Technical Report
LAX Master Plan Supplement to the Draft EIS/EIR

S-2c. Supplemental Automated People Mover Technical Report

June 2003

Prepared for:

Los Angeles World Airports

U.S. Department of Transportation
Federal Aviation Administration

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1. INTRODUCTION

Los Angeles International Airport Master Plan Alternative D includes two separate automated people mover (APM) systems. The Landside APM would be an above ground system, and would carry passengers between the major landside facilities of the airport: the Central Terminal Area (CTA), the Ground Transportation Center (GTC), the Intermodal Transportation Center (ITC), and the Rental Car Facility (RAC). The Airside APM would be an underground system connecting the western part of the CTA with a new West Satellite Concourse. Both the landside and airside systems are shown in **Figure S1**, Alternative D Automated People Mover Systems. This document provides a summary of the key features of both APM systems and how they fit into this Master Plan.

2. LANDSIDE APM SYSTEM

The Landside APM, or LAPM, system consists of two independently functioning routes: 1) CTA-GTC and 2) CTA-RAC-ITC. The CTA-GTC route is a dual lane, pinched loop system that serves stations in the north and south areas of the CTA and GTC. This system is essentially in a U-shaped configuration, with both ends at the west end of the CTA. This results in there being four APM lanes between the CTA and GTC. The CTA-RAC-ITC route is a dual lane, pinched loop system that connects the four CTA landside terminals with the RAC and the ITC.

Many different routes were examined. Along with the route structure described above, other options considered include:

- A system using a pair of counter-rotating loops serving all the GTC and CTA stations. In this scenario, the outer loop could have been shared (with higher headways on each system) between the CTA-GTC route and the CTA-ITC route.
- Two entirely separate systems between the GTC and CTA, one each on the north and south sides. In this configuration, a passenger on the north side of the GTC who wanted to travel to the south side of the GTC may have been forced to walk a considerable distance.
- A system where all passengers from the ITC are delivered to the GTC – there would be no direct connection from the ITC to the CTA. In this system, all passengers coming into the CTA would ride the CTA-GTC system.

The selected route structure was chosen on the basis of ridership, system capacity (considering that most passengers will be carrying their bags), allowing for high availability and failure management, and flexibility for future changes.

The CTA-GTC passenger flows are expected to be about 50 percent of the total peak design peak hour APM users, but these riders would have more baggage, so they represent about 62 percent of the capacity requirements. Similarly the RAC passenger flows are about 15 percent of the peak hour total but about 18 percent of the capacity requirements. Finally, the ITC-CTA passenger flows are about 35 percent of the ridership and (with typically less baggage, only carry-ons) about 21 percent of the capacity. Thus with a maximum of three pairs of guideways in the CTA, and, with all three required for capacity reasons, the separate CTA-GTC route and the combined CTA-RAC-ITC routing makes the most sense from a capacity standpoint – it provides more balanced loads on the routes. Combining the GTC and RAC riders overloads a CTA-RAC-GTC route while the CTA-ITC route would operate well below capacity.

2.1 CTA-GTC Route

This route connects these two major passenger activity areas with four stations in the CTA and two in the GTC. Starting at the Terminal 3 station, a train would travel to the Terminal 4 station in the CTA, then on to the station in the South Pier of the GTC, the station in the North Pier of the GTC, and then to stations in the CTA Terminals 1 and 2. It then returns to the southern CTA Terminal stations via the GTC stations using the opposite track of the dual guideway. This route can be seen in **Figure S2**, Alternative D Landside APM System CTA-GTC Route.

With ticketing and bag claim in the new CTA landside terminal buildings, air passengers would have all, or most of, their baggage, so the trains on this system would accommodate riders, baggage, and baggage carts. Trains could also have a “baggage car” for skycap-checked baggage that could include very large objects such as skis and surfboards.

