were considered during the first phase of this study:

- On-Street Alignment: This uses existing streets to reach the median of I-238 immediately east of Mission Street. This alignment would result in slow operation on congested streets, need for residential property taking, loss of parking and other problems.

- Eastside Alignment: This alignment would bring the light rail tracks into the east side of the Bay Fair Station. This alignment has a number of drawbacks, including design problems at the BART station, loss of existing parking and bus loading areas, environmental impacts and construction costs.

- Westside Alignment: This alignment would use Union Pacific Railroad right-of-way, connecting to the west side of the Bay Fair station. A new light-rail platform would be constructed on the west side of the station.

- Shared Alignment: Light rail tracks would share the existing BART alignment between I-238 and the Bay Fair Station.

The on-street and eastside options do not appear to merit further consideration. The westside alignment and joint trackage scheme were retained for further consideration.

The choice of alignment at the Bay Fair station approach primarily affects right-of-way requirements and capital costs of the system (although the shared alignment option would preclude use of a separate fare system for the DPX). Right-of-way requirements would be greater with the west side option, due to the use of UPRR right-of-way for part of the alignment. However, capital costs are projected to be about $16 Million less for the west side alignment than for the shared alignment, even with an allowance for increased right-of-way cost. This is due to reduced structural costs as well as less elaborate train control for the west side alignment. Accordingly, use of the west side alignment is recommended for the light rail alternative.

Track Gauge

The key issue here is whether to use one of the several gauges commonly used in light rail applications or the wider BART gauge. Two manufacturers claim that standard LRV's could be adapted to BART gauge without cost penalty and without loss of reliability. Turning radius would be restricted but this is not an issue with the DPX route alignment. Selection of BART gauge might increase overall capital costs slightly but would simplify a potential shared alignment at Bay Fair as well as any future conversion to BART.

Power Supply

The most economical voltage for the DPX appears to be 1,500 volts. The BART system operates on a 1,000 volt power supply, however, and there may be some advantage in using this lower voltage on the DPX to facilitate joint operation and to simplify any future conversion to BART. Light rail vehicles can be built for this voltage at the same cost as for 1,500 volts but more sub-stations would be required at the lower voltage.

Communications and Train Control

Requirements for train control will vary depending on the operating speeds of the vehicles and whether trackage at the Bay Fair Station approach is shared by BART vehicles and LRV's. It appears likely that both Automatic Train Protection (ATP) and Automatic Train Stop (ATS) would be required for the light rail operation. A shared alignment at Bay Fair would additionally require light rail vehicles and a portion of the light rail alignment to be equipped for BART-compatible Automatic Train Operation (ATO).

DPX ALIGNMENT AND STATIONS

Conceptual design features of the DPX alignment and stations are described below from west to east, reflecting the options and requirements discussed above.

Bay Fair Station to I-238

Two alignment alternatives were considered during the evaluation process:

- West side alignment
- Shared alignment with BART

The west side option would start at an at-grade platform adjacent to the west side of the Bay Fair BART station. It would then travel at-grade parallel to and west of the BART tracks. North of I-238, the light-rail tracks would rise up on an aerial structure, turn to the east and cross over the BART tracks to an aerial structure on the north side of I-238.

With the shared alignment, the light rail would share the BART structure (and some or all of the track) at Bay Fair station. At a point north of I-238, the light rail tracks would diverge to each side of the BART tracks and rise up on independent aerial structures. The southbound light rail track would cross over the BART tracks and join the northbound light rail track on an aerial structure north of I-238.

I-238 to Castro Valley

In this segment, the light rail would travel on aerial structure between the BART tracks and the I-580 interchange, then at-grade in the median of I-580 to the first station at Castro Valley. The conceptual rail alignment would start out on the north side of I-238, cross over to the south side of I-238 to cross Mission Boulevard, and then cross back into the median of I-238 just west of the I-580 intercahnge. This alignment was used to develop cost estimates for both the light rail and BART alternatives, and represents a slight refinement of BART alignments shown in previous studies.

To reduce costs, a single track section was considered for this segment, utilizing the existing I-238 median. However, a preliminary examination of the I-238 median indicates that the existing median is too narrow and cannot be easily widened. This, combined with the inherent operating disadvantages of single track, suggests that this option be eliminated from further consideration.

Castro Valley To Dublin/Pleasanton

The DPX light rail alignment would follow the I-580 freeway median from west of the I-580/I-238 interchange through the Dublin Canyon to the Dublin/Pleasanton area, utilizing double tracks all the way. This section of I-580 has been reconstructed with a median width that can accommodate either heavy or light rail.

DPX Stations and Yard

The Dublin/Pleasanton Extension would involve modifications to the Bay Fair BART station and construction of new stations at Castro Valley and West Dublin/Pleasanton, with the possibility of a third station to serve East Dublin/Pleasanton. Locations of the stations have been established in the earlier BART planning studies.

- Bay Fair Station: The shared alignment option would require no major changes to Bay Fair station. The aerial structure north of the station would be rebuilt to accommodate light rail storage tracks. The westside light rail option would require a new single platform at grade level. If the DPX uses the BART fare system, then the DPX platform would provide a direct open transfer. If the DPX has an independent fare system, an additional set of fare gates, ticket machines, change machines and addfare machines would be installed adjacent to the westside platform.

- Castro Valley Station: The Castro Valley station would be located in the median of I-580, immediately west of Redwood Road. Parking would be on the north side of the freeway, on property which has mostly been already purchased by BART. Access to the station would be by a pedestrian underpass.

- Dublin/Pleasanton Stations: The West Dublin/Pleasanton station would be located in the median of I-580 between Foothill Road and I-680. The East Dublin/Pleasanton station, if and when it is built, would be located in the median of I-580 immediately west of the planned Hacienda Drive interchange. Both stations would feature parking lots both north and south of the freeway, with access provided by pedestrian overpasses over the freeway.

- Storage/Maintenance Yard: A full-service storage/maintenance yard would be needed to service the light rail vehicles used on the line. A site has not been established for the yard, although it would preferably be located near the east end of the line. A location in the freeway median would be feasible, although a location adjacent to the freeway would be preferable.

COMPARISON OF LIGHT RAIL AND BART ALTERNATIVES

Evaluation of the two light rail alternatives and the BART alternative has considered a variety of factors including right-of-way impacts, patron access, ridership potential, capital costs, operating costs and revenues, and implementation issues. Below is a comparison of these criteria based on the analyses presented in the report. Table S-1 summarizes and compares key factors that differ among the three alternatives. Since the alignments and station locations are similar for all alternatives, the differences are essentially in performance characteristics and in costs and revenues.

Right-of Way/Displacement Impacts

Differences in right-of-way needs are relatively minor among the alternatives. All alternatives involve some use of UPRR right-of-way alongside the Bay Fair BART station; however the west side alignment for both light rail alternatives would involve more extensive use of this alignment. Also, the two light rail alternatives would require land acquisition for a full service maintenance/storage yard.

Patron Access

Since station locations are common to all alternatives, there are no differences among them in terms of how easily patrons can reach the stations. In general, station sites have been located and configured so as to provide adequate access and circulation for pedestrians, bikes, automobiles and buses and parking for automobiles. As discussed later, however, the West Dublin/Pleasanton station may not be appropriate as an interim terminal station due to traffic access and parking constraints.

Ridership Potential

Projected year 2005 ridership is shown in the summary table. These figures are for comparative purposes only; they assume no capacity constraints on the lines or at the stations. The BART alternative has the greatest ridership potential among the three alternatives, although ridership potential for the high performance LRT alternative is almost as high. A 20 percent ridership loss is projected for the high speed conventional LRT alternative due to slower running speeds as well as the need for a transfer at Bay Fair. It should be noted, however, that LRT ridership levels would be higher should frequency of service be increased over the 9 minute service assumed.

Fleet Requirements

Fleet requirements are greatest for the high performance LRT alternative and lowest for the BART alternative. In all cases, additional BART cars would be needed on the Fremont line to accommodate DPX passengers travelling beyond Bay Fair.

Table S-1
SUMMARY COMPARISON OF DPX ALTERNATIVES

	High Speed Conventional*	High Performance	BART**
1. Travel Times (Station-to-Station)			
a. West Dub/Plstn to Bay Fair (mins.)	19	14	14
b. West Dub/Plstn to Montgomery (mins.)	58	53	48
Increase over BART time (mins.)	5-10	0-5	—
2. Ridership Potential			
a. Total Daily Riders, year 2005	18,800	22,550	23,700
Percent of BART Volume	79%	95%	—
3. Fleet Size			
a. Extension Portion Only	39	44	33
b. Total Cars***	100	112	97
4. Capital Costs ($1987 Millions)			
a. Construction & Contingencies	$133.1	$133.1	$164.1
b. Right-of-Way Allowance	23.2	23.2	17.3
c. Total Fixed Facility	$156.3	$156.3	$181.4
Savings over BART	$ 25.1	$ 25.1	—
d. Rolling Stock (Extension Only)	$50.3	$81.4	$50.2
Savings over BART	-$0.1	-$31.2	—
e. Total Capital Cost	$206.6	$237.7	$231.6
Total Savings over BART	$25.0	-$6.1	—
5. Annual Costs and Revenues ($1987 Millions)			
a. Additional Costs	$11.7	$12.2	$12.8
b. Less Additional Revenues	-5.9	-7.3	-7.7
c. Net Additional Costs	$5.8	$4.9	$5.1
Farebox Recovery Ratio	50%	60%	61%

* Assumes stand-alone system with barrier-free fare system; use of BART fare system would add $0.3 Million to capital cost but would improve passenger convenience and safety.

** Assumes through-service operated to Daly City. Shuttle service times would be identical to those of high performance LRT alternative..

*** Includes additional BART cars for service increase on Fremont lines to accommodate DPX passengers travelling beyond Bay Fair.

Capital Costs

Capital costs vary significantly between the light rail and BART alternatives. Based on planning level cost estimates, fixed facilities and rolling stock for the BART alternative would total $226 Million, in 1987 dollars. The high speed conventional LRT alternative would save about $25 Million, or 11 percent, over BART. The high performance LRT alternative would cost $6 Million, or 3 percent, more than BART.

Assuming 4 percent annual inflation to 1992 (projected midpoint of construction), the capital costs are estimated to range from $244 Million for the high speed conventional LRT alternative to $275 Million for the BART alternative, in 1992 dollars.

These capital costs do not consider the number of BART vehicles needed to increase capacity on the Fremont line to accommodate DPX passengers travelling beyond Bay Fair. Nor is the availability of 26 BART cars for the extension included since these cars could alternatively be used to meet other BART service expansion needs.

Annual Costs and Revenues

Differences among alternatives in net annual operating costs are less than 15 percent, with the high speed conventional LRT being highest and the high performance LRT being lowest. Projected farebox recovery ratios are highest for the high performance LRT and BART alternatives. In all cases the farebox recovery ratios are likely to be somewhat overstated as they are substantially higher than BART's current system-wide performance. To some extent this may reflect the inherent operating efficiency of the corridor.

Other Considerations

Other factors to be considered in the evaluation include implementation requirements, flexibility to adapt to future conditions and passenger convenience. These factors generally favor the BART alternative. As a system that is already operating at one end of the corridor, and with vehicles and maintenance facilities already in use, there would be fewer inherent implementation risks with BART. Also, the BART alternative is more adaptable to longer range plans for extending the line east to Livermore, when vehicle speeds and passenger capacities would be more important. Finally, the BART alternative would offer the convenience of one integrated system to passengers, particularly in comparison to a separate barrier-free fare system on the DPX.

EXTENSION TO EAST DUBLIN/PLEASANTON

Previously established BART policy calls for the rail extension to extend east from Bay Fair BART station to the proposed West Dublin/Pleasanton station. This initial phase would include two new stations and an interim storage yard in the Dublin-Pleasanton area. Based on analysis in this study as well as in the previous BART LPX studies in 1983 and 1986, a third station is potentially needed before 2005 to avoid potential West Dublin/Pleasanton station overloading and eventual constraints on ridership growth on the line. This third station should be considered for construction in the initial stage.

For the BART alternative, the additional construction cost to extend the line from the West Dublin/Pleasanton station to the East Dublin/Pleasanton station would be $37 Million, in 1987 dollars. For the light rail alternatives, the incremental cost is estimated to be $29 Million. This assumes the minimum cost design option (at-grade construction in the freeway median) and no major reconstruction of I-580 Freeway or its interchange with I-680 Freeway.

IMPLEMENTATION SCHEDULE FOR THE EXTENSION

A tentative implementation schedule for the Dublin/Pleasanton Extension, based on input from BART staff, is as follows:

Adoption of Conceptual Alternative:	October, 1987
Preliminary engineering and environmental assessment:	January, 1988 - August, 1989
Environmental Clearance:	August, 1989
ROW & Final Design, including plans, specifications and costs:	September, 1989 - March, 1991
Procurement and Construction:	September, 1990 - January, 1995
Testing and Start-up:	January, 1995 - June, 1995
Commence Service:	June, 1995

Major steps in the implementation process include preliminary engineering and environmental assessment (18 months), final design and specifications (18 months) and procurement and construction (4+ years). This schedule is not dependent upon which alternative is selected for the DPX.

CONCLUSIONS

Any of the three alternatives considered appear feasible for implementation in the corridor, and the differences among them are not great. Based on the various factors discussed earlier, the BART alternative is recommended over both of the light rail alternatives.

The differences between the high performance LRT alternative and the BART alternative are generally quite small in terms of level of performance and costs. On the other hand, the BART alternative is operationally more flexible, potentially permitting through service to other parts of the system. BART also poses less uncertainty in implementation since some of the needed vehicles are already potentially available for service and minimal new maintenance or other facilities are needed for start-up.

Between BART and the high speed conventional light rail alternative, a more difficult trade-off is involved. The high speed conventional light rail alternative would save up to $25 Million, or 11 percent, in capital costs over BART. In our judgment, this is outweighed by the better travel times and resulting higher patronage potential of BART in the corridor, the availability of BART cars to reduce start-up costs and risks, and the reduced annual operating costs with BART.

I. INTRODUCTION

The purpose of the Livermore-Amador Valley Rail Alternatives Study is to develop a conceptual design for a light-rail transit system to serve the Dublin/Pleasanton area, and compare the light-rail alternative with previously proposed extensions of BART in the same corridor. The overall objective of the study is to help local decision-makers select the mode of transit service (BART or light rail) to be constructed for the Dublin/Pleasanton Extension (DPX).

The study is being conducted by a consultant team under the joint direction of BART and LAVTA. It fulfills a condition of Measure "B" in which voters of Alameda County approved in November, 1986, assessment of a sales tax to fund transportation improvements within the county. This condition requires completion of a rail alternatives study of the Dublin Canyon corridor as a prerequisite to using sales tax revenues to assist in implementing rail transit service in that corridor.

This Draft Final Report presents conceptual design alternatives for a light rail transit line extending from the existing Bay Fair BART station to the Dublin/Pleasanton area. The report addresses a number of design features including the interface with BART, vehicle options, fare collection options and train control. The report also compares cost estimates and patronage projections and other impacts of the candidate light rail alternatives to impacts of the previously studied BART alternative.

CONTENTS OF REPORT

Following this introductory chapter, Chapter II of the report describes general characteristics of light rail systems and technologies. Chapter III discusses key design issues for a light rail system operating in the DPX corridor. Chapter IV presents options and recommendations for the specific alignment and station layouts for a light rail system. Chapter V presents ridership projections for the light rail alternatives, and compares these to projections for the previously studied BART alternative. Light rail and BART operations are described in Chapter VI, including operating speeds, passenger capacity, fleet requirements and vehicle maintenance and storage. Chapter VII describes cost and revenue characteristics for the various DPX alternatives. Finally, Chapter VIII presents comparative information on the light rail and BART alternatives.

PREVIOUS STUDIES

Previous studies of this corridor assumed that rail service in the corridor would be an extension of the existing BART system. The 1976 Livermore-Pleasanton BART Extension Study evaluated a number of alternative routes for the extension of BART to the Livermore/Amador Valley. Following that study, a specific alignment was adopted by BART. An update analysis was presented in 1983 which re-evaluated specific portions of the alignment to reflect policy decisions, land use, and other changes since 1976. In particular, the 1983 report evaluated alignments which would run through the Dublin/Pleasanton area along the I-580 corridor rather than through downtown Pleasanton. From this analysis, the BART Board of Directors adopted an alignment for the proposed extension from the Bay Fair BART station to Dublin. Finally, a Supplemental Analysis Report was prepared in 1986 which reviewed alternative BART alignments between the eastern city limits of Pleasanton and downtown Livermore. This study led to adoption by BART of the remaining alignment from Dublin to East Livermore via the Interstate 580 freeway.

REVIEW OF THE ADOPTED ALIGNMENT

The previous BART extension studies identified a general alignment starting at the existing BART Bay Fair station (see Figure 1 in Summary). The line would travel south to Interstate 238 (State Route 238 at the time of the previous studies), follow Interstate 238 (I-238) to its junction with Interstate 580 (I-580), and then travel in the median of I-580 through Dublin Canyon to the Dublin/Pleasanton area. East of Pleasanton, the rail alignment would continue in the median of I-580 to a terminus in East Livermore. Five new stations were proposed, with one at Castro Valley, two in the Dublin/Pleasanton area and two in Livermore, with a possible additional station near the research labs.

Previous policy decisions by BART determined that the initial phase of a BART extension to the Livermore/Amador Valley area would extend from the BART Bay Fair station to Dublin/Pleasanton, consisting of two new stations. This study examines only the initial phase of the extension. The light-rail alignment would follow the proposed BART alignment, mostly in the medians of I-580 and I-238. Stations would be located at the same locations as proposed in the BART studies, with one at Castro Valley in the vicinity of Redwood Road, and one in the Dublin/Pleasanton area west of the I-580/I-680 interchange. A third station to the east in Dublin/Pleasanton has also been considered in this study as a means of reducing station loads in the other station.

PUBLIC AND STAFF INPUT

Public and staff input has been solicited throughout the study. The study is under the joint direction of LAVTA and BART staff. A public meeting is being conducted to review the Draft Final Report as well as the Final Report. Additionally, a Technical Advisory Committee and a Policy Liaison Committee, consisting of elected officials and staff of the various affected agencies, have provided technical and policy guidance.

II. LIGHT RAIL CHARACTERISTICS

This section describes Light Rail Transit (LRT) in generic terms. Light rail spans a wide range of operations, capacity and equipment types. There is no 'standard' light rail system, nor any standard light rail vehicles (LRV's). Light rail vehicles in use in the United States range from proven reliable vehicles to new designs that have demonstrated, at best, mediocre reliability and high maintenance requirements. In applying light rail to the DPX it is assumed that North American and European experience will be taken into account, and vehicle and subsystem procurement restricted to proven "off-the-shelf" technology with the minimum of adaptation to meet the specific Livermore/Amador Valley requirements.

WHAT IS LIGHT RAIL TRANSIT?

Light Rail Transit (or Light Rapid Transit) refers to the use of electrically propelled rail vehicles on partially or wholly segregated rights of way. Light rail differs from heavy rail transit such as BART in that the vehicles are derived from streetcars and can run on street in mixed traffic or in partially protected in-street rights of way. To allow this, LRV's collect power from overhead wires. However some totally segregated LRT lines use third rail power collection which reduces visual clutter.

One of the major attributes of LRT is the street running capability. The cars are designed with the ability to accelerate and brake rapidly and to traverse very sharp curves and steep grades. Cars are usually narrower than those in heavy rapid transit to meet the maximum allowed highway width of 8.5 feet. However standard LRV's can range in width from 7.5 feet to 9.0 feet, with a few wider. With 8.5 foot wide cars, a double track alignment requires only a 25 foot wide right-of-way, as compared to BART requirements for 36 feet or more. Where necessary, substandard clearances may be allowed for light rail, reducing right-of-way requirements to 22 feet minimum. In both cases extra width may be required for drainage or embankments, and will be required at stations to accommodate the platform(s), bus loading areas and parking. Traction sub-stations are not included in this minimum width. Tunnel or underpass sections can be correspondingly narrower than heavy rail although height must allow for the overhead power collection.

Single track sections are possible where space is tight. They can result in substantial reductions in land acquisition and construction costs but introduce headway restrictions. With long double track passing sections and careful design such restrictions are minor down to headways in the six to seven minute range for one section of single track, no longer than one mile. However, if there are numerous single track sections (spaced to fit the schedule), headways below ten minutes are not recommended, as scheduling of "meets" becomes restrictive and will introduce delays.

The geometric flexibility of light rail usually allows alignments to be planned and built in less time, with lower costs and less environmental impact or construction disruption than heavy rapid transit. For example, where no right-of-way is available, LRT can run on a street or make a sharp curve around a historic, or expensive, building, avoiding property take and destruction. There is a price to be paid in that street running and tight curves increase travel times. This flexibility and subsequent lower capital cost is the "light" in LRT. There is nothing light about the cars which typically weigh more than heavy rail rapid transit cars.

PASSENGER CAPACITY

Light rail systems can be built to handle from 15,000 to 300,000 passengers per day, equivalent to 3,000 to 30,000 passengers per peak hour direction. The lower range is well within the economic capability of a bus line and the light rail must be built at low cost to be competitive. The San Diego light rail line is a good example of this. The upper capacity range of light rail requires long trains of LRV's at close headways with advanced signalling and a wholly or predominantly grade separated right-of-way. At these levels, light rail capacity exceeds the capacity of many heavy rapid transit lines.

Automatic Train Operation (ATO) can be applied to any rail vehicle with multiple-unit capability. Full automation is a feature of the Vancouver system and is being installed on a new light rail line in Dusseldorf, West Germany. Because Vancouver's Advanced Light Rail (ALRT) system is fully grade separated and uses nontraditional vehicles and propulsion, it is not regarded by some in the industry as light rail. One publication has coined the word "mini-metro" for this system and others of its ilk that span the range between light rail and heavy rail rapid transit. It does retain the geometric flexibility of light rail which permitted its construction in Vancouver at lower costs than would have been involved in heavy rail rapid transit. It has handled up to 200,000 passengers on a peak day and is designed to be expandable to 300,000 passengers per day by adding vehicles.

LIGHT RAIL VEHICLES

Typical Light Rail Vehicles (LRV's) are designed for on-street use, with high rates of acceleration and maximum speeds in the 40-50 mph range. All North American vehicles are 4-axle or 6-axle single articulated cars. In Europe multiple articulations are common with an LRV having 8, 10 or 12 axles. Only the front and rear trucks of an articulated LRV are usually powered. The single articulated LRV typical in North America has high rates of acceleration and braking and a maximum speed in the 45-55 mph range. The multiple articulated cars used in Europe have more limited performance suitable for flat terrain and urban use unless additional motored trucks are provided.

Several European and one North American LRT system use high performance LRV's capable of speeds up to 80 mph and sustained operation on grades. This level of performance requires either four-axle non-articulated cars or articulated LRV's with higher powered motors and/or a powered truck under each articulation. This latter arrangement usually results in a higher floor level which is undesirable for street level loading. Such cars are substantially comparable to the standard urban LRV's but carry a price premium for the higher powered propulsion equipment. In Europe they are regarded as off-the-shelf technology and have achieved standards of reliability and maintenance comparable to urban LRV's.

An intermediate variant is the standard urban LRV equipped with higher ratio gearing that increases maximum speeds to 60 to 65 mph at reduced rates of acceleration. (These are referred to in this report as "high speed conventional" vehicles to distinguish them from the other types of LRV's considered.) The best example of this type of vehicle is on the KBE line in Cologne, Germany, where they have been used for a number of years. The Norristown, Philadelphia, procurement can be considered to be in this category as well, although these vehicles are not yet on line. Several of the medium and high performance cars in Europe are now equipped with alternating current motors which permit more power in a single truck and reduce maintenance costs.

There is no complete manufacturer of LRV's in the United States. All recent North American acquisitions have come from two Canadian, two Japanese, one Italian or one West German manufacturer. Local assembly with many United States components is used to meet the "Buy American" requirements in UMTA funded procurements. In some cases entire U.S. made propulsion systems are installed on European designed LRV's. The one attempt to design and manufacture a standard U.S. LRV with UMTA support resulted in the Boeing-Vertol cars used in Boston and San Francisco. These cars have been less than satisfactory. One Canadian manufacturer has a complete plant in the United States and comes close to a U.S. built unit, although the LRV design is by BN of Belgium. The first order of these cars recently entered service in Portland.

In the past decade there have been, or are outstanding, 19 LRV procurements in North America. Five properties have bought substantially the same West German vehicle; others have procured custom designs with inherently greater technical risk. With the exception of the current SEPTA (Philadelphia) Norristown procurement for 60-foot long 4-axle LRV's, all are urban cars generally unsuited for high speed operation.

FARE COLLECTION SYSTEMS

All recently opened or planned light rail lines except for San Francisco's MUNI Metro use "self-service" or barrier-free fare collection, sometimes referred to as "proof-of-payment". (Three LRT systems were planned for barrier (turnstile) collection but converted to self-service, including Pittsburgh, Buffalo and Edmonton. In the case of Edmonton, the conversion took place after opening and installing turnstiles and station agents' booths.) This is understandable given that self-service on typical light rail systems can avoid full time attendance of stations, reduce station construction costs and reduce operating costs (including amortization of capital costs) to one-third to one-fifth that of a barrier system. The seven self-service fare systems in North American have demonstrated evasion rates of one to two percent, considerably less than many turnstile systems. In addition, the on-board ticket inspection has provided a multiple role of security and passenger information plus, on several systems, operational supervision. The results have not only been low fare evasion but also low vandalism and graffiti incidents coupled with reductions in the provision of security staff.

Older light rail systems in North America use a variety of fare collection methods, usually with operators handling collection in a conventional bus fashion except in city center stations. Here, staffed cashier booths and turnstiles prevent fare collection delays at entry to the car. Boston, Newark, Philadelphia, Pittsburgh, Cleveland and San Francisco have such hybrid systems. Except in stations with turnstiles, LRV entry is restricted to the door by the operator. Multiple-unit light rail trains must have an operator on each car. This arrangement is an inefficient use of labor.

POTENTIAL FOR FUTURE UPGRADING

Designing light rail for future upgrading to heavy rail rapid transit is a feature of several systems, particularly in Europe where it is called "pre-metro". Light rail flexibility allows incremental improvements that can sequentially increase the amount of segregated running to a point where, with a change in vehicles, the system can become traditional heavy rail rapid transit. Again this involves a trade off. The line must be built or retrofitted to the larger profile, longer stations, lower grades and wider curves of heavy rapid transit, all with associated cost penalties. Such upgrading can usually be planned to avoid service disruptions. During construction, shoe-flies (temporary cross-overs), temporary trackage and single track sections can be used with low speed manual operation to maintain rail service. Major tasks, such as connecting special work (junctions) can be performed in the early morning hours or on weekends when headways are longer or bus substitutions can be provided. The pre-metro concept may have particular applicability to the Livermore/Amador Valley Rail Extension.

III. LIGHT RAIL TRANSIT SYSTEM DESIGN

There are several design issues with respect to a light rail transit extension from Bay Fair to Dublin. These issues include the type of vehicle, the fare collection system, the track gauge, the power supply, and communications and train control. In addition, several agencies have design requirements which must be met. Several of the design issues relate directly to decisions regarding the light-rail interface with BART at the Bay Fair station. For example, if an alignment is chosen where the light rail and BART share right-of-way for a segment, this has implications on the control, operations and power supply for the light rail system.

VEHICLE OPTIONS

The choice of vehicle can influence the travel time on the system, and hence the attractiveness of the system to potential users as well as the operating costs and the fleet requirements. Three general types of light rail vehicles (LRV's) with differing vehicle performance characteristics were considered for the DPX. A "conventional" LRV would be similar to the vehicles used in San Diego. These have a maximum speed in the range of about 45 to 55 mph. A "high-speed conventional" LRV is similar to the San Diego vehicle, but would be equipped with higher ratio gearing to allow maximum speeds of up to 65 mph, with some loss in acceleration rate. Several systems use "high performance" LRV's that provide speeds and performance characteristics similar to BART.

Table III-1 summarizes estimated travel times between Bay Fair and Pleasanton for the three vehicle types described above. Also shown for comparison are the estimated travel times for a BART line in the corridor and scheduled peak period times on the existing BART express buses.

Travel times on the DPX should be equal to or better than the BART express buses that currently operate within the corridor (Route U to Hayward Station and Routes UL and UP to Bay Fair Station). The current scheduled express bus travel times between Dublin Golden Gate Transfer Station (close to the proposed West Dublin/Pleasanton rail station) and Bay Fair Station are 20 minutes off-peak and 21 to 24 minutes during peak hours in the peak direction. Increased congestion on I-580 and the adjacent access roads can be expected to increase these travel times in the future. This increase could be offset, at least in part, by freeway improvements currently under construction or planned, particularly at the I-580/I-238 interchange.

Table III-1
ESTIMATED STATION-TO-STATION TRAVEL TIMES
Bay Fair BART Station to East Dublin/Pleasanton

Vehicle Option	Peak Period Travel Time to Bay Fair Station (Minutes): From West Dublin/ Pleasanton	From East Dublin/ Pleasanton
Conventional LRV	23.7	29
High-speed Conventional	18.8	23
High performance	13.5	16
BART	13.5	16
Express Buses (Existing)	21-24 (scheduled)	--

The conventional LRV appears unsuitable for use on the DPX as it has inadequate power for the Dublin Canyon grades and too low a top speed for the long distances between stations. It would take almost 30 minutes to cover the 14.5 miles of the DPX. This is not competitive with the existing BART express buses. (In San Diego the actual travel time for a 14.5 mile distance is over 40 minutes but includes more stations and on-street running in the city center). Moreover, the longer travel times of the conventional LRV's would contribute to greater fleet requirements and higher operating costs than the other alternatives considered.

A high speed conventional LRV could cover the same distance in 23 minutes, which is comparable with express bus running times. A high performance LRV with higher ratio gearing, possibly with all axles powered, and a top speed of 75-80 mph could cover the same distance in 16 minutes; this is comparable to BART running times in the corridor.

Based on these considerations, the conventional LRV was not included in subsequent analysis. Both the High Speed Conventional and the High Performance LRV's are evaluated in later chapters of this report.

FARE COLLECTION

The Dublin/Pleasanton Extension could be operated with either self-service (barrier-free) or BART-type fare collection. Some trade-offs are involved due to the nature of the DPX and its connection with BART. Self-service fares would reduce equipment costs and improve operations at the DPX stations, but would require entire trainloads of passengers to enter the BART faregates all at once at the Bay Fair station and would increase operating costs on the DPX. A BART-type fare system on the DPX would improve the transfer to BART at the Bay Fair station and would reduce operating costs on the DPX, but would add to equipment requirements.

Self-Service Fare Collection

As discussed in Chapter II, most light rail systems use a barrier-free fare collection system. Such a system could be provided on the DPX extension with 3 to 5 ticket vending machines at each station. No barriers or turnstiles are required, although the entry into a fare paid area must be clearly designated.

The Bay Fair station is an exceptional situation. Here almost the entire ridership on the DPX would transfer to and from BART with its stored value magnetic ticket fare system and a distance based tariff. For the westbound transfer, a full DPX train would deposit up to 250 passengers every five minutes. Most of these passengers would pass through a fare gate to access BART and in many cases would need to purchase or add value to tickets. This would require 9 additional BART ticket vendors, 7 faregates, 3 addfare machines, 9 DPX self-service ticket vending machines for the reverse movement and transfer-issuing machines for any DPX-BART joint fare. The fare concourse at Bay Fair would contain considerable equipment and would be congested. This, together with the dual fare transaction, would cause delays and add substantially to the inconvenience of the transfer. Moreover, BART has expressed safety concerns regarding crowd control on platforms and in escalator/stairwell areas of stations in a barrier-free fare collection system. Activated barriers at the entry to stations and station agents provide crowd control capabilities.

BART Fare Collection

One alternative to a self-service fare system is to adopt the BART fare system throughout the extension. There could then be a free movement of passengers at Bay Fair between BART and the DPX. At the other DPX stations BART-type fare gates and ticket equipment would be installed. Passengers would exit through fare gates at other existing BART stations in the normal way.

Since there are only two new stations currently proposed on the DPX (with possibly a third if needed) and each has only one or two entries, the amount of BART fare equipment required is within reason. While cash handling costs would be comparable for the two fare systems, equipment maintenance would be higher for the BART fare gate system and station agent requirements would add to operating costs. However, the combined number of station agents and on-board inspectors for a barrier-free system would exceed the number of station agents required for a BART fare gate system. Consequently, the total operating cost for fare collection would be lower for the BART fare gate system.

As all extension stations would be in the middle of the freeway with restricted access, the self-service advantage of open stations with unrestricted access from several directions does not apply. Also, with most riders transferring to BART at Bay Fair, the BART fare collection system would be more convenient for most DPX passengers.

Station Staffing

Fare equipment and agent booths at the DPX stations could be provided at entry level similar to BART. However, there may be some advantages and cost savings if the equipment and booths were at platform level with adequate surge space between the escalator and fare gates. The station agent could provide platform security and assist handicapped passengers. At off-peak times, costs could be reduced by remotely monitoring one or two of the stations from Bay Fair or Dublin/Pleasanton. Security and passenger assistance could be provided by closed circuit television and intercom links to one staffed station. Turnstiles could be equipped with higher security barriers to minimize jump throughs; however, given the BART exit requirements this may not be necessary. The full height jail type turnstiles used at unattended entrances in Toronto and in New York and Philadelphia are undesirable. They are ugly and difficult for passengers to use. Since this off-peak unstaffed entrance arrangement is contrary to current BART standards, policy changes would be required.

TRACK GAUGE

Light rail vehicles in recent North American procurements have been built to standard gauge (4 feet 8.5 inches), Toronto gauge (4 feet 10.8 inches), and Pennsylvania broad gauge (5 feet 2.5 inches). In Europe LRV's are also built to narrow, standard and broad gauge. Two manufacturers have been contacted and have advised that "standard" LRV's can be built to BART gauge (5 feet 6 inches) without cost penalties but with some possible restriction in the turning radius. They further advise that LRV reliability and maintenance requirements are not affected by gauge. As there are no tight radius curves on any of the proposed DPX alignments, turning radius restrictions are inconsequential and it appears there is little difference pertaining to gauge in vehicle selection and cost. Selection of the BART gauge will increase capital costs slightly but will simplify any future conversion to a BART extension and reduce construction disruption to existing BART service south of Bay Fair if a joint trackage option is selected. Additionally there may be some cost penalties in purchasing rail-borne maintenance equipment, and minor construction cost consequences from track contractors who would wish to use their standard gauge equipment. The selection of gauge is therefore left open pending further consideration of construction costs.

POWER SUPPLY

Light rail vehicles can be designed to operate at a variety of voltages. Overhead wire suspension can be the basic trolley type or catenary with a simple or fully stitched messenger wire. Supports can be from poles with bracket arms between the tracks or from side poles with span wires. Typical pole spacing is 120 to 180 feet, closer on tight curves. Feeder cables are usually avoided or minimized by providing adequate conductance in the catenary and messenger wires.

Voltage

LRV's typically operate at 650 volts, 750 volts or 1,500 volts direct current supplied from overhead wires. The 1,500 volt DC LRV's carry a small cost premium that can be offset by the reduced number of sub-stations required at this voltage. This is very much the case on the DPX where there are long distances between stations and a relatively small number of LRV's. Sub-station(s) would be required between passenger stations on the long Dublin canyon section of the DPX.

The Bay Fair Station section of the light rail would require a common negative return with BART if there is any shared trackage. The BART system operates on a 1,000 volt DC power supply, and BART staff has expressed opposition to tying together the negative returns from two propulsion power voltages. This is technically possible, and several systems use or have used shared trackage with vehicles at different voltages. However, there may be some advantage in building the DPX light rail to BART's voltage of 1,000 volts DC. Light rail vehicles can be provided for this voltage at the same cost premium as for 1,500 volts; however, sub-station spacing would have to be reduced resulting in extra costs for additional sub-stations. Selecting a power supply of 1,000 volts will also simplify any future conversion to a BART extension which will require the addition of a 1,000 volt DC power rail.

Pending further examination of possible joint operation and future long term conversion of the DPX into a BART extension, the most economical voltage for the light rail is 1,500 volts DC.

Sub-stations

Sub-stations will be compact pad mounted modules that can fit within the freeway right-of-way including the median in most locations. Although such sub-stations have low maintenance requirements, road access is preferable and off-median locations should be explored. Sub-stations should be expandable to permit the future addition of transformer/rectifier modules to handle longer light rail trains or any conversion to BART.

Remote control and monitoring of the substations is unnecessary for light rail. Adequate protection is provided by automated circuit breakers. The DC breakers have automatic triple reclose features that, combined with highly discriminating fault protection, can provide exceptional reliability almost up to the point where the overhead wire is down. San Diego's light rail does not have remote control, but it appears that the California PUC is requiring this on the Los Angeles-Long Beach line, possibly because of the underground section. BART has commented that its own safety standards would require that all substations be continuously monitored and remotely controlled from BART Central.

COMMUNICATIONS AND TRAIN CONTROL

Light rail can be designed and operated with modest communication and train control facilities. San Diego's system is a good example of this. The San Diego system uses telephones leased from the public network, a basic two-way radio system, and has minimal sections with track circuits to safely separate light rail and the freight railroad trains. The railroad used in San Diego, however, has a wide time separation between freight service and passenger service.

Train Communications

Details of communication systems for the DPX are beyond the scope of this study. However CCTV has been suggested at the three stations and it is now economical to install fibre optics along the right-of-way to carry this along with an internal telephone system, limited remote alarms covering fare collection equipment and substation supervision as required.

Train Control Requirements

Train control would require special arrangements at the Bay Fair station approach for the shared alignment option. Along the extension the minimal train control that meets PUC requirements varies with the vehicle performance. Conventional light rail trains with speeds to 45 mph can operate on line of sight combined with radio supervision and direct train-to-train radio to allow a train operator to monitor the train ahead. Higher performance cars would require Automatic Train Protection (ATP) and Automatic Train Stop (ATS). Should joint trackage operation on a shared alignment be selected, the light rail cars would also have to be equipped with BART communication systems and Automatic Train Operation (ATO) equipment. Wayside ATO equipment would have to extend out to at least the Castro Valley Station. Here, trains inbound to Bay Fair would switch from manual to automatic operation.

The California PUC adds a requirement for ATS if operation exceeds 55 mph. This could be added to any of the proprietary systems above by either inductive or mechanical trips.

Automatic Train Control

If the high performance LRV's are used on the extension, both ATS and ATP would have to be provided. In this case further study is necessary to determine whether a fully computer controlled ATO system should be used rather than conventional signalling with track circuits and color light signals. ATO would be required if there were joint operation over BART tracks. It may be economical to move to a fully automated moving block control, given the secure fully grade-separated nature of the DPX. A Vancouver-type operation could be possible. This could provide some operating cost savings since driving cabs could be eliminated and train operators used instead as attendants roving both trains and stations. The Vancouver control system is used in West Germany on light rail, heavy rapid transit and railroad systems. Costs per mile depend on the number of vehicles, but are typically 80 to 90 percent of the cost of a conventional, full feature fixed block color light system with cab signaling. While such an arrangement does not preclude the shared alignment option, it does favor the independent west side approach to Bay Fair station as discussed in the next chapter.

AGENCY DESIGN REQUIREMENTS

Several public agency requirements must be taken into consideration in the design of the DPX.

Public Utilities Commission

California Public Utilities Commission (PUC) General Order No. 143 sets specific requirements for light rail design and operation in California. The rules are not restrictive but do impose higher emergency braking rates and signalling requirements than are used on certain North American light rail systems. These requirements are used in this study.

Safety Standards

Stations on the BART system are required to meet NFPA 130 fire and life safety standards. These standards are not mandatory for light rail and their adoption is a policy decision. Stations on the DPX could be designed to meet NFPA 130 standards as recommended by BART staff. This would be essential at Bay Fair but should be examined at the other stations to ensure that the additional costs are acceptable.

All alignment alternatives must meet the applicable codes including seismic requirements.

IV. DPX ALIGNMENT AND STATIONS

This chapter describes, from west to east, features of the DPX alignment and stations, reflecting the general design options and requirements discussed in the previous chapters. The proposed alignment for the DPX is 11.6 miles long, extending from the Bay Fair BART station to a West Dublin/Pleasanton station. The great majority of the alignment would be in the median of Interstate 580, as determined by the BART extension studies. Stations would be located at Castro Valley, 3.1 miles from Bay Fair, and at the West Dublin/Pleasanton location 8.5 miles farther east. A possible third station, described in this study but not currently proposed in the initial stage of the extension, would be located 2.3 miles farther east to serve the east Dublin/Pleasanton area. Possible alignments and stations farther east in Livermore are not included in this study since they are not proposed in the initial stage of implementation.

BAY FAIR STATION APPROACH

While most of the DPX alignment is predetermined to follow the freeway medians, there are a variety of options for the section of the light rail extension between the Bay Fair BART station and Interstate 238. These relate to a number of other design issues, particularly the choice between a separate alignment for the light rail versus a shared alignment between the light rail and BART. Four variants have been examined for the light rail alignment in this section:

- On-street alignment
- East side of BART
- West side of BART
- Shared alignment with BART

On-Street Alignment

This variant would use existing streets to reach the widened median of I-580 immediately east of Mission Boulevard (E. 14th Street). A protected right-of-way could be provided through the BART parking lots with some loss of parking spaces. However, any such route would involve operation on congested streets, particularly Mission Boulevard. This alternative would also require the taking of residential property west of the I-580/I-238 interchange, together with a steeply graded aerial structure to access the freeway median. The results would be higher cost, greater environmental problems, and, even with traffic signal pre-emption at the turns onto and off Mission, slow operation that is inconsistent with the high speed operations desirable for this extension. Travel time would not be competitive with either the existing express buses or the automobile. Consequently this variant has not been examined further.

Eastside Alignment

The eastside option would use a ramp down from the I-238 median and a sharp turn north, bringing the light rail tracks into the east side of the BART right-of-way. This would require consultation with Caltrans as it would involve reconstruction of part of the deck and the east abutments of the I-238/BART overpass.

The BART right-of-way between I-238 and Bay Fair would be widened to carry the light rail tracks to Bay Fair on the east side. Several residential properties would have to be acquired and the present footpath under I-238 relocated. The alignment would then move into mixed traffic operation on Bertero Avenue for the station approach. Immediately south of the station a two block section of right-of-way is available alongside BART, but access to the station is blocked by a traction sub-station. The light rail tracks would veer around this since its relocation is undesirable.

The light rail station would be located in the forecourt of the BART station, adjacent to the existing main entrance. While this could be an at-grade station with street level loading, the other stations on the DPX would be high platform. LRV's can be equipped with movable steps as on the San Francisco MUNI cars but this is a capital and maintenance expense and passenger inconvenience that should not be accepted for a single station. Consequently, the eastside option should have raised platforms with ramps and steps to handle the typical light rail floor height of 3 feet to 3 feet 4 inches. This is difficult to design while retaining good pedestrian, automobile and bus access to the existing station. The parking and bus loading areas would require rearrangement and some space would be lost. Tailtracks would extend north of the station to provide storage. They would remove further parking spaces and require a small structure over the ACFC and WCD canal to gain access to the land under the BART aerial structures to the north of the station.

The costs and environmental problems described in the 1983 BART LPX Update Study report would apply to this option with the exception that the light rail trackage requires slightly less space than BART trackage. These environmental problems, when combined with the slower running, land take and costs of the eastside alignment, make this an unattractive alternative. They are sufficient to justify removing this option from further consideration.

Westside Alignment

An alignment approaching the station on the west side would provide a better transfer connection at Bay Fair than would the eastside option. It would fit at grade between the BART tracks, which are either at grade or on an embankment with retaining walls, and the Union Pacific Railroad (UPRR) tracks. This alignment is shown conceptually in Figure 2.

The railroad currently has a single track mainline in a right-of-way of 62 to 75 feet. The UPRR will require provision for at least a second track in the future. The right-of-way is wide enough to fit the light rail tracks between existing BART tracks and a relocated UPRR mainline, leaving room for an additional UPRR track. Alternatively, provision could be made for a total of three UPRR tracks on 17 feet centers if the light rail were single track in places. Either arrangement would avoid the taking of any property except for that of the railroad, but relocating the mainline would require grading and changes to drainage.

North of Bay Fair Station the light rail track would become double or triple and would extend alongside and under the BART structure to provide storage. Storage flexibility and light rail curvatures should permit this addition without changes to BART structures. Overhead catenary height would be reduced but would still meet PUC requirements. At the station, a new single face at-grade platform would be built with direct open connection to the west side of the existing fare paid zone; the station configuration is described later in this chapter.

Shared Alignment

Another alternative for the Bay Fair Station approach is for the light rail tracks to share the existing BART alignment between I-238 and Bay Fair (see Figure 3).

A shared alignment is feasible whether the DPX is built at BART gauge or standard gauge. The shared alignment would reduce right-of-way requirements and would provide for efficient transfers between the DPX and BART, with minimal modifications to the Bay Fair station. However, the shared alignment would dictate many of the design and operational characteristics of the DPX, including full BART communications and safety requirements. There is also the potential for disruption of existing BART service, although this would be identical for a BART extension alternative.

There is nothing unusual in sharing an alignment and trackage between light rail and rapid transit or railroad operations. It occurs in numerous locations in Europe and over a considerable distance, with several stations, on the Cleveland system. Special arrangements and regulations are usually adopted to allow non-compatible rolling stock to share trackage. The California PUC permits this in San Diego on a time divided basis.

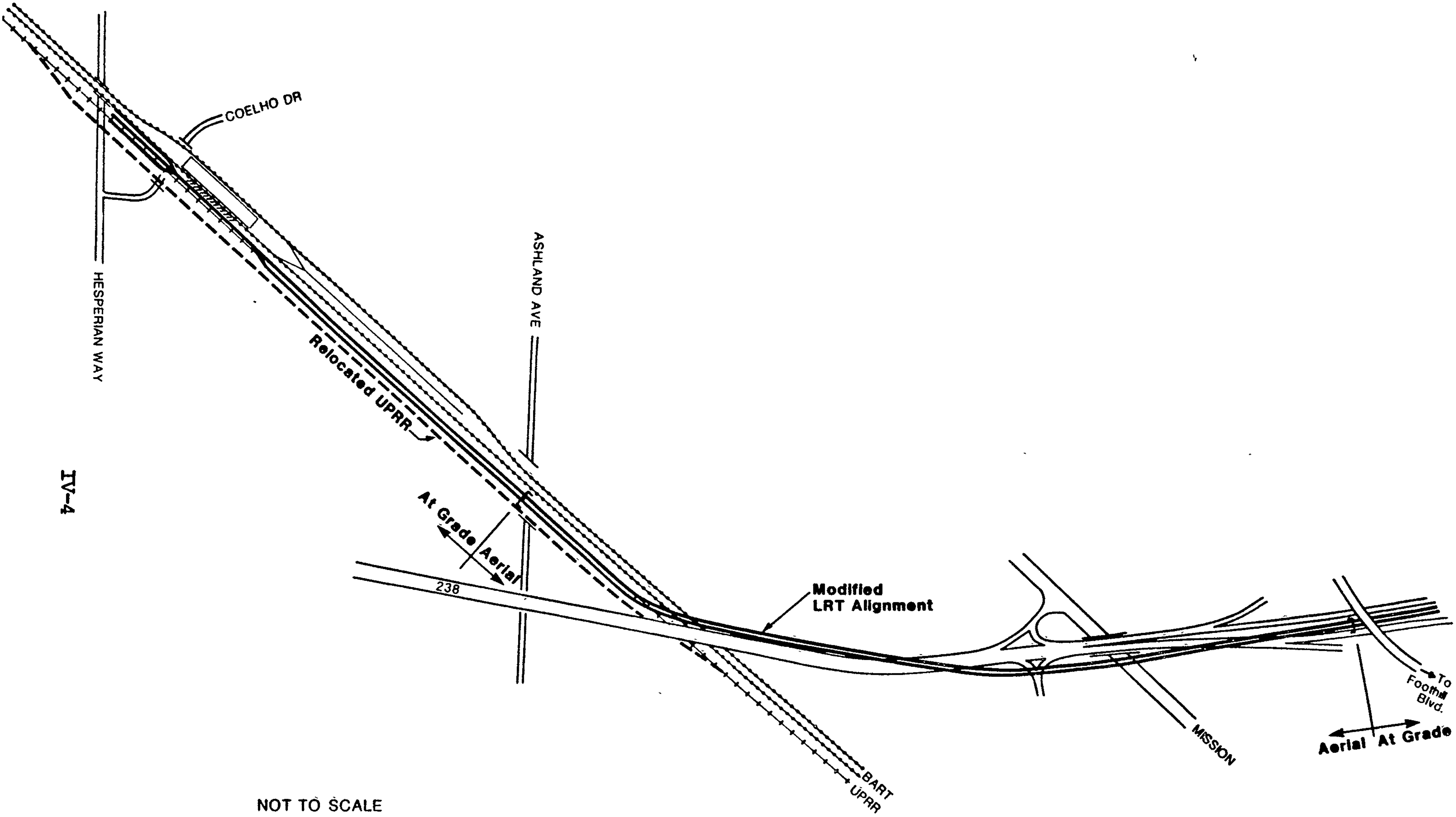


Figure 2
LRT WESTERN ALIGNMENT ALTERNATIVE

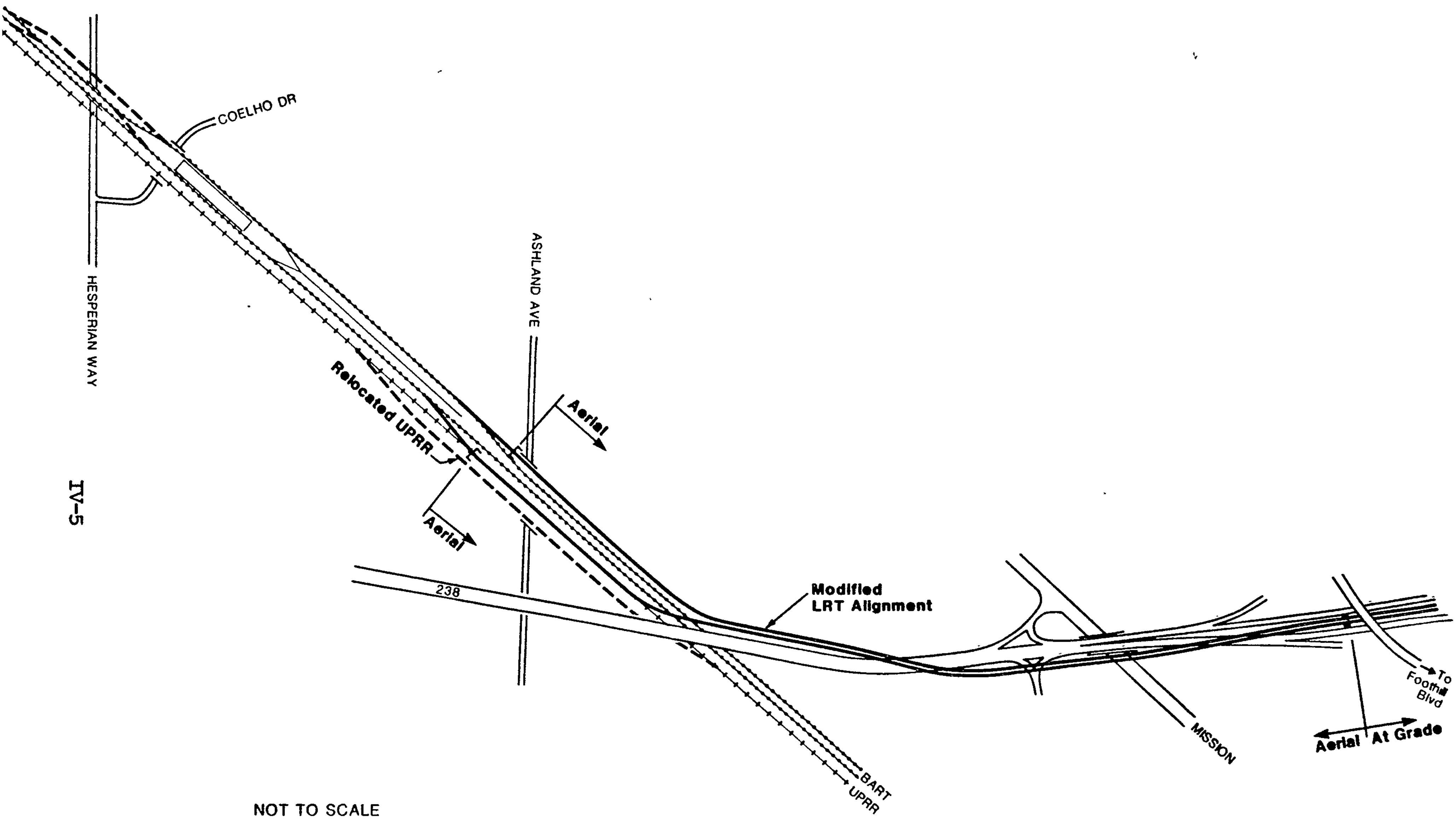


Figure 3
BART/LRT SHARED TRACK ALTERNATIVE

The shared running for the DPX would involve a distance of 8,500 feet. In addition to the light rail operation being time divided from BART, the LRV's would be comparable to BART cars in performance and floor height, and could be specified with BART-compatible couplers and anticlimbers. If non-articulated cars were specified, the full BART standards could be met, including buffing strength. Modern LRV's are exceptionally well fire-hardened and many light rail systems are built to the full NFPA 130 standards.

This joint running arrangement is possible and practical whether the LRV's are specified for standard gauge or BART gauge. If standard gauge were used, a third running rail would be required between the BART rails from I-238 to Bay Fair. Within the station area two rails would be added (gauntlet track) to bring the narrower light rail cars to within 3 inches of the platform edge. If BART gauge is specified the BART tracks would be used except in the station where gauntlet track would bring the LRV's closer to the platform edge. The light rail tracks at the platform would be centered 10 inches away from those of BART. This is more than sufficient distance to accommodate standard "T" rail and standard fastenings. This combination of mixed gauge track, single point switches and gauntlet track is a common feature of the new U-bahn light rail system in Stuttgart, West Germany. BART has commented, however, that this joint track arrangement could cause service disruptions to the existing BART system should the mechanical switches fail.

The light rail would have overhead catenary power collection at a height of approximately 18 feet. This would be independent of, and provide no conflict with, existing BART operations. Similarly the BART power rail would be well clear of the LRV's profile. Such duplication of overhead and third rail power collection occurs elsewhere.

Train Storage: Irrespective of track gauge, immediately north of Bay Fair, switches would take the LRV's onto a pocket track between the two BART tracks. There is insufficient distance and space between the two BART aerial guideways to ramp this pocket track to ground. The pocket track must remain on aerial structure between the BART main tracks. To permit this, the existing northbound main track would be converted to pocket track and a new northbound main track would be constructed east of the existing structure. Major structural modifications would be required for constructing turnouts to and from the existing aerial tracks.

Operating Procedures: Light rail operations are proposed to have a common headway with the BART Fremont line. Each DPX train would connect with each Fremont BART train. Present minimum headways are 7.5 minutes; improvements to 4.5 minutes are planned in the future. The shared trackage would allow safe time separation to headways as low as 3.75 minutes, including approach and egress clearance, switch movement and light rail station dwells of 45 to 60 seconds. A light rail train from Pleasanton would be timed to approach the BART junction about midway between BART northbound trains and be detected by a BART ATO track circuit beginning at the Castro Valley Station. Once detected at Castro Valley, the light rail train would be operated and tracked by the BART ATO system, thereby providing protection from following BART trains.

The light rail train would deposit all its passengers on the northbound platform and then pull off onto the pocket track to turn around. Once clear of BART tracks, the blocks south of the station would be cleared to allow the preceding BART train from Fremont to pull into the platform and provide a direct same-platform transfer for the DPX passengers. In the reverse direction the southbound BART train would drop passengers off at Bay Fair and, after clearing the signal block(s), allow the light rail train to be released via the ATO system directly into the southbound platform. The light rail train would then follow some two minutes behind the BART train until leaving the BART right-of-way at I-238, and proceed to the Castro Valley Station where it would return to manual operation.

This operating procedure would provide optimal passenger transfer convenience. Northbound transfers would require 2-4 minutes, southbound transfers 1-3 minutes. The dispatch of BART trains from Fremont and DPX trains from Pleasanton could be coordinated to minimize the transfer impedance. Trains on the relatively short fully grade-separated alignments from Fremont and Pleasanton to Bay Fair are unlikely to sustain delays. The BART pocket track south of Bay Fair would remain unaltered and would be available for short-turn BART trains, as may be needed to handle the additional passenger flows from the DPX. Transfer times between light rail trains and BART Bay Fair short-turns could be better than with Fremont trains given the shorter BART possession of trackage from Bay Fair to I-238.

The shared alignment arrangement would increase capital costs and require additional land take. It would only modestly disrupt current BART operations during construction, particularly with the common gauge option.

Summary of Bay Fair to I-238 Alternatives

The on-street and eastside options have insufficient merit to pursue further. The westside alignment and joint trackage scheme are both possible. However, BART staff have commented that the shared trackage option would require special considerations, such as equipping all light rail cars with full BART train control. This would be an additional expense. Notwithstanding this consideration, both the westside and shared trackage options were retained for further consideration.

I-238 TO CASTRO VALLEY SEGMENT

This segment of the DPX alignment involves a crossover from the Bay Fair Station approach into the median of the I-238 freeway. One issue here is whether to provide double tracks, as previously proposed for the BART alternative, or to use single tracks.

Previous Double Track Options

The three shuttle service options in the 1983 BART LPX Update Study report proposed a new double track route between Bay Fair Station and I-238 to the east of the existing BART tracks. To surmount the narrow median in I-238 between the Bay Fair BART station approach and the I-580 interchange, the BART alignment options include a north and south aerial alternative and a south subway-aerial alternative. All these alternatives are feasible for light rail and have the advantage of retaining BART standards for possible long term conversion from light rail to BART. They have the disadvantages of land and property requirements, relatively high cost and, in the case of subway segments, involve some reconstruction of I-238.

Single Track Option

Light rail transit can use sections of single track to reduce costs and reduce or avoid property take. This arrangement was considered for the alignment segment between the Bay Fair BART station approach and I-580 to the east. It would involve squeezing a single light rail track into the existing median of I-238. Given that Caltrans plans to widen I-238 eventually, this might be acceptable as an interim operation. The single track median section could be relocated to the south and converted to double track when I-238 is widened. In San Diego single track sections were used initially but were doubled as soon as funding permitted.

The single track section would be 3,000 to 3,500 feet long and require less than one minute to traverse. This would produce no limits on headways above 5.5 to 6.5 minutes and would not introduce any delays given the proximity to a terminal station where Dublin/Pleasanton-bound trains could be held and dispatched to avoid any conflicts. BART has commented, however, that holding and dispatching of trains to accommodate single track operations would delay trains at the stations and would preclude the shared alignment option for the Bay Fair station approach. Moreover, single track sections reduce system reliability; this places more importance on procuring reliable vehicles.

A preliminary examination of the I-238 median indicates that the existing median is too narrow for a single, at grade light rail track and there is insufficient room to widen the median by narrowing freeway lanes or shoulders. The single track could be accommodated on an aerial structure in the existing median; however, future widening of I-238 as planned by Caltrans would relocate the median to the south, requiring relocation of the light rail line and removal of the aerial structure. The additional cost of construction and demolition of an interim aerial structure and the inherent operating disadvantages of single track suggest that this option be eliminated from further consideration.

Modified Double Track Option

In reviewing the previous alignment options, a new alignment option along I-238 was identified. The conceptual alignment is shown previously in Figures 2 and 3. A general profile for the alignment is given in the Appendix. This alignment would serve both the LRT Westside and Shared Alignment alternatives for the Bay Fair Station approach, would provide double track operation and would permit the future widening of I-238, as planned by Caltrans, without major track realignment or aerial structure modifications. It is also compatible with a BART alternative.

Within the I-238 corridor, the proposed alignment begins on the north side of the freeway on aerial structure. Proceeding east, the aerial structure transitions to the south side of I-238 at the low point of the freeway (midway between the UPRR and Mission Boulevard). Continuing east, the aerial structure passes over Mission Boulevard and transitions to the median near the newly reconstructed I-238/Foothill Boulevard off-ramp, and returns to grade in the I-580 median. This alignment requires additional aerial structure over that shown previously for BART in the 1983 BART LPX Update Study. However, due to the profile of I-238, this additional structure appears to be required for the BART alternative as well in order to keep grades below 3 percent.

Between Bay Fair BART station and I-238, the configuration of this new double track option would depend on whether the west side or shared alignment is used.

CASTRO VALLEY TO DUBLIN/PLEASANTON

The DPX light rail alignment would follow the I-580 freeway median from west of the I-580/I-238 interchange through the Dublin Canyon to the Dublin/Pleasanton area, utilizing double tracks all the way. This section of I-580 has been reconstructed with a median width and grade profiles that can accommodate BART. The median would also readily accommodate light rail tracks. The grades of up to 3 percent are reflected in the estimation of light rail travel times discussed in Chapter III, and are a factor in favoring high performance LRV's for the light rail operation.

The previous BART studies considered several design variations from the West Dublin/Pleasanton station to Livermore, as the freeway median is not wide enough to accommodate double tracks and a station platform for BART. These options included widening the freeway and remaining at-grade in the median; aerial alignments in the median and south of the freeway; and a combined subway/aerial alignment south of the freeway. All variants involved additional land take and higher costs than an at-grade alignment in the existing median.

Although moving the rail alignment out of the freeway median would provide improved pedestrian access and the possibility of joint station development, there is little advantage at either Dublin/Pleasanton station, suggesting that the most economical light rail alignment is to remain in the median.

DPX STATIONS AND YARD

The Dublin/Pleasanton Extension would involve modifications to the Bay Fair BART station and construction of new stations at Castro Valley and West Dublin/Pleasanton, with the possibility of a third station to serve East Dublin/Pleasanton. Locations of the stations have been established in the earlier BART planning studies. Additionally, a storage/maintenance yard would be needed to service the light rail vehicles used on the line. A site has not been established for the yard.

Bay Fair Station Modifications

The option using a shared alignment between I-238 and the Bay Fair station would require no change to the station itself except for the addition of rail and overhead wires. The light rail storage track with access switches would be to the north and independent of the station structure. This would require changes to the BART aerial structure, including construction of a new northbound BART aerial structure. The existing northbound BART track would become the light rail storage track.

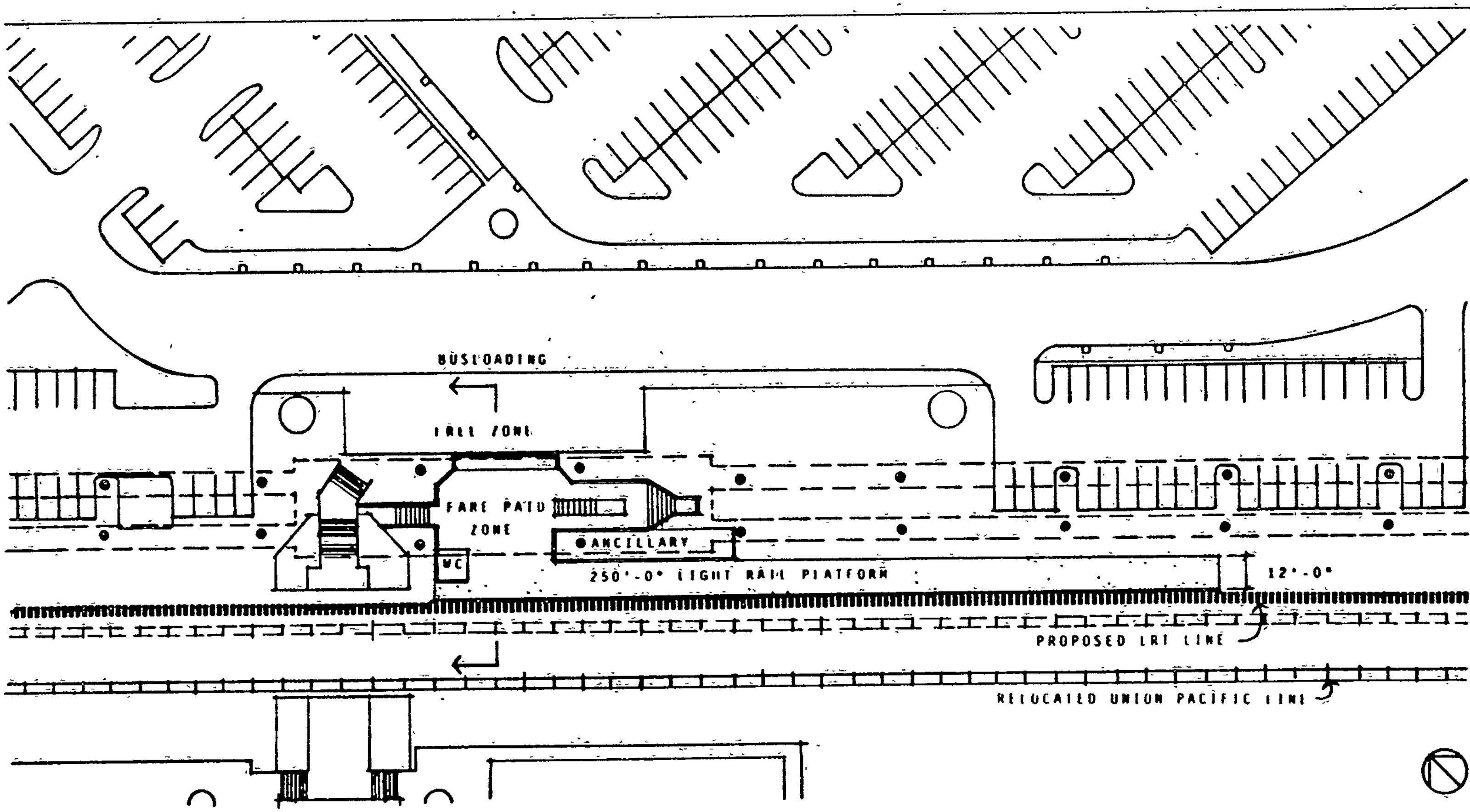
The westside light rail approach would require a new single platform at grade level, served by a single track. This platform would occupy the space currently used for janitorial rooms and pay telephones. This section of the station would have to be demolished, and the facilities relocated. If the DPX has an independent fare collection system an additional set of fare gates, ticket machines, change machines and addfare machines would be installed here. If the DPX uses the BART fare collection system, then the DPX platform would provide the convenience of a direct open transfer. DPX passengers not transferring to or from BART would enter or exit the station through the existing fare gates. Handicapped passengers would continue to require the assistance of the station agent to exit the fare paid area and reach the existing elevator at the north end of the station. A sketch of this westside arrangement is shown in Figure 4.

Castro Valley Station

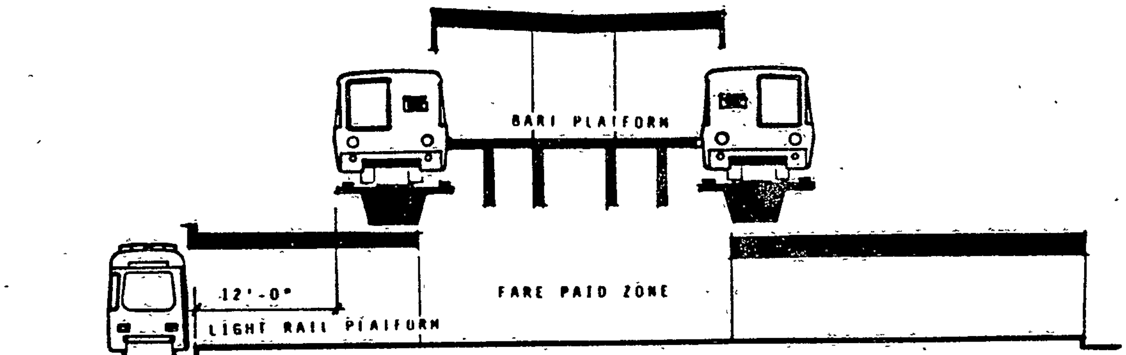
The Castro Valley station would be located in the median of I-580, immediately west of Redwood Road. The freeway is on a retained embankment with additional width to accommodate the Redwood Road access roads. BART has purchased the majority of the needed station property which is entirely on the north side of the freeway, sized to accommodate 900 to 1,000 parking spaces. Future needs of up to 1,100 spaces are predicted for the BART alternatives previously studied. This is the only station with significant walk-on patronage projected.

Access to the station would be by a pedestrian underpass. A center platform is reached from this underpass by elevator, escalator and stairway. BART type fare gates can be provided as one option discussed in the fare collection section. A platform length of 250 feet plus immediate

Figure 4
BAY FAIR STATION MODIFICATIONS
Westside Option



SITE PLAN



SECTION

single-side platform at grade

access through existing station entrance

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growth allowance of 90 feet, for a 340 foot total, is shown. This would accommodate three 85-foot articulated cars or four 4-axle cars. This would be adequate for projected year 2005 ridership levels assuming 4.5 minute peak period service. To accommodate 8-car trains, longer platforms would be needed. Station layout should allow for long term expansion to 700 foot platforms so as to accommodate the longer LRT trains or BART. Single western access is adequate with a section of the future station platform extension fenced off for safe refuge to meet NFPA 130 emergency exit requirements. A conceptual layout for the Castro Valley station is shown in Figure 5.

Dublin/Pleasanton Stations

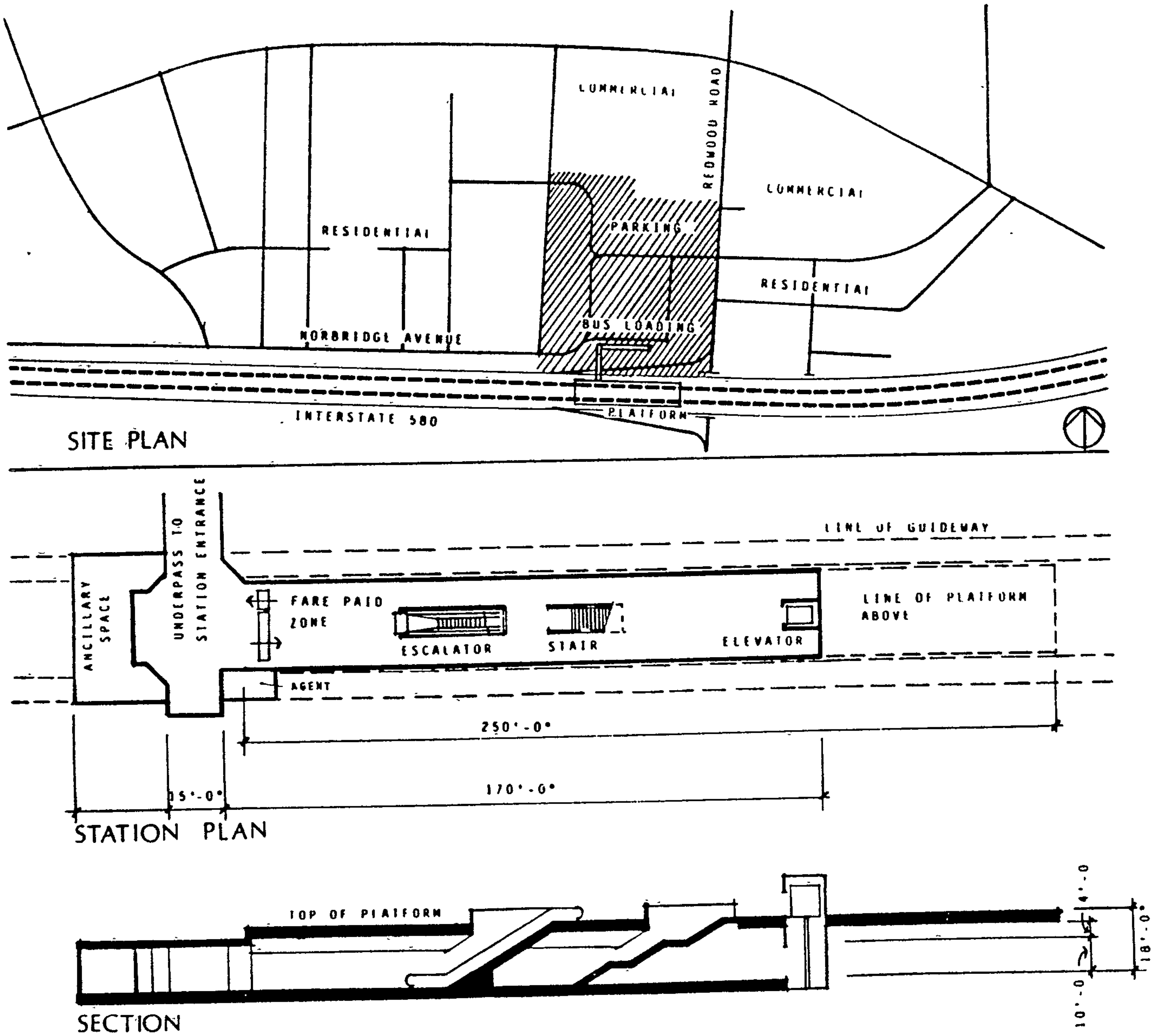
The West Dublin/Pleasanton Station (referred to as the "Dublin" station in the previous BART studies) would be located in the median of I-580 between the Foothill Road interchange and I-680 freeway. Parking and access would be provided from both the north and south. Provision should be made for new I-580/I-680 freeway flyovers.

A conceptual layout for this station is shown in Figure 6. The station layout is similar to Castro Valley except that access is from a pedestrian overpass rather than an underpass. Access and parking lot requirements and layouts would be identical to those outlined in the 1983 BART LPX update study. Depending on median width available, either a single track configuration with a wide platform or double track configuration with narrower platform is possible. BART has commented that a single track configuration should not be used as it would make it difficult to schedule trains.

The east station in the Dublin/Pleasanton area would be located in the median of I-580 immediately west of the planned Hacienda Drive interchange. Although not a part of the initial stage of construction planned for the Pleasanton/Dublin Extension, previous BART planning studies have indicated that it may be needed to avoid overloading of the Dublin/Pleasanton station to the west. For this reason, the easterly station has also been included in the ongoing analysis.

A conceptual layout for the easterly station is given in Figure 7. Access would be by a pedestrian overpass from parking lots and bus bays to the north and south. The south access would also permit interconnection with any future San Ramon Valley transitway on the right-of-way of the Southern Pacific Transportation Company (SPTC). Despite the recent decline in interest in this transitway, this opportunity should be retained. To achieve this, the southern overpass would be longer than otherwise desirable and would also bridge Owens Drive, the principal access road to the southern part of the station. The overpass is on the west side of the station platform to minimize this distance. As such, this station is a mirror image of the West Dublin/Pleasanton station.

