

7.0 Executive Summary

This Milestone Report on Capital and Operating Cost Estimates is the seventh in a series of eleven. It provides cost estimates for a high-speed ground access system from Los Angeles International Airport (LAX) to Palmdale Regional Airport (PMD). The three finalist alternative alignments are evaluated, the Airport Connector, Maximum Coverage and the Transit Hubs.

The intent of this milestone is to provide a reliable cost estimate for the alignment alternatives. This information is to be used in determining and comparing the cost effectiveness and feasibility of the proposed alternatives. It is important to note that the cost estimates are a planning-level estimate and reflect a 5% level of conceptual engineering. This milestone report provides cost information for both Very High-Speed Maglev (VHSM) and High-Speed Rail/Very High-Speed Rail (HSR/VHSR) systems for comparison purposes. The VHSM technology has been selected by the SCAG Maglev Task Force as the preferred technology.

The cost estimates contained in Milestone 7 serve two functions:

- Provide input to the Financial Plan (Milestone 8) and the Partnering Alternatives Analysis (Milestone 9). These Milestones require an understanding of the project definition, the resulting capital and operating costs, and the operating revenues¹ of each alternative.
- Provide a basis for comparing costs of alignment and technology alternatives, leading to preparation of a Project Implementation Plan (Milestone 10). Milestone 10 will bring together the various elements from the other milestones to recommend a combined alignment, technology and implementation alternative for the LAX-PMD Ground Access System.

Milestone 7 consists of six primary components:

- 7.1 Project Definition
- 7.2 Project Related Data Collection
- 7.3 Capital Cost Estimates
- 7.4 Operating Cost Estimates
- Appendix A: Plans and Profiles
- Appendix B: Quantity Estimates

The results of each task are described in subsequent sections of this report. This executive summary provides an overview of the alternatives and their associated cost estimates. Appendix A contains a detailed set of Plans and Profiles for the three alignment alternatives. The Plans and Profiles served as the basis for the conceptual engineering design, quantity and cost estimates.

Project Definition

This report provides estimates for both the capital and operating costs of the system alternatives. The capital costs reflect hard cost items such as structures, earthwork,

¹ Operating revenues, mostly from passenger fares, were documented in Milestone 5.

stations, maintenance facilities, vehicles, utility relocation, related infrastructure and system costs, and right-of-way costs. Right-of-way costs reflect an allowance for the alignment envelope. The general system concept of using public rights-of-way was used as much as possible, where right-of-way costs would be minimal, but some areas would require private land to be purchased or an aerial easement secured. This allowance is used to account for such instances.

Capital costs also contain design and construction contingencies, program implementation and environmental impact mitigation costs. These costs are not to be considered as potential costs but rather a component of the overall system costs that will be used as more design information becomes available in the development of the project.

The operating costs represent softer cost items necessary for the operation of the system. They include items such as maintenance, power, passenger and station services, and administrative and insurance costs.

Capital and operating costs have been prepared for three alignment and two technology alternatives, originally identified in Milestone 3, and subsequently refined during the preparation of plans and profiles for this Milestone. The alignment alternatives are: Airport Connector, Maximum Coverage, and Transit Hubs. The two technologies are Maglev (VHSM) and High Speed Rail (HSR/VHSR). These alternatives are explained in detail in Section 7.1.

Development of Project Alternatives

Based on the thorough evaluation described in Milestones 3 and 4, alignment, technology and station alternatives were selected for additional study. These alignments and station options were brought forward by the LAX-Palmdale planning team and were approved by the Maglev Task Force at their December 2000 and February 2001 meetings.

The three alignment alternatives are:

- **Airport Connector**, from LAX via I-405 through West Los Angeles (L.A.) and Van Nuys to Santa Clarita, and via the Metrolink Right-of-Way to PMD;
- **Maximum Coverage**, from LAX via I-405 to West L.A., then via I-10 to L.A. Union Station and the Metrolink Ventura corridor to Burbank and Van Nuys, then via I-405 and I-5 to Santa Clarita, and the Metrolink corridor to PMD;
- **Transit Hubs**, from LAX via I-405 to West L.A., then via I-10 to L.A. Union Station and the Metrolink Antelope Valley corridor to Burbank and Santa Clarita, then the SR-14 Freeway corridor to PMD.

