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SCRTD METRO RAIL PROJECT
Preliminary Engineering

EVALUATION OF OPERATING DIFFERENCES
FOR
ALTERNATIVE ALIGNMENTS

WBS 15B

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EVALUATION OF OPERATING DIFFERENCES
FOR ALTERNATIVE ALIGNMENTS

1.0 INTRODUCTION

This report was prepared by Booz, Allen & Hamilton Inc. as part of Task 15B, Evaluate Design Alternatives. The report provides information for use in comparing alternative alignments as part of the Milestone 3 community participation process.

This report evaluates the operational parameters of the four alternative alignments defined in Technical Memorandum No. 3 prepared by DMJM/PBQD and compares them with the approved alternative. The four alternatives are as follows:

Alternative A	Hill Street alignment in CBD
Alternative C	Flower Street alignment in CBD
Alternative 1	Sunset Boulevard through Hollywood
Alternative 2	North Hollywood via Fairfax and the Santa Monica Mountains.

Each of these alternatives was evaluated using the criteria defined in Technical Memorandum No. 2 prepared by DMJM/PBQD. A description of the Milestone 3 and 4 evaluation objectives, goals, and criteria is given in Appendix A. The criteria for operational analysis have been assigned to Booz Allen & Hamilton; these criteria are:

- . Daily energy requirements,
- . On-board passenger time difference,
- . Network expansion capability, and
- . Annual operating costs.

1.1 Methodology

Operating performance parameters for each alternative were developed from the preliminary operating plan prepared

for the approved alternative. Adjustments of run times, operating miles, and fleet size were based on the changes in route distance and station stops.

The variations in energy requirements among alternatives were derived from the differences in transit and auto ridership among the alternatives. These ridership differences were estimated from the patronage data furnished by Barton-Aschman Associates.(1) Additional data on CBD employment area estimates were developed by William Hoey (Memorandum from N. Tahir to J. Crawley, March 26, 1982). The analyses of ridership differences are discussed in more detail in Appendixes B and C.

The following chapters discuss the analysis methods and the evaluation results for each of the evaluation criteria. Booz, Allen was requested to analyze only a portion of the criteria used for evaluation of alternative alignments; therefore, no conclusions or recommendations are provided in this report.

2.0 DAILY ENERGY REQUIREMENTS

This category provides a quantitative assessment of the transportation energy consumption differences among the alternative alignments. For this assessment, only the energy consumption differences in British thermal units (Btu) for auto and rail were used. These were determined from auto vehicle miles traveled (VMT) and operating power consumption for the Metro Rail car VMT.

Auto VMT was estimated by distributing the difference in patronage for each alternative between auto and transit trips. The distribution was achieved by assuming that the increased transit ridership for the Metro Rail case over the Transit System Management (TSM) bus case in the Alternative Analysis/Environmental Impact Statement (AA/EIS) would return to auto travel.(2) It is implicit in this assumption that

the riders associated with the TSM case are confirmed transit users and would use bus service if rail service is not offered. The AA/EIS shows a 16.3 percent mode split for the Metro Rail case and a 12.9 percent split for the TSM bus case. These mode splits are the portion of daily trips using transit.

The change in auto ridership was determined by the relationship

$$A = R \frac{(1-12.9)}{16.3}$$

where A = the change in auto riders and R = the change in transit riders.

The change in transit ridership is derived in Appendix B for each alternative.

Auto energy was determined from the following factors, as obtained from the AA/EIS:

- . Auto occupancy, 1.2 passengers per vehicle,
- . Average trip length, 7.1 miles,
- . 7,159 Btu energy consumption per auto vehicle mile, and
- . 70,600 Btu energy consumption per rail car vehicle mile.

2.1 Results

The differences in daily energy consumption relative to the approved alignment are shown in Table 1. Alternative A has a net decrease in energy consumption because of the increased ridership and resulting auto trip reductions. Alternative A reduced auto VMT because of increased ridership associated with the Hill Street Station over the 5th and Broadway Station. Alternative C has a significant decrease in ridership as a result of the station location at Third and Flower and corresponding increase in auto travel. There

is an increase in rail energy caused by the added travel distance for the curve between 7th and Flower and Wilshire Boulevard.

Only minor differences in patronage are anticipated between the two optional alignments through Hollywood. Alternative 1 shows no significant difference in either auto energy or rail energy over the approved alternative. Alternative 2 shows the largest decrease in energy consumption. The large increase in auto-related energy consumption resulting from the loss of the Hollywood area ridership is less than the energy savings resulting from the reduced rail car vehicle miles on the shortened line through the mountains. An additional assumption is made that the auxiliary transit system of Alternative 2, either bus or rail, will not generate significantly different Metro Rail patronage than the approved alternative feeder bus system. It is further assumed that the net energy consumption of either type of feeder system is the same as the bus feeder for the approved alternative. The assumption is reasonable for this level of analysis since either bus or light rail would operate in mixed traffic, and travel times or service frequency would not differ significantly between modes.

3.0 ON-BOARD PASSENGER TIME

This category provides a quantitative assessment of the travel time comparisons between selected station pairs. Four station pairs were selected from the AA/EIS as representative of typical trip ends. This method thus matches the comparison used in the AA/EIS. Derivation of travel times is shown in Appendix C. A more detailed comparison using the aggregate of the passenger boarding travel time product for each station pair could not be made since the station-to-station patronage data were not available for each alternative.