Figure 5
CASTRO VALLEY STATION LAYOUT



center platform at grade

underpass access

in-line circulation

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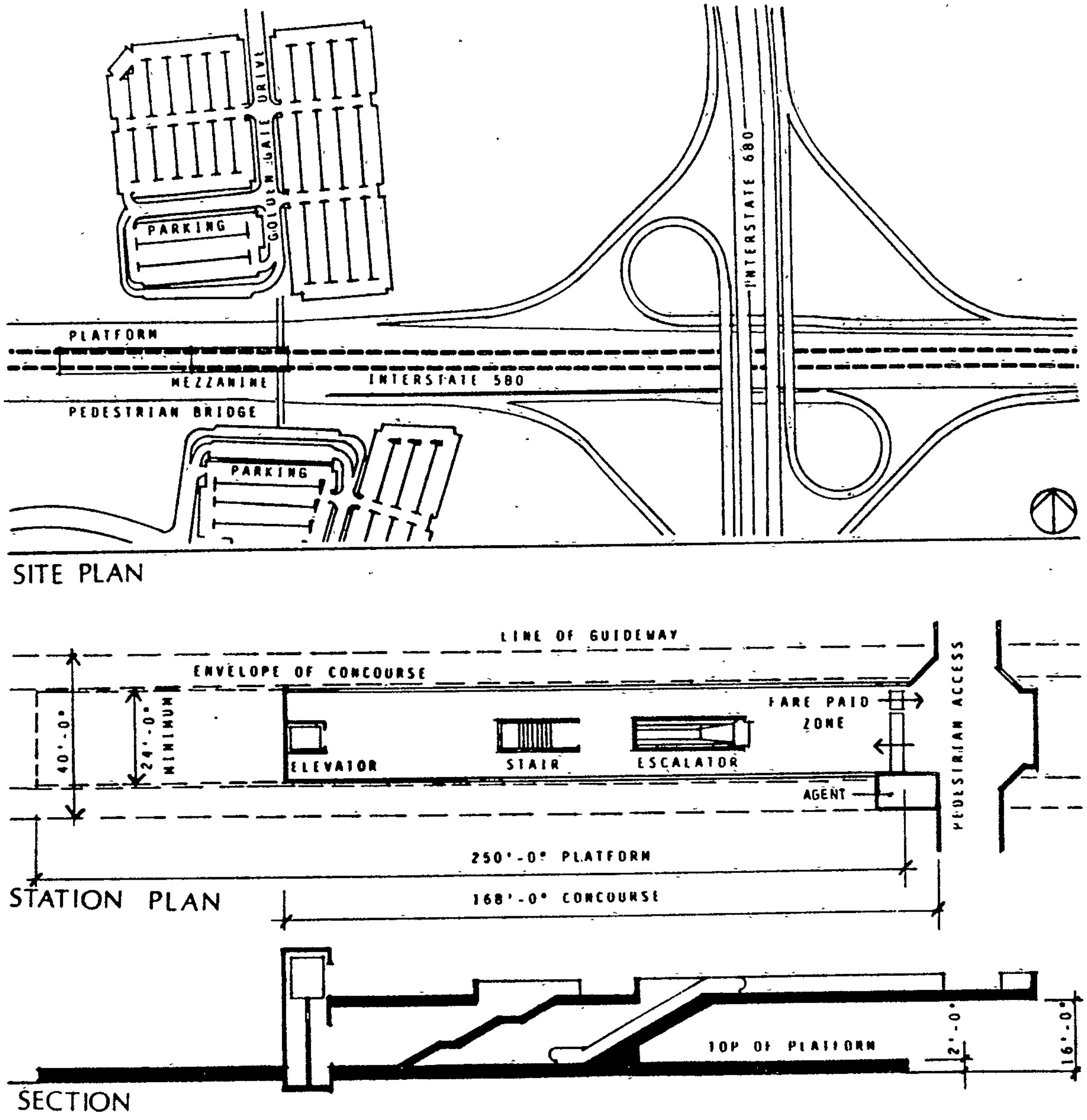
Figure 6
WEST DUBLIN/PLEASANTON STATION LAYOUT



center platform at grade

aerial access

in-line circulation

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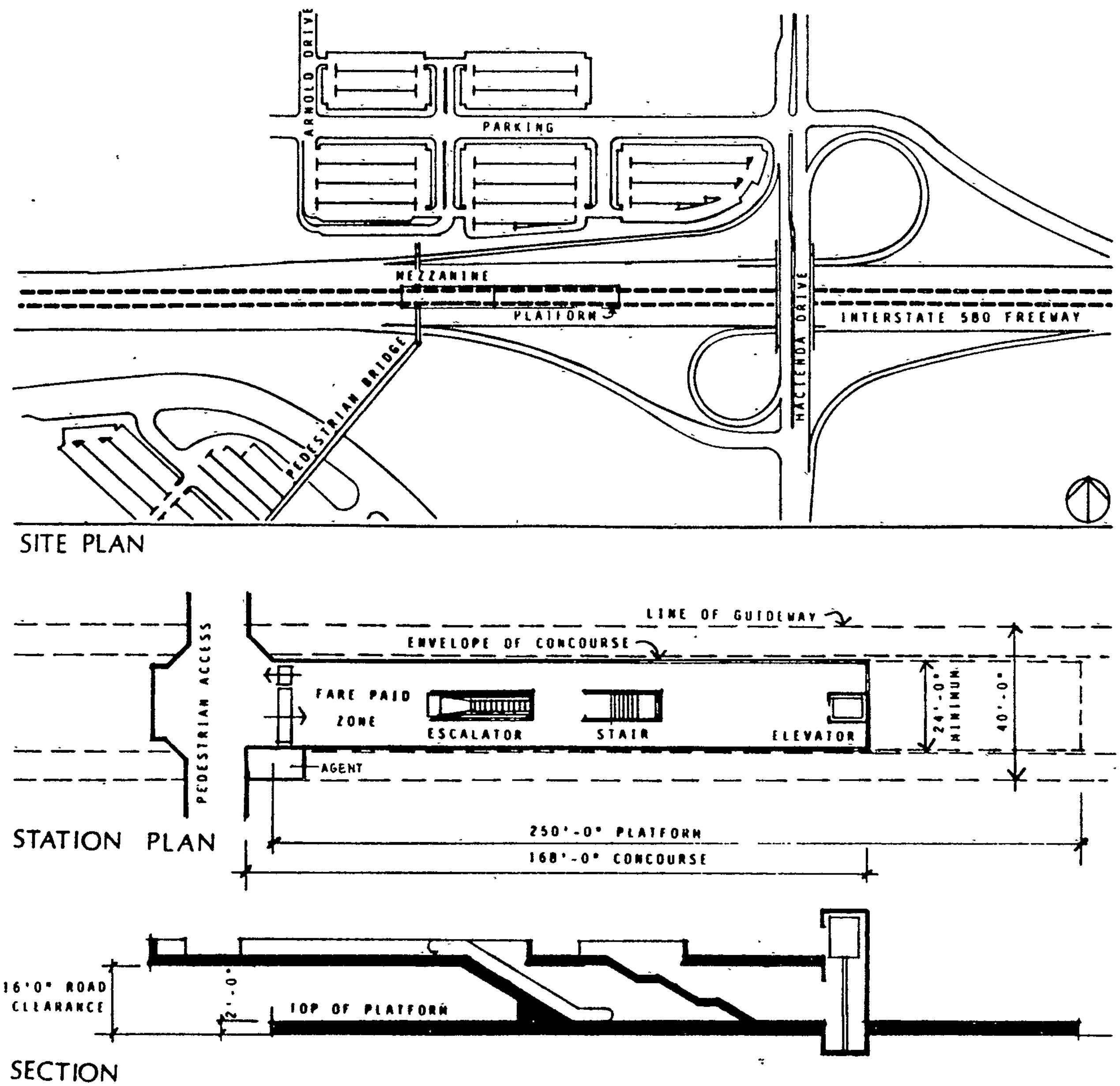
Figure 7
EAST DUBLIN/PLEASANTON STATION LAYOUT



center platform at grade

aerial access

in-line circulation

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Storage and Maintenance Facilities

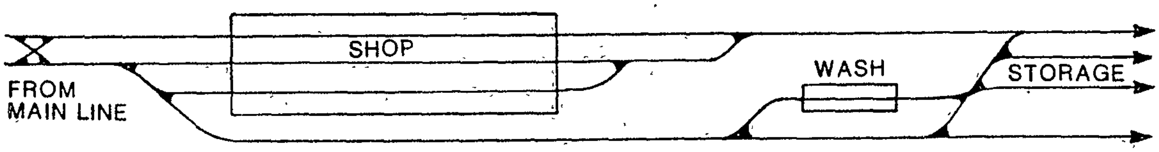
The DPX light rail alternative would require a storage yard at some location in the Dublin/Pleasanton area. In addition, facilities must be provided for certain types of maintenance, as the light rail alternative would not be able to share existing BART maintenance facilities.

The light rail yard could be located at any point along the line where appropriately zoned low cost land is available. Access from the rail alignment in the freeway median to a yard outside the freeway would require an aerial connection. Given the availability of off-peak train storage under the BART aerial guideway north of Bay Fair, the least deadhead (unproductive) mileage would occur with a yard at the eastern end of the line. A facility in the freeway median is marginally possible given at least 65 feet of width. From the Foothill Boulevard overcrossing east along I-580, the median is insufficient in width for a light rail yard. Subject to closer investigation, one possibility is in the proposed industrial park in the northeast quadrant of the I-580/Santa Rita Road interchange. This would require a track extension in the freeway median of over one mile, plus a single track aerial crossing of the westbound lanes of I-580.

Two conceptual layouts for yards are shown in Figure 8. Option A is a linear layout requiring about 10 acres and capable of adaptation to the freeway median. Option B ideally requires at least 20 acres and has the advantage of looped operation. The outside circle track can also be used as a test track and gives greater flexibility in moving LRV's between storage, maintenance, interior and exterior wash facilities. It is also less prone to disruption with a single disabled train. In either option the maintenance shop tracks can be connected at both ends, a convenience that may justify the cost of additional track, switches and shop doors. Road access is required to the yard and staff parking must be provided. These considerations favor an off-median site.

The BART alternative would, at most, require a minimal yard for light maintenance with most maintenance being done at existing facilities.

A. LINEAR LAYOUT (14 Switches)



B. MORE OPTIMAL LAYOUT (20 Switches Min.)
Road Access is Required (not shown)

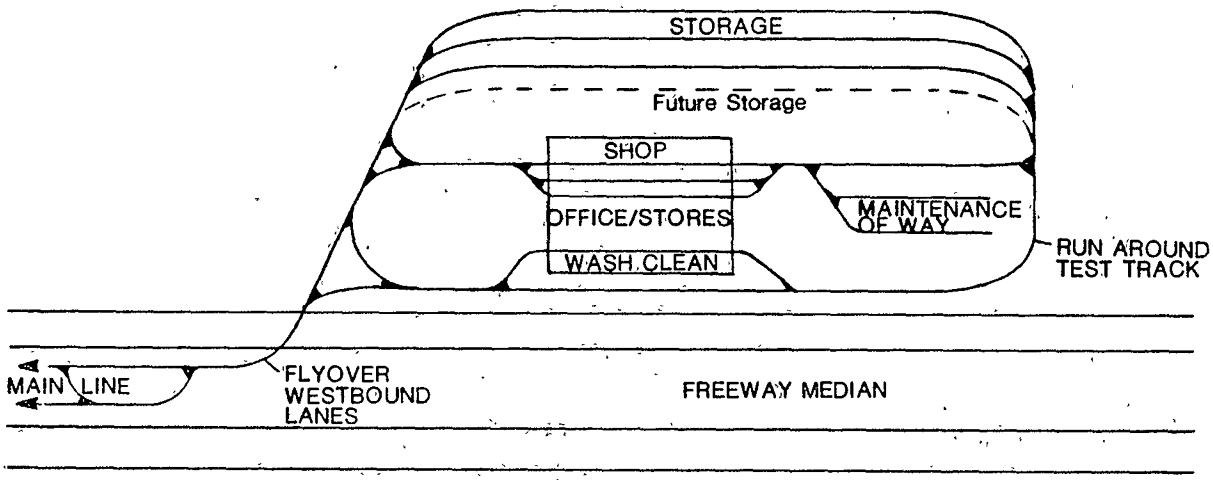


Figure 8
STORAGE/MAINTENANCE YARD ALTERNATIVE LAYOUTS

V. RIDERSHIP PROJECTIONS

Projections of year 2005 ridership on the light rail alternatives were made using procedures consistent with those used in the 1986 BART LPX Supplemental Analysis. These procedures reflect ABAG Projections '85 growth projections, transit forecasting procedures from the I-680/I-580 Corridors Study, and the alignment and service characteristics being considered for the light rail alternatives. These projections provide a consistent basis for comparison with those made in the earlier study for the BART alternative. Separate projections were also prepared to test the effects on DPX ridership of adding a third transit station in East Dublin/Pleasanton. The projections do not include shifts in corridor development potentially induced by the BART extension, nor the potential for further growth of the area beyond the year 2005 horizon.

Although the DPX could commence operation as early as 1995, ridership projections were not developed for this shorter range horizon since the data base was not readily available. LAVTA staff have expressed concerns about using year 2005 ridership projections on a system that could start operating as early as 1995. The longer range projections presented here are valid for comparing among alternatives, however, and are consistent with those used in previous BART studies when service start-up was not considered likely until at least 2000.

METHODOLOGY

The LPX ridership forecasts were developed utilizing a multi-modal rapid-response model prepared by DKS Associates for the I-680/I-580 Corridors Study under the direction of the Metropolitan Transportation Commission (MTC). This computer-based model forecasts future person-travel as a function of population and employment growth, allocates person-travel among transit and non-transit modes based on transit and highway network characteristics, and assigns the resulting transit and highway trips to specific transit lines and highway facilities in each corridor. The model was adapted in November, 1985 for use in the BART LPX Supplemental Analysis Study. The modified version was used in the current study to ensure comparability between the BART and Light Rail Transit projections for the DPX.

Figure 9 shows the general process involved in applying the model. This process and its inputs are described in detail in the User's Guide (1) for the model. Below is a summary of its four main modules.

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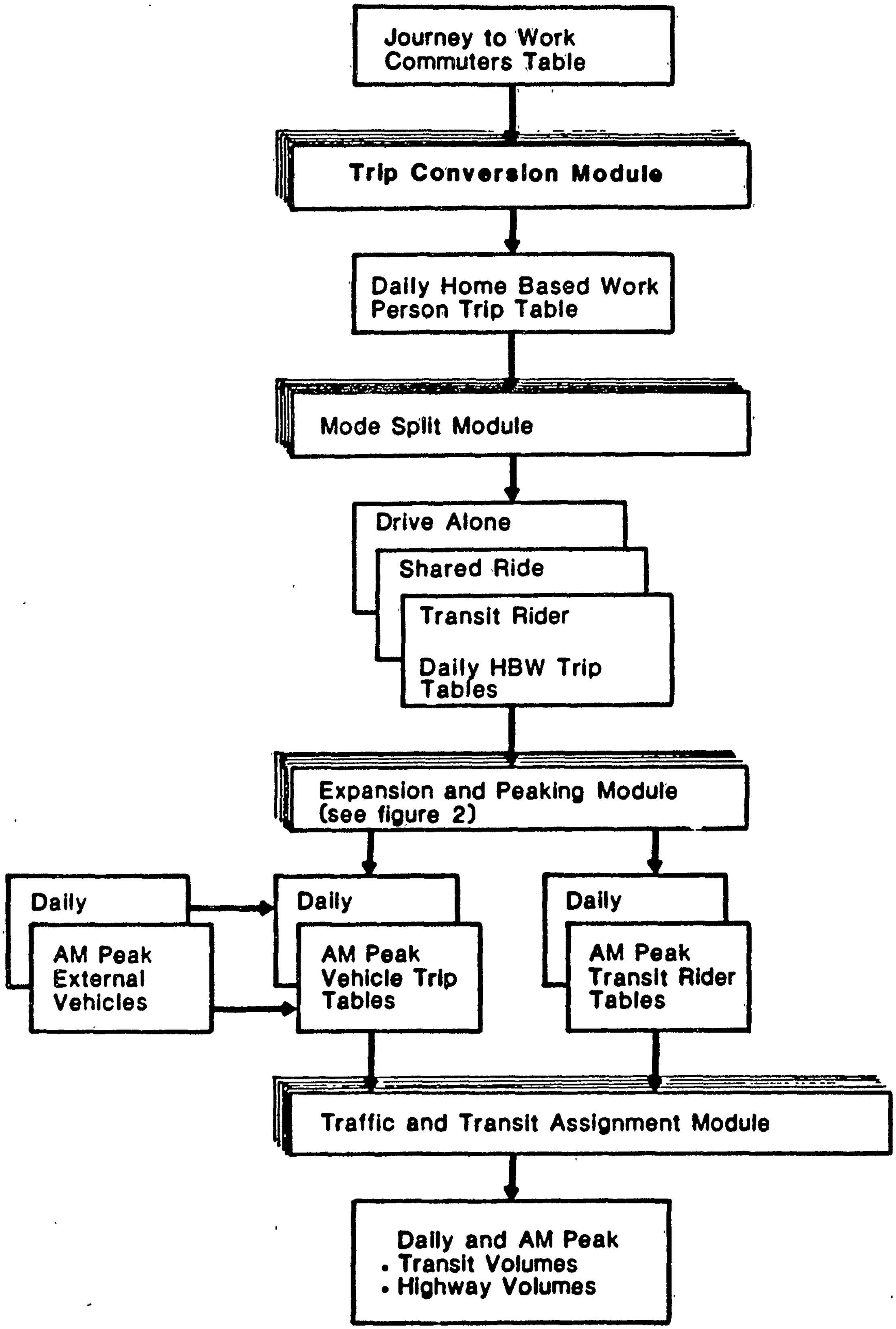
(1) <u>I-680/I-580 Corridors Model User's Guide</u>, DKS Associates, January, 1986.

Figure 9
I-680/I-580 Corridors Model
CONCEPTUAL FLOW DIAGRAM



SOURCE: I-680/I-580 Corridors Model Users Guide,
DKS Associates, October 1985.

Trip Conversion

The trip generation and distribution steps found in most conventional models are combined into one step in the I-680/I-580 Corridors model. The input to this step is a "commuter matrix" which indicates the number of commuters living in each zone and working in each other zone in the region. The base year (1980) commuter matrix was prepared by MTC from the 1980 U.S. Census Journey-to-Work data. The forecast year (2005) commuter matrix was prepared by MTC by expanding the 1980 commuter matrix based on 1980-2005 zonal growth factors derived from ABAG Projections '85 population and employment forecasts.

Mode Split

The mode split module allocates daily home-based work trips to drive alone, shared ride and transit modes based on the following types of factors:

- Zone-to-zone peak period highway travel time and trip cost, including auto operating cost and parking cost
- Zone-to-zone peak period transit travel time (including walk and/or drive access times, wait times, in-vehicle time, transfer time) and transit fare
- Zonal factors such as average household income, autos per worker, household size, presence of CBD, etc.

Trip Factoring

For each mode, daily home-based work trips are expanded to total daily trips by all purposes. Also, daily trips are factored to AM peak period trips for subsequent trip assignment steps.

Trip Assignment

As a final step, the zone-to-zone transit trips are assigned to transit lines and vehicle trips are assigned to highway facilities based on minimum time paths between the zones. For determination of minimum transit paths, transit networks were coded for each distinct DPX alternative, as described below. Minimum paths determined from the networks reflect access times, transfer times and in-vehicle times.

Adaptation of the I-680/I-580 Corridors Model for the DPX Study

The I-680/I-580 Corridors Model covers the entire 9-county Bay Area. In areas of Alameda and Contra Costa Counties east of the Oakland/Berkeley Hills a detailed zone system and networks are represented in the model. In the remainder of the Bay Area, however, the zones and networks are much less detailed, with zones generally corresponding to the MTC superdistricts.

For the 1986 BART LPX Supplemental Analysis study, the zone system and highway and transit networks in the East Bay areas west of the hills were further detailed to more accurately portray BART access opportunities. The I-680/I-580 Corridors model was expanded to include an additional 24 East Bay zones. These were defined so as to distinguish between walk and auto/transit access to each BART station in the East Bay. Additional transit and highway links and lines were coded within the expanded area. Zonal highway terminal data and socio-economic data were also modified for the refined East Bay zones. The revised model was recalibrated using 1980 data prior to application to LPX alternatives.

Future Highway Network

The base future highway network is identical to that used in the I-680/I-580 Corridors Study as of late 1985. It includes all major highway improvements made between 1980 (the base year) and 1985 plus currently programmed improvements listed in the 1985 preliminary State Transportation Improvement Program. In addition, MTC staff identified improvements to arterials in the primary study area that are likely to be implemented. Major improvements affecting the DPX corridor include:

- Interstates 238/880 Interchange -- WB to SB ramp
- Interstate 80, Bay Bridge to Carquinez Bridge -- Add auxiliary lane and HOV lanes
- Interstate 580, Collier Canyon Rd -- New interchange
- Interstate 580, I-680 to Santa Rita Rd -- Add auxiliary lanes
- Interstate 580, Route 238 to Eden Canyon Rd -- Widen to 8 lanes
- Interstate 580, Route 24 to Bay Bridge -- Add HOV lane

A complete list of assumed highway network improvements is provided in the Users' Manual for the I-680/I-580 Corridors Study.

Assumed Background Transit Improvements

The assumed background transit improvements are generally consistent with those used in the I-680/I-580 Corridors study as of late 1985. In addition to the DPX, each transit network alternative includes all transit system improvements called for in the five year plans for each transit system as of late 1985, as summarized below:

- Existing BART Rail Service — Peak period headways reduced on all lines to 9 minutes. Concord line extended to Pittsburg and Antioch.
- BART Express Bus Service — D Express bus service in I-680 corridor changed to freeeway flyer type service. All local service discontinued on express bus routes.
- CCCTA — New local service in San Ramon corridor, taking place of current local D Express line service, and connecting Walnut Creek Station to Alcosta Boulevard and Village Parkway (the Alameda-Contra Costa County line).
- LAVTA — New service in Pleasanton and Dublin areas. Four new routes following currently proposed service plan except for assumed longer-range modifications to improve access to DPX, including localized route revisions, expansion of peak period service to 20 minute headways and new inter-city route along Stanley Boulevard. Rideo service retained and incorporated into LAVTA system.
- AC Transit, Westcat — No major service changes.
- ECCCTA — Four new lines at 30 minute peak headways.

Freeway flyer type Express Bus service was assumed to extend easterly from the West Dublin/Pleasanton Station stations along I-580 to east Livermore. It was also assumed that all Tri-Valley areas would have auto access to the West Dublin/Pleasanton Station.

DPX RIDERSHIP FORECASTS

Ridership forecasts were developed for three DPX alternatives between Bay Fair and West Dublin/Pleasanton:

- BART alternative following the adopted freeway alignment between Bay Fair and the proposed West Dublin/Pleasanton station, with through service to Daly City. This is identical to the "truncated" BART LPX alternative that was tested in the 1986 Supplemental Analysis.

- LRT alternative using High Performance (HP) light rail vehicles on the same alignment, with a transfer at Bay Fair.

- LRT alternative using High Speed Conventional (HSC) light rail vehicles on the same alignment, with a transfer at Bay Fair.

For comparative purposes, the ridership projections assume a 9-minute peak headway on all DPX alternatives, consistent with future headways assumed for existing BART lines. For the BART alternative, through service to Daly City is assumed on all peak period runs, rather than a shuttle. (Based on work done in previous studies, a reduction on the order of 5 percent can be expected if the DPX were to operate as a shuttle between Bay Fair and Pleasanton, with the greatest impact being on Castro Valley station boardings. For the High Performance and the High Speed Conventional light rail alternatives, a transfer is necessarily assumed at Bay Fair Station.

A subsequent section discusses impacts on DPX ridership of extending the line from West Dublin/Pleasanton to East Dublin/Pleasanton.

Line Patronage

Table V-1 presents projected year 2005 daily ridership on the DPX. Among the three alternatives shown, daily ridership varies from a low of 18,800 trips to a high of 23,700 trips, a difference of slightly more than 20 percent. The projected ridership for the High Performance LRT alternative is 5 percent lower than that of BART. Since the two alternatives would have similar travel times and headways, the difference is attributable to the requirement of the High Performance LRT alternative for a transfer at Bay Fair. The lowest ridership is projected for the High Speed Conventional LRT. The reduced ridership is attributable to longer travel times on the extension coupled with the transfer at Bay Fair station.

The peak load point on the DPX is between the Bay Fair and Castro Valley stations, at which point almost 18-23,000 passengers would be carried over the day. Volumes through the Dublin Canyon would be on the order of 15-18,000 daily riders. For the BART alternative (i.e., the higher ridership projections) this is 12-15 percent lower than volumes projected in the 1986 BART LPX Supplemental Analysis Study. This is due to the shorter extension and fewer stations being considered in this study than in the 1986 study.

The foregoing ridership projections are "unconstrained demand" estimates; i.e., they presume sufficient capacity at each DPX station to handle the peak loads, including adequate traffic access and on-site parking. As shown later, the West Dublin/Pleasanton Station may not be able to accommodate the projected loads as a terminus station. In this case, the ridership volumes projected would not be achieved. All three DPX alternatives would be affected by such capacity constraints.

Table V-1
PROJECTED TRANSIT RIDERSHIP, BAY FAIR TO WEST DUBLIN
Daily Two-Way Riders, Year 2005 Unconstrained Demand

	HSC LRT	HP LRT	BART*
Line Loads			
West Dublin to Castro Valley	15,250	17,190	18,090
Castro Valley to Bay Fair	18,220	21,830	22,980
Passenger Trips			
Trips to/from DPX	18,220	21,830	22,980
Intra-DPX Trips	580	720	720
TOTAL DPX TRIPS	18,800	22,550	23,700
Percent of BART Volume	79%	95%	100%
Net Additional Ridership			
Total DPX Trips	18,800	22,550	23,700
Less Corridor Trips without DPX**	2,700	2,700	2,700
Net New Trips due to DPX	16,100	19,850	21,000

* Assumes through service to Daly City

** From 1983 BART LPX Update Study.

DPX Station Patronage

Table V-2 summarizes projected 2005 AM peak two-hour and total daily station activity at each DPX station, assuming no station capacity constraints. Altogether, some 19,000 to 24,000 passengers are projected to board or alight at DPX stations over the day, representing up to 20 percent variation among alternatives. Slightly more than 25 percent of the total daily activity is projected to occur during the AM peak two-hour period.

Projected activity is greatest at the West Dublin/Pleasanton station which is the terminus of the DPX. For the BART alternative, 18,000 daily ons and offs are projected at this station by 2005, assuming sufficient station capacity. For the High Speed Conventional LRT alternative, 15,000 daily ons and offs are projected, or 15 percent less than for the BART alternative. For all alternatives, projected ridership activity is lowest at the Castro Valley station.

In all cases, AM peak offs (i.e., trips to nearby employment sites) at the West Dublin/Pleasanton station are relatively low. This underscores the need to provide attractive transit services from the station to local employment sites. The projections do not reflect special shuttle services as are currently operated by Hacienda Business Park.

Table V-2
PROJECTED STATION ACTIVITY
Unconstrained Year 2005, AM Peak Two Hours and Total Daily Passengers

STATION	HSC LRT	HP LRT	BART
Castro Valley			
AM Peak Ons	871	1,267	1,325
AM Peak Offs	177	237	247
AM Peak Total	1,048	1,504	1,572
Total Daily Ons & Offs	4,127	6,044	6,324
West Dublin/Pleasanton			
AM Peak Ons	3,826	4,290	4,513
AM Peak Offs	435	578	599
AM Peak Total	4,261	4,868	5,112
Total Daily Ons & Offs	15,251	17,221	18,090
Total - Both Stations			
AM Peak Ons	4,697	5,557	5,838
AM Peak Offs	612	815	846
AM Peak Total	5,309	6,372	6,684
Total Daily Ons & Offs	19,378	23,265	24,414

Station Access and Parking

Access mode split estimates for the LPX stations were taken from the 1983 BART LPX Update Study. They are based on existing access mode splits at similar suburban BART stations.

The DPX stations should have a slightly higher proportion of auto access trips than most existing stations, at least in the year 2005. This assumes that the stations are designed with sufficient parking to accommodate the demand for park-and-ride access. Table V-3 displays projected access mode percentages for the DPX stations.

Projected parking needs at each station are premised on these auto percentages and assume an average auto occupancy of 1.2 persons per auto and average parking space turnover rate of 1.2 vehicles per space. Projected parking needs for each of the LPX stations are summarized in Table V-4. These are for the BART alternative; the Light Rail alternatives could have slightly lower parking requirements due to their lower patronage levels.

For the two station alternative, projected parking needs at the Castro Valley station can potentially be met with the site previously purchased by BART, which has a capacity for on the order of 900-1,000 surface parking spaces. Castro Valley parking needs for the three station alternative are slightly greater due to the potential for reverse direction commute, but can still be largely met. However, with the two-station extension as currently planned, potential parking needs at the West Dublin/Pleasanton Station greatly exceeds the likely site capacity. For the BART alternative, up to 3,400 parking spaces are projected to be needed. Previous site planning indicated capacity for up to 2,500 surface spaces, but the currently available site is smaller.

Also shown on the table are projected station parking needs for a three-station extension. This alternative is discussed in the next section.

Table V-3
ACCESS MODE SPLIT PERCENTAGES

Station	Park/ Ride*	Drop-Off	Transit	Walk/Bicycle
Castro Valley	58	12	18	12
West Dublin/Pleasanton	60	12	16	12
East Dublin/Pleasanton	70	11	11	8

* Including drivers and passengers.

Table V-4
PROJECTED STATION PARKING NEEDS, YEAR 2005
BART Alternative

	Daily Passengers (Home-Based)	Number of Parking Spaces
Two-station Extension:		
Castro Valley	5,200	1,000
West Dublin/Pleasanton	16,400	3,400
Three-station Extension:		
Castro Valley	5,300	1,100
West Dublin/Pleasanton	6,300	1,300
East Dublin/Pleasanton	10,100	2,500

Note: Parking needs are approximate only, and may vary greatly due to parking supply at adjacent station(s), transit feeder access and other factors. Does not include kiss-ride parking.

POTENTIAL EFFECTS OF EAST DUBLIN/PLEASANTON TERMINUS ON LPX RIDERSHIP

This study considers a two-station extension from Bay Fair to West Dublin/Pleasanton. This is consistent with BART's current adopted extension policy which calls for construction of the DPX in two phases. The first phase would extend BART from Bay Fair past Castro Valley to the proposed West Dublin/Pleasanton Station. The latter station would serve as a terminus station until such time as the line is extended to East Livermore.

The previous BART LPX Studies concurred with the two-phase construction approach, but raised the issue of whether a third station (East Dublin/Pleasanton) would be needed in the first phase to accommodate the projected year 2005 patronage levels. As indicated earlier in this chapter, up to 18,000 daily passengers are projected to use the West Dublin/Pleasanton station as a terminus station. This suggests the need for up to 3,400 parking spaces by year 2005. Given the limited land available for the station site and the rather difficult traffic access, this would constrain DPX ridership substantially and would cause adverse impacts on the local streets near the station.

To help provide further insight into this issue, year 2005 patronage was also estimated for a three-station DPX extending to the proposed East Dublin/Pleasanton Station site.

Table V-5 presents results of this analysis, including a comparison to ridership levels with the two-station extension currently planned. The High Speed Conventional LRT, the High Performance LRT and the BART alternatives are all shown. The table shows that the third station would greatly reduce passenger loadings at the West Dublin/Pleasanton station. Assuming all Livermore trips use the East Dublin/Pleasanton Station, ridership at the West Dublin/Pleasanton Station would be reduced to 7-8,000 passengers, or less than half the ridership projected for the two-station alternative. Effects would be even more pronounced for AM peak boardings.

The third station would also reduce parking needs at the West Dublin/Pleasanton station. For the BART alternative, parking requirements at the West Dublin/Pleasanton Station are projected to be reduced from 3,400 spaces to 1,300 spaces, assuming all Livermore patrons use the East Dublin/Pleasanton station. Up to 2,500 parking spaces are projected to be needed at the East Dublin/Pleasanton station in this case.

The addition of a third station on the extension would also increase overall ridership. Ridership increases of 1,200-1,400 daily riders, or about 6 percent, are projected.

Table V-5
PROJECTED RIDERSHIP IMPACT OF EXTENSION TO EAST DUBLIN/PLEASANTON
Unconstrained Year 2005, AM Peak Two Hours and Total Daily Riders

	HSC IRT to		HP IRT to		BART to	
	West Dub/Plstn	East Dub/Plstn	West Dub/Plstn	East Dub/Plstn	West Dub/Plstn	East Dub/Plstn
1. Station Activity						
a. Castro Valley:						
AM Peak Ons	870	880	1,270	1,290	1,330	1,340
AM Peak Offs	180	180	240	240	250	250
AM Peak Total	1,050	1,060	1,510	1,530	1,580	1,590
Total Daily Ons/Offs	4,130	4,190	6,040	6,130	6,320	6,420
b. West Dublin/Pleasanton:						
AM Peak Ons	3,830	1,490	4,290	1,680	4,510	1,770
AM Peak Offs	430	530	580	600	600	630
AM Peak Total	4,260	2,020	4,870	2,280	5,110	2,400
Total Daily Ons/Offs	15,250	6,750	17,220	7,620	18,090	8,010
c. East Dublin/Pleasanton:						
AM Peak Ons	--	2,700	--	3,090	--	3,230
AM Peak Offs	--	570	--	650	--	680
AM Peak Total	--	3,270	--	3,740	--	3,910
Total Daily Ons/Offs	--	10,060	--	11,490	--	12,010
All Stations:						
AM Peak Ons	4,700	5,080	5,560	6,060	5,840	6,340
AM Peak Offs	610	1,280	810	1,490	850	1,570
AM Peak Total	5,310	6,360	6,370	7,550	6,690	7,910
Total Daily Ons/Offs	19,380	21,000	23,270	25,240	24,410	26,430
2. Daily DPX Passengers						
Trips to/from DPX	18,220	18,900	21,830	22,640	22,980	23,830
Intra-DPX	580	1,050	720	1,300	720	1,300
Total	18,800	19,950	22,550	23,940	23,700	25,130

VI. DPX OPERATIONS

This chapter describes and compares operational characteristics of the alternatives for the Dublin/Pleasanton Extension. The first section presents travel times and service levels for trips on the DPX. Capacity requirements are analyzed based on the patronage projections from Chapter V. These in turn determine the fleet requirements for each DPX alternative.

TRAVEL TIMES

Table VI-1 compares estimated station-to-station travel times between the proposed West Dublin/Pleasanton DPX station and the Montgomery Street BART station in downtown San Francisco. Four alternatives are included: a conventional LRV line, a high speed conventional LRV line, a high performance LRV line and a BART line.

The in-vehicle travel time is the largest component of total travel time on the DPX, and consists of:

- Acceleration
- Cruise between stations
- Braking
- Dwell time at stations

Travel times for conventional (San Diego type) LRV's are based on an initial acceleration rate of 3.0 to 3.5 miles per hour per second (mphps). These rates would be reduced to 2.0 to 2.5 mphps for the higher performance cars, with an average acceleration of 1.0 mphps to balancing speed for full seated passenger loads. Conventional LRV times are based on a balancing speed up the Dublin Canyon grade of 30 to 35 mph. High speed conventional LRV travel times are predicated on a balancing speed of 45 mph, while high performance LRV times assume a balancing speed of 75 mph. Acceleration and braking rates for the BART alternative are based on known performance characteristics of BART vehicles. Maximum cruise speeds were assumed to range from 70 miles per hour on level track to 55 miles per hour on the maximum (3 percent) uphill grade.

In all cases station dwells of 30 seconds are assumed. All travel times are approximate; a full computerized performance evaluation is beyond the scope of this study.

Table VI-1
TRAVEL TIMES FROM WEST DUBLIN/PLEASANTON STATION TO MONTGOMERY STATION

	AM Peak Period Travel Time (Minutes)			
	Conventional	High Speed Conventional	High Performance	BART
Initial Wait	4.5	4.5	4.5	4.5
In-Vehicle				
West Dub/Plst to Castro V.	16.3	12.9	9.2	9.2
Castro V. to Bay Fair	7.5	5.9	4.3	4.3
Subtotal	23.8	18.8	13.5	13.5
Transfer at Bay Fair	5.0	5.0	5.0	--
In-Vehicle				
Bay Fair to Montgomery	30.0	30.0	30.0	30.0
TOTAL STATION-TO-STATION	63.3	58.3	53.0	48.0

NOTE: All times include 30 second dwell time at each station. Station access/egress times not included.

For the light rail alternatives, a 5 minute average transfer time is included, or roughly half the headway on each BART line. BART has commented that passengers with physical problems would not make this. BART also has noted that a BART train from San Francisco would potentially deposit 400 DPX-bound passengers. This would require some people to wait 3 minutes more for a second train since this exceeds the capacity of a 4-car LRT train.

The analysis shows a variation of up to 15 minutes among station-to-station travel times for the four alternatives. For the DPX portion of the trip, the average speeds vary from approximately 29 miles per hour (conventional LRV's) to as much as 51 miles per hour (BART or high performance LRV's). The difference between through service times and transfer service (shuttle) times assumes a projected peak-period headway of 9.0 minutes on the Fremont- Daly City line, resulting in an average transfer time of about 5 minutes at Bay Fair Station. This would be increased slightly should the west side alignment rather than a shared alignment be utilized for the Bay Fair station approach.

As noted in Chapter III, the conventional LRV's of the type used in San Diego appear unsuitable for use on the DPX as their travel times would not be competitive with those of the express buses currently operating in the Dublin Canyon corridor. Accordingly, the conventional LRV alternative was dropped from consideration.

SERVICE LEVELS

Trains on the Fremont-Daly City and Fremont-Richmond lines currently operate every 15 minutes during the day. The Fremont-Richmond line operates every 20 minutes during evenings and weekends; the Fremont-Daly City line does not operate during these off-peak periods. Eventual completion of all system improvements currently programmed by BART, including the Daly City turnback, could allow 2.25 minute spacings on Transbay lines, corresponding to 9 minute peak-hour headways on the Fremont-Daly City line. For this analysis, 9 minute headways are assumed for year 2005 peak-period operation on each of the Fremont lines. Actual headways operated would depend on patronage needs at any given time. BART currently operates 15 minute midday service on weekdays and this should continue.

Light Rail Alternatives

For the light rail alternatives, DPX train headways should be compatible with those of the BART Fremont line so as to provide optimal transfers. Operation of 9 minute headways on the DPX would permit timed transfers with all Fremont-Daly City trains during peak periods. Operation of 4.5 minute service would permit DPX trains to also meet BART Fremont-Richmond trains.

Transfer arrangements at Bay Fair Station between the DPX shuttle and BART trains would depend upon the fare collection system selected and the alignment chosen for the Bay Fair Station approach.

BART Alternative

The BART alternative could either operate as a shuttle between Dublin/Pleasanton and Bay Fair Station or as a through service, for example between Dublin/Pleasanton and Daly City. As a shuttle service, service levels and ridership would be similar to those of the High Performance LRT alternative utilizing a shared alignment with BART at the Bay Fair Station approach.

Two through-service options are possible for the BART alternative. One would add Dublin/Pleasanton-to-Daly City or Dublin/Pleasanton-to-Richmond service to the existing lines. Frequencies on the DPX would be constrained by the minimum headways and required service on other lines.

The other option for providing through service would reroute some Daly City-Fremont or Richmond-Fremont trains to Dublin/Pleasanton instead of Fremont. Headways would remain the same as on the Fremont routing (assumed to be 9 minutes during peak periods). Dublin/Pleasanton-to-Daly City through service would require some passengers from the Fremont line to transfer at Bay Fair station. Similarly, Dublin/Pleasanton-to-Richmond through service would require some Fremont line passengers to transfer at Bay Fair station.

Off-Peak Service

DPX patronage during non-peak hours would be much lower than peak-hour ridership (about one-third). Accordingly, 15 minute midday and 20 minute evening and weekend service are assumed for all alternatives.

For the BART alternative, the DPX could be operated as a shuttle even if peak period service were operated as through-service to Daly City. If operated as a through-service during off-peak hours, the actual headway would be determined by policy and operating requirements on other BART segments.

PASSENGER CAPACITY

Seating capacity requirements are normally determined by the peak passenger load at the maximum load point. It would be desirable to provide a seat for all passengers over the long Dublin Canyon section. Projected passenger volumes are about 20 percent higher in the section between Castro Valley and Bay Fair; however, it should be acceptable for 20 percent of the passengers to stand for this four to five minute trip. Accordingly, the analysis of capacity requirements is based on providing seats for all peak hour passengers through the Dublin Canyon. This is an exceptionally low ratio for an urban transit line, but appropriate for its commuter type operation. (Although this assumption is used for analysis here, it should be noted that BART's policy is that all passengers should be provided a seat where possible.)

Table VI-2 compares required peak hour seating capacities and train lengths to accommodate the projected ridership volumes on each alternative.

Table VI-2
PASSENGER CAPACITY REQUIREMENTS, 2005

	High Speed Conventional	High Performance	BART
Peak Hour Volume*	2,300	2,600	2,700
Number of Seats per Car	60	60	72
Number of Cars per Hour	38	44	38
Number of Cars per Train			
At 9 minute headways	6	7	6
At 4.5 minute headways	3	4	3

* 60 percent of AM peak two-hour volume, peak direction between Pleasanton/Dublin and Castro Valley stations.

Passenger capacity requirements are for 38-44 cars per hour through the Dublin Canyon. For the LRT options, this would require operating 3- or 4-car trains at 4.5 minute headways to avoid excessively long trains and longer platforms at stations. This assumes use of 80- to 90-foot articulated LRV's with high density seating. Because of the space taken by vestibules for the many doors on LRV's and by the train operator's cab, they cannot provide the same seating per unit length as heavy rapid transit. Seating can, however, be increased by specifying single ended cars or jump seats in the vestibules and articulation (if any).

BART "A" and "B" cars have 72 seats per car, while the new "C" cars are estimated to have about 68 seats per car. Based on the 72 seat capacity, 38 BART cars would be required during the peak hour in the peak direction. Therefore, 6-car trains operating at 9 minute headways would meet passenger capacity requirements. Four- or five-car trains every 15 minutes could probably accommodate the weekday non-peak ridership, based on current non-peak station activity on the Concord line.

FLEET REQUIREMENTS

The required fleet size is determined by round-trip travel time (including turnaround and layover at the terminal stations), service frequency and train length requirements during the peak hour. Required fleet sizes for each of the alternatives are summarized in Table VI-3. These fleet requirements include an allowance for at least 15 percent spares, which is reasonable for planning purposes. Actual requirements for spare vehicles will depend on the regular cycle for preventative maintenance and for unscheduled repairs and modifications.

For the high speed conventional LRT alternative, eleven 3-car trains would be needed for peak period service. Two 3-car trains would be added for spares, for a total of 39 cars. The high performance LRV alternative would require nine 4-car trains plus two spare trains for a total of 44 cars. The BART alternative, operating as a shuttle, would require 36 new cars, including spares, for DPX service.

For all DPX shuttle alternatives, additional BART cars would be needed on existing BART lines in order to accommodate DPX passengers transferring to BART to travel beyond the Bay Fair station. Preliminary estimates from BART indicate that 61-72 additional BART cars would be needed; differences are due to the varying numbers of passengers projected to transfer under each alternative.

Table VI-3
YEAR 2005 FLEET REQUIREMENTS
Bay Fair to West Dublin/Pleasanton Station

	High Speed Conventional	High Performance	BART Shuttle	BART Thru-Ser.*
Assumed Headways (mins.)	4.5	4.5	9.0	9.0
Number of Trains	11	9	5	16
Train Length (Cars)	3	4	6	5+
Number of cars in service, DPX	33	36	30	28
Number of spare cars	6	8	6	5
Total Number of cars - DPX	**39**	**44**	**36**	**33**
Additional BART cars needed**	61	68	72	64
Total Cars - DPX and BART	**100**	**112**	**108**	**97**

* Preliminary estimate by BART for Dublin/Pleasanton-Daly City service, adjusted for service headways and patronage projections for DPX. Number of cars apportioned to DPX is based on ratio of DPX mileage to total Dublin/Pleasanton-to-Daly City mileage.

** Number of cars needed to accommodate passengers transferring to BART at Bay Fair Station; derived from BART estimates.

With the BART alternative operating through-service between Daly City and Pleasanton/Dublin, a total of 97 cars, including spares, are preliminarily estimated by BART. This includes fleet requirements on both the DPX and on the remainder of the BART line to Daly City. Based on the ratio of DPX mileage to total mileage operated to Daly City, about 33 cars (33 percent of the fleet), are attributable to the DPX portion of the trip. Overall fleet requirements for this alternative are less than for the shuttle BART alternative due to reduced turnaround/layover time with through service.

The current Five-Year Plan for BART estimates that BART will have 26 cars available at the end of the five year period, assuming an extension of current system patronage levels. According to BART, all of these cars could be used in service for the DPX. Additional cars would have to purchased, however, in order to provide 9 minute service on the DPX by year 2005 as well as to service other growth needs.

VII. COST/REVENUE ANALYSIS

Preliminary estimates of capital and operating costs and revenues of the light rail and BART alternatives for the Dublin/Pleasanton Extension are compared in this chapter. These are planning level cost estimates that are intended only for comparing the alternatives. Cost estimates for the selected alternative will be refined during preliminary engineering.

CAPITAL COSTS - FIXED FACILITIES

Planning level capital cost estimates were developed by applying unit costs for each type of construction or facility to the quantity involved. Contingency allowances were added to allow for contractor and agency costs. (Agency costs include engineering and construction management.) Right-of-way allowances include land acquistion and building relocation. All costs are expressed in 1987 dollars.

Unit Costs of Construction

Unit costs for BART were taken from 1985 unit costs used in the 1986 Supplemental Analysis Study, increased by 5 percent to reflect general construction cost increases between 1985 and 1987 and revised in some cases to reflect more recently available unit costs from other studies. Unit costs for the LRT alternatives were developed based on a variety of sources, including cost estimates for the Guadalupe Corridor light rail transit system under construction in Santa Clara County. Where LRT costs would not differ from BART costs (e.g., trackage), the BART costs were used for consistency with the BART alternative. Specific unit costs were developed for the following items:

- Trackwork
- Structures and civil work (including earth work, BART or LRT structures, other structures, highway modifications, retaining walls, and street and railroad relocation).
- Utilities relocation
- Track electrification (Third rail for BART; catenary for LRT)
- Train Control (ATO for BART or BART-compatible; ATS/ATP for LRT)
- Communications

- Stations (including platform, fare collection equipment, and parking)

- Maintenance yard (LRT only; BART maintenance assumed at Hayward yard; storage tracks provided at end of line)

- Other items such as fencing, landscaping and detours

- Design contingencies

Right-of-Way

Right-of-way allowances arbitrarily assume land values of about $10 per square foot. No cost was assigned to land within I-238 or I-580 freeway rights-of-way. It is recognized, however, that this would be subject to negotiation with Caltrans since a market value is difficult to place on such land. Where freeway right-of-way was known to be unavailable or restricted because of future freeway widening plans, an allowance was made for purchase of adjacent land for replacement of right-of-way that might be utilized for the rail line. An allowance was also made for purchase of UPRR right-of-way at the Bay Fair Station approach for the Westside alternative and for possible purchase of homes near the I-238 segment. Right-of-way requirements are greatest for the LRT alternatives due to the need for a full-service maintenance/storage yard and, in the case of the alternatives using a west side approach to Bay Fair station, impacts on the UPRR right-of-way.

Total Construction Costs by Alternative

Table VII-1 summarizes the estimated fixed facility costs for each study alternative. Four alternatives are compared in the table. These include two light rail alternatives utilizing a west side alignment approaching Bay Fair Station (one with a separate, barrier-free fare system on the extension and the other using the BART fare system on the extension) and one using a shared alignment with BART at the approach. Capital costs of fixed facilities would be the same for the High Speed Conventional and the High Performance light rail vehicle alternatives, so these are not shown separately. The fourth alternative shown is the minimum cost BART alternative as defined in the 1986 Supplemental Analysis for the LPX, with costs modified to conform to the modified alignment along I-238 and the truncation of the line at west Dublin/Pleasanton.

The lowest cost alternatives are the light rail alternatives utilizing the west side approach to the Bay Fair BART station. These alternatives are estimated to cost $25 Million or 14 percent less to construct than the BART alternative. The other light rail alternative would cost $7 Million less to construct than BART. Most of the cost savings shown for light rail over BART are associated with electrification costs. These costs are quite variable and, in our judgment, probably overstate the differences between light rail and BART electrification.

Table VII-1
ESTIMATED CAPITAL COSTS - BAY FAIR TO WEST DUBLIN/PLEASANTON
Fixed Facilities Only

	1987 COSTS ($ MILLIONS)*			
	Light Rail Transit**			BART
	Westside Alignment		Shared	Minimum
Cost Item	Sep. Fares	BART Fares	Alignment	Cost***
1. Trackwork	$19.6	$19.6	$19.0	$18.8
2. Structures & Civil	21.5	21.5	32.2	32.2
3. Utility Relocation	0.4	0.4	0.4	0.4
4. Electrification	17.1	17.1	18.1	31.1
5. Train Control	4.3	4.3	6.7	14.3
6. Communications	3.3	3.3	3.2	3.2
7. Stations	15.5	15.7	16.3	18.9
8. Maintenance Yard	16.0	16.0	16.0	1.6
9. Additional Items	2.9	2.9	3.4	3.6
10. 15% Contingency	15.1	15.1	17.3	18.6
CONSTRUCTION COST	$115.7	$116.0	$132.4	142.7
15% AGENCY COST	17.4	17.4	19.9	21.4
RIGHT-OF-WAY	23.2	23.2	21.7	17.3
TOTAL FIXED FACILITY COST	$156.3	$156.6	$174.0	$181.4

* Planning level cost estimates only. Include design contingency of 15 percent of base construction cost plus 15 percent agency contingency fee on total construction cost (base plus design contingency). Does not include rolling stock.

** Light rail alternatives are: (1) westside approach to Bay Fair with barrier-free fare system separate from BART, (2) westside approach with BART fare system on DPX and (3) shared alignment on Bay Fair station approach with BART fare system on DPX.

*** BART alternative utilizes single platform transfer at Bay Fair as described in 1986 Supplemental Analysis Report; follows modified alignment along I-238 as described for light rail alternatives; utilizes median at-grade design option.

The choice of fare system does not appear to affect overall costs significantly. This is because savings in fare collection equipment at the DPX stations for the barrier-free or separate fare system are offset by increased equipment needs at the Bay Fair station over the BART fare system option. The station costs are about $3 Million lower for the light rail alternatives than for BART due to the shorter platforms at the two new stations; the major station cost elements of auto parking and fare collection equipment are comparable between the light rail and BART alternatives, however. Train control would also be less expensive for light rail alternatives. On the other hand, the light rail alternatives would require a full service maintenance/storage yard whereas the BART alternative would, at most, require a minimal yard for light maintenance with most maintenance being done at an existing yard. This would also contribute to higher right-of-way costs for the light rail options in comparison to BART. For the westside LRT alignment alternatives, the right-of-way costs would also be increased due to use of the UPRR right-of-way.

CAPITAL COSTS - ROLLING STOCK

Rolling stock costs are based on the analysis of fleet requirements in Chapter VI. These costs are compared in Table VII-2. Three LRT alternatives are shown: the High Speed Conventional LRV system, and the High Performance LRV system with either a westside approach to the Bay Fair station or a shared alignment with BART. Additionally, two BART alternatives are shown: one operating as a shuttle service between Dublin/Pleasanton and Bay Fair and one that operates thru-service from Dublin/Pleasanton to Daly City.

Table VII-2
1987 CAPITAL COSTS FOR ROLLING STOCK*
Bay Fair to West Dublin/Pleasanton Station

	HSC Westside	HP Westside	HP Shared	BART Shuttle	BART Thru Service
No. of Cars	39	44	44	36	33
Unit Cost ($Millions)	$1.29	$1.85	$2.05	$1.52	$1.52
Total Cost ($Millions)	$50.3	$81.4	$90.2	$54.7	$50.2

* For DPX service only. Does not include potential costs of additional BART cars to serve DPX passengers continuing past Bay Fair BART station.

Unit vehicle costs are lowest for the High Speed Conventional LRV's since these would be essentially off-the-shelf vehicles with minimum train communications and control. The High Performance LRV's for use with the westside approach alternative include provision for ATS/ATP train control. Unit costs are highest for the High Performance LRV's for use with shared alignment with BART. These are assumed to include ATO as well as ATS/ATP control and to use broad gauge for compatibility with BART, in addition to the higher powered propulsion equipment. All LRV's are assumed to be articulated vehicles. BART vehicle costs are lower than the High Performance LRV's, but slightly higher than those of the High Speed Conventional LRV's. Total estimated fleet costs are highest for the fully equipped High Performance LRV's associated with the shared alignment alternative.

This comparison does not take into account the potential availability of up to 26 BART cars from BART's fleet now on order, with a value of $39 Million. Also, for all alternatives, additional BART cars would be needed to accommodate DPX passengers transferring to the BART Fremont line at Bay Fair station.

ANNUAL OPERATING COSTS

Annual operating costs for the DPX are comprised of labor, power, maintenance and overhead, and are based on assumed year 2005 operating levels. The total annual costs for each alternative are shown in Table VII-3. The estimated increases in operating costs on the remaining BART system attributable to the DPX are also shown.

All cost estimates are in 1987 dollars. The costs are valid for comparison among alternatives. However, LAVTA staff have expressed concerns that operating costs should be in 1995 dollars, the year service is expected to begin. Assuming 4 percent annual inflation to 1995, all costs would be inflated by 37 percent beyond those shown.

Labor costs for the DPX operation include all wages, benefits and other costs associated with employees working on the DPX itself. For comparison purposes, labor costs for all alternatives are based on BART's labor rules and unit costs. Accordingly, three shifts per day are assumed for train operators and station agents. No significant cost savings are projected in station agent costs for a barrier-free fare system on the DPX since any savings at the DPX stations would be offset by roving inspectors on the trains and by additional station agents needed at Bay Fair. Maintenance costs are based on unit costs per car mile, and were assumed to be the same for all vehicle types. Specific costs of deadheading vehicles to the storage/maintenance yards are not included in the estimates since no detailed operating plan has been developed by BART nor have specific sites been located for the LRT yard.

Table VII-3
ANNUAL OPERATING COSTS (1987 Dollars)
Two-Station Dublin/Pleasanton Extension

Item	Annual Cost (Millions) High Speed Conventional	High Performance	BART
Power	$1.51	$1.51	$1.77
Maintenance	1.64	1.64	1.92
Operators	1.55	1.26	1.01
Agents	0.50	0.50	0.50
Supervisors	0.58	0.46	0.40
Subtotal	$5.78	$5.37	$5.61
15% Overhead	0.87	0.81	0.84
TOTAL - DPX Only	$6.65	$6.18	$6.45
Increased BART operating cost on remaining system*	$5.01	$6.00	$6.31
Total system-wide increase in operating cost	$11.66	$12.18	$12.76

* These figures were provided by BART staff in December 1983 and were adjusted to reflect greater service frequency than previously assumed and 1982-87 cost inflation.

Comparable factors were used by BART staff to estimate incremental operating costs on other parts of the system attributable to the DPX. These represent costs of providing additional peak- and off-peak equipment to accommodate DPX riders continuing beyond the Bay Fair Station. Existing BART riders from Dublin/Pleasanton were excluded from the calculations since they would not add to the volumes carried on the Fremont line.

Operating costs differ by less than 10 percent among the three alternatives considered. For the DPX alone, operating costs are highest for the High Speed Conventional alternative. This is due to increased operations resulting from the slower speed of operation in the corridor. Considering total operating costs for the DPX plus impacts on existing BART lines, the BART alternative is highest in cost. This is because of slightly higher passenger loadings projected for the BART alternative. It is also likely that operating costs associated with deadheading would be higher for the BART alternative with use of the Hayward yard for most maintenance and storage of vehicles.

ANNUAL FARE REVENUES

Projected fare revenues are based on ridership and estimates of average fare per trip. The total revenue from DPX trips is divided between revenue which is directly attributable to the DPX and that which would be captured by BART regardless of the DPX.

The 1986 BART fare structure was assumed for all alternatives so as to provide a consistent basis of comparison. BART fares include a base fare plus a charge per mile, plus charges for Transbay service. Average fares were estimated for each major destination area: Intra-Valley, Daly City, San Francisco, Oakland, Berkeley, Richmond, Fremont, Hayward and Castro Valley. Revenues were calculated by multiplying the average fare by the corresponding weekday patronage, then factoring by 88 percent to account for discounted fares (youth, elderly). The weekday revenue estimate was multiplied by 297.4 to obtain the total annual revenue from DPX passengers (Table VII-4).

These figures represent system-wide fare revenues from all riders entering and exiting stations on the DPX. The revenues attributable to service on only the DPX portions of these trips (based on average fares for the DPX trip segments) are approximately 30 percent of total revenues generated by DPX passengers. The remaining revenues correspond to service on the rest of the BART system.

Some of the total system-wide revenues shown would be collected by BART in the absence of the DPX. They come from passengers who would use Express Buses or private automobiles to access the existing BART lines. These revenues are estimated at $1.26 Million.

The farebox recovery ratio indicates the amount of the DPX operating costs which would be covered by passenger fares. It is calculated by dividing the total system-wide revenue increase generated by the DPX by the system-wide increase in operating costs due to the DPX. Projected farebox recovery ratios for year 2005 are included in Table VII-4. Judging from BART's current and projected system-wide farebox recovery ratios, the DPX values may be overstated, although to some extent this may also reflect the inherent operating efficiency of a relatively high speed line with few stations. However, the projected farebox recovery ratios are considered valid for comparison among the alternatives. The ratios are similar for the High Performance LRV system and the BART alternative. Both alternatives have significantly higher ratios than the High Speed Conventional LRT alternative; this is due to the combination of lower revenues and higher operating costs for the latter alternative.

Table VII-4
PROJECTED LPX ANNUAL REVENUES[1]

	Annual Revenues ($ Millions)		
	High Speed Conventional	High Performance	BART
Total Annual Revenue - All DPX riders	$7.14	$8.56	$9.01
Revenue from Trips made regardless of DPX	-1.26	-1.26	-1.26
Net additional revenue generated by DPX	$5.88	$7.30	$7.74
Additional BART operating cost due to DPX	11.66	12.18	12.76
Farebox Recovery Ratio[2]	50 %	60 %	61 %

1 Assumes shuttle service on DPX.
2 Ratio of system-wide increase in fare revenues to system-wide increase in operating costs due to DPX, as a percentage.

VIII. CONCLUSIONS AND RECOMMENDATIONS

This chapter summarizes the evaluation of DPX alternatives based on information in previous chapters, and documents the Consultant's recommendations. These conclusions and recommendations are intended as input to the BART and LAVTA Boards who will ultimately select the appropriate alternative for implementation.

Once a decision has been made on the alternative to be implemented, the responsible agencies can commence with preliminary and final engineering, environmental studies, right-of-way acquisition and finally construction. The scheduling of these necessary steps is outlined in this chapter. Also discussed is the issue of further extension to East Pleasanton/Dublin.

PREFERRED LRT ALTERNATIVE

Since a preferred alignment and conceptual design has already been developed for the BART alternative, the first step in this study was to define a preferred light rail alternative for comparison. What resulted from the first phase of work was a decision to carry forward several variations of a light rail alternative for comparison to BART. This is reflected in the preceding chapters on ridership, operations and costs/revenues. These variations included the following:

- Two light rail vehicle options: High speed conventional and high performance
- Two alignment options for approach to Bay Fair Station: West side and shared alignment with BART
- Two fare system options: Barrier-free fare system at DPX stations and BART fare system at all stations

Comparison of Vehicle Options

Below is a summary of the key differences between high speed conventional and high performance LRV's for use on the extension.

	HSC	HP
Travel time, West Dublin/Pleasanton to Bay Fair (mins.)	18.8	13.5
Daily Riders, Total DPX	18,800	22,550
Fleet size, including spares	39	44
Capital Cost of Fleet ($Millions)	$50.3	$81.4-90.2
Annual Operating Cost, DPX only	$6.7 M	$6.2 M

The high speed conventional LRV's would be less expensive to purchase than high performance LRV's, and perhaps easier to procure. The main drawback to the high speed conventional LRV's is a projected 16 percent loss in ridership as a result of the slower travel time through the Dublin Canyon. The trade-off between ridership and fleet cost is the main issue in terms of selecting a vehicle type for the light rail alternative. For this reason, both alternatives were retained for comparison to the BART alternative later in this chapter.

Comparison of Alignments

The choice of alignment at the Bay Fair station approach primarily affects right-of-way requirements and capital costs of the system. The shared alignment option would preclude use of a separate fare system for the DPX. Right-of-way requirements would be greater with the west side option, due to the use of UPRR right-of-way for part of the alignment. However, capital costs are projected to be about $16 Million less for the west side alignment than for the shared alignment, even with an allowance for increased right-of-way cost. This is due to reduced structural costs as well as less elaborate train control for the west side alignment. Accordingly, use of the west side alignment is recommended for the light rail alternative.

Comparison of Fare Systems

The choice of fare systems impacts capital costs, station operating costs and convenience to riders. Capital and operating costs are not projected to be significantly different between the separate LRT fare system and the BART fare system. Reduced equipment needs at the two DPX stations for the separate system would be offset by increased equipment needs at the Bay Fair station where DPX passengers would have to enter the BART fare-paid area. Capital costs of fare collection equipment differ by only about $300,000 including all contingencies, favoring the separate fare system.

Station costs of the separate system would be lower, but this would be offset by roving inspectors on the trains and additional station agents at Bay Fair Station. Passenger convenience would be better with the BART fare system being extended to both DPX stations. Considering all these factors, use of the BART fare system is recommended for the DPX.

Conclusion

Consistent with the foregoing discussion, two light rail alternatives are compared below with the BART alternative: one using high speed conventional vehicles (minimum cost) and the other using high performance vehicles (maximum ridership). Both alternatives should use the west side alignment at the Bay Fair Station approach. For passenger convenience, either LRT alternative should incorporate the BART fare system. However, for comparative purposes, the high speed conventional LRT alternative assumes separate barrier-free fare collection in the ensuing discussion.

COMPARISON OF LIGHT RAIL AND BART ALTERNATIVES

Evaluation of the three alternatives has considered a variety of factors including right-of-way impacts, patron access, ridership potential, capital costs, operating costs and revenues, and implementation issues. Below is a comparison of these criteria based on the analyses presented in the previous chapters. Table VIII-1 summarizes and compares key factors that differ among the two light rail alternatives and the BART alternative. Since the alignments and station locations are similar for all alternatives, the differences are essentially in performance characteristics and in costs and revenues.

Right-of Way/Displacement Impacts

Differences in right-of-way needs are relatively minor among the alternatives. All alternatives involve some use of UPRR right-of-way alongside the Bay Fair BART station; however the west side alignment for both light rail alternatives would involve more extensive use of this alignment. Also, the two light rail alternatives would require land acquisition for a full service maintenance/storage yard.

Table VIII-1
SUMMARY COMPARISON OF DPX ALTERNATIVES

		High Speed Conventional*	High Performance	BART**
1.	Travel Times (Station-to-Station)			
	a. West Dub/Plstn to Bay Fair (mins.)	19	14	14
	b. West Dub/Plstn to Montgomery (mins.)	58	53	48
	Increase over BART time (mins.)	**5-10**	**0-5**	**—**
2.	Ridership Potential			
	a. Total Daily Riders, year 2005	18,800	22,550	23,700
	Percent of BART Volume	**79%**	**95%**	**—**
3.	Fleet Size			
	a. Extension Portion Only	39	44	33
	b. Total Cars***	100	112	97
4.	Capital Costs ($1987 Millions)			
	a. Construction & Contingencies	$133.1	$133.1	$164.1
	b. Right-of-Way Allowance	23.2	23.2	17.3
	c. Total Fixed Facility	$156.3	$156.3	$181.4
	Savings over BART	$ 25.1	$ 25.1	—
	d. Rolling Stock (Extension Only)	$50.3	$81.4	$50.2
	Savings over BART	-$0.1	-$31.2	—
	e. Total Capital Cost	$206.6	$237.7	$231.6
	Total Savings over BART	**$25.0**	**-$6.1**	**—**
5.	Annual Costs and Revenues ($1987 Millions)			
	a. Additional Costs	$11.7	$12.2	$12.8
	b. Less Additional Revenues	-5.9	-7.3	-7.7
	c. Net Additional Costs	$5.8	$4.9	$5.1
	Farebox Recovery Ratio	**50%**	**60%**	**61%**

* Assumes stand-alone system with barrier-free fare system; use of BART fare system would add $0.3 Million to capital cost but would improve passenger convenience and safety.

** Assumes through-service operated to Daly City. Shuttle service times would be identical to those of high performance LRT alternative..

*** Includes additional BART cars for service increase on Fremont lines to accommodate DPX passengers travelling beyond Bay Fair.

Patron Access

Since station locations are common to all alternatives, there are no differences among them in terms of how easily patrons can reach the stations. In general, both station sites have been located and configured so as to provide adequate access, circulation and parking for pedestrians, bikes, automobiles and buses. As discussed later, however, the west Dublin/Pleasanton station may not be appropriate as an interim terminal station due to traffic access and parking constraints.

Ridership Potential

The BART alternative has the greatest ridership potential among the three alternatives, although ridership potential for the high performance LRT alternative is almost as high. A 20 percent ridership loss is projected for the high speed conventional LRT alternative due to slower running speeds as well as the need for a transfer at Bay Fair. It should be noted, however, that LRT ridership levels would be higher should frequency of service be increased over the 9 minute service assumed.

Fleet Requirements

Fleet requirements are greatest for the high performance LRT alternative and lowest for the BART alternative. In all cases, additional BART cars would be needed on the Fremont line to accommodate DPX passengers travelling beyond Bay Fair.

Capital Costs

Capital costs vary significantly between the light rail and BART alternatives. Fixed facility costs for BART are estimated to be $25 Million higher than either of the light rail alternatives. Rolling stock would be most expensive for the high performance LRT alternative. Considering both fixed facilities and rolling stock for the DPX only, the high speed conventional LRT alternative would save about $25 Million over BART while the high performance LRT alternative would cost $6 Million more than BART.

All capital costs are expressed in current (1987) dollars. Assuming that the midpoint of construction is 1992 (consistent with the tentative schedule outlined later in this chapter), that vehicle procurement takes place at that time, and that inflation averages 4 percent annually between now and 1992, the inflated capital costs (in 1992 dollars) would be as follows:

	HSC	HP	BART
Fixed Facilities	$190.2 M	$190.2 M	$220.7 M
Rolling Stock	61.2 M	99.0 M	61.1 M
Total Capital Cost	$251.4 M	$289.2 M	$281.8 M

The capital cost estimates do not consider the number of BART vehicles needed to increase capacity on the Fremont line to accommodate DPX passengers travelling beyond Bay Fair. Nor is the availability of 26 BART cars for the extension included since these cars could alternatively be used to meet other BART service expansion needs.

Annual Costs and Revenues

Differences among alternatives in net annual operating costs are less than 15 percent, with the high speed conventional LRT being highest and the high performance LRT being lowest. Projected farebox recovery ratios are highest for the high performance LRT and BART alternatives. In all cases the farebox recovery ratios are likely to be somewhat overstated as they are substantially higher than BART's current system-wide performance. To some extent this may reflect the inherent operating efficiency of the corridor.

Other Considerations

Other factors to be considered in the evaluation include implementation requirements, flexibility to adapt to future conditions and passenger convenience. These factors generally favor the BART alternative. As a system that is already operating at one end of the corridor, and with vehicles and maintenance facilities already in use, there would be fewer inherent implementation risks with BART. Also, the BART alternative is more adaptable to longer range plans for extending the line to east Livermore, when vehicle speeds and passenger capacities would be more important. Finally, the BART alternative would offer the convenience of one integrated system to passengers, particularly in comparison to a separate barrier-free fare system on the DPX.

Conclusions

Any of the three alternatives considered appear feasible for implementation in the corridor, and the differences among them are not great. Based on the various factors discussed earlier, the BART alternative is recommended over both of the light rail alternatives.

The differences between the high performance LRT alternative and the BART alternative are relatively small in terms of level of performance and costs. On the other hand, the BART alternative is operationally more flexible, potentially permitting through service to other parts of the system. BART also poses less uncertainty in implementation since some of the needed vehicles are already potentially available for service and minimal new maintenance or other facilities are needed for start-up.

Between BART and the high speed conventional light rail alternative, a more difficult trade-off is involved. The high speed conventional LRT alternative would save $25 Million, or 11 percent, in capital costs over BART. In our judgment, this is outweighed by the better travel times and resulting higher ridership potential of BART, the availability of BART cars to reduce start-up costs and risks, and the reduced annual operating costs of BART in the corridor.

EXTENSION TO EAST DUBLIN/PLEASANTON

Previously established BART policy as well as requirements of the Alameda County Measure B call for the rail extension to extend east from Bay Fair BART station to the proposed West Dublin/Pleasanton station. This initial phase would include two new stations and an interim storage yard in the Dublin-Pleasanton area. A second stage would ultimately extend BART to East Livermore and include an additional station in East Dublin/Pleasanton, two stations in Livermore, a permanent yard and a possible additional station near the research labs.

Based on analysis in this study as well as in the previous BART LPX studies in 1983 and 1986, a third station is potentially needed before 2005 and should be considered for construction in the initial stage. This is needed to avoid potential West Dublin/Pleasanton station overloading and eventually constraints on ridership growth on the line.

As noted in Chapter V, the 2005 ridership levels projected for the DPX line assume adequate parking and access capacity can be provided at the West Dublin/Pleasanton station to accommodate up to 3,400 parked cars. This does not appear possible given the amount of land currently planned for the station and the lack of good freeway access to the site. Hence, the ridership that could be effectively accommodated on the DPX would be substantially less than projected. While this would not be a problem initially, over time it would become one. Addition of a second station in East Dublin/Pleasanton would alleviate this problem by diverting two-thirds of the riders to that station. The additional station would not only alleviate the station capacity problem at West Dublin/Pleasanton, but would also potentially increase overall ridership by 5 percent. Furthermore, it would be easier to construct an interim storage/maintenance yard beyond the Pleasanton station than beyond the Dublin station.

For the BART alternative (assuming the minimum cost design option involving at-grade/median construction), the additional construction cost to extend the line from east of the West Dublin/Pleasanton station to east of the East Dublin/Pleasanton station would be $36.6 Million, in 1987 dollars. For the light rail alternatives, the incremental cost is estimated to be $29 Million. These costs include estimated station costs for the East Dublin/Pleasanton station and parking for 2,600 vehicles, but no major reconstruction of the I-580 freeway or its interchange at I-680.

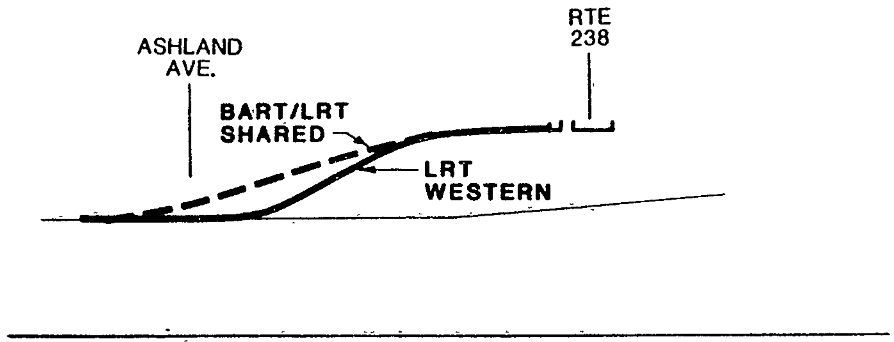
IMPLEMENTATION SCHEDULE FOR THE EXTENSION

A tentative implementation schedule for the Dublin/Pleasanton Extension, based on input from BART staff, is as follows:

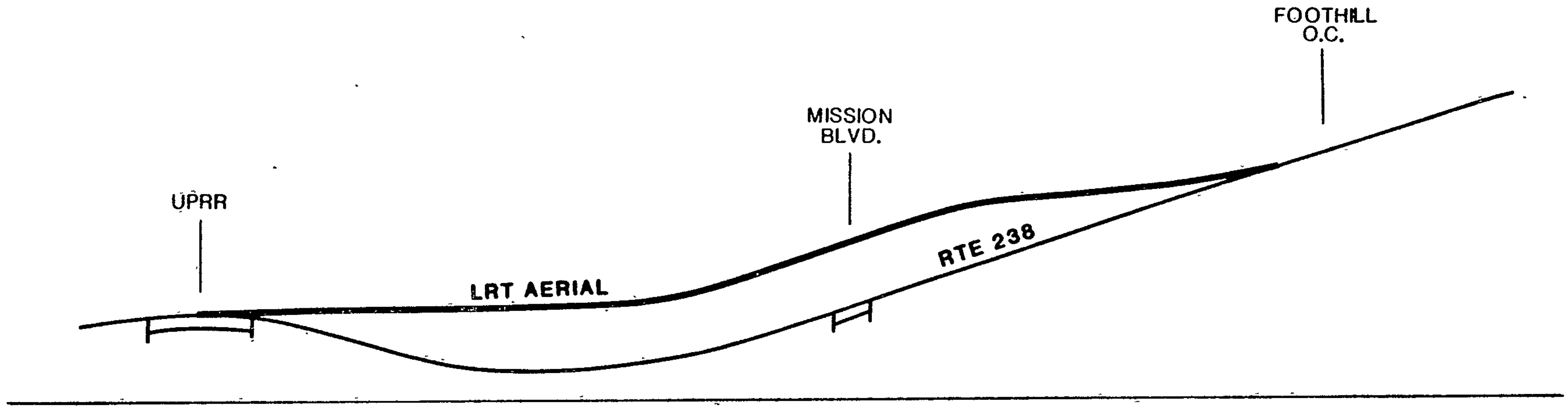
Adoption of Conceptual Alternative:	October, 1987
Preliminary engineering and environmental assessment:	January, 1988 - August, 1989
Environmental Clearance:	August, 1989
ROW & Final Design, including plans, specifications and costs:	September, 1989 - March, 1991
Procurement and Construction:	September, 1990 - January, 1995
Testing and Start-up:	January, 1995 - June, 1995
Commence Service:	June, 1995

Major steps in the implementation process include preliminary engineering and environmental assessment (18 months), final design and specifications (18 months) and procurement and construction (4+ years). This schedule is not dependent upon which alternative is selected for the DPX.