As input to the development of refined travel times (for the Milestone 5 demand modeling), plans and profiles were developed to identify the length, curves and grades associated with each alignment alternative. The plans and profiles include some optimization of the three alternatives, to shorten the alignments and reduce the severity of grades and curves along each. Due to differences in maximum grades

achievable by Maglev and High-Speed Rail, some of the steeper sections of terrain have slightly different profiles for each technology.

Basic Characteristics of Alternatives

The basic characteristics that govern the cost estimates are summarized in Table 7.0-1. The differences between technologies are reflected in the lower proportion of tunnel and higher proportion of aerial alignment for Maglev relative to High-Speed Rail.

Table 7.0-1
Basic Quantities for LAX-Palmdale Alignment and Technology Alternatives

Alternative	Type of Profile (Length in Meters)					Total Length	
	Aerial	Fill	Cut	Tunnel	Station	Meters	Miles
Airport Connector, Maglev	98,380	3,760	7,750	4,015	1,560	115,465	71.7
	85%	3%	7%	3%	1%		
Airport Connector, HSR	98,630	4,175	7,085	4,015	1,560	115,465	71.7
	85%	4%	6%	3%	1%		
Maximum Coverage, Maglev	150,863	2,270	13,665	2,390	2,080	171,268	106.4
	88%	1%	8%	1%	1%		
Maximum Coverage, HSR	146,965	2,460	11,745	7,845	2,080	171,095	106.3
	86%	1%	7%	5%	1%		
Transit Hubs (Via West LA), Maglev	126,221	3,400	14,035	6,970	2,080	152,706	94.9
	83%	2%	9%	5%	1%		
Transit Hubs (Via West LA), HSR	126,311	3,295	14,000	7,025	2,080	152,711	94.9
	83%	2%	9%	5%	1%		

Approach and Basic Assumptions

Cost estimates were developed for the LAX-Palmdale alignment and technology alternatives, following these steps:

- Plans and profiles were developed for the Maglev technology for each alignment. Areas with grades over 3.5% were revisited for high-speed rail to develop a feasible (lower) profile, generally resulting in a shift from aerial or fill sections to cut sections or tunnels. The Plans and Profiles form Appendix A, which is attached under separate cover.
- Quantity sheets from the Plans and Profiles were prepared as an input to capital cost estimating. The quantity sheets are included as Appendix B to this report.
- Travel times were estimated from the Plans and Profiles for demand modeling. Results from modeling (Milestone 5) were used to determine the size of the vehicle fleet and stations, and to feed into calculation of operating characteristics for the operating and maintenance cost estimates.

- Capital and operating cost estimates were initially prepared for the Technology Selection analysis comparing Maglev and High-Speed Rail technologies. This provided an opportunity for review and fine-tuning of the cost estimating approaches and assumptions for the two technologies. Initial results from this review exercise were included in the technical paper on Technology Selection, approved by the Maglev Task Force in May 2001.
- Based on the fine-tuned quantities, approach and assumptions, final draft estimates were prepared for the three alignment alternatives, Airport Connector Maximum Coverage, and Transit Hubs alignments.

Major Assumptions

The following major assumptions were made to estimate capital and operating costs:

- Fleet sizes for Maglev and High-Speed Rail are consistent with the Milestone 5 modeling assumptions and results, and the parameters defined by the study. The vehicle fleets for each alternative are large enough to operate trains every 10 minutes, with enough room to carry the peak directional passenger demand estimated on each alternative.
- Service will operate 18 hours per day, from 5:30 a.m. to 11:30 p.m.
- Station costs and the cost of parking facilities at stations are separate. Parking structures have not been included in the operating or capital cost estimates.
- The entire alignment is double-tracked from LAX to Palmdale, to facilitate operating at 10-minute headways.
- The Maglev costs have been prepared as a stand-alone system.
- The High-Speed Rail technology has been treated as a stand-alone system for comparison purposes only.

Item-specific assumptions are documented in Section 7.3.

Maglev Cost Estimates

The Very High-Speed Maglev (VHSM) technology was selected as the locally preferred technology for the system. Table 7.0-2 summarizes the key capital and operating cost estimates if this project were built as a stand-alone system.