Table 1. Daily energy requirement differences, million Btu.

Factor	Approved	Alternative			
		A	C	1	2
Auto VMT	0	-8762	+10243	200	+29,000
Auto energy, million Btu	0	-62.7	+73.3	0	+207.6
Railcar VMT	0	0	574	0	-4400
Rail energy, million Btu	0	0	+40.5	0	-309.7
Net total	0	-62.7	+113.8	0	-102.1

The Alternative 2 comparisons include a light-rail trip from Hollywood and transfer to the Metro Rail system at Fairfax.

3.1 Results

The trip end time comparisons are given in Table 2. The comparisons show insignificant differences among alternatives, with the exception of Alternative 2, as would be expected. Alternative 2 provides slightly improved trip times for the San Fernando Valley passengers (4 minutes) but significantly longer trip times for the Hollywood patrons with destinations toward the CBD because of the slow light rail travel time and transfer to the Metro Rail.

4.0 NETWORK EXPANSION CAPABILITY

This category provides a qualitative assessment of the ability of each alternative to meet the goal of expansion within the region. The evaluation criteria used for this category consider the convenience and travel time of the rider in a general and subjective sense. These criteria have been divided into two parts:

- . Do the transfer points provide a convenient transfer location that minimizes the number of people who must transfer to reach the desired destination?
- . Do the transfer points allow for a direct route to the extension corridor that minimizes trip time?

All alternatives are expandable from an engineering standpoint, and therefore the rider's view was used as the best discriminator for this category.

The alternative alignments were evaluated relative to the expansion capability in the following corridors:

- . San Fernando Valley,
- . Wilshire West,

Table 2. Comparison of transit travel time (minutes).

Alternative	Origin-Destination			
	North Hollywood to 5th/Broadway	North Hollywood to Wilshire/La Brea	Wilshire/La Brea to 5th/Broadway	Hollywood/Cahuenga to 5th/Broadway
Approved	28	17	11	20
A W/Witmer	29 [⊖]	17	12 [⊖]	21 [⊖]
W/O Witmer	28 [⊖]	17	11	20
C W/Witmer	30+	17	13+	22+
W/O Witmer	29+	17	12+	21+
1 W/Sunset/La Brea	30	20	10	22
W/O Sunset/La Brea	29	19	10	21
2 W/Sunset/Fairfax	25	14	11	37*
W/O Sunset/Fairfax	24	13	11	37*

+ Time to 3rd/Flower rather than 5th/Broadway.

⊖ Time to 5th/Hill rather than 5th/Broadway.

* Composition: 16 minutes run time LRT to Fairfax/Santa Monica, 2 minutes transfer time, 2 minutes waiting time for Metro, 17 minutes run time Metro Rail (16 minutes LRT time based on 2.4 miles at 9.0 mph).

- . Airport-South Bay,
- . Long Beach-Glendale, and
- . Santa Ana-El Monte.

4.1 Results

The results of the evaluation of the expansion capability of each alternative by corridor are shown in Table 3.

Alternative A affords the same opportunities for extension of the north-south Long Beach corridor as the approved alternative. Transfers would occur at the Fifth and Hill and Civic Center stations.

Alternative C is judged to be less attractive since only a single transfer point is provided at the Civic Center. In this alternative, rides originating in the south corridor and transferring at the Civic Center station will double back to the south to reach the employment center along Flower Street. This doubling back will increase the trip time for the south corridor riders over the approved alternative.

Alternative 1 provides the same expansion capability as the approved alternative. This alternative does not alter the terminal ends or transfer points from the approved alternative.

Alternative 2 was judged to provide a slight improvement in trip time for some riders traveling to the Airport and South Bay expansion corridor. This improved trip time would be available to San Fernando Valley riders traveling south. Similarly, shortened trip times would be available to San Fernando Valley riders transferring to a western extension along Wilshire at the Wilshire/Fairfax station.

Table 3. Evaluation of expansion capability.

Expansion Capability	Approved	Alternative			
		A	C	1	2
San Fernando Valley	0	0	0	0	0
Wilshire and West	0	0	0	0	0
Airport, South Bay	0	0	0	0	0
Long Beach, Glendale	0	0	-	0	0
Santa Ana, El Monte	0	0	0	0	+

Key:

- Worse
- 0 About equal
- + Better

5.0 OPERATING COSTS

Rail car miles have been selected as the parameter that relates most directly to differences in operating costs among alternatives. Differences in patronage affect operating costs in such areas as changes in station equipment maintenance and fare collection costs. Similarly, the addition or deletion of a station affects overall operating cost, but to a smaller degree than the effects of the operating plan on car miles. Since the analysis shows small differences in car miles among alternatives, only those costs directly related to mileage were then selected as a sensitive measure of operating cost differences.

The following car-miles-related cost elements were extracted from the AA/EIS. These mileage-related maintenance costs reflect a combination of manpower and materials:

Track maintenance	\$ 0.155/VMT
Electrification maintenance	0.074
Vehicle maintenance	0.5
Power	0.27
	<hr/>
	\$ 0.999 or \$1.00/car mile

5.1 Results

These costs were applied to the annual car mile difference for each alternative as shown in Table 4.