APPENDIX



Bay Fair Station Approach



Route 238 Segment Profile

NOT TO SCALE

Figure A-1
LRT PROFILES

bart

SAN FRANCISCO BAY AREA RAPID TRANSIT

WEST CONTRA COSTA EXTENSION STUDY

FINAL REPORT

PREPARED FOR
THE BAY AREA RAPID TRANSIT DISTRICT
JUNE, 1983

WILBUR SMITH AND ASSOCIATES
DE LEUW CATHER AND COMPANY

Wilbur Smith and Associates, Inc.

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2nd FLOOR
SAN FRANCISCO, CA. 94105
PHONE (415) 896-0670

CABLE WILSMITH
TELEX 57-3439

June 17, 1983

Mr. Richard Wenzel
Project Planner
Bay Area Rapid Transit District
800 Madison Street
Oakland, California 94607

Subject: Transmittal of Final Report
West Contra Costa Extension Study

Dear Mr. Wenzel:

We are pleased to submit to you our final report for the BART West Contra Costa Extension Study. This report combines and amplifies the evaluation and findings presented in our three interim reports. In addition, this report addresses the comments and inputs provided by BART staff, by representatives of the various governmental agencies, and by the public involved during the course of the study.

The study identified and developed 15 alternative BART extension alignments which could feasibly serve the study area. Capital cost estimates were developed for each of these alignments. The interim review of these alternatives allowed the identification of seven alternatives with significant merit to warrant in-depth consideration. For these promising alternatives, estimates of patronage, operating costs, and revenues were developed. The development of this data allows the evaluation of the productivity and cost-effectiveness of each of the alternatives.

We have concluded that the alternatives offer significant tradeoffs of capital investment versus patronage and overall benefits to the study area. It is our hope that this study will provide adequate information relative to the alternatives and their implications to allow a proper assessment of these tradeoffs.

We would also like to gratefully acknowledge the assistance of Walter P. Quintin, Jr. and Earthmetrics, Incorporated. Mr. Quintin advised us on the development of operating strategies;

Earthmetrics staff prepared the initial environmental analysis.

Very truly yours,

Wilbur Smith ~~and~~ Associates

Gerard L. Drake
Vice President

GLD:rj
172740

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bart

SAN FRANCISCO BAY AREA RAPID TRANSIT

WEST CONTRA COSTA EXTENSION STUDY

FINAL REPORT

PREPARED FOR
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EXECUTIVE SUMMARY

The BART West Contra Costa Extension Study evaluated the potential alternatives for an extension of BART's Richmond line into northwest Contra Costa County. The study involved the identification of all feasible alignment options and potential station sites. Each of the alignments was then analyzed in terms of capital costs, operating costs, patronage potential, and revenue potential.

A total of 15 alternative alignments were initially identified. The evaluation of these alignments with subsequent review by BART staff, by representatives of local governments in the study area, and by community interests, allowed the identification of seven alternatives which warranted further consideration.

Alignment Alternatives

The seven most promising alternatives are depicted in Figure S-1 and listed below:

1 - Southern Pacific
2 - AT&SF Railway
3 - Interstate-80
4 - San Pablo Avenue
5 - Rumrill/Hilltop/I-80
13 - Hilltop/I-80
14 - AT&SF Railway/I-80

A key conclusion of the study was that a logical northern terminus for an extension within the study area would be in the vicinity of the Interstate-80 and State Route 4 Interchange. This location was identified because it provides:

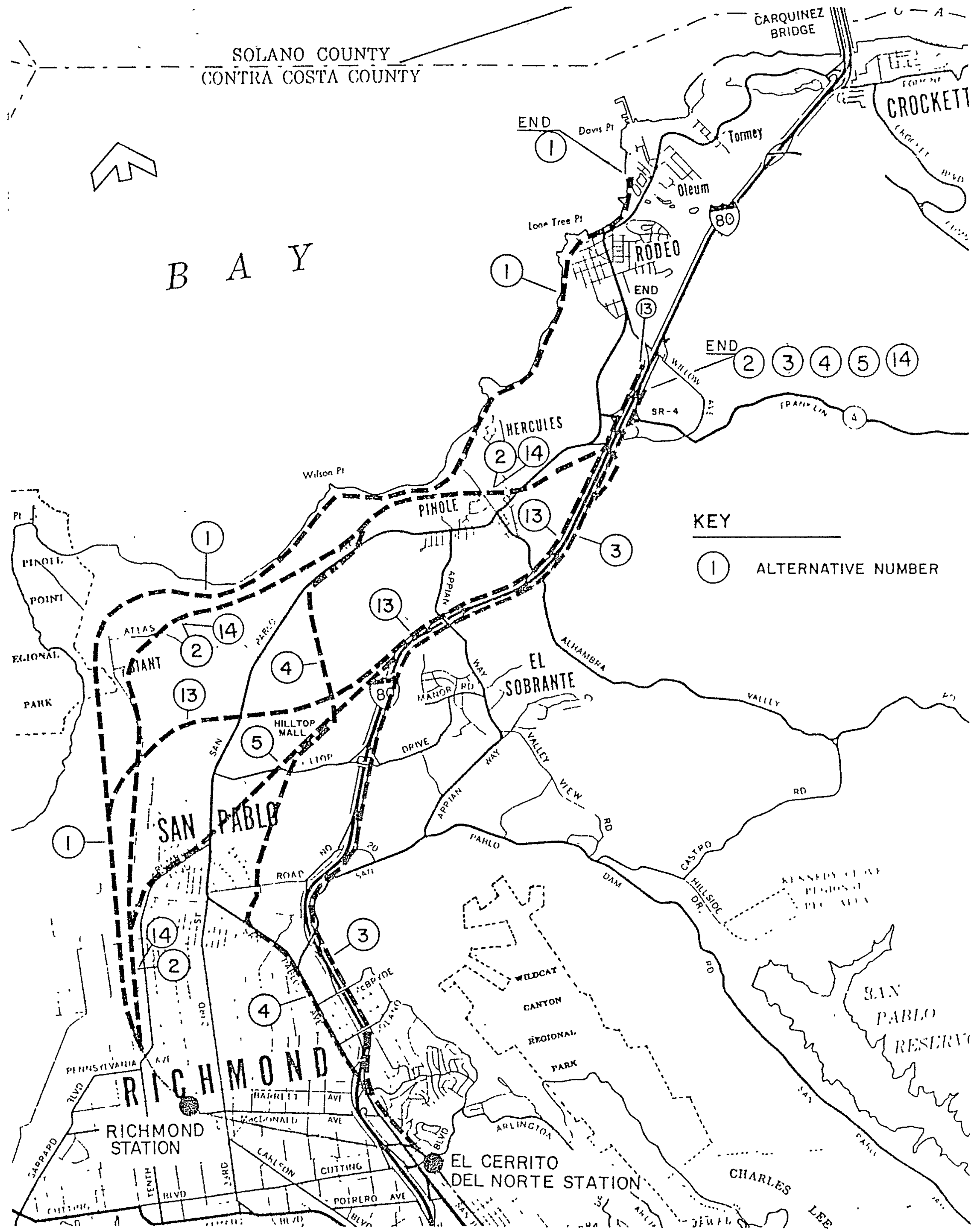

FIGURE S-1
ALTERNATIVE BART RAIL EXTENSIONS 1, 2, 3, 4, 5, 13 & 14
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

1. An excellent "intercept" point for Interstate-80 and State Route 4 travelers.

2. Sufficient undeveloped and relatively flat land for construction of a BART station and end-of-the-line train storage tracks.

3. Future flexibility for BART extension to the north or east.

Extensions further north to either Crockett or Cummings Skyway were found to be unattractive in terms of the potential for added patronage versus the added capital and operating costs. Thus, the seven selected alternatives were all modified to terminate at State Route 4 or at nearby Rodeo.

Key Physical Features

Those alternatives which extend north from the El Cerrito Del Norte Station pose two significant disadvantages compared to those which extend north from the Richmond Station.

1. Yard and Storage Facilities - The Richmond yard offers sufficient capacity to service the additional train maintenance and storage needs of the extensions. Extensions from El Cerrito Del Norte would, however, be too remote from the Richmond yard to operate efficiently. Thus Alternatives 3 and 4 would require a new yard facility which is proposed in the Refugio Valley east of Interstate-80 near State Route 4.

2. El Cerrito Del Norte Junction - Alternatives 3 and 4 require a junction of the existing BART tracks north of El Cerrito Del Norte and the extension tracks. This junction should be fully grade separated to avoid operational conflicts, requiring a vertical crossover of the existing BART tracks. The remaining section of the Richmond line would then become a separate terminal, with the new terminus near State Route 4.

Capital Costs

The total capital costs of the alignment alternatives including vehicles would range from $175 million to $449 million. The most costly alternatives, Alternative 4 ($449 million) and Alternative 5 ($337 million) require extensive tunnel construction to gain access to Hilltop Mall. Alternatives 1, 2 and 14 require the least costs ($175-$176 million) because of their potential use of the relatively flat and unobstructed path created by the Southern Pacific and Santa Fe Railroads. Alternative 13 is the only alternative which provides a station at Hilltop Mall without the extensive tunnelling required in Alternatives 4 and 5. Its capital cost estimate of $203 million is competitive with the railroad alignments, as is the cost of Alternative 3 - Interstate-80 ($223 million).

The relative attractiveness of Alternative 13 depends upon the uncertain assumption that CalTrans would not implement a presently planned HOV lane project on I-80, and that the BART line extension could be accommodated within the existing I-80 right-of-way. Additional construction cost and some right-of-way acquisition would be necessary if both projects were implemented. In this case, substantial additional costs would be incurred to create a feasible alignment.

Performance Indicators

A summary comparison of the performance of the alternatives in terms of various indicators or measures of cost effectiveness and productivity is shown in Table S-1.

Patronage - The alternatives would differ greatly in terms of total future transit ridership. Alternatives 1, 2 and 14 would have the least ridership potential, 5,200 - 9,800 one-way passenger trips. These alternatives follow the Southern Pacific

Table S-1

SUMMARY COMPARISON OF ALTERNATIVES
PERFORMANCE INDICATORS FOR THRU SERVICE

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	EXTENSION FROM	NORTH TERMINUS (1)	LENGTH (Miles)	NUMBER OF STATIONS	NUMBER OF TRAINS/CARS REQUIRED (7)	ONE-WAY DAILY PASSENGER TRIPS (3)	CAPITAL COSTS (1982 $ Millions) FIXED FACILITIES	CARS	TOTAL	FIXED FACILITY COST PER MILE (4) (1982 $ Millions)	ANNUAL OPERATING COST (1982 $ Millions)	FAREBOX RECOVERY RATIO (5)	OPERATING COST/TRIP
1 - Southern Pacific	Richmond	Rodeo	9.9	4	2/24	5,200 - 8,200	$146	$29	$175	$14.7	$ 6.9	23	$ 6.59
2/14 - AT&SF Railway (2)	Richmond	SR-4	8.2	3	2/27	6,400 - 9,800	144	32	176	17.6	6.8	28	5.38
3 - Interstate-80	El Cerrito	SR-4	8.1	3	3/33	8,400 - 13,200	183	40	223	22.6	6.2	40	3.66
4 - San Pablo Avenue	El Cerrito	SR-4	8.9	4	3/39	10,000 - 16,000	402	47	449	45.2	7.1	42	3.46
5 - Rumrill/Hilltop/I-80	Richmond	SR-4	7.6	4	3/38	10,000 - 15,600	291	46	337	38.3	6.7	43	3.31
13 - Hilltop/I-80	Richmond	SR-4	8.0	4	3/32	7,800 - 12,400	165 (6)	38	203 (6)	20.6	6.9	33	4.33

(1) For purposes of comparison all alternatives were terminated at either State Route 4 or Rodeo.
(2) Between Richmond and State Route 4 Alternatives 2 and 14 have identical alignments.
(3) Includes existing BART patrons ("old riders").
(4) Fixed facility costs only, excludes vehicles.
(5) Ratio of fare revenues to operating cost.
(6) Cost estimate assumes CalTrans does not implement I-80 HOV lane.
(7) Trains required were developed assuming 10 car trains and 15 percent spare requirements.

and Santa Fe Railroad alignments which serve the extreme western portions of the study area and are removed from Interstate-80 and much of the study area population. The greatest patronage potential, 10,000 - 16,000 one-way passenger trips, would be associated with Alternatives 4 and 5 which were specifically planned to serve central San Pablo, Hilltop, Pinole and the State Route 4 area directly. The high level of access provided by these alternatives has to be weighed against their higher capital costs. Alternatives 3 and 13 would provide less access to the developed southern portion of the study area than Alternatives 4 and 5, as is reflected by lower forecast patronage levels.

Farebox Recovery Ratio

The ratio of estimated fare revenues to operating cost is an important indicator of overall system productivity. Currently the BART system recovers 45 percent of the system's operating expense from passenger revenues. The estimated farebox recovery for the proposed extension alternatives ranges from 23 to 43 percent. Alternatives 1, 2 and 14 would have a considerably lower farebox recovery ratio than any of the other alternatives.

Operating Cost/Trip

Currently BART's operating cost per passenger mile is 16.4 cents. A typical longer commute trip (the type expected on the West Contra Costa Extension) is forecast to cost between $3.30 and $6.60 to provide; in contrast, a similar trip on today's system would cost about $3.30 to provide. Thus, the extension would tend to raise the cost of the average trip. And again, the performance of Alternatives 1, 2, and 14 is significantly poorer than that of the other alternatives.

These operating costs reflect a "thru" service operating concept where trains would operate directly to San Francisco/ Daly City from the State Route 4 terminal. The costs also reflect headways or service frequencies at levels consistent with current BART service policy, with service every 15 minutes from 6 A.M. to 7 P.M. and 20 minute service evenings and weekends.

A "shuttle" service concept was also evaluated, which would involve trains operating on the extension only. Through passengers would have to transfer at the southern terminus of the extension, either the Richmond or El Cerrito Del Norte Stations. The shuttle service concept represents reduced service convenience for extension patrons which would be reflected in reduced patronage as compared with through service. A substantial operating cost savings of approximately $2 million per year could be achieved by using shuttle service rather than through service.

Environmental Factors

A preliminary environmental assessment of the alternatives was completed to discern any significant environmental impacts which would be associated with each alternative. None of the identified potential impacts were of a severity which would suggest eliminating any of the alternatives. Alternatives 3, 4, and 13, which require earth cuts and fills, would have visual and geological impacts. The aerial structure required with Alternative 4 along San Pablo Avenue would have adverse traffic and noise impacts. Potential displacement of businesses and residences were negligible for all the alternatives.

Conclusions

The alternatives suggest that significant trade-offs are available in terms of the capital costs initially invested in a BART extension and the ultimate patronage or total benefit derived from the alternative. Use of either the Southern Pacific or Santa Fe alignments (Alternatives 1, 2 and 14) would involve the least investment in fixed facilities but also would yield low productivity in terms of patronage and revenue. The greatest productivity would be derived from Alternatives 4 and 5, which would generate 70 percent more patronage than Alternatives 1, 2 and 14, but would require an additional $161 to $274 million in total capital costs, or 91 to 157 percent more capital costs than Alternatives 1, 2 and 14. Alternatives 3 and 13 also offer increased productivity as compared with Alternatives 1, 2 and 14, generating 40 percent more patronage. These alternatives would involve additional total capital costs of $27 to $48 million or 16 to 27 percent greater costs than those associated with Alternatives 1, 2 and 14. A key concern related to Alternative 13 is its conflict with the planned Interstate-80 carpool/bus lane. Alternatives 3 and 4 have the disadvantages related to an extension from El Cerrito Del Norte, namely the need to construct a new yard facility and a grade-separated junction with the existing BART tracks.

1. PROJECT BACKGROUND

The West Contra Costa Extension Study explores the implications of a northward extension of the Bay Area Rapid Transit (BART) District's Richmond Line into the northwestern portions of Contra Costa County. The study area, its relationship to the San Francisco Bay Region, and the existing BART system is presented in Figure 1. The study focused on an area extending north from Richmond and El Cerrito to the Carquinez Strait. This area includes portions of Richmond and El Cerrito as well as San Pablo, Pinole, Hercules, Crockett, Rodeo and unincorporated areas of the County.

1.1 BART Extension Policies

In 1957 the San Francisco Bay Area Rapid Transit Commission presented its recommendations to the State Legislature for a five county, 370-mile rapid transit system. Subsequently, three of the five counties, Contra Costa, Alameda and San Francisco voted to join the proposed Bay Area Rapid Transit District (BARTD). The BART Plan was modified to provide services in the three county area. The first phase of development was the basic 71-mile system now in operation. Future phases were to provide service extensions of the Concord Line from Concord to Pittsburg and Antioch and of the Fremont Line to both South Fremont/Warm Springs and Pleasanton/Livermore.

In the early 1970's BART participated in several extension studies which investigated the feasibility of extending its lines within the three-county district as well as into San Mateo County. In 1979, an additional study was conducted of an extension of the Fremont line to the Warm Springs area.

In 1980, the BART Board adopted a policy statement on

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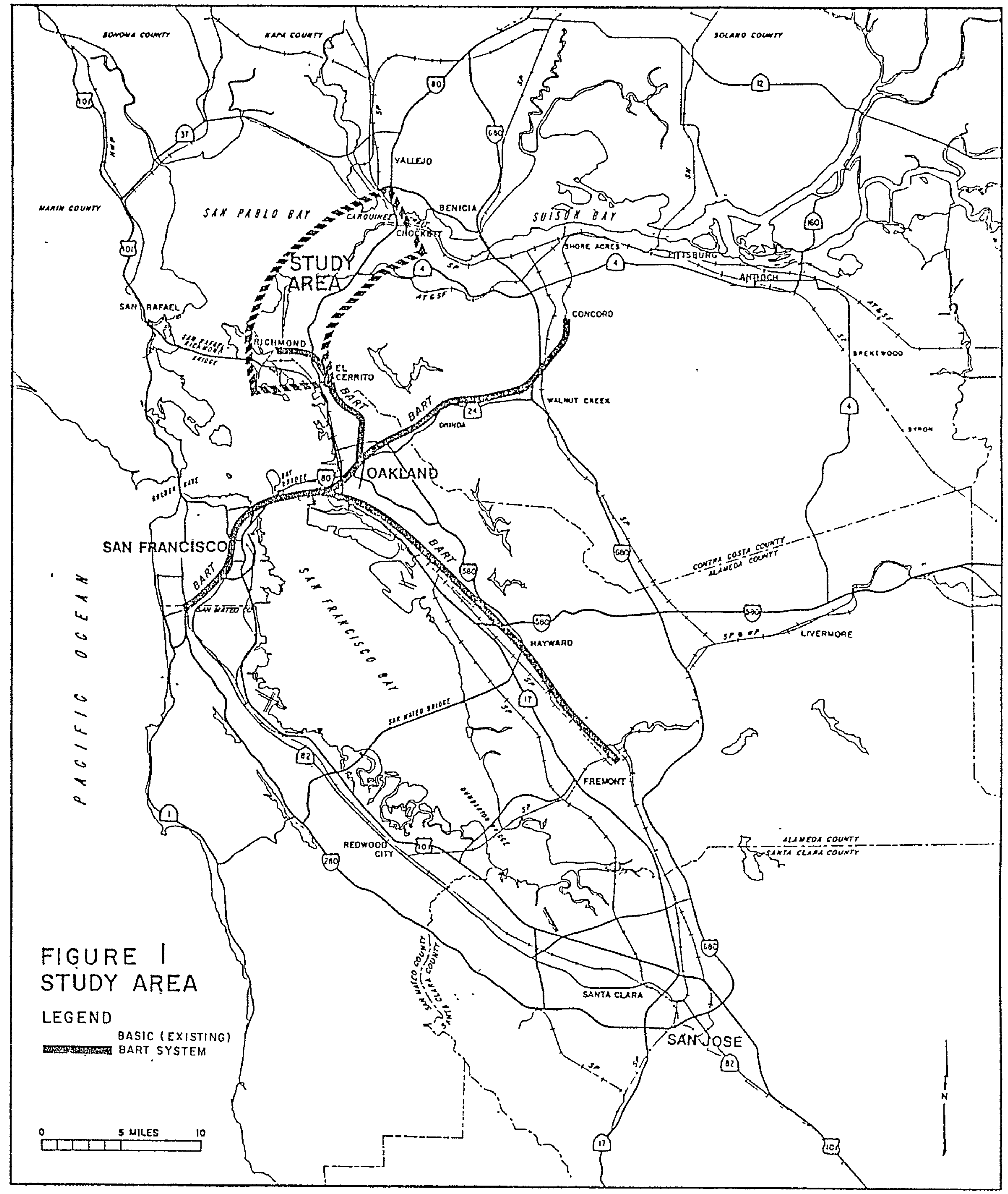


FIGURE 1
STUDY AREA

BART extensions.[1] This statement established a four-phase program for completion of extensions to Antioch, Livermore, South Fremont/Warm Springs and to the San Francisco Airport. The policy states that the BART system would be expanded incrementally with concurrent construction of various extension segments.

More recently the BART Board recognized the need to develop definitive information relative to the feasibility of a West Contra Costa Extension. Up until this time, almost no reliable information was available upon which to judge the merits or feasibility of a West Contra Costa Extension. This study would provide an information base comparable to that now available or under development for the other potential extensions.

1.2 Study Purpose

The objectives of the West Contra Costa Extension Study were to:

- Define practical alignment alternatives extending north from either the Richmond or El Cerrito Del Norte BART Stations;
- Identify potential locations for passenger stations and storage yards for each alternative alignment;
- Establish the service characteristics of each alternative to the extension and related patronage potentials;
- Analyze the comparative impacts of the alternatives on passenger accessibility, and determine patron access needs; and

(1) BART Board of Directors, Resolution No. 2815 - A Policy on Extension Right-of-Way and Expenditures, April 14, 1980.

- Provide reliable preliminary estimates of implementation capital and operating costs, and revenues.

The study was designed in a manner which would facilitate active review of the study efforts by local government officials and staff, by concerned community interests, and by BART staff at several points during the study process. In order to assure that all identified alternatives were given equal consideration, a uniform set of concept design guidelines, unit capital cost factors and operating cost factors were developed and utilized to evaluate each alignment concept.

1.3 Study Area Overview

In 1980 the study area had a population of approximately 145,000 persons. The Association of Bay Area Governments (ABAG) has projected (ABAG Projections-79) that by 1995 the total study area population will grow to 175,000, a 21 percent population increase. Richmond contains the densest concentration of residents in the corridor. There is also considerable commuting from the communities north of Richmond to Oakland and San Francisco. These communities -- San Pablo, Pinole, Hercules, Rodeo, and Crockett -- are principally suburban in nature and rely on other communities for most of their employment.

The northern communities contain a considerable amount of developable open space. Much of this land is already slated for residential, commercial, and light industrial or office development. These projects include the Hercules Industrial Park, the planned office-residential development surrounding Hilltop Mall and the proposed development of the Chevron/Standard Oil property.

Interstate-80 is the major north-south travel facility in the area serving over 100,000 vehicles per day in the vicinity of Richmond. This key link between the Bay Area, Sacramento and points east is also an important regional commuter route. This route is often heavily congested during peak morning and afternoon commute periods. Commute traffic is generated by residents of both Contra Costa and Solano Counties. State Route 4 is the major east-west highway link in northern Contra Costa.

Two major railroad rights-of-way traverse the study area. The Southern Pacific Railroad extends through Richmond to the Bayfront, and parallels the shoreline up to and along the Carquinez Strait. The Atchison Topeka and Santa Fe Railway parallels the Southern Pacific until turning to the east near State Route 4.

Currently BART operates two express bus routes, one of which operates between the El Cerrito Del Norte station and Pinole, and the other between El Cerrito Del Norte and Rodeo. The current ridership of these lines is approximately 750 passengers per weekday. To further encourage the use of transit and high occupancy vehicles (HOV) in the Interstate 80 corridor, CalTrans is proposing to develop an exclusive HOV lane paralleling the existing Interstate-80.

The West Contra Costa County study area is a growing area with a pattern of long distance commuting to the major Bay Area employment centers. This type of growth increases the need for alternative long-distance travel options to the congested Interstate-80 corridor.

1.4 The Study Process

The study involved three major analytical tasks, as follows:

Task 1 - System Conceptual Design - In this task the full range of route alignment alternatives extending north from the Richmond and El Cerrito Del Norte Stations was identified. Candidate locations for station and yard facilities were also defined. Specific drawings of the alignments in terms of their route, vertical profile and cross-section were prepared (See Appendix E).

Task II - Revenue Service and Patronage Analysis - The purpose of this task was to define the characteristics of the BART service which could be provided on any of the extension options in terms of service frequency, capacity (length of trains) and service type (through service versus a local shuttle service, for example). Estimates of potential patronage were then prepared based upon the proposed quality of service, the anticipated growth of the study area, and the accessibility of the various potential station locations.

Task III - Cost/Revenue Analysis - This task required the development of estimates of the capital costs and operating costs associated with the alternative alignments. A uniform set of specially developed unit cost factors was utilized to develop the costs associated with each alternative. This approach assured that the comparison of one alternative with another would be presented in an accurate and valid fashion. The final step in this analysis was to estimate the fare revenue to be generated by patronage of the extension and to determine the ratio of revenue to operating costs. This ratio provides a measure of service productivity which can be compared directly with the productivity estimates for other extensions and with the productivity of the existing BART system.

At the end of each task an interim report was prepared and submitted for review by BART, the local governmental agencies, and interested community members in the study area. This process allowed a means of screening all the identified alternatives into a group of "most promising" alternatives which could be considered in greater detail. A total of 15 alternatives were identified during the course of the study. Of these, seven alternatives were found to have special promise worthy of further consideration.

1.5 Community Participation

The study design allowed for active involvement of the communities in the study area. At the onset of the study in December 1982, special community meetings were held in Pinole and in San Pablo. Members of local community governments, and other interested community members were briefed on the study and presented with a preliminary discussion of the alignment options. These meetings resulted in the identification of new alternatives, and the refinement of the earlier identified alternatives to improve accessibility and reduce conflicts with local development plans.

During the study each of the community representatives and interests was given the opportunity to review and comment on each of the three interim reports. The inputs received from these review efforts have been incorporated into this final project report.

2. ROUTE ALTERNATIVES

This portion of the study involved the identification of the full range of basic route alignment alternatives for a feasible BART extension from the existing Richmond and/or El Cerrito Del Norte BART Stations in West Contra Costa County to Crockett. Additionally, candidate locations for stations were determined for each alternative alignment. Potential sites for the storage and maintenance yard facilities that would be required were also located.

The route alignments were defined in terms of various route segments. Various combinations of the segments define each alternative alignment. Individual segments and given combinations of segments are often common to several alternatives. The use of route segments to define the alternatives simplifies the overall process of developing and evaluating alternatives. New alternatives can be easily reviewed by combining the appropriate segments.

2.1 Criteria for Alternatives Identification

The primary objective in the selection of candidate alignment segments was to develop alternatives which maximized service to the developed and developing portions of the study area. The alternatives should also exploit the use of available publicly and privately owned rights-of-way to the maximum extent possible. Railroad rights-of-way are an example of those which could provide a corridor for BART development.

Given this overall objective, the selection of the candidate alignment segments was based on five critical factors:

1. Right-of-way availability potential.
2. Conformance to BART design criteria and standards.
3. Potential environmental impacts such as displacement of housing and/or businesses.
4. Significant obstacles or routing feasibility problems from a technical standpoint.
5. Potential conflicts with existing rail operations, street or highway traffic, or with major utilities and pipelines.

Within the alignment segments, potential station sites were identified based on four evaluation factors:

1. Station accessibility via bus, auto, bicycle and pedestrian modes.
2. Service to potential trip generators.
3. Land availability.
4. Sufficient station spacing for high speed operation.

Emphasis was given in the right-of-way availability evaluation to maximize the use of publicly owned land and to identify certain privately owned parcels which may have potential for interim lease until BART construction commences.

To provide conformance with BART design standards, the following design criteria were used in developing the alternatives.

2.1.1 Alignment and Profile Criteria

To maintain a fully grade-separated exclusive right-of-way for double tracks, a minimum right-of-way width of 40 feet is required for at-grade alignment and 26 feet is required for BART aerial structure. Right-of-way requirements of the at-grade and aerial BART cross-sectional configurations are illustrated in Figures 2 and 3.

FIGURE 2
TYPICAL CROSS SECTION
AT- GRADE ALIGNMENT

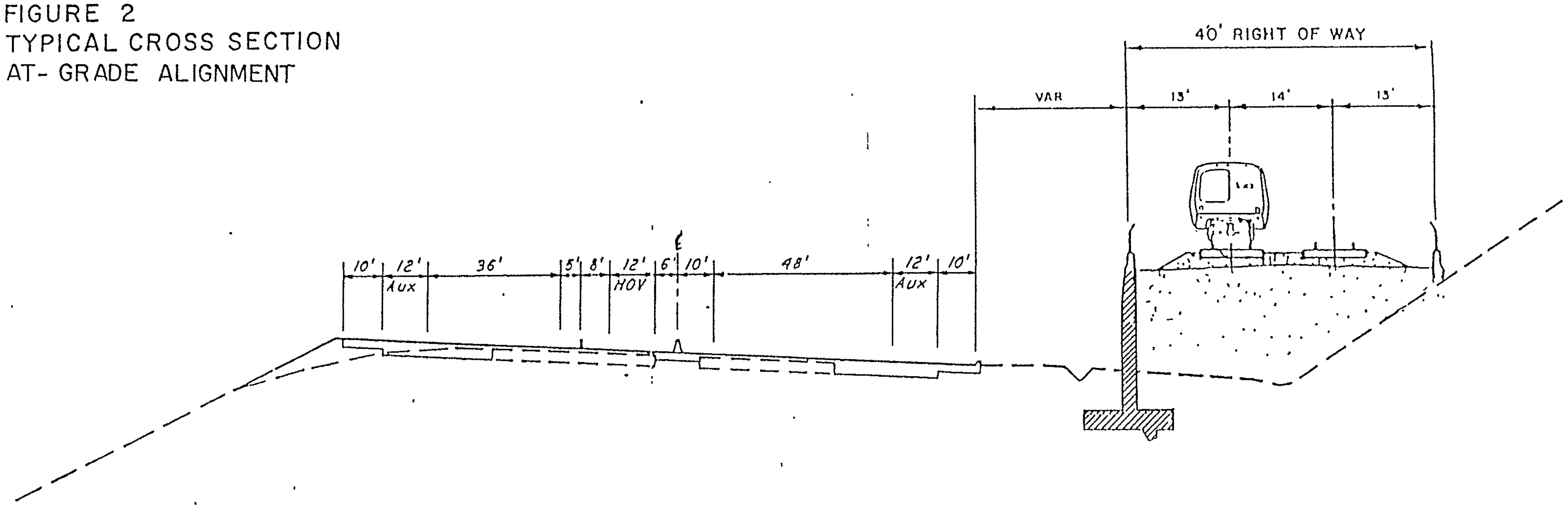
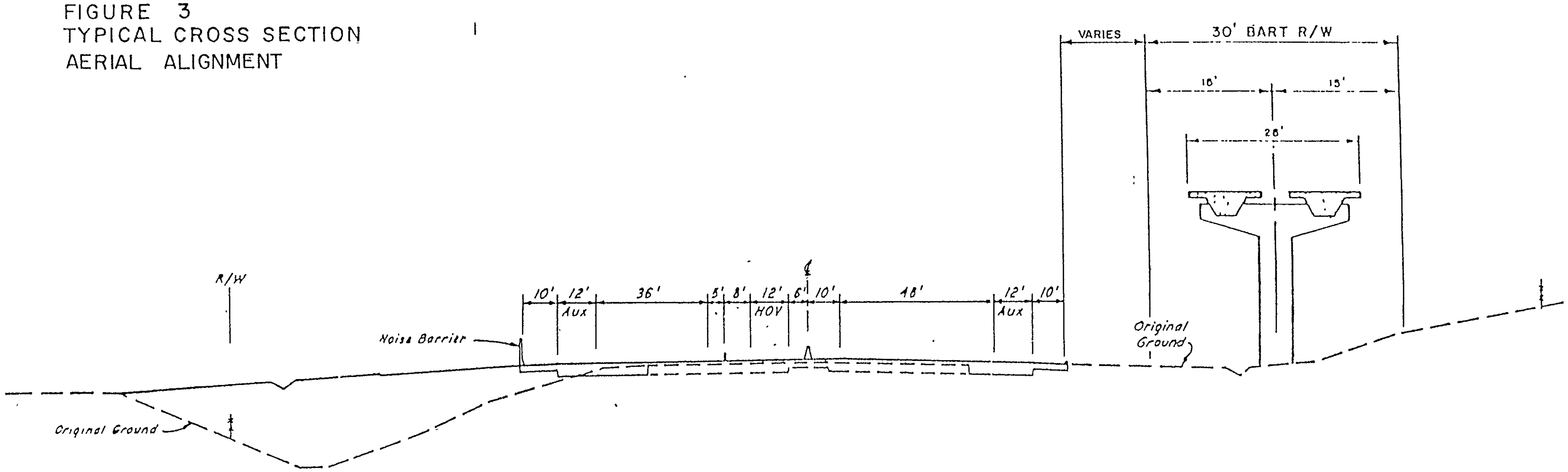


FIGURE 3
TYPICAL CROSS SECTION
AERIAL ALIGNMENT



To maintain reasonable operating speeds BART uses a desired maximum profile gradient of 3.0 percent, and an absolute maximum of 3.5 percent. Considering the varied and hilly terrain of West Contra Costa, the desired maximum profile gradient of 3.0 percent could not be maintained in every alignment segment. Use of the maximum grade of 3.5 percent was required in some areas. In order to reduce steep transitions between grades in conformance with the BART criteria for vertical curves, and for the maximum rate of change of grade, aerial structures of exceptional heights are required, in combination with subways. Even so, in some areas the design train velocity is only 30 MPH.

Horizontal curves were kept within the minimum acceptable radius of 1,000 feet. Reverse curves and compound curves were laid out with the consideration of providing spiral transition curves to run off the superelevation and also of providing at least the absolute minimum tangent length of 100 feet between curves.

The minimum vertical clearance to the underside of BART aerial structures was established in conformance with the California PUC regulations, as follows:

23' - 0" feet above railroad
15' - 0" above highways; and
16' - 6" above Interstate Highways.

2.2.2 Stations and Yard Facilities

Station requirements were developed in conformance with BART design standards for aerial, at-grade, and subway station design. Requirements for new access roadways and parking areas were based on specific site characteristics and on estimates of station patronage and mode of access.

Requirements for yard facilities and other train storage facilities were developed in cooperation with BART system operations staff. It was determined that these requirements would vary for extensions from the El Cerrito Del Norte Station versus those extending from the Richmond Station as follows:

> Extensions north of the Richmond Station could make use of the existing BART yard at Richmond and would not require an additional yard. A tail track 3000 feet in length for train storage, however, would be required beyond the last station on the alignment.
>
> Extensions north of the El Cerrito Del Norte Station would require a new yard and train storage facility, preferably near the northern terminus of the extension. In this case a 1000 foot tail track would be required beyond the last station.

To facilitate operations, the BART extension trackage should also include evenly spaced train storage tracks and crossover tracks, so that out of service trains can be either bypassed or moved off the mainline tracks. It is important to note that such facilities are generally difficult to provide on alignments through hilly terrain.

2.2.3 El Cerrito Del Norte Junction

An extension north of the El Cerrito Del Norte station would require the new BART tracks to join the existing BART tracks between El Cerrito Del Norte and Richmond just north of the El Cerrito Del Norte Station. This junction could be constructed in either an at-grade crossover or a full grade-separated configuration. For the purposes of this study a full grade separated crossover of the northbound Richmond tracks by the southbound extension trackage was assumed. This assumption is consistent with the design philosophy used in planning the existing BART system, and eliminates potential operating conflicts and problems which could be associated with an at-grade crossing.

2.2 Alternatives Description

The original planning and engineering efforts performed by the consultant team generated twelve alternatives. The review of these alternatives by BART staff and by local community interest generated three additional alternatives and prompted various modifications to the original concepts. Thus, the alternatives represent a full range of BART extension concepts which are feasible from an engineering and planning standpoint. Table 1 presents a summary description of the 15 alternatives. Figure 4 defines and locates the various route segments which constitute each alternative alignment. By referring to the segment combination description of each alternative as given in Table 1, the route alignment can then be traced in Figure 4. A description of the key features of each alternative follows:

Alternative 1. This alignment would extend from the Richmond Station to a northern terminus at Crockett via the Southern Pacific right-of-way. Five stations would be provided, with stations at Parr Boulevard and Atlas Road in Richmond, and stations serving Pinole, Rodeo and Crockett. In order to avoid conflicts with utilities and spur tracks within the Southern Pacific right-of-way, a substantial portion of this alignment would have to be on elevated aerial structure. This route would have a total length of 13.3 miles plus a 3000 foot long tail track along the Crockett waterfront. The Crockett Station and the tail track would require a significant land area in the waterfront industrial area immediately under the Carquinez Strait Bridges. It is important to note that the Southern Pacific right-of-way is subject to chronic slide conditions. In these areas the BART alignment would have to be protected by a box structure.

Alternative 2. This alternative would also extend from the Richmond Station to Crockett. The route would parallel the Santa Fe right-of-way from Richmond to the vicinity of State Route 4 and Interstate-80. At State Route 4 the route turns to the northwest via an abandoned railroad right-of-way through the proposed Hercules Industrial Park area. The alignment could be constructed largely using an at-grade BART configuration, as utility and railroad spur conflicts are not extensive. The route, however, may conflict with the Hercules Industrial Park development plans. Five stations would be provided along the 13.6 mile route with stations in Richmond, Pinole, near State Route 4/Interstate-80, Rodeo and Crockett. A 3000 foot tail track would be provided in Crockett as in Alternative 1.

Alternative 3. This alternative would parallel the east side of Interstate-80 from the El Cerrito Del Norte Station to a station near the Cummings Skyway Interchange, a distance of 10.9 miles. The extension north of El Cerrito Del Norte requires that a vertically separated crossover of the existing northbound tracks to Richmond be provided as previously discussed. The alignment traverses very rugged, hilly terrain by the freeway, and would require extensive use of aerial structures and earth cuts and fills. The grades approaching the Hilltop Drive Interchange from the south would equal 3.5 percent, the maximum allowable BART design gradient. The northern approach to this interchange would require a long 2.6 percent grade. Four stations would be provided in the freeway interchange areas at Hilltop,

Table 1

ALIGNMENT ALTERNATIVES

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	SEGMENT COMBINATION	EXTENSION FROM	TERMINATION POINT	TOTAL LENGTH* LINEAR FEET	TOTAL LENGTH* MILES	TAILTRACK LINEAR FEET	NUMBER OF STATIONS
1 - Southern Pacific	1A+1B+1C+1D	Richmond	Crockett	70,000	13.3	3,000	5
2 - AT&SF Railway	2A+2B+2C+2D+2E+Y2+1D	Richmond	Crockett	71,500	13.6	3,000	5
3 - Interstate-80	3A+3B+3C	El Cerrito	Cummings Skyway	57,300	10.9	1,000	4
4 - San Pablo Ave.	4A+4B+2C+2D+2E+Y2+1D	El Cerrito	Crockett	75,000	14.2	1,000	6
5 - Rumrill/Hilltop/ I-80	2A+5A+5B+3B+3C	Richmond	Cummings Skyway	54,300	10.3	3,000	5
6 - AT&SF/Hilltop Southern Pacific	2A+5A+4B+2C+X+1B+1C+1D	Richmond	Crockett	65,500	12.4	3,000	6
7 - AT&SF/Southern Pacific	2A+2B+2C+X+1B+1C+1D	Richmond	Crockett	67,500	12.8	3,000	5
8 - Southern Pacific/ AT&SF	1A+1B+Z+2E+Y2+1D	Richmond	Crockett	74,000	14.0	3,000	5
9 - I-80/Southern Pacific	3A+3B+Y1+Y2+1D	El Cerrito	Crockett	71,000	13.5	1,000	5
10 - San Pablo Ave/ Southern Pacific	4A+4B+2C+X+1B+1C+1D	El Cerrito	Crockett	71,000	13.5	1,000	6
11 - AT&SF/Hilltop/ Southern Pacific	2A+5A+4B+2C+2D+2E+Y2+1D	Richmond	Crockett	69,500	13.2	3,000	6
12 - AT&SF/Hilltop/ Southern Pacific	2A+5A+5B+Y1+Y2+1D	Richmond	Crockett	68,000	12.9	3,000	6
13 - Hilltop/I-80	1A/1+13	Richmond	State Route 4	42,000	8.0	3,000	4
14 - AT&SF/I-80	2A+2B+2C+2D+2E+1+Y4+Y5+3C/2	Richmond	Cummings Skyway	61,300	11.6	3,000	4
15 - San Pablo Ave/ I-80	4A+5B+3B+3C	El Cerrito	Cummings Skyway	59,800	11.3	1,000	5

Note: Alignment Alternatives extending from El Cerrito are serviced by new storage yard.

*New construction w/o tail tracks and w/o storage yard.

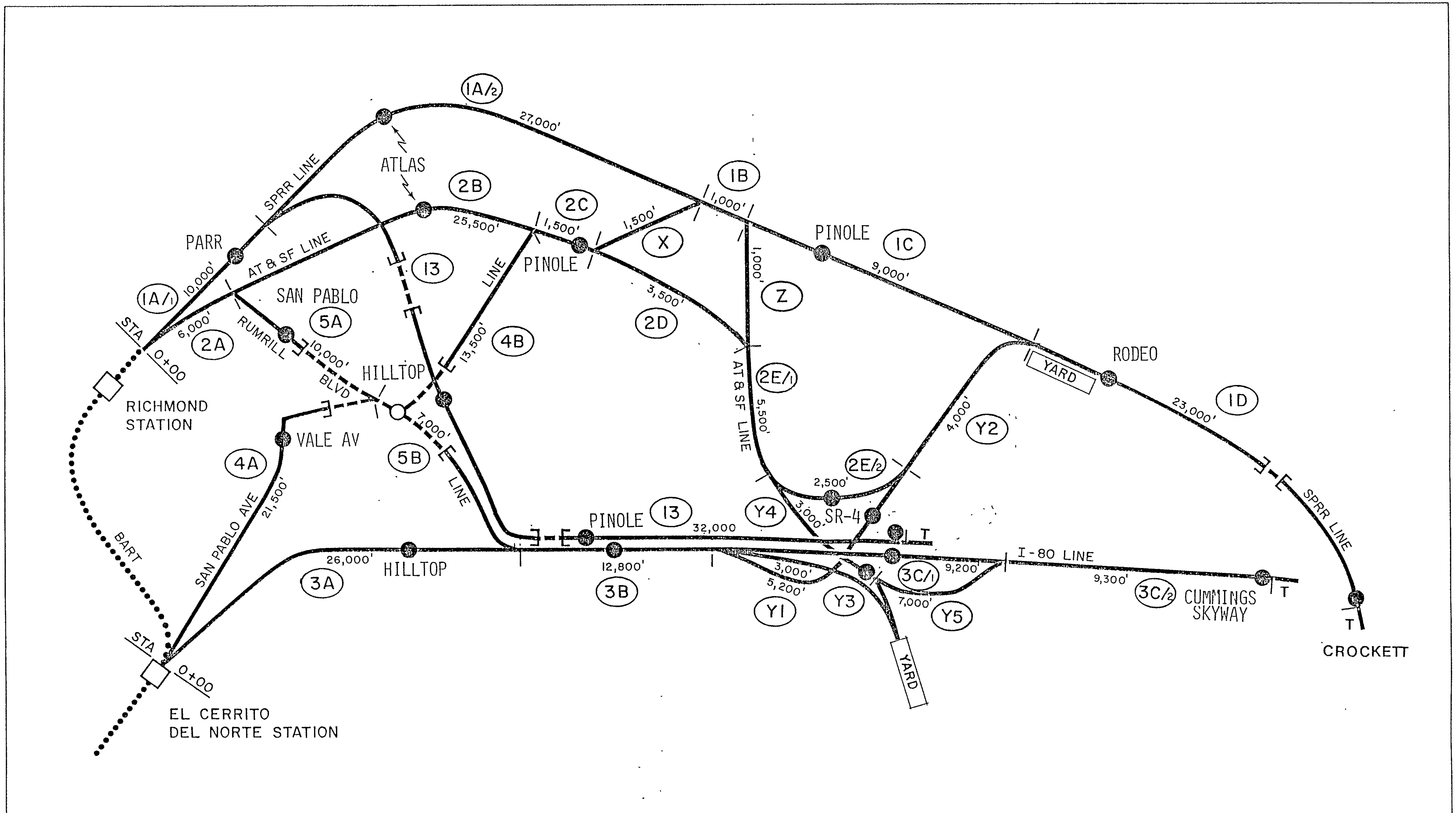


FIGURE 4

SEGMENT DIAGRAM

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

LEGEND

- ●●●●● Existing Line
- □ Existing Station
- ◉ Proposed At-Grade/Aerial Station
- ○ Proposed Subway Station
- (3A) Segment Identifier
- ▬▬ Proposed At-Grade/Aerial Line
- ▬ ▬ Proposed Subway Line
- T Tail Track

REV. 2/3/83

NOT TO SCALE

Pinole, State Route 4, and Cummings Skyway. A maintenance and train storage yard would be provided east of the State Route 4/ Interstate-80 interchange in the Refugio Valley, and a 1000 foot tail track would be provided immediately north of the Cummings Skyway Station.

Alternative 3 is the only alternative which would cross the Hayward fault with an aerial structure. The trackage would have to be specially designed to accommodate creepage of the fault.

Alternative 4. Alternative 4 extends from the El Cerrito Del Norte Station to Crockett via San Pablo Avenue and the Hilltop Mall. The route utilizes an aerial structure over the median of San Pablo Avenue. Near Church Lane in the City of San Pablo, the alignment extends through privately owned lands to the Hilltop Mall. The approach to Hilltop Mall requires the use of tunneling and cut and cover construction. North of Hilltop Mall, the alignment would utilize aerial structures when traveling through the Chevron properties before joining San Pablo Avenue. The aerial structure would follow the median of San Pablo Avenue to Pinole and would then join the Santa Fe right-of-way. From that point north the alignment would be identical to that of Alternative 2 with a terminus in Crockett. Six stations would be provided along the 14.2 mile route with stations in San Pablo, Hilltop, Pinole, State Route 4, Rodeo, and Crockett where a 1000 foot tail track would be provided. A maintenance yard would be provided in Refugio Valley.

Alternative 5. This alignment would extend from the Richmond Station to Hilltop Mall and then to the Interstate-80 corridor with a terminus at Cummings Skyway. The route would briefly follow the Santa Fe right-of-way to Rumrill Boulevard in San Pablo. An aerial structure would be used in the median of Rumrill Boulevard. Near the Contra Costa College Campus the alignment would enter a tunnel sloping upward towards Hilltop Mall at a 3.0 percent grade. Beyond Hilltop Mall, the alignment would require both aerial structure and a short tunnel to join Interstate-80. This alignment follows the east side of Interstate-80 to a terminus at Cummings Skyway for a total distance of 10.3 miles. Stations would be provided at San Pablo, Hilltop, Pinole, State Route 4, and Cummings Skyway where a 3000 foot tail track would be required.

Alternative 6. This route combines features of Alternatives 1, 4, and 5. The route to Hilltop Mall via the Santa Fe right-of way and Rumrill Boulevard is as proposed in Alternative 5. After Hilltop Mall, however, the alignment would be similar to that of Alternative 4, extending to Pinole through the Chevron properties. In Pinole the alignment joins the Southern Pacific right-of-way to continue north to a terminus in Crockett, similar to Alternative 1. Six stations would be provided including San Pablo, Hilltop, Pinole (2 stations), Rodeo and Crockett (3000' tail track). The total length of this extension would be 12.4 miles.

Alternative 7. This alternative is a combination of Alternatives 1 and 2. The route would extend north of the Richmond Station via the Santa Fe alignment and would then shift to the Southern Pacific alignment in Pinole. The alignment then would continue north to Crockett in the Southern Pacific right-of-way, a total distance of 12.8 miles. Station locations would include San Pablo, North and South Pinole, Rodeo, and Crockett. A total of five stations and a 3000 foot tail track at Crockett would be provided.

Alternative 8. This alternative also represents a combination of Alternatives 1 and 2. In this case, the line would extend from Richmond to Pinole via the Southern Pacific right-of-way. In Pinole it would shift to the Santa Fe right-of-way, approach Interstate-80, but double back to the Southern Pacific right-of-way to an eventual terminus in Crockett consistent with

Alternative 2. This alternative totals 14.0 miles in length with 5 stations and a 3000 foot tail track in Crockett. Stations would be provided in Richmond, San Pablo, Pinole, Rodeo and Crockett.

Alternative 9. This alternative extends north from El Cerrito Del Norte and the Interstate-80 corridor to State Route 4. At State Route 4 it would turn northwest to the alignment provided for Alternative 2, extending through Hercules to the Southern Pacific right-of-way, and then terminating in Crockett for a total distance of 13.5 miles. Five stations would be provided with stops at Hilltop, Pinole, State Route 4, Rodeo and Crockett. A yard would be required either at the Refugio Valley site or in Rodeo near the Southern Pacific tracks. A 1000 foot tail track would be provided at Crockett.

Alternative 10. This alignment is a variation of Alternative 4. It would extend from the El Cerrito Del Norte Station to Pinole via San Pablo Avenue and the Hilltop Mall. In Pinole the alignment would directly join the Southern Pacific alignment extending the full distance to Crockett (13.5 miles). A yard would be required in Rodeo and a 1000 foot tail track at Crockett. Stations would be in San Pablo, Hilltop, North and South Pinole, Rodeo and Crockett.

Alternative 11. This alignment is a variation of Alternative 6. The basic route extends from Richmond to Hilltop Mall via Rumrill Boulevard and then to Pinole via the Chevron properties. In Pinole the alignment reverts to the routing of Alternative 2, along the Santa Fe and Southern Pacific rights-of-way, ultimately terminating at Crockett. A total of six stations would be provided including San Pablo, Hilltop, Pinole, State Route 4, Rodeo and Crockett. The route would extend 13.2 miles plus a 3000 foot tail track at Crockett.

Alternative 12. As in the alignment proposed for Alternative 5, Alternative 12 extends from Richmond to Hilltop via the Santa Fe right-of-way and Rumrill Boulevard and then continues to the east side of Interstate-80. The alignment would shift from the Interstate-80 corridor near State Route 4 and join the Southern Pacific right-of-way in Rodeo, with a northern terminus in Crockett. Station locations are proposed at San Pablo, Hilltop, Pinole, State Route 4, Rodeo and Crockett for a total of six stations in 12.9 miles. A 3000 foot tail track would be provided beyond the Crockett Station.

Alternative 13. This alternative enters Hilltop Mall from Richmond via an alignment departing from the Southern Pacific right-of-way, over-crossing the Santa Fe right-of-way and traversing the Chevron properties to Hilltop Mall. Some tunneling and aerial structure is required to traverse the hilly terrain in this area. Beyond Hilltop Mall, the alignment would travel along the west side on Interstate-80 and would terminate near State Route 4. The route represents the shortest of the alternatives, 8.0 miles in length. Stations would be provided in north Richmond, Hilltop, Pinole, and at State Route 4 where a 3000 foot tail track would be provided.

Alternative 14. This alternative extends from Richmond to Interstate-80 via the Santa Fe alignment. Near State Route 4 the alignment follows Interstate-80 to a terminal station at Cummings Skyway where a 3000 foot tail track would be provided. Three other stations would be located at San Pablo, Pinole, and State Route 4, along an 11.6 mile total route.

Alternative 15. Extending from the El Cerrito Del Norte Station, this alternative represents a variation of the Interstate-80 alignment (Alternative 3) that is designed to provide direct access to Hilltop Mall via the San Pablo Avenue alignment provided in Alternative 4. From Hilltop Mall this alignment would return to and parallel the east side of Interstate-80 up to its termination at the Cummings Skyway Interchange. Stations would include San Pablo and Hilltop, as well as the Pinole, State Route 4 and Cummings Skyway stations along Interstate-80. This route extends 11.3 miles and would require a yard in the Refugio Valley and a 1000 foot tail track.

2.3 Potential Station Locations

The descriptions of the alternative alignments identified a number of potential station locations. Table 2 provides a summary of the notable accessibility characteristics of each station. The precise location and configuration of each station would tend to vary with different BART alignments but the general accessibility of each station is constant except as noted.

2.4 Storage Tracks and Crossovers

Alternatives 3, 4, 5, 6, 9, 10, 11, 12, 13 and 15 all traverse major areas of hilly terrain. Such terrain would complicate the ability to produce well located storage tracks and crossovers along the extension. Alternatives 1, 2, 7, 8, and 14 follow relatively level routes offering better opportunities for providing the necessary storage and crossover tracks.

Table 2

STATION ACCESSIBILITY CHARACTERISTICS

BART WEST CONTRA COSTA EXTENSION STUDY

STATION SITE	CHARACTERISTICS			
	Land Availability & Parking	Street Access & Circulation	Transit Service	Proximity to Existing Housing/Jobs
VALE AVENUE	Good	Good from San Pablo Avenue & San Pablo Dam Road; Easy Access to I-80 via San Pablo Dam Road	AC Routes 70-78A-L1	Near Brookside Hospital, Shopping Center, Richmond High School, Residential
HILLTOP MALL/DRIVE	Fair/Good-Could Share Parking With Shopping Center, Structure Needed for Alt. 3 (I-80)	Hilltop Drive and San Pablo Avenue; Good Access to I-80	AC Routes 69-70 70A-78	All Alternatives Except 3 Near Hilltop Mall Shopping Center
SAN PABLO	Use School Site, Otherwise Structure May Be Required	Good via San Pablo Avenue & Rumrill Boulevard; Road 20 Provides Fairly Good Access to I-80	AC Routes 69-70-78	Serves Contra Costa College, Junior High School
PARR BOULEVARD	Excellent	Poor-Difficult Access to I-80	AC Route 78	Low Density/Light Industry Nearby. No Residential Within Walking Distance
ATLAS ROAD	Excellent	Poor-Difficult Access To I-80	AC Route 78	Little Nearby
PINOLE	Good For All Alternatives Except Alternative 3 (I-80) Which Requires Structure	Pinole Valley Road Provides Good Access For I-80 Station, Southern Pacific Alignment Station Is Remote	Q BART Express (Alt. 3) No Service To Other Sites	Near Low Density Housing; Few Jobs In Area
RODEO	Fair-May Require Structure	Good Access to I-80 Via Willow Avenue	AC Route 78	Near Central Rodeo Development Potential To Southwest
CROCKETT	Good-Room For Large Surface Lot	Good Access To I-80 and Carquinez Bridge	No Fixed Service Good Future Intermodal Transfer Site	Near Central Crockett and Housing
CUMMINGS SKYWAY	Fair-Expensive Earthwork Required	Good Access To I-80 and Cummings Skyway	No Fixed Service	None Now But Future Potential
STATE ROUTE 4	Excellent-Good Temporary Terminal Station	New Street Connections To SR-4 To Be Built; Good Access To Hercules And Rodeo	No Fixed Service	None Now But Future Potential

3. CAPITAL COSTS - FIXED FACILITIES

The development of the capital cost estimates for the fixed facilities for each of the alternative alignments involved several steps. Initially, a set of unit cost factors was developed to express the estimated cost to construct or provide each unit of the physical construction items required for any of the alternatives. These cost factors were carefully adjusted to reflect 1982 cost levels. Separate cost factors were developed to allow an assessment of right-of-way costs. Then the physical construction and right-of-way requirements of each of the 15 alignment alternatives were developed. This analysis established the quantities of each cost item associated with each alternative; for example, the number of feet of trackwork by type, the number of stations by type, and yard and tail track requirements. By applying the unit cost factors to the quantity estimates a cost estimate was generated for each alternative.

The cost estimates and the general review of the alignments as presented in Chapter 2 provided a basis for identifying those alternatives which showed promise for further consideration. These alternatives are identified in the final section of this chapter (see Table 4).

3.1 Unit Cost Assumptions

The unit cost figures used in preparing the BART extension cost estimates are expressed in 1982 dollars, and are listed in Appendix A. Most of the unit cost information was prepared from cost data for previous BART construction contracts or from estimates. This unit cost information was compared with prevailing construction cost figures published in the Engineering News Record and with unit costs obtained from CalTrans. Unit prices involving railroads and trackwork were based on information received from the Southern Pacific Transportation Company.

Where the available data were not current, prices were adjusted to mid-1982 levels by using the revised California Price Index compiled by CalTrans, which is based on 1977 prices having an index value equal to 100.0. The index value used for the current unit costs (except trackwork) was 173.5, which represents the last twelve months average ending with the second quarter of 1982. This eliminates the erratic price fluctuations within the various quarters due to the economic recession of 1981-1982. While most of the construction prices have gone down during the preceding 12 months, track construction and rail-related unit cost items have not changed; consequently, the unit price for trackwork in this estimate is tied to the second quarter of 1981 index value of 187.7. The following illustrates the methodology applied to establish the 1982 unit prices from previous BART construction contract costs which were supplied by BART staff.

Example: Cut-and-cover subway station.

1 Structural shell construction cost of $6.0 million (1970 dollars) was multiplied by a factor of 173.5/45.4 = 3.82 where 45.4 is the 1970 index value.

2 Finish contract cost of $1.5 million (1971 dollars) was multiplied by a factor of 173.5/50.0 = 3.47 where 50.0 is the 1971 index value.

While there are several methods for adjusting unit prices to reflect inflation, it was found that the methodology of tying the unit prices to the California Price Index will enable the BART staff to update the estimate for this line extension in any future year by applying the ratio of indices.

The unit cost figures include appropriate allowances for contractor overhead, profit and mobilization/demobilization costs. A 15 percent agency cost for engineering and construction management was added to the construction cost as a common element of all costs. The following is a brief description of the elements included in each item listed in the capital cost estimate:

1. Trackwork. All costs for continuous welded rail, ties, ballast, fasteners, turnouts and their installation.

2. Structures and Civil Work. Costs to construct the transit structures and at-grade trackbed, including related costs such as site preparation, drainage, street relocation and restoration; costs for grade separation structures and retaining walls; costs for the modification of existing grade separations and highway abutments and for railroad relocation.

3. Utility Relocation. Costs to relocate overhead transmission lines or underground utilities, such as cables and pipelines running parallel with BART tracks within the contemplated right-of-way estimated in accordance with site specific requirements.

4. Track Electrification. Costs of the electrical system to furnish power for train propulsion and control, including utility feeder connections, sub-stations (assumed at 1.5 miles average spacing), contact rail, insulators and auxiliary electrical facilities.

5. Train Control - All costs of the automatic train control system, including a train control room and interlock with Lake Merritt Operations Control Center.

6. Communications. All costs for complete train communications systems, including wayside signals and on-board equipment.

7. Stations. Costs for all station construction, including finish work, furnishings and automatic fare collection equipment. Excluded from aerial stations are the BART standard aerial girders supporting the trackwork, which are included in the Structures and Civil Work item.

8. Parking Facilities. Costs of constructing park-and-ride lots or structures and associated kiss-ride and bus transfer areas, including site preparation, drainage, paving, signing, striping, landscaping and lighting. Access roads are included where applicable.

9. Additional Items. Unit prices for additional or specific items were established from documents of authorized sources; including fencing, concrete barriers, landscaping and temporary highway and rail traffic maintenance during construction.

10. Storage Facilities. Costs of storage facilities include all site prepartion, drainage, trackwork, paving, fencing, electrification, communication, lighting, and control facility for a yard and tail track. In addition, yard facilities such as office, vehicle service, inspection and cleaning facilities, parking area and service roads are not included. For those alternatives which would extend from the Richmond station through the Richmond yard facility, a cost of $500,000 for modifications to the yard trackage was included.

3.2 Right-of-Way Costs

The right-of-way of the various alignment segments would occupy publicly and privately owned land of widely differing values. No cost was assumed for publicly owned land required for the BART extension where the requirement was for a minor encroachment onto an existing right-of-way. Market level unit cost values were used for all privately owned land, including residential, commercial and industrial uses. The right-of-way of some of the segments would occupy property which is presently the right-of-way of operating railroads, the availability of which could not be confirmed in this preliminary study.

The unit costs for estimating the right-of-way requirements for each segment of the BART extension alternatives were compiled from available statistical data of recent real estate sales in the study area; from advertised sales literature and from information received from the Southern Pacific Transportation Company in 1981 pertaining to a rough appraisal of a 35 foot wide strip of their mainline right-of-way in Contra Costa County. The unit cost assumed for both the SP and AT&SF railroad rights-of-way is $2.60 per square foot.

The cost for undeveloped residential land was assumed at $4.00 per square foot, commerical land unit cost was assumed at $8.50 per square foot, and industrial land values were assumed at $5.20 per square foot. An allowance for the compensation of displaced housing and business is included in the estimate for each segment, where applicable.

Based on recommendation of BART staff, the following unit relocation costs were used as representative values in the capital cost estimates:

Housing Displacement:

- Replacment cost $100,000
- Moving cost $ 30,000

Small Business Displacement:

- Replacement Cost $ 50,000
- Moving Cost $ 20,000

Wherever only aerial structure columns were located on business property, such as in the case of a trailer storage yard and a nursery, a compensation of $20,000 was included per column for land and air rights.

The right-of-way and relocation costs for each segment are included in Appendix B.

3.3 Expanded Cost Estimates for Fixed Facilities

Expanded cost estimates for fixed facilities are shown for complete alignments in Table 3, and on a detailed segment-by-segment basis in Appendix B. Total estimated fixed facility costs vary greatly depending upon the alignment selected and the assumptions made relative to design and right-of-way availability. Costs for fixed facilities include trackwork, structural and civil work, utility relocation, electrification, train control, communications, stations, parking facilities, storage facilities, right-of-way, and all related costs. Specifically,

Table 3

COMPARISON OF FIXED FACILITY COSTS FOR EXTENSION ALTERNATIVES
BART WEST CONTRA COSTA EXTENSION STUDY

Alternative	FIXED FACILITY COSTS (1)	LENGTH (2)	COST PER MILE (3)	COMMENTS
1 - Southern Pacific	258.7	13.3	19.5	Requires relocation of four parallel pipelines
2 - AT&SF Railway	254.4	13.6	18.7	AT&SF R/W inadequate, so requires relocation of business and houses.
3 - Inter-State-80	234.6	10.9	21.5	Cost of storage facility high due to 3,000' double track required to reach the yard at SR-4.
4 - San Pablo Avenue	453.9	14.2	32.0	Costly civil and strucure work due to extensive aerial and tunnel sections.
5 - Rumrill/ Hilltop/I-80	346.5	10.3	33.6	Requires little private right-of-way.
6 - AT&SF/Hill-top/Southern Pacific	403.8	12.4	32.6	Same as Alternative 4.
7 - AT&SF/Southern Pacific	240.9	12.8	18.8	Cost low because of few aerial structures and at-grade.
8 - Southern Pacific/AT&SF	278.5	14.0	19.9	Second longest alignment, but mostly at grade.
9 - I-80/Southern Pacific	307.3	13.5	22.8	Civil/structural cost high because of long sections along I-80 and retaining wall.
10 - San Pablo Ave/Southern Pacific	434.2	13.5	32.2	Extensive tunnel and aerial sections; storage yard in Hercules.
11 - AT&SF/Hilltop	422.7	13.2	32.0	Extensive tunnel and aerial sections.
12 - AT&SF/Hilltop Southern Pacific	384.5	12.9	29.8	Same as Alternative 11
13 - Hilltop/I-80	165.4	8.0	20.7	Shortest route (uses Richmond yard) terminating at SR-4; assumes I-80 encroachment at no cost and that HOV lanes are not built.
14 - AT&SF/I-80	198.9	11.6	17.1	AT&SF right-of-way costs uncertain; extensive relocation required.
15 - San Pablo Ave/I-80	378.4	11.3	33.5	Civil/structural costs high due to many aerial and tunnel sections. Cost of storage facility high due to 3,000'double track required to yard.

(1) Excludes vehicle costs
(2) In miles
(3) 1982 dollars in millions.

costs for additional BART vehicles are excluded (see Table 24, Chapter 7 for these estimates), and so are operational and maintenance costs of the line (discussed in Chapter 6).

Table 3 shows that the capital cost for fixed facilities range from $165 million to $454 million (1982 dollars). Much of the cost differences between lines can be attributed to the length of the extension; although Alternative 13 has the lowest total cost (partly because its terminus at SR-4 makes it the shortest alternative), its $20.7 million per mile cost is actually somewhat higher than that for Alternatives 1, 2, 7, 8 and 14.

3.4 Identification of the Most Promising Alternatives

With the development of the cost estimates for each of the 15 alternatives and with an understanding of their physical requirements and route characteristics it was possible to identify those alternatives which offered sufficient potential for further consideration.

Seven alternatives were identified as having sufficient merit to warrant further consideration. Each of the alternatives and their key cost-related features are discussed below:

Alternative 1 (Southern Pacific) - The principal advantage of this alternative is that it could be constructed within the Southern Pacific right-of-way. Use of the right-of-way, however, entails certain engineering complexities and costs. This alignment would use a considerable amount of aerial structure in order to avoid interference with rail sidings along the line. There are four parallel pipelines to relocate for this alignment; therefore, utility relocation costs are high.

Alternative 2 (AT&SF Railway) - The existing AT&SF right-of-way cannot entirely accommodate a BART line, so additional right-of-way acquisition and some dislocation of existing structures is required. The right-of-way unit costs are not highly reliable for this alternative.

Alternative 3 (Interstate-80) - This alternative has excellent accessibility from Interstate-80 and from areas close to the freeway interchanges where stations could be provided. The cost for storage facilities is high for this alternative because a 3,000' double tail track is required to reach the yard at SR-4, and this track would drop 45 feet. Right-of-way costs are low because the line stays within the I-80 right-of-way, at the additional cost of higher retaining walls.

Alternative 4 (San Pablo Avenue) - This is the longest and most expensive line (in cost) but it provides direct service to San Pablo and the Hilltop Mall area. Civil and structural costs are particularly high because of the construction of extensive aerial structures, tunnels, and the subway station at Hilltop Mall. A storage yard is required along the SP railroad line in Hercules; use of the Richmond yard presents prohibitive operational problems because this extension would be from El Cerrito Del Norte Station. Right-of-way costs for this alternative are high because relatively little public property would be used.

Alternative 5 (Hilltop Mall and I-80) - Similar to Alternative 4, this alternative involves substantial construction costs to reach Hilltop Mall. However, unlike Alternative 4, a storage yard is not needed; a tail track can be substituted for the storage yard, since the existing Richmond yard would serve this alternative. This results in a significant cost savings.

Alternative 13 (Hilltop Mall and I-80) - This is the shortest extension (8.0 miles); it has only four stations and terminates at SR-4. Desirable features of this alternative are that it serves Hilltop Mall and utilizes mainly public right-of-way. One assumption which will require further resolution concerns the encroachment of the BART right-of-way into the existing I-80 right-of-way earmarked for the High Occupancy Vehicle (HOV) lane widening programmed by CalTrans. The cost estimates assume that this project will not be implemented. If the HOV lane is implemented by CalTrans, then additional costs would be incurred in terms of property acquisition/displacement costs and civil/structural work including retaining walls to create a feasible alignment.

Alternative 14 (AT&SF) Railway and I-80 - Between Richmond and State Route 4 this alignment follows the AT&SF Railway right-of-way as does Alternative 2. Beyond State Route 4, however, this alignment continues north along Interstate-80 to Cummings Skyway. This alternative would have the least cost per mile of any of the 15 options.

3.5 Comparison of Costs with State Route 4 Terminus

A second major consideration that developed during the course of the study was the identification of a logical northern terminus for the alternatives. The alternatives were planned with a northern terminus at either Crocket or Cummings Skyway. The only exception to this was Alternative 13 which would terminate near State Route 4. A suitable northern terminus for the BART extension should provide the following features:

- The last station should serve as an accessible intercept point for travelers on Interstate-80.
- The terminal station should provide adequate accessibility from northern locations of the study area.
- The terminus should have the flexibility of allowing further future extension either to the north along the Interstate-80 corridor, or to the east along the State Route 4 corridor.

Each of the proposed station locations was reviewed in light of these factors. It was concluded that State Route 4 offered a highly suitable northern terminus point since it is quite accessible from both Interstate-80 and the northwest portions of Contra Costa County and would offer flexibility in developing further extensions. The Cummings Skyway Station would also provide good accessibility, but would limit the ease of an eastward extension. The additional 2.8 miles of BART construction from State Route 4 to Cummings Skyway would cost approximately $51.6 million, over 20 percent of the total extension cost.

Several of the initial fifteen alternatives would not offer a station near the State Route 4/Interstate-80 Interchange. These alternatives would terminate in Crockett. The Crockett terminal offers good accessibility from Interstate-80, but poor flexibility in terms of future extensions to both the north and east. Stations further to the south along the bayfront, such as in Rodeo and Pinole, lack direct access from Interstate-80, but have better extension flexibility. In order to preserve this extension flexibility, it was decided to select the Rodeo Station as the terminal station for Alternative 1 in the "most promising alternatives" analysis. The other six "most promising alternatives" selected for further consideration were assumed to terminate near State Route 4.

Table 4 provides a summary of the comparative capital costs of the seven most promising alternatives terminating near State Route 4/Rodeo.

Table 4

CAPITAL COST SUMMARY - MOST PROMISING ALTERNATIVES - STATE ROUTE 4/RODEO TERMINUS

BART WEST CONTRA COSTA EXTENSION STUDY

NEW CONSTRUCTION

ALTERNATIVES	REVISED TERMINUS	LENGTH (miles)	TOTAL FIXED FACILITY COST (1) (millions $1982)
1 - Southern Pacific	Rodeo	9.9	$146
2 - AT&SF Railway	SR-4	8.2	144
3 - Interstate 80	SR-4	8.1	183
4 - San Pablo Avenue	SR-4	8.9	402
5 - Rumrill/Hilltop/I-80	SR-4	7.6	291
13 - Hilltop/I-80	SR-4	8.0	165
14 - AT&SF Railway/I-80	SR-4	8.2	144

[1] Fixed Facility Cost only - excludes vehicles.

4. OPERATING PLANS

This chapter covers issues relating to revenue service operation of the proposed line. This includes:

- Development of alternative operating (service) plans for the BART extension:
- Analysis of the line-haul vehicle travel speeds, vehicle travel times, and passenger travel times; and
- Determination of BART line-haul capacities with each operating plan.

The previous chapters indicated that there were seven promising alignment alternatives. In order to provide a more meaningful basis for comparison, each of these alternatives was analyzed here as terminating in the vicinity of the State Route 4/Interstate 80 interchange. Section 4.6 provides a discussion of the operational impacts of extensions beyond State Route 4 (SR-4).

4.1 Operational Strategies

Six operational "strategies" have been examined and are shown in Table 5. They include various types of shuttle and direct services. Each strategy is discussed below in terms of its advantages and potential problems or constraints.

1M Direct SR-4/Daly City Service

Under this strategy, existing Richmond-Daly City trains would be extended to SR-4 (or whatever station is the north-east-most terminus) at 15 minute headways (or possibly shorter headways in the future). This alternative is considered promising because it does not require any increase in transbay tube or Oakland wye capacity, and it provides maximum service to the

Table 5
POTENTIAL SERVICE STRATEGIES
BART WEST CONTRA COSTA EXTENSION STUDY

MOST PROMISING	PLAN #	DESCRIPTION
*	1M	Direct SR-4/Daly City service by extending trains at 15 min. headways.
	2A	Direct SR-4/Fremont service at 15 minute headways.
	2AM	Alternating Daly City & Fremont service, each at 15 minute headways, resulting in 7.5 minute headways between trains.
	3S	Shuttle trains which couple/uncouple at Richmond or El Cerrito Del Norte. Shuttle service could be along W. Contra Costa line, or between Richmond and El Cerrito Del Norte Station. Service at 15 minute intervals.
*	3ST	Shuttle service with across-the-platform (ATP) transfer by passengers. Shuttle service could be along W. Contra Costa line, or between Richmond and El Cerrito Del Norte station. Service at 15 minute intervals.
	3SK	Shuttle from SR-4 to MacArthur, with ATP transfer. Service at 15 minute intervals.

riders of the line. Using existing El Cerrito Del Norte patrons as a guide, 82 percent of the extension riders can be expected to travel to San Francisco stations as opposed to Fremont line stations.

2A SR-4/Fremont Service

Direct service to Fremont could be provided either by adding cars to existing trains or by adding new trains (if necessary and after completion of the KE track). The KE track is a third track through downtown Oakland (see Glossary). The transbay tube acts as an indirect constraint since passengers transferring to San Francisco-bound trains would still have to be provided space (seats or standing room) on other transbay trains. The extra inconvenience of transferring would certainly reduce patronage from what it would be under 1M; and, aside from ease of implementation, there are no other clear advantages to this plan over 1M. Weekday service would be provided at 15 minute intervals.

2AM Alternating Daly City and Fremont Service

This operating plan is similar to the one provided on the Richmond line during weekdays. It provides patrons a choice of destinations via direct trains, and provides good local service for within-line travel. The disadvantage of this plan is the additional car miles (and thus cost) generated. Within-line travel (to stations north of MacArthur) is expected to be a relatively small fraction of total ridership. Consequently, the additional cost of this plan is not likely to be warranted by the additional demand created. Trains would run at 15 minute headways for all weekday service.

3S Shuttle Trains with Coupling

New "C" cars will give increased flexibility in adding cars to and cutting cars from an in-service train consist. This plan attempts to exploit this flexibility to reduce the car-miles on the line by running only as many cars as demand on the extension alone warrants. This alternative would also provide 15 minute headways during weekday service.

To successfully use this plan, a four-track station would be necessary at the junction station (Richmond or El Cerrito Del Norte). The major disadvantage of this plan is the time it takes to couple cars--an average of three to four minutes has been utilized in the travel time analysis. Uncoupling trains generally takes a matter of only a few seconds. The new "C" cars can be in the lead, middle, or trailing portion of trains made up of A, B, and C cars.

A variant of this alternative would provide direct service to passengers along the proposed extension, but would utilize shuttle train service between Richmond and El Cerrito Del Norte. This service option would result in a lower quality of service to patrons of the existing Richmond Station compared with present day service, but would also reduce costs by eliminating the need to bring additional cars from or to Richmond to accomodate the passengers who are crossing the platform at El Cerrito Del Norte.