Table 7.0-2
Maglev (VHSM) Stand-Alone System Costs (\$ million)

Item	Airport Connector	Maximum Coverage	Transit Hubs
Length	115 km (72 mi)	171 km (106 mi)	153 km (95 mi)
Structures/Foundation/Tunnels	\$1,758	\$2,660	\$2,465
Earthwork/Cut/Fill/Drainage	\$17	\$31	\$32
Stations	\$506	\$743	\$648
Maintenance Facility	\$474	\$474	\$474
Track/Comm/Signal/Power	\$2,974	\$4,412	\$3,933
Vehicles	\$1,700	\$2,391	\$2,072
ROW	\$701	\$1,037	\$949
Utility Relocation	\$94	\$139	\$126
System Capital Cost (2000 \$)	\$8,200	\$11,900	\$10,700
Cost/Length	\$71 /km (\$115 /mi)	\$69 /km (\$112 /mi)	\$70 /km (\$113 /mi)
Maintenance of Way	\$19	\$28	\$25
Maintenance of Equipment	\$40	\$57	\$51
Transportation/Power	\$51	\$74	\$65
Passenger/Station Service	\$16	\$23	\$21
General/Administration	\$20	\$29	\$26
Annual O&M	\$146	\$212	\$188

High Speed Rail Cost Estimates

The High-Speed Rail/Very High-Speed Rail (HSR/VHSR) cost estimate is provided for comparison purposes. This analysis assumes a stand-alone HSR/VHSR system configuration. Table 7.0-3 summarizes the cost for a HSR/VHSR system.

Table 7.0-3
High-Speed Rail Stand Alone System Costs (\$ million)

Item	Airport Connector	Maximum Coverage	Transit Hubs
Length	115 km (72 mi)	171 km (106 mi)	153 km (95 mi)
Structures/Foundation/Tunnels	\$3,110	\$5,332	\$4,411
Earthwork/Cut/Fill/Drainage	\$15	\$8	\$33
Stations	\$591	\$912	\$804
Maintenance Facility	\$575	\$575	\$575
Track/Comm/Signal/Power	\$819	\$1,217	\$1,081
Vehicles	\$2,105	\$2,553	\$2,139
ROW	\$610	\$924	\$950
Utility Relocation	\$86	\$129	\$126
System Capital Cost (2000 \$)	\$7,900	\$11,700	\$10,200
Cost/Length	\$69 /km (\$110 /mi)	\$68 /km (\$110 /mi)	\$66 /km (\$107 /mi)
Maintenance of Way	\$30	\$44	\$38
Maintenance of Equipment	\$89	\$132	\$112
Transportation/Power	\$119	\$176	\$159
Passenger/Station Service	\$21	\$32	\$27
General/Administration	\$22	\$33	\$28
Annual O&M	\$281	\$418	\$355