6.0 SUMMARY OF DIFFERENCES IN OPERATING CHARACTERISTICS

The operating differences selected as criteria for comparing the alternative alignments are shown in Table 5. No attempt is made in this report to develop a conclusion or recommendation of a preferred alternative. Any conclusions must include other factors that were analyzed by others in the preparation of the milestone data.

Table 4. Operating cost comparison.

Alternate	Annual Miles (000)	Mileage Difference	Annual Cost Difference(\$)	Daily Cost Difference(\$)
Approved	10884	--	--	--
A	10884	0	0	0
C	11059	+175,000	175,000	574
1	10884	0	0	0
2	9546	-1,338,000	-1,338,000	4,400

Table 5. Summary of differences in operating characteristics.

Factor	Alternative			
	A	C	1	2
Ridership change	+7,100	-8,300	+200	-23,500
Daily auto VMT	-8,762	+10,243	0	+29,000
Daily rail car VMT	0	+574	0	-4,400
Energy, auto, million Btu	-62.7	+73.3	0	+207.6
Energy, rail, million Btu	0	+40.5	0	-309.7
Net energy, operating cost, million Btu	0	+574	0	-4,400

REFERENCES

- (1) Barton-Aschman Associates, Patronage Impact of Possible Future Line Extensions, Phase II, for SCRTD Metro Rail Project, March 1982.
- (2) U.S. Department of Transportation, Urban Mass Transportation Administration, Alternatives Analysis/Environmental Impact Statement/Report on Transit System Improvements in the Los Angeles Regional Core, April 1980.

APPENDIX A
ALTERNATIVE ANALYSIS CRITERIA

This appendix provides a description of all of the criteria used to evaluate the alternative alignment and station locations. These criteria are organized under goals and objectives derived from various Federal, state, regional, and local goals. The information in this appendix was obtained from DMJM/PBQD Technical Memorandum No. 2, Alternatives Evaluation Methodology and Criteria, March 1982. The material is included to provide a more complete understanding of the evaluation process used for alternative alignments and stations.

The goals as defined here are general statements of what is to be accomplished, while objectives are more specific expressions of those desires. Criteria are indicators or measures of how well a possible alternative does or does not help achieve the desired goals and objectives.

Included in the listing of the preliminary engineering phase goals and objectives is an indication of the kind of measure or measures to be used (quantitatively where possible, qualitatively where this is necessary or more appropriate), and the agency or firm representative who will be responsible for assembling the needed data, directing related analytical efforts, and making the assessment of goal achievement attained by each alternative relative to the approved alignment and station locations.

ENVIRONMENTAL/COMMUNITY GOALS, OBJECTIVES, AND MEASURES

1. Goal: Conservation of Natural and Cultural Resources

1.1 Objective: Reduce air pollution

1.1.1 Measure: Difference in daily vehicle miles of travel by automobile

1.1.2 Measure: Difference in air quality improvement; i.e., tons per day of RHC, NOX, and CO

1.2 Objective: Reduce petroleum requirements; conserve energy

1.2.1 Measure: Difference in daily automobile trips

1.2.2 Measure: Difference in annual energy requirements—equivalent Btu

1.3 Objective: Minimize impacts to historical sites and parklands (Sec. 106 and 4.f)

1.3.1 Measure: Number of sites and/or acres of parkland impacted

2. Goal: Enhance Regional Land Use and Urban Form

2.1 Objective: Help structure urban form in desirable directions

2.1.1 Measure: Qualitative assessment of relative compatibility with existing land use development plans

2.1.2 Measure: Qualitative assessment of potential for revitalization of existing urban areas

2.1.3 Measure: Estimated joint development potential, using either dollar value as in the final AA/EIS or qualitative discussion

2.1.4 Measure: Estimate if right-of-way availability for station enhances shafts, etc.; impacts on surrounding land use; cost

3. Goal: Enhance Regional Mobility and Ability to Meet Transportation Needs of Today and the Future by Public Transportation

3.1 Objective: Reduce travel time and cost

3.1.1 Measure: Difference in travel time for on-board passengers per marginal passenger, minutes/passenger

3.1.2 Measure: Difference in potential for attracting choice riders, total daily trips diverted or a qualitative assessment

3.2 Objective: Improve the total regional transit system

3.2.1 Measure: Difference in daily patronage on rail line alone and, if possible, on rail and background bus service

3.2.2 Measure: Difference in system considerations, i.e., compatibility and ease of coordination with bus, pedestrian, and automobile links, qualitative assessment

3.2.3 Measure: Assessment of difference in capability to expand rail service, network considerations

4. Goal: Reduce the Need for Parking and Highway-Related Investments

4.1 Objective: Encourage use of public transportation instead of automobiles

4.1.1 Measure: Difference in percent increase in traffic flow to the regional core

4.1.2 Measure: See Measures 1.1.1, 1.2.1, and 3.1.2

5. Goal: Develop Rapid Transit Responsive to Community Needs

5.1 Objective: Reflect public participation input in systems design

5.1.1 Measure: Assessment of degree of support from the general public, elected officials, and public agencies

5.2 Objective: Help meet identified social goals

5.2.1 Measure: Assessment of difference in service provided to transit-dependent groups

5.2.2 Measure: Difference in accessibility to employment centers, community services

5.3 Objectives: Minimize community disruption

5.3.1 Measure: Assessment of construction noise and other impacts on circulation patterns, access to homes and/or jobs, utilities, geologic conditions, etc.