This configuration offers several advantages:

- Considerable capacity (up to 13,500 passengers per hour per direction [pphpd] with full baggage loads and 19,500 pphpd with carry-on baggage only with 6-car, large-sized rubber-tired APM vehicles). At this master planning level, such capacity is important, particularly given the likelihood of many passengers carrying their baggage and using baggage carts and the varying passenger loads over the day, including flows on the north and south guideways.
- A passenger can board at any CTA or GTC station and travel to any GTC or CTA (respectively) station without concern about being on the “correct” north or south side. Thus passenger information is relatively easy.
- By doubling the LAPM back on itself, there would be considerable redundancy. Thus if there is a failure at a station or at one point of the guideway, shorter pinched-loop and/or shuttle failure management routes can carry at least half of the normal capacity.

Riders would include:

- Arriving and departing air passengers who park, are dropped off/picked up by a third party, or use commercial transportation at the GTC.
- Meeters/greeters and well-wishers who park at the GTC and ride to/from the CTA with their air passengers. This would be during periods of normal security; in heightened security times the LAPM could be restricted to air passengers only.
- Other airport visitors, also only during normal security periods.
- Airport and airline employees who work in the CTA and GTC and need to travel between work stations.

It would take about 5 minutes to travel from a west south CTA station to the first GTC station. Although the train length could be varied by operating period to meet the fluctuating passenger loads, the operating headway (time between trains) would remain at approximately 2 to 3 minutes for the majority of the day, only increasing during night operations. This results in a daytime average waiting time of about 1 minute. Thus the total typical trip between the CTA and GTC would usually be about 6 to 7 minutes. During night operations, headways could increase to 4 to 5 minutes, adding 1 to 2 minutes to the average waiting time and trip time. A detailed breakdown of operating hours can be seen in **Table S1**, Landside APM - Possible Operating Scenario. This figure represents a potential operating scenario; the ultimate operating plan may differ from what is shown here.

Table S1

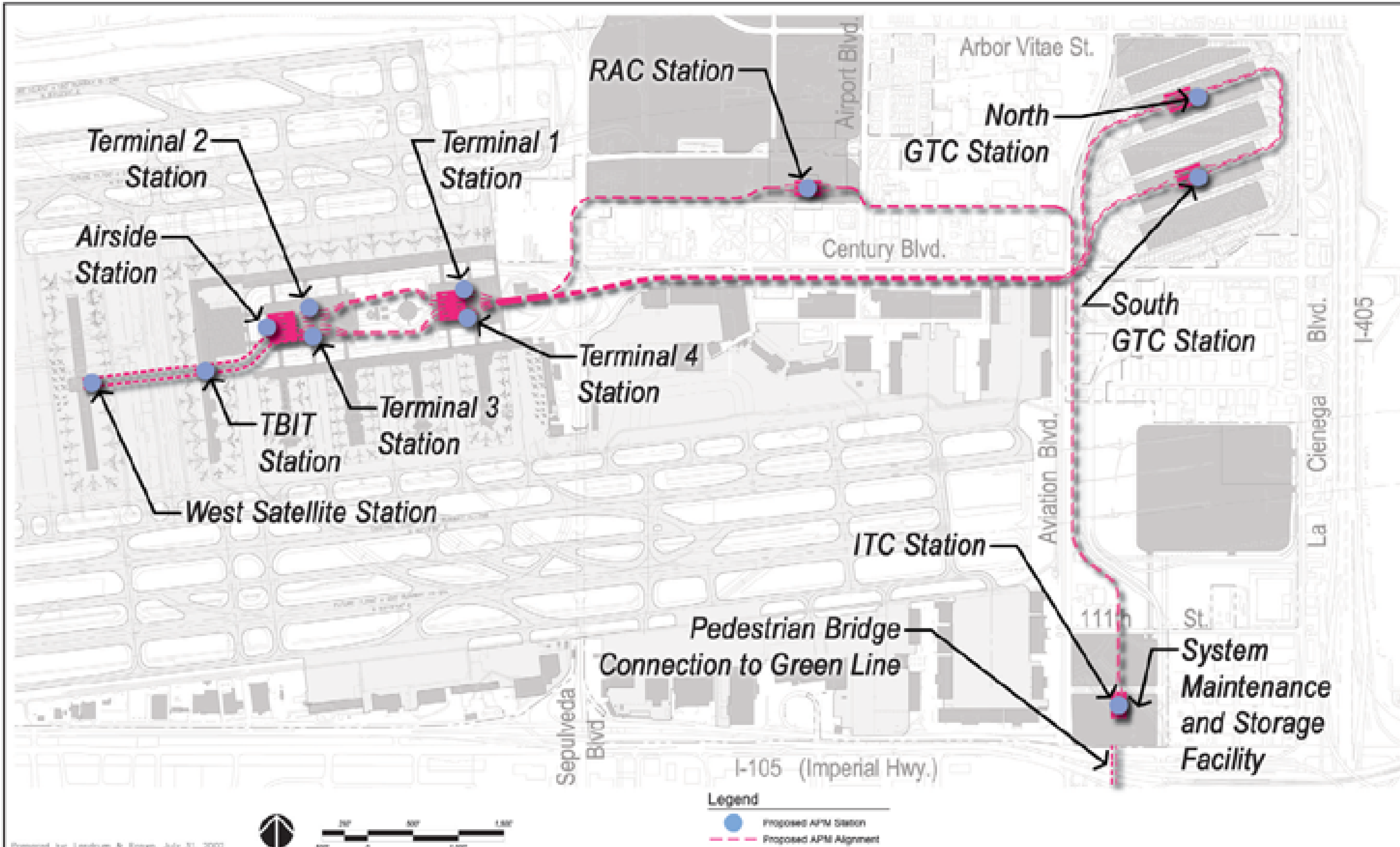
Landside APM - Possible Operating Scenario