3ST Shuttle With Across-the-Platform (ATP) Transfers

This is a simplified version of 3S, which avoids the operational complexities involved in coupling and uncoupling cars. Instead, a short shuttle train would operate from SR-4 to the junction station (Richmond or El Cerrito Del Norte). Passengers would be required to transfer and wait for the next train. Such "out of vehicle" travel time is generally considered by patrons to be two or three times as onerous (on a minute-for-minute basis) as "in-vehicle" travel time. Thus, the ATP transfer would have some downward effect on patronage (as dicussed in Section 5.4.3).

A variant of this alternative, as with 3S, would provide direct service to passengers along the proposed extension with a shuttle service between Richmond and El Cerrito Del Norte. This would reduce the car-miles which would be involved in this alternative, since it eliminates the need to run additional cars from or to Richmond to accommodate the individuals who are crossing the platform at El Cerrito Del Norte.

3SK SR-4/MacArthur Shuttle

This shuttle would provide more direct service than 3ST, and somewhat faster service than 3S, for those passengers travelling entirely within the Richmond line. Trains would be turned around at MacArthur. Service would be provided at 15 minute intervals during all weekday hours.

Three disadvantages of significant proportions occur with this plan. One is that, particularly during peak hours, MacArthur station is already very busy. Any delay in turning around an SR-4 train could have major systemic impacts. The second disadvantage, from the passenger's viewpoint, is the required across-the-platform transfer at MacArthur Station, since most passengers want to travel to downtown Oakland or San Francisco. Finally, a third disadvantage would occur because there is no yard facility at MacArthur. Extra capacity would be required on the Concord/Daly City line for the patrons to and from the West Contra Costa Extension, which would increase the car-miles and cost to the District over an across-the-plaftorm transfer at Richmond or El Cerrito Del Norte. The KE track could be used to turn around trains, but this would preclude its use by other trains (such as a Concord-San Francisco express).

4.2 Service Level Assumptions

BART rail service is currently operated between the hours of 6 AM and 12 midnight Monday through Saturday, and 9 AM to 12 midnight on Sundays and holidays. Existing service frequencies on the Richmond line are shown below: (all times in minutes).

	TRAIN DESTINATION	
	DALY CITY	FREMONT
	T = Transfer Required	
Weekdays		
Peak Hours	15	15
Mid-Day	15	15
Night	T	20
Saturdays		
Daytime	20	20
Night	T	20
Sundays/Holidays		
All Hours	T	20

Trains on the Richmond-Daly City line, the service of greatest interest to this report, vary from three to eight cars in length, with an average of approximately five cars per train.

In order to provide the necessary capacity on the proposed extension, a minimum of 24 cars per hour would have to be run on the extension in the peak hour/peak direction (using a 27 percent peak hour/direction factor, presently found at El

Cerrito Del Norte). This is shown in Table 6, which is an operating plan for purposes of analysis. Peak hour capacity depends upon service frequency and train length.

Another consideration is that 15 minute headways may not provide adequate capacity to accommodate future Richmond line growth (stations between Richmond and Ashby). This could constrain patronage.

4.3 Travel Time and Average Speeds

Running times for various alternatives have been developed in this study using a detailed section-by-section analysis of dwell, acceleration, cruise, and braking time. This provides a more accurate assessment of running times than would an assumption of a "system average speed," because the run times are affected by grades, and the grades of various alternatives vary considerably from each other and from the existing BART lines.

4.3.1 Car Performance Characteristics

Acceleration characteristics of cars depend most significantly on grades. This analysis accounts for grades using car procurement specifications (nominal acceleration of 1.6 MPH/second with a 0% grade). New C cars are expected to have about the same acceleration characteristics as the existing fleet. Cruise velocity depends on grade, but is nominally 70 MPH (under Performance Level 2) on grades up to one percent. Braking performance currently programmed into the Automatic Train Operation system is:

- 1.6 MPH/sec in tunnels
- 1.2 MPH/sec in all other locations

Normal maximum station dwell time used is 30 seconds, and 15 minutes is assumed as the normal maximum "turn around" time at the end of the line.

Table 6

SERVICE CHARACTERISTICS OF PROPOSED EXTENSION
BART WEST CONTRA COSTA EXTENSION STUDY

	TRAINS/HOUR	HEADWAYS	CARS / TRAIN Thru Service	CARS / TRAIN Shuttle(1)
WEEKDAYS				
7-9AM	4	15	10	6
6-7AM, 9AM-4PM, 6P-12A	4	15	5*	2
4-6PM	4	15	10	6
Saturdays				
6A-12A	3	20	4*	2
Sundays				
9A-12A	3	20	4*	2

* To be adjusted as total Richmond line demand warrants.

(1) Shuttle service would provide a seat for every passenger, in most cases.

Table 7 shows the line lengths, travel times, and scheduled operating speeds (including dwell time) for the seven most promising alternatives. The average speeds are generally quite high (ranging from 41 to 45 MPH). By way of comparison, the average schedule speed between Orinda and Concord is 33-35 MPH. The high speeds along the proposed extension can be attributed to the long station spacings. Distances between stations on the proposed extension are between 2.2 and 4.2 miles. Average spacing between Orinda and Concord is around 2.7 miles.

Longer interstation spacings allow trains to cruise at 70 MPH for longer periods, thereby increasing the average schedule speed. The speeds shown in Table 7 also assume ideal operating conditions, and as such, are probably best used only for comparison purposes between alternatives. It is important to note that although fewer stations have a favorable impact on line-haul speed, such an arrangement also means that access to the BART system is more limited and is likely to be more auto-oriented. Table 8 shows station-to-station travel times for the various alignments.

4.4 Line-Haul Capacities

Line-haul capacity depends on four factors: the number of seats per car, the policy regarding maximum number of standees, the number of cars per train, and the frequency of trains. Each of these is considered in turn below.

- Seats per Car - A and B cars seat 72 passengers, while C cars will seat 68. 70 passengers have been used for an average capacity in this analysis.
- Standee Policy - BART's Board of Directors has adopted a policy which calls for an equalization of the load factors (total passengers/number of seats) for all lines. As a maximum, 1.5 is used during peak periods, and 1.05 during off-peaks.

Table 7

COMPARISON OF RUNNING TIMES AND AVERAGE SPEEDS TO SR-4

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	DISTANCE(1)	NO. OF STATIONS	RUNNING TIME (mins)	DWELL TIME (mins)	TOTAL(2) (mins)	AVERAGE SPEED (mph)
1 - Southern Pacific	10.4*	4	13.0	1.5	14.5	43
2/14 - AT&SF Railway(3)	8.7*	3	10.6	1.0	11.6	45
3 - Interstate-80	8.1	3	10.6	1.0	11.6	42
4 - San Pablo Avenue	8.9	4	11.6	1.5	13.1	41
5 - Rumrill/Hilltop/I-80	8.1*	4	10.3	1.5	11.8	41
13 - Hilltop/I-80	8.5*	4	11.0	1.5	12.5	41

*Includes 0.5 miles of existing track north of Richmond Station.

(1) Distance from Richmond or El Cerrito Del Norte to SR-4, excluding tail track.

(2) Excludes dwell at junction and SR-4 stations.

(3) Alignments 2 and 14 are identical up to SR-4.

See text for other important assumptions.

Table 8

SCHEDULED RUNNING TIMES FOR ALTERNATIVES*

BART WEST CONTRA COSTA EXTENSION STUDY

Minutes:Seconds	KEY
00:00	Cumulative including station dwell
(00:00)	Run time from prior station (without dwell)

ALTERNATIVE	1	2/14	3	4	5	13
Junction (from)	Richmond	Richmond	EC Del N.	EC Del N.	Richmond	Richmond
TO						
Parr Blvd.	3:24 (2:54)	N/A	N/A	N/A	N/A	3:24 (2:54)
Vale Avenue	N/A	N/A	N/A	3:37 (3:07)	N/A	N/A
San Pablo	N/A	N/A	N/A	N/A	4:27 (3:57)	N/A
Hilltop Mall/Drive	N/A	N/A	5:25 (4:55)	6:48 (2:41)	6:46 (1:49)	6:43 (2:49)
Atlas Road	6:31 (2:37)	5:12 (4:42)	N/A	N/A	N/A	N/A
Pinole	11·27 (4:26)	8:50 (3:08)	9:13 (3:18)	10:23 (3:05)	9:28 (2:12)	9:58 (2:45)
State Route 4**	N/A	11:34 (2:44)	11:35 (2:22)	13:07 (2:44)	11:49 (2:21)	12:31 (2:33)
Rodeo **	14:28 (3:01)	N/A	N/A	N/A	N/A	N/A

N/A = Not applicable to this alternative.

* Using average maximum dwell of 30 seconds per station.

** Station does not include dwell time if it is end of line.

Note: All times exclude dwell time at junction station (El Cerrito Del Norte and Richmond).

- Number of Cars per Train - With train control improvements, train lengths can be between two and ten cars. The shortest combination now operable with A and B cars is three cars (in an ABA configuration).

- Frequency of Trains - Train frequency can be adjusted within constraints dictated by capacity of the Oakland wye and transbay tube.

Based on these assumptions, Figure 5 shows line-haul capacity as a function of train frequency and length. Based on the patronage projections in Chapter 5, a capacity of 1,700 persons per hour in the peak direction would be required. With 15 minute headways, this would require a minimum of four-car trains operating on the line during the peak 60 minutes, which could either be in shuttle-type service, or part of a longer train serving the Richmond line.

4.5 Fleet Requirements

Fleet requirements (i.e. cars) are shown in Table 9. The fleet requirements are based upon the travel times and operating plans discussed in the previous sections. The number of cars required varies with each alternative and depends both on the length of the line (cycle time) and the patronage of the line (see Section 5.4.3).

The car requirements also depend upon whether shuttle or through service is operated. If through service is operated then all trains on the Richmond/Daly City line would have to be increased in length to accommodate the additional passengers on the Extension. This results in more cars being required then for the shuttle alternatives.

All fleet requirements shown in the table include the spare cars typically required for maintenance purposes.

FIGURE 5
FEASIBLE COMBINATIONS OF HEADWAY AND TRAIN LENGTH TO MEET PASSENGER DEMAND FOR A RATIO OF TOTAL TO SEATED PASSENGERS OF 1.5
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

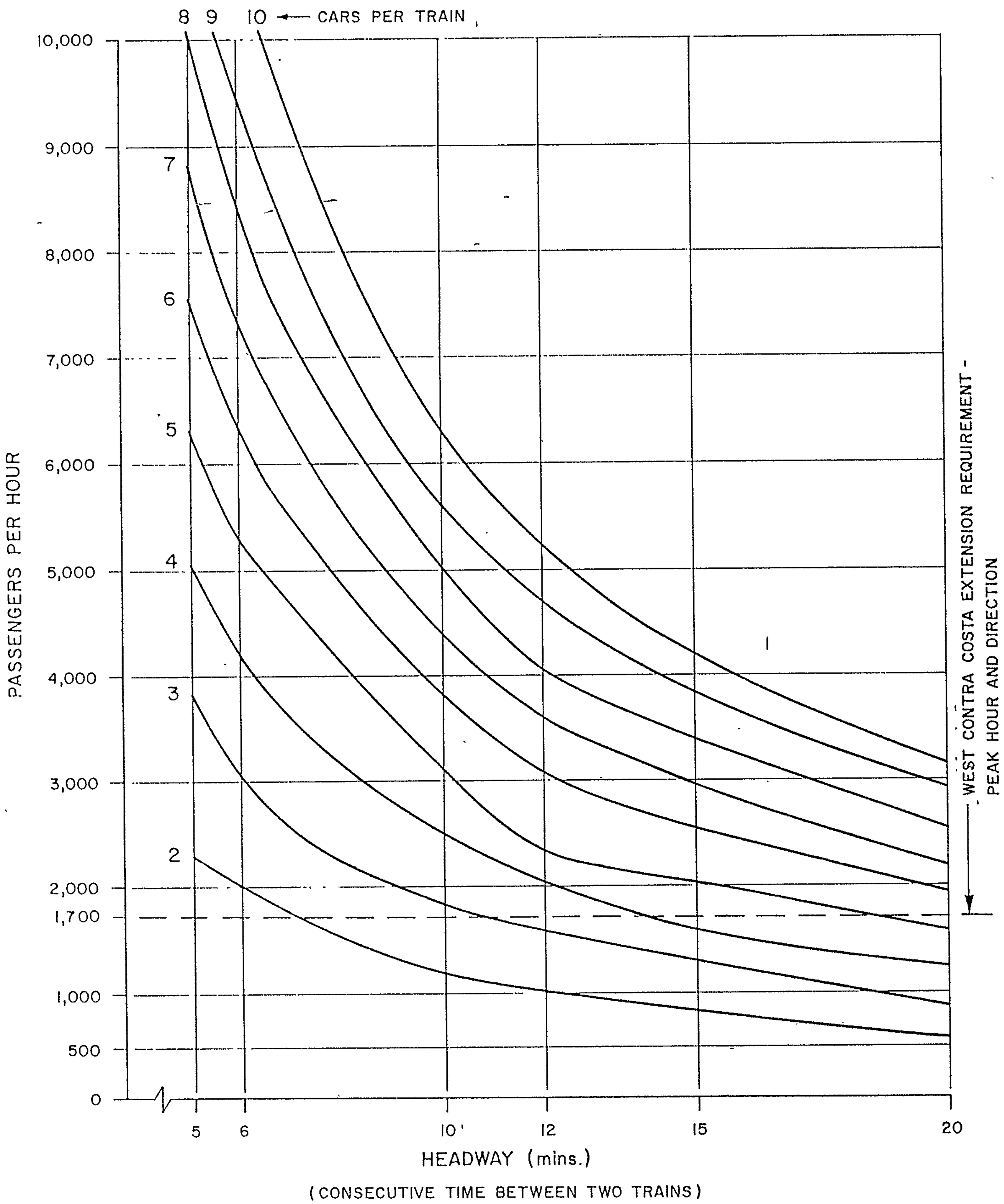


Table 9

FLEET REQUIREMENTS FOR EXTENSION ALTERNATIVES TO SR-4
BART WEST CONTRA COSTA EXTENSION STUDY

	ALTERNATIVE	CARS REQUIRED SERVICE Thru	Shuttle
1	Southern Pacific[(1)]	24	24
2	AT&SF Railway[(2)]	27	25
3	Interstate-80	33	28
4	San Pablo Avenue	39	30
5	Rumrill/Hilltop/I-80/SR-4	38	30
13	Hilltop/I-80	32	27
14	AT&SF/I-80	27	25

(1) Alignment #1's terminus near SR-4 is assumed at Rodeo. There is no SR-4 station for this alignment.

(2) Identical to Alignment #14 up to SR-4.

Note: Car requirements include 15 percent spares.

4.6 Extensions Beyond State Route 4

There are two basic route alignments that could take the West Contra Costa extension beyond a terminus at State Route 4 (SR-4). The shortest route would follow the Interstate-80 freeway to a terminus about one mile south of Crockett, near Cummings Skyway interchange. The other route would follow the shoreline/Southern Pacific right-of-way to a terminus near downtown Crockett. Alternatives 1, 2, and 4 would utlize the SP alignment, while Alternatives 3, 5, 13, and 14 would utilize the I-80 alignment.

The operational strategies and service levels presented in Sections 4.1 and 4.2 are equally applicable to an alternative ending at SR-4 as they are to one terminating near Crockett, so no additional discussion of them is provided here. The travel time needed to reach the Crockett area from SR-4 amounts to between 4.0 and 4.5 minutes depending on whether the I-80 or Southern Pacific alignment is used.

The additional travel time involved in reaching Crockett from State Route 4 has implications so far as the operating costs and fleet requirements are concerned. The additional operating costs created by running to Crockett are discussed in Section 6.2. The total cars required for through service beyond SR-4 are shown in Table 10. A total of between 30 and 47 cars are required to provide Crockett service with the same operating plan as used in discussing the other alternatives.

Table 10

FLEET REQUIREMENTS FOR THROUGH SERVICE BEYOND SR-4

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	NORTHERN TERMINUS	CARS REQUIRED-THRU SERVICE INCREMENTAL	TOTAL
1 - Southern Pacific	Crockett	6*	30
2 - AT&SF Railway	Crockett	8	35
3 - Interstate-80	Cummings	8	41
4 - San Pablo Avenue	Crockett	8	47
5 - Rumrill/Hilltop/I-80	Cummings	8	46
13 - Hilltop/I-80	SR-4	N/A	N/A
14 - AT&SF Railway	Cummings	8	35

N/A = Not applicable to this alignment

Car requirements include 15 percent spares.

*Lower car requirement because of shorter distance between Rodeo and Crockett (this alternative ends near Rodeo, not SR-4).

5. PATRONAGE ANALYSIS

The patronage assessment of a BART extension into the West Contra Costa County study area focused on the potential for growth of the study area in terms of population and employment. Other key factors which would affect patronage are the quality and accessibility of the proposed BART service.

5.1 West Contra Costa Corridor Characteristics

According to estimates by the Association of Bay Area Governments (ABAG), the West Contra Costa corridor had a population of approximately 145,000 in 1980. In the corridor, Richmond contains the densest concentration of residents and, to an even greater extent, employment. There is also considerable commuting from the communities north of Richmond to Oakland and San Francisco. These communities--San Pablo, Pinole, Hercules, Rodeo, and Crockett--are principally suburban in nature and rely on other communities for most of their employment.

The northern communities contain a considerable amount of developable open space. ABAG is currently preparing revised forecasts of future land use, population, and employment in these communities, however, only older information based on Projections-79 (1979) is available for this study. In particular, the employment forecasts in Projections-83 are expected to be substantially different. The data from the 1979 projections are shown in Table 11.

There are a number of major activity centers which are major attractors of trips in the corridor. These include Hilltop Mall Shopping Center, Brookside Hospital and Contra Costa College. In the future, the City of Hercules is planning some industrial development in the Refugio Valley (I-80/SR-4 vicinity) which could be a significant employment center in the area.

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Table 11

COMPARISON OF 1980 AND 1995 POPULATION/EMPLOYMENT IN WEST CONTRA COSTA COMMUNITIES

BART WEST CONTRA COSTA COUNTY EXTENSION STUDY

	1980		1995		% POPULATION GROWTH	
AREA	TOTAL POPULATION	TOTAL EMPLOYMENT	TOTAL POPULATION	TOTAL EMPLOYMENT	ANNUAL	CUMULATIVE
Hercules	7,300	1,102	22,190	1,449	7.7	204
Pinole	27,050	3,096	29,772	3,833	0.6	10
Richmond	82,650	36,129	85,634	42,342	0:2	4
Rodeo/Crockett	8,858	4,360	13,000	5,204	2.6	47
San Pablo	19,400	5,582	24,063	7,479	1.4	24
TOTAL	145,258	50,269	174,659	60,307	1.2	20

SOURCE: Association of Bay Area Governments, Projections-79.

These figures are under revision by ABAG, and new projections will be available later in 1983.

Based on extrapolation of existing development trends, most of the future development in the corridor is likely to be of a relatively low-density residential nature, with some medium density residential and light industrial facilities clustering near the major transportation arteries. One objective of the extension would be to focus some of this development around the BART stations.

The West Contra Costa area is expected to grow somewhat faster than the rest of the Bay Area, with a population growth rate averaging 1.2 percent per year between 1980-95 versus one percent per year for the tri-county BART District. The only areas with "high" growth rates (above two percent per year) are Rodeo and Hercules. Even though Projections-79 population estimates are probably low (relative to the 1980 Census), the absolute gain in the population between now and 1995 is likely to be under 40,000 persons. While employment in Contra Costa County is expected to grow dramatically in the next few decades, most developer interest seems to be in the central county and the San Ramon Valley. There is little evidence to suggest that West Contra Costa (north of Richmond) would provide enough employment to be a major trip attractor for "reverse commute" trips, although there certainly will be increases in employment, such as in the Refugio Valley.

The principal highway routes in the area include Interstate-80, San Pablo Avenue (State Route 123), and State Route 4. Transit systems are discussed in the following section (5.2). The proposed BART extension would generally parallel I-80. I-80 is currently a six lane freeway which becomes heavily congested during commute hours. CalTrans hopes to increase capacity here by constructing a carpool (high occupancy vehicle lane) along the west side of I-80 in this area.

5.2 Existing Transit Systems and Ridership

BART rail service currently serves the southern edge of the study area with its Richmond and El Cerrito Del Norte Stations. These stations currently serve about 4,600 and 8,200 one-way passenger trips on an average weekday, respectively. Total system ridership is about 185,000 one-way passenger trips. Many residents of the West Contra Costa area use BART by driving or taking buses to the Richmond or El Cerrito Del Norte Stations. These stations also indirectly serve residents of Napa and Solano Counties.

Existing fixed route bus transit service in the corridor is provided by AC Transit and the Western Contra Costa County Transit Authority (WCCCTA).[1] AC Transit service is concentrated in the Richmond area, with two exceptions. A route 78A bus travels all the way to Crockett on San Pablo Avenue, and the "Q" BART Express bus, which is operated under contract to BART, feeds the El Cerrito Del Norte Station. WCCCTA also operates dial-a-ride service. Generally, transit service can be characterized as sparse and oriented towards commuters (in AC Transit's case) and students (WCCCTA service).

Local transit service in the current WCCCTA service area was virtually non-existent until 1976, when BART began operating an express bus service between Pinole and El Cerrito Del Norte BART Station. This operation provides transit service to an area that was not directly served by BART, but which contributed to BART's construction and operations through county-wide taxes.

(1) Some of this material was adapted from "Western Contra Costa County Transit Authority Short-Range Transit Plan", JHK & Associates, August, 1981.

At the same time, local support had been developing for initiating more local transit service; and this movement culminated in the formation of the Western Contra Costa County Transit Authority in August, 1977. The WCCCTA was the result of a Joint Exercise of Powers Agreement between Contra Costa County and the Cities of Pinole and Hercules. The WCCCTA was empowered to own, operate, and maintain public transit services in the area extending from Montalvin Manor in the south to Port Costa in the north. This area is immediately north of Richmond, which is the northernmost part of the Alameda-Contra Costa County Transit District (AC Transit) and which is well served by AC Transit services.

Initial transit planning for the area was conducted by the Metropolitan Transportation Commission and Contra Costa County. Three fixed routes (404, 405, and 406) were established and operated under a contract between WCCCTA and Vaca Valley Bus Lines, Incorporated, beginning September 5, 1978. In addition, WCCCTA contracted with AC Transit to extend Route 78A north to Crockett. There was considerable duplication of service, but together, they provided excellent coverage of the service area.

All of these routes operated at headways between 45 minutes and an hour, except for the BART Express route during the peak period, which had 30-minute headways. The BART line had a base fare of 25¢ (10¢ for children, elderly and handicapped); the other routes charged 35¢ (25¢ for students, 10¢ for elderly and handicapped).

Routes 78A and Q continue to operate today. The three routes operated by Vaca Valley Bus Lines were terminated after one year. During this brief period, ridership on the three routes reached about 1,500 persons per day, and over 80 percent of these riders were students going to and from school. Ridership during July and August 1979--the last two months of service--dropped off sharply as fewer students rode.

5.3 Travel Time Comparisons

Table 12 shows a comparison of two typical trips made by transit from Hilltop Mall and from SR-4 to Montgomery Station in San Francisco. The table shows that there would be a time savings of 10 minutes over the existing bus-access trip from Hilltop Mall (i.e., bus from Hilltop Mall to BART El Cerrito Del Norte Station and then BART to Montgomery Station), and a 20 minute savings for a trip from SR-4.

5.4 Estimated 1995 Patronage for Alternative Alignments

5.4.1 Patronage Estimation Methodology

In order to develop meaningful comparisons between alternative alignments, as well as between different extension alternatives in the tri-county BART area, patronage projections were developed. It is especially important that the differences between alternatives are highlighted and analyzed as they affect the physically different alternatives. The patronage forecasts also become input to the subsequent cost analyses and financial assessments, since they provide the basis for estimating fare revenue. As noted in the prior section, they also serve an important role in the development of the service/operating policies.

Four patronage estimation techniques have been selected for use here. While they are not the only ones available, they are the ones most appropriate to a study of this type.

- "Similar Stations" Model - With this model, existing BART stations' patronage is used to develop patronage forecasts for the proposed West Contra Costa Stations.
- "Percent of I-80 Traffic" Model - This technique uses peak hour and all-day traffic volumes on the principal regional highway (I-80) and a forecast modal diversion to BART to estimate peak and all day patronage.

Table 12

COMPARISON OF TRANSIT TRAVEL TIMES

CURRENT AND WITH EXTENSION, TO MONTGOMERY STATION
(Times in Minutes)

BART WEST CONTRA COSTA EXTENSION STUDY

TRIP SEGMENT	FROM HILLTOP MALL		FROM STATE ROUTE 4	
	Current	w/Extension	Current	w/Extension
Walk to Stop/Station	5	5	5	5
Wait for Bus	5	-	5	-
*Bus In-Vehicle Time	10	-	26	-
Transfer to BART	2	-	2	-
Wait for Daly City Train	8	8	8	8
**BART In-Vehicle Time to Mongtomery	35	42	35	48
Walk to Destination	5	5	5	5
TOTALS	70	60	86	66

*Time from public timetable for J Bus (from Hilltop) and Q bus (from State Route 4 park-and-ride lot).

**From "BART Weekday Train Schedules," dated April 1983.

- "Build-Out of Station Area" Model - This model assumes a "build out" of the immediate area surrounding the proposed stations, and uses generalized land uses, trip generation rates, and modal diversion percentages to allocate trips to BART.

- "Service Elasticity (Pivot Point)" Model - Patronage on the existing BART Express Bus lines is used in this technique to provide a "pivot point" for the analysis. The percent change in travel times and service frequency (waiting time) are used to "pivot" this existing patronage into a patronage estimate if the extension were built today. A growth factor is then applied to develop future-year projections of patronage, based on population and other growth in the area.

It should be stressed from the outset that these techniques provide "order of magnitude" estimates of the proposed line's patronage. However, using more than one technique provides a useful cross-check on the others--a kind of "patronage triangulation" which permits evaluation of the reasonableness of the estimates. The time frame chosen for the future patronage is the period 1995-2000, when the line might reasonably be expected to be complete.

5.4.2 Comparison of Forecast Results

The four techniques above provide somewhat disparate results so far as a single patronage number is concerned. A good mid-range estimate would be 5,500 - 7,200 new one-way passenger-trips per day (line E, Table 13). This represents the upper-end of the percentage of I-80 traffic estimate, and the lower end of the "similar stations" method (see Table 13), and it assumes the service frequencies shown in Table 6 (15 minute peak headways). The station area "build out" technique must be discounted to a large extent because it assumes intensive development around stations, without respect to prevailing market focuses. For service operational planning, 6,300 passenger-trip productions (i.e., round-trips) per day have been used.

Table 13

COMPARATIVE BASELINE TRAVEL FORECASTS FOR WEST CONTRA COSTA EXTENSION[1]
BART WEST CONTRA COSTA EXTENSION

		Low	High
(A)	Range of estimates of passenger trip productions (round-trips): low end is from pivot-point technique; high end from station build-out technique.	3,000	16,000
(B)	Mid-range estimate (i.e. most likely) of (A) above, in trip productions per day	5,400	7,100
(C)	Multiply by two to get total weekday one-way trips (productions and attractions)	10,800	14,200
(D)	Subtract trips foregone if extension is built only to State Route 4 (minus 800 to 1,200 trips)	10,000	13,000
(E)	Multiply (D) by 0.55, to get newly attracted trips (those which wouldn't be made without the extension)	5,500	7,200
(F)	Multiply (D) by .5 and by 27%, to get peak sixty minute/peak direction passenger demand	1,350	1,750

(1) For average weekday in 1995. Includes full extension to Crockett, except where noted, and assumed headways shown in Table 6: 15 minute headways all day during weekdays.

The existing Richmond Station ridership by way of comparison, is 2,300 passengers (round-trips) per day. The El Cerrito Del Norte Station serves 4,100 passengers per day (compare to lines A and B of Table 13).

5.4.3 Patronage Forecasts for Alternative Alignments

Ridership projections for the various route alternatives are shown in Table 14.

These results agree with intuition, in that the alignments most central to existing and proposed population centers (Alternatives 3, 4, and 5) have the greatest ridership; routes also differ in ridership due to the number of stations provided along each line.

The impact of utilizing a shuttle service with across-the-platform transfers at Richmond or El Cerrito Del Norte would have the impact of lowering these estimates by approximately 22 percent.

Ridership along the proposed alignment would come from two sources: those who would use BART only because of the extension (i.e., those who switch modes), and those who would ride BART anyway (by either driving or taking transit to El Cerrito Del Norte or Richmond Stations). Based on past estimates of latent BART ridership, and estimates from the Warm Springs BART Extension Study, somewhere between 50 and 60 percent of the ridership on the line (5,500 - 7,200 one-way passenger trips/day) would be "new riders"--travelers who would switch from other modes of travel.

Table 14

1995 FORECAST OF RIDERSHIP BY ROUTE ALIGNMENT
BART WEST CONTRA COSTA EXTENSION STUDY

ALIGNMENT	GROSS DAILY ONE-WAY PASSENGER TRIPS
1 - Southern Pacific	5,200 - 8,200
2 - AT&SF Railway	6,400 - 9,800
3 - Interstate-80	8,400 - 13,200
4 - San Pablo Avenue	10,000 - 16,000
5 - Rumrill/Hilltop/I-80	10,000 - 15,600
13 - Hilltop/I-80	7,800 - 12,400
14 - AT & SF/I-80	6,400 - 9,800

Note: For trip productions (round trips), divide the above forecasts by two. Assumes extension to State Route 4, with half of all patrons who would have used a Crockett area station (400 - 600 trips per day) now assumed to use SR-4 station.

5.4.4 Patronage Forecasts for Individual Stations

An important, albeit difficult, task in the patronage forecasting process is to develop disaggregated projections of 1995 line and station volumes. The approach used in this effort was to try to use all available information sources which might bear upon the individual station's ridership: peak freeway on-ramp volumes nearest the proposed station location, community population, and other descriptors of activity levels (such as enrollment, in the case of Contra Costa College, or square feet of retail space for Hilltop Mall). In the case of a community having more than one station location, a community "centroid" was estimated, and pivot-point travel modeling techniques were used to determine what impacts movement of a station away from this centroid would have in terms of patronage.

Table 15 shows the individual station volumes (in passenger trip productions per day) as they have been forecast by this report. The analysis uses 10,000 - 13,000 one-way trips per day as the baseline for the highest-ridership alternatives, and allocates patrons from this total. Stations having the highest ridership include Vale Avenue, Hilltop Mall, San Pablo, and State Route 4.

These projections are subject to a number of caveats, the most significant of which is the assumption regarding the local land development patterns in the vicinity of stations. Different growth rates in Napa and Solano Counties would also effect ridership at the terminal station (Crockett, Cummings Skyway, or SR-4).

5.5.5 Station Access Needs

Most of the proposed passenger stations are expected to be primarily reached by automobile. This is because, in most

Table 15

1995 STATION PATRONAGE FORECAST[1]

BART WEST CONTRA COSTA COUNTY EXTENSION STUDY

STATION	PATRONAGE[2]	COMMENTS
Vale Avenue	800-1,300	Near Brookside Hospital and developed portions of North Richmond
Hilltop Mall	1,100-1,800	Shopping Center with 550,000 square feet of retail space; housing to east
San Pablo	1,100-1,600	Near Contra Costa College (1982 enrollment 9,000, plus 400 staff); nearby residential development in N. Richmond
Parr Boulevard	700-1,100	Fairly isolated; mostly auto access
Atlas Road	400 - 500	Very isolated; mostly auto access
Pinole	800-1,200	Nearby residential
State Route 4	1,700-2,600	Intercepts many trips from east along SR-4; also serves Rodeo; good access from I-80
Rodeo	400 - 700	Relatively little population served by this station , some employment planned nearby
Crockett	700-1,100	Relatively little population served by station; mostly intercepts trips from Solano County
Cummings Skyway	700-1,100	See comment above for Crockett

(1) Based on mid-range estimates of patronage (Average Weekday Trip Productions).

(2) Passenger trip productions (round-trip). See Table 6 for headway assumptions.

NOTE: Patronage figures are not strictly additive because of variations in station locations and line lengths (travel times).

cases, the area around stations is presently low density development (or undeveloped), there is high auto ownership among households, and relatively little transit service exists. Future changes in this situtation--higher density development near stations or improved transit service--may alter this situation. However, for planning purposes here, it was generally assumed that the "worst case" situation would involve predominantly auto-oriented access to stations.

Evidence which further reinforces this conclusion is the nature of the proposed station service areas, which is primarily that of a trip-producing suburban area. Shopping and employment sites typically are trip-attracting areas which rely heavily upon walk and transit egress modes because of the lack of a car being available at the destination-end of the trip.

The existing access modal splits at Richmond and El Cerrito Del Norte Stations have been used as a guideline for predicting West Contra Costa station modal splits. They are shown in Table 16.

In order to assess the future parking requirements and access needs of potential stations, the ten candidate station groups have been sorted into three categories, according to type of access. They are the stations that would be auto-dominated, those that would be non-auto-dominated (i.e., high walk and transit usage), and "hybrid" stations which fit into neither category. The forecast access mode splits and classification of stations are shown in Table 17 on the following page. The table shows that five of the stations would be auto-dominated, four would be hybrid, and one station (Vale Avenue near El Cerrito Del Norte) would be non-auto-dominated. Estimated station parking requirements are shown in Appendix C.

Table 16
EXISTING (MAY 1982) ACCESS MODAL SPLITS
BART WEST CONTRA COSTA EXTENSION STUDY

TRAVEL MODE	RICHMOND	EL CERRITO DEL NORTE
Auto Alone and Shared (2 persons)	35%	51%
Carpool (3 or more persons)	2	3
Kiss/Ride (Drop off)	10	10
Transit	19	14
Walk or Bicycle	34	22

Table 17
STATION ACCESS CHARACTERISTICS
BART WEST CONTRA COSTA EXTENSION STUDY

	PERCENT OF PASSENGER ACCESS TRIPS BY STATION TYPE		
TRAVEL MODE	Auto-Dominated	Station Type Hybrid	Non-Auto-Dominated
Auto Alone	55%	35%	25%
Shared Ride (2+)*	15	10	10
Kiss/Ride	10	15	10
Transit	5	15	25
Walk/Bicycle	15	25	30
Stations			
	Parr Boulevard	Hilltop	Vale Avenue
	Atlas Road	San Pablo	
	Pinole	Rodeo	
	Cummings Skwy.	Crockett	
	SR-4		

* Assumes average vehicle occupancy is 2.3 persons.

6

6. OPERATING COSTS AND FARE REVENUE

The operating and maintenance costs of the proposed extension are based upon the service levels described in Chapter 4 and unit cost assumptions obtained from various departments within BART. The service levels have been designed to match the forecast demand on the line in 1995. They involve 15 minute headways during weekday peak and off-peak hours, and 20 minute headways on Saturdays, Sundays, and holidays.

6.1 Basic Assumptions

6.1.1 Unit Operating Costs

The unit costs of BART service are divided into four expense components:

- Power
- Vehicle Maintenance
- Transportation
- Administrative and Overhead

Power costs include the costs for electricity used to propel trains, run train auxiliaries (air conditioning, etc.), and service passenger stations. Maintenance costs include BART's estimated cost of maintaining cars, including repairs and preventive maintenance. Both of these costs are based on current BART per-vehicle-mile unit cost experience.

Transportation costs include the wages, fringe benefits, employer taxes, and shift/overtime premiums of staff employed directly to serve the extension. This includes station agents, additional train operators, and supervisory personnel for station agents and train operators. Unit transportation costs have been developed on a per-person basis.

Administrative and overhead costs include general support, administration of right-of-way, plant maintenance, fare collection operation and maintenance costs, and police services. While BART has not developed an incremental cost function for overhead, a reasonable estimate is 15 percent of the total of all other costs.

The unit cost estimates applied are shown in Table 18.

6.1.2 Fare Policy

Current BART rail fares are computed using a formula incorporating a basic charge (60 cents) plus a distance charge, plus special surcharges (e.g. for transbay and Daly City trips). Adult express bus fares are 60 or 90 cents, depending upon whether one or two zones are traversed, respectively.

Because the per-mile charge drops with increasing trip length, the incremental fare revenue generated by the West Contra Costa Extension will depend upon the average trip length. The average trip length for passengers originating from extension stations has been estimated at 20 miles, which is approximately the distance from Pinole Station to Montgomery Station.(1)

An average fare generated by the extension of 79 cents per passenger trip has been used here. This average fare also includes the fare concessions currently granted to elderly and youth riders.

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(1) The average rail trip length from El Cerrito Del Norte Station is 13.5 miles.

Table 18

OPERATING AND MAINTENANCE UNIT COST ASSUMPTIONS

BART WEST CONTRA COSTA EXTENSION STUDY

		COST (1982 $)	UNITS
(P)	POWER	$ 0.61	vehicle-mile
(VM)	VEHICLE MAINTENANCE	$ 0.66	vehicle-mile
(TL)	TRANSPORTATION LABOR		
	Train Operators	$ 35,800	operator
	Station Agents	$ 35,800	agent
	Supervisor/foreworker*	$ 46,000	supervisor
(OH)	OVERHEAD AND ADMINISTRATION		
	OH = 0.15 X (P+VM+TL)		

*One supervisor is required for every 6.9 train operators and station agents.

A 25 percent back-up requirement is needed for train operators. One train operator is required per train. Three station agents are required per station day (i.e. three shifts per day, 21 shifts per seven day week).

The average trip length on the extension itself is expected to be about six miles. All fares (as well as costs) in this report are in 1982 dollars and would be adjusted for inflation in the future.

6.2 Operating Cost Analysis

6.2.1 Service to State Route 4

Operating costs for various alignments and service operations were developed using the assumptions above. All costs are shown assuming service to State Route 4 area[1], in order to maintain comparability among alternative alignments. Extensions beyond SR-4 are discussed in Section 6.2.2. The operating costs include the costs of operating the extension itself plus those of increasing the capacity of existing service on the Richmond-Daly City line to accommodate passengers newly attracted by the extension.

Table 19 shows the results of the operating cost analysis (operating cost, as used here, includes power, transportation and vehicle maintenance costs). There are two important implications to the table. One is that substantial cost savings (of about 30 percent) could be achieved by using shuttle service rather than through service. This is a result of fewer car-miles being generated by the shuttle alternative, particularly during peak hours. During peak hours, 10 car trains would operate on the line, even though only four car trains would be required.

The second implication is that a substantial difference exists between the operating costs of the alignments, with a difference of almost $1 million per year between the least and

(1) Since the Southern Pacific Alignment (#1) does not have an SR-4 station, Rodeo is used as the terminus.

Table 19

COMPARISON OF ANNUAL OPERATING COSTS
FOR ALIGNMENT AND SERVICE OPTIONS TO SR-4

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	LENGTH	AVERAGE SPEED(2)	ANNUAL OPERATING COSTS (In 1982 $ millions) THRU SERVICE	SHUTTLE SERVICE	EXISTING SYSTEM(3)	TOTALS THRU SERVICE	TOTALS SHUTTLE SERVICE
1 - Southern Pacific(1)	10.4*	43 MPH	$4.7	$2.7	$2.2	$6.9	$4.9
2/14 - AT&SF Railway	8.7*	45 MPH	4.6	2.5	2.2	6.8	4.7
3 - Interstate-80	8.1	42 MPH	4.0	2.4	2.2	6.2	4.6
4 - San Pablo Avenue	8.9	41 MPH	4.9	2.7	2.2	7.1	4.9
5 - Rumrill/Hilltop/I-80	8.1*	41 MPH	4.5	2.7	2.2	6.7	4.9
13 - Hilltop/I-80	8.5*	41 MPH	4.7	2.7	2.2	6.9	4.9

*Includes 0.5 miles of existing track north of Richmond Station.

(1) Terminates at Rodeo.

(2) Includes station stops.

(3) Cost of additional service on Richmond-Daly City line for newly attracted trips.

the most costly alternatives. This variation is attributable to differences in average speed and length between alternatives. Alternative 1, for example, has an average speed of 43 MPH and a length of 10.4 miles to the State Route 4 vicinity (Rodeo). Alternative 3, by comparison, has an average speed of 42 MPH and a length of only 8.1 miles to SR-4.

Current operating costs of BART Express Bus services in the corridor are approximately $0.9 million per year. This service would be eliminated (at least south of SR-4) as a result of a BART rail extension in the West Contra Costa corridor. The net operating costs would thus be somewhat less than that shown in Table 19. The operating cost per trip was developed by annualizing the average weekday patronage, and then dividing by the total operating costs shown in Table 19. The annualization factor, based on the existing relationship between weekday and annual ridership at El Cerrito Del Norte Station, was 287.

6.2.2 Extensions Beyond State Route 4

The incremental operating cost for service north of SR-4 to the Crockett area (in addition to that shown in Table 19) is shown in Table 20. The analysis shows that the I-80 route would have somewhat less incremental operating cost than the Southern Pacific alignment. Incremental extension service costs for a shuttle operation to Richmond or El Cerrito Del Norte Station would almost halve the costs of the service compared to running through trains.

6.3 Fare Revenue

6.3.1 Service to SR-4

Gross fare revenue projections have been made on the basis of patronage projections contained in Chapter 5. These projections make allowances for differences in patronage for each

Table 20

COSTS OF THRU CROCKETT SERVICE

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	ANNUAL OPERATING COST (in 1982 $ millions) THRU SERVICE INCREMENTAL	TOTAL	SHUTTLE SERVICE INCREMENTAL	TOTAL
1 - Southern Pacific	$1.6	$8.5	$0.9	$5.8
2 - AT&SF Railway	2.4	9.2	1.3	6.0
3 - Interstate-80	1.4	7.6	0.8	5.4
4 - San Pablo Avenue	2.4	9.5	1.3	6.2
5 - Rumrill/Hilltop	1.4	8.1	0.8	5.7
13 - Hilltop/I-80	N/A	N/A	N/A	N/A
14 - AT&SF Railway	1.4	8.2	0.8	5.5

NOTE: All costs include additional service on Richmond-Daly City line to accommodate newly-attracted trips.

N/A = Not applicable to this alternative.

alternative alignment, along with the reduction in patronage which would result from requiring across-the-platform transfer of passengers in a shuttle-type service. The forecast annual fare receipts are shown in Table 21.

This table is labeled "gross fare revenue" because it includes fares from two types of passengers: those who are attracted to BART solely because of the West Contra Costa Extension, and those who would have ridden BART anyway, using the El Cerrito Del Norte or Richmond Stations. The revenue estimates are based on the incremental revenue for trips on the extension which would be part of longer trips beyond the extension.

The new fare revenue was calculated as follows: fare revenue would come both from existing passengers (passengers who would use BART in the absence of the extension) and from newly-attracted passengers. For the old passengers, the net fare revenue would be the additional rail fare obtained from the portion of the trip north of Richmond or El Cerrito Del Norte. For an average trip of six miles, and fare charge of 2.4 cents per mile (based on BART's current "fare taper"), this equals about 14 cents. For new trips, the entire fare charge is credited to the extension. The average fare, based on the 14 mile current average rail trip length from El Cerrito Del Norte, plus six miles on the extension, is expected to be $1.50. Based on a weighted average of the two groups, and assuming half the riders are new riders and half old, the revenue per passenger would be 90 cents. This (adult) fare needs to be adjusted by a factor of 0.88 to reflect fare discounts to youth and elderly riders. Therefore, the average fare revenue generated would be 79 cents.

Offsetting the fare revenue would be a loss of somewhat over $0.1 million per year which represents fares collected on BART Express Buses in the corridor.

The important conclusion from the table is that the shuttle service results in lower fare revenue because it is less attractive due to the transfer required at the junction station.

Table 21

GROSS FARE REVENUES FROM VARIOUS ALIGNMENTS (ANNUAL)
BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	FARE REVENUE (1982 $ millions) THRU SERVICE Low	High	SHUTTLE SERVICE Low	High
1 - Southern Pacific	$1.2	$1.9	0.9	1.5
2 - AT&SF Railway	1.5	2.2	1.2	1.7
3 - Interstate-80	1.9	3.0	1.5	2.3
4 - San Pablo Avenue	2.3	3.6	1.8	2.8
5 - Rumrill/Hilltop/I-80	2.3	3.5	1.8	2.7
13 - Hilltop/I-80	1.8	2.8	1.4	2.2
14 - AT&SF Railway	1.5	2.2	1.2	1.7

NOTES: All alternative shown end near State Route 4. Calculations assume a 79 cent average incremental fare, which includes adjustments for special senior and youth fares.

However, this reduction (22 percent) is more than offset by the reduction in operating costs shown in Table 19.

6.3.2 Extensions Beyond SR-4

The incremental fare revenue attributable to an extension beyond SR-4 would be modest. Many passengers from Rodeo, Crockett, and Napa and Solano Counties would utilize BART by travelling first to the SR-4 station. It is likely that only 800-1,200 additional one-way passenger trips would occur due to the Crockett extension, which would result in additional annual fare revenue of $180,000 - $270,000. As was shown in Table 20, the incremental costs of operating the Crockett service are many times greater than this.

While the incremental patronage estimates stated for the Crockett extension are low, there is always the possibility that future development in the area could substantially increase patronage. In that case, the Crockett extension would be more justified. In any case, the option to extend beyond SR-4 has been kept open throughout the study.

6.4 Farebox Recovery

6.4.1 Extensions to SR-4

The farebox recovery ratio represents the percentage of operating costs covered by passenger fares. The analysis performed for various alignment and service alternatives is shown in Table 22. The analysis shows that the extension would probably have a lower farebox recovery ratio than the existing BART rail system. BART Planning and Analysis Department staff project a farebox recovery ratio of between 53 and 56 percent in 1990 for the basic system. The current (FY 1983) farebox recovery is about 45 percent.

The estimated farebox recovery for the proposed extension is less than the present ratio, except for shuttle service with

Table 22

COMPARISON OF FAREBOX RECOVERY RATIOS, BY ALIGNMENT AND SERVICE TYPE TO SR-4

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE/ALIGNMENT	THROUGH SERVICE			SHUTTLE SERVICE		
	FARES	COST	RATIO	FARES	COST	RATIO
1 - Southern Pacific	$1.6	$6.9	23	$1.2	$4.9	24
2 - AT&SF Railway	1.9	6.8	28	1.5	4.7	32
3 - Interstate-80	2.5	6.2	40	1.9	4.6	41
4 - San Pablo Avenue	3.0	7.1	42	2.3	4.9	47
5 - Rumrill/Hilltop/I-80	2.9	6.7	43	2.3	4.9	47
13 - Hilltop/I-80	2.3	6.9	33	1.8	4.9	37
14 - AT&SF Railway	1.9	6.8	28	1.5	4.7	32

NOTES: All fare and cost figures are annual, in 1982 millions of dollars.

Ratios are expressed in percent, rounded to the nearest whole number.

Fare revenues are based on mid-range values in Table 14.

Alternatives 4 and 5. In no case do any of the alternatives match the projected 1990 farebox recovery ratio of at least 53 percent.

One apparent anomally in Table 22 deserves explanation. Some alignment alternatives which have an equal recovery ratio for through services have unequal recoveries for shuttle service. This situation occurs because shuttle service is operated differently than the through service, with layovers at both ends of the line. Depending on the exact cycle time for trains on the route alternative, the ratio of car miles and hours is not constant between the shuttle and through service options. Consequently, it is possible for alternative alignments 4 and 5 to both have a 47 percent farebox recovery for shuttle service, but alignment 5 has a slightly greater farebox recovery for through service (43 as compared with 42 percent).

6.4.2 Extensions Beyond SR-4

The annual incremental operating costs of extensions beyond SR-4 would vary between $1.4 - $2.4 million for through service, and $0.8 - $1.3 million for shuttle service. As noted in Section 6.3.2, fare revenues are expected to be in the range of $180,000 - $270,000. Using the mid-range values of these estimates, an extension beyond State Route 4 would recover only 12 percent of costs for through service, and 17 percent for shuttle service. Under the most optimistic conditions ($800,000 annual operating cost and $270,000 annual fare revenues), the incremental Crockett portion of the extension would recover only about 34 percent of costs.

7. SUMMARY EVALUATION OF ALTERNATIVES

This chapter summarizes and draws conclusions from the development and evaluation of the alternatives provided in the previous chapters. The summary discussion is limited to those alternatives which were determined to have sufficient promise to justify further consideration during the course of the study. These alternatives include those identified as listed below (see Figure 6):

1 - Southern Pacific
2 - AT & SF Railway
3 - Interstate-80
4 - San Pablo Avenue
5 - Rumrill/Hilltop/I-80
13 - Hilltop/I-80
14 - AT & SF Railway/I-80

In addition, to facilitate comparisons between alternatives, all alternatives were treated here as having a common terminus near the State Route 4 and Interstate-80 Interchange, or near Rodeo (Alternative 1). This terminus was chosen for the following reasons:

1. A terminus near the State Route 4 and Interstate-80 Interchange would provide flexibility for consideration of a future extension to either the north or the east.
2. This interchange area offers an excellent opportunity to "intercept" commute traffic using Interstate-80 or State Route 4.
3. The interchange area appears to have available land resources to support the required BART station, parking areas and tail track which would be required at the terminus.

Given a common terminus point near State Route 4, Alternatives 2 and 14 are identical in alignment from State Route 4 south and can be considered as one alternative. A separate

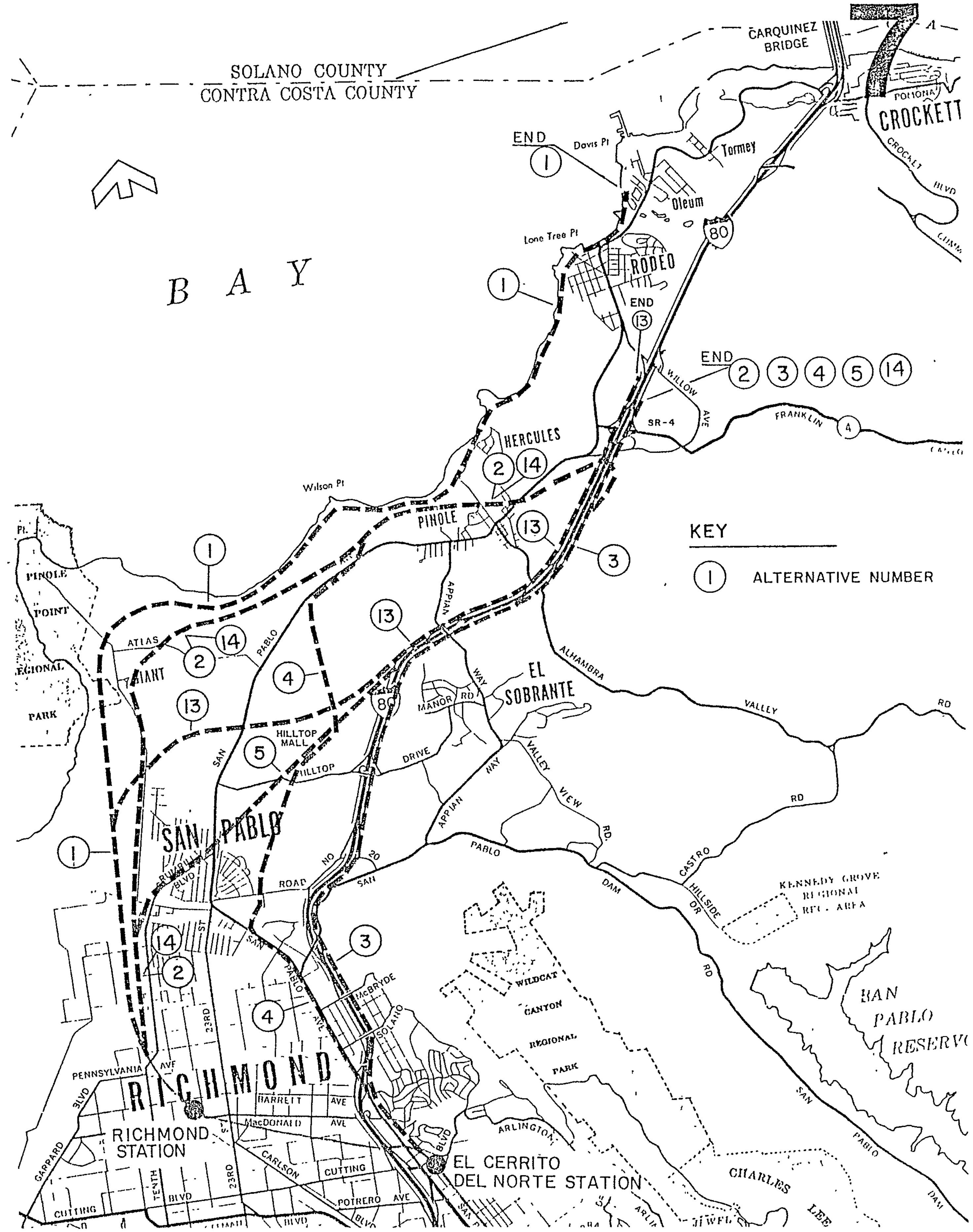


FIGURE 6
ALTERNATIVE BART RAIL EXTENSIONS 1, 2, 3, 4, 5, 13 & 14
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

section of this chapter discusses the implications of further extensions beyond State Route 4.

7.1 Physical Features

The key physical features of the alternatives are summarized in Table 23. Alternatives 1, 2/14, 5, and 13 would extend directly north from the existing Richmond Station. Alternatives 3 and 4 would extend north from the El Cerrito Del Norte Station. In order to accomplish an extension from El Cerrito Del Norte, a grade separated crossover and junction of the BART tracks would be required north of the station. Extensions from El Cerrito Del Norte would create two BART terminals in the study area, one at the existing Richmond Station and a new terminal near State Route 4. Detailed drawings depicting the alignment and vertical profiles of the alternatives are presented in Appendix E.

7.1.1 Northern Terminus

With the exception of Alternative 1, which follows the Southern Pacific alignment along the Bayfront, all the alternatives could provide a terminus near the State Route 4/ Interstate-80 Interchange area. Alternative 1 would have the disadvantage of reduced accessibility from Interstate-80 and State Route 4, and of reduced flexibility for future extensions as compared with the other alternatives.

7.1.2 Length

The alterntatives range from 7.6 to 9.9 miles in length. Alternative 1, which extends from Richmond to Rodeo via the Southern Pacific right-of-way is 1.0 mile longer than any of the other alignments. The shortest alignment is Alternative 5, which extends from the Richmond Station to State Route 4 via Rumrill Boulevard, Hilltop Mall, and Interstate-80. The remainder of the alternatives are clustered between 8.0 and 8.9 miles in length.

7.1.3 Stations

The majority of the alternatives provide the opportunity for four logically spaced and located stations in the study area. Alternatives 2/14 and 3, however, afford the opportunity for three stations along their alignments, somewhat reducing their relative accessibility from the study area.

7.1.4 Yards and Tail Tracks

Those alignments which extend north of the Richmond Station would offer significant advantages in terms of maintenance and train station facilities. The Richmond Station extensions would not require a new yard in the study area. This is an important consideration, since a new yard would be costly to construct and limited sites are available in the study area which are suitable for a yard facility. These alternatives would require a 3000 foot train storage track (tail track) at the end of the line to reduce the need to deadhead trains taken out of service during the midday and evening all of the way from the end of the line to Richmond and then back when the trains are returned to service.

Alternatives 3 and 4 which extend from El Cerrito Del Norte would require a new yard facility because of their remoteness from the Richmond yard. A potential site for the yard facility has been located in the Refugio Valley east of Interstate-80, adjacent to existing State Route 4. With construction of a new yard along the extension the tail track requirement is reduced to 1000 feet.

Table 23

SUMMARY COMPARISON OF ALTERNATIVES

PHYSICAL FEATURES

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE		EXTENSION FROM	NORTH TERMINUS(1)	LENGTH (Miles)	NUMBER OF STATIONS	YARD REQUIREMENTS	TAIL TRACK LENGTH
1	Southern Pacific	Richmond	Rodeo	9.9	4	Use Richmond Yard	3,000 Ft.
2/14	AT & SF Railway (2)	Richmond	SR-4	8.2	3	Use Richmond Yard	3,000 Ft.
3	Inter-State-80	El Cerrito	SR-4	8.1	3	New Yard/ Refugio Valley	1,000 Ft.
4	San Pablo Avenue	El Cerrito	SR-4	8.9	4	New Yard/ Refugio Valley	1,000 Ft.
5	Rumrill/Hill-top/I-80	Richmond	SR-4	7.6	4	Use Richmond Yard	3,000 Ft.
13	Hilltop/I-80	Richmond	SR-4	8.0	4	Use Richmond Yard	3,000 Ft.

1) For purposes of comparison all alternatives were terminated at State Route 4 or Rodeo
2) Between Richmond and State Route 4 Alternatives 2 and 14 have identical alignments

7.1.5 Other Features

Other important physical features which distinguish the alternatives are summarized below:

Alternative 1 - This alternative uses the Southern Pacific right-of-way, but must incorporate extensive aerial structures to avoid conflicts with utilities and spur tracks.

Alternative 2/14 - This alternative follows the Santa Fe alignment but requires additional adjacent right-of-way. Conflicts with utilities and spur tracks are much less extensive than those associated with Alternative 1, allowing at-grade construction.

Alternative 3 - This alignment parallels the east side of Interstate-80 through very hilly terrain. Extensive earth cuts and fills, aerial structures and some tunnelling would be required to build this alignment. The alignment would be characterized by several grades which equal BART's maximum design standards, limiting train speeds. This alignment would cross the Hayward Fault on an aerial structure, posing design complexities.

Alternative 4 - This alignment would require an aerial structure down the median of San Pablo Boulevard. The approaches to Hilltop Mall would require steep gradients and extensive tunnelling.

Alternative 5 - Alternative 5 requires an aerial structure in the median of Rumrill Boulevard in San Pablo. Similar to Alternative 4, access to Hilltop Mall would require extensive tunnelling.

Alternative 13 - This alternative would traverse hilly terrain near Hilltop Mall and along the west side of Interstate-80 requiring earth cuts and fills and some tunnelling. Unlike the other alternatives which parallel Interstate-80, this alternative would conflict with the proposed Interstate-80 HOV lane project.

7.2 Capital Costs - Fixed Facilities

The total capital costs for fixed facilities of the alternatives vary significantly, from $144 million to $402 million. As shown in Table 24, Alternative 4 would have the greatest total fixed facilities cost primarily due to the tunnelling requirements near Hilltop Mall, the aerial structure required along San Pablo Avenue and the new yard required in the Refugio Valley. Alternatives 1 and 2/14 would require the least investment in capital facilities. This is due to their use of the relatively flat, obstruction-free alignments created by both the Southern Pacific and Santa Fe railroads. The costs per mile for each alternative also vary dramatically from $17.4 million for Alternative 1 to $45.2 million for Alternative 4. Alternatives 4 and 5, both of which require costly tunnels to reach Hilltop Mall, are considerably more expensive than the other alternatives.

7.2.1 Vehicle Requirements

The number of additional vehicles required to operate the planned level of service on the extension ranges from 24 vehicles for Alternative 1 to 39 vehicles for Alternative 4 (see Table 24). The number of vehicles required is a direct function of the length of the extension and the average operating speeds which are achievable on each extension. The analysis of vehicle requirements considered two basic service concepts: through service with direct Daly City - State Route 4 trains and shuttle service which would serve only the extension and require a transfer at either the Richmond Station or the El Cerrito Del Norte Station. This summary evaluation of the alternative considers only the through service option in order to simplify comparisons between the alignment alternatives. The costs of the vehicles required would range from $29 million for Alternative 1 to $47 million for Alternative 4.

Table 24

SUMMARY COMPARISON OF ALTERNATIVES

CAPITAL COSTS

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE (1)		CAPITAL COSTS-FIXED FACILITIES (In 1982 $ millions)	FIXED FACILITY COST/MILE (In 1982 $ millions)	NUMBER OF TRAINS VEHICLES REQUIRED (3) (4)	VEHICLE COSTS (In 1982 $ millions)	TOTAL CAPITAL COSTS (In 1982 $ millions)
1	Southern Pacific	$ 146	$ 14.7	2/24	$ 29	$ 175
2/14	AT & SF Railway (2)	144	17.6	2/27	32	176
3	Interstate-80	183	22.6	3/33	40	223
4	San Pablo Avenue	402	45.2	3/39	47	449
5	Rumrill/Hill-top/I-80	291	38.3	3/38	46	337
13	Hilltop/I-80	165	20.6	3/32	38	203

(1) For purposes of comparison all alternatives were terminated at State Route 4 or Rodeo
(2) Between Richmond and State Route 4 Alternatives 2 and 14 have identical alignments
(3) Additional BART cars required to operate through service (State Route 4 to Daly City)
(4) Trains required were developed assuming 10 car trains and 15 percent spare requirements.

7.3 Operating Costs, Patronage and Revenues

A summary of the operating costs, patronage and revenue estimates for each alternative is provided in Table 25.

7.3.1 Operating Costs

The estimated annual operating costs of the new extension service would range from $6.2 million to $7.1 million. The difference between alternatives is largely a function of the length of the extension. The variation in operating costs is significant. For example, the operating costs for Alternative 4 would be 15 percent greater than those of Alternative 3.

7.3.2 Patronage

A considerable variation in the future patronage generated by the various extension alternatives is anticipated. Table 26 presents the service quality or performance characteristics of the alternatives which would influence patronage. The least patronage is expected for the two railroad related alignment Alternatives 1 and 2/14. The alignments of these alternatives are well to the west of the existing population centers of the study area and are not very accessible from Interstate-80. The greatest patronage is expected on Alternatives 4 and 5. These alignments allow stations at key developed and developing areas of the study area, such as central San Pablo, Hilltop Mall, Pinole, and State Route 4. The other alternatives, 3 and 13, would provide mid-range patronage levels. They offer better accessibility than the two railroad alignments, but are not as well oriented to serve North Richmond and San Pablo as Alternatives 4 and 5.

7.3.3 Fare Revenue/Cost Relationships

The ratio of estimated fare revenues, as derived from the patronage forecast, to the operating costs of the extension provides a direct measure of system productivity. Currently the BART system recovers 45 percent of its operating costs from farebox revenues. The farebox ratio for the extension alternatives would range from 23 percent for Alternative 1 to 43 percent for Alternative 5. The railroad alignment Alternatives 1 and 2/14 have significantly poorer estimated future recovery ratios than the other alternatives.

7.3.4 Operating Cost Per Passenger

Another productivity measure is the operating cost for each one-way passenger trip. This value was measured for both gross patronage (total future ridership on the extension) and incremental patronage (new ridership excluding existing BART riders). The estimated cost to BART for providing service to each new or incremental passenger trip would be $3.31 to $6.59. Thus, the cost per passenger trips associated with Alternative 1 would be 100 percent greater than that associated with Alternative 5.

7.4 Environmental Factors

A preliminary environmental assessment of the alternatives was conducted to discern any potentially significant environmental impacts which could be associated with each alternative. The key environmental issues which were identified in areas where significant impacts may occur include:

1. Displacement of Businesses and Homes
2. Traffic or Transportation Impacts

Table 25

SUMMARY COMPARISON OF ALTERNATIVES

OPERATING COSTS, PATRONAGE AND REVENUES

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE[1]	ANNUAL[3] OPERATING COST (In 1982 $ millions)	ONE-WAY DAILY[4] PASSENGER TRIPS	ANNUAL FARE REVENUE[3] (In 1982 $ millions)	FAREBOX[3][5] RECOVERY RATIO	OPERATING COST/PASSENGER TRIP
1 - Southern Pacific	6.9	5,200 - 8,200	1.2 - 1.9	23	$ 6.59
2/14 - AT&SF Railway[2]	6.8	6,400 - 9,800	1.5 - 2.2	28	5.38
3 - Interstate-80	6.2	8,400 - 13,200	1.9 - 3.0	40	3.66
4 - San Pablo Avenue	7.1	10,000 - 16,000	2.3 - 3.6	42	3.46
5 - Rumrill/ Hilltop/I-80	6.7	10,000 - 15,600	2.3 - 3.5	43	3.31
13 - Hilltop/I-80	6.9	7,800 - 12,400	1.8 - 2.8	33	4.33

(1) For purposes of comparison all alternatives were terminated at State Route 4 or Rodeo.

(2) Between Richmond and State Route 4 Alternatives 2 and 14 have identical alignments.

(3) For thru service operating concept, direct State Route 4 to Daly City trains.

(4) Includes existing BART patrons ("old riders").

(5) Ratio of mid-range gross fare revenue to operating cost, thru service.

Table 26
SUMMARY COMPARISON OF ALTERNATIVES [1]
SERVICE PERFORMANCE INDICATORS

BART WEST CONTRA COSTA EXTENSION STUDY

ALTERNATIVE	SPEED MPH	TRAVEL TIMES (MINUTES) [3]				SERVICE COVERAGE (AREAS SERVED) [6]					
		SR-4 To San Francisco [2]	SR-4 To Richmond	SR-4 To El Cerrito	Hilltop To El Cerrito	Central San Pablo	Central Pinole	Hilltop	Hercules	SR-4/I-80	Rodeo
1 - Southern Pacific	43	55.0	14.5	19.5	N/A [5]	NO	YES	NO	YES	NO	YES
2/14 - AT&SF Railway	45	51.5	11.6	16.0	N/A [5]	NO	YES	NO	YES	YES	NO
3 - Interstate-80	42	48.5	24.0 [4]	11.5	5.4	NO	YES	YES	NO	YES	NO
4 - San Pablo Avenue	41	49.1	24.6 [4]	12.5	6.8	YES	YES	YES	NO	YES	NO
5 - Rumrill/Hilltop/I-80	41	51.8	11.8	16.3	11.3	YES	YES	YES	NO	YES	NO
13 - Hilltop/I-80	41	52.5	12.5	17.0	11.3	NO	YES	YES	NO	YES	NO

(1) For purposes of comparison all alternatives are assumed to terminate at State Route 4 or Rodeo.
(2) Montgomery Street Station.
(3) In-Vehicle-Time plus transfer station wait time. Excludes dwell times at boarding station.
(4) Transfer required at El Cerrito Del Norte Station.
(5) This alignment does not serve Hilltop Mall.
(6) Station within approximately one mile of served area.

3. Visual or Aesthetic Impacts
4. Noise Impacts
5. Air Quality Impacts
6. Biological Impacts
7. Geologic Impacts
8. Impacts to Historic Sites, Archeological Sites, and Park Lands.

Table 27 presents preliminary findings of environmental sensitivity for each alternative. Sensitivity ratings are based upon the following ranking system: 1 representing least sensitive, 2 representing moderately sensitive, and 3 representing most sensitive. A summary discussion of the environmental features of each alternative is provided below:

Alternative 1: Southern Pacific Railroad Route

This alignment would utilize an existing transportation corridor. Proximity to the Bay would result in Bay Conservation and Development Commission (BCDC) involvement and potential review by the East Bay Regional Park District. Several rare or endangered species inhabit areas within this route and could be impacted. This route is least accessible to potential users except at its northern terminus. Special engineering would be required for extensive cuts, location on bayfill and one tunnel. Potential parkland and archaeological impacts are likely.

Alternative 2/14: Santa Fe Railway Route

This alignment would result in displacement of several mobile homes. The route would be more accessible to potential users and less prominent visually. Utilizing an existing transportation corridor, this alignment would be one of the three less sensitive alternatives.

Alternative 3: Paralleling East Side of Interstate-80

This alignment would result in several displacements. Utilizing an existing transportation corridor, this route would require extensive cuts, fills and aerial sections that would be highly visible. This alternative crosses the Hayward Fault on an aerial structure, a design problem which must be addressed.

Alternative 4: San Pablo Avenue and Hilltop Mall

This route would serve downtown San Pablo and the Hilltop Mall. Three displacements would be necessary. The aerial section along San Pablo Avenue would be highly visible and could result in traffic and parking related impacts. This urban area contains several receptors sensitive to noise. Potential parkland and historical impacts are likely.

Alternative 5: Rumrill Boulevard

This alignment would result in several displaced mobile homes. By avoiding dense urban areas this alternative would be less sensitive visually and acoustically than other alternatives. Sensitive receptors are minimal for this route.

Alternative 13: Hilltop Mall and Interstate-80 to State Route 4

This route would not result in any displacements and would be readily accessible to users. By avoiding urban street rights-of-way, traffic disruptions during construction would be minimized. Extensive cuts and fills and a tunnel section would require special design consideration.

7.5 Extensions North of State Route 4

Initially many of the alternatives were developed with a northern terminus at either Crockett or Cummings Skyway. To

Table 27

SUMMARY EVALUATION OF ALTERNATIVES

ENVIRONMENTAL SENSITIVITY

BART WEST CONTRA COSTA EXTENSION STUDY

ENVIRONMENTAL ISSUE	ALTERNATIVE					
	1	2/14	3	4	5	13
Displacements	1	2	2	2	2	1
Traffic Impacts	3	2	1	3	2	1
Visual and Aesthetics	2	1	3	3	2	3
Noise	1	2	2	3	1	1
Air Quality	1	1	1	1	1	1
Biology	3	2	2	2	2	1
Geology	3	2	2	2	2	3
Historic Sites/Archaeology/Park lands	3	2	2	3	1	1

Note: Sensitivity ratings are based on the following ranking; 1 representing least sensitive, 2 representing moderately sensitive, and 3 representing most sensitive.

facilitate comparisons between alternatives and to provide a logical northern terminus in the study area which would not rule out future extensions, the terminus was modified to either State Route 4 or Rodeo. This section summarizes the implications of a further extension to either Crockett or Cummings Skyway.

7.5.1 Crockett Extensions

Alternatives 1 and 2 were originally planned to terminate in Crockett. An extension from Rodeo to Crockett would require an additional 3.3 miles of BART trackage (excluding tail tracks) and $113 million dollars in fixed facilities cost. This cost represents 78 percent of the capital costs for Alternatives 1 and 2 with a Rodeo terminus. The additional daily patronage generated by a Crockett station would be modest, approximately 800-1,200 one-way passenger trips/day. The incremental operating cost per passenger trip would be about $11.15, depending on the alignment and type of service. Additionally, the Crockett Station and tail track would be disruptive to the Crockett waterfront area and would considerably complicate the option of a future extension across the Carquinez Strait.

7.5.2 Cummings Skyway Extensions

An extension from State Route 4 to Cummings Skyway would involve an additional 2.7 miles of BART construction and $51.6 million, representing an increase of 28 percent in the total cost of the extension of Alternative 3 which terminates at SR-4. The additional patronage generated by this extension would also be low, since most patrons, particularly Interstate-80 commuters, could just as easily use the State Route 4 Station. Incremental operating costs per new passenger trip of $9.76 are estimated for a further extension to Cummings Skyway.

APPENDIX

Appendix A

BART UNIT COST ASSUMPTIONS

Appendix A
BART UNIT COST ASSUMPTIONS

Item		Unit	1982 $
Trackwork			
1	At Grade Track	Trackfoot	137
2	Track on aerial structure	Trackfoot	100
3	Yard track	Trackfoot	73
4	Turnout #20	EA	30,000
5	Turnout #15	EA	25,000
6	Turnout #10	EA	18,000
7	Turnout #8 (Yard)	EA	15,000
Structures and Civil Work			
1	Earthwork:		
	a) Major Cuts (in excess of 3 ft.)	Cu. Yd.	6.50
	b) Rock excavation	Cu. Yd.	72.80
	c) Major fills (in excess of 3 ft.)	Cu. Yd.	4.70
2	Cut and cover structure (double track)	Trackfoot	3,400
3	Tunnel	Trackfoot	8,000
4	BART aerial structure (single)	LF	1,620
5	BART aerial structure (double track)	LF	2,163
6	Major Culvert	SF	42
7	Highway concrete box girder bridge:		
	a) Span: L<130'	SF	55
	b) Span: 130'<L<160'	SF	74
	c) Span: 160'<L<200'	SF	92
8	Pedestrian overcrossing	SF	50
9	Pumping plant	EA	277,000

BART UNIT COST ASSUMPTIONS (Cont'd)

Item		Unit	1982 $
10	Retaining walls:		
	a) Height 6' to 10'	LF	290
	b) Height 12' to 20'	LF	880
11	40 ft. wide city street relocation	LF	225
12	Railroad relocation	Trackmile	360,000
Utility Relocation			
1	Site-specific requirements	LS	-
Track Electrification			
1	Traction power (substations @ 1.5 mi.)	Dbl. Trackft.	327
Train Control			
1	Train control complete	Dbl. Trackft.	208
Communications			
1	Train communications complete	Dbl. Trackft.	48
Stations (fully equipped)			
1	At-grade station	EA	2,965,000
2	Aerial station	EA	5,240,000
3	Cut and cover subway station	EA	28,135,000
Parking Facilities			
1	Parking lot space	EA	2,372
2	Two level parking structure space	EA	4,400
3	50' wide access road (2 lane)	LF	280

BART UNIT COST ASSUMPTIONS (Cont'd)

Item		Unit	1982 $
Additional Items			
1	Fencing (CL6)	LF	7
2	Concrete barrier	LF	93
3	Landscaping	SF	4
4	Temporary detour maintenance	LS	100,000
Storage Facilities			
1	Yard track (10,000 T.F.) & appurtenances	LS	5,693,000,
2	Tail track 1,000 LF (Site Specific)	LS	-
3	Tail track 3,000 LF (Site Specific)	LS	-
Transit Vehicles			
1	Model 'C' Cars	EA	1,200.000

Appendix B

SEGMENT COST ESTIMATES

Table B-1

BART CAPITAL COST ESTIMATES
1982 Dollars (000's)

Estimated Capital Costs and Fixed Facilities Alternative Alignments - BART West Contra Costa Extension

Capital Cost Items	Alternative 1	Alternative 2	Alternative 3	Alternative 4	Alternative 5	Alternative 6	Alternative 7	Alternative 8
1. Trackwork	$ 18,579	$ 19,574	$ 13,640	$ 18,469	$ 13,899	$ 16,813	$ 18,789	$ 19,364
2. Structures & Civil Work	84,602	87,651	87,131	193,234	147,725	173,921	78,883	93,407
3. Utility Relocation	18,698	8,930	800	13,100	1,520	13,630	11,740	16,183
4. Track Electrification	22,890	23,383	18,737	24,528	17,756	21,419	22,001	24,199
5. Train Control	14,562	14,874	11,918	15,602	11,294	13,626	14,042	15,394
6. Communication	3,288	3,432	2,750	3,600	2,606	3,144	3,240	3,552
7. Stations	17,100	19,375	18,685	47,510	46,820	45,235	17,100	19,375
8. Parking Facilities	3,922	4,382	5,232	5,093	5,280	4,523	3,574	4,730
9. Additional Items	1,034	935	1,522	910	1,798	920	936	1,033
10. Storage Facilities	2,848	2,848	11,559	6,660	6,615	2,848	2,848	2,848
Base Total	187,523	185,384	172,074	328,706	255,313	296,079	173,153	200,085
+15% Contingencies	28,128	27,808	25,811	49,306	38,297	44,412	25,973	30,013
Construction Costs	215,651	213,192	197,885	378,012	293,610	340,491	199,126	230,098
+15% Agency Cost*	32,348	31,979	29,683	56,702	44,041	51,074	29,869	34,515
Subtotal	247,999	245,170	227,568	434,714	8,454	391,564	228,995	264,613
Right-of-Way Cost	10,733	7,339	6,513	17,959	8,454	11,257	10,612	13,710
Relocation Cost	-	1,850	490	1,220	400	930	1,330	130
GRAND ESTIMATED TOTAL	258,732	254,359	234,571	453,893	346,505	403,751	240,937	278,453

NOTES: 1) Vehicle fleet costs are not included.
2) Row costs for tailtrack and yard are included.