5.3.2 Measure: Number of homes, businesses, jobs, and other displacements, if any

COST AND COST EFFECTIVENESS GOALS, OBJECTIVES, AND MEASURES

6. Goal: Develop Financially Feasible Transportation Systems

6.1 Objective: Minimize capital cost requirements

6.1.1 Measure: Difference in estimated total capital costs

6.2 Objective: Reduce the impact of inflation on costs

6.2.1 Measure: Difference in construction/implementation schedule

6.3 Objective: Minimize operating cost requirements

6.3.1 Measure: Difference in estimated annual operating costs

6.4 Objective: Minimize the need for public financial support

6.4.1 Measure: Assessment of potential cost-sharing opportunities; also see Measure 2.1.3

7. Goal: Improve Public Transportation in a Cost-Effective Manner

7.1 Objective: Maximize return from capital investment

7.1.1 Measure: Annualized difference in capital cost requirements per marginal passenger and per marginal passenger mile

- 7.2 Objective: Maximize return from operating expenditures
- 7.2.1 Measure: Marginal operating cost per marginal passenger and per marginal passenger mile
- 7.3 Objective: Maximize return from combined capital and operating expenditures
- 7.3.1 Measure: Total annualized difference in capital cost and marginal operating cost per marginal passenger and per marginal passenger mile

It is not necessary to carry out additional time-consuming computerized patronage model runs or apply complex analytical techniques to establish assessment values for the quantitative measures outlined above. Simple manual computations and/or judgmental modifications to the results of prior work will be sufficient to provide the data needed to make relative comparisons among the options under consideration.

Where qualitative evaluations are indicated, these will be made by experienced personnel drawing upon past experiences with similar evaluations in Los Angeles and elsewhere.

In carrying out the assessment of alternatives, it may be found that, for example, the expected differences among them for a particular measure are expected to be so small that the measure does not furnish a useful guide to decision-

making. In such cases, the measure should be disregarded as not being applicable and the explanation for its not being utilized should be documented.

APPENDIX B
RIDERSHIP ESTIMATES FOR ALTERNATIVE ALIGNMENTS

The impact of the 1995 patronage of alternative alignments and station locations has been estimated. The following alternatives have been examined:

- . Downtown alignments
 - Hill Street (Alternative A)
 - Flower Street (Alternative C)
- . Optional station at Witmer/Wilshire (Alternatives A and C)
- . Sunset Boulevard alignment with a station at Sunset/LaBrea (Alternative 1)
- . Direct route to Studio City (Alternative 2)
 - No station at Sunset/Fairfax
 - Station at Sunset/Fairfax

SUMMARY OF CONCLUSIONS

The following conclusions are drawn from the ridership analyses.

- . Downtown Alignments
 - Alternative A (Hill Street) will generate 7,100 more trips than the approved alignment because the location of a station at 5th/Hill would be convenient to more riders than the 5th/Broadway station that is part of the approved alignment.
 - Alternative C (Flower Street) will generate 8,300 fewer trips because of the lower number of jobs served by the smaller population of workers served by the location of the station at 3rd/Flower instead of at 5th/Broadway.
- . Witmer/Wilshire Station
 - Although the addition of a station at Witmer/Wilshire would affect ridership volumes at the stations on either side (i.e., 7th/Flower and Wilshire/Alvarado), it would not appreciably affect overall ridership.

- . Sunset Boulevard Alignment with a Sunset/La Brea station
 - The addition of a station at Sunset/La Brea will not appreciably affect total ridership volumes, according to Barton-Aschman Associates projections.
- . Direct Route to Studio City
 - Bypassing the Cahuenga and the Hollywood Bowl stations would result in a net decrease of 23,500 daily trips, with or without an auxiliary rail system.
 - The addition of a station at Sunset/Fairfax along the direct Studio City route would not significantly affect total ridership volumes, according to estimates by Barton-Aschman Associates.

The effects of these alternatives on projected daily ridership for 1995 are summarized in Table B-1.

Analysis of Downtown Alignment

Ridership analysis for the Hill Street and Flower Street alignments used the following data:

- . Projected 1990 catchment employment (PMM 1980) from memorandum, March 25, Hoey to Tahir (transmitted to Crawley March 26 as attachment to "Input to Milestone 3 Report").
- . Mode of arrival estimates for downtown stations, from the AA/EIS Technical Appendix E.

Employment Catchment Area. Hoey focused on the midtown station in the area of 5th/Broadway and did not address the alternative uptown locations near the Civic Center. Based on the proximity of the Civic Center alternatives to each other (either 1st/Broadway or 1st/Hill), it was assumed that ridership would remain unchanged from the approved alignment regardless of where the uptown station would be located.

Table B-1. Total daily ridership,
by alternative.

Alternative	Daily Ridership (1995)*
Approved	309,000
A	312,600
C	304,900
1	309,200
2	285,500

* Elimination of optional stations will not significantly affect these estimates.

