Appendix X

Cost of Alternatives Technical Memorandum

Metro

TECHNICAL MEMORANDUM

Cost of Alternatives

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This Cost of Alternatives Memorandum will provide an overview of the approach used to estimate the cost of each alternative being considered in the Alternatives Analysis. It will also summarize the methodology used for ranking each alternative's performance in relation to cost criteria in the evaluation matrix.

Cost Estimate Development

Project Cost
The methodology used in developing the conceptual cost estimates is in conformance with Caltrans guidelines for estimating capital costs for freeway, highway/arterial, and TSM/TDM alternatives. Transit alternatives used information from the Federal Transit Authorities (FTA) Standardized Cost Categories (SCC) to develop costs. The transit cost categories were incorporated into the Caltrans standard template. This combined template was used for all Alternatives.

Cost data and quantity take-offs for each alternative have been developed as a design team collaborative effort. Unit costs have been developed using Caltrans Cost Database and most recent Metro transit projects costs. These reflect the current bidding climate and bids, and our recent experience on similar projects. Ancillary costs were estimated as a percentage of the major items of work using engineering judgment and Caltrans standard guidelines. Due to the high level conceptual approach of the Alternatives Analysis (AA) cost estimate, summary costs were rounded typically to the nearest million dollars.

General Approach
Each alternative's conceptual design serves as the basis for the quantity take offs and is used to identify the various infrastructure elements needed to be included in the cost estimate. Cost items not shown on the conceptual plans or items estimated by a percentage, such as tunnel systems, have been identified and estimated based on our experience and using historical data.

Cost Estimating Assumptions
The basic assumptions and criteria used to develop the cost data were as follows:

- Estimates have been prepared using 2012 dollars

- Contingency amount is 35% for all items except for ROW which is 25%

- Right of Way (ROW) acquisition costs are inclusive of full and partial acquisitions. ROW costs such as temporary construction easements, railroad easements, relocation assistance, clearance and demolition of residential and commercial properties and fees associated with title, escrow and appraisals are also included.

Adequacy of Cost Estimates
At the AA stage, the cost estimates are rounded to the nearest million dollars which is reasonable based on the conceptual engineering level of the project design.

Future phases of work will require a more comprehensive estimating approach along with a complete development and re-assessment of project risks.

Risk Assessment
Any risk involved in estimating is accounted for in the contingency cost.

Cost Efficiency

One of the objectives identified for the SR 710 Study is to optimize the cost-efficiency of public investments. This objective was evaluated through three performance measures: 1) Constructionand ROW costs, 2) Available funding, and 3) Technical feasibility.

Descriptions of Performance Measures

Each of the three performance measures related to cost efficiency was developed to address the financial feasibility of the alternative. The performance measures are described in the following sections.

Construction and Right-of-way Costs
The total cost consisting of construction cost and right-of-way cost were used as the basis for this performance measure. The conceptual engineering plans for each alternative served as the basis to identify the quantities of various construction elements required such as roadway, guideway, structures, and earthwork. To account for additions and minor items, 25 percent of the roadway costs have been added for each, and a contingency of 35 percent has been added to account for unknown costs.

Right-of-way costs include potential residential and commercial acquisitions, railroad easements, temporary construction easements, relocation assistance, clearance and demolition of residential and commercial properties and fees associated with title, escrow, and appraisals. Right-of-way costs assume full property acquisitions if a property is impacted in any way other than a subsurface easement, and therefore are are conservative. A contingency of 25 percent has been added to right-of-way costs to account for unknown costs.

Construction and right-of-way costs were summed. Because of the uncertainty inherent in costs estimates at this stage of project development, each alternative was assigned a score from 1 to 7 using the scale shown in Table 5-1.

Table 5-1: Cost Performance Scale

Score	Cost Range
1	Over $6B
2	$4.25B - $6B
3	$2.25B - $4.25B
4	$1.25B - $2.25B
5	$250M - $1.25B
6	$10M - $250M
7	Less than $10M

Available Funding

This performance measure compared the total cost of an alternative to the funding expected to be available to construct the improvements. Because of the variety of transportation modes represented in the alternatives, different funding sources could be expected to be available for each alternative. The Measure R allocation for the project would be available for all of the alternatives. Transit fare revenues would be available to the transit alternatives and the transit components of the TSM/TDM alternative. Although no analysis of tolling was performed as part of this Alternatives Analysis, an independent study conducted by Metro concluded that toll revenues could be used to fund any budget shortfalls for a freeway tunnel project. Each alternative was assigned a score from 1 to 5 using the scale shown in Table 5-2.

Table 5-2: Available Funding Performance Measure Scale

Score	Definition
1	Funding not available
2	Large deficit of available funds compared to construction costs
3	Some deficit of available funds compared to construction costs
4	Can be constructed with available Measure R funds plus revenues from users
5	Can be constructed with available Measure R funds

Technical Feasibility

This performance measure was intended to distinguish alternatives that were known to be technically feasible from those that still require technological innovations. All of the alternatives being evaluated in the secondary screening use established technologies, so all were assigned the same score for this measure.