*(Eng. & Cost Mangt.)

Table B-1 (Continued)

BART CAPITAL COST ESTIMATES
1983 Dollars (000's)

Capital Cost Items	Alternative 9	Alternative 10	Alternative 11	Alternative 12	Alternative 13	Alternative 14	Alternative 15
1. Trackwork	$ 17,494	$ 17,684	$ 17,598	$ 14,331	$ 9,974	$ 17,532	$ 14,770
2. Structures & Civil Work	121,966	184,457	182,698	172,134	51,880	56,815	158,261
3. Utility Relocation	9,190	15,910	10,820	9,910	1,688	1,440	3,800
4. Track Electrification	23,217	23,218	22,729	18,050	13,734	20,047	19,555
5. Train Control	14,770	14,770	14,458	11,484	8,736	12,750	12,438
6. Communication	3,408	3,408	3,336	2,650	2,016	2,942	2,870
7. Stations	21,650	45,235	47,510	44,545	18,685	16,590	46,820
8. Parking Facilities	5,591	4,285	5,331	4,787	5,769	4,387	5,042
9. Additional Items	1,189	911	919	846	985	1,381	1,789
10. Storage Facilities	6,660	6,660	2,848	2,848	4,971	6,615	11,559
Base Total	225,135	316,538	308,247	281,585	118,438	140,499	276,904
+15% Contingencies	33,770	47,481	46,237	42,238	17,766	21,075	41,536
Construction Costs	258,905	364,019	354,484	323,823	136,204	161,574	318,440
+15% Agency Cost*	38,836	54,306	53,173	48,573	20,431	24,236	47,766
Subtotal	297,741	418,622	407,657	372,396	156,634	185,810	366,206
Right-of-Way Cost	9,065	14,857	14,364	11,664	8,764	11,253	11,663
Relocation Cost	490	700	650	400	-	1,850	570
GRAND ESTIMATED TOTAL	307,296	434,179	422,671	384,460	165,398	198,913	378,439

NOTES: 1) Vehicle fleet costs are not included.
2) Row costs for tailtrack and yard are included.

*(Eng. & Cost Mangt.)

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 1A/1

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,649
2. Structures and Civil Work	16,152
3. Utility Relocation	1,388
4. Track Electrification	3,270
5. Train Control	2,080
6. Communications	480
7. Stations	5,240
8. Parking Facilities	1,005
9. Additional Items	155
Base Total	32,419
+15% Contingencies	4,863
Construction Costs	37,282
+15% Agency Cost[2]	5,592
Subtotal	42,874
Right-of-Way Cost	1,699
Relocation Cost	-
Estimated Grand Total	$44,573

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 1A/2

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	6,858
2. Structures and Civil Work	19,447
3. Utility Relocation	6,270
4. Track Electrification	8,829
5. Train Control	5,616
6. Communications	1,296
7. Stations	2,965
8. Parking Facilities	530
9. Additional Items	473
Base Total	52,284
+15% Contingencies	7,843
Construction Costs	60,127
+15% Agency Cost[2]	9,019
Subtotal	69,146
Right-of-Way Cost	3,242
Relocation Cost	-
Estimated Grand Total	$72,388

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 1B

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	274
2. Structures and Civil Work	24
3. Utility Relocation	295
4. Track Electrification	327
5. Train Control	208
6. Communications	48
7. Stations	-
8. Parking Facilities	-
9. Additional Items	14
Base Total	1,190
+15% Contingencies	179
Construction Costs	1,369
+15% Agency Cost[2]	205
Subtotal	1,574
Right-of-Way Cost	104
Relocation Cost	-
Estimated Grand Total	$1,678

[1] Excludes yard and tail track requirements.
[2] Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 1C

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,466
2. Structures and Civil Work	1,589
3. Utility Relocation	2,655
4. Track Electrification	2,943
5. Train Control	1,872
6. Communications	432
7. Stations	2,965
8. Parking Facilities	852
9. Additional Items	126
Base Total	15,900
+15% Contingencies	2,385
Construction Costs	18,285
+15% Agency Cost[2]	2,743
Subtotal	21,028
Right-of-Way Cost	1,654
Relocation Cost	-
Estimated Grand Total	$22,682

[1] Excludes yard and tail track requirements.
[2] Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 1D

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	6,332
2. Structures and Civil Work	47,390
3. Utility Relocation	8,090
4. Track Electrification	7,521
5. Train Control	4,786
6. Communications	1,104
7. Stations	5,930
8. Parking Facilities	1,535
9. Additional Items	266
Base Total	82,954
+15% Contingencies	12,443
Construction Costs	95,397
+15% Agency Cost[2]	14,310
Subtotal	109,707
Right-of-Way Cost	3,317
Relocation Cost	-
Estimated Grand Total	$113,024

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2A

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,204
2. Structures and Civil Work	7,146
3. Utility Relocation	120
4. Track Electrification	1,962
5. Train Control	1,248
6. Communications	288
7. Stations	-
8. Parking Facilities	-
9. Additional Items	184
Base Total	13,152
+15% Contingencies	1,973
Construction Costs	15,125
+15% Agency Cost[2]	2,269
Subtotal	17,394
Right-of-Way Cost	598
Relocation Cost	400
Estimated Grand Total	$18,392

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2B

Item	Cost 1982 Dollars (000's) (1)
1. Trackwork	6,691
2. Structures and Civil Work	22,676
3. Utility Relocation	510
4. Track Electrification	8,339
5. Train Control	5,304
6. Communications	1,224
7. Stations	5,240
8. Parking Facilities	475
9. Additional Items	304
Base Total	50,763
+15% Contingencies	7,614
Construction Costs	58,377
+15% Agency Cost (2)	8,757
Subtotal	67,134
Right-of-Way Cost	3,715
Relocation Cost	800
Estimated Grand Total	$71,649

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2C

Item	Cost 1982 Dollars (000's) (1)
1. Trackwork	411
2. Structures and Civil Work	21
3. Utility Relocation	30
4. Track Electrification	491
5. Train Control	312
6. Communications	72
7. Stations	2,965
8. Parking Facilities	712
9. Additional Items	21
Base Total	5,035
+15% Contingencies	755
Construction Costs	5,790
+15% Agency Cost (2)	869
Subtotal	6,659
Right-of-Way Cost	1,048
Relocation Cost	130
Estimated Grand Total	$7,837

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2D

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	959
2. Structures and Civil Work	49
3. Utility Relocation	70
4. Track Electrification	1,145
5. Train Control	728
6. Communications	168
7. Stations	-
8. Parking Facilities	-
9. Additional Items	49
Base Total	3,168
+15% Contingencies	475
Construction Costs	3,643
+15% Agency Cost[2]	546
Subtotal	4,189
Right-of-Way Cost	413
Relocation Cost	390
Estimated Grand Total	$4,992

[1] Excludes yard and tail track requirements.
[2] Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2E/1

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	1,418
2. Structures and Civil Work	5,748
3. Utility Relocation	110
4. Track Electrification	1,799
5. Train Control	1,144
6. Communications	264
7. Stations	-
8. Parking Facilities	-
9. Additional Items	62
Base Total	10,545
+15% Contingencies	1,582
Construction Costs	12,127
+15% Agency Cost[2]	1,819
Subtotal	13,946
Right-of-Way Cost	601
Relocation Cost	130
Estimated Grand Total	$14,677

[1] Excludes yard and tail track requirements.
[2] Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 2E/2

Item	Cost 1982 Dollars (000's)(1)
1. Trackwork	500
2. Structures and Civil Work	2,408
3. Utility Relocation	-
4. Track Electrification	818
5. Train Control	520
6. Communications	120
7. Stations	5,240
8. Parking Facilities	1,660
9. Additional Items	-
Base Total	11,266
+15% Contingencies	1,690
Construction Costs	12,956
+15% Agency Cost(2)	1,943
Subtotal	14,899
Right-of-Way Cost	2,124
Relocation Cost	-
Estimated Grand Total	$17,023

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 3A

Item	Cost 1982 Dollars (000's)(1)
1. Trackwork	5,593
2. Structures and Civil Work	56,483
3. Utility Relocation	800
4. Track Electrification	8,502
5. Train Control	5,408
6. Communications	1,248
7. Stations	5,240
8. Parking Facilities	1,376
9. Additional Items	126
Base Total	84,776
+15% Contingencies	12,716
Construction Costs	97,492
+15% Agency Cost(2)	14,624
Subtotal	112,116
Right-of-Way Cost	785
Relocation Cost	490
Estimated Grand Total	$113,391

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 3B

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	3,322
2. Structures and Civil Work	10,426
3. Utility Relocation	-
4. Track Electrification	4,186
5. Train Control	2,662
6. Communications	614
7. Stations	5,240
8. Parking Facilities	852
9. Additional Items	619
Base Total	27,921
+15% Contingencies	4,188
Construction Costs	32,109
+15% Agency Cost[2]	4,816
Subtotal	36,925
Right-of-Way Cost	374
Relocation Cost	-
Estimated Grand Total	$37,299

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 3C/1

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,247
2. Structures and Civil Work	14,756
3. Utility Relocation	-
4. Track Electrification	3,008
5. Train Control	1,914
6. Communications	442
7. Stations	5,240
8. Parking Facilities	1,744
9. Additional Items	180
Base Total	29,531
+15% Contingencies	4,429
Construction Costs	33,960
+15% Agency Cost[2]	5,094
Subtotal	39,054
Right-of-Way Cost	1,200
Relocation Cost	-
Estimated Grand Total	$40,254

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 3C/2

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,578
2. Structures and Civil Work	5,466
3. Utility Relocation	-
4. Track Electrification	3,041
5. Train Control	1,934
6. Communications	446
7. Stations	2,965
8. Parking Facilities	1,260
9. Additional Items	597
Base Total	18,287
+15% Contingencies	2,743
Construction Costs	21,030
+15% Agency Cost[2]	3,154
Subtotal	24,184
Right-of-Way Cost	640
Relocation Cost	-
Estimated Grand Total	$24,824

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 4A

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	5,090
2. Structures and Civil Work	80,493
3. Utility Relocation	3,800
4. Track Electrification	7,031
5. Train Control	4,472
6. Communications	1,032
7. Stations	5,240
8. Parking Facilities	474
9. Additional Items	343
Base Total	107,975
+15% Contingencies	16,196
Construction Costs	124,171
+15% Agency Cost[2]	18,626
Subtotal	142,797
Right-of-Way Cost	2,585
Relocation Cost	210
Estimated Grand Total	$145,592

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 4B

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,700
2. Structures and Civil Work	54,912
3. Utility Relocation	1,000
4. Track Electrification	4,415
5. Train Control	2,808
6. Communications	648
7. Stations	28,135
8. Parking Facilities	712
9. Additional Items	120
Base Total	95,450
+15% Contingencies	14,318
Construction Costs	109,768
+15% Agency Cost[2]	16,465
Subtotal	126,233
Right-of-Way Cost	2,336
Relocation Cost	-
Estimated Grand Total	$128,569

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 5A

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,015
2. Structures and Civil Work	62,811
3. Utility Relocation	1,400
4. Track Electrification	3,270
5. Train Control	2,080
6. Communications	480
7. Stations	5,240
8. Parking Facilities	712
9. Additional Items	168
Base Total	78,176
+15% Contingencies	11,726
Construction Costs	89,902
+15% Agency Cost[2]	13,485
Subtotal	103,388
Right-of-Way Cost	1,312
Relocation Cost	-
Estimated Grand Total	$104,700

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: 5B

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	1,533
2. Structures and Civil Work	47,120
3. Utility Relocation	-
4. Track Electrification	2,289
5. Train Control	1,456
6. Communications	336
7. Stations	28,135
8. Parking Facilities	712
9. Additional Items	50
Base Total	81,631
+15% Contingencies	12,245
Construction Costs	93,876
+15% Agency Cost[2]	14,081
Subtotal	107,957
Right-of-Way Cost	2,870
Relocation Cost	-
Estimated Grand Total	$110,827

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Y1

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	1,188
2. Structures and Civil Work	5,454
3. Utility Relocation	300
4. Track Electrification	1,700
5. Train Control	1,082
6. Communications	250
7. Stations	5,240
8. Parking Facilities	1,828
9. Additional Items	129
Base Total	17,171
+15% Contingencies	2,576
Construction Costs	19,747
+15% Agency Cost[2]	2,962
Subtotal	22,709
Right-of-Way Cost	952
Relocation Cost	-
Estimated Grand Total	$23,661

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Y2

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	1,059
2. Structures and Civil Work	2,213
3. Utility Relocation	-
4. Track Electrification	1,308
5. Train Control	832
6. Communications	192
7. Stations	-
8. Parking Facilities	-
9. Additional Items	49
Base Total	5,653
+15% Contingencies	849
Construction Costs	6,502
+15% Agency Cost[2]	975
Subtotal	7,477
Right-of-Way Cost	1,898
Relocation Cost	-
Estimated Grand Total	$9,375

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Y3

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	803
2. Structures and Civil Work	2,891
3. Utility Relocation	300
4. Track Electrification	981
5. Train Control	624
6. Communications	144
7. Stations	-
8. Parking Facilities	-
9. Additional Items	123
Base Total	5,866
+15% Contingencies	880
Construction Costs	6,746
+15% Agency Cost[2]	1,012
Subtotal	7,758
Right-of-Way Cost	440
Relocation Cost	-
Estimated Grand Total	8,198

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Y4

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	702
2. Structures and Civil Work	5,128
3. Utility Relocation	500
4. Track Electrification	981
5. Train Control	624
6. Communications	144
7. Stations	5,420
8. Parking Facilities	1,940
9. Additional Items	115
Base Total	15,554
+15% Contingencies	2,333
Construction Costs	17,887
+15% Agency Cost[2]	2,683
Subtotal	20,570
Right-of-Way Cost	1,478
Relocation Cost	-
Estimated Grand Total	$22,048

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Y5

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	2,069
2. Structures and Civil Work	10,581
3. Utility Relocation	100
4. Track Electrification	2,289
5. Train Control	1,456
6. Communications	336
7. Stations	-
8. Parking Facilities	-
9. Additional Items	49
Base Total	16,880
+15% Contingencies	2,532
Construction Costs	19,412
+15% Agency Cost[2]	2,912
Subtotal	22,324
Right-of-Way Cost	1,320
Relocation Cost	-
Estimated Grand Total	$23,644

(1) Excludes yard and tail track requirements.
(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST

WEST CONTRA COSTA EXTENSION

SEGMENT: 13

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	7,325
2. Structures and Civil Work	35,728
3. Utility Relocation	300
4. Track Electrification	10,464
5. Train Control	6,656
6. Communications	1,536
7. Stations	13,445
8. Parking Facilities	4,764
9. Additional Items	830
Base Total	81,048
+15% Contingencies	12,157
Construction Costs	93,205
+15% Agency Cost[2]	13,981
Subtotal	107,186
Right-of-Way Cost	7,065
Relocation Cost	-
Estimated Grand Total	$114,251

(1) Excludes yard and tail track requirements.

(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST

WEST CONTRA COSTA EXTENSION

SEGMENT: X

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	411
2. Structures and Civil Work	28
3. Utility Relocation	40
4. Track Electrification	490
5. Train Control	312
6. Communications	72
7. Stations	-
8. Parking Facilities	-
9. Additional Items	21
Base Total	1,374
+15% Contingencies	206
Construction Costs	1,580
+15% Agency Cost[2]	237
Subtotal	1,817
Right-of-Way Cost	176
Relocation Cost	-
Estimated Grand Total	$1,993

(1) Excludes yard and tail track requirements.

(2) Includes engineering and construction management.

ESTIMATED CAPITAL COST
WEST CONTRA COSTA EXTENSION

SEGMENT: Z

Item	Cost 1982 Dollars (000's)[1]
1. Trackwork	274
2. Structures and Civil Work	17
3. Utility Relocation	30
4. Track Electrification	327
5. Train Control	208
6. Communications	48
7. Stations	-
8. Parking Facilities	-
9. Additional Items	14
Base Total	918
+15% Contingencies	138
Construction Costs	1,056
+15% Agency Cost[2]	158
Subtotal	1,214
Right-of-Way Cost	112
Relocation Cost	-
Estimated Grand Total	$1,326

[1] Excludes yard and tail track requirements.
[2] Includes engineering and construction management.

TAIL TRACK COSTS (IN 1982 DOLLARS $000)

COST ITEM	END SEGMENT 1D 1,000LF	1D 3,000LF	3 C/2 1,000LF	3 C/2 3,000LF	13 1,000LF	13 3,000LF
Trackwork	334	942	334	942	260	868
Structures & Civil Work	25	76	1,294	3,880	1,328	2,316
Utility Relocation	10	30	-	-	-	-
Track Electrification	327	981	327	981	327	981
Train Control	208	624	208	624	208	624
Communication	48	144	48	144	48	144
Additional Items	15	43	16	44	8	38
Base Total	967	2,840	2,227	6,615	2,179	4,971
Right-of-Way	239	717	480	1,440	Ø	Ø

NOTE: The appropriate base total cost for the tail tracks is included in the Capital Cost Estimate item "Storage Facilities" of each Alignment Alternative of Table B-1.

Appendix C

STATION PARKING REQUIREMENTS

Appendix C

PARKING REQUIREMENTS AT STATIONS
West Contra Costa BART Extension

Station	Spaces
Vale Avenue	200
Hilltop Mall	300
San Pablo (El Portal)	300
Parr Boulevard	400
Atlas Road	200
Pinole	300
SR-4	700
Rodeo	300
Crockett	300
Cummings Skyway	300

NOTE: Based on the upper range of the station patronage forecasts for each station (Interim Report #2, Table 8, Page 27).

Compared to: Oakland West (400 spaces), Lake Merritt (225), El Cerrito del Norte (1,100), Richmond (800), North Berkeley (500).

2-1-83

Appendix D

GLOSSARY

GLOSSARY

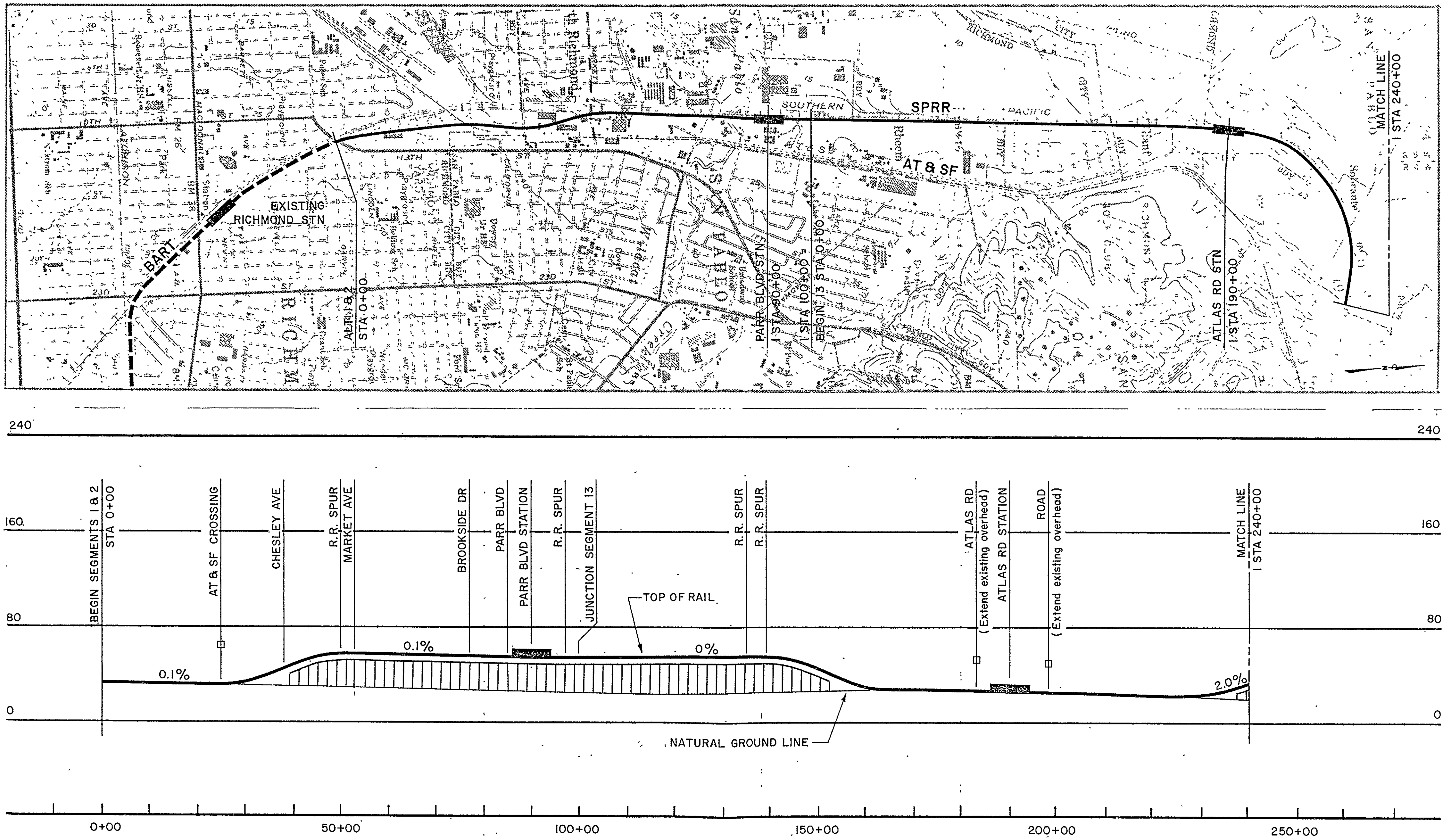
DAS	Data Acquisition System. A computerized system which collects origin-destination information by time of day through BART's fare gates (exit gates).
Dwell	Time spent by a train in a passenger station.
KE Track	A third track currently being completed in downtown Oakland. The track extends from just south of MacArthur to just east of Oakland West. (M-line side Oakland wye). The name of the KE track was recently changed to the MX-CX track.
Performance Level 2	One of six performance levels used to adjust train performance. PL-2 is the level used for train scheduling.
wye	A railroad track arrangement that permits direct double-track train movement between all lines. The wye track arrangement is in the shape of a triangle.

Appendix E

ALIGNMENT AND PROFILE DRAWINGS

NOTE:

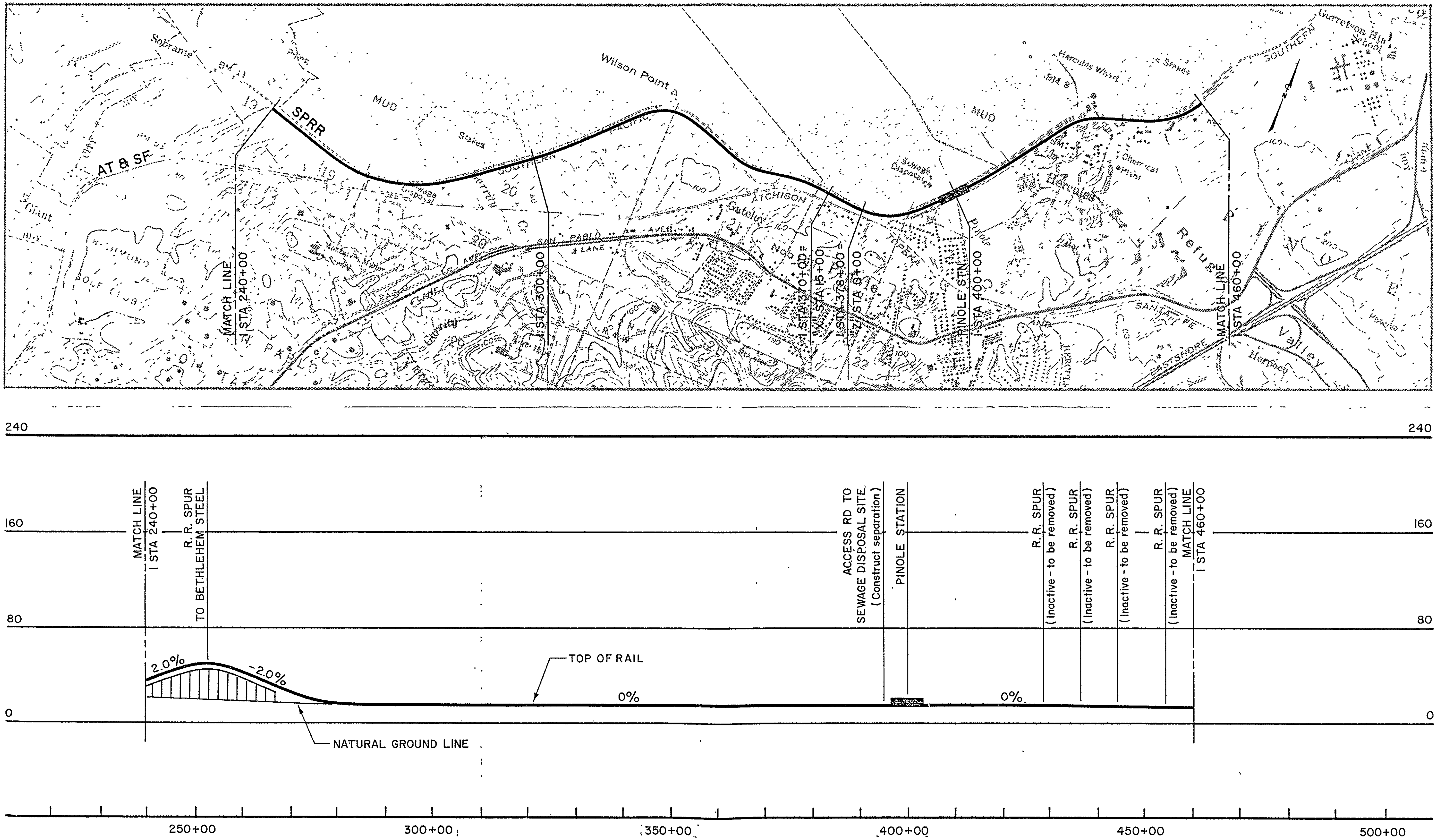
VERTICAL LINES UNDER AERIAL STRUCTURES ARE SYMBOLIC ONLY AND DO NOT REPRESENT ACTUAL COLUMN LOCATIONS.



ALIGNMENT ALTERNATIVE I
PARALLELING THE SOUTHERN PACIFIC R.R. LINE (Segment IA)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 7 SHEET I of 3

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE



ALIGNMENT ALTERNATIVE I

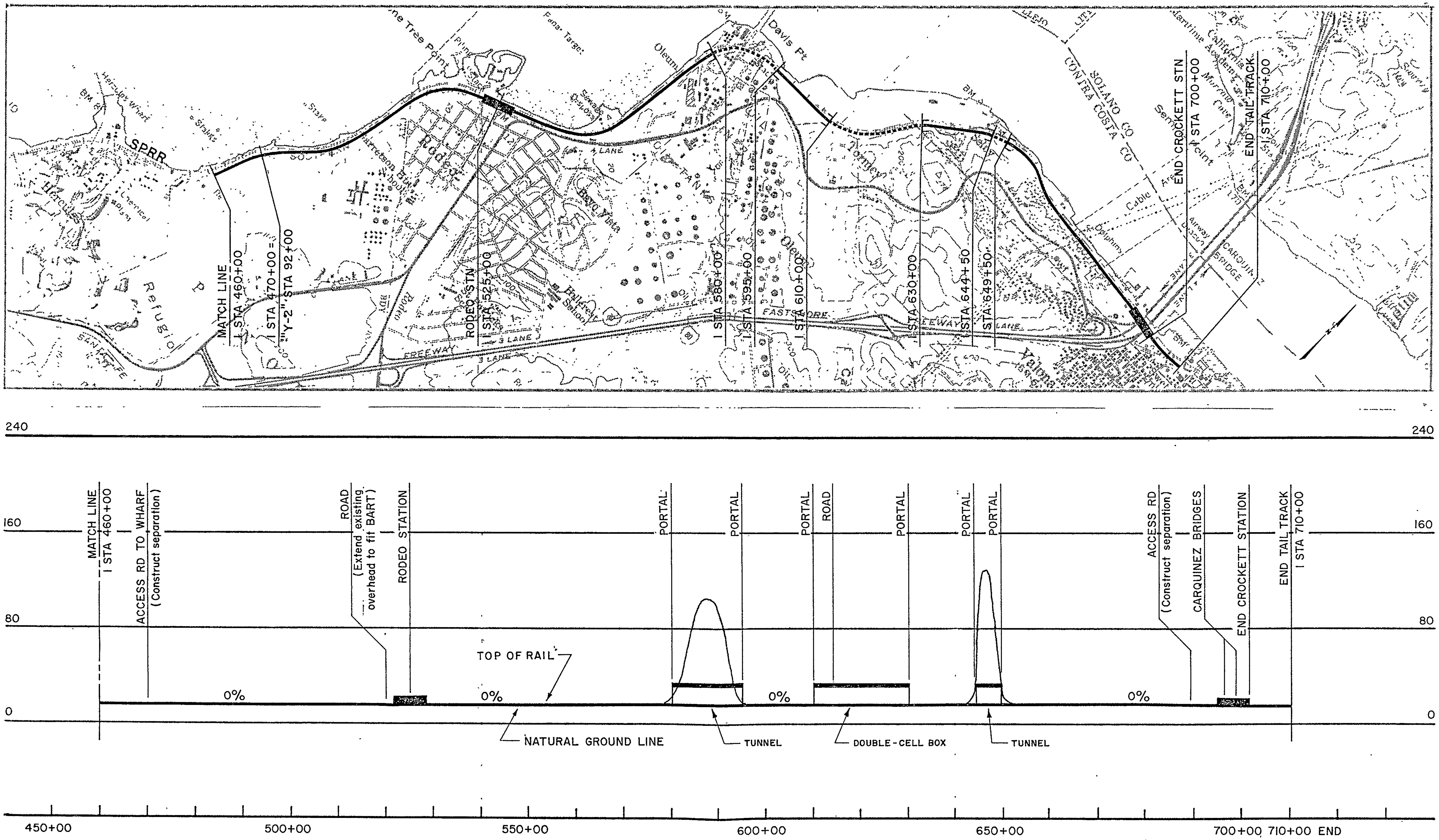
PARALLELING THE SOUTHERN PACIFIC R.R. LINE (Segments IA, IB, IC)

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 18 SHEET 2 of 3

0 80 FEET
VERTICAL SCALE

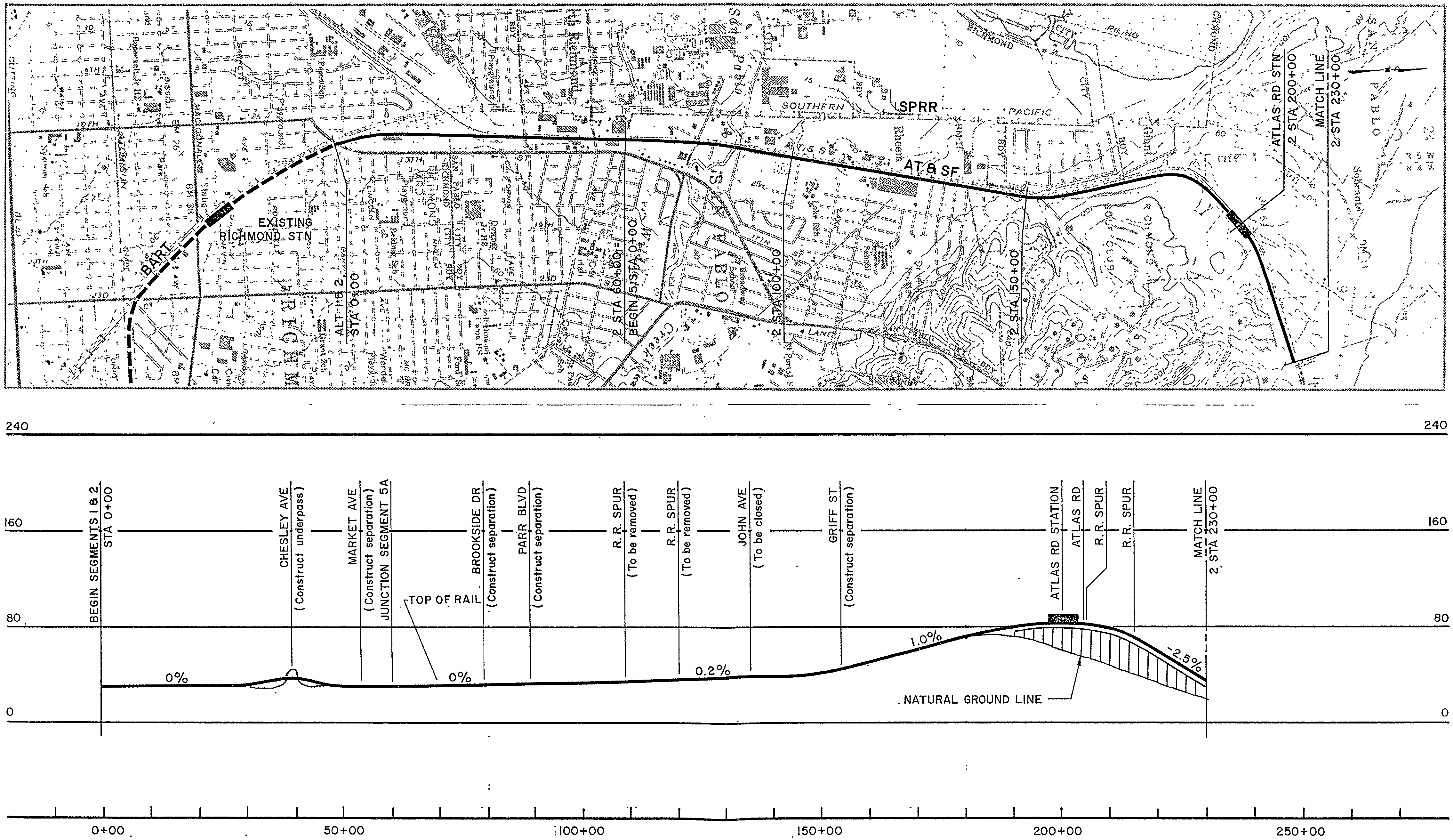
0 2000 FEET
HORIZONTAL SCALE



ALIGNMENT ALTERNATIVE I
PARALLELING THE SOUTHERN PACIFIC R.R. LINE (Segment ID)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 9 — SHEET 3 of 3

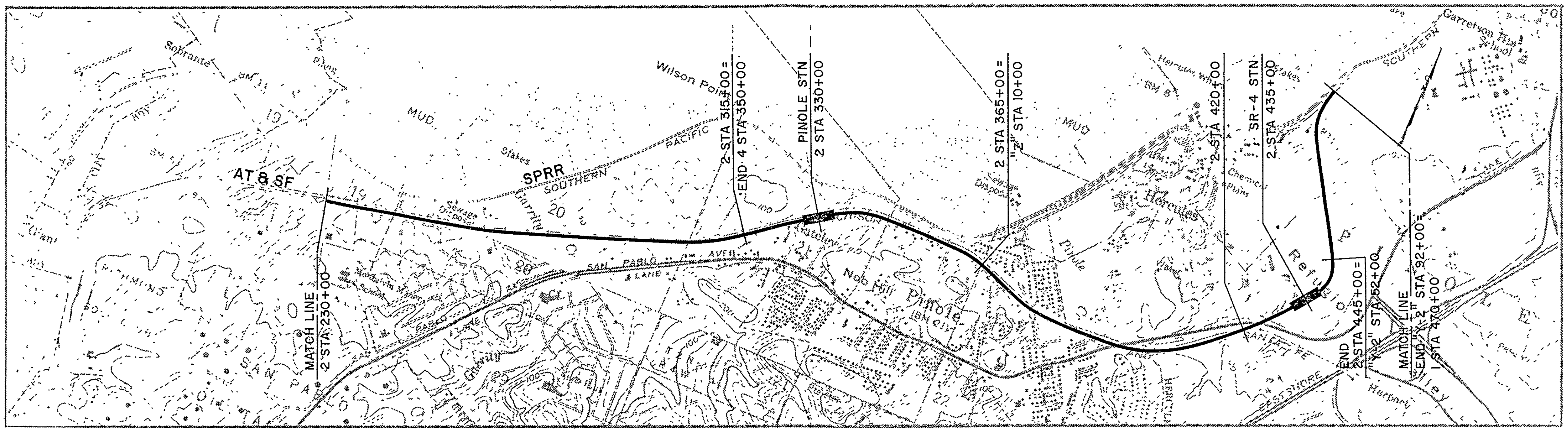
VERTICAL SCALE: 0 — 80 FEET
HORIZONTAL SCALE: 0 — 2000 FEET

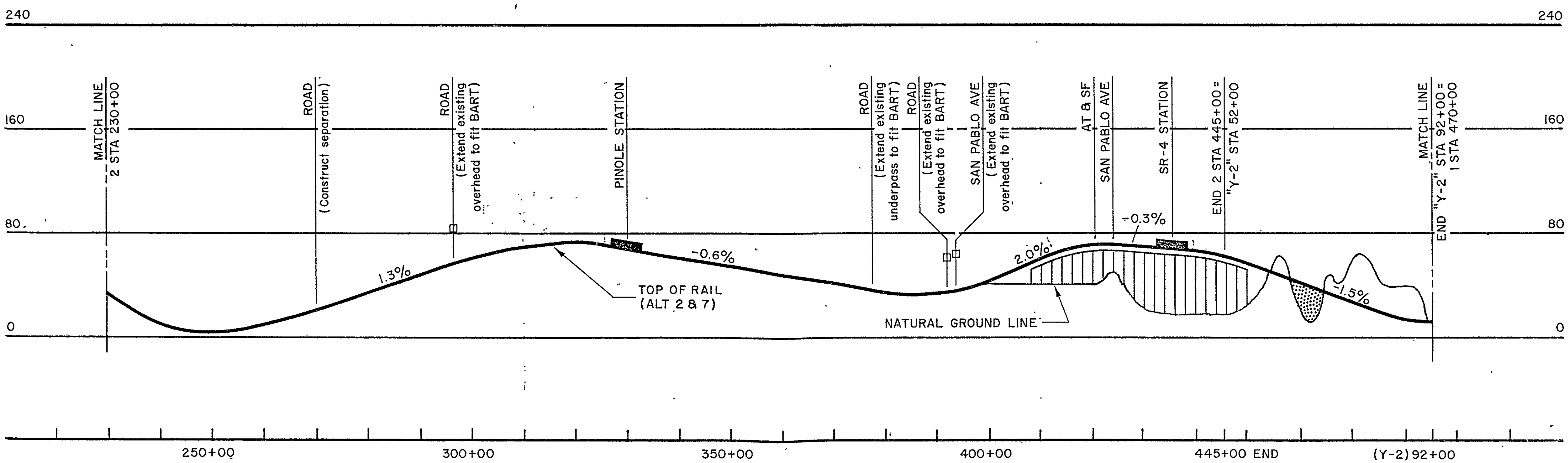


ALIGNMENT ALTERNATIVE 2/14
PARALLELING THE ATCHISON, TOPEKA & SANTA FE R.R. LINE (Segments 2A, 2B)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 10 SHEET 1 of 2

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE



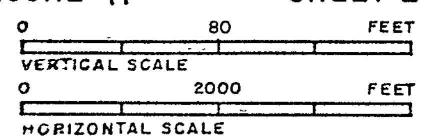


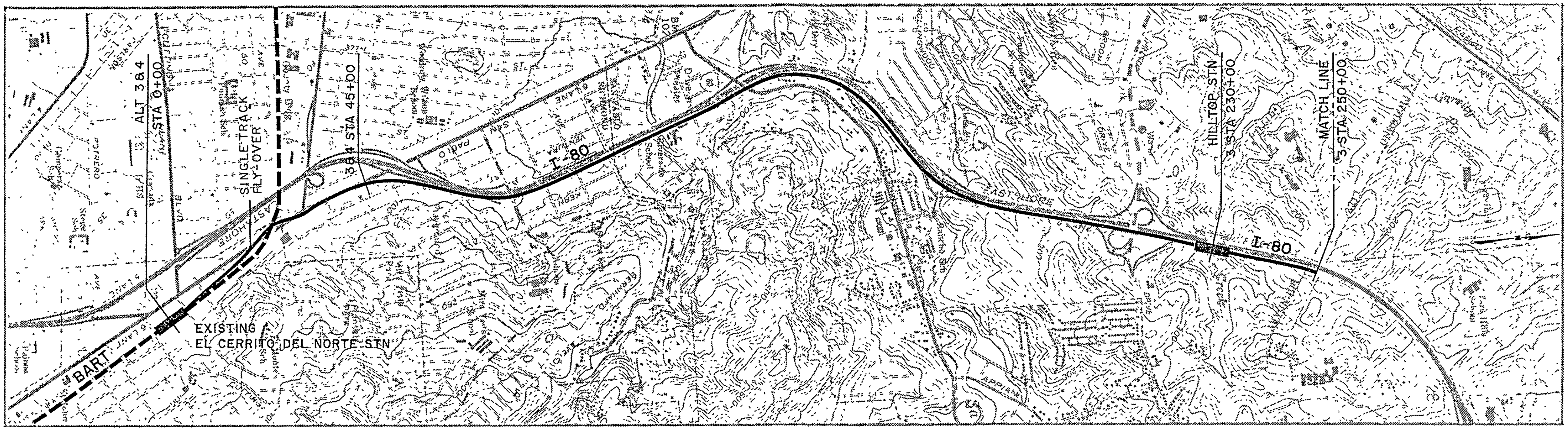
ALIGNMENT ALTERNATIVE 2/14

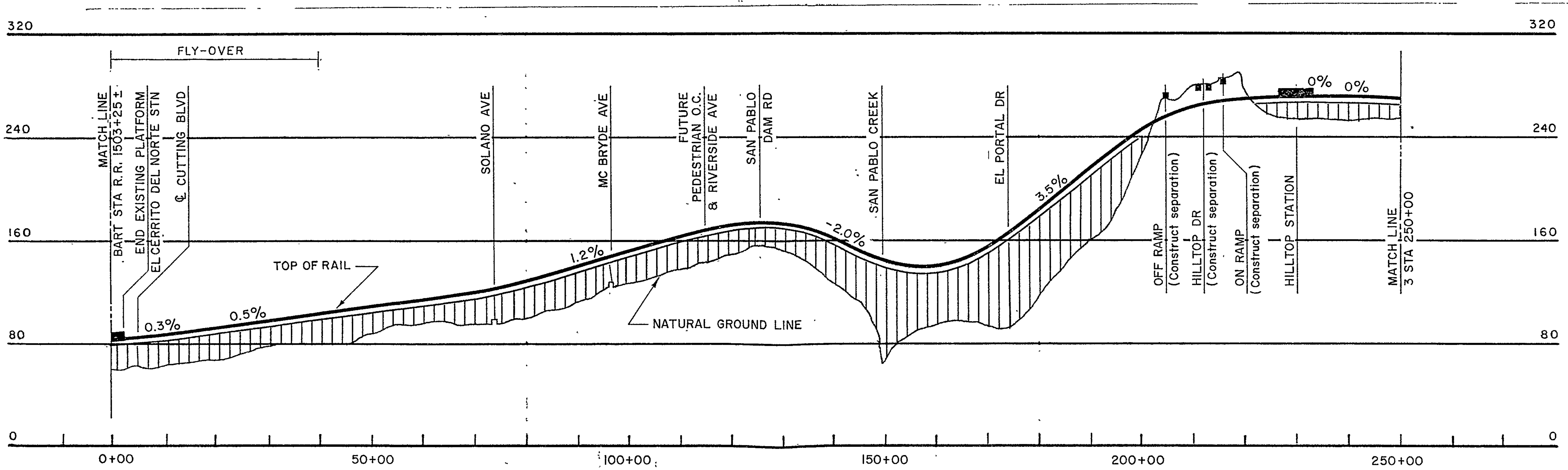
PARALLELING THE ATCHISON, TOPEKA & SANTA FE R.R. LINE (Segments 2B, 2C, 2D, 2E, Y-2)

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 11 SHEET 2 of 2





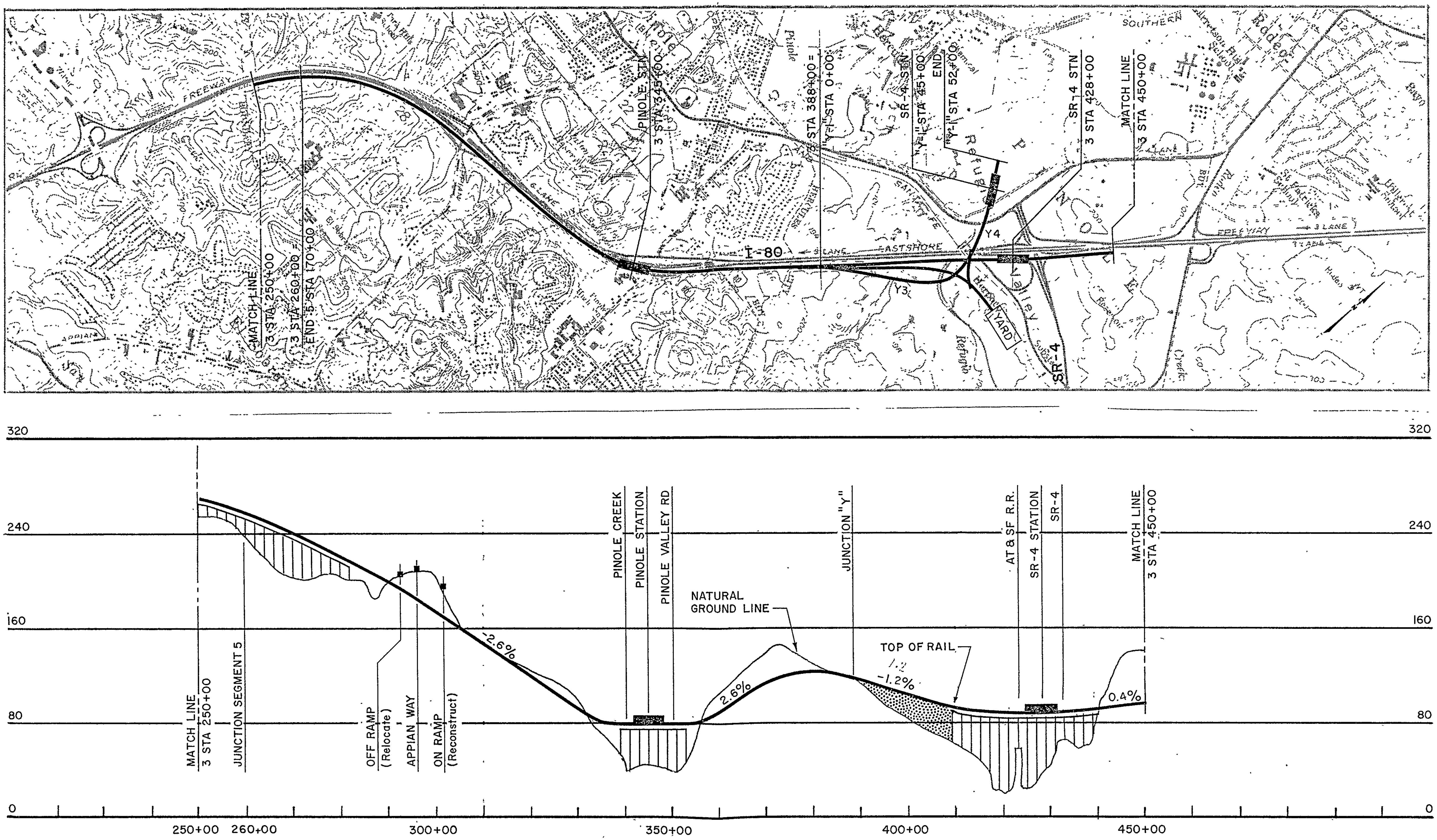


ALIGNMENT ALTERNATIVE 3
PARALLELING I-80 FREEWAY EAST SIDE (Segment 3A)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 12 SHEET 1 of 3

VERTICAL SCALE 0 80 FEET

HORIZONTAL SCALE 0 2000 FEET



ALIGNMENT ALTERNATIVE 3

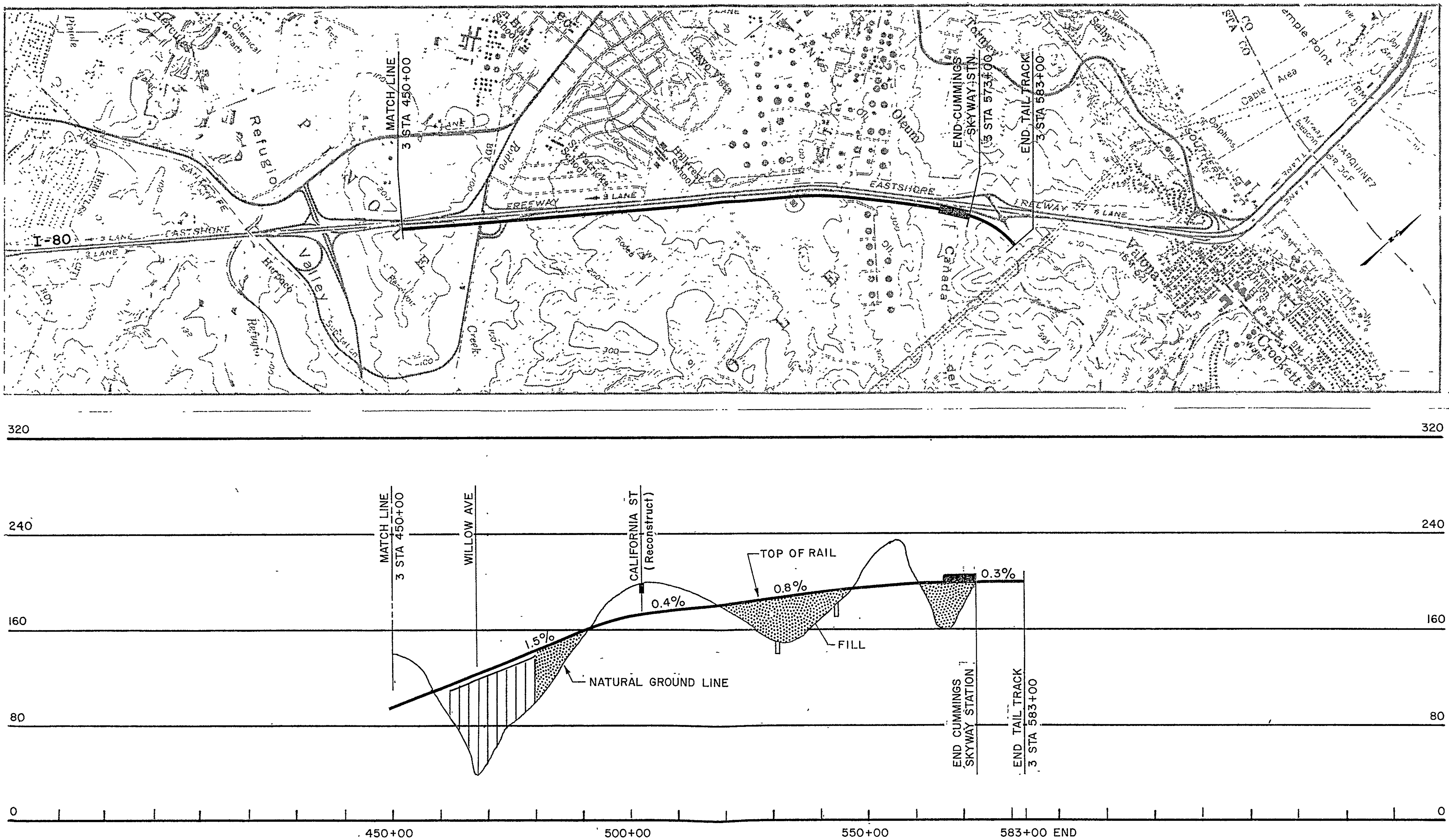
PARALLELING I-80 FREEWAY EAST SIDE (Segments 3A, 3B)

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 13 SHEET 2 of 3

0 80 FEET
VERTICAL SCALE

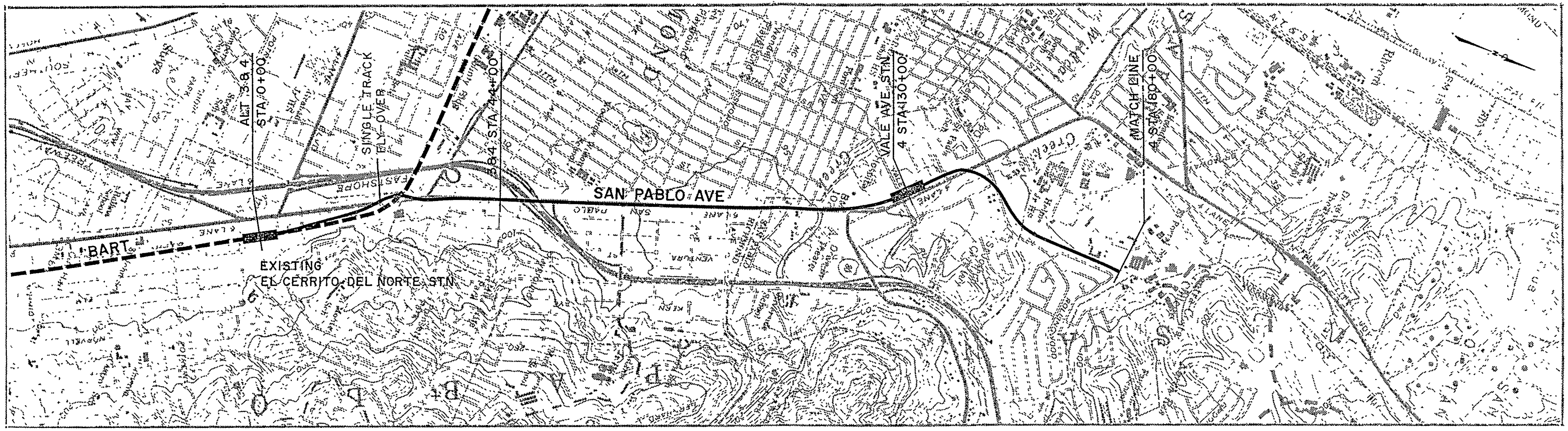
0 2000 FEET
HORIZONTAL SCALE

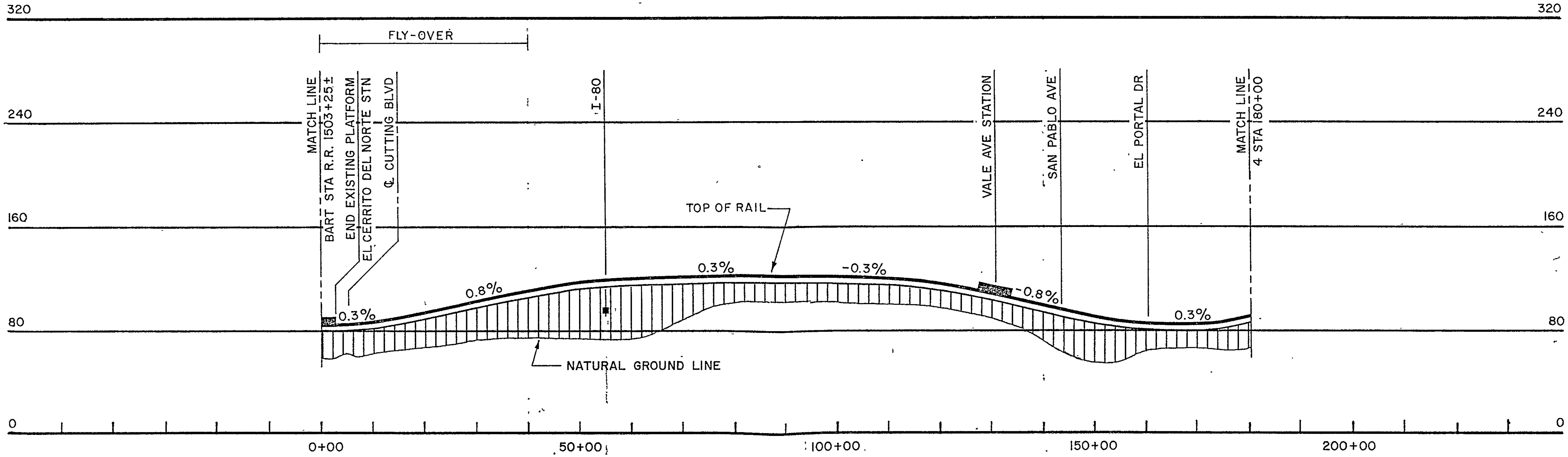


ALIGNMENT ALTERNATIVE 3
PARALLELING I-80 FREEWAY EAST SIDE (Segment 3C)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 14 SHEET 3 of 3

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE

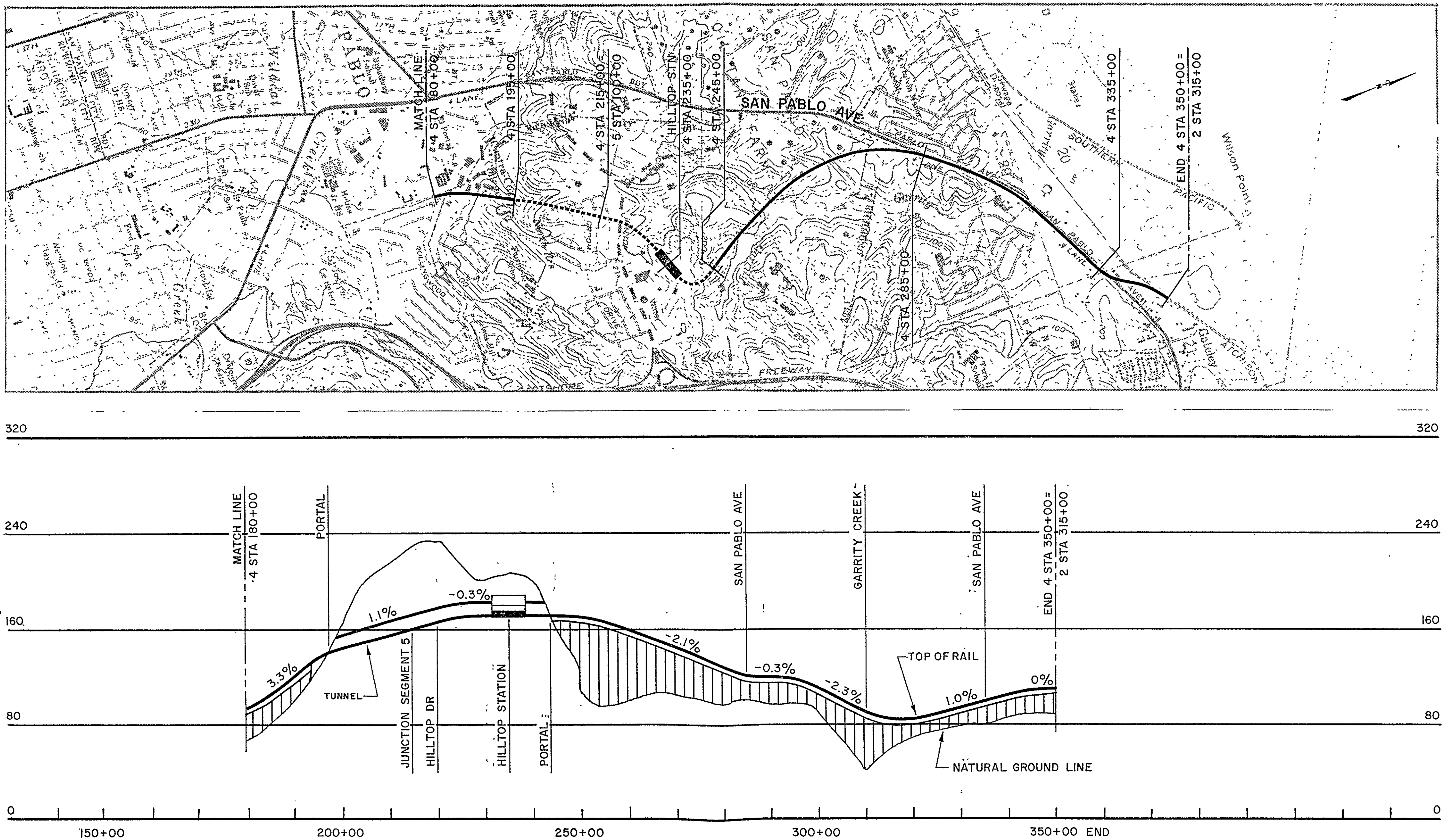




ALIGNMENT ALTERNATIVE 4
VIA SAN PABLO AVENUE TO HILLTOP MALL TO AT & SF R.R. LINE (Segment 4A)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 15 SHEET 1 of 2

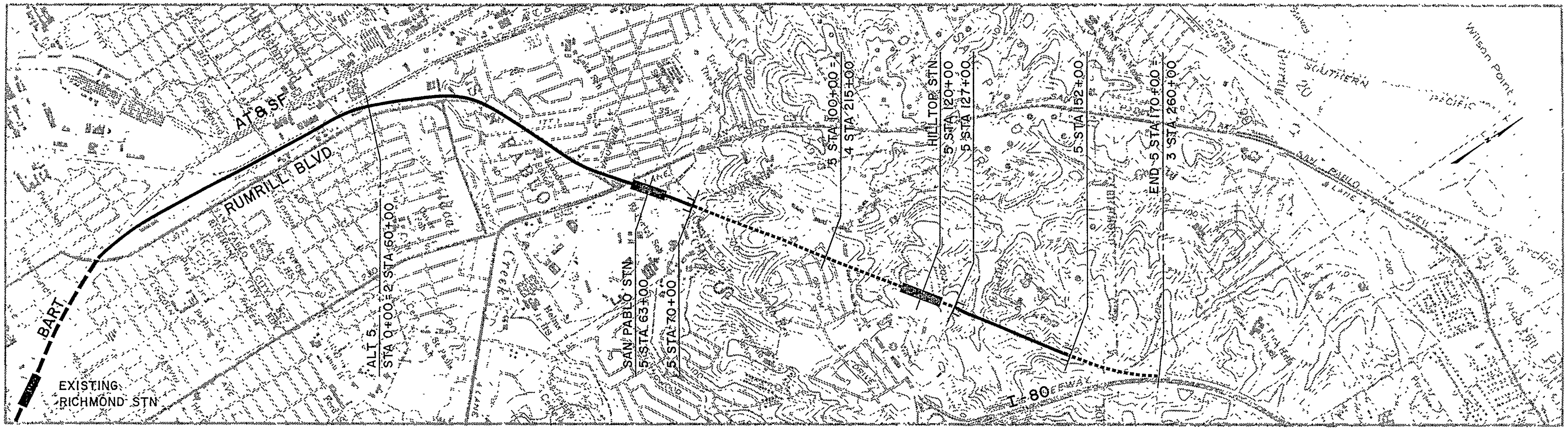
0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE

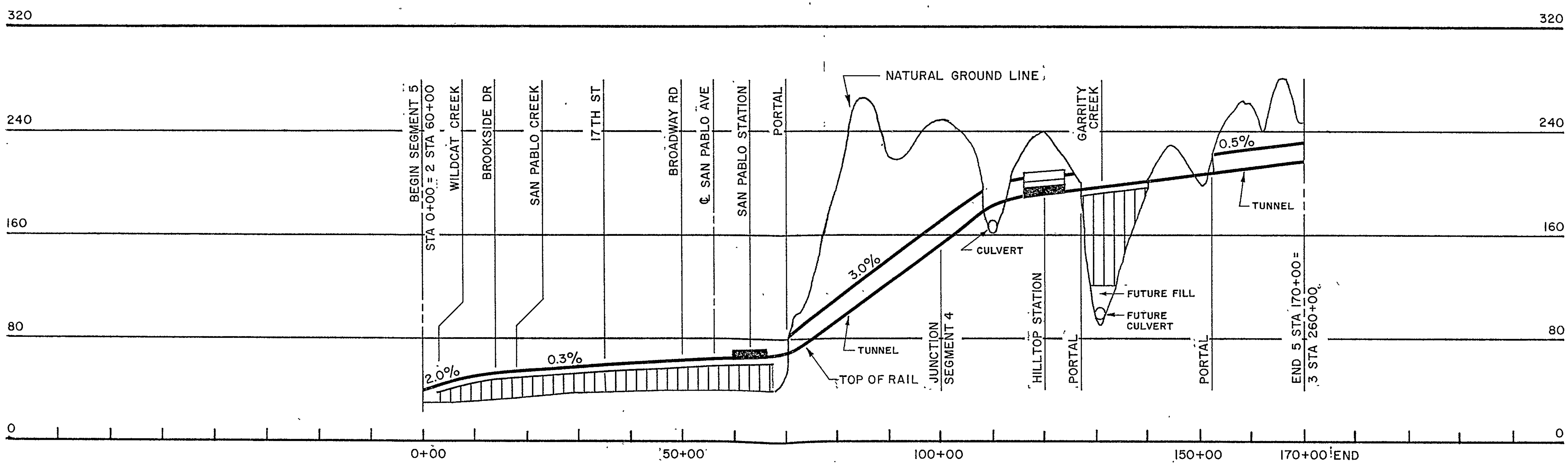


ALIGNMENT ALTERNATIVE 4
VIA SAN PABLO AVENUE TO HILLTOP MALL TO AT & SF R.R. LINE (Segment 4B)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 16 SHEET 2 of 2

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE

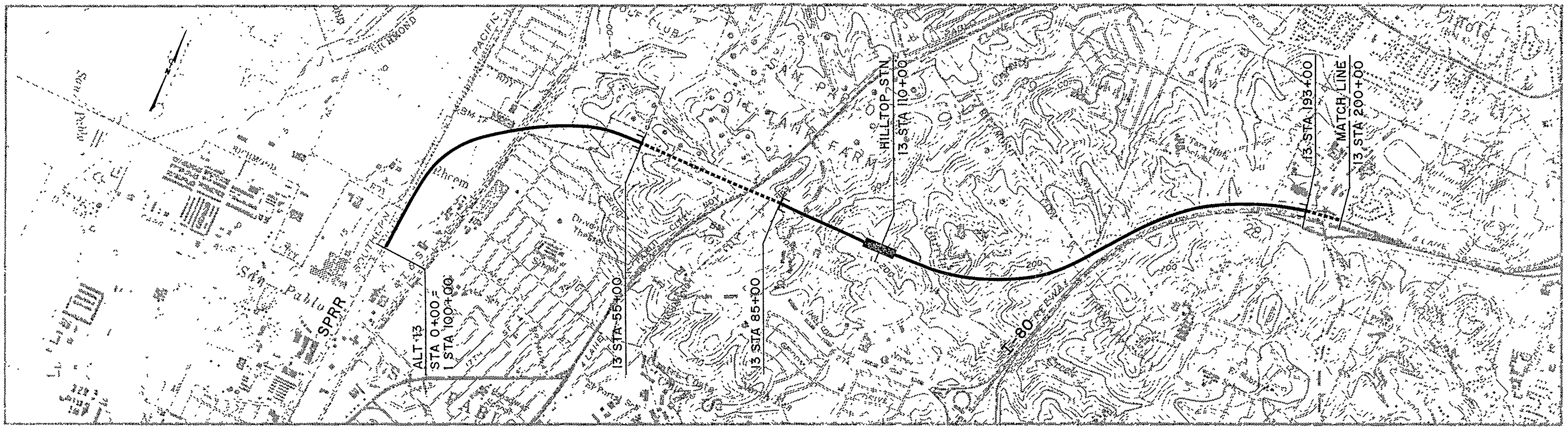


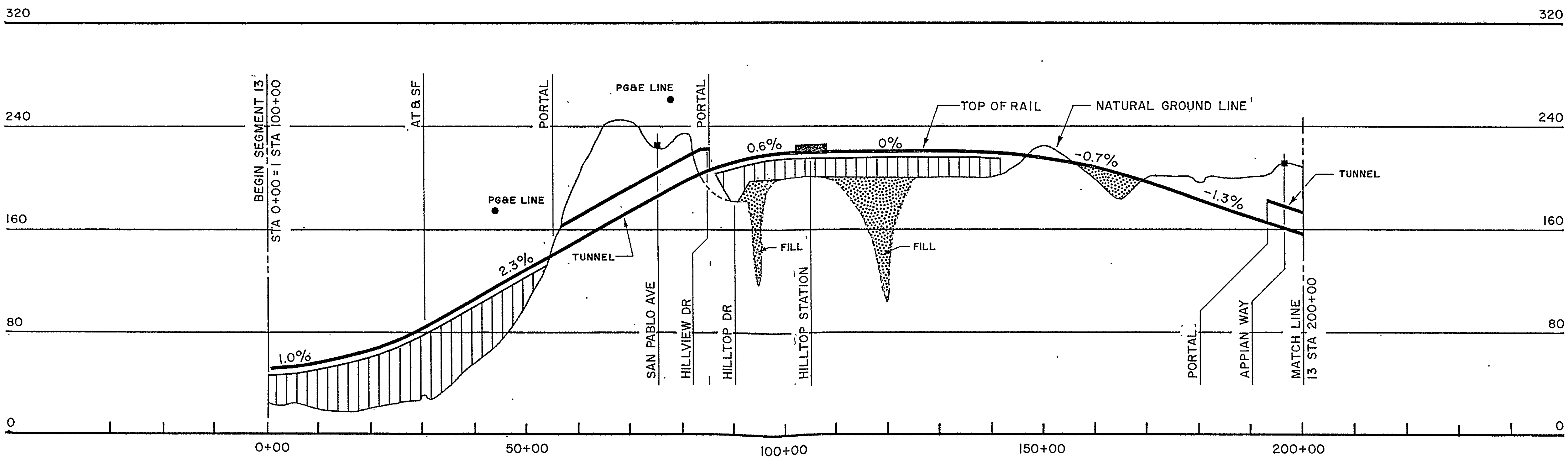


ALIGNMENT ALTERNATIVE 5
FROM AT&SF R.R. TO HILLTOP MALL VIA RUMRILL BOULEVARD (Segments 5A, 5B)
WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 17 SHEET 1 of 1

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE





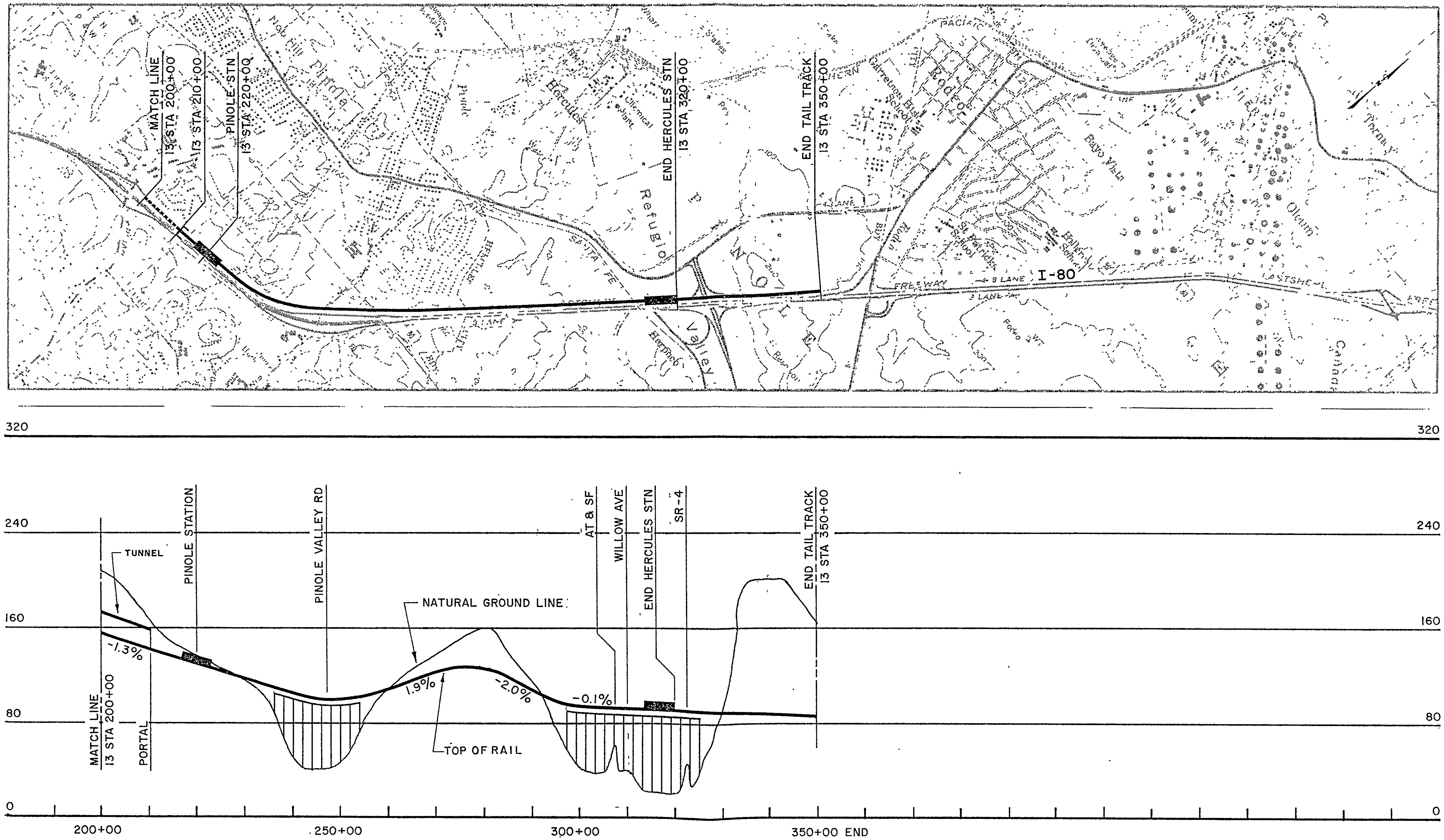
ALIGNMENT ALTERNATIVE 13

SOUTHERN PACIFIC R.R. LINE TO HILLTOP MALL TO I-80 FREEWAY WEST SIDE (Segments 1A/1, 13)

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE 18 SHEET 1 of 2

0 80 FEET
VERTICAL SCALE
0 2000 FEET
HORIZONTAL SCALE



ALIGNMENT ALTERNATIVE 13

I-80 FREEWAY WEST SIDE TO SR-4 (Segment 13)

WEST CONTRA COSTA COUNTY BART EXTENSION STUDY

FIGURE: 19 SHEET 2 of 2

0 80 FEET
VERTICAL SCALE

0 2000 FEET
HORIZONTAL SCALE

511 Your Bay Area travel guide.

October 2003

On behalf of the Bay Area Partnership, a coalition of transportation agencies in the San Francisco Bay Area, we would like to introduce the eleventh edition of *Commute Profile.*

The 2003 *Commute Profile,* which explores commuters' choices and perceptions, is one of several regional efforts to gather performance data on our transportation system. Conducted annually, this survey is one way to better understand how our transportation system performs from the commuter's perspective. The Metropolitan Transportation Commission continues to explore ways to integrate the data in *Commute Profile* with other data on transportation system performance. In particular, information on commuters' choices and perceptions complements the transportation system performance assessment in the annual *State of the System* report, which is based on direct observation of the transportation system and features data on mobility, safety and the system's state of repair. In the future, look for integration of these two perspectives on system performance.