Mode of Arrival. Hoey reported the projected 1990 catchment employment for 9 midtown stations as follows:

<u>Alternative</u>	<u>Station Location</u>	<u>1990 Catchment Employment</u>
Approved	Fifth/Broadway	38,500
A	Fifth/Hill	51,300
C	Third/Flower	29,600

Hoey also sketched the catchment area for the stations on each downtown alignment. Overlap of catchment areas was estimated on the basis of Hoey's map and is summarized in Table B-2. In some cases, none of the ridership attracted to one station (e.g., Union Station) would be diverted to another station (e.g., 1st/Broadway or 1st/Hill). In other cases, ridership would be attracted to another station under the approved alternative (e.g., approximately 5 percent of the riders boarding at 1st/Broadway would elect to board at 5th/Broadway if there was a station there).

Analysis of Ridership. For the midtown station, the AA/EIS estimated that half of the boarding riders would arrive by walking; the remainder would transfer from buses, park 'n' ride, or kiss 'n' ride. This analysis has assumed that only those walking would be affected by station location.

Midtown ridership estimates were based on ridership estimates under the approved alternative, adjusted for mode of arrival, catchment employment, and catchment area overlap:

$$\begin{matrix} \text{Non-walk-in} & & \text{Walk-in} & & \text{Catchment} & & \\ \text{Ridership} & & \text{Ridership} & & \text{Employment} & & \\ \text{(Approved} & + & \text{(Approved} & \times & \text{Ratio of} & \times & \text{Overlap} \\ \text{Alt.)} & & \text{Alt.)} & & \text{Alternatives} & & \text{Adjustment} \end{matrix}$$

For Alternative A:

$$(35,909/2) + (35,909/2) \times (51,334/38,545) \times (90 \text{ percent}) = 39,475$$

For Alternative C:

$$(35,909/2) + (35,909/2) \times (29,635/38,545) \times (100 \text{ percent}) = 31,759$$

Table B-2. Catchment area overlap.

Alternative	Between	Overlap (percent)
Approved	Union Station	0
	1st/Broadway	5
	5th/Broadway	0
	7th/Flower	0
A	Union Station	0
	1st/Hill	5
	5th/Hill	10
	7th/Flower	10
C	Union Station	0
	1st/Broadway	5
	3rd/Flower	5
	7th/Flower	5

The impact of the alternative downtown station locations on total daily ridership will be double the number of boardings, since both boardings and alightings will be affected.

Analysis of Witmer/Wilshire Station Ridership

In lieu of any information dealing specifically with an optional station at Witmer/Wilshire, an analysis was made of the impact of other optional stations on projected ridership. To date, Barton-Aschman Associates has examined the impact on ridership of a Wilshire/Crenshaw Station, a Sunset/La Brea Station, and a Fairfax/Sunset Station. (1) As shown in Table B-3, the effect on total ridership would be insignificant, varying between 0.02 percent and 0.05 percent. Assuming that a Witmer/Wilshire station would affect total ridership by the same order of magnitude, it is judged that there would be no appreciable increase. An analysis of its impact on ridership activity at adjacent stations was not undertaken, although it is evident that a diversion of some trips from these stations to Witmer would occur.

Analysis of Ridership for Sunset Boulevard Alignment

Ridership would not be affected by a shift of the Hollywood alignment from Fountain to Sunset, unless a station would be established at Sunset/La Brea. As shown in the previous section, Barton-Aschman Associates has projected an insignificant impact in ridership if this station is constructed: a 0.03 percent increase of 157 trips from 309,065 to 309,222.

Patronage estimates at Sunset/La Brea and Fairfax/Sunset assumed that a station at Wilshire/Crenshaw would exist. If this were not the case, daily ridership would increase even less, to 309,173, for an alignment including a Sunset/La Brea Station.

Table B-3. Station location impact
on daily ridership
(1995 ridership levels).

Station	With Station	Without Station	Percent
Wilshire/Crenshaw	309,065	309,016	0.02
Sunset/La Brea	309,222	309,065	0.05
Fairfax/Sunset	285,611	285,536	0.03

Analysis of Ridership With a Direct Route to Studio City

Barton-Aschman Associates has estimated that daily ridership for a route that bypasses downtown Hollywood would decrease by approximately 23,500 trips. The impact of an optional station at Fairfax/Sunset has also been examined for the bypass route. With a Fairfax/Sunset station, ridership would decrease from 309,065 to 285,611. Without the station, ridership would decrease slightly more to 285,536.

If the daily ridership figures are adjusted for elimination of the Wilshire/Crenshaw station, estimated patronage falls to 285,566 with the Fairfax/Sunset station and 285,491 without it.

An analysis by Hoey (Memorandum, March 25, Hoey to Tahir) indicates that, as currently planned, an auxiliary rail line feeding the Metro Rail system at Fairfax/Santa Monica will have an average speed that is not appreciably different from existing bus service in the same corridor. It is, therefore, estimated that the auxiliary rail line would not significantly affect the above ridership projections.

APPENDIX C
TRAVEL TIMES AND OPERATING PARAMETERS

The following tables give the results of analysis of travel time, fleet size, and operating statistics undertaken for the five alternative alignments identified for Milestone 3. The five alignments described by DMJM/PBQD in their Technical Memorandum No. 3 (March 8, 1982) are as follows:

Alternative A	CBD via Hill
Alternative B	CBD via Flower
Alternative C	CBD via Convention Center
Alternative 1	Hollywood via Sunset
Alternative 2	Studio City via direct mountain route.

Each alternative was analyzed both with and without the inclusion of certain stations identified as optional.