Performance of Alternatives

A detailed evaluation of the performance of the twelve alternatives (plus three design variations) pertaining to cost efficiency is presented below. For alternatives that will be evaluated further in the PA/ED phase, designs will be refined to reduce construction and right-of-way costs where possible without compromising their performance or increasing impacts.

Construction and Right-of-Way Costs

Table 5-3 presents the construction and right-of-way costs of each alternative, along with the score assigned to its cost.

Table 5-3: Construction and Right-of-Way Costs

Alternative	Construction Cost (millions $)	ROW Cost (millions $)	Total Cost (millions $)	Score
No Build	0	0	0	7
TSM/TDM	30	90	120	6
BRT-1	50	30	80	6
BRT-6	50	0	50	6
BRT-6A	50	0	50	6
LRT-4A	2,400	200	2,600	3
LRT-4B	2,200	225	2,425	3
LRT-4D	2,100	300	2,400	3
LRT-6	1,125	700	1,825	4
F-2	6,100	325	6,425	1
F-5	5,750	525	6,275	1
F-6	1,450	675	2,125	4
F-7	5,350	75	5,425	2
H-2	500	850	1,350	4
H-6	325	425	750	5

The lowest cost alternatives include the No Build Alternative, the TSM/TDM Alternative, and Alternatives BRT-1, BRT-6, and BRT-6A. The No Build Alternative is the least expensive since no infrastructure improvements would be constructed. The BRT alternatives are relatively low cost since their infrastructure improvements are primarily designed within existing right-of-way, reducing construction and right-of-way costs, and do not include any major structures.

Alternatives with moderate construction and right-of-way costs include Alternatives LRT-6, H-2, H-6 and F-6. These alternatives may require significant right-of-way but have lower construction costs than the tunnel alternatives. Alternative F-6 has a higher right-of-way cost than tunneled freeway alternatives due to the higher number surface impacts, but its construction costs are significantly lower because its alignment includes only one short cut-and-cover tunnel segment.

Light rail and freeway alternatives with tunnels (Alternatives LRT-4A, LRT-4B, LRT-4D, F-2, F-5, and F-7) are the most expensive alternatives. Alternatives F-2 and F-5 have large construction costs associated with lengthy bored tunnel sections and significant right-of-way impacts in their respective north portal areas. The construction cost of Alternative F-7 is slightly lower than F-2 and F-5, due to slightly shorter bored tunnel length and less expensive

structures with the connection at the northern terminus. Also, because Alternative F-7 improvements are within Caltrans' right-of-way, the right-of-way costs are lower than the other freeway and highway alternatives. Therefore, Alternative F-7 is somewhat less expensive than tunneled freeway alternatives F-2 and F-5.

Tunneled light rail Alternatives LRT-4A, LRT-4B, and LRT-4D are intended to limit right-of-way costs, but they do include high tunnel construction costs. While most of the LRT tunnel segments are bored, cut-and-cover techniques would have to be employed at the underground station locations.

Financial Feasibility

The best performing alternatives on this measure include the No Build Alternative, the TSM/TDM Alternative, and Alternatives BRT-1, BRT-6, BRT-6A, H-2 and H-6. The total cost of each of these alternatives is less than the funds available from Measure R.

All freeway alternatives (Alternatives F-2, F-5, F-6, F-7) rank in the moderate range. This score reflects the conclusions of an independent study conducted by Metro that concludes that freeway tunnel alternatives could be funded by future toll revenues. However, no analysis of toll revenues has been conducted in this Alternatives Analysis so this conclusion will be verified in the PA/ED phase.

Alternatives LRT-4A, LRT-4B, and LRT-4D score the lowest, since transit fare revenues generally do not exceed transit operating costs. Therefore, future revenues would not be available to fund construction costs. All have estimated construction costs that are greater than the funds available from Measure R. Alternative LRT-6 scores slightly more favorably because of lower construction costs since it has no tunnel sections. Table 5-3 summarizes the ratings of the financial feasibility performance measure.

Table 5-4: Financial Feasibility with Relative Ratings

Alternative	Score
No Build	5
TSM/TDM	5
BRT-1	5
BRT-6	5
BRT-6A	5
LRT-4A	2
LRT-4B	2
LRT-4D	2
LRT-6	3
F-2	4
F-5	4
F-6	4
F-7	4
H-2	5
H-6	5

Technical Feasibility

The technical feasibility performance measure assesses the constructability of each alternative, given current technologies. The evaluation of each alternative has determined that all alternatives are equally feasible, since the technology, construction methods, and construction personnel required are available to construct each alternative. Therefore, each alternative was assigned the same score for this measure.