Commute Profile is prepared by RIDES for Bay Area Commuters, Inc. (RIDES) under contract to the MTC. RIDES provides information and assistance to commuters to help them make informed decisions about carpooling, vanpooling, transit, bicycling and other commute options in the Bay Area.

For more information about the survey findings, contact Steve Beroldo, RIDES' Research and Evaluation Manager, at (510) 273-2063 or sberoldo@rides.org.

Sincerely,

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Executive Director
Metropolitan Transportation Commission
101 Eighth Street
Oakland, CA 94607

Catherine Showalter

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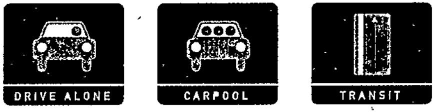
Executive Director
RIDES for Bay Area Commuters, Inc.
300 Frank H. Ogawa Plaza, Suite 275
Oakland, CA 94612



A Survey of San Francisco Bay Area Commute Patterns in

Alameda • Contra Costa • Marin • Napa • San Francisco • San Mateo
Santa Clara • Solano • Sonoma

COMMUTE PROFILE 2003

A Survey of San Francisco Bay Area Commute Patterns

Published by RIDES for Bay Area Commuters, Inc.

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Editor: Julia Maglione
Design: Angelo Martinez
Production: Kiera Lofgreen

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TABLE OF CONTENTS

EXECUTIVE SUMMARY

This is the eleventh edition of *Commute Profile*. It is the Bay Area's only annual study which focuses on commuters and the decisions that influence their choice of travel mode to work. *Commute Profile* is based on a survey of commuters who live in the nine-county Bay Area. The survey is designed to track the commuting patterns of residents. It provides a better understanding of travel behavior; it helps to define and target segments of the commuter population. The report is presented in two main sections. The regional profile section examines a single weighted data set of the nine Bay Area counties. Within this section are longitudinal comparisons of travel patterns, perceptions and motivations for the region as a whole. The second section profiles each of the nine counties individually. Within this section, a core set of the data are examined to provide a perspective on how commute patterns vary on a county-by-county basis.

THE TYPICAL BAY AREA COMMUTER

A typical Bay Area commuter is just as likely to be male as female based on the profile of respondents to *Commute Profile 2003*. He or she is more likely to drive alone than use any of the other commute options combined. The typical commuter drives alone mainly because he or she has "no one to carpool with," because an "irregular work schedule" requires the flexibility that driving offers and "no practical transit options exist." A one-way trip to work is 16 miles and takes them 29 minutes. The typical Bay Area commuter is in his or her early 40's and has a before tax household income in the $66,000 - $80,000 range. Eight of 10 commuters have free parking at or near their worksite and nine of 10 have regular access to the Internet.

COMMUTE MODES

Although driving alone to work continues to be, without a doubt, the most popular commute mode in the Bay Area, there was a five percentage point decline this year. This is the lowest level recorded in the *Commute Profile* series since 1996. The drive-alone rate was very stable between 1999 and 2002—varying by only one percentage point each year. The large drop this year is surprising. The combined use of carpools and vanpools was unchanged from last year—18 percent of Bay Area commuters carpool or vanpool to work. Between 2000 and 2002 carpooling had increased from 14 percent to 18 percent. Both transit and the use of "other" modes by commuters (i.e., walking, bicycling and telecommuting) have increased since last year. Transit use is up by two percentage points; this is primarily due to an increase in the percentage of commuters using BART. The increase in "other" mode use is due to an increase in walking and telecommuting.

DRIVING ALONE

2001	2002	2003
69%	69%	64%

COMMUTE DISTANCE AND TRAVEL SPEED

For the second year in a row, after many years of declining, estimated travel speed increased. Respondents are asked how far they travel to work and how long it takes them. Based on this data, travel speeds are estimated. While the increase in travel speed is interesting, it is also interesting to note average trip distance is the same now as in 1992. It had increased slightly between 1998 and 2001, but the average commute trip is currently 16 miles one way—the same as in 1992.

Supporting the trend of decreasing or stable commute distances over the past three years is a greater percentage of respondents living and working in the same county. For example, in Alameda County there has been a three percent increase in commuters both living and working there over the past three years. In Sonoma County there has been a 22 percent increase. Region-wide between 2001 and 2003, there has been a 12 percent increase in commuters living and working in the same county.

ESTIMATED TRAVEL SPEED

2001	2002	2003
30 mph	32 mph	33 mph

CHANGING COMMUTE CONDITIONS

Between 1999 and 2001, respondents to *Commute Profile* were clear—commute conditions were getting worse each year. In 2002, there was a notable change for the better. For the first time, the percentage of respondents indicating conditions were "better" in 2002 was greater than the percentage indicating conditions were "worse." In 2003, respondents' perceptions of their commute conditions continued to improve. More commuters indicated conditions had improved and fewer indicated conditions had gotten worse. The most common reason given for improved conditions was "lighter traffic."

COMMUTE CONDITIONS

	2001	2002	2003
Better	14%	29%	30%
Worse	43%	25%	18%

CARPOOL LANES

About 10 percent of Bay Area commuters use a carpool lane and almost nine out of 10 commuters who use carpool lanes save time getting to work. The reported time savings has decreased in the last two years as congestion in the mixed flow lanes has decreased; travel speeds in the carpool and mixed flow lanes are more similar now than in previous years. Consistent with this decreasing travel time advantage of carpool lanes was a decrease in the percentage of respondents who indicated the carpool lane influenced their decision to carpool or use transit. A new carpool lane opened in November 2002 in the Santa Rosa area. Access to carpool lanes for Sonoma County residents (Santa Rosa is the largest city in Sonoma County) doubled from 18 percent to 36 percent this year.

EMPLOYER ASSISTANCE

Commute Profile data has consistently documented the connection between free parking at the worksite (as well as the services associated with densely populated job centers) and mode choice. Locations with free parking have a drive-alone rate of 71 percent, while those without free parking have a drive-alone rate of 37 percent. Transit use is four percent in areas with free parking and 38 percent where free parking does not exist. Another factor influencing mode choice is incentives or services offered by employers to encourage use of commute alternatives by their employees. About 40 percent of employers offer incentives and services, but it varies considerably by company size—smaller employers are less likely to do so. The drive-alone rate is about seven percent lower at sites where commute alternative programs are operated.

EMPLOYER-BASED COMMUTE ALTERNATIVE PROGRAMS

Companies with	
fewer than 100 employees	24%
more than 100 employees	61%

CHANGING ATTITUDES

Over the past five years, a more positive attitude toward the use of transit and bicycling has been evolving. In 1999, 13 percent of drive-alone respondents indicated it would be "easy" to "somewhat possible" to make their current commute by transit. This group steadily increased over the last five years; now almost one in four commuters consider transit a feasible option. A similar trend has been emerging for bicycle commuting. Over the last five years, the percentage of respondents indicating it would be "easy" to "somewhat possible" to commute by bicycle one or two days a week increased from 12 percent to 22 percent. Respondents' attitudes toward carpooling have also shown a slight upward trend with about 25 percent of respondents indicating carpooling was a possible option for them.

EASY TO SOMEWHAT POSSIBLE TO COMMUTE BY

	1999	2001	2003
Transit	13%	22%	24%
Bicycle	12%	20%	22%

The main deterrents commuters who are currently driving alone encounter to carpooling are "finding partners" and "irregular work schedules." The main deterrents to using transit are a lack of "direct service between home and work" and the "additional time required to commute by transit." For drive-alone commuters considering bicycling, the main deterrent is distance (i.e., "it's too far to ride my bike"). However, for commuters who travel five miles or fewer to work, bicycling is more attractive—almost half of this group (47 percent) sees bicycling as a feasible option.

TYPE OF INFORMATION DESIRED

Traffic	Map of Roadway Congestion
Transit	Schedule and Route Maps
Rideshare	Casual Carpool and Matching Information
Bicycle	Route Maps

511 TRAVELER INFORMATION

Approximately three months prior to fielding the Commute Profile 2003 survey, the Metropolitan Transportation Commission (MTC) launched the new 511 telephone traveler information service. Almost two percent of respondents had already tried the 511 information service prior to responding to the Commute Profile survey. Most of them had used the service to get traffic information. Looking toward the future of the cutting-edge 511 service, respondents were asked what types of information were of most interest to them. Commuters who are likely to seek traffic information are most interested in seeing congestion depicted on a real-time map, potential transit patrons are most interested in schedule and route maps, rideshare users are looking for casual carpool and matching information and bicycle commuters are interested in having route maps available.

COUNTY COMPARISONS

Each Bay Area county has characteristics that reflect and influence its commute patterns. Some of the characteristics monitored in Commute Profile include: travel mode, trip distance, travel time, parking, vehicle availability and carpool lane access. The county profile section of this report further explores the similarities and differences between the counties.

COUNTY "SOUND BITES"

Alameda	Most BART riders (11%, tie) Most commuters bicycling to work (2%, tie)
Contra Costa	Longest travel time to work (38 minutes) Most BART Riders (11%, tie)
Marin	Most ferry riders (3%) Highest concentration of small employers (76%)
Napa	Most commuters driving alone (76%) Highest concentration of free parking (95%)
San Francisco	Most transit riders (35%) Smallest supply of free parking (33%)
San Mateo	Highest percent of telecommuters (3%, tie) Most often near the average (when counties are ranked)
Santa Clara	Best access to carpool lanes (58%) Highest percentage of residents working in the county (88%)
Solano	Most carpoolers/vanpoolers (22%) Longest trip to work (23 miles)
Sonoma	Most likely to have vehicle available for commute (99%) Most commuters bicycling to work (2%, tie)

INTRODUCTION

this section describes *Commute Profile's* history and methodology

In the spring of 2003, RIDES conducted the Bay Area's eleventh *Commute Profile* survey. RIDES operates the Bay Area's Regional Rideshare Program under contract to the Metropolitan Transportation Commission (MTC). *Commute Profile* is an annual region-wide telephone survey of commuters. The study is designed as a tool to help the Regional Rideshare Program and others better understand Bay Area commuters and their commute patterns. *Commute Profile* is unique among Bay Area surveys in that it focuses on commuters, their travel behavior and trends that emerge from year to year.

To track commute trends over time, *Commute Profile* has retained a group of core questions. The core questions include:

- Commute Modes
- Factors that Influence Mode Choice
- Travel Conditions
- Commute Distance and Time
- Use of HOV Lanes
- Influence of Employers and Employment Sites on Travel Behavior
- Potential Use of Options to Driving Alone
- Awareness of Commuter Information Services
- Demographic Information

Additional questions are rotated each year depending on current topics of interest to MTC and other partners who participate in the planning of *Commute Profile.* These rotating blocks of questions add an important element of flexibility to the study. This year's survey included a series of questions to examine current use of the 511 phone and web sites, as well as the type and frequency of traveler information in which Bay Area commuters are interested. *Commute Profile 2003* took place in partnership with BART, which added a series of questions to better understand potential use of their system by commuters. The findings from the BART questions are not reported in this document. BART staff are doing their own analysis.

METHODOLOGY

The target population for *Commute Profile* is adults over the age of 18 who are employed full-time (30 hours or more) outside the home. Because this is a key customer group for the Regional Rideshare Program's services, *Commute Profile* focuses on them.

The sample size for *Commute Profile* has varied from year to year as a result of budget considerations, but the last five years have been consistent (Table 1). Larger sample sizes allow for more accurate regional data and for data that are meaningful at the county level.

TABLE 1
COMMUTE PROFILE HISTORICAL SUMMARY

Year	Completed Questionnaires	Counties With Full Sample	Direct Costs Budget*
1992	1,600	1	$22,245
1993	2,800	6	$40,325
1994	3,200	7	$44,600
1995	1,090	2	$11,844
1996	3,450	8	$41,152
1997	No Survey	–	–
1998	1,608	2	$19,000
1999	3,628	9	$42,000
2000	3,600	9	$42,670
2001	3,600	9	$44,740
2002	3,643	9	$57,530
2003	3,600	9	$51,883

*This is the budget for acquiring the sample, conducting the telephone interviews and delivering a clean data set. It does not include questionnaire design, analysis, report preparation, graphic design or printing.

Between March 6 and May 6, 2003, a market research consultant administered telephone surveys to 3,600 Bay Area residents or 400 for each of the nine counties. Phone numbers were randomly generated, and calls were made in the evenings or on weekends. For the region-wide analysis, a weighted data set is used. The weighting is based on employed residents per county (Table 2). For the county-level analysis, the original data are used to provide the maximum sample size for each county.

TABLE 2
REGIONAL WEIGHTING FACTORS BY COUNTY

County	Weighting Factor
Alameda	1.85
Contra Costa	1.21
Marin	0.34
Napa	0.16
San Francisco	1.14
San Mateo	0.97
Santa Clara	2.26
Solano	0.46
Sonoma	0.61

n=400 per county

Commute Profile data are based on samples and, as with any sample, some of the year-to-year fluctuations are due to normal sampling error. County populations, based on employed residents, vary from 68,500 (Napa) to 844,000 (Santa Clara).[1] The samples of 400 from each county have a normal sampling error of five percent and a confidence level of 95 percent associated with them. The region-wide population of employed residents is estimated to be 3,336,500 according to the 2000 census. The regional sample of 3,600 has a normal sampling error rate of two percent and a confidence level of 98 percent. A two percent sampling error means if the survey was conducted 100 times, one would be confident 98 times out of 100, the characteristics of the sample would reflect the characteristics of the population within plus or minus two percent.

In some cases, *Commute Profile* examines sub-samples of the regional or county data sets where the sample sizes are smaller. Each table in Commute Profile includes the actual sample size in the format of (n=sample size). The normal sampling error increases as the sample size decreases as is shown in Table 3.

TABLE 3
NORMAL SAMPLING ERROR RATES

Sample Size (n=)	Sampling Error	Confidence Level
3,600	2%	98%
400	5%	95%
270	6%	95%
200	7%	95%
150	8%	95%
120	9%	95%
100	10%	95%

[1] Estimate of employed residents in 2003 are from the 2000 Census.

HOW BAY AREA RESIDENTS COMMUTE

this section discusses commute modes, commute distance, travel time, start time and flexibility, carpool lane use, carpool composition and telecommuting

COMMUTE MODE

To develop a relatively complete view of commuters' travel modes, *Commute Profile* looks at the trip to work in terms of "primary," "connecting" and "occasional" modes. The "primary" mode of travel is defined as the method used for all or the part of the trip that covers the greatest distance. All respondents were asked if their entire commute trip was made using one mode or if their normal trip to work involved the use of additional or "connecting" modes. Finally, if the number of days per week an individual used their primary mode did not match the number of days per week worked, they were asked what other modes they used on an "occasional" basis.

The percentage of respondents who drive alone as their primary commute mode declined by five percentage points between the 2002 and 2003 surveys (Table 4). This is the lowest level recorded over the last five years. The decrease in commuters driving alone was offset by an increase in carpoolers, BART riders, telecommuters and commuters walking to work. Carpooling has shown a steady increase as a primary mode over the last five years. In 1999, the carpool rate was 14 percent; it increased to 17 percent in 2001 and is now at 18 percent. BART showed the biggest gain increasing from three percent to five percent. Over the last five years, the percentage of commuters using BART has fluctuated from a high of six percent in 2000 to a low of three percent in 2002. The three percent of respondents indicating they walk as a primary mode and the two percent indicating they telecommute as a primary mode are also at five-year highs. Both of these modes are about one percentage point higher than their average over the last five years.

Approximately 12 percent of respondents indicated their normal trip to work involved the use of more than one mode (Table 4). The most popular connecting modes are driving alone and riding the bus. Riding BART, walking, carpooling, bicycling and riding light rail systems are the next most popular group of connecting modes. The results are similar to last year both in terms of the percentage of commuters using

TABLE 4

HOW BAY AREA RESIDENTS COMMUTE

Primary Commute Mode

Drive Alone	63%	Light Rail	1%
Carpool*	18%	Caltrain	1%
BART	5%	Motorcycle	1%
Bus	5%	Vanpool	<1%
Walk	3%	Ferry	<1%
Telecommute	2%	ACE Train	<1%
Bicycle	1%	Other	<1%

n=3,609

Connecting Mode

Drive Alone	4%	Caltrain	<1%
Bus	3%	Vanpool	<1%
BART	1%	Motorcycle	<1%
Walk	1%	Ferry	<1%
Carpool	1%	Other	1%
Bicycle	1%	None	88%
Light Rail	1%		

n=3,609

Primary and Connecting Modes Combined

Drive Alone	59%	Light Rail	2%
Carpool	16%	Caltrain	1%
Bus	7%	Motorcycle	1%
BART	6%	Vanpool	<1%
Walk	4%	Ferry	<1%
Bicycle	2%	Other	1%
Telecommute	2%		

n=3,609

Occasional Commute Modes

Drive Alone	2%	Walk or Jog	<1%
Telecommute	2%	Light Rail	<1%
Carpool	1%	Caltrain	<1%
Bus	1%	Motorcycle	<1%
BART	1%	Other	1%
Bicycle	1%	None	93%

n=3,609

* Respondents who initially indicated that they drive alone, but later indicated that they have others in the car with them 3-5 days per week were reclassified as carpools.

connecting modes and the type of modes used—the six most commonly used connecting modes are the same this year as last year.

When primary and connecting modes are combined, a view of the journey to work is provided that gives equal weight to each mode regardless if it is used for the whole or just a portion of the trip. For an individual who drives to BART, their trip will show up twice—once in the drive-alone category and once in the BART category. Because one person's trip to work can include multiple modes, the total number of trips represented here is greater than the number of trips represented in the portion of the table that shows only primary trips. There are some differences between this combined view and the view of just the primary mode of travel. The percentage of trips made driving alone decreases by about four percentage points (from 63 percent to 59 percent) and the percentage of carpooling drops by two percent (Table 4). The percentage of bus, BART, walk and bike trips increase when these connecting modes are given equal weight.

An occasional mode is a completely separate mode used on days when commuters do not use their primary travel mode for their trip to work. Approximately seven percent of respondents indicated they use a different method of commuting on an occasional basis. This represents a decline from the 2002 survey where almost 11 percent of respondents indicated they used an occasional mode as part of the normal commuting pattern, but it is in line with the 2001 survey where the percentage of respondents using an occasional mode was also seven percent. Driving alone and telecommuting are the most popular occasional modes. About four of 10 of respondents who use an occasional mode either drive alone or telecommute (Table 4). The use of telecommuting as an occasional mode is down from last year (when it was at five percent), but at approximately the same level as it was in 2001. It was noted earlier that telecommuting as a primary mode has increased over the last year. This may partially explain its decline as an occasional mode. In 2002, the average number of days telecommuted per month was four. In 2003, the number increased to five and a half.

The primary and connecting modes in Table 5 have been clustered in four groups (drive alone, carpool, transit and other)[2] for easier comparisons. The table shows the types of connecting modes used based on primary mode. For example, of those commuters whose primary mode is driving alone (first row), 10 percent drive to meet a carpool, 65 percent drive to catch transit and 26 percent drive and then use an "other" mode to complete their journey to work.

Transit users were the most likely to use connecting modes on their normal commute trip (55 percent use a connecting mode), and they are most likely to drive for part of their trip or use multiple transit modes. Drive-alone commutes were the least likely—only three percent use a connecting mode. Twenty-four percent of "other" mode users and eight percent of carpoolers use connecting modes. Transit was the most frequently used connecting mode for individuals who drive alone and carpool. Driving alone was the most frequently used connecting mode for individuals whose primary mode was either transit or "other" modes.

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2 "Drive Alone" includes motorcycles and taxis, "carpool" includes vanpools, "transit" includes buses, trains and ferryboats; and "other" includes bike, walk and telecommute.

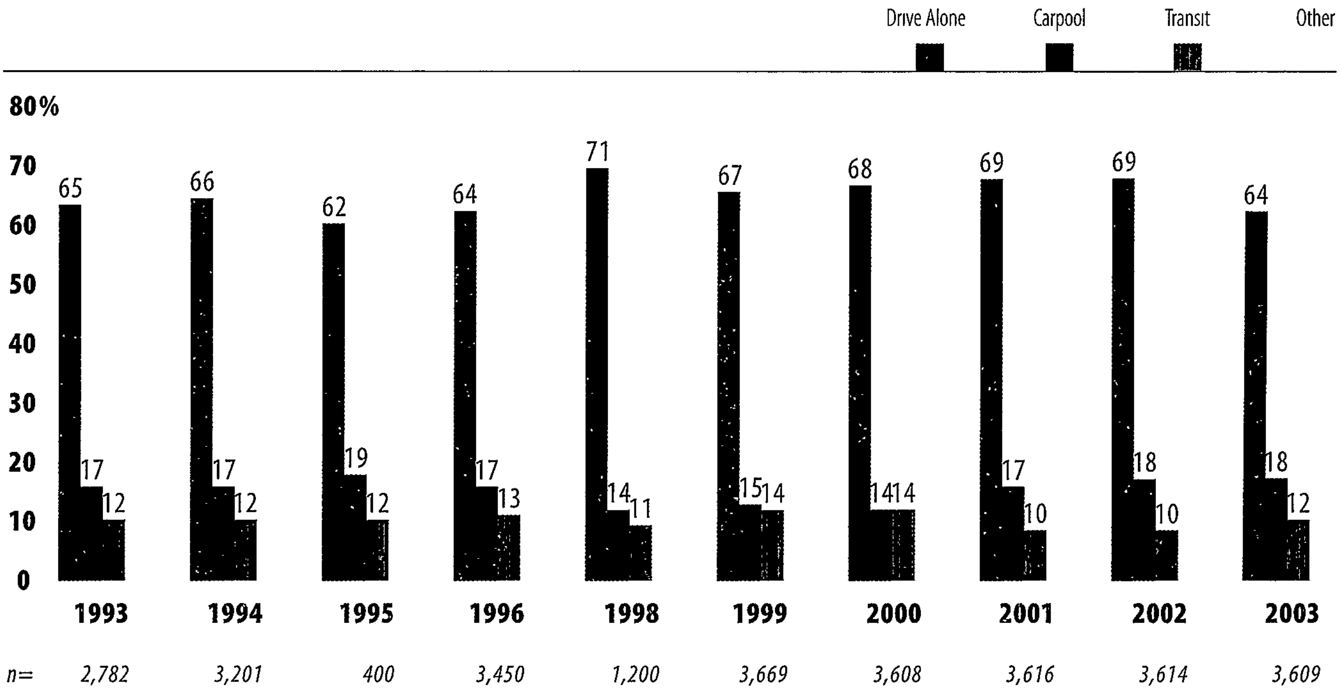
TABLE 5
PRIMARY MODE BY CONNECTING MODE

Primary Modes	Connecting Modes			
	Drive Alone	Carpool	Transit	Other
Drive Alone 3% of drive alones use a connecting mode *n=74*	--	10%	65%	26%
Carpool 8% of carpoolers use a connecting mode *n=53*	33%	7%	41%	19%
Transit 55% of transit users use a connecting mode *n=236*	38%	8%	36%	19%
Other 24% of other mode users use a connecting mode *n=57*	38%	9%	34%	19%

Grouping commute modes into clusters makes it easier to view patterns which emerge over time. The biggest change from last year is a five percentage point drop in the drive-alone rate (Figure 1). It had been fairly steady over the previous four years with a gradual upward trend; the drop this year is contrary to past trends. To balance the decline in driving alone both transit and the use of "other" modes increased. The increase in transit use runs counter to the trend observed in *Commute Profile* over the last two years and counter to the trend of generally lower overall ridership on transit reported by operators. Although the lower ridership levels reported by operators appear to contradict the *Commute Profile* data, it is feasible that the percentage of commuters using transit can increase while overall ridership decreases. The fact that employment has declined would lower ridership levels, but not necessarily impact the percent of commuters riding transit. For "other" modes, this marks an upward movement of a trend line which has been flat over the last five years. The carpooling rate this year is consistent with the trend which has emerged over the last five years showing a gradual increase.[3]

[3] There have been two changes in methodology since the survey began in 1992 In 1998, a change was made in how carpools were classified (drivers who have passengers a minimum of three days per week are classified as carpoolers—previously data was not available on frequency so all drivers with passengers were classified as carpoolers), which resulted in a shift of about two percentage points from carpooling to driving alone. In 2001, the survey began collecting more detailed information on the mode used to get to work This information was expanded to include primary, connecting and occasional modes This had the impact of shifting some trips from transit to other modes.

FIGURE 1
CLUSTERED MODES OVER TIME*

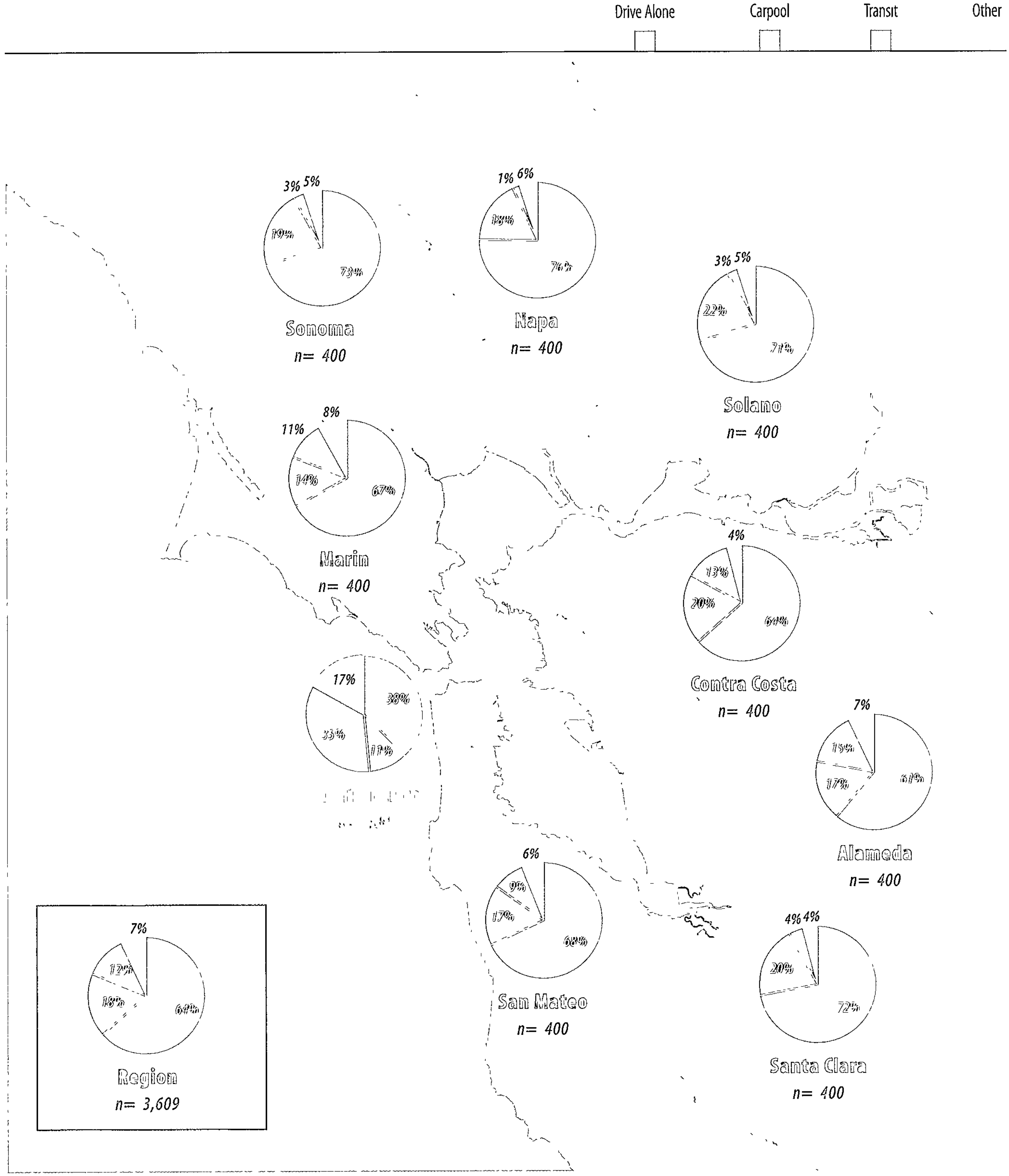


*It is important to note that sample sizes in 1995 and 1998 (because of budget considerations) were smaller, data from these two years should be viewed with added caution

COUNTY COMPARISONS

There are a number of differences in commute modes between commuters who live in different counties—some subtle, some more obvious, but mostly related to the options that are available. The availability of transit and parking, as well as travel distances, appears to influence commuters' choices. Consistent with previous years, driving alone is most popular for commuters who live in Santa Clara, Sonoma and Napa counties (Figure 2). San Francisco commuters are the least likely to drive alone to work; they have the highest transit and "other" mode use and the lowest carpooling rate. Solano once again has the highest carpool rate; it was temporarily unseated as the "carpool capital" by Contra Costa in 2002. Santa Clara tied Contra Costa for the second highest drive-alone rate this year. Consistent with previous years, transit use is distinctly lower in Napa, Solano, Sonoma and Santa Clara.

FIGURE 2
COMMUTE MODE CLUSTERS BY COUNTY



COMMUTE DISTANCE

Trip distance has remained fairly constant since 1992—varying from a low of 14 miles to a high of 17 miles (Figure 3). The 2003 data supports the 2002 data which showed a small decline from 17 to 16 miles one-way. This year's trip distance is almost identical to the average of all years. Data collected here does not support common claims that commute distances are getting longer. *Commute Profile* does not sample residents from counties beyond the nine core counties. Commuters from counties such as San Joaquin and Stanislaus, who may be making longer trips, are not included in this study. Even if commuters from some of these outlying counties were included in the study, they comprise a small percentage of total commuters and would not dramatically influence results on a regional basis.[4]

FIGURE 3

AVERAGE REGIONAL COMMUTE DISTANCE (one-way)

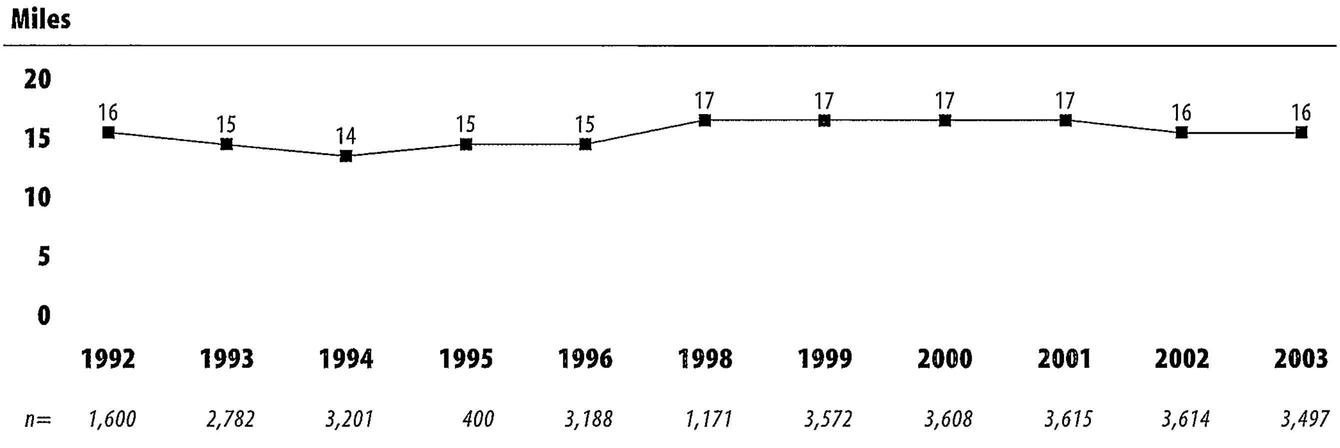


Table 6 provided additional insight into the distances commuters travel to get to work each day. Long-distance commuters (those traveling more than 41 miles each way) are the minority—only seven percent are in this category. At the other extreme, short distance commuters (those traveling five miles or less) comprise the largest group. The flat trend line shown by average commute distances in Figure 3 is clearly reflected by the lack of any upward or downward trends in the grouped mileage categories.

Short-distance commuters are the least likely to drive alone (Figure 4) and the most likely to participate in "other" modes which include biking and walking. Transit usage is more common among short-distance commuters (0-5 and 6-10 mile

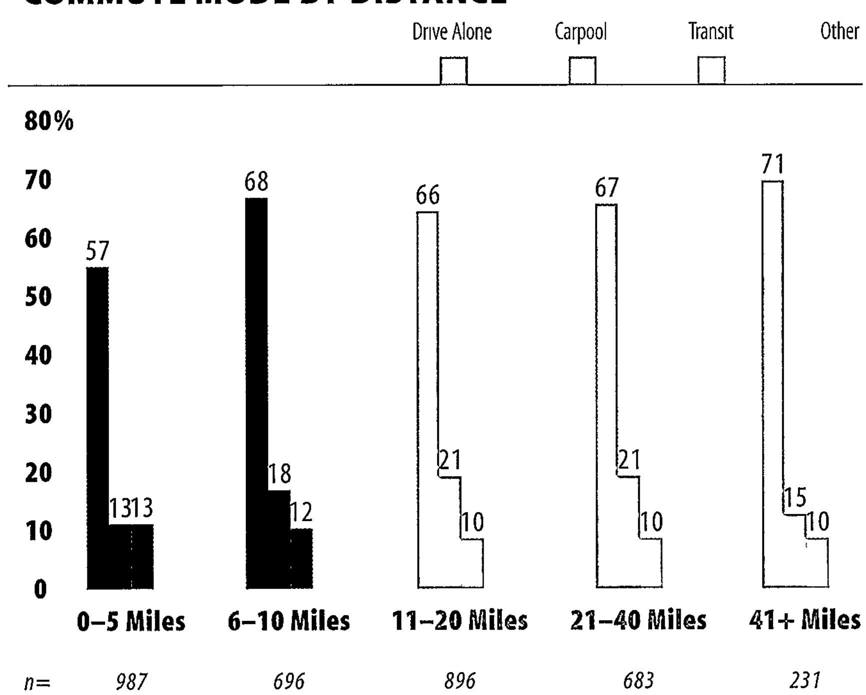
[4] For example, about 13,000 San Joaquin and Stanislaus residents commute to Santa Clara and San Mateo counties—common long-distance commutes. This is less than one half of one percent of Bay Area commuters. (Source: 2000 Census, compiled by KnightRidder)

TABLE 6
COMMUTE DISTANCE OVER TIME

One-Way Miles	1996	1998	1999	2000	2001	2002	2003
0 - 5 miles	33%	25%	28%	28%	28%	30%	28%
6 - 10 miles	20%	20%	20%	17%	20%	20%	20%
11 - 20 miles	25%	28%	26%	26%	25%	27%	26%
21 - 40 miles	16%	21%	19%	22%	20%	18%	20%
41 miles +	7%	7%	8%	7%	6%	6%	7%
n=	*3,188*	*1,171*	*3,572*	*3,608*	*3,615*	*3,614*	*3,493*

ranges), but not dramatically different than longer distance commuters. It is possible shorter distance commuters may be more likely to find a direct transit link between home and work and longer distance commuters may appreciate the lower cost and "useable time" advantages of transit. Carpooling is highest among commuters who travel 11-20 and 21-40 mile ranges, and those traveling the longest distances are the most likely to drive alone. These long-distance travelers, although they represent only seven percent of commuters, are an excellent target market for the use of alternatives to driving alone because they have the greatest potential benefit.

FIGURE 4
COMMUTE MODE BY DISTANCE



	Drive Alone	Carpool	Transit	Other
Average miles	17	17	15	8

COUNTY COMPARISONS

Solano County residents continue to travel the longest distance to work (Table 7). On average, these commuters travel twice the distance that San Francisco residents travel. Contra Costa County residents, after a dip in 2002, travel on average only one mile less than Solano residents. The commute distance for Santa Clara County residents is up slightly after what looked like a decrease in 2001. In 2001, Santa Clara actually had the shortest commutes—a distinction owned by San Francisco all other years. Napa showed the largest decrease in commute distance. Compared with earlier years the 14 miles recorded this year seems unusually low. With the few exceptions mentioned above, the ranking of counties by commute distance has been fairly consistent since 1996.

TABLE 7

AVERAGE ONE-WAY COMMUTE MILES BY COUNTY*

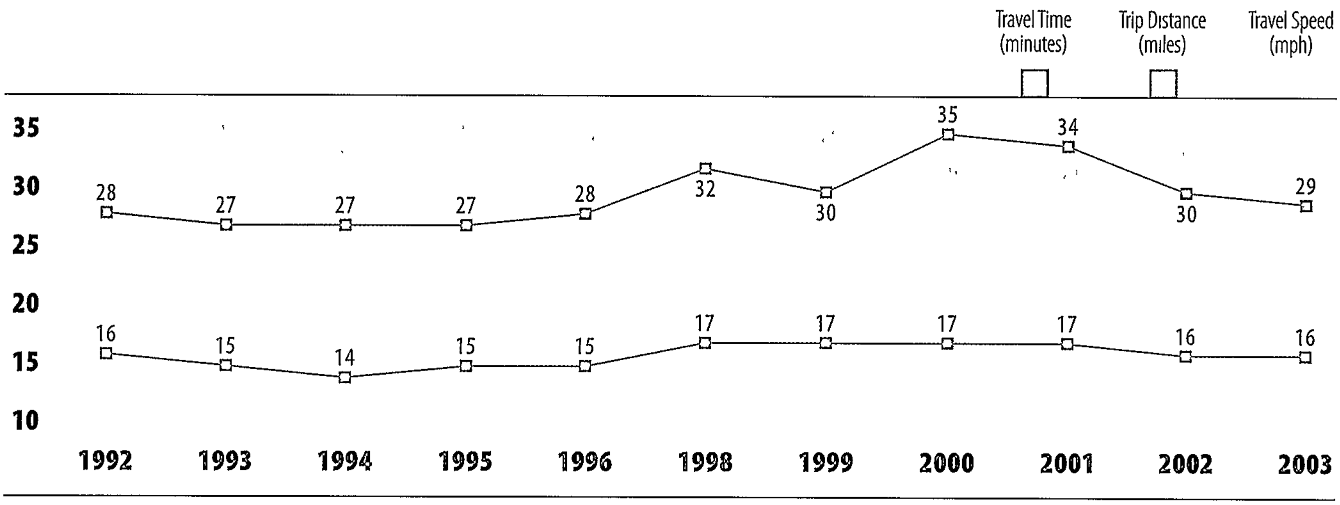
County	1996	1999	2000	2001	2002	2003
Solano	23	27	27	25	25	23
Contra Costa	19	21	22	23	20	22
Sonoma	19	21	20	20	19	18
Marin	16	17	18	18	17	17
Alameda	16	17	17	17	16	16
San Mateo	16	15	16	16	15	15
Santa Clara	14	14	14	12	14	15
Napa	19	19	20	18	17	14
San Francisco	9	11	12	13	11	10

*n=approximately 400 for each county each year

COMMUTE TIME

In 2002, the trend of increasing travel time to work took a dramatic turn in the other direction—decreasing from 34 to 30 minutes (Figure 5). With the economy continuing to be slow and traffic congestion lighter, travel time to work decreased again in 2003. Travel times have mirrored the increases and decreases in economic activity. Economic activity hit its peak in 2000; as the economy started to cool down in 2001, travel times began to decrease and have continued to do so in 2003. Based on the data gathered on distance and time, travel speeds were calculated. For the second year in a row this measurement of commute conditions shows an increase in speeds—as fewer commuters on the road each morning and roadway improvements positively influence traffic flow. Respondents' perceptions of commute conditions have again

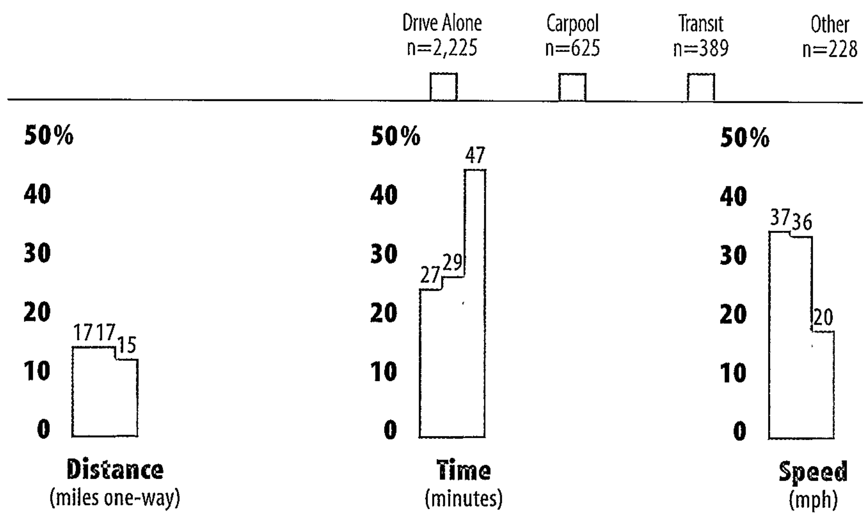
FIGURE 5
TRAVEL TIME TO WORK



improved over the last year (discussed in more detail later)—lending further support to the hypothesis of improved commute conditions as a result of fewer commuters.

Auto-based modes and non-auto modes have considerably different travel characteristics (Figure 6). Commuters who drive alone and carpool have similar distance, time and speed characteristics. Carpoolers who regularly use carpool lanes on their commute, however, travel longer distances (26 miles each way) and do so at greater speeds (41 mph). Transit users travel slightly shorter distances compared to the auto-based commuters, and do so at slower average travel speeds. Transit riders travel longer distances than "other" mode commuters but do so at about the same speed.

FIGURE 6
TRAVEL CHARACTERISTICS BY PRIMARY MODE



COUNTY COMPARISONS

Solano residents have the fastest estimated travel speeds on their daily commutes (Table 8). Napa and Sonoma residents have the next fastest speeds. Commuters who live in San Francisco have the slowest estimated travel speeds. Over the last three years, travel speeds have increased for seven of the nine counties. In Napa and San Francisco counties, travel speeds decreased. Employment figures provided by the State of California show, that unlike the rest of the Bay Area, the Vallejo-Fairfield-Napa area has actually registered gains in employment of about four percent since late 2000.

TABLE 8
ESTIMATED TRAVEL SPEED (MPH) BY COUNTY*

County	1996	1999	2000	2001	2002	2003	Change 1996-2003
Solano	44	48	37	37	39	41	−3
Napa	43	45	38	39	37	37	−6
Sonoma	43	41	35	35	36	37	−6
Contra Costa	35	39	32	33	34	34	−1
San Mateo	37	34	31	30	34	35	−2
Santa Clara	36	32	29	26	32	35	−1
Alameda	35	34	30	28	30	33	−2
Marin	31	33	27	28	30	32	+1
San Francisco	21	25	20	24	23	21	=

*n=approximately 400 for each county each year

In 2002, only one of eight counties (San Francisco) had posted an increase in travel speed since 1996. One additional county (Marin) moved into the "positive change" category in 2003. With the exception of San Francisco, all counties show positive or no change from last year.

START TIME AND FLEXIBILITY

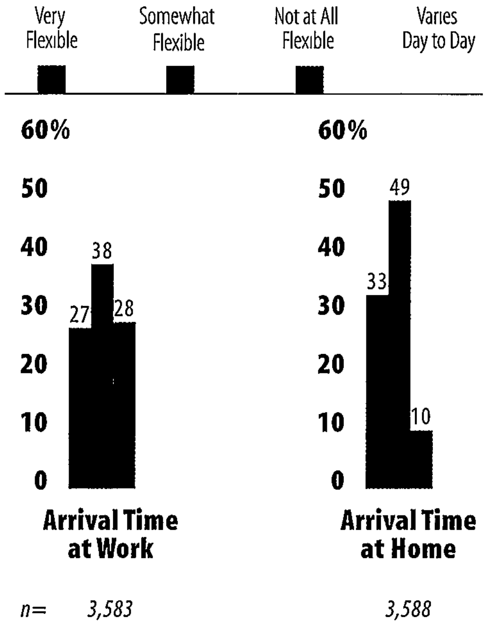
For the second year, data were collected on the time respondents start work (Table 9). Predictably, the highest percentage of respondents starts work between 8 a.m. and 8:59 a.m. More than 80 percent of respondents start work during the morning peak period (6 a.m. to 9:59 a.m.). Since many of the survey calls were made in the evening (some were also made on weekends), the 4 p.m. to 11:59 p.m. may be underrepresented in this sample.

TABLE 9
START WORK TIME

06:00 am – 06:59 am	8%
07:00 am – 07:59 am	24%
08:00 am – 08:59 am	34%
09:00 am – 09:59 am	18%
10:00 am – 03:59 pm	7%
04:00 pm – 11:59 pm	3%
Midnight – 05:59 am	5%
Varies	2%

n=3,604

FIGURE 7
FLEXIBILITY OF ARRIVAL TIMES AT WORK AND HOME



Also for the second year, respondents were asked about the flexibility of their arrival and departure times (Figure 7). Arrival times at home are more flexible than arrival times at work. Just over 80 percent of respondents indicated their arrival time at home was "very flexible" to "somewhat flexible." Even though arrival times at work were less flexible than arrival times at home, just over one in four respondents indicated their arrival time at work was "not at all flexible."

CARPOOL LANE USE

Just over 40 percent of respondents have a carpool lane along their route to work. Of those who have a carpool lane along their route to work, about 22 percent use the lane regularly to get to work. This translates to about 10 percent of all commuters using a carpool lane; most of them (86 percent) save time by using the lane. The amount of time respondents estimated saving was about the same as the previous year, but less than the prior couple of years (Figure 8). In 2000 and 2001, when most indicators showed higher levels of congestion, the time saved using carpool lanes was at its highest. The 17 minutes saved in 2003 was similar to the time saved in 1999 and earlier. As noted last year, the decreased amount of time saved by using the carpool lane may be related to the adjacent mixed flow lanes being less congested.

Also consistent with the decrease in time saved and last year's results was a decrease in the percentage of respondents who indicated the carpool lane influenced their decision to carpool or use transit (Figure 9). Although fewer respondents indicated the carpool lane influenced the decision to carpool or use transit, about the same percentage of commuters (61 percent) indicated they would continue with their carpool or transit mode even if the carpool lanes did not exist. One of four respondents indicated they would no longer carpool without access to a carpool lane.

FIGURE 8
MINUTES SAVED BY USING CARPOOL LANE (one-way)

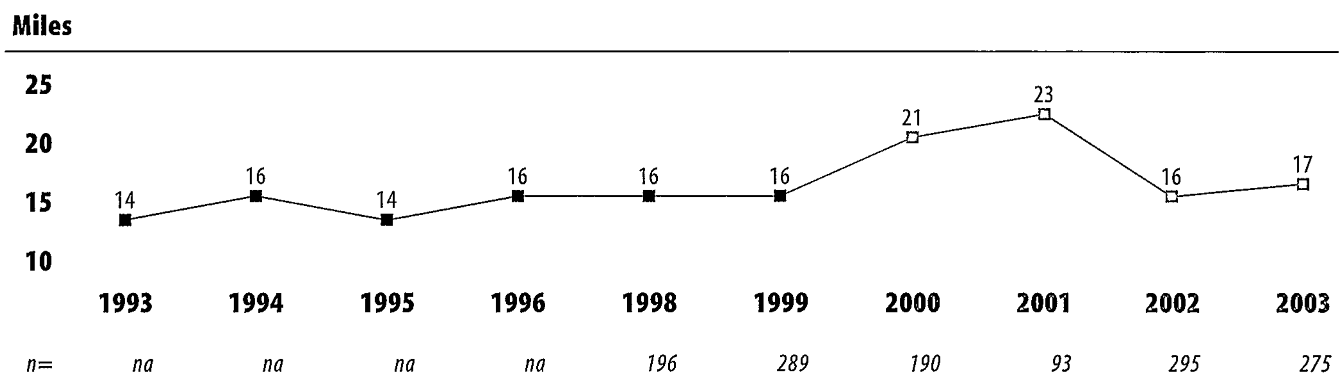
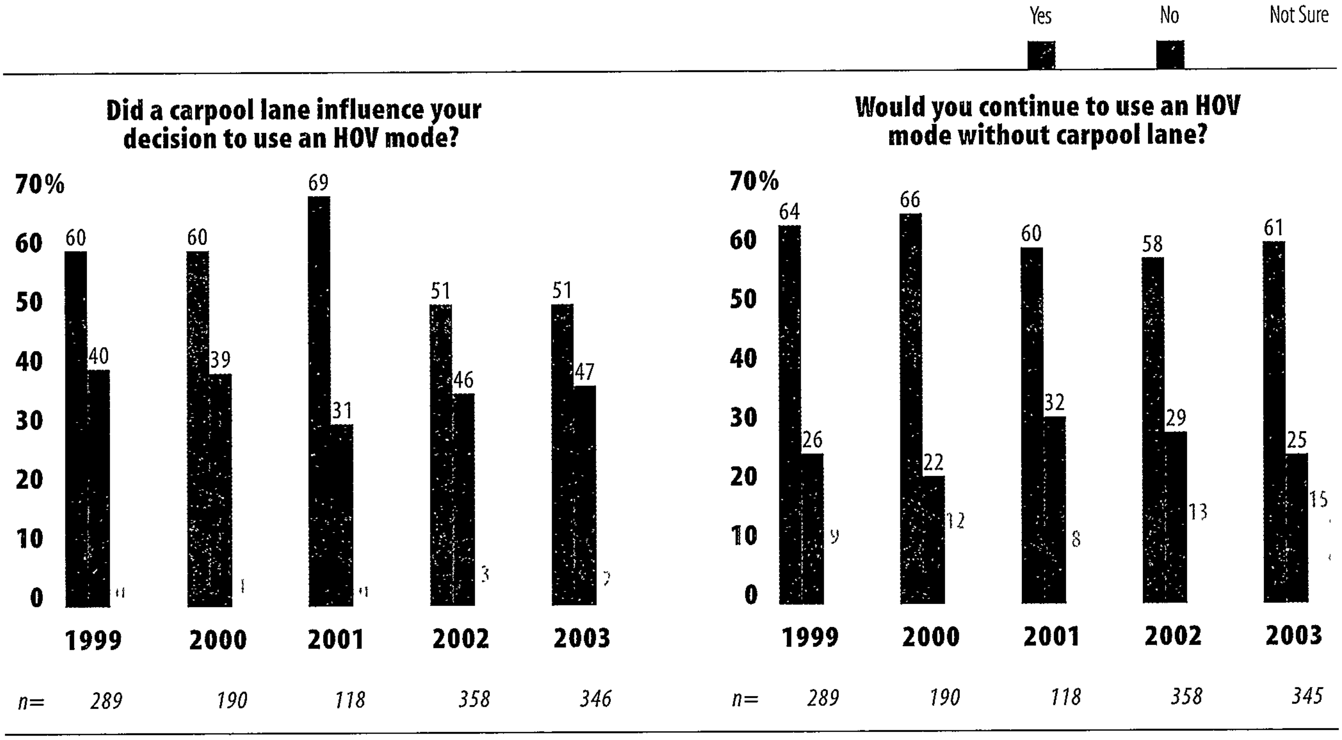


FIGURE 9
CARPOOL LANE AND COMMUTE MODE CHOICE



COUNTY COMPARISONS

Santa Clara, Marin and Contra Costa residents were most likely to report having a carpool lane along their route to work (Table 10). Napa County residents have the lowest level of access to carpool lanes. One significant change from last year occurred in Sonoma. Access to carpool lanes for Sonoma residents increased from 18 percent to 36 percent. A new carpool lane in the Santa Rosa area opened in November 2002.

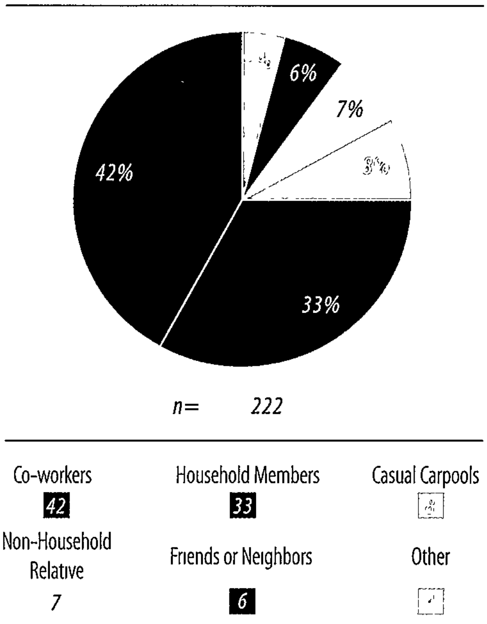
Of those commuters who have a carpool lane along their route, San Francisco and Solano residents are the most likely to use it. Solano County commuters make the longest trips and many of them travel along the congested Interstate 80 corridor where the carpool lane offers a significant advantage. In three counties (Sonoma, Santa Clara and Alameda), 90 percent or more of respondents indicated the carpool lane saves them time. San Francisco residents were the least likely to indicate carpool lanes saved them time.

The question which elicited the most varied response (when looked at on a county-by-county basis) addressed the influence of the carpool lanes on a respondent's decision to carpool or use transit. Alameda and San Mateo residents were most heavily influenced by the presence of carpool lanes on their route to work. San Francisco and Sonoma county residents were the least likely to indicate the carpool lane influenced their choice of travel mode.

TABLE 10
CARPOOL LANE INFLUENCE BY COUNTY

County	Access to Carpool Lane	Use of Carpool Lane	Save Time	Influence Decision
Alameda	49%	21%	90%	70%
Contra Costa	53%	16%	85%	59%
Marin	54%	22%	81%	47%
Napa	12%	24%	82%	46%
San Francisco	24%	38%	72%	33%
San Mateo	25%	16%	88%	63%
Santa Clara	58%	23%	91%	45%
Solano	30%	32%	79%	55%
Sonoma	36%	24%	94%	32%
n=	*3,537*	*1,348*	*305*	*302*
Region	43%	22%	86%	51%

FIGURE 10
CARPOOL MAKE UP



CARPOOL COMPOSITION

The average carpool size is 2.4 persons (including the driver). If vanpoolers are included in the calculation the average increases to 2.7 persons per vehicle. For vanpools only, the average is eight and a half persons per van. Co-workers are the most common type of participant in a carpool followed by household members (Figure 10). Casual carpoolers (i.e., carpools which are formed near transit stops on an informal basis with different drivers and passengers each day) make up approximately 8 percent of carpools. More than 60 percent of carpoolers have been participating in a carpool for more than two years (Figure 11).

TELECOMMUTING (TELE-WORK)

About a quarter (23 percent) of respondents have the option to telecommute rather than travel to work. This has been very consistent over the last three years with between 22 percent and 24 percent of employees having the option to telecommute. About 77 percent of respondents who have the option to telecommute take advantage of it. This is down slightly from last year when just over 80 percent of respondents exercised the option to telecommute, but more similar to earlier years. Of those who telecommute:

- 15 percent do so one day per month,
- 45 percent do so two to four days per month,
- 41 percent do so five or more days per month.

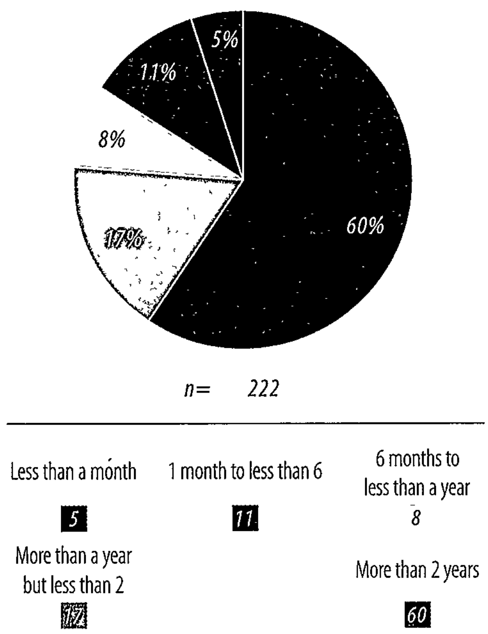
The average telecommuter does so about five and a half days per month. This is an increase from last year but more in line with previous years where the average was between five and six days per month.

Since one goal of telecommuting is to reduce vehicle trips, respondents were asked if they made more, the same or fewer trips on days when they telecommute compared with days when they commuted to work. In 2003, about two of three telecommuters reported making fewer trips (Table 11). Although there have been changes from year to year, the long-term pattern is clear—most telecommuters make fewer trips on days they telecommute.

TABLE 11
TRIPS MADE ON TELECOMMUTING DAYS

	1998	1999	2000	2001	2002	2003
Fewer	60%	67%	74%	57%	69%	66%
Same	35%	24%	20%	31%	22%	28%
More	5%	9%	7%	13%	9%	6%
n=	*159*	*674*	*645*	*571*	*726*	*713*

FIGURE 11
CARPOOL DURATION



TRAVEL MODE CHOICE

this section looks at why commuters choose specific modes, changing commute conditions, the ease of using specific modes and parking and employer incentives

WHY COMMUTERS CHOOSE SPECIFIC MODES

"Travel time to work," "needing a vehicle to transport children," "difficulty finding carpool partners" and "a comfortable commute" top the lists of reasons commuters choose a particular mode of travel. Respondents were asked in an open-ended format to describe their reasons for using their primary commute mode. The responses are shown in Table 12 for each of the four clustered mode categories—commuters who drive alone, carpool, take transit and use "other modes." The reasons cited for using a particular mode varied considerably for each mode.

Commuters who drive alone were most likely to tell us they "could not find anyone to carpool with," "the irregular nature of their work schedule required the flexibility associated with driving alone" and there were really "not any practical transit options for their commute." Combining those three reasons probably provides the most accurate picture of why most commuters choose to drive alone. It is difficult to find carpool partners or use public transit when their job and lifestyle are better suited to the flexibility inherent in driving alone. The top four reasons cited this year are identical to the top four reasons cited last year. One reason that moved up substantially on the list was driving is "easiest and fastest"—another indicator of lessened congestion as a result of the slow economy and roadway improvements.

Carpoolers provided the longest list of reasons for selecting their mode. The "lack of practical transit options" and "the need to transport kids"[5] were the two most commonly cited reasons for carpooling. "Keeping commuting costs down" by sharing the driving expenses and "reduced travel time" (presumably by using carpool lanes) were the next two most common reasons for carpooling. Like drive-alone commuters, carpoolers also mentioned driving is easier. Last year "driving is easy" was not even on the list of reasons commuters chose for carpooling.

[5] Respondents who initially indicated they drive alone, but later indicated they have others in the car with them three to five days per week were reclassified as carpools.

TABLE 12

REASONS FOR USING COMMUTE MODE

Reasons for Driving Alone

No one to carpool with	17%
Work hours/work schedule	16%
No practical transit options	16%
Need vehicle during work	11%
Driving is easiest and fastest	10%
Travel time to work	7%
Comfort/relaxation	5%
Need vehicle before/after work	4%
Come and go as I please	2%
Not being dependent on others	2%
Commuting costs	1%
Need vehicle to transport kids	1%
Enjoy privacy	1%
Like to drive	1%
Other	7%

n=2,262

Reasons for Carpooling

Need vehicle to transport kids	17%
No practical transit options	13%
Commuting costs	8%
Travel time to work	7%
Driving is easiest and fastest	7%
Need vehicle during work	7%
Comfort/relaxation	6%
Work hours/work schedule	5%
Need vehicle before/after work	4%
Better for environment	3%
Use carpool lane	2%
Enjoy company	2%
Don't own a car	1%
Not being dependent on others	1%
Come and go as I please	1%
Safety	1%
Other	13%

n=644

Reasons for Using Transit

Comfort/relaxation	16%
Commuting costs	13%
Travel time to work	12%
Don't own a car	11%
Parking availability/cost	11%
No practical transit options	6%
Stress	4%
Better for environment	3%
Work hours/work schedule	1%
Other	21%

n=429

Reasons for Using Other Modes

Travel time to work	19%
Comfort/relaxation	13%
Commuting costs	9%
Better for Environment	7%
Don't own a car	6%
No practical transit options	5%
Stress	3%
Parking availability/cost	2%
Other	33%

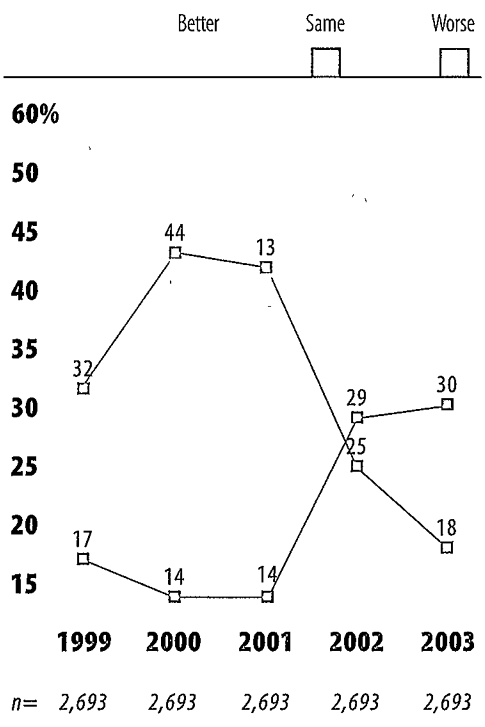
n=160

There are five reasons that top the list transit riders provided. Although the order changed somewhat within the top five, they are the same five reasons cited in 2002. A "comfortable and relaxing commute" was the most commonly cited reason for using transit this year. While some drive-alone commuters also mentioned they found their mode comfortable and relaxing, there were several reasons which distinguish transit from driving alone. Part of the top five list for transit but not part of the drive alone list, were commuting costs, not owning a car and parking costs. There was an unusually large "other" response for the transit mode group. A good number of the "other" responses related to discounts available for the use of transit (e.g., Commuter Checks or other employer-sponsored discounts).

For users of "other modes," such as bicycling and walking, two responses appeared in double digits at the top of the list. "Travel time to work" was cited by one of five respondents and "a more comfortable, relaxing commute" was cited by 13 percent of respondents. Commuting costs and a concern for the environment were also near the top of the list. As with the transit group, there was an unusually large "other" response. Some of the reasons included in this "other" category were "living close to work," "enjoy walking or biking when the weather is good," "more convenient than other modes" and "for exercise."

FIGURE 12

COMMUTE CONDITIONS



CHANGING COMMUTE CONDITIONS

For the first three years (1999–2001) which data were collected on respondents' perceptions of commute conditions relative to a year earlier, the trend was clear. Each year conditions were getting worse. In 2002, commute conditions began to change—for the better. The percentage of respondents indicating conditions were "better" in 2002 was greater than the percentage of respondents indicating conditions were "worse" for the first time. In 2003, respondents' perceptions of their commute conditions continued to improve. A slightly higher percentage of commuters indicated conditions had improved and fewer respondents indicated conditions had gotten worse (Figure 12). While there may be a number of factors contributing to this finding, such as improved transit operations and roadway improvements, it is likely the slower economy, fewer jobs and consequently fewer commuters are a major factor.

Prior to last year, at the top of the list of reasons for improved commute conditions was a "change in home or job location." In other words, conditions had not really improved but individuals had made choices that improved their commute. For the last two years, however, respondents have been clear: "traffic is lighter" (Table 13). Between 1999 and 2000 the trend was beginning to emerge as the percentage mentioning lighter traffic had increased from 16 percent to 26 percent. Last year it jumped 60 percent and this year it is at almost 50 percent. For those whose commute had gotten worse, "heavier traffic" was once again the most commonly cited reason. Just over half indicated traffic was heavier, however, between 1999 and 2001 the percentage of respondents indicating their commute was worse because of heavier traffic was in the mid to lower 70 percent range.

TABLE 13
HOW COMMUTE HAS GOTTEN BETTER OR WORSE

Better		Worse	
Traffic lighter	49%	**Traffic heavier**	52%
Moved home/job location	14%	**Construction delays**	9%
Roadway improvements	10%	**Moved home/job location**	8%
Changed route	6%	**Transit slower/crowded**	7%
Better transit service	4%	**Road maintenance**	4%
Travel at different time	3%	**Changed route**	3%
Changed mode	3%	**Travel at different time**	1%
Less road work	2%	**Changed mode**	1%
Other	9%	**Other**	15%
n=1,059		*n=635*	

Changing commute conditions for each of the four clustered commute modes are shown in Table 14. Carpoolers were more likely to indicate conditions had improved. Transit and "other" mode users were the most likely to indicate conditions had not changed. As in the past year, respondents in automobiles (driving alone or carpooling) were more likely to be the ones indicating conditions had gotten worse.

TABLE 14
CHANGE IN COMMUTE CONDITIONS BY MODE

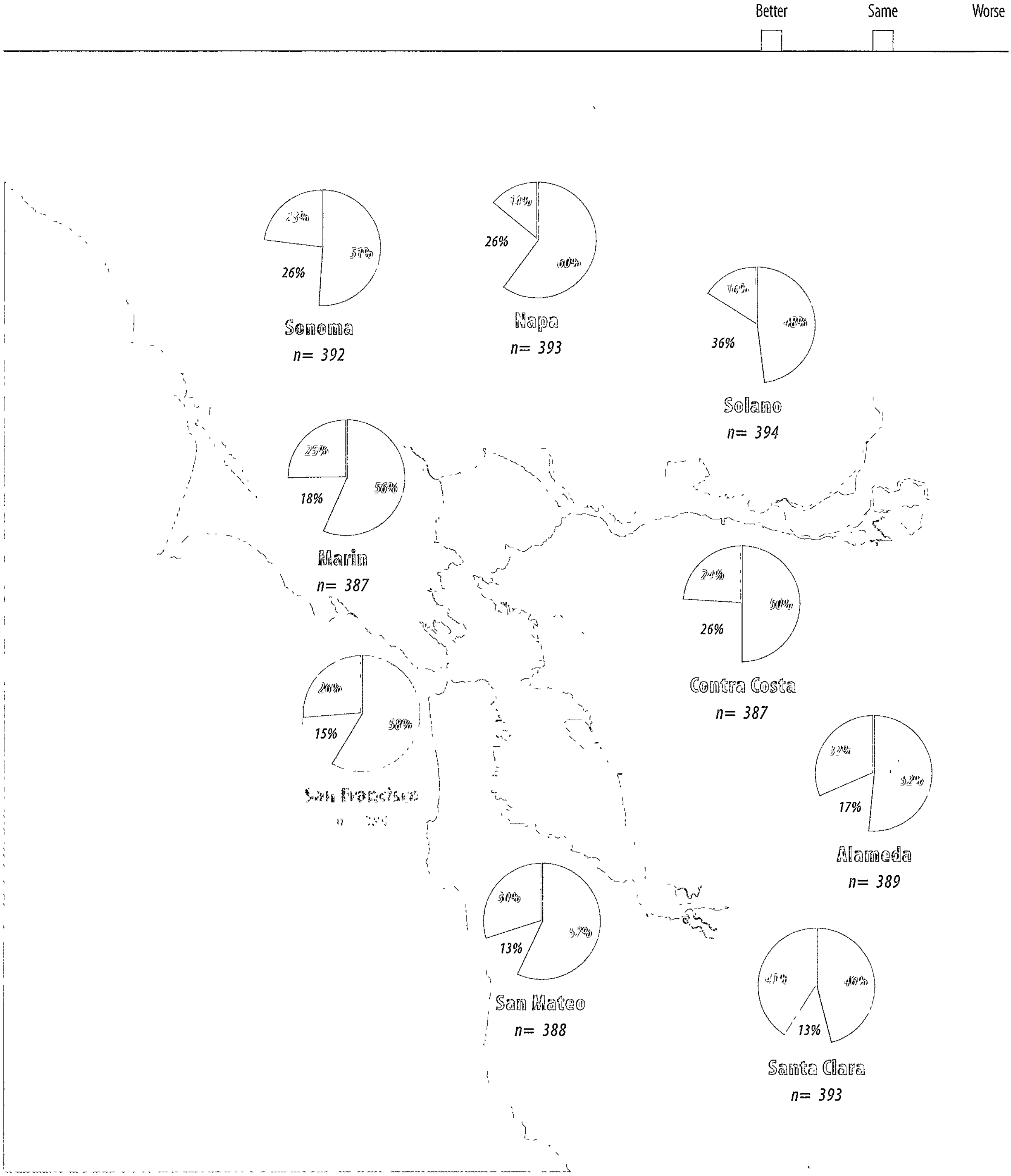
	Drive Alone	Carpool	Transit	Other
Better	30%	35%	23%	29%
Same	51%	45%	62%	58%
Worse	19%	20%	15%	13%
n=	*2,238*	*634*	*419*	*228*

COUNTY COMPARISONS

Respondents from five of nine counties were more likely to report improved conditions compared with last year. Commuters who live in Santa Clara and Alameda counties were most likely to report improved commute conditions (Figure 13). The biggest improvements were in Santa Clara (41 percent indicating conditions were better than a year

FIGURE 13

CHANGE IN COMMUTE CONDITIONS BY COUNTY

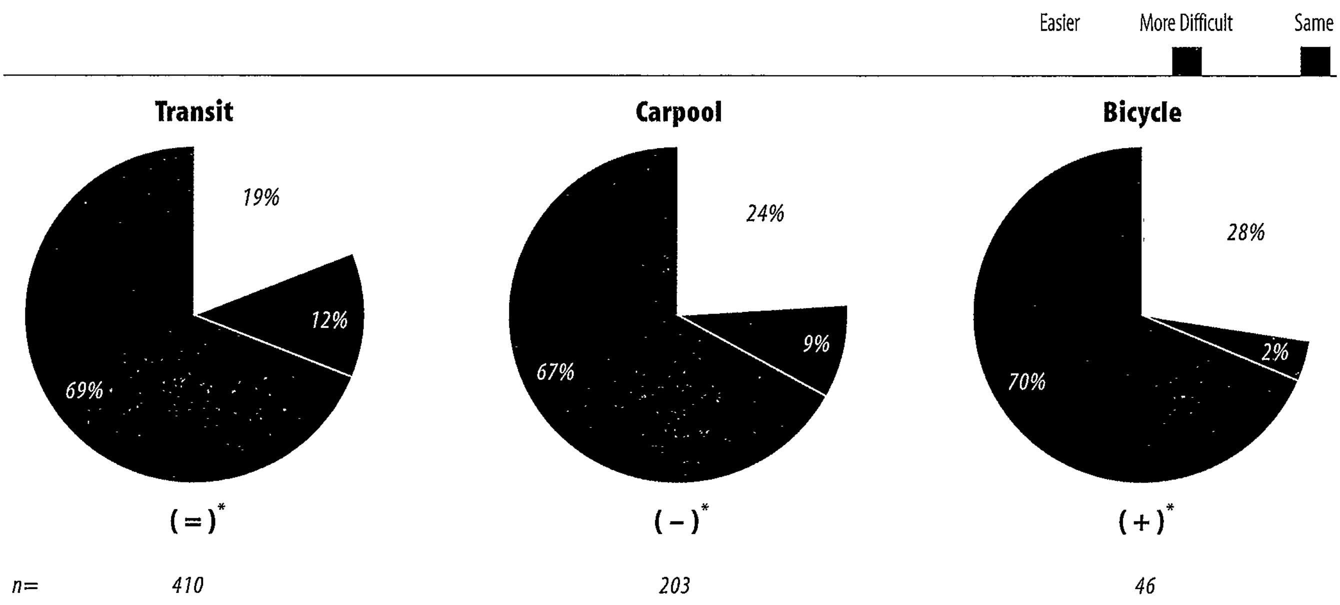


ago), Alameda (32 percent) and San Mateo (30 percent). Commuters who live in Napa and Sonoma counties were the least likely to report improved conditions. Respondents from Solano were most likely to report conditions had gotten worse. It appears likely that there is a connection between changes in employment within counties and perceptions of commute conditions within those counties. According to the California Employment Development Department job losses in the San Jose metro area in 2001 and 2002 amounted to 16 percent of peak employment while the North Bay has fallen by less than two percent.

EASE OF USING SPECIFIC MODES

Respondents commuting by transit, carpool or bicycle on a regular basis were asked if it is easier, about the same or more difficult to use those modes now than it was a year ago. As was the case last year, carpoolers and bicycle commuters were the most positive about the use of their modes (Figure 14). Very few bicycle commuters (two percent) indicated conditions were worse this year compared with a year earlier. A higher percentage of respondents indicated it was no more or less easy (i.e., essentially the same) to use transit, carpool or bicycle to work. Overall, results are similar to last year.

FIGURE 14
EASE OF USING TRANSIT, CARPOOLING AND BICYCLING FOR WORK TRIP



*Changes from last year range from (++) to (——) with (++) being much better conditions, (=) being about the same as last year and (——) being much worse than last year

For those respondents who indicated using transit, carpooling or bicycling was easier or more difficult, a follow-up question was asked to determine why their experience had changed. The most frequently cited reasons are shown in Figure 15. "Improvements in reliability and frequency" topped the list of positive transit responses. For those who found transit more difficult to use, the opposite was true—transit service was "less reliable and frequent."

FIGURE 15

HOW USING TRANSIT HAS GOTTEN...

TRANSIT

EASIER *n=76*
- service reliability or frequency has improved
- changed home or work location
- new service has been added

MORE DIFFICULT *n=45*
- service is less reliable
- service cut
- service is less frequent

HOW CARPOOLING HAS GOTTEN...