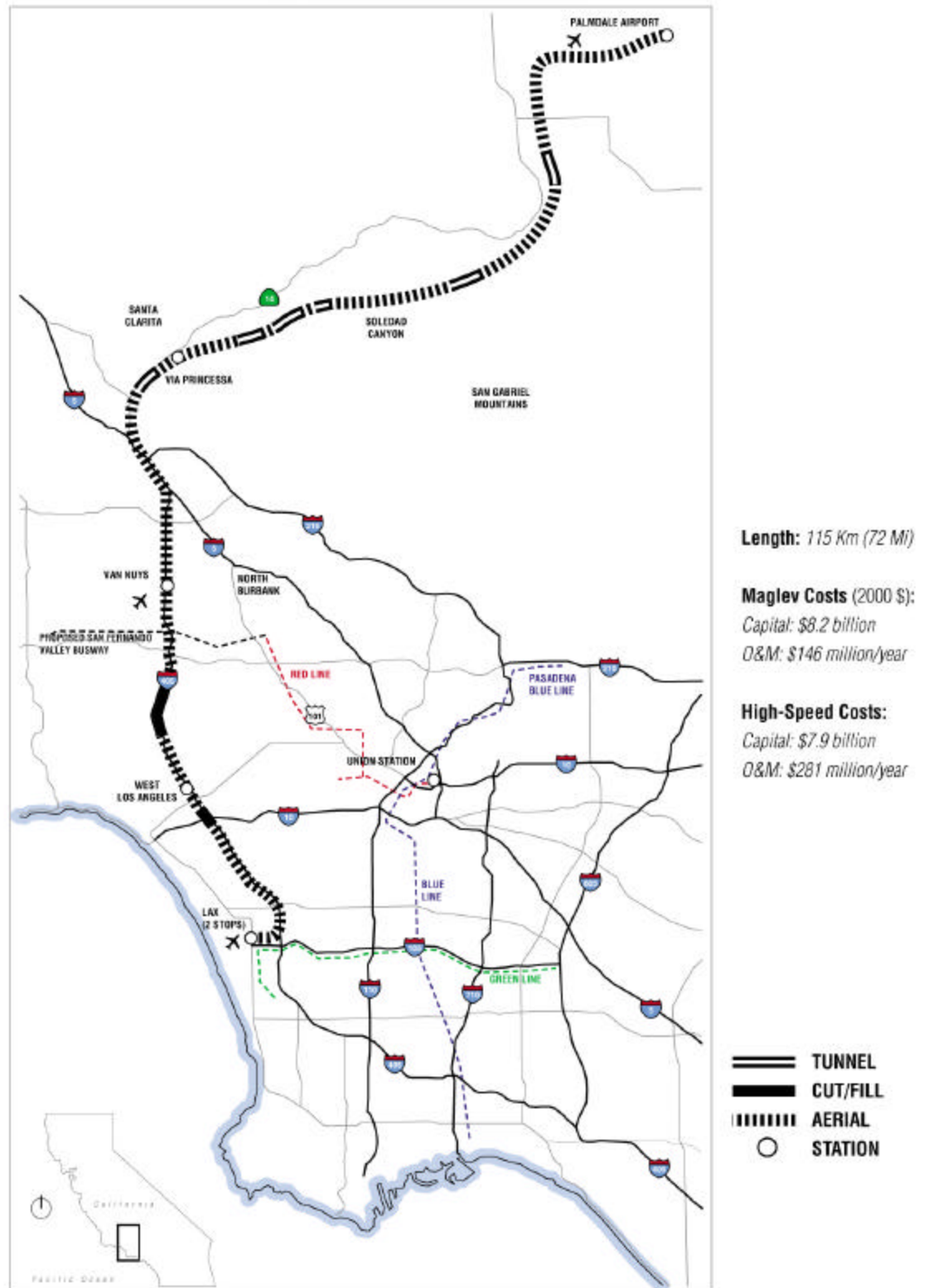
The most significant difference is the lower annual operating and maintenance cost for Maglev. While the complex Maglev technology, which includes power supply in the guideway, has a higher initial capital cost for a new alignment, the lower annual costs offset this difference within two to four years of operations for each alternative.

Maglev operating costs are lower because the passenger volumes estimated for the corridor require a substantial peak capacity. The Maglev system is able to provide this capacity using fewer vehicles, thereby incurring much lower costs, because it does not require locomotives (the power comes from the guideway) and the vehicles are configured to carry more people per unit of length of train set.

Overview of Results

Exhibits 7.0-1 through 7.0-3 illustrate the three alignment alternatives and summarize physical configuration of the alignments from LAX to PMD. For comparison purposes, the maglev and high-speed rail costs are presented for the stand-alone system. Table 7.0-4 summarizes the system characteristics and cost items between the various alignment and configuration options examined in this report.

Exhibit 7.0-1
AIRPORT CONNECTOR ALTERNATIVE



MAXIMUM COVERAGE ALTERNATIVE

Table 7.0-4
Comparison of Capital and Operating Cost Estimates

Characteristic	Alignment Alternative		
	Airport Connector	Maximum Coverage	Transit Hubs
Stand-Alone LAX-PMD System			
Length	115 km (72 mi)	171 km (106 mi)	153 km (95 mi)
Number of Stations	5	7	6
Maglev (VHSM) System Costs			
Capital	\$8.2 billion	\$11.9 billion	\$10.7 billion
Average per km (mi)	\$71 million/km (\$115 million/mi)	\$69 million/km (\$112 million/mi)	\$70 million/km (\$113 million/mi)
Annual O&M	\$146 million	\$212 million	\$188 million
High-Speed Rail (HSR/VHSR) Costs			
Capital	\$7.9 billion	\$11.7 billion	\$10.2 billion
Average per km (mi)	\$69 million/km (\$110 million/mi)	\$68 million/km (\$110 million/mi)	\$66 million/km (\$107 million/mi)
Annual O&M	\$281 million	\$418 million	\$355 million