TRAVEL TIME

The travel time information (Tables C-1 through C-7) is a formal transmittal of data provided to Joel Sandberg on March 12, 1982. The documentation includes station-to-station run times, terminal-to-terminal travel times, and complete travel time matrices (each matrix assuming the optional station is operational).

To generate the run times, a modified BART performance curve was utilized, similar to that used for the preliminary operating plan and energy management report. A 30-second average dwell time was assumed for each intermediate station.

Fleet Size and Operating Statistics

Fleet size and operating statistics (Table C-8) were derived to reflect changes in run times and route miles from the baseline described in the 1995 operating plan. The calculation assumes that service levels (number of train trips and car trips) will remain unchanged in each case. This assumption can be reviewed once the ridership estimates are available.

Table C-1. Station-to-station run times
(dwell times not included).

Alternative	Station	Run Time (sec)	Run Time (sec)
A	Wilshire/Alvarado	54	89 Skip Witmer
	Witmer	65	
	7th/Flower	56	
	5th/Hill	56	
	1st/Hill	82	
	Union Station		
B	Wilshire/Alvarado	70	126 Skip Union/9th
	Union/9th	77	
	Convention Center	83	
	7th/Flower	48	
	3rd/Flower	74	
	1st/Broadway	94	
	Union Station		

Table C-1, continued

Alternative	Station	Run Time (sec)	Run Time (sec)
C	Wilshire/Alvarado	64	124 Skip Witmer
	Witmer	90	
	7th/Flower	48	
	3rd/Flower	74	
	1st/Broadway	94	
	Union Station		
1	Hollywood/Cahuenga	133	186 Skip La Brea
	Sunset/La Brea	127	
	Fairfax/Santa Monica		
2	Studio City	192	217 Skip Sunset
	Fairfax/Sunset	55	
	Fairfax/Santa Monica		

Table C-2. Travel times for alternatives.

Station	Time	
	Without Optional	With Optional
Alternative A		
North Hollywood	dp 0:00	dp 0:00
Studio City	0:03	0:03
Hollywood Bowl	0:06½	0:06½
Cahuenga/Hollywood	0:08	0:08
Fairfax/Santa Monica	0:11½	0:11½
Fairfax/Beverly	0:13½	0:13½
Wilshire/Fairfax	0:16	0:16
Wilshire/La Brea	0:17½	0:17½
Wilshire/Western	0:20½	0:20½
Wilshire/Normandie	0:22	0:22
Wilshire/Vermont	0:23	0:23
Wilshire/Alvarado	0:25	0:25
Wilshire/Witmer (optional)	--	0:26½
7th/Flower	0:27	0:28
5th/Hill	0:28½	0:29½
1st/Hill	0:30	0:31
Union Station	ar 0:31½	ar 0:32½
Alternative B		
North Hollywood	dp 0:00	dp 0:00
Studio City	0:03	0:03
Hollywood Bowl	0:06½	0:06½
Cahuenga/Hollywood	0:08	0:08
Fairfax/Santa Monica.	0:11½	0:11½
Fairfax/Beverly	0:13½	0:13½
Wilshire/Fairfax	0:16	0:16
Wilshire/La Brea	0:17½	0:17½
Wilshire/Western	0:20½	0:20½
Wilshire/Normandie	0:22	0:22
Wilshire/Vermont	0:23	0:23
Wilshire/Alvarado	0:25	0:25
9th/Union (optional)	--	0:27
Convention Center	0:28	0:28½
7th/Flower	0:30	0:30½
3rd/Flower	0:31	0:32
1st/Broadway	0:32½	0:33½
Union Station	ar 0:34½	ar 0:35

Table C-2, continued

Station	Time	
	Without Optional	With Optional
Alternative C		
North Hollywood	dp 0:00	dp 0:00
Studio City	0:03	0:03
Hollywood Bowl	0:06½	0:06½
Cahuenga/Hollywood	0:08	0:08
Fairfax/Santa Monica	0:11½	0:11½
Fairfax/Beverly	0:13½	0:13½
Wilshire/Fairfax	0:16	0:16
Wilshire/La Brea	0:17½	0:17½
Wilshire/Western	0:20½	0:20½
Wilshire/Normandie	0:22	0:22
Wilshire/Vermont	0:23	0:23
Wilshire/Alvarado	0:25	0:25
Witmer (optional)	--	0:26½
7th/Flower	0:27½	0:28½
3rd/Flower	0:29	0:30
1st/Broadway	0:31	0:32
Union Station	ar 0:32½	ar 0:33½
Alternative 1		
North Hollywood	dp 0:00	dp 0:00
Studio City	0:03	0:03
Hollywood Bowl	0:06½	0:06½
Cahuenga/Hollywood	0:08	0:08
Sunset/La Brea (optional)	--	0:11
Fairfax/Santa Monica	0:12	0:13½
Fairfax/Beverly	0:13½	0:15½
Wilshire/Fairfax	0:16	0:18
Wilshire/La Brea	0:18	0:20
Wilshire/Western	0:21	0:22½
Wilshire/Normandie	0:22	0:24
Wilshire/Vermont	0:23½	0:25½
Wilshire/Alvarado	0:25½	0:27
7th/Flower	0:27½	0:29
5th/Broadway	0:29	0:30½
Civic Center	0:30½	0:32
Union Station	ar 0:31½	ar 0:33½