CARPOOL

EASIER *n=47*
- more people to share ride with
- changed home or work location
- new carpool lane on commute

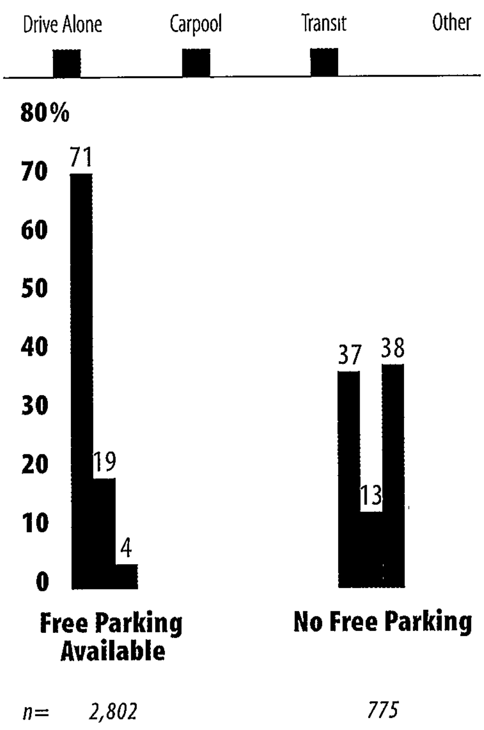
MORE DIFFICULT *n=18*
- traffic is worse
- partners no longer available

HOW BICYCLING HAS GOTTEN...

BICYCLE

EASIER *n=13*
- new bike lane
- changed home or work location
- improved facilities

FIGURE 16
FREE PARKING AND TRAVEL MODE



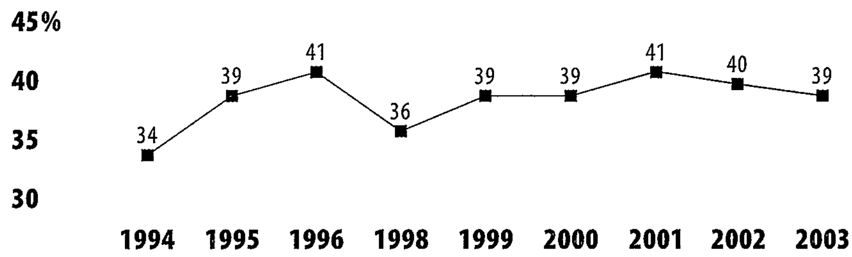
A greater availability of partners was the most frequently cited positive response by carpoolers. Increasing traffic was the most common response for respondents who felt carpooling had become more difficult. Although the sample size is small, new bike lanes were cited by bicycle commuters as an improvement that made their bicycle commute easier.

PARKING AND EMPLOYER INCENTIVES

Identical to last year and similar to previous years almost eight of 10 respondents (78 percent) have free all-day parking available at or near their worksite. The influence on mode choice of destinations with and without free parking is substantial.[6] Locations with free parking have a drive-alone rate of 71 percent, while those without free parking have a drive-alone rate of 37 percent (Figure 16). The difference in transit use is even greater than the difference in the drive-alone rate. For those with free parking, the transit use rate is four percent; for those without, it jumps to 38 percent. The effect of paid parking (and the services associated with densely populated job centers) on the decision to drive one's car or use transit is substantial. The influence of free parking on the decision to carpool is less obvious.

FIGURE 17
EMPLOYERS WHO ENCOURAGE USE OF COMMUTE ALTERNATIVES

Employers with Programs

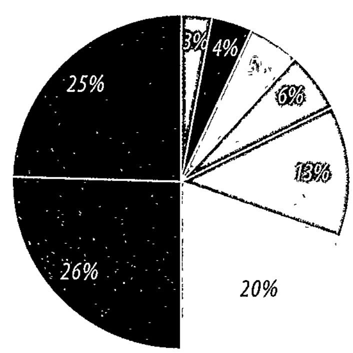


n=	3,056	382	3,295	1,516	3,530	3,472	3,460	3,429	3,446

The percentage of employers who encourage employees to use transit, carpool, bicycle and walk to work remains consistent with earlier years (Figure 17). *Commute Profile* data provide only an estimate of employer involvement because it is based on respondents' awareness and understanding of what their employer does. The sampling methodology is also designed to be representative of commuters from the nine counties—not necessarily a representative sample of all Bay Area employers. With this consideration, the data do indicate that employers remain involved in providing commute assistance to their employees. The most common types of programs employers operate to encourage the use of commute alternatives are transit sales and/or subsidies and carpool or vanpool programs (Figure 18).

The drive-alone rate is about seven percent lower at employer sites where the use of alternatives is encouraged (Figure 19). This is identical to last year, up somewhat from two years ago when the difference was only four percent, but close

FIGURE 18
TYPES OF EMPLOYER ENCOURAGEMENT

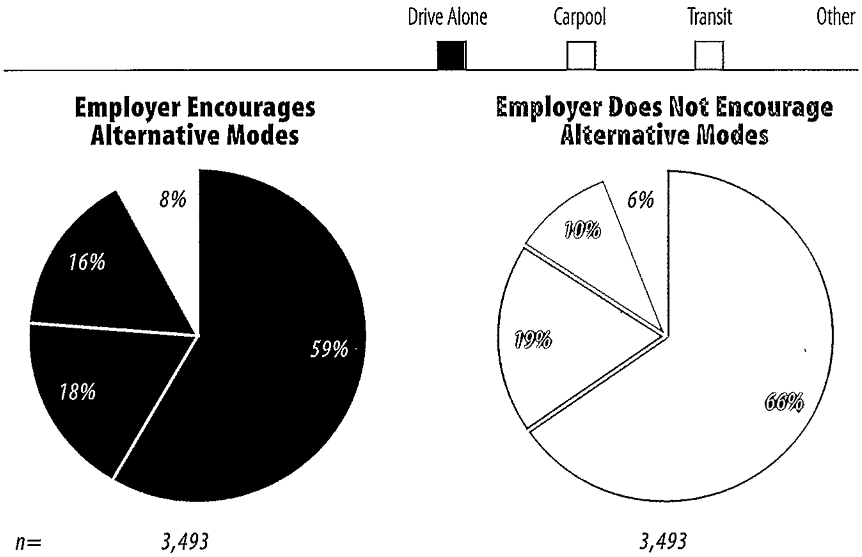


n= 1,956

Transit ticket Sales/Subsididies 26	Incentives/Rewards 4
Guaranteed Ride Home 3	Bike Lockers/Showers 1
Carpool or Vanpool Programs 20	Flexible Hours 13
Preferential Carpool Parking 6	Other 25

[6] Although parking is the variable identified here, other conditions associated with parking are likely to have an influence on mode choice In other words, paid parking may not be the causative variable itself—it may simply identify areas with specific characteristics For example, in areas such as downtown San Francisco where free parking is scarce, there is also more transit service, more amenities within walking distance of offices and significant local congestion The combination of conditions is what most likely influences behavior rather than any single factor

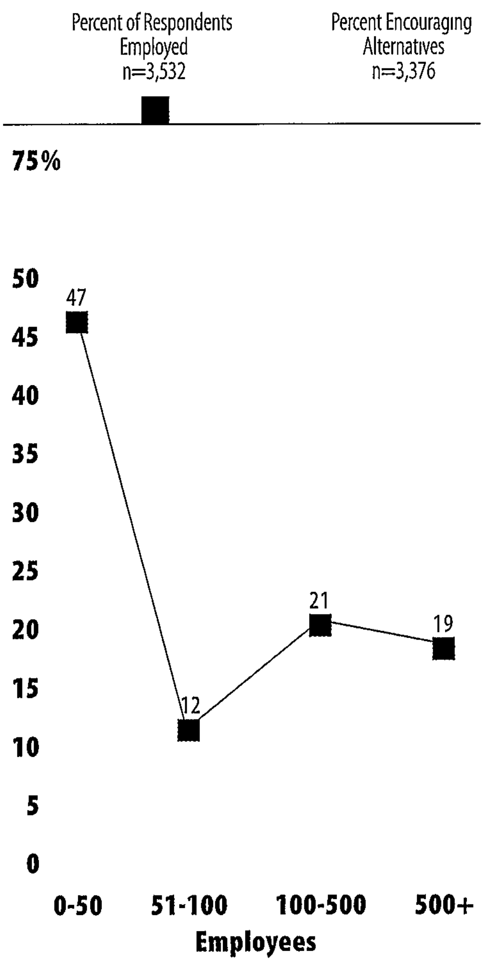
FIGURE 19
COMMUTE MODES WITH AND WITHOUT EMPLOYER ENCOURAGEMENT



to 2000 when the drive-alone rate was eight percent lower where employers encourage the use of alternatives to driving alone. The influence of employer encouragement appears to be strongest among smaller employers. The drive-alone rate at smaller employer worksites (100 or fewer) that encourage the use of alternate modes is 51 percent. It is 66 percent at smaller employer sites that do not encourage the use of alternative modes. The difference is less pronounced with larger employers (more than 100 employees). The drive-alone rate is 63 percent at employer site that encourage the use of alternatives and 67 percent where commute alternative use is not encouraged.

Smaller employers, those with 50 or fewer employees, accounted for the largest percentage of respondents (Figure 20); just under half (47 percent) of respondents work for employers with 100 or fewer employees. The likelihood an employer will operate a program that encourages employees to use commute alternatives increases with employer size. Less than a quarter of companies with 50 or fewer employees operate a commute incentive program while almost three quarters (74 percent) of larger companies (more than 500) do something to encourage the use of commute alternatives.

FIGURE 20
EMPLOYER CHARACTERISTICS BY NUMBER OF EMPLOYEES



ASSESSING MARKET DEMAND

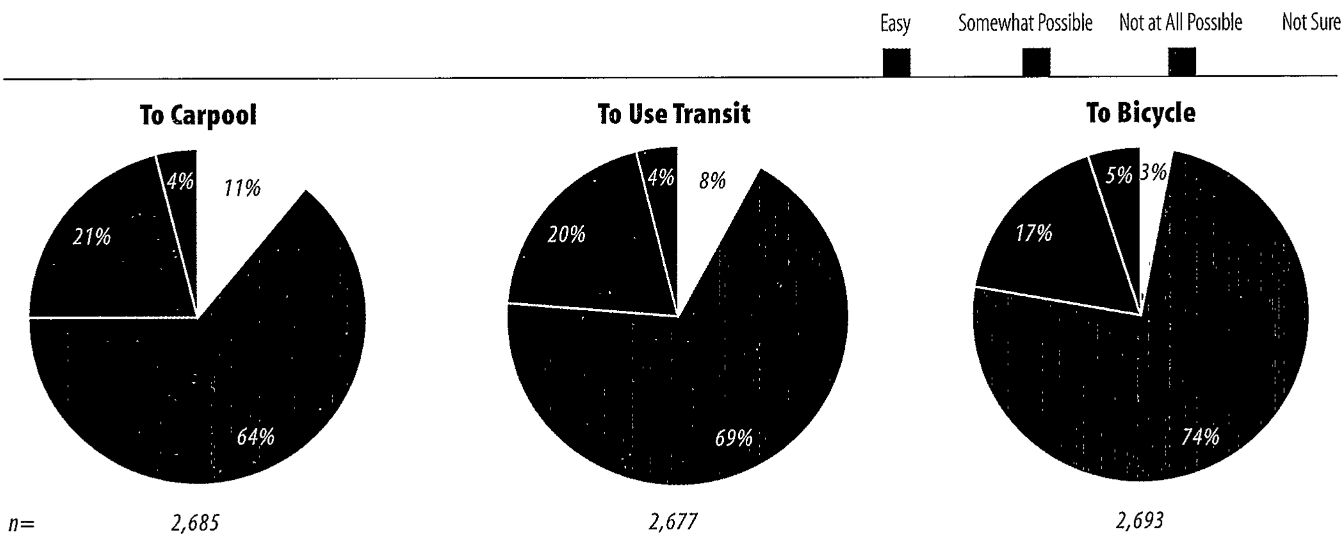
this section discusses the use of commute alternatives, characteristics of commuters more likely to use alternative modes, impediments to the use of commute alternatives and types of traveler information desired

LIKELIHOOD OF COMMUTE ALTERNATIVE USE

Driving by oneself to work is the choice of most Bay Area commuters. Drive-alone respondents to Commute Profile were asked how possible it would be for them to carpool, use transit or ride a bike to work at least one or two days a week. Most drive-alone commuters indicated it is "not at all possible" to try an alternative (Figure 21). For those who did indicate options to driving alone might be feasible, carpooling was the most popular of the proposed alternatives with approximately one in four respondents indicating it is "easy" to "somewhat possible" for them to carpool one or two days a week.

FIGURE 21

HOW POSSIBLE WOULD IT BE TO USE AN ALTERNATIVE TRAVEL MODE



Over the past five years, an increasingly more positive attitude toward the use of transit and bicycling has been evolving. The number of respondents indicating it would be "easy" to "somewhat possible" to use transit has increased. In 1999, it was 13 percent; in 2000 it went up to 18 percent and now it is up to 24 percent (Table 15). A similar trend has emerged with regard to bicycling to work. In 1999 and 2000, about 12 percent to 13 percent of respondents felt bicycling was a feasible option. In 2003, the group who sees bicycling as a feasible option has grown to 22 percent.

Driving alone continues to dominate the commute mode market and encouraging the use of other modes can sometimes feel a bit futile. The data presented here does, however, show an encouraging trend of more commuters at least having a positive attitude toward the potential use of options to driving alone.

TABLE 15

ATTITUDE TOWARD USE OF TRANSIT AND BICYCLING

	1999	2000	2001	2002	2003
Easy to Somewhat Possible to Use Transit	13%	18%	22%	21%	24%
n=	*2,216*	*2,262*	*3,095*	*2,817*	*2,677*
Easy to Somewhat Possible to Bicycle	12%	13%	20%	19%	22%
n=	*2,233*	*2,674*	*3,544*	*2,824*	*2,693*

IMPEDIMENTS TO THE USE OF COMMUTE ALTERNATIVES

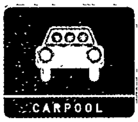
The reasons commuters find it difficult to use alternatives to driving alone are shown in Figure 22. The most common reasons respondents cited for not being able to carpool include "difficulty finding partners" and the "flexibility needed to accommodate their irregular work hours." Respondents found using transit to get to work challenging because of the "lack of direct service along their route to work" and the "additional time required to make the trip." When considering the bicycle as an option, most commuters feel it is just "too far to ride their bike to work." Even if commuters who travel 10 miles or less to work are selected, "too far to ride" is still the primary concern; the number of respondents giving that reason does, however, drop from 32 percent to 17 percent. Looking at respondents who travel five miles or fewer drops it to eight percent, and it becomes the fifth most commonly cited deterrent on the list. Respondents also indicated "safety on the road" was a concern. The average commute distance for respondents who cited distance as a deterrent to bicycling was 25 miles (one-way). This compares with an average distance of 13 miles for those who did not mention distance as a factor. For all three modes (carpooling, transit and bicycling), respondents indicated the "need for a car at work" made it difficult to use an alternative.

FIGURE 22

WHY IS IT DIFFICULT TO CARPOOL TO WORK?

- Can't find partners to carpool with *(40%)*
- Irregular work hours *(20%)*
- Need my car for work *(11%)*

WHY IS IT DIFFICULT TO USE TRANSIT TO GET TO WORK?



- No transit service along my route to work *(23%)*
- Takes too much time compared with driving *(23%)*
- Need my car for work *(13%)*

WHY IS IT DIFFICULT TO BICYCLE TO WORK?

- Too far to bicycle *(32%)*
- I don't feel safe bicycling to work *(12%)*
- Need my car for work *(11%)*

CHARACTERISTICS OF COMMUTERS WHO ARE MORE LIKELY TO USE AN ALTERNATIVE

Knowing what impediments need to be addressed to encourage the use of commute alternatives is helpful. It is also valuable to know some characteristics of the respondents most likely to try alternatives to driving alone as a step in the process of crafting messages which will get their attention.

The data gathered in *Commute Profile* offer some insights into which subgroups of commuters indicated a higher level of interest in the use of alternatives to driving alone. In addition to the demographic variables shown in Table 17, for a second year six other variables were examined to see if some subgroups were more likely than others to indicate carpooling, riding transit or bicycling to work were possibilities for their commute. Those variables were:

- flexibility of arrival time at home and work
- access to carpool lanes along route to work
- availability of free parking at the worksite
- size of employer worksite
- commute trip distance
- county of origin.

Those respondents with a greater degree of flexibility in their work and home arrival times were more likely to indicate transit or bicycling were a possible option for them. Transit use appeared more feasible for this group both last year and this year, carpooling only last year and bicycling only this year.

Access to carpool lanes did not seem to influence responses this year or last year. Respondents without free parking at the worksite were more likely to indicate transit was a possibility for their commute both last year and this year. The opposite was true for bicycling; it seemed more feasible to bicycle to work to respondents at worksite where free parking was available. Employer size (i.e., worksites with more than or less than 100 employees) did not seem to influence the individual's perception of using any of the modes this year. Last year carpooling appeared to be more feasible for employees of larger companies.

Data from last year and this year show no difference in carpooling interest based on commute trip distance. The potential use of transit, on the other hand, shows a pretty clear pattern of declining feasibility with distance (Table 16). Twenty-seven percent of commuters traveling six to 10 miles one-way indicated using transit was "easy" to "somewhat possible" while only 18 percent of commuters traveling over 40 miles one-way indicated the same. The possibility of commuting by bicycle, as one might expect, declines precipitously with distance. Forty-seven percent of short-distance commuters (five miles or less one-way) indicated bicycling was a potential option, while only six percent of longer-distance commuters (over 40 miles one-way) indicated bicycling was "easy" to "somewhat" possible. These findings are similar to last year.

TABLE 16
FEASIBILITY OF USING TRANSIT OR BICYCLING BY TRIP DISTANCE (miles, one-way)

	0-5	6-10	11-20	21-40	41+
Possible to Use Transit *n=2,677*	24%	27%	24%	19%	18%
Possible to Bicycle *n=2,693*	47%	25%	13%	8%	6%

County of origin also seemed to influence, to some extent, respondents' feelings about their commute options. Commuters from Solano and San Mateo were most positive about carpooling and those from Napa were least positive. These results, however, vary considerably from year to year—leading one to believe there is not a strong correlation between county of origin and perceived ability to carpool.

More consistent with previous years were San Francisco respondents' attitude toward the use of transit. San Francisco commuters, by a large margin, were once again the most likely to see transit as a possible commute option. Respondents from Solano and Napa were the least likely to view transit as a potential commute option. Again this is consistent with previous years—leading one to believe there is a stronger correlation between county of origin and perceived ability to use transit. Attitudes toward bicycling were also very similar to past years. Napa residents showed the most interest and Contra Costa and Solano residents the least.

Demographic information collected in *Commute Profile* can also provide some insights into higher potential customer groups. Understanding the demographics of these higher potential groups is helpful in developing a targeted approach to marketing services. Gender, age and income characteristics are summarized in Table 17 and compared with the characteristics of all drive-alone respondents as a control group.

TABLE 17

DEMOGRAPHICS OF HIGHER POTENTIAL ALTERNATIVE USERS

	Drive Alone Respondents	Higher Potential Carpool	Higher Potential Transit	Higher Potential Bicycle
Income of $65,000+	59%	57%	58%	63%
n=	*1,953*	*594*	*545*	*522*
Gender				
Male	53%	52%	50%	59%
Female	47%	48%	50%	41%
n=	*2,291*	*670*	*618*	*606*
Under age 40	38%	48%	39%	40%
n=	*2,264*	*659*	*612*	*600*

Respondents who were more likely to indicate carpooling was a potential option for their commute are also more likely to be under the age of 40. There is a 10 percentage point difference between all drive-alone respondents and higher potential carpoolers. This is consistent with the last few years. In past surveys, higher potential carpoolers have been somewhat more likely to be male. The difference has been between three and five percentage points higher. This year, however, there is no difference in the gender characteristics of the survey population of drive-alone commuters and the higher potential carpoolers.

Higher potential transit users show very little variation this year from other commuters who drive alone. In past surveys, there has been a definite tendency for higher potential transit users to be younger. The biggest difference this year is in the gender makeup, but even this is not great. The higher potential group is slightly more likely to be female. This is contrary to findings from past surveys when this group was actually slightly more likely to be male.

The most pronounced difference in demographic characteristics shows up among the potential bicycle commuters. While 53 percent of all respondents are male, 59 percent of the higher potential bicycle commuters are male; this is similar to but less exaggerated than previous years where there was an eight to nine percentage point difference between "all drive-alone respondents" and those in the higher potential bicycle group. In past surveys, higher potential bicycle commuters have tended to be younger. While that is still the case, this difference is less. This year there is a two percentage point difference—the last few years it has been in the five to 10 percentage point range. Potential bicycle commuters this year also tend to have somewhat higher incomes.

How does the intention of respondents compare with their actual behavior? Table 18 looks at the current travel modes based on age and gender. Females are more likely to currently be using a commute alternative, and carpooling appears to be their preferred mode. Carpool use is especially high among females under the age of 40. There is consistently (even if not dramatic) higher use of carpooling, transit and other modes among younger respondents. Last year's results are consistent with the data here showing younger commuters more likely to be using alternatives to driving alone.

TABLE 18
GENDER, AGE AND CURRENT TRAVEL MODE

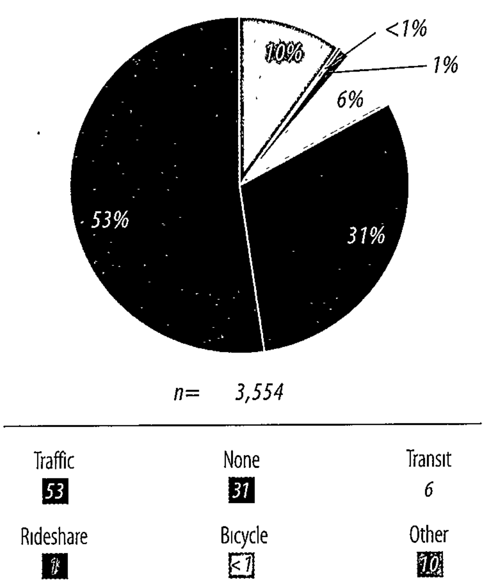
	Drive Alone	Carpool	Transit	Other
Males *n=1,824*	67%	16%	11%	7%
Under age 40 *n=817*	63%	16%	13%	8%
Over age 40 *n=991*	69%	15%	9%	6%
Females *n=1,785*	60%	20%	13%	7%
Under age 40 *n=687*	51%	25%	15%	9%
Over age 40 *n=1,066*	66%	17%	12%	5%

SERVICE INTERESTS

A few months prior to fielding the *Commute Profile 2003* survey, the MTC launched the new 511 telephone traveler information service. Just less than two percent of respondents had already tried the 511 information service prior to being contacted for *Commute Profile 2003*. Most of them had used the service to get traffic information. Respondents who had not used the 511 service were asked to elaborate on the types of information which interested them, or the types of information they commonly get from radio, television and the Internet. Figure 23 shows traffic information to be the most common type of information sought followed by transit and rideshare information. A fairly high percentage of respondents (31 percent) do not commonly turn to media sources for traveler information. Of those who do seek travel information, about 61 percent look for it once a day or more, about 26 percent look for it once a week or less and about 12 percent less than once a month.

Within the four main categories of information offered by the 511 service (traffic, transit, rideshare and bicycle), respondents were asked to further elaborate on the specific type of information they are most interested in having available (Table 19). Each of the four categories had one or two specific types of information that were of interest to a majority of respondents. Within the traffic category, a "map of roadway congestion" clearly topped the list. For those commuters who seek transit information, "schedules" (printed and real time) and "route maps" were of the most interest. "Casual carpool

FIGURE 23
PRIMARY TYPE OF TRAVEL INFORMATION SOUGHT FROM RADIO, TV AND INTERNET



information" and "carpool matching" were of interest to individuals looking for rideshare-related information. Finally, for the few respondents who were looking for bicycle information, "maps" and a "trip planner" were of most interest.

TABLE 19
TYPE OF TRAVEL INFORMATION DESIRED

Traffic	
Map of Roadway Congestion	63%
Information on Alternative Routes	15%
Estimated Driving Time	7%
Information on Alternative Modes	2%
HOV Lane Map	<1%
Information on FasTrak	<1%
Other	13%

n=1,835

Transit	
Schedule and Route Maps	43%
Real-time Schedule Information	20%
Delays and Changes	11%
Trip Planning	8%
Fare Information	5%
How To Get To Popular Destinations	2%
Paratransit Information	2%
Other	10%

n=187

Rideshare	
Casual Carpooling Information	35%
Carpool Matching	25%
Employer Provided Benefits	10%
Park and Ride Information	5%
Other	25%

n=16

Biking	
Bike maps	36%
Bike Trip Planner	27%
Bicycle Safety Information	9%
Information about Bikes on Bridges	9%
Information about Bicycle Organizations	9%
Other	9%

n=6

COUNTY PROFILES

The county section of *Commute Profile 2003* looks at each of the nine Bay Area counties separately, notes their unique commute characteristics, comments on the differences between them and identifies trends within the counties. Data from each county is compared with data from previous years, the Bay Area region as a whole and other individual counties. As discussed in detail in the methodology section of this report, each county analysis is based on a sample of 400 residents who are employed full-time outside the home. The data reviewed for each county are:

- Primary commute modes
- Occasional and connecting modes
- Commute distance and time
- Destination characteristics
- Perceptions of commute conditions and options

PRIMARY COMMUTE MODES

The "primary" mode is the means of travel used for the entire or longest segment of an individual's commute. Data are presented for all modes of travel—even those used by less than one percent of the respondents. Primary commute modes are also presented in a clustered[7] format to facilitate comparison over time. Data for some counties (where sample sizes have been large enough) are presented for 10 years. While there are many similarities between the counties, the narrative focuses on identifying key differences. These differences are clearly influenced by factors such as the limitations of transit service, employment patterns and commute distances. The narrative stops short of speculating on why these differences exist and focuses on identifying the differences.

OCCASIONAL AND CONNECTING MODES

Data were also collected and are discussed for each county on "occasional" and "connecting" modes used on a regular basis for a normal commute trip. An occasional mode is defined as a completely separate mode used on days when commuters do not use their primary mode. A connecting mode is defined as the mode or modes used in addition to the primary mode on

7 "Drive Alone" includes motorcycles and taxis, "carpool" includes vanpools; "transit" includes buses, trains and ferryboats, and "other" includes bike, walk and telecommute.

COUNTY PROFILES

a normal trip to work. The occasional and connecting mode data complement the primary mode information to provide a more complete picture of all modes commuters use to make their trips to work each day.

COMMUTE DISTANCE AND TIME

Commute distance and time shows the trip distance, length of time and travel speed of an average commute for each county. Average travel speed provides an indication of the levels of congestion (based on the assumption that slower speeds are indicative of greater congestion) respondents from specific counties experience. Data are presented for a number of years to provide a view of longitudinal trends.

DESTINATION CHARACTERISTICS

Although the *Commute Profile* sampling methodology is based on commuters' origins, a brief analysis is presented of some of the characteristics of the counties as commute destinations. Sample sizes are noted for each of the counties as a destination. Key destinations within the county, parking availability, employer size, employer programs which encourage commute alternatives use and telecommuting opportunities are examined.

PERCEPTION OF COMMUTE CONDITIONS AND OPTIONS

The perceptions of commute conditions and options are also included for each of the nine counties. This combination of information provides a general sense of how commuters in each county perceive their trips to work. The heading was chosen carefully to reflect that it is not a quantitative index or an "official" performance measure, but a summary of related data collected in *Commute Profile* based on respondents' perceptions. The perceptions of commute conditions and options include data from three separate survey questions.[8]

- The first question asked all respondents whether they felt their commute had gotten worse, better or stayed the same during the past year. It is based on their overall perception of how or if their commute has changed.

- The second question asked respondents who reported driving alone as their main commute mode, how possible it would be to use a commute alternative. The percentage of those who responded said it would be "easy" to "somewhat possible" to use one of the three modes examined in *Commute Profile* (carpool, transit or biking) is included in the table.

[8] It is important to note that because most respondents drive alone, the sample sizes for other subgroups (e.g., carpoolers, transit riders or bicyclists) may be small and, therefore, have higher margins of error.

- The third question asked respondents who were using a commute alternative whether their travel mode has become easier, more difficult or stayed the same in the past year. The percentage of commuters who reported their mode (either transit, carpool or bicycling) has gotten easier is included as a part of this table.

The data in each of the three sections was compared to regional responses, as well as those from *Commute Profile 2001* and *2002*. If the percentage of people who had a positive answer to any one of the questions was higher than the regional or *Commute Profile 2002* percentages, the county was awarded a positive (+) sign for improvement. If the percentages were lower, the county received a negative (–) sign, and if there was little to no difference an equal (=) sign was awarded. The signs were then added together to create a summary score for each county (Table 20). This approach allows us to compare perceptions among commuters from the different counties, and is not meant to be a comprehensive analysis of the success of transportation facilities and services in each county.

TABLE 20

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

County	Summary Score 2001	Summary Score 2002	Summary Score 2003
Alameda	+1	+5	+2
Contra Costa	–3	–2	+2
Marin	–1	+1	=
Napa	=	–4	–1
San Francisco	+4	+2	+1
San Mateo	–3	–1	=
Santa Clara	+5	+2	+2
Solano	–2	–4	+1
Sonoma	–4	+3	+2

ORIGINS AND DESTINATIONS

The highest percentage of residents who live and work in the same county is from Santa Clara (Figure 24). Marin, Contra Costa and Solano counties have the lowest percentages of residents who live and work in the same county. The trend over the past three years has been for a greater percentage of respondents to live and work in the same county. For example, in Sonoma County, in 2001 63 percent lived and work there, 72 percent in 2002 and 77 percent in 2003. Between 2001 and 2003, all nine counties have shown an increase. Sonoma County showed the greatest change (an increase of 14 percentage points) and Alameda the smallest (an increase of two percentage points). The average change for all nine counties is seven percentage points. Figure 24 also shows the three most common destination counties outside of a commuter's home county. San Francisco and Alameda are the most common destination counties—each appears seven times on the lists for other counties.

VEHICLE AVAILABILITY

Almost all respondents (95 percent) to this survey have a vehicle available for their commute "always" or "sometimes" (Table 21). For 90 percent a vehicle is always available. Availability varies a bit from county to county. San Francisco stands out as being the least auto dependent. Approximately 19 percent of San Francisco residents who responded to the survey "never" have a vehicle available for their commute. This is up from last year when 13 percent of respondents indicated they "never" have a vehicle available. The variation between other counties is small.

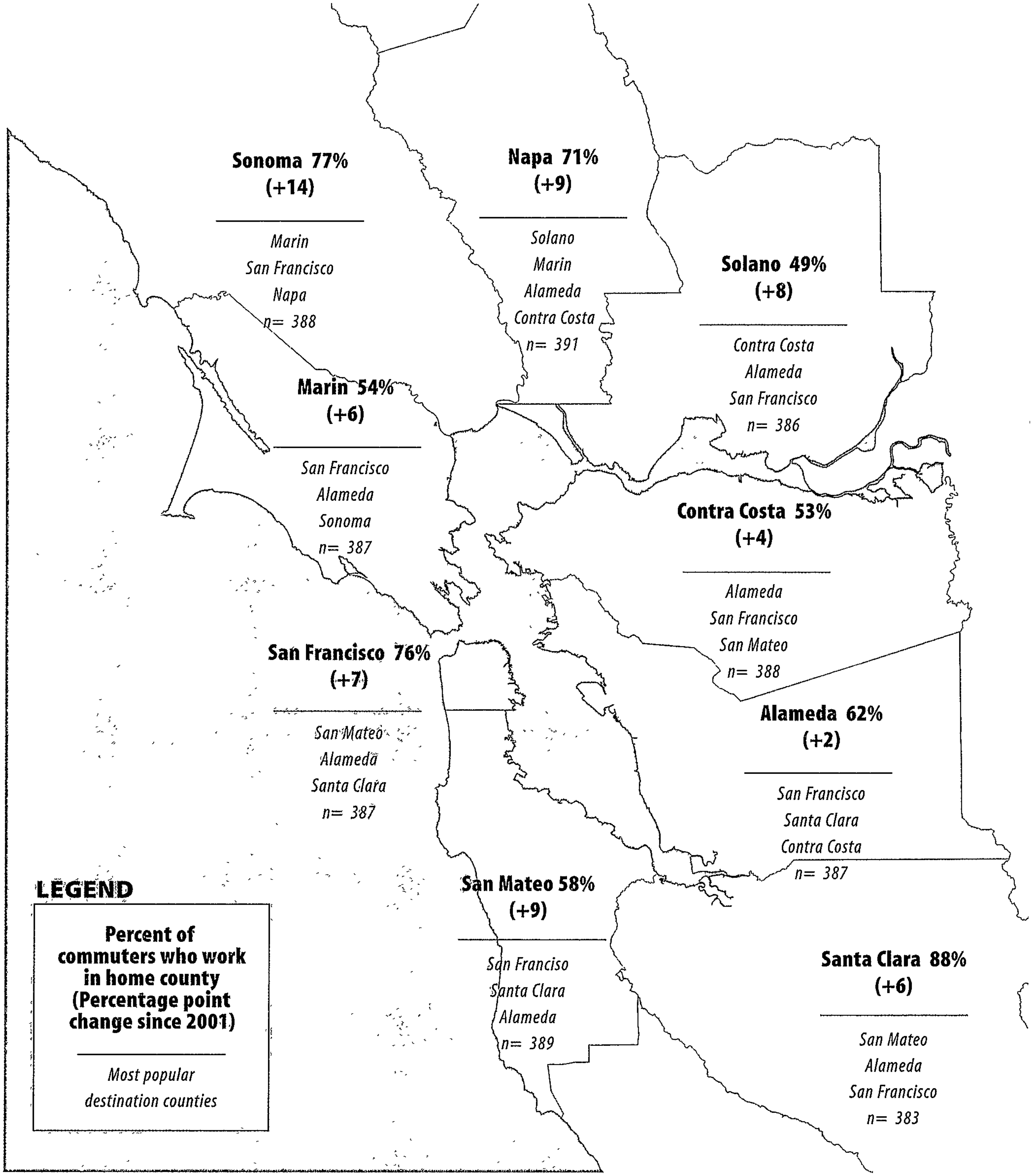
As one might guess, vehicle availability has a strong influence on mode choice. For those who drive alone, 97 percent "always" have a vehicle available. For those who carpool, "always available" drops slightly to 94 percent, for those who use "other" modes it drops to 65 percent and for those who use transit as their primary commute mode it drops significantly to 55 percent.

TABLE 21

VEHICLE AVAILABILITY BY COUNTY

County	Always	Sometimes	Never
Alameda *n=400*	89%	7%	5%
Contra Costa *n=400*	92%	5%	3%
Marin *n=399*	93%	4%	4%
Napa *n=400*	96%	3%	1%
San Francisco *n=400*	70%	11%	19%
San Mateo *n=399*	91%	6%	3%
Santa Clara *n=398*	95%	3%	2%
Solano *n=399*	94%	5%	1%
Sonoma *n=400*	95%	3%	2%
Regional Average *n=3,595*	90%	5%	4%

FIGURE 24
PERCENT OF COMMUTERS WHO LIVE AND WORK IN HOME COUNTY



ALAMEDA COUNTY

TABLE 22
PRIMARY COMMUTE MODE

Drive Alone	61%
Carpool	17%
BART	11%
Bus	4%
Walk	4%
Telecommute	2%
Bicycle	2%
Ferry	<1%
Ace	<1%

n=400

PRIMARY COMMUTE MODES

Alameda County residents have the second lowest drive-alone rate in the region (Table 22)—only San Francisco residents have a lower drive-alone rate. Alameda residents also have the second overall highest use of transit for commute purposes. Contributing to the high overall use of transit is the region's highest use of BART (tied with Contra Costa at 11 percent). The rate of carpooling is about equal to the regional average. Alameda County residents are also strong participants in walking and bicycling modes. They have the highest percentage of bicycle commuters (along with San Francisco and Sonoma residents) and the second highest percentage of walkers after San Francisco.

Over the past year, the number of drive-alone commuters in Alameda County has declined by five percentage points (Table 23). Carpooling has also decreased, while both transit and other mode usage have become more popular. These trends began to emerge between 2001 and 2002 and have continued at an accelerated pace between 2002 and 2003.

Alameda County residents who commute by transit mentioned "travel time," "comfort" and "commuting costs" as the reasons for choosing that mode. Carpoolers most often cited "commuting costs" and "taking kids to school." Residents who drive alone to work were most likely to cite "having no one to carpool with," "a lack of practical transit options" and "needing a car at work" as reasons for their mode choice. Compared with the region, driving alone and carpool

TABLE 23
CLUSTERED MODES OVER TIME

	1993	1994	1996	1999	2000	2001	2002	2003
Drive Alone	62%	66%	65%	62%	63%	68%	66%	61%
Carpool	14%	16%	15%	16%	14%	20%	19%	17%
Transit	17%	13%	13%	18%	20%	10%	11%	15%
Other	7%	6%	7%	4%	4%	3%	5%	7%

n=approximately 400 each year

use are less common, transit use is more prevalent and "other" mode use is at the same level.

OCCASIONAL AND CONNECTING MODES

In addition to the primary commute modes, data on "occasional" modes (a completely separate mode used on days when commuters do not use their primary mode) and "connecting" modes (modes used in addition to the primary mode on a normal trip to work) were gathered for Alameda County residents. The use of occasional and connecting modes is more common in Alameda than most other counties. About eight percent of commuters in the county use an occasional mode and about 16 percent use a connecting mode—compared with seven percent and 12 percent for the region. Driving alone and BART are the two most common occasional modes. Driving alone is a common occasional mode in almost all counties; BART as an occasional mode is more common in Alameda than any other county. The most common connecting modes are the bus and driving alone. Alameda and San Francisco are the two counties where buses are one of the most common connecting modes.

COMMUTE DISTANCE AND TIME

The average commute time decreased by two minutes and the commute distance remained unchanged in 2003 (Figure 25). The result is an increase in estimated travel speed of approximately two miles per hour. Alameda County commuters are representative of the "typical" Bay Area commuter in terms of their travel time, distance and speed. One-way trip distance and travel speed are identical to the region-wide average, and travel time is within one minute of the region-wide average.

FIGURE 25
COMMUTE DISTANCE AND TIME

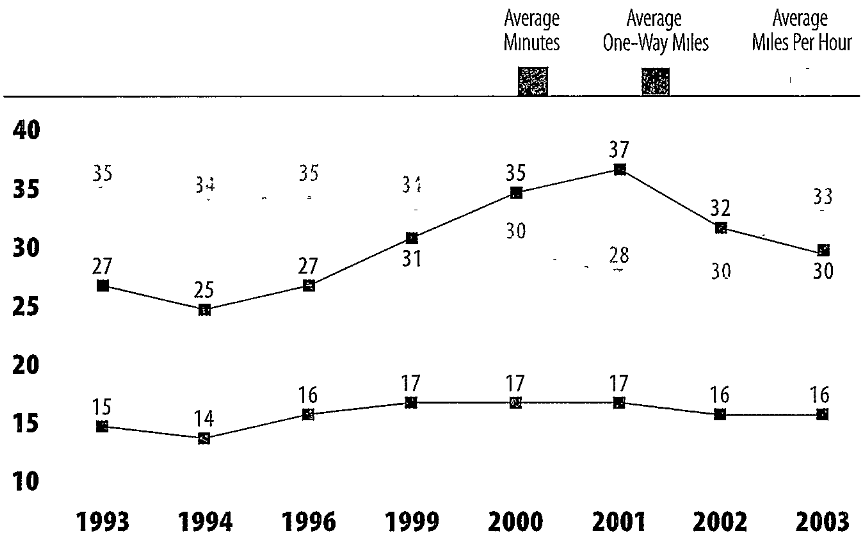


TABLE 24
MOST COMMON DESTINATIONS WITHIN ALAMEDA COUNTY

Zip Code (within the city of)
94612 (Oakland) Downtown, City Center
94538 (Fremont)
94545 (Hayward)
94577 (San Leandro)
94607 (Oakland) Port of Oakland
94588 (Pleasanton)
94703 (Berkeley)
94550 (Livermore)

DESTINATION CHARACTERISTICS[9]

About 19 percent of all *Commute Profile* respondents (based on the weighted regional data set) had a destination within Alameda County, and about 62 percent of Alameda County respondents live and work within the county. Oakland was the most common work destination within the county for *Commute Profile* respondents—showing up first and fifth on the list (Table 24). Fremont and Hayward were the next two most common destinations.

Commuters headed to Alameda are less likely, with the exception of San Francisco-bound commuters, than any others to find free parking at their worksite. One in four commuters within Alameda County does not have free parking at their worksite. In San Francisco, only one in three commuters has free parking. Commuters are also more likely to end up at a larger company in Alameda County. Forty-three percent of respondents work at an employer with more than 100 employees. Only commuters headed for Santa Clara County are more likely to end up at a large employer—46 percent of respondents destined for Santa Clara worked for employers with more than 100 employees.

[9] The sample size for respondents with a destination of Alameda was 441.

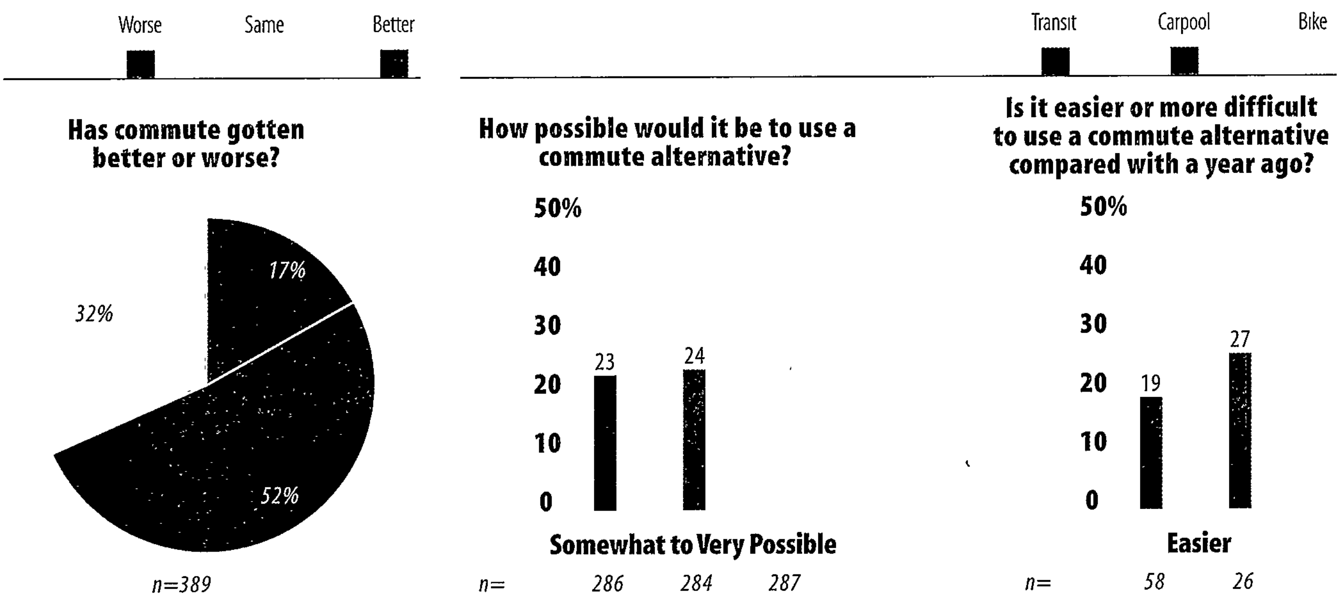
PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Compared with a year ago and the perceptions of commuters from throughout the region, Alameda County residents again have the most positive perceptions of changes in their commute options and conditions (Figure 26). In 2002, that distinction was theirs alone; this year they share it with three other counties who also received a summary score of (+2) based on questions about current commute conditions, the accessibility to commute alternatives and the ease of use of specific modes.

Alameda respondents believe commute conditions have improved relative to the view of commuters from throughout the region; a higher percentage than last year also expressed the view conditions had improved over the last year. The main reasons cited for improved conditions were "less traffic" and "roadway improvements." The other area where Alameda scored positively was in the potential use of commute alternatives by respondents who were currently driving alone. The only negative comparison was of Alameda respondents who were currently using commute alternatives; they were less likely to indicate it being easier to use transit or carpool. The reasons cited were transit service was "less reliable" or had been "cut".

FIGURE 26

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Has commute gotten better or worse?	How possible would it be to use a commute alternative?	Is it easier or more difficult to use a commute alternative compared with a year ago?
Compared to region: +	Compared to region: +	Compared to region: =
Compared with 2002 +	Compared with 2002: =	Compared with 2002: –

Summary Scores 2001 +1 2002 +5 2003: +2

CONTRA COSTA COUNTY

TABLE 25
PRIMARY COMMUTE MODE

Drive Alone	64%
Carpool	20%
BART	11%
Bus	2%
Telecommute	2%
Walk	1%
Vanpool	<1%
Bicycle	<1%
Motorcycle	<1%

n=400

PRIMARY COMMUTE MODES

Contra Costa County has the third lowest drive-alone rate in the Bay Area; only San Francisco with its robust transit systems and Alameda have lower drive-alone rates (Table 25). Contra Costa residents are also the second most likely to carpool in the region. Only Solano County residents are more likely to carpool. The reason behind the relatively low drive-alone rate is the high level of carpooling and also the highest level of BART ridership—tied with Alameda County at 11 percent. An extensive incentive program promoted within the county provides residents and employees with additional reasons to carpool, vanpool and take transit.

During the past two years the percentage of drive-alone commuters has dropped from 70 percent to 64 percent; this matches the lowest drive-alone rate recorded in 1993 (Table 26). The carpooling rate dropped a bit from a high recorded in 2002, but still shows an upward trend since 1994. Transit use, thanks to the high level of BART ridership mentioned earlier, has rebounded from a decline over the last couple years and increased by five percentage points. The main reasons Contra Costa respondents cite for driving alone is their "work hours vary too much to carpool or use transit," "there is not direct transit service along their route to work" and "it is difficult to find someone with whom to carpool." The reasons for using transit include comfort, travel time and reduced commute costs. Compared with the region, driving alone is at the same level, carpooling and transit use are more common and "other" mode use is less prevalent.

TABLE 26
CLUSTERED MODES OVER TIME

	1993	1994	1996	1999	2000	2001	2002	2003
Drive Alone	64%	69%	67%	66%	66%	70%	66%	64%
Carpool	22%	17%	17%	13%	16%	19%	23%	20%
Transit	12%	12%	15%	16%	16%	9%	8%	13%
Other	3%	2%	2%	5%	3%	2%	4%	4%

n=approximately 400 each year

OCCASIONAL AND CONNECTING MODES

"Occasional" modes and "connecting" modes were also tracked for respondents from Contra Costa. An occasional mode is used on days when commuters do not use their primary mode and a connecting mode is used in addition to the primary mode on a normal trip to work. The use of occasional modes is less common among Contra Costa residents than Bay Area residents in general. The use of connecting modes is more common in Contra Costa than most other counties. About four percent of commuters in the county use an occasional mode and about 17 percent use a connecting mode—compared with seven percent and 12 percent respectively for the region.

Driving alone and telecommuting are the two most common occasional modes. These two methods of travel are the most common occasional modes in six of the nine counties. The most common connecting modes are driving alone, BART and the bus in that order. Driving alone is the most common connecting mode used in seven of the nine counties.

COMMUTE DISTANCE AND TIME

Both commute time and distance decreased substantially in 2002, and although they are still down from 2000-2001 levels they are up a bit from 2002 (Figure 27). The trend of increasing travel time and distance between 1996 and 2001 appears to be turning into a trend of decreasing travel time and distance as 2002-2003 show a decline from the years just prior. Travel speed has been increasing steadily, at the rate of one to three miles per hour per year, since 2000. Contra Costa commuters have the longest travel time of all nine Bay Area counties (38 minutes).

FIGURE 27
COMMUTE DISTANCE AND TIME

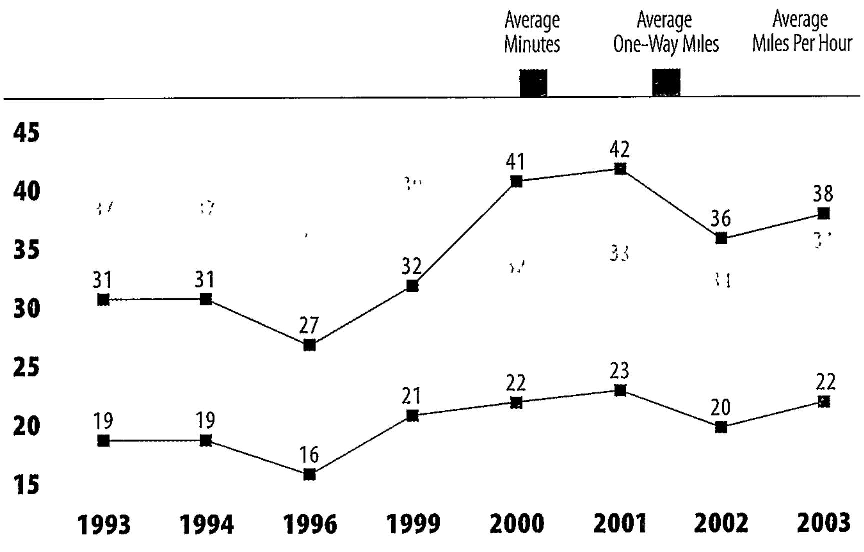


TABLE 27
MOST COMMON DESTINATIONS WITHIN CONTRA COSTA COUNTY

Zip Code (within the city of)
94520 (Concord)
94596 (Walnut Creek)
94553 (Martinez)
94804 (Richmond)
94583 (San Ramon)
94518 (Concord)
94565 (Pittsburg)

DESTINATION CHARACTERISTICS [10]

Contra Costa County is one of the largest exporters of commuters. Only 53 percent of respondents live and work within the county. Only Solano County exports more commuters—about 49 percent live and work within that county. About 10 percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Contra Costa County. Zip codes in Concord and Walnut Creek are the two most common destinations (Table 27) of *Commute Profile* respondents.

Commuters headed to or traveling within the county have good odds of finding free parking available at their worksite. Ninety-four percent of respondents who work in Contra Costa indicated they have free parking at or near their worksite. Only in Napa County, where 95 percent have free parking available, are commuters more likely to have free parking at or near their worksite. About 65 percent of respondents worked at companies with fewer than 100 employees—this is typical of respondents from other counties. Contra Costa employers are more likely to provide programs which encourage their employees to use options to driving alone than employers from other counties. Respondents indicated about 40 percent of their employers have on-site programs.

[10] The sample size for respondents with a destination of Contra Costa was 348.

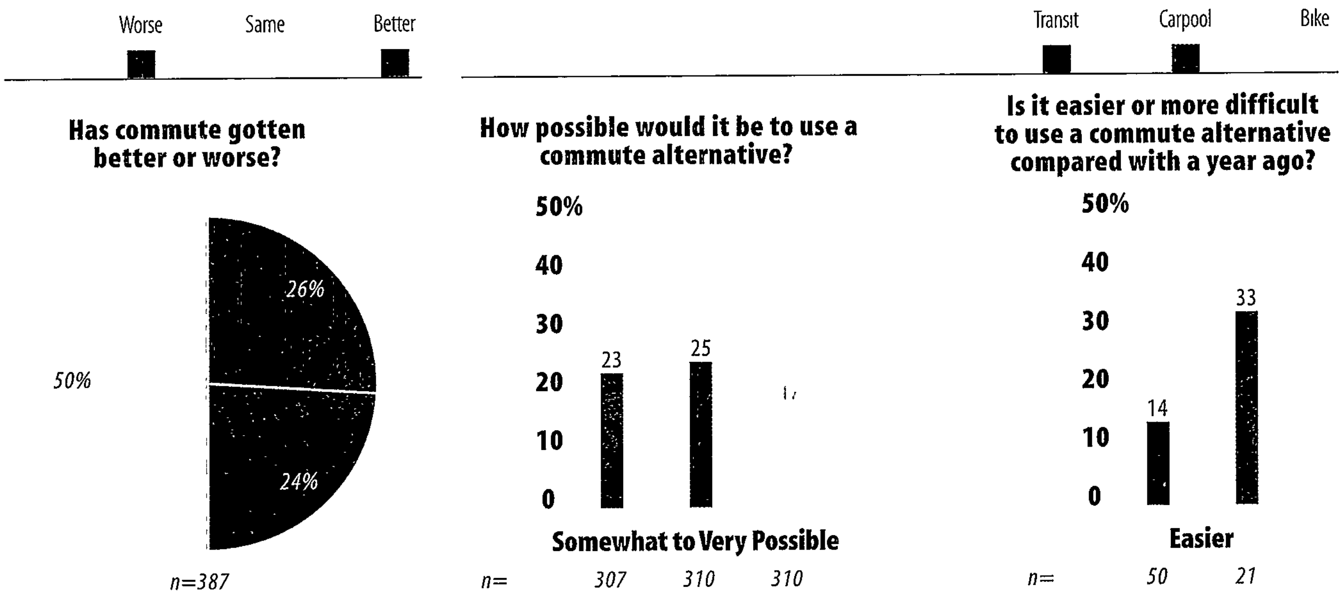
PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Contra Costa respondents perceptions of their commute conditions and options changed dramatically over the past year. For the last couple of years, Contra Costa respondents were less satisfied with the commute conditions than the average Bay Area resident. This year's score of (+2) makes them some of the most satisfied (Figure 28). They share the most positive summary score with three other counties.

When asked to compare their current commute conditions with their commute conditions of a year ago, they were somewhat less positive than commuters from the region as a whole, but more positive than Contra Costa respondents from a year ago. When asked why conditions had improved respondents indicated "lighter traffic" and "roadway improvements" had made their commute easier. Respondents who were currently driving alone were asked how possible they thought it would be to use an alternative. Compared with last year, respondents indicated using commute alternatives would be more possible. Of those who were currently using a commute alternative, they were more likely to indicate using transit or carpooling was easier this year than a year ago. Transit riders indicated "service improvements" had helped their commute and carpoolers indicated it was "easier to find partners."

FIGURE 28

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: -
Compared with 2002:+

Compared to region =
Compared with 2002 +

Compared to region. =
Compared with 2002.+

Summary Scores 2001 -3 2002: -2 2003 +2

MARIN COUNTY

TABLE 28
PRIMARY COMMUTE MODE

Drive Alone	66%
Carpool	13%
Bus	8%
Walk	4%
Telecommute	3%
Ferry	3%
Bicycle	1%
Motorcycle	1%
Vanpool	1%
Other	1%

n=400

PRIMARY COMMUTE MODES

Sixty-six percent of residents in Marin drive alone to work, three percentage points higher than the regional average (Table 28). The rate of carpool use is lower than the regional average. Transit use is at about the same level as the region as a whole. It is, however, the highest of the counties which do not have extensive BART service. Only Alameda, Contra Costa and San Francisco have a higher level of transit use. Buses and ferries are the most popular transit modes. Bus use is second only to San Francisco and ferry ridership, which accounts for three percent of Marin's commute trips, is the highest in the region. Marin is also tied with San Mateo County for the highest level of telecommuting as a primary commute mode—also at three percent.

In eight of nine counties, the drive-alone rate has declined. In Marin, it is down to the lowest level in four years (Table 29). Between 1996 and 2001, the drive-alone rate had been increasing steadily; it started to level off between 2001 and 2002 and this year it has declined by three percentage points. Carpool use has declined slightly in Marin, but is at the same level as the historical (1994-2003) average. Transit use has changed little in the past three years. The use of "other" modes is up substantially. Marin has a good number of telecommuters, and accounting for half (about four percent) of all "other" mode users are commuters who walk to work. Compared with the region, driving alone is more common, carpooling less prevalent, and transit and "other" mode use about the same.

TABLE 29
CLUSTERED MODES OVER TIME

	1994	1996	1999	2000	2001	2002	2003
Drive Alone	67%	61%	64%	68%	71%	70%	67%
Carpool	14%	15%	15%	12%	15%	16%	14%
Transit	10%	17%	16%	16%	10%	10%	11%
Other	11%	7%	6%	6%	5%	4%	8%

n=approximately 400 each year

OCCASIONAL AND CONNECTING MODES

In addition to data on Marin commuters' primary modes of travel, data on "occasional" modes (a completely separate mode used on days when commuters do not use their primary mode) and "connecting" modes (modes used in addition to the primary mode on a normal trip to work) were gathered. The use of occasional modes is more common in Marin than the rest of the Bay Area. Region-wide, seven percent of commuters use an occasional mode; in Marin 12 percent do so. Connecting modes are used by 12 percent of all Bay Area commuters and 12 percent of Marin County commuters.

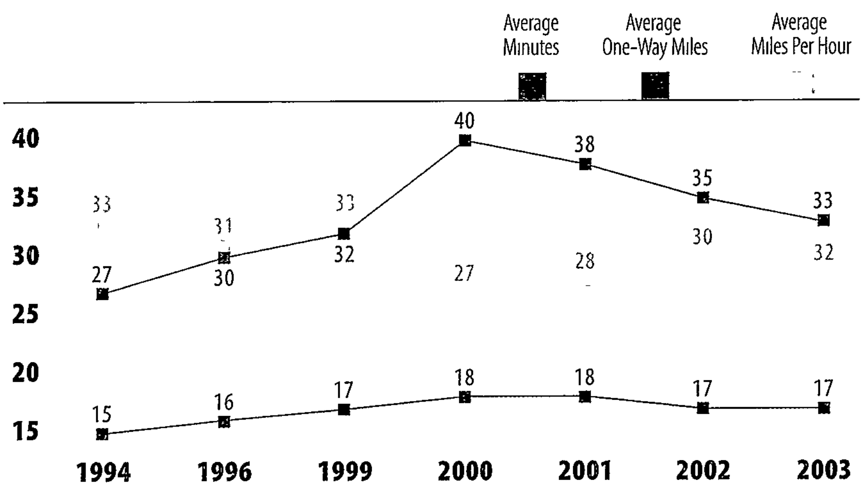
Driving alone, telecommuting and the bus are the most commonly used occasional modes. The use of buses for an occasional mode is uncommon in other counties. In only one other county, Contra Costa, were buses identified as one of the most commonly used (top three) occasional modes. The types of connecting modes used in Marin also reflect the nature of its excellent bus and ferry system. While driving alone is the most commonly used connecting mode (as it is in seven of nine counties), bus and ferry are the second and third most commonly used. Marin is the only county where the ferry is mentioned as a connecting mode.

COMMUTE DISTANCE AND TIME

The average one-way commute distance was unchanged between 2002 and 2003 (Figure 29). The average travel time, however, decreased by two minutes between 2002 and 2003. Travel time has been decreasing since 2000 when it reached a high of 40 minutes. Travel speed has been increasing over that same period. Marin County commuters are tied with Solano commuters for the second longest travel time (33 minutes). Only Contra Costa commuters have longer travel times.

FIGURE 29

COMMUTE DISTANCE AND TIME



MARIN COUNTY

TABLE 30
MOST COMMON DESTINATIONS WITHIN MARIN COUNTY

Zip Code (within the city of)
94901 (San Rafael)
94903 (San Rafael)
94945 (Novato)
94941 (Mill Valley)
94939 (Larkspur)
94949 (Novato)

DESTINATION CHARACTERISTICS[11]

Only 54 percent of Marin County respondents live and work within the county. Marin has the third lowest percentage of residents who live and work in the same county—only Solano and Contra Costa have fewer. About four percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Marin County. Zip codes in San Rafael were the most common destinations within the county (Table 30).

Free parking is common at worksites in Marin County. Ninety-three percent of commuters with a destination in Marin have free parking at or near their worksite. Commuters headed to Marin County were more likely than commuters going to any of the other Bay Area counties to work for a smaller employer. Seventy-four percent of commuters work for employers with less than 100 employees. Marin employers were among the least likely to provide programs designed to encourage the use of commute alternatives. Only employers in Napa and Solano were less likely to have employee commute transportation programs. Since larger employers are more likely to offer these programs, it follows that Marin employers, with a relatively high percentage of smaller companies, would be less likely.

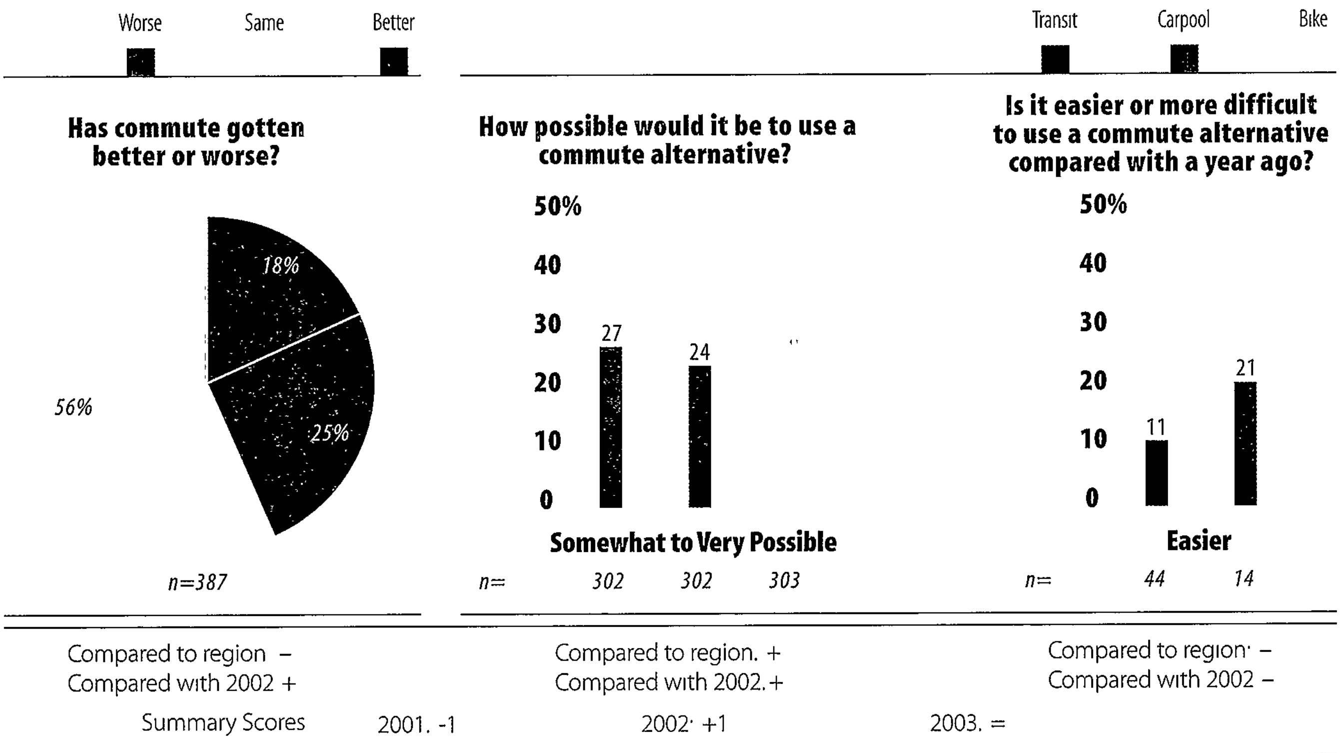
[11] The sample size for respondents with a destination of Marin was 297.

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Perceptions of commute conditions in Marin County have changed little in the past year. Comparisons of conditions a year ago and with the region as a whole yielded three (+s) and three (-s) for an overall score of (=) (Figure 30). Over the last three years Marin has received summary scores of one (-), one (+) and one (=)—seeming to indicate conditions are not changing radically.

Compared with the region, commute conditions have not improved, but compared with a year ago conditions are better. Reasons given for improved conditions included "lighter traffic" and "roadway improvements." Marin respondents, who were currently driving alone, indicated that it seemed more possible for them to use an alternative now than a year ago. On the other hand, Marin respondents who were currently using transit or carpooling were less likely to indicate it had become easier over the last year to do so. The main reasons cited were "reductions in service" and "difficulty finding carpooling partners."

FIGURE 30
PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



NAPA COUNTY

TABLE 31
PRIMARY COMMUTE MODE

Drive Alone	75%
Carpool	17%
Walk	4%
Telecommute	2%
Bicycle	1%
Bus	1%
Motorcycle	<1%
Vanpool	<1%

n=400

PRIMARY COMMUTE MODES

Napa has the highest drive-alone rate of the Bay Area counties (Table 31). Carpooling and the use of "other" modes is similar to that of the region as a whole. Napa has the second highest percentage of commuters who walk to work. Transit use is considerably lower among Napa residents. Transit access is similar to other counties; approximately 70 percent of Napa's 125,000 residents are within a third of a mile of a bus line. Frequency of service may be more of an inhibiting factor. As a result, carpooling is the most convenient alternative mode of transportation available to Napa residents.

The percentage of drive-alone commuters, carpoolers, transit riders and "other" mode commuters in Napa County has fluctuated by one percent or less in the past three years (Table 32). In 2000, the percentage of drive-alone commuters reached a high point, but since then has returned to levels similar to previous years. Commuters who primarily drive alone to work indicated a "lack of direct transit service between home and work," "difficulty finding carpool partners" and "irregular work hours" made driving to work the best option for them. Compared with the region, driving alone is more common, carpool use identical, transit use much less common and "other" mode use about the same.

OCCASIONAL AND CONNECTING MODES

An "occasional" mode is used on days when commuters do not use their primary mode and a "connecting" mode is used in

TABLE 32
CLUSTERED MODES OVER TIME

	1994*	1996*	1999	2000	2001	2002	2003
Drive Alone	70%	73%	74%	79%	74%	75%	76%
Carpool	19%	18%	20%	16%	20%	19%	18%
Transit	5%	4%	1%	1%	2%	2%	1%
Other	7%	5%	5%	5%	4%	5%	6%

n=approximately 400 each year

*Napa and Sonoma counties

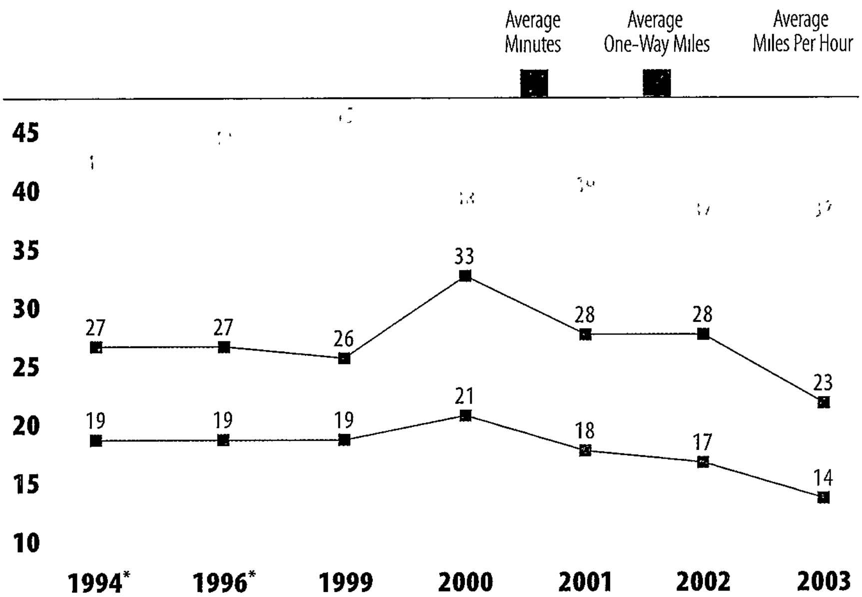
addition to the primary mode on a normal trip to work. About eight percent of Napa commuters use an occasional commute mode (similar to the seven percent average for the region). However, only five percent use a connecting—the lowest percent of any county. The use of connecting modes is much more common among transit riders. Fifty-five percent of transit riders use a connecting mode, whereas only three percent of commuters who drive alone use a connecting mode. Since Napa County has relatively low transit usage, it follows that the use of a connecting mode would also be low.

The most common occasional modes used are driving alone, telecommuting and carpooling. Napa and Sonoma are the only two counties where carpooling is one of the most common occasional modes. For those residents of Napa who do use connecting modes, driving alone, bicycling and riding the bus are the most commonly used modes.

COMMUTE DISTANCE AND TIME

The average Napa commuter travels 14 miles in 23 minutes one-way to work (Figure 31). Both distance and travel time are down from previous years. Because both measures declined proportionally, estimated average travel speed has not changed. In six of nine counties, estimated average travel speed increased from last year. In Napa and Marin travel speed remained constant between 2002 and 2003. San Francisco is the only county where travel speed for residents declined. Napa commuters enjoy the shortest travel time to

FIGURE 31
COMMUTE DISTANCE AND TIME



*Napa and Sonoma counties

TABLE 33
MOST COMMON DESTINATIONS WITHIN NAPA COUNTY

Zip Code (within the city of)
94558 (Napa)
94559 (Napa)
94574 (St. Helena)

work, and their average speed of 37 miles per hour is equaled only by residents of Sonoma County.

DESTINATION CHARACTERISTICS[12]

About 71 percent of Napa respondents live and work within the county. Only two percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Napa County. This is the least common destination of the nine Bay Area counties. Other less common destination counties were Solano (three percent) and Marin (four percent). The largest destination county is Santa Clara—27 percent of respondents worked in that county. The most common destinations with the County of Napa are zip codes in the City of Napa (Table 33).

Free parking at or near the worksite is more common in Napa than any other county in the Bay Area. Ninety-five percent of commuters are able to park free at the work-end of their trip. Employers tend to be smaller; about three of four commuters who work in Napa County are employed at companies with less than 100 employees. Only Marin County has a slightly higher percentage of commuters working at companies with less than 100 employees. Napa County employers are also the least likely to operate programs which encourage employees to participate in commute alternatives. Since larger employers are more likely to offer these programs it follows that Napa employers, with a relatively high percentage of smaller companies, would be less likely.

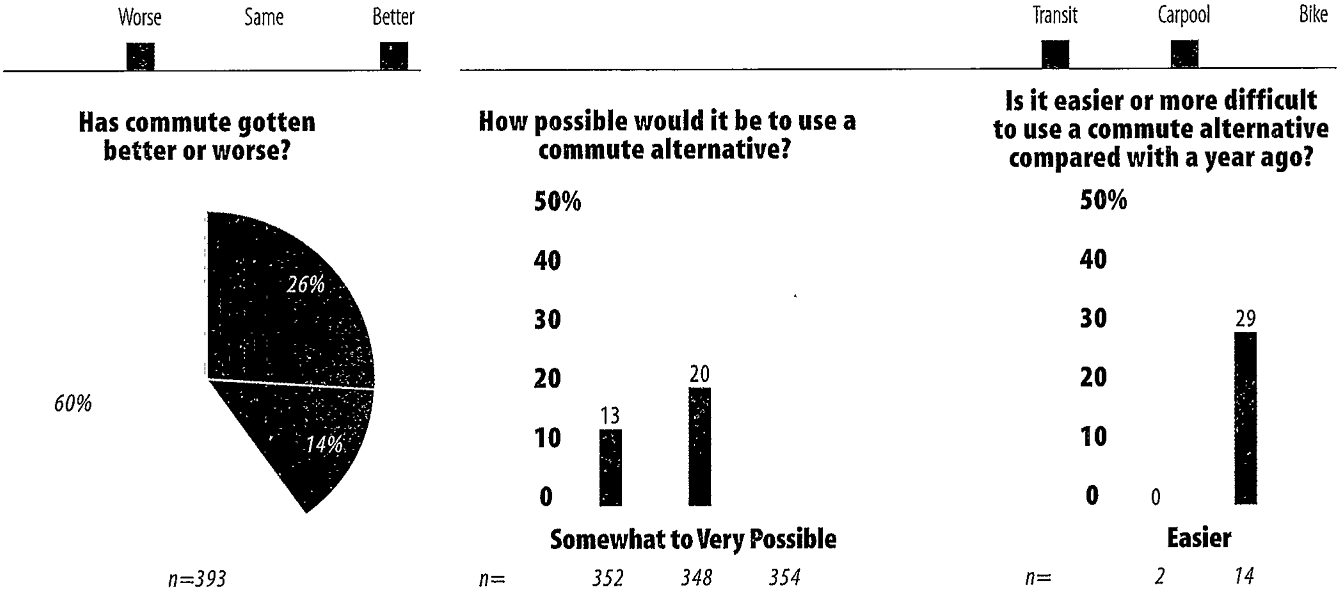
[12] The sample size for respondents with a destination of Napa was 306

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Relative to data gathered in 2002, perceptions of commute conditions and options among Napa residents have improved in 2003 (Figure 32). In three of the six categories, there has been little change over the last year. In 2002, five of the six categories showed a negative trend. Respondents indicated commute conditions within the county improved over the last year, however, relative to commute conditions throughout the region conditions have not improved as much. The main reason for improvement was a "decrease in traffic."

FIGURE 32

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: –
Compared with 2002 +

Compared to region: =
Compared with 2002: =

Compared to region: =
Compared with 2002: –

Summary Scores 2001: = 2002: –4 2003 –1

SAN FRANCISCO COUNTY

TABLE 34
PRIMARY COMMUTE MODE

Drive Alone	37%
Bus	20%
Carpool	11%
Walk	10%
BART	8%
Light Rail	7%
Telecommute	2%
Bicycle	2%
Motorcycle	1%
Vanpool	1%
Caltrain	<1%
Other	2%

n=400

PRIMARY COMMUTE MODES

San Francisco residents participate in a broad range of commute modes. The drive-alone rate is by far the lowest in the region—only 37 percent of commuters drive by themselves to work (Table 34). The percentages of commuters who take the bus and walk are each more than double the total for the next closest county. Twenty percent of San Francisco residents take the bus to work; Marin has the second highest bus ridership at eight percent. Ten percent of San Francisco residents walk to work compared with four percent in counties with the second highest percentage of walkers. The combined transit use is also more than double the nearest "competitor." The combined transit use in San Francisco is 35 percent and the second highest is Alameda County at 15 percent. San Francisco can also claim the highest percentage of residents commuting by bicycle along with Alameda and Sonoma counties.