Table C-2, continued

Station	Time	
	Without Optional	With Optional
Alternative 2		
North Hollywood	dp 0:00	dp 0:00
Studio City	0:03	0:03
Fairfax/Sunset (optional)	--	0:07
Fairfax/Santa Monica	0:07½	0:08½
Fairfax/Beverly	0:09	0:10
Wilshire/Fairfax	0:11½	0:12½
Wilshire/La Brea	0:13½	0:14½
Wilshire/Western	0:16	0:17
Wilshire/Normandie	0:17½	0:18½
Wilshire/Vermont	0:19	0:20
Wilshire/Alvarado	0:21	0:22
7th/Flower	0:23	0:24
5th/Broadway	0:24½	0:25½
Civic Center	0:26	0:27
Union Station	ar 0:27	ar 0:28

Table C-3. Travel time matrix (minutes), Alternative A, Witmer station operational.

Station	Union Station	1st/Hill	5th/Hill	7th/Flower	Witmer	Alvarado	Vermont	Normandie	Western	La Brea	Wilshire/Fairfax	Beverly	Santa Monica	Cahuenga	Hollywood Bowl	Studio City	North Hollywood
North Hollywood	32	31	29	28	26	25	23	22	20	17	16	13	11	8	6	3	-
Studio City	29	28	26	25	23	22	20	19	17	14	13	10	8	5	3	-	
Hollywood Bowl	26	25	23	22	20	19	17	16	14	11	10	7	5	2	-		
Cahuenga/Hollywood	24	23	21	20	18	17	15	14	12	9	8	5	3	-			
Fairfax/Santa Monica	21	20	18	17	15	14	12	11	9	7	4	3	-				
Fairfax/Beverly	19	18	16	15	13	12	10	9	7	4	3	-					
Wilshire/Fairfax	16	15	13	12	10	9	7	6	4	1	-						
Wilshire/La Brea	15	14	12	11	9	8	6	5	3	-							
Wilshire/Western	12	11	9	8	6	5	3	2	-								
Wilshire/Normandie	10	9	7	6	4	3	1	-									
Wilshire/Vermont	9	8	6	5	3	2	-										
Wilshire/Alvarado	7	6	4	3	1	-											
Wilshire/Witmer	6	5	3	2	-												
7th/Flower	4	3	1	-													
5th/Hill	3	2	-														
1st/Hill	1	-															
Union Station																	

Table C-4. Travel time matrix (minutes), Alternative B, 9th/Union station operational.

Station	Union Station	1st/Broadway	3rd/Flower	7th/Flower	Convention Center	9th/Union	Alvarado	Vermont	Normandie	Western	La Brea	Wilshire/Fairfax	Beverly	Santa Monica	Cahuenga	Hollywood Bowl	Studio City	North Hollywood
North Hollywood	35	33	32	30	28	27	25	23	22	20	17	16	13	11	8	6	3	-
Studio City	32	30	29	27	25	24	22	20	19	17	14	13	10	8	5	3	-	-
Hollywood Bowl	29	27	26	24	22	21	19	17	16	14	1	10	7	5	2	-	-	-
Cahuenga/Hollywood	27	25	24	22	20	19	17	15	14	12	9	8	5	3	-	-	-	-
Fairfax/Santa Monica	24	22	21	19	17	16	14	12	11	9	6	5	2	-	-	-	-	-
Fairfax/Beverly	22	20	19	17	15	14	12	10	9	7	4	3	-	-	-	-	-	-
Wilshire/Fairfax	19	17	16	14	12	11	9	7	6	4	1	-	-	-	-	-	-	-
Wilshire/La Brea	18	16	15	13	1	10	8	6	5	3	-	-	-	-	-	-	-	-
Wilshire/Western	15	13	12	10	8	7	5	3	2	-	-	-	-	-	-	-	-	-
Wilshire/Normandie	13	11	10	8	6	5	3	1	-	-	-	-	-	-	-	-	-	-
Wilshire/Vermont	12	10	9	7	5	4	2	-	-	-	-	-	-	-	-	-	-	-
Wilshire/Alvarado	10	8	7	5	3	2	-	-	-	-	-	-	-	-	-	-	-	-
9th/Union	8	6	5	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-
Convention Center	7	5	4	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-
7th/Flower	5	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
3rd/Flower	3	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
1st/Broadway	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Union Station	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

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Table C-5. Travel time matrix (minutes), Alternative C, Witmer station operational.

Station	Union Station	1st/Broadway	3rd/Flower	7th/Flower	Witmer	Alvarado	Vermont	Normandie	Western	La Brea	Wilshire/Fairfax	Beverly	Santa Monica	Cahuenga	Hollywood Bowl	Studio City	North Hollywood
North Hollywood	33	32	30	28	26	25	23	22	20	17	16	13	11	8	6	3	-
Studio City	30	29	27	25	23	22	20	19	17	14	13	10	8	5	3	-	
Hollywood Bowl	27	26	24	22	20	19	17	16	14	11	10	7	5	2	-		
Cahuenga/Hollywood	25	24	22	20	18	17	15	14	12	9	8	5	3	-			
Fairfax/Santa Monica	22	21	19	17	15	14	12	11	9	6	5	2	-				
Fairfax/Beverly	20	19	17	15	13	12	10	9	7	4	3	-					
Wilshire/Fairfax	17	16	14	12	10	9	7	6	4	1	-						
Wilshire/La Brea	16	15	13	11	9	8	6	5	3	-							
Wilshire/Western	13	12	10	8	6	5	3	2	-								
Wilshire/Normandie	11	10	8	6	4	3	1	-									
Wilshire/Vermont	10	9	7	5	3	2	-										
Wilshire/Alvarado	8	7	5	3	1	-											
Witmer	7	6	4	2	-												
7th/Flower	5	4	2	-													
3rd/Flower	3	2	-														
1st/Broadway	1	-															
Union Station	-																

Table C-6. Travel time matrix (minutes), Alternative 1, Sunset/La Brea station operational.

Station	Union Station	Civic Center	5th/Broadway	7th/Flower	Alvarado	Vermont	Normandie	Western	La Brea	Wilshire/Fairfax	Beverly	Santa Monica	La Brea	Cahuenga	Hollywood Bowl	Studio City	North Hollywood
North Hollywood	33	32	30	29	27	25	24	22	20	18	15	13	11	8	6	3	-
Studio City	30	29	27	26	24	22	21	19	17	15	12	10	8	5	3	-	
Hollywood Bowl	27	26	24	23	21	19	18	16	14	12	9	7	5	2	-		
Cahuenga/Hollywood	25	24	22	21	19	17	16	14	12	10	7	5	3	-			
Sunset/La Brea	22	21	19	18	16	14	13	11	9	7	4	2	-				
Fairfax/Santa Monica	20	19	17	16	14	12	11	9	7	5	2	-					
Fairfax/Beverly	18	17	15	14	12	10	9	7	5	3	-						
Wilshire/Fairfax	15	14	12	11	9	7	6	4	2	-							
Wilshire/La Brea	13	12	10	8	7	5	4	2	-								
Wilshire/Western	11	10	8	6	5	3	2	-									
Wilshire/Normandie	9	8	6	4	3	1	-										
Wilshire/Vermont	8	7	5	3	2	-											
Wilshire/Alvarado	6	5	3	1	-												
7th/Flower	5	4	2	-													
5th/Broadway	3	2	-														
Civic Center	1	-															
Union Station	-																

Table C-7. Travel time matrix (minutes), Alternative 2, Fairfax/Sunset station operational.

Station	Union Station	Civic Center	5th/Broadway	7th/Flower	Alvarado	Vermont	Normandie	Western	La Brea	Wilshire/Fairfax	Beverly	Santa Monica	Sunset	Studio City	North Hollywood
North Hollywood	28	27	25	24	22	20	18	17	14	12	10	8	7	3	-
Studio City	25	24	22	21	19	17	15	14	11	9	7	5	4	-	-
Fairfax/Sunset	21	20	18	17	15	13	11	10	7	5	3	1	-	-	-
Fairfax/Santa Monica	20	19	17	16	14	12	10	9	6	4	2	-	-	-	-
Fairfax/Beverly	18	17	15	14	12	10	8	7	4	2	-	-	-	-	-
Wilshire/Fairfax	16	15	13	12	10	8	6	5	2	-	-	-	-	-	-
Wilshire/La Brea	14	13	11	10	8	6	4	3	-	-	-	-	-	-	-
Wilshire/Western	11	10	8	7	5	3	1	-	-	-	-	-	-	-	-
Wilshire/Normandie	10	9	7	6	4	2	-	-	-	-	-	-	-	-	-
Wilshire/Vermont	8	7	5	4	2	-	-	-	-	-	-	-	-	-	-
Wilshire/Alvarado	6	5	3	2	-	-	-	-	-	-	-	-	-	-	-
7th/Flower	4	3	1	-	-	-	-	-	-	-	-	-	-	-	-
5th/Broadway	3	2	-	-	-	-	-	-	-	-	-	-	-	-	-
Civic Center	1	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Union Station	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table C-8. Fleet size and operating statistics for alternative alignments.

Alternative	Travel Time (minutes)	Route Miles (miles)	Change From Baseline		Fleet Size	Annual Statistics		
			(minutes)	(miles)		Train Hours (000)	Car Hours (000)	Car Miles (000)
Approved alignment	31½	18.7	-	-		59.8	331	10,884
A Without Witmer station	31½	18.7	0	0	140	59.8	331	10,884
With Witmer station	32½	18.7	+1	0	140	61.6	341	10,884
B Without 9th/Union station	34½	19.6	+3	+0.9	148	65.1	360	11,408
With 9th/Union station	35	19.6	+3½	+0.9	148	66.0	365	11,408
C Without Witmer station	32½	19.0	+1	+0.3	140	61.6	341	11,059
With Witmer station	33½	19.0	+2	+0.3	148	63.3	350	11,059
1 Without Sunset/La Brea station	31½	18.7	0	0	140	59.8	331	10,884
With Sunset/La Brea station	33½	18.7	+2	0	148	63.3	350	10,884
2 Without Fairfax/Santa Monica station	27	16.4	-4½	-2.3	120	51.9	287	9,546
With Fairfax/Santa Monica station	28	16.4	-5½	-2.3	120	50.2	278	9,546

Note: Number of trains and number of car trips held constant in each case to 52,633 and 290,950, respectively, annually per direction.