San Francisco residents continue to provide the most volatile changes in travel mode from year to year. The drive-alone rate is at its lowest level in six years (Table 35). Carpooling and transit use have both made small changes in opposite directions. Carpool use has declined slightly and transit use has increased slightly. The largest change is in the use of "other" modes. The 17 percent of respondents who indicated they walk, bicycle, telecommute, etc. is the highest percentage recorded to date. Commuters who walk account for 10 of the 17 percent of all "other" mode users—up from six percent in 2002. The main reasons commuters use transit in San Francisco is "lack of parking," "commuting costs" and "not

TABLE 35
CLUSTERED MODES OVER TIME

	1993	1994	1996	1999	2000	2001	2002	2003
Drive Alone	41%	46%	37%	40%	45%	44%	45%	38%
Carpool	11%	9%	9%	12%	8%	13%	13%	11%
Transit	35%	35%	41%	37%	36%	31%	32%	35%
Other	14%	10%	13%	10%	11%	12%	10%	17%

n=approximately 400 each year

owning a car." The main reasons cited for using "other" modes were "travel time," "comfort" and a "lack of better transit options." Compared with the region, driving alone is much less common, carpooling is below the regional average, and transit and "other" mode use are much more widespread.

OCCASIONAL AND CONNECTING MODES

In addition to the primary commute modes, data on "occasional" modes (a completely separate mode used on days when commuters do not use their primary mode) and "connecting" modes (modes used in addition to the primary mode on a normal trip to work) were gathered for San Francisco County residents. It is more common for San Francisco respondents to indicate the use of occasional and connecting modes than respondents from any other county. Eleven percent use an occasional mode and 18 percent use a connecting mode—compared with seven percent and 12 percent respectively from the region as a whole. The high use of connecting mode coincides with the high use of transit in the city. Fifty-five percent of transit riders and 24 percent of "other" mode commuters use a connecting mode, whereas only three percent of commuters who drive alone use a connecting mode.

The most commonly used occasional modes are driving alone, riding the bus and telecommuting. The use of buses as an occasional mode is more common among San Francisco residents than residents from any of the other counties. The most common connecting modes are the bus, driving alone and walking. The use of the bus as the most common connecting mode is unique to San Francisco and Alameda counties.

COMMUTE DISTANCE AND TIME

The average San Francisco resident travels 10 miles to work in 29 minutes (Figure 33). Travel time is up slightly from last year and travel distance is down slightly from last year. These changes translate to a decrease in estimated average travel speed. San Francisco is the only county where estimated travel speed declined between 2002 and 2003. This small decline in travel speed is most likely related to a higher percentage of San Francisco residents using transit for their commute. In 2002, 32 percent of respondents used transit, and in 2003, 35 percent of respondents used transit for their commute. The average travel speed for a transit commuter in San Francisco is 10 miles per hour whereas the average travel speed for a commuter who drives alone is 32 miles per hour. The average travel speed for San Francisco residents who drive alone to work has not changed over the last three years. Travel speed for San Francisco residents has increased compared with 2000 when the average speed was 28 miles per hour. In six of the nine counties travel speed increased and in two (Napa and Marin) travel speed remained constant over the last year. San Francisco residents have the shortest commutes and the slowest travel speeds. Compared to the nine-county region, the average speed in San Francisco is 12 miles per hour less.

FIGURE 33
COMMUTE DISTANCE AND TIME

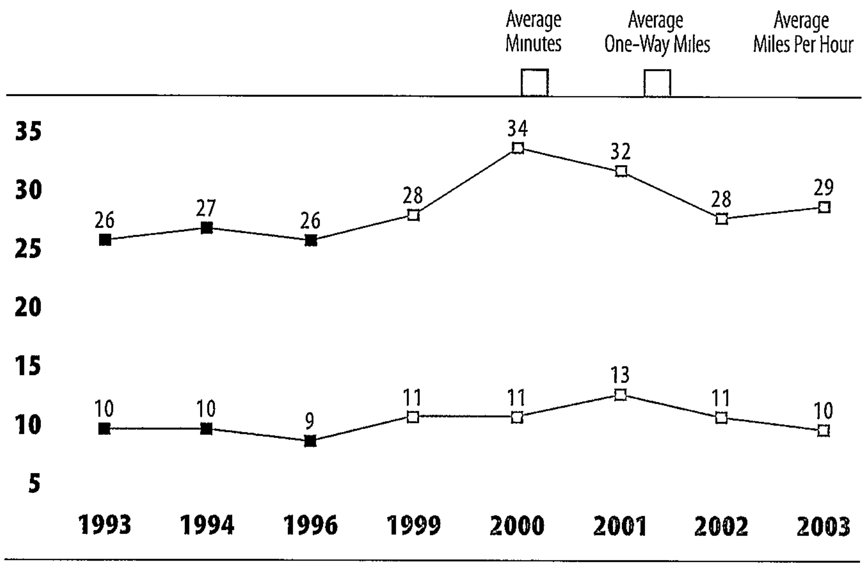


TABLE 36
MOST COMMON DESTINATIONS WITHIN SAN FRANCISCO COUNTY

Zip Code (within the city of)
94111 (Financial District)
94105 (South of Market) Bay Bridge Area
94103 (South of Market) Moscone/Civic Center
94104 (Financial District)
94102 (Civic Center)
94108 (Financial District)
94110 (Mission District)
94107 (China Basin)
94115 (UC Medical Center Area)

DESTINATION CHARACTERISTICS[13]

About three of four San Francisco residents live and work within the county. This is the third highest percentage of respondents who live and work in the same county—Santa Clara and Sonoma have higher percentages. About 19 percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within San Francisco County. Zip codes in the Financial District and the South of Market areas were the most common destinations within San Francisco (Table 36).

Commuters headed to San Francisco are, by far, the least likely to find free parking at or near their worksite. Only 33 percent of respondents indicated they had free parking available. By contrast in the county with the second smallest supply (Alameda), 75 percent indicated they had free parking available. In the other counties, free parking is available to more than 90 percent of respondents. Commuters headed to San Francisco were more likely to be going to larger (more than 100 employees) employers than commuters in other counties. Only Santa Clara has a higher percentage of commuters headed to large employers. San Francisco employers were also the most likely to operate programs designed to encourage their

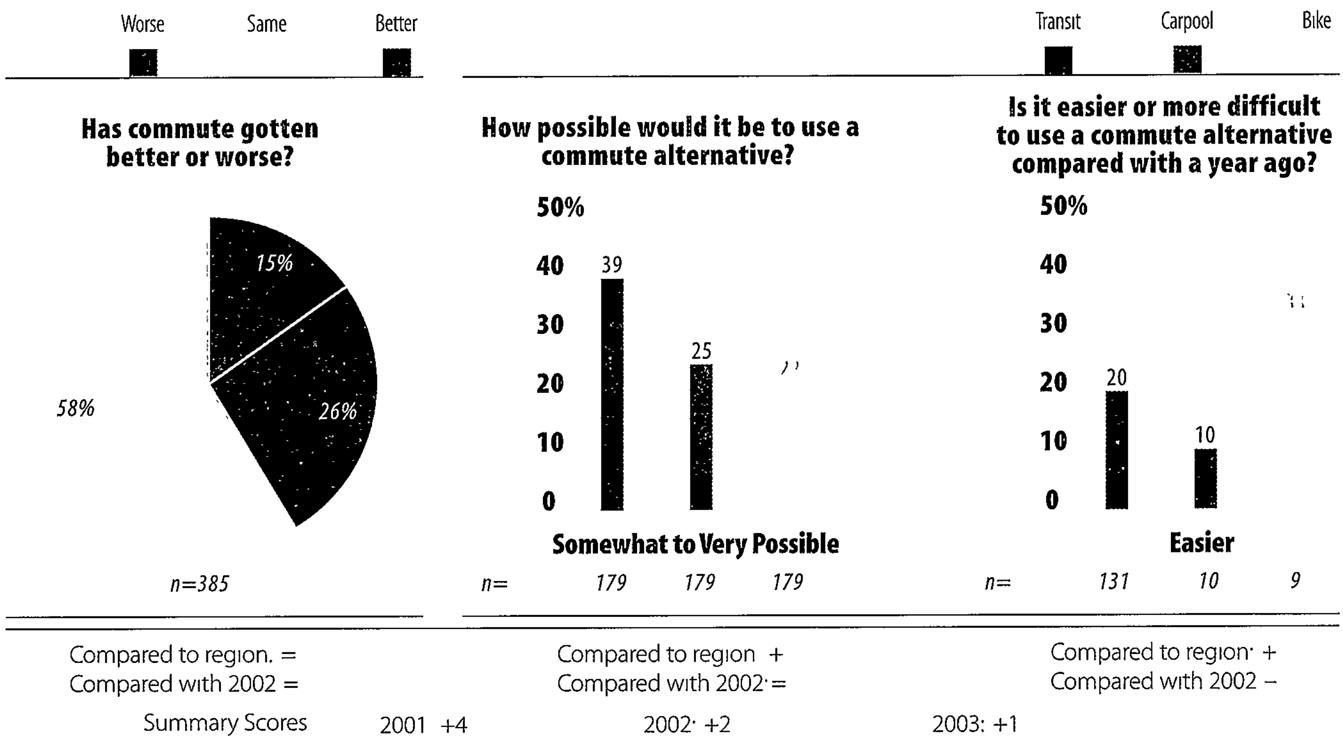
[13] The sample size for respondents with a destination of San Francisco was 653.

employees to use commute alternatives. Respondents indicated 49 percent of employers operated programs. San Francisco employers (along with Santa Clara employers) were also most likely to allow employees to telecommute—26 percent indicated telecommuting was an option.

PERCEPTION OF COMMUTE CONDITIONS AND OPTIONS

The overall perception of commute conditions and options in San Francisco, although down from last year, is still positive (Figure 34). There has been little change in how commuters perceive their overall commute conditions this year compared with last year. Those who did indicate conditions had improved cited "less traffic" and "improvements to transit service." San Francisco respondents were the only ones who mentioned "improved transit service" as one of the main reasons for improved conditions. Compared with the region as a whole, the use of commute alternatives seemed more feasible to commuters currently driving alone. For commuters currently using transit, carpools or bicycles to get to work results were mixed—better compared to the region but more difficult compared to a year ago. For those indicating transit use was easier, the main reason cited was "service improvements." For those indicating transit use was more difficult, the main reason cited was "service being less reliable or frequent."

FIGURE 34
PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



SAN MATEO COUNTY

TABLE 37
PRIMARY COMMUTE MODE

Drive Alone	68%
Carpool	17%
BART	4%
Bus	4%
Telecommute	3%
Walk	3%
Bicycle	1%
Caltrain	1%
Light Rail	<1%
Vanpool	<1%
Motorcycle	<1%

n=400

PRIMARY COMMUTE MODES

Commuters who live in San Mateo County are somewhat more likely to drive alone than commuters from the region as a whole. The percentage of commuters who drive alone to work in San Mateo County is five percentage points higher than the regional average (Table 37). Their use of carpools, BART, buses, Caltrain, telecommuting, bicycles and walking are all equal to or one percentage point below the regional average. In general, commuters who live in San Mateo County are fairly representative of the typical Bay Area commuter. Their reasons for driving alone are quite similar to reasons stated by commuters from other parts of the region. The most commonly given reasons for driving alone are a "lack of direct transit service," "difficulties finding carpool partners" or "working irregular hours."

The drive-alone rate, after remaining relatively stable over the last four years, has dropped by six percentage points in 2003 (Table 38). Carpool use had increased between 2001 and 2002—that increase remained stable in 2003. Both transit and "other" mode use increased between 2002 and 2003 to balance the decrease in driving alone. Compared with the region, driving alone is more widespread, carpool and "other" mode use are about the same; transit use is less common.

TABLE 38
CLUSTERED MODES OVER TIME

	1993	1994	1996	1999	2000	2001	2002	2003
Drive Alone	70%	72%	66%	75%	73%	75%	74%	68%
Carpool	17%	17%	18%	12%	13%	14%	17%	17%
Transit	8%	7%	9%	9%	11%	9%	7%	9%
Other	5%	4%	6%	4%	4%	2%	3%	6%

n=approximately 400 each year

OCCASIONAL AND CONNECTING MODES

"Occasional" modes and "connecting" modes were also tracked for respondents from San Mateo. An occasional mode is used on days when commuters do not use their primary mode and a connecting mode is used in addition to the primary mode on a normal trip to work. The use of occasional and connecting modes reflects the similarities between commute modes in San Mateo County and the region as a whole. About eight percent of San Mateo residents use an occasional mode (compared with seven percent for the region) and about 10 percent use a connecting mode (compared with 12 percent for the region). The use of transit is three percentage points below the regional average (nine percent compared with 12 percent)—transit users are considerably more likely to use a connecting mode than drive-alone commuters.

For eight of the nine counties, driving alone is the most common occasional mode (i.e., commuters who primarily take transit or carpool occasionally drive alone). In San Mateo County, the most commonly used occasional mode is telecommuting. Driving alone and BART are the next two most commonly used occasional modes. The most commonly used connecting modes are driving alone, BART and SamTrans.

COMMUTE DISTANCE AND TIME

Between 2001 and 2002 as the economy cooled, there was a dramatic five minute decrease in commute times and a four mile per hour increase in travel speed (Figure 35). In 2003, the average travel time did not change, nor did the average travel distance. The small increase in travel speed (despite the time and distance being identical in (Figure 35) is a result of the miles per hour calculation being done with two decimal places and the table showing rounded numbers. San Mateo residents have some of the shortest commutes in the region. Only Napa residents have a shorter average commute distance. The same holds true for travel time—only Napa residents have a shorter travel time.

FIGURE 35
COMMUTE DISTANCE AND TIME

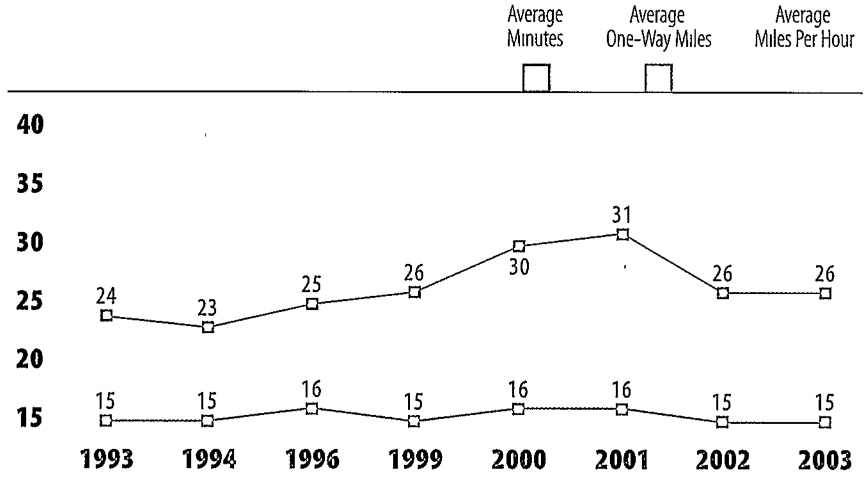


TABLE 39
MOST COMMON DESTINATIONS WITHIN SAN MATEO COUNTY

Zip Code (within the city of)
94080 (South San Francisco)
94025 (Menlo Park)
94010 (Burlingame)
94066 (San Bruno)
94070 (San Carlos)
94015 (Daly City)
94404 (San Mateo)
94401 (San Mateo)
94065 (Redwood City)

DESTINATION CHARACTERISTICS[14]

Over half (58 percent) of San Mateo County residents live and work within the county. Like many of the other characteristics of San Mateo residents, they represent close to the middle ground (three counties having more and five having fewer residents living and working in the same county). About 11 percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within San Mateo County—the fourth most popular destination county within the region. The most common destination zip code was in South San Francisco followed by Menlo Park and Burlingame (Table 39).

Nine of 10 commuters headed for San Mateo County have free parking available at or near their worksite—similar to most counties. San Francisco and Alameda are the only counties where free parking is less available. San Mateo is also at the midpoint for the region with respect to employer size and the percentage of employers operating programs to encourage the use of commute alternatives. Approximately 59 percent of commuters headed to San Mateo County work for employers with fewer than 100 employees (compared with 63 percent for the region). Employers in San Mateo rank fifth of nine in terms of their likelihood to operate programs which encourage the use of commute alternatives to driving alone.

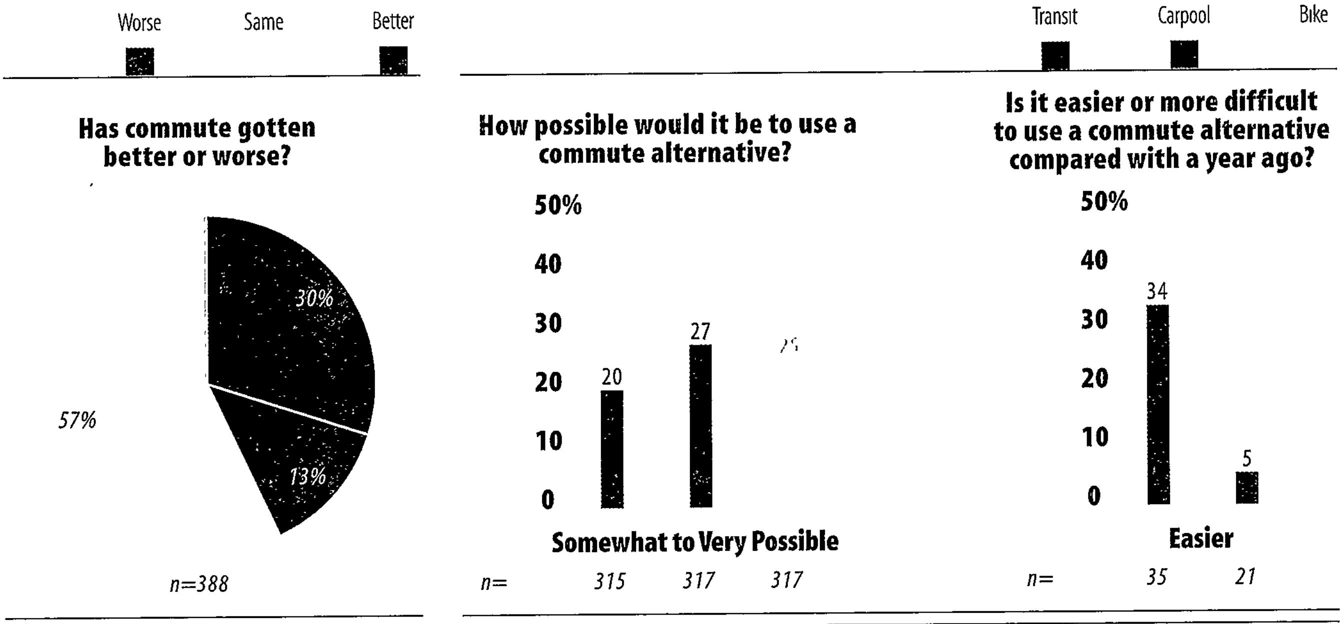
[14] The sample size for respondents with a destination of San Mateo was 345.

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Commute conditions and options have not changed dramatically in San Mateo County based on residents' perceptions. It is one of two counties whose summary score was an (=)—Marin was the other. Compared with both the region and conditions a year ago, San Mateo residents felt commute conditions were worse. The reasons cited were "increased traffic," "road construction" and "road maintenance work." Residents who were currently driving alone were positive about the possibilities of using transit, carpooling or bicycling to work. Those respondents who were currently using transit or carpooling indicated their conditions had changed little over the last year.

FIGURE 36

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: –
Compared with 2002: –

Compared to region +
Compared with 2002: +

Compared to region: =
Compared with 2002: =

Summary Scores 2001: –3 2002: –1 2003: =

SANTA CLARA COUNTY

TABLE 40
PRIMARY COMMUTE MODE

Drive Alone	71%
Carpool	20%
Caltrain	2%
Walk	2%
Bicycle	1%
Motorcycle	1%
Telecommute	1%
Light Rail	1%
Bus	1%
Other	<1%

n=400

PRIMARY COMMUTE MODES

For the past few years, Santa Clara County residents have had the highest drive-alone rate. This year, because of an increase in the use of carpools, Caltrain and walking modes, Santa Clara's drive-alone rate ranks third (Table 40). Napa and Sonoma counties have higher rates. The percentage of commuters carpooling is second only to Solano. The highest percentage of commuters using Caltrain is also from this county.

The distribution of commute modes had been relatively stable between 1998 and 2002 (Table 41). Following the regional trend, that has changed in 2003. The drive-alone rate dropped seven percentage points from 79 percent to 72 percent. The carpooling rate increased by four percentage points and both transit and "other" mode use posted increases. Compared with the region, driving alone is considerably more widespread and carpool use is higher than the rest of the region; transit use and "other" mode use are less common.

OCCASIONAL AND CONNECTING MODES

In addition to the primary commute modes, data on "occasional" modes (a completely separate mode used on days when commuters do not use their primary mode) and "connecting" modes (modes used in addition to the primary mode on a normal trip to work) were gathered for Santa Clara County residents. The use of both occasional and connecting modes in Santa Clara is lower than the regional averages.

TABLE 41
CLUSTERED MODES OVER TIME

	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003
Drive Alone	78%	71%	71%	74%	77%	77%	77%	78%	79%	72%
Carpool	15%	17%	21%	18%	18%	15%	15%	17%	16%	20%
Transit	4%	7%	4%	3%	3%	5%	4%	3%	3%	4%
Other	3%	5%	4%	5%	1%	2%	4%	3%	2%	4%

n=approximately 400 each year

About four percent of Santa Clara residents use an occasional mode (compared with seven percent for the region) and seven percent use a connecting mode (compared with 12 percent for the region). Santa Clara has a relatively low transit use rate and transit users are considerably more likely to use a connecting mode than drive-alone commuters.

Driving alone, telecommuting and bicycling are the most commonly used occasional modes. Bicycling as an occasional mode is more common in Santa Clara than any other county. Driving alone, carpooling and bicycling are the most commonly used connecting modes. Santa Clara is the only county where carpooling shows up as one of the most common connecting modes.

COMMUTE DISTANCE AND TIME

Average travel time to work for Santa Clara residents did not change between 2002 and 2003 (Figure 37). Average one-way travel distance increased by one mile. The estimated travel speed increased again; it is up by nine miles per hour since 2001—reflecting decreasing levels of congestion. Santa Clara (in a tie with San Mateo) has the second fastest commute time. Only Napa residents enjoy a faster commute. Santa Clara residents (also in a tie with San Mateo) have the third shortest one-way commute distance.

FIGURE 37
COMMUTE DISTANCE AND TIME

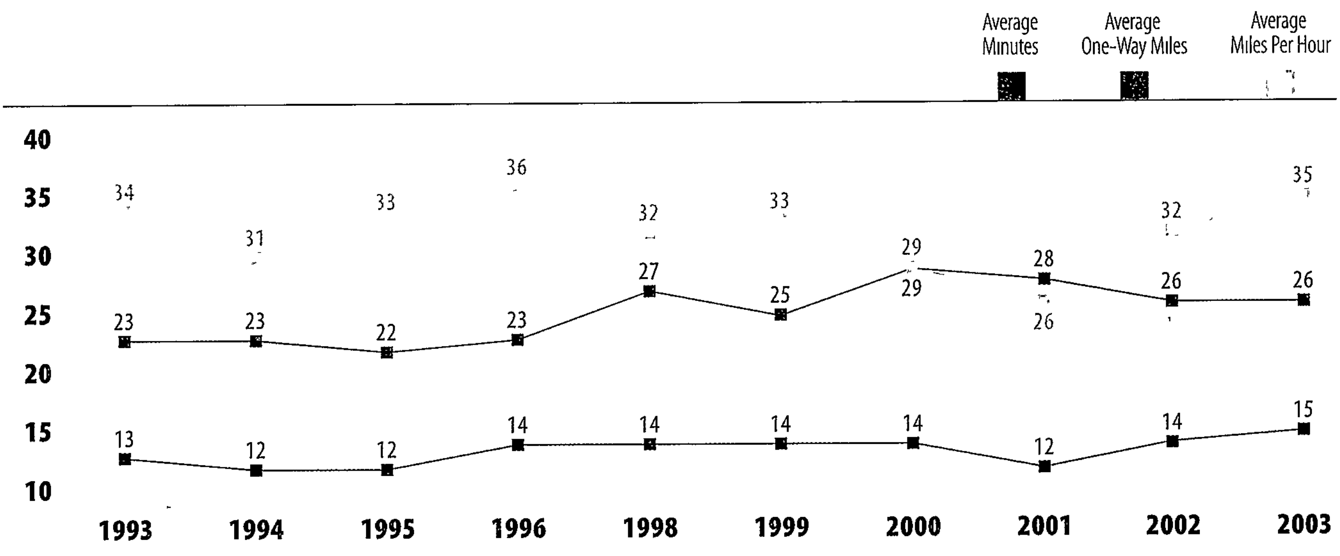


TABLE 42
MOST COMMON DESTINATIONS WITHIN SANTA CLARA COUNTY

Zip Code(within the city of)
95112 (San Jose)
94303 (Palo Alto)
95054 (Santa Clara)
94089 (Sunnyvale)
95035 (Milpitas)
94035 (Mountain View)
95134 (San Jose)

DESTINATION CHARACTERISTICS[15]

Santa Clara respondents are more likely to live and work within the same county than residents of any other Bay Area county. Eighty-eight percent of commuters who live within the county also work within the county. This is substantially more than any other county; the next closest is Sonoma County where 77 percent of commuters live and work within the county. Santa Clara is also the destination of more commuters than any other single county. About 27 percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Santa Clara County (Table 42). Within Santa Clara County, zip codes in the cities of San Jose, Palo Alto and Santa Clara are most common destinations.

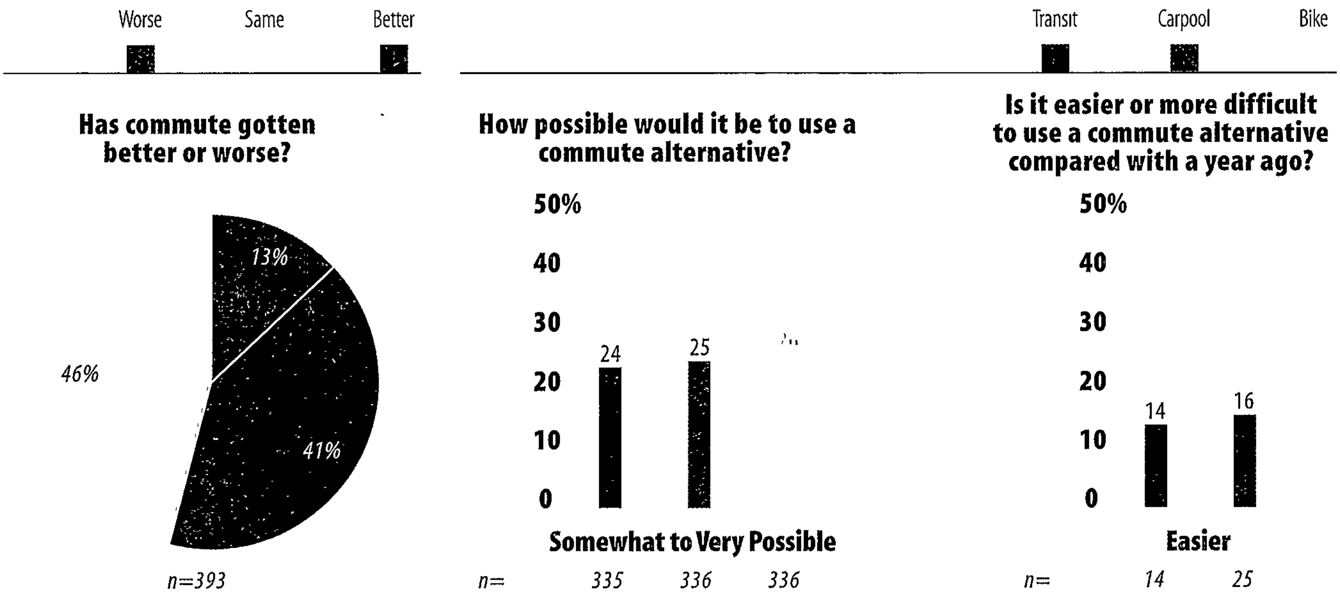
[15] The sample size for respondents with a destination of Santa Clara was 459.

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Santa Clara County residents feel better about the commute options available to them than residents of most other counties in the region (Figure 38). Alameda, Contra Costa and Sonoma also scored a (+2). Compared with both the region and conditions a year ago, Santa Clara residents indicated commute conditions were better. The main reasons cited for improved conditions were "less traffic" and "roadway improvements." Residents who were currently driving alone were positive about the possibilities of using transit, carpooling or bicycling to work. A greater percentage of respondents who were currently using transit or carpooling, indicated it was more difficult to do so now compared with a year ago.

FIGURE 38

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: +
Compared with 2002: +

Compared to region: +
Compared with 2002 +

Compared to region: –
Compared with 2002: –

Summary Scores 2001: +5 2002: +2 2003 +2

SOLANO COUNTY

TABLE 43
PRIMARY COMMUTE MODE

Drive Alone	70%
Carpool	20%
Walk	2%
BART	2%
Vanpool	1%
Telecommute	1%
Bus	1%
Bicycle	1%
Motorcycle	1%
Ferry	<1%
Other	1%

n=400

PRIMARY COMMUTE MODES

The combined use of carpools and vanpools is higher in Solano County than any other county in the region (Table 43). The average Solano County resident commutes 23 miles one-way to work; the average for the region is 16. These longer commutes appear conducive to carpooling and vanpooling. The drive-alone rate is about seven percentage points above the regional average. Transit use is well below the regional average. The most commonly cited reasons for driving alone were "the need to work irregular hours," "no direct transit service along the route to work" and "difficulty finding carpool partners."

The drive-alone rate in Solano County fluctuated considerably between 1993 and 1999, was relatively stable between 2000 and 2002 and shows a small decline in 2003 (Table 44). The carpool rate is identical to last year. The 22 percent of residents carpooling to work is the highest of any county. Both transit use and "other" modes posted a small increase in 2003 compared with 2002. Compared with the region, driving alone is more common, carpool use is higher, transit use is considerably lower and "other" mode use about the same.

OCCASIONAL AND CONNECTING MODES

An "occasional" mode is used on days when commuters do not use their primary mode and a "connecting" mode is used in addition to the primary mode on a normal trip to work. The use of both occasional and connecting modes in Solano

TABLE 44
CLUSTERED MODES OVER TIME

	1993	1994	1995	1996	1998	1999	2000	2001	2002	2003
Drive Alone	68%	72%	73%	67%	77%	66%	72%	73%	73%	71%
Carpool	25%	22%	22%	23%	18%	25%	19%	24%	22%	22%
Transit	4%	3%	3%	5%	4%	4%	7%	2%	2%	3%
Other	3%	3%	3%	6%	2%	4%	3%	1%	3%	5%

n=approximately 400 each year

County was about half the level for the region. Only three percent of residents use an occasional mode (compared with seven percent for the region) and six percent use a connecting mode (compared with 12 percent for the region). The limited use of connecting modes is most likely a reflection of the longer distances residents travel and limited transit options. Transit users are considerably more likely to use a connecting mode (55 percent do so) than drive-alone commuters (three percent do so). Driving alone, telecommuting and vanpooling are the most commonly used connecting modes. Solano is the only county where vanpooling appears as one of the most common connecting modes. Similar to other counties, driving alone, BART and walking are the most commonly used connecting modes.

COMMUTE DISTANCE AND TIME

Although average travel distance declined between 2002 and 2003, commuters living in Solano County still travel the longest distance of any county in the Bay Area (Figure 39). The decrease in travel distance was offset by an even greater decrease in average travel time. This combination gives Solano residents the fastest estimated travel speed—41 miles per hour. Despite having the longest distance commutes, Solano residents do not have the longest commute times—as a result of having a relatively fast travel speed—that distinction goes to Contra Costa commuters.

FIGURE 39

COMMUTE DISTANCE AND TIME

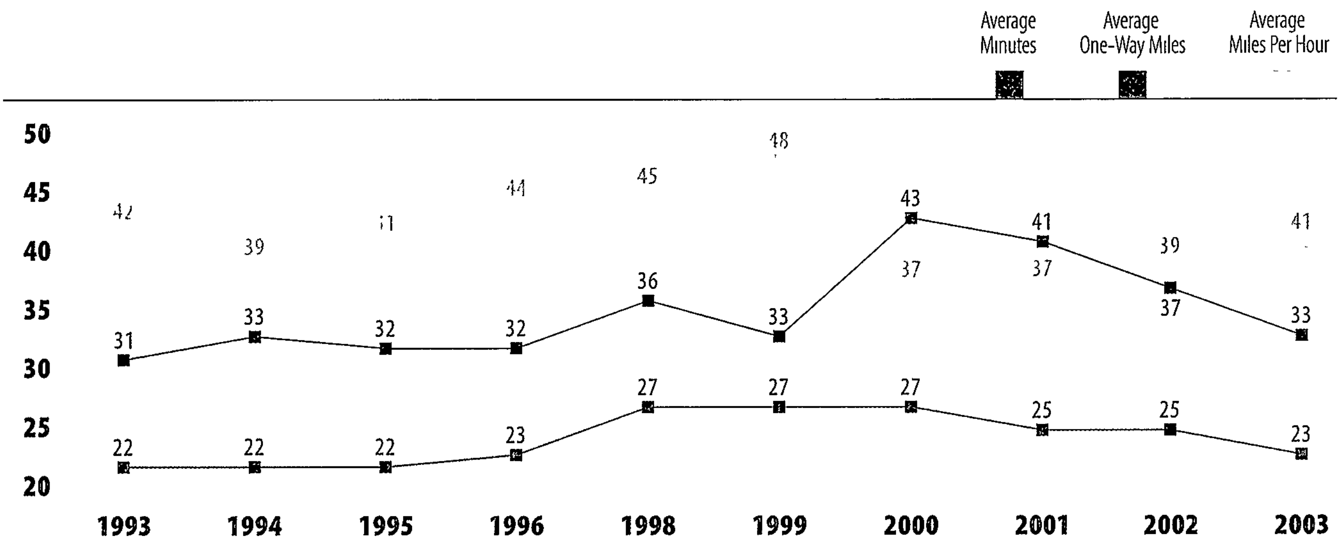


TABLE 45
MOST COMMON DESTINATIONS WITHIN SOLANO COUNTY

Zip Code (within the city of)
94533 (Fairfield)
94510 (Benicia)
95688 (Vacaville)
94591 (Vallejo)
94590 (Vallejo)

DESTINATION CHARACTERISTICS[16]

Solano County has the smallest percentage of residents who live and work within the county. Just under half of respondents (49 percent) live and work within the county. This is almost 40 percentage points less than Santa Clara (which has the highest percentage living and working within the same county) where 88 percent do so. About three percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Solano County. Only Napa County had a smaller percentage of respondents headed to work there. Zip codes in Fairfield and Benicia were the most common destinations (Table 45).

For those commuters who are going to work within the county there is a good chance they will have free parking available at or near their worksite. Ninety-four percent of respondents destined for an employer within Solano County indicated they had free parking—only commuters headed to Napa were more likely to find free parking. Solano is approximately at the midpoint for the region with respect to employer size. Approximately 61 percent of commuters headed to Solano County work at employer sites with fewer than 100 employees (compared with 63 percent for the region). With the exception of employers in Napa County, Solano employers are the least likely to operate programs which encourage employees to use commute alternatives—approximately 25 percent of employers within the county do so. Employers in Solano County are also the least likely to offer their employees the option to telecommute—only nine percent do so.

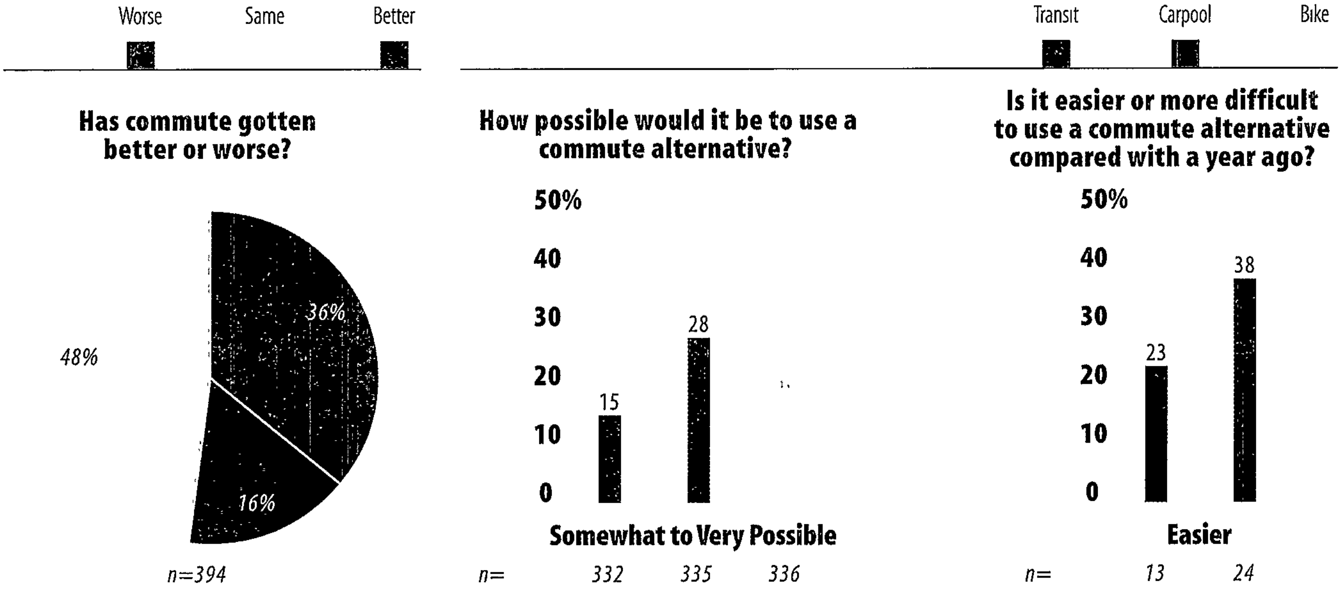
[16] The sample size for respondents with a destination of Solano was 240.

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

The perceptions of commute conditions in Solano County are considerably more positive this year than last year (Figure 40). Last year's summary score of (-4) was among the lowest; this year's score of (+1) is more in the middle. Compared with other respondents from the region, Solano commuters were less positive about how conditions had changed over the last year, but more positive than Solano respondents last year. The main reasons cited for improved conditions were "less traffic" and individual "changes in commute route." For respondents who were currently driving alone, results were mixed. Compared with other respondents from the region Solano commuters were less optimistic about the potential use of an alternative to driving alone, but compared with a year ago they were more positive about potentially using transit, carpooling or bicycling to work. Respondents who were currently taking transit or carpooling indicated conditions had gotten easier (compared with the region) or stayed the same (compared with Solano respondents last year). The main reasons cited for carpooling being easier were the availability of "more partners" and being able to "use carpool lanes."

FIGURE 40

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: –
Compared with 2002 +

Compared to region: –
Compared with 2002 +

Compared to region. +
Compared with 2002: =

Summary Scores 2001 –2 2002. –4 2003· +1

SONOMA COUNTY

TABLE 46

PRIMARY COMMUTE MODE

Drive Alone	72%
Carpool	19%
Bus	3%
Walk	3%
Bicycle	2%
Motorcycle	1%
Telecommute	1%
Vanpool	<1%

n=400

PRIMARY COMMUTE MODES

Just less than three of four commuters in Sonoma County (72 percent) drive alone to work (Table 46). Napa is the only county in the Bay Area where residents are more likely to drive alone to work. The carpool rate in the county is slightly above average, but use of transit modes is on the low end for the region. Bicycle use is fairly high—only two other counties have two percent of commuters using bicycles as their primary mode of travel to work. The main reasons cited by Sonoma commuters for driving alone were "difficulty finding carpool partners," a "lack of direct transit service" and "irregular work hours."

The use of "other" modes in Sonoma County increased notably between 2001 and 2002. That gain seems to have been consolidated in 2003—around the level where it was in 1999 and earlier (Table 47). The drive-alone rate reached a high of 77 percent in 2000 and 2001; it has dropped by four percentage points to 73 percent in 2003. To offset the decline in driving alone the use of both carpooling and transit options have increased slightly. Compared with the region, driving alone is more common, carpool and "other" mode use is similar and transit use is lower.

OCCASIONAL AND CONNECTING MODES

In addition to the primary commute modes, data on "occasional" modes (a completely separate mode used on days when commuters do not use their primary mode) and "connecting"

TABLE 47

CLUSTERED MODES OVER TIME

	1994*	1996*	1999	2000	2001	2002	2003
Drive Alone	70%	73%	74%	77%	77%	76%	73%
Carpool	19%	18%	17%	17%	19%	18%	19%
Transit	5%	4%	4%	3%	3%	2%	3%
Other	7%	5%	5%	4%	2%	5%	5%

n=approximately 400 each year

*Napa and Sonoma counties

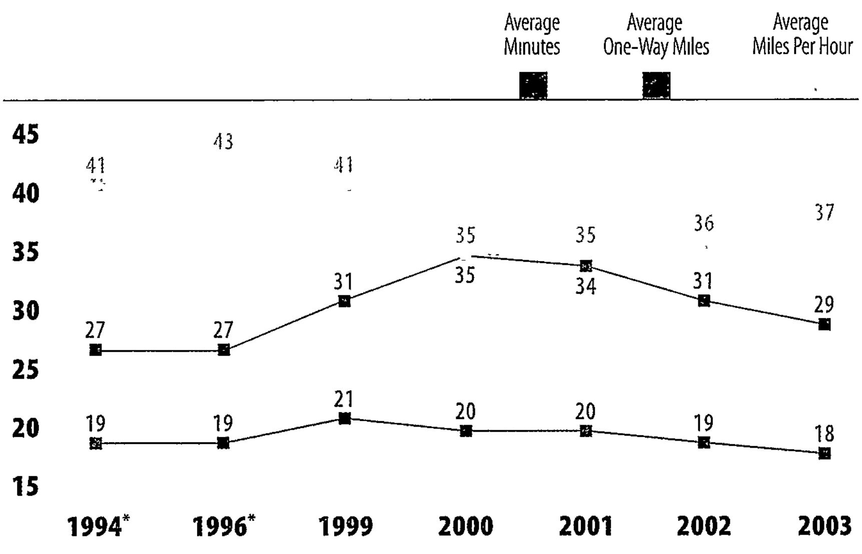
modes (modes used in addition to the primary mode on a normal trip to work) were gathered for Sonoma County residents. About eight percent of Sonoma commuters use an occasional mode for their trip to work (compared with seven percent for the region). Only six percent use a connecting mode—compared with an average of 12 percent for the region. Transit use is on the low end in Sonoma and connecting modes are commonly used as part of a transit trip so the less frequent use of connecting modes makes sense.

The most commonly used occasional modes are driving alone, telecommuting and carpooling—very similar to the types of occasional modes used in other counties. The most commonly used connecting modes are driving alone, walking and carpooling.

COMMUTE DISTANCE AND TIME

Sonoma residents travel an average of 18 miles to work, in 29 minutes and at an estimated speed of 37 miles per hour (Figure 41). Travel time is identical to the regional average even though the average one-way distance is about two miles farther. Both travel time and distance have been declining over the past three to four years and travel speed has increased gradually.

FIGURE 41
COMMUTE DISTANCE AND TIME



*Napa and Sonoma counties

TABLE 48
MOST COMMON DESTINATIONS WITHIN SONOMA COUNTY

Zip Code (within the city of)
95401 (Santa Rosa)
95403 (Santa Rosa)
95407 (Santa Rosa)
94952 (Petaluma)
95404 (Santa Rosa)
94928 (Rohnert Park)
95476 (Sonoma)

DESTINATION CHARACTERISTICS[17]

Just over three quarters of Sonoma County respondents (77 percent) live and work within the county. The only county with a higher percentage of residents living and working in the same county is Santa Clara. About six percent of *Commute Profile* respondents (based on the weighted regional data set) had a destination within Sonoma County. This is on the lower end although three counties (Napa, Solano and Marin) have a smaller share of Bay Area commuters working in their county. Within Sonoma County, zip codes in Santa Rosa are clearly the most popular destinations with four of the top five most common destinations (Table 48).

Approximately nine of 10 commuters (91 percent) with a destination of Sonoma County have free parking available at or near their worksite. Worksites tend to be smaller with 69 percent having fewer than 100 employees. Only Marin and Napa have a higher percentage of small worksites. Thirty-three percent of respondents with a destination of Sonoma County indicated their employers operate a program which encourages the use of commute alternatives. Sonoma employers are less likely to offer commute encouragement programs than employers from counties which, on average, have larger work forces. Sonoma employers are the third most likely to offer employees the option to telecommute—San Francisco and Santa Clara employers are more likely to offer the option to telecommute.

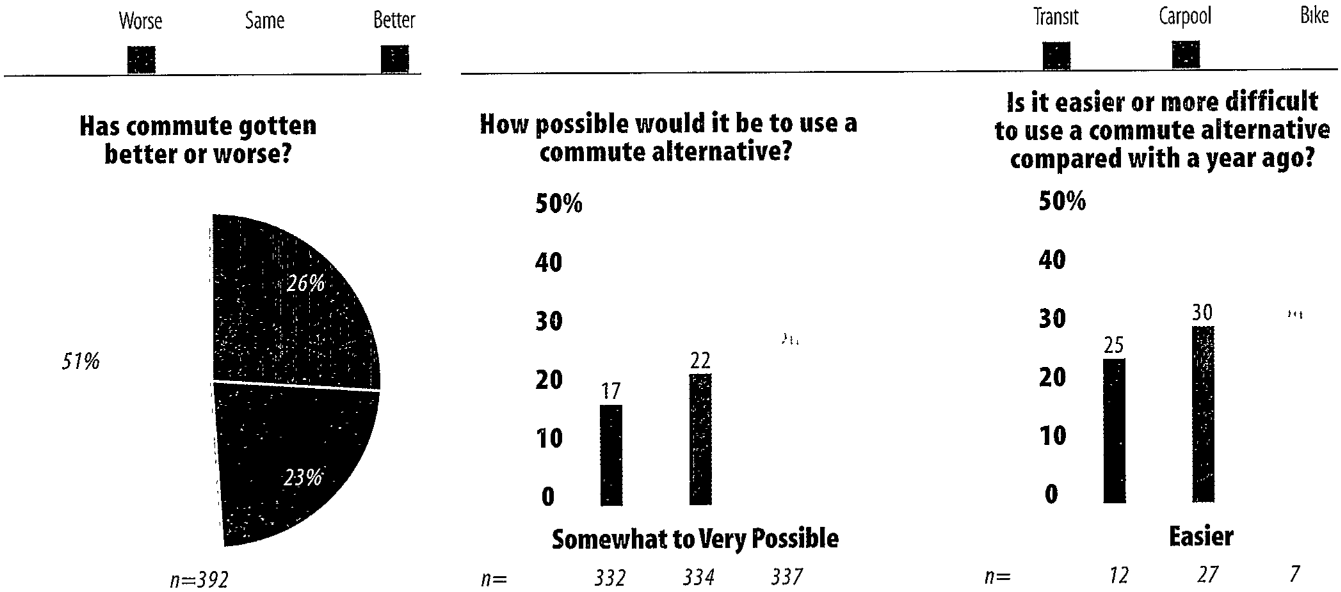
[17] The sample size for respondents with a destination of Sonoma was 342.

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS

Similar to last year, Sonoma County residents have an overall positive perception of their commute conditions and options (Figure 42). Compared with both respondents from the rest of the region and with Sonoma respondents from last year, a higher percentage indicated their commute had improved. Respondents cited "reduced traffic" and "roadway improvements" as key reasons for improved commute conditions. For respondents who were currently driving, results were mixed. Compared with other respondents from the region, Sonoma commuters were less optimistic about the potential use of an alternative to driving alone, but compared with a year ago they were more positive about potentially using transit, carpooling or bicycling to work. Respondents who were currently taking transit, carpooling or bicycling indicated conditions had gotten easier—both compared with the region and with Sonoma respondents from last year. The main reason cited for improved carpooling conditions was the addition of a new carpool lane.

FIGURE 42

PERCEPTIONS OF COMMUTE CONDITIONS AND OPTIONS



Compared to region: – Compared with 2002: +	Compared to region: – Compared with 2002: +	Compared to region: + Compared with 2002: +

Summary Scores 2001 –4 2002 +3 2003 +2

APPENDIX A

commute profile 2003 questionnaire

Hello, my name is __________, with [contractor's name], a public opinion research firm. We're talking to people about their commute experiences to help improve commuting in the Bay Area.

1. In which county do you live?

1. Alameda	21%
2. Contra Costa	14%
3. Marin	4%
4. Napa	2%
5. San Francisco	13%
6. San Mateo	11%
7 Santa Clara	25%
8. Solano	5%
9. Sonoma	7%
10. Other (end)	

2. Are you 18 years or older and do you work 30 hours or more a week as an employee or independent business person?

1. Yes (skip to 6)
2. No (skip to 3)

3. May I speak with someone in your household who is?

1. Yes (skip to 6)
2. No/not available now
3. No one here matches criteria (end)
4. No/decline

4. What is the person's name: ________________

5. When is a good time to call: _______________ (end)

6. Do you currently hold more than one job?

1. Yes 10% [If Yes: Please answer the questions in this survey with respect to your primary job and primary work site.]
2. No 90%

7. How many days do you work each week?

1 2 3 4 5 6 7 average=5

8. How do you usually get to work? [select one]

1 Drive alone	63%	(skip to 10)
2. Carpool	18%	(skip to 10)
3. Vanpool	<1%	(skip to 10)
4. BART	5%	(skip to 10)
5. Bus	5%	(skip to 10)
6. Caltrain	1%	(skip to 10)
7. Altamont Commuter Express	<1%	(skip to 10)
8. Capitol Corridor Train	0%	(skip to 10)
9. Light Rail	1%	(skip to 10)
10. Ferry	<1%	(skip to 10)
11. Bicycle	1%	(skip to 10)
12. Motorcycle	1%	(skip to 10)
13. Walk	3%	(skip to 10)
14. Work at home/telecommute	2%	(ask 9)
15. Other	<1%	(skip to 10)

9. Is this a home-based business without any other regular work location outside your home?

1. Yes	0%	(end)
2. No	100%	

10. Would that be [response to Q7] days a week?

1. Yes	93%	(skip to Q12)
2. No	7%	

11. How else do you get to work? [select up to 3 most frequently used]

1. Drive alone	31%
2 Carpool	9%
3 Vanpool	<1%
4. BART	8%
5. Bus	8%
6. Caltrain	2%
7. Altamont Commuter Express	0%
8. Capitol Corridor Train	0%
9. Light Rail	3%
10. Ferry	<1%
11. Bicycle	7%
12. Motorcycle	1%
13. Walk	5%
14. Work at home/telecommute	20%
15. Other	8%

12. You indicated that you normally commute to work by [response to Q8]. Is the entire trip made by [response to Q8] or is some other type of transportation combined with this on the same day to get from home to work?

1. Yes	12%
2. No (if Q8=1 skip to 17; if Q8=2 or 3 skip to 14; if Q8=4+ skip to 20)	88%
3. Refused/don't know (if Q8=1 skip to 17; if Q8=2 or 3 skip to 14, if Q8=4+ skip to 20)	0%

13. What other modes do you use? [select up to 3]

1. Drive alone	31%
2. Carpool	7%
3. Vanpool	2%
4. BART	10%
5. Bus	23%
6. Commute Train	2%
7. Light Rail	5%
8. Ferry	<1%
9. Bicycle	6%
10. Motorcycle	<1%
11. Walk	9%
12. Work at home/telecommute	0%
13. Other	4%

Questions 14-16 for primary mode = carpool or vanpool (Q8 = 2 or 3)

14. Including yourself and the driver, what is the total number of persons usually in the vehicle?

_______ average=3

15. With whom do you regularly carpool/vanpool? [readchoices; select all that apply]

1. Household members	33%
2 Non-household relatives	7%
3. Co-workers	42%
4. Friends, acquaintances, neighbors	6%
5. Someone from a matchlist/RIDES/ 755-POOL/511	1%
6. Casual carpool with different people each day	8%
7 Other	2%
8. Refused/don't know	1%

16. How long have you been in a carpool or vanpool?

1. Less than a month	5%
2. 1 month to less than 6 months	11%
3. 6 months to less than a year	8%
4 More than a year but less than two	17%
5. More than two years	60%

Questions 17-19 for primary mode = drive alone (Q8=1)

17. When you say you drive alone to work, do you mean [read choices; select up to 3]

1. You sometimes have children?	15%	
2. You sometimes have other household members?	4%	
3. You sometimes have "others"?	7%	
4. You never have anyone with you?	74%	(skip to Q19)
5. Refused/don't know	0%	

18. How often do you have other people in the vehiclewith you? [select one]

1 Three to five days per week	62%
2. One to two days per week	23%
3. Less than one day per week	15%

19. What are your reasons for driving alone to work? [select up to 3]

1. No practical transit options	14%	(skip to 21)
2. Comfort/relaxation	5%	(skip to 21)
3. Travel time to and from work	7%	(skip to 21)
4. No one to carpool with	16%	(skip to 21)
5. Privacy	1%	(skip to 21)
6. Having vehicle during work	10%	(skip to 21)
7 Having vehicle before/after work	4%	(skip to 21)
8. Having vehicle to take kids to daycare/school	5%	(skip to 21)
9 Safety	<1%	(skip to 21)
10. Commuting costs	1%	(skip to 21)
11. Work hours/work schedule	14%	(skip to 21)
12. Not being dependent on others	2%	(skip to 21)
13. Want to get home in an emergency	<1%	(skip to 21)
14 Like to come and go as I please	2%	(skip to 21)
15 Driving is easiest and fastest	10%	(skip to 21)
16. Love to drive my car	<1%	(skip to 21)
17 Enjoy private time driving to work	1%	(skip to 21)
18. Transit not reliable	1%	(skip to 21)
19. Transit not frequent enough	1%	(skip to 21)
20. Other	7%	(skip to 21)
21. Refused/don't know	<1%	(skip to 21)

Q20 for other than drive alone respondents Q8<>1

20. What are your reasons for [response to Q8]? (select up to 3)

1 No practical transit options	5%
2. Comfort/relaxation	13%
3. Travel time to work	12%
4. Can use diamond (HOV, carpool) lane	2%
5. Don't own a car	8%
6 Having vehicle during work	1%
7. Having vehicle before/after work	<1%
8. Having vehicle to take kids to daycare/school	1%
9 Safety	1%
10. Commuting costs	15%
11. Work hours/work schedule	2%
12. Too far to transit	1%
13. Need to get home in an emergency	<1%
14. No parking available or parking too expensive	6%
15 Enjoy private time driving to work	1%
16 Environment (reduce pollution/save energy)	6%
17 Stress	3%
18. Enjoy talking to someone/company	2%
19. Other	23%
20. Refused/don't know	<1%

21. Is your commute better, about the same or worse now than it was a year ago? [select one]

1. Extremely better	4%	
2. Better	25%	
3 About the same	50%	(skip to 24)
4. Worse	16%	(skip to 23)
5. Extremely worse	2%	(skip to 23)
6. Refused/don't know	3%	(skip to 24)

22. How has it gotten better? [select a maximum of 3]

1. Traffic lighter	49% (1+ = skip to 24)
2 Roadway improvements	10%
3 Changed mode	3%
4 Moved home/changed job or job location	14%
5 Changed commute route	6%

6 Commuting at different time 3%
7 Less road maintenance work 2%
8 Weather improved <1%
9. Improved/new transit service 4%
10. Other 9%
11. Refused/don't know <1%

23. How has it gotten worse? [select a maximum of 3]
1 Traffic heavier 52%
2. Construction delays 9%
3 Changed mode 1%
4. Moved home/changed job or job location 8%
5 Changed commute route 3%
6. Commuting at different time 1%
7. More road maintenance 4%
8 Weather worse <1%
9 Transit more crowded/slower 7%
10 Other 15%
11 Refused/don't know <1%

Transit only: Q8=4-10

24. Would you say that it is easier, about the same or more difficult to use transit to get to work now than it was a year ago? [select one]
1. Extremely easier 2%
2 Easier 17%
3. About the same 66% (skip to 27)
4. More difficult 10% (skip to 24b)
5. Extremely more difficult 1% (skip to 24b)
6. Refused/don't know 4% (skip to 27)

24a. Why is it easier? [select up to 3]
1. Changed my home or work location (1+ skip 27) 21%
2 Better information available 1%
3. Service reliability or frequency has improved 30%
4. New service has been added 9%
5. Employer provides incentives 1%
6. Schedule/responsibilities have changed at home or work 4%
7. Other 31%
8. Refused/don't know 3%

24b. Why is it more difficult? [select up to 3]
1. Changed my home or work location 0%
2. Service has been cut 22%
3. Service is less frequent 15%
4 Service is less reliable 23%
5 Schedule/responsibilities have changed at home or work 7%
6. Other 30%
7. Refused/don't know 3%

Carpool only Q8=2

25. Would you say that it is easier, about the same ormore difficult to carpool to work now than it was a year ago? [select one]
1. Extremely easier 3%
2. Easier 20%
3 About the same 64% (skip to 27)
4. More difficult 7% (skip to 25b)
5. Extremely more difficult 1% (skip to 25b)
6. Refused/don't know 4% (skip to 27)

25a. Why is it easier? [select up to 3]
1. Changed my home or work location (1+skip to 27) 12%
2 New carpool lane 9%
3. More people to share ride with 33%
4. Change in home/work schedule 2%
5. Other 40%
6. Refused/don't know 4%

25b. Why is it more difficult? [select up to 3]
1. Changed my home or work location (1+ skip to 27) 5%
2. Traffic is worse 50%
3 Can't use carpool lane 0%
4 Change in home/work schedule 0%
5. Partners no longer available 9%
6. Other 36%
7. Refused/don't know 0%

Bicycle commuters only. Q8=11

26. Would you say that it is easier, about the same ormore difficult to bicycle to work now than it was a year ago? [select one]
1. Extremely easier 0%
2. Easier 27%
3. About the same 67% (skip to 27)
4. More difficult 2% (skip to 26b)
5. Extremely more difficult 0% (skip to 26b)
4. Refused/don't know 4% (skip to 27)

26a. Why is it easier? [select up to 3]
1. Changed my home or work location (1+skip to 27) 23%
2. New bike lane 39%
3. Found someone to ride with 0%
4. Improved facilities to lock bike or change cloths, etc. 8%
5. Other 31%
6. Refused/don't know 0%

26b. Why is it more difficult? [select up to 3]
1. Changed my home or work location 0%
2 Traffic is worse 0%
3. Less safe to ride on streets 0%
4. No safe place to lock bike 0%
5. Other 100%
6. Refused/don't know 0%

27. About how many miles do you travel to work onaverage, one-way? __________ average=16 miles

28. How many minutes does your commute to work take door to door? _______ average=29minutes

29. What time do you normally start work? __________

29a. AM _____ or PM ______

30. How flexible would you say your arrival time at work is?
1. Extremely flexible 26%
2. Flexible 38%
3 Neutral 7%
4. Inflexible 20%
5. Extremely inflexible 8%
6. Refused/don't know 1%

31. How flexible would say your arrival time at home is?
1. Extremely flexible 33%
2. Flexible 49%
3. Neutral 8%
4. Inflexible 8%
5 Extremely inflexible 2%
6. Refused/don't know 1%

32. Is there a special diamond lane, that can be used only by carpools, vanpools and buses, along your route to work?
1. Yes 43%
2. No 55% (skip to 38)
3. Refused/don't know 2% (skip to 38)

33. Do you regularly use the diamond lane to get to work?
1. Yes 22%
2. No 78% (skip to 38)
3 Refused/don't know 0% (skip to 38)

34. Does the diamond lane save you time in getting to work?
1. Yes 86%
2. No 13% (skip to 36)
3. Refused/don't know 1% (skip to 36)

35. How many minutes does it save you?
______ average=16

36. Did the diamond lane influence your decision to carpool or ride transit?
1. Yes 51%
2. No 47%
3. Refused/don't know 2%

37. How likely are you to continue to carpool or ride transit if the diamond lane did not exist?
1 Extremely flexible 38%
2 Flexible 23%
3 Neutral 11%
4 Inflexible 14%
5. Extremely inflexible 11%
6. Refused/don't know 4%

38. What is the zip code where you live? ____________

Ask 39 only if they do not know their home zip code in 38

39. What city do you live in? __________________

40. What is the zip code where you work? __________

Ask 41 only if they do not know their work zip code in 40

41 What city do you work in? __________________

42. Is there free all-day parking at or near your worksite?
1. Yes 78%
2. No 22%
3 Refused/don't know 1%

43. How many employees work for your company at your site?
1. 0 –50 46%
2. 51-100 12%
3 101-500 21%
4 More than 500 19%
5. Refused/don't know 2%

44. Does your employer encourage employees to use transit, carpool, bicycle or walk to work?
1. Yes 38%
2. No 58% (skip to 45)
3. Refused/don't know 5% (skip to 45)

44a. How does your employer encourage the use of these modes? [select a maximum of 5]
1. Carpool and/or vanpool program 19%
2. Transit ticket sales/subsidies 25%
3. Guaranteed ride home 3%
4. Bike lockers/showers 5%
5 Flexible hours 4%
6. Special carpool parking 6%
7. Incentives/rewards 12%
8 Other 24%
9. Refused/don't know 4%

45. As part of your employment, do you have theopportunity to work at home instead of going to your regular place of work?
1. Yes 23%
2. No 77% (skip to 48)
3. Refused/don't know <1% (skip to 48)

46. Approximately how many days per month do you work at home instead of at your regular place of work? ___average=4

47. Would you say you make more, fewer or about the same number of trips with your car on days that you work at home? [select one]
1 More 5%
2. Fewer 58%
3 Same 24%
4. Refused/don't know 13%

Questions 48-53 for primary mode = drive alone Q8=1

48. How possible would it be for you to carpool at least one or two days a week? Would it be . . . [read choices; select one]
1. Extremely possible 4% (skip to 50)
2. Possible 21% (skip to 50)
3 Neutral/not sure 11%
4. Impossible 45%
5. Extremely impossible 19%
6. Refused/don't know <1% (skip to 50)

APPENDIX A *commute profile 2003* questionnaire

49. Why is it difficult to carpool to work? [select a maximum of 3]

1. Takes too much time 4%
2. Desire privacy 1%
3. Need vehicle during work 11%
4. Need vehicle before/after work 5%
5. Transport children 6%
6. Safety <1%
7. Work irregular hours 20%
8. Work overtime 2%
9. Prefer to drive alone 2%
10. Can't find carpool or vanpool partners 41%
11. Never considered carpooling 1%
12. Other 8%
13. Refused/don't know <1%

50. How possible would it be for you to use transit at least one or two days a week? Would it be . . . [read choices; select one]

1. Extremely possible 4% (skip to 52)
2. Possible 19% (skip to 52)
3. Neutral/not sure 8%
4. Impossible 43%
5. Extremely impossible 25%
6. Refused/don't know 1% (skip to 52)

51. Why is it difficult to use transit to get to work? [select a maximum of 3]

1. Takes too much time 23%
2. Desire privacy 1%
3. Need vehicle during work 13%
4. Need vehicle before/after work 4%
5. Transport children 6%
6. Safety 1%
7. Work irregular hours 7%
8. Work overtime 1%
9. Transit unreliable 8%
10. Prefer to drive alone 2%
11. Cost/too expensive 1%
12. No service available on my commute 23%
13. Never considered using transit 1%
14. Don't know how to use transit 2%
15. Other 7%
16. Refused/don't know 1%

52. How possible would it be for you to bicycle all or partof the way to work at least one or two days a week? Would it be . . .[read choices; select one]

1. Extremely possible 5% (skip to 54)
2. Possible 17% (skip to 54)
3. Neutral/not sure 3%
4. Impossible 38%
5. Extremely impossible 36%
6. Refused/don't know <1% (skip to 54)

53. Why is it difficult to ride a bicycle to work? [select amaximum of 3]

1. I don't ride or own a bike 8%
2. Too far to ride 32%
3. Can't ride in work clothes 4%
4. Don't feel safe riding to work 12%
5. No safe place to park/lock my bike <1%
6. No place to change/shower at work 1%
7. Takes too much time 7%
8. Need car at work or before/after work 11%
9. Need to get in better shape first 7%
10. Never even considered it 1%
11. Other 16%
12. Refused/don't know 0%

Questions for all respondents Q1=1-9

54. How familiar are you with the phone number (800) 755-POOL? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware.

1. 67%
2. 10%
3. 10%
4. 5%
5. 9%
6. 1% Refused/don't know

55. How familiar are you with the phone number 817-1717? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware.

1. 92%
2. 3%
3. 2%
4. 1%
5. 2%
6. 1% Refused/don't know

Question 56 for Solano and Napa respondents only Q1=4 or 8

56. How familiar are you with the phone number (800)53-KMUTE ? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware.

1. 72%
2. 9%
3. 8%
4. 6%
5. 6%
6. 0% Refused/don't know

Questions 57 and 58 for Contra Costa County respondents only_ Q1=2

57. How familiar are you with the Contra Costa Commute Alternatives Network, also know as CC-can? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware?

1. 87%
2. 5%
3. 4%
4. 1%
5. 2%
6. <1% Refused/don't know

58. How familiar are you with commute incentivesavailable for people who either work or live in Contra Costa County? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware?

1. 79% (skip to 59)
2. 7% (skip to 59)
3. 7%
4. 2%
5. 6%
6. <1% Refused/don't know

58a. Can you name any of the available incentives? [selectall that apply]

1. No/don't know 54%
2. Vanpool 3%
3. Transit tickets 12%
4. Carpool (script) 15%
5. Guaranteed Ride Home 3%
6. Carpool to BART 10%
7. School Pool 0%
6. Refused 3%

Questions for all respondents Q1=1-9

59. Have you ever heard of a carpooling or vanpooling program that serves your area or the region?

1. Yes 44%
2. No 56% (skip to 60)
3. Not Sure <1% (skip to 60)

59a. Can you name it?

1. RIDES for Bay Area Commuters (RIDES) 3%
2. Solano Napa Commuter Information <1%
3. Contra Costa Commute Alternatives Network (CC-can) <1%
4. Peninsula Traffic Congestion Relief Alliance (commute.org) 0%
5. 511 <1%
6. Name of person 21%
7. Can't remember name of person 75%

60. Have you ever used the 511 phone service or visited www.511.org?

1. Yes 2% (skip to 61)
2. No 98%
3. Not Sure <1%

60a. When thinking about the kinds of travel information you get from radio, TV, or on the Internet, what is the main topic of information (e.g., traffic, transit, ridesharing, etc.) you MOST often seek?

1. Traffic 53% (skip to 65)
2. Transit 6% (skip to 65)
3. Rideshare(carpool/vanpool) 1% (skip to 65)
4. Biking <1% (skip to 65)
5. Other 10% (skip to 67)
6. None/Not Sure 31% (skip to 67)

61. Would you recommend the 511 service to other peo-pleseeking Bay Area travel information?

1. Yes 87%
2. No 6%
3. Not sure 7%

62. What do you primarily use 511 information for?

1. Traffic 71% (skip to 64)
2. Carpooling/Vanpooling 11%
3. Bicycling 0% (skip to 64)
4. Using public transit 6% (skip to 64)
5. Airport Information 0% (skip to 64)
6. Other [capture]:______ 13% (skip to 64)

63. How satisfied were you with the carpooling or vanpooling information? Use a scale of 1 to 5 with 1 being not at all satisfied and 5 being very satisfied.

1 33%
2. 0%
3. 0%
4. 33%
5. 33%
6. 0% Refused/don't know

64. How valuable or useful do you find this information?

1. Extremely valuable 29%
2. Valuable 47%
3. Neutral 14%
4. Not very valuable 0%
5. Not valuable at all 4%
6. Refused/don't know 6%

65. How often do you actively seek __[response to Q60a or Q62]_____information?

1. More than twice a day 18%
2. Once to twice a day 43%
3 Less than once a day 6%
4. Once a week 11%
5. Less than once a week 9%
6. Less than once a month 12%
7. Refused/don't know 1%

Ask Q66 only if Q60<>1

66. Regarding ____[response to Q60a]_____ information,what information are you specifically most interested in having available? [Choose up to three for one of the following four categories]

Traffic

1. Estimated driving time on your commute 7%
2. Traffic congestion map 61%
3. FasTrak info <1%
4. HOV lane maps <1%
5. Alternative route information 14%
6. Information on alternative transportation options 2%
7. Other 13%
8. Refused/don't know 2%

Transit

1. Real-time bus/train/ferry departure/arrival information 19%
2. Announcements for delays and service changes 11%
3. Trip planning services 7%
4. Schedules & route maps 41%
5. Fare info 5%
6. How to get to popular destinations 2%
7. Paratransit information 1%
8 Other 9%
9 Refused/don't know 4%

Rideshare

1 Carpooling benefits provided by your employer 4%
2. Other employer benefits, such as guaranteed ride home or reserved carpool parking 4%
3. Carpool or vanpool matching 20%
4. Casual carpooling information 28%
5. HOV lanes maps 0%
6. Park & Ride lot locations 4%

7 Other 20%
8. Refused/don't know 20%

Biking

1. Bike trip planner 27%
2 Taking bikes on transit 0%
3. Bicycle safety 9%
4. Bicycles on bridges 9%
5. Bicycling organizations 9%
6. List of Bay Area bike maps 36%
7. Bike Buddy matching 0%
8. Other 9%
9. Refused/don't know 0%

67. How familiar are you with an organization called "RIDES for Bay Area Commuters"? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware.

1. 72%
2. 13%
3. 8%
4. 3%
5. 5%
6. <1% Refused/don't know

Question 68 asked of Solano and Napa county respondents Q1=4 or 8

68. How familiar are you with an organization called "Solano Commuter Information"? Use a scale of 1 to 5 with 1 being not aware at all and 5 being very aware.

1. 73%
2. 11%
3. 9%
4. 3%
5. 4%
6. 0% Refused/don't know

Questions 69 to end for all respondents

69. Have you ever used a Call Box on the side of the road?

1. Yes 19%
2. No (skip to 70) 81%

69a. How would you rate your overall experience with the person who helped you over the phone?

1. Extremely good 47%
2. Good 36%
3. Neutral/not sure 8%
4. Bad 3%
5. Extremely bad 3%
6. Refused/don't know 3%

70. Have you ever used the Freeway Service Patrol (FSP)?

1. Yes 20%
2. No (skip to 72) 77%
3 Don't know 4%

70a. If yes, how would you rate your overall experience with the person who helped you on site?

1. Extremely good 72%
2. Good 25%
3 Neutral/not sure 2%
4. Bad 1%
5. Extremely bad 0%
6 Refused/don't know 0%

71. Do you have regular access to the Internet at homeor at work?

1. Yes 90%
2. No 10%
3. Refused/don't know <1%

72. Do you always, sometimes or never have a vehicle available for getting to work?

1 Always available 89%
2. Sometimes available 6%
3. Never available 5%
4. Refused/don't know <1%

73. How old are you? Are you . . .

1 Less than 20 1%
2. In your 20's 14%
3 30's 27%
4 40's 29%
5. 50's 22%
6. 60 or older 7%
7 Refused 1%

74. And what is your combined annual (before-tax) household income? Is it . . .

1. $20,000 or less 5%
2 $21,000 to $35,000 9%
3 $36,000 to $50,000 11%
4. $51,000 to $65,000 13%
5. $66,000 to $80,000 12%
6. $81,000 to $100,000 11%
7. Or more than $100,000 25%
8. Refused/don't know 14%

75. Gender of respondent: [Do not need to ask]

1. Male 50%
2. Female 50%

Those are all the questions I have for you. Thank you very much for participating.

APPENDIX B
demographic variables and mode

AGE, INCOME AND GENDER

Commuters above the age of 50 are more likely to drive alone and are less likely to carpool compared with younger commuters (Table 49). The sample of younger commuters (under the age of 20) is small and results have varied somewhat from year to year. Two years ago they had the highest proportion of "other" mode users, last year they were among the smallest in this category and this year they are again notably larger. The "younger than 20" group's use of carpools is also quite high this year—whereas last year it was average. Looking beyond the "younger than 20" group, the highest carpool usage is among the 30-39 and 40-49 year old groups. The 20-29 and 30-39 groups have the highest proportion of "other" mode users. The highest transit use is among 20-29 year olds.

TABLE 49
AGE AND COMMUTE MODE

	Drive Alone	Carpool	Transit	Other	Total
Younger than 20 (1% of respondents)	53%	25%	3%	19%	100%
20 to 29 (14% of respondents)	54%	18%	20%	9%	100%
30 to 39 (27% of respondents)	60%	21%	11%	8%	100%
40 to 49 (29% of respondents)	62%	21%	11%	6%	100%
50 to 59 (22% of respondents)	73%	11%	10%	5%	100%
60 or older (7% of respondents)	74%	13%	10%	4%	100%
n=3,561					
Regional Average	64%	18%	12%	7%	100%

The percentage of respondents driving alone goes up for respondents with incomes above $35,000 (Table 50). Carpool use is highest among the highest income respondents. This is not consistent with last year when carpooling rates were highest among commuters in the $21,000 to $50,000 ranges. Both transit and "other" mode use decline as income increases. This is consistent with data from last year that showed a similar pattern of lower transit and "other" mode use among higher income respondents.

TABLE 50

ANNUAL HOUSEHOLD INCOME AND COMMUTE MODE

	Drive Alone	Carpool	Transit	Other	Total
Less than $20,000 (5% of respondents)	48%	10%	25%	17%	100%
$21,000 to $35,000 (11% of respondents)	52%	20%	22%	7%	100%
$36,000 to $50,000 (13% of respondents)	62%	16%	14%	9%	100%
$51,000 to $65,000 (15% of respondents)	66%	15%	11%	8%	100%
$66,000 to $80,000 (14% of respondents)	66%	19%	9%	6%	100%
$81,000 to $100,000 (13% of respondents)	67%	19%	9%	5%	100%
More than $100,000 (30% of respondents)	66%	22%	7%	5%	100%
n=3,094					
Regional Average	64%	18%	12%	7%	100%

Female respondents are less likely to drive alone (Table 51). Only 60 percent of women drive alone while 67 percent of men do so. This is similar to last year but not as exaggerated—last year female respondents were 10 percentage points below males in their tendency to drive alone. This contradicts other data gathered in *Commute Profile* that shows male respondents more likely to indicate carpooling, transit and bicycling are possible commute options.

TABLE 51

GENDER AND COMMUTE MODE

	Drive Alone	Carpool	Transit	Other	Total
Male (50% of respondents)	67%	16%	11%	7%	100%
Female (50% of respondents)	60%	20%	13%	7%	100%
n=3,609					
Regional Average	64%	18%	12%	7%	100%

Funding for Rideshare Program services is provided by the Bay Area Air Quality Management District, the Metropolitan Transportation Commission, the Federal Highway Administration and county congestion management agencies.

On the phone. 511 On the web. 511.org On your way. 511™

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RIDES
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RIDES for Bay Area Commuters, a nonprofit organization, provides Rideshare Program services under contract to the MTC.