	Train Length (Cars)	Approximate Headway (min)	Capacity (per car)	Capacity (pphpd)
GTC-CTA System				
Peak Hours (7 a.m. - 10 p.m.)	5[1]	2.0	38	9,100
Off-Peak Hours (10 p.m. - 12 a.m., 6 a.m. - 7 a.m.)	3[1]	2.0	38	4,550
Night Hours (12 a.m. - 6 a.m.)	3[1]	4.4	38	2,100
ITC-RAC-CTA System				
Peak Hours (7 a.m. - 10 p.m.)	6	2.1	51	8,900
Off-Peak Hours (10 p.m. - 12 a.m., 6 a.m. - 7 a.m.)	4	2.0	51	6,000
Night Hours (12 a.m. - 6 a.m.)	2	7.1	5.1	850

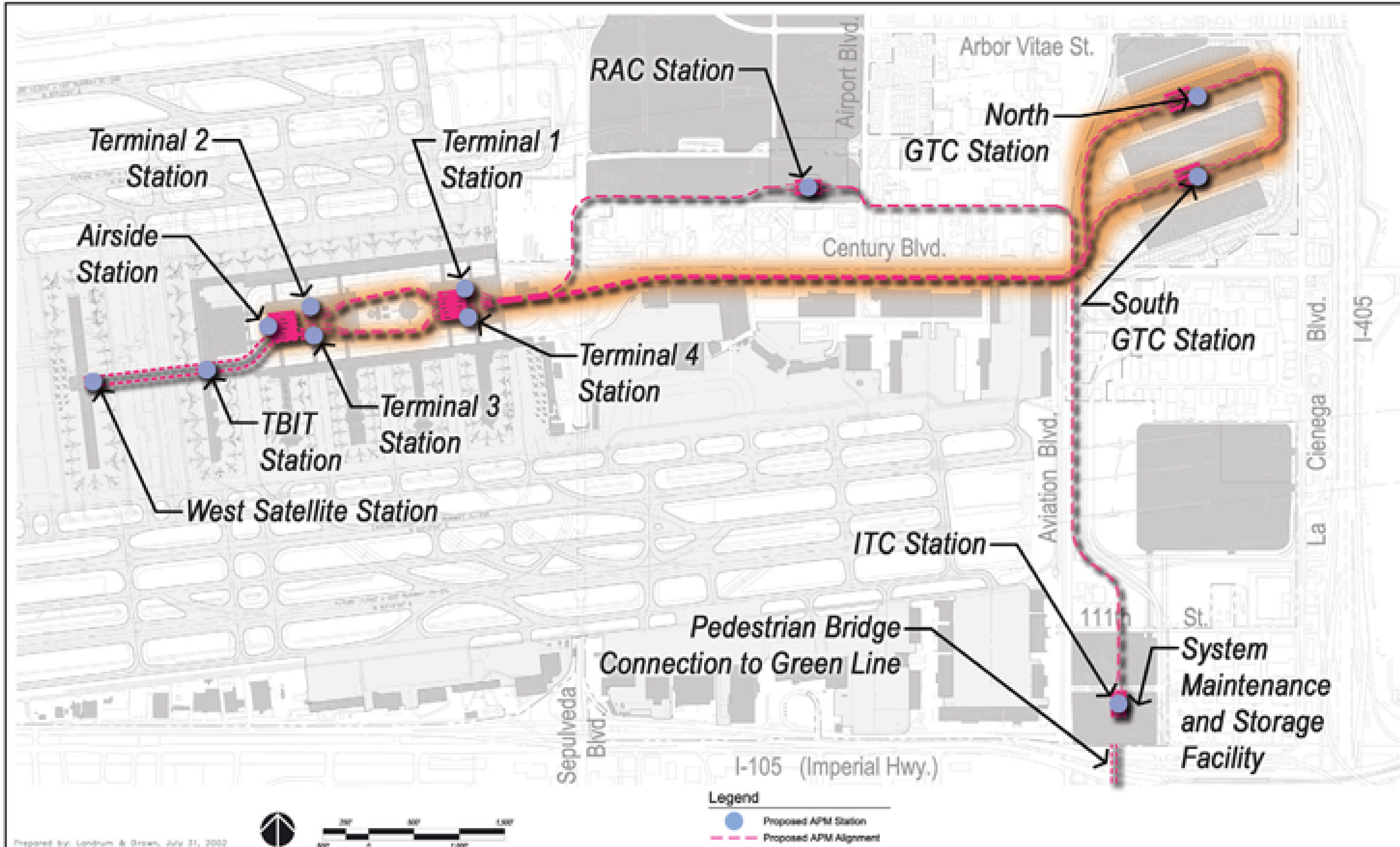
[1] Includes one car for baggage.

Notes: Discrepancy in capacity per car is due to differing baggage assumptions.
GTC-CTA capacity is Train Capacity * Trains per hour * 2 because of U shaped configuration.
Operating plan subject to change as planning moves forward.

Source: Lea+Elliott, 2003.



LAX Master Plan - Supplement to the Draft EIS/EIR	Alternative D Automated People Mover Systems	Figure S1



LAX Master Plan - Supplement to the Draft EIS/EIR	Alternative D Landside APM System CTA-GTC Route	Figure S2

With six car trains and no baggage cars, the system could carry up to 13,500 passengers with full baggage loads, and about 19,500 with only carry on baggage.

2.2 CTA-RAC-ITC Route

This route runs from a western station between the new landside Terminals 2 and 3 to a second CTA station between Terminals 1 and 4 at the CTA, and then on to the RAC, and the ITC. There, trains would reverse and return to the CTA stations via the RAC. This would give direct service to the RAC users and direct, but with one intermediate stop, service to the ITC users. This route can be seen in **Figure S3**, Alternative D Landside APM System CTA-RAC-ITC Route.

Riders would include:

- Arriving and departing air passengers who park, are dropped off/picked up by a third party, or use commercial transportation at the ITC. Most would be short-term parkers.
- Air passengers and employees using the MTA Green Line light rail transit system.
- Air passengers who park in the long-term surface lot west of La Cienega Boulevard and are shuttled by buses to/from the ITC.
- Meeters/greeters who park at the ITC or use the Green Line (during periods of normal security).
- Air passengers renting or returning rental cars at the new Consolidated Rental Car Facility (i.e., the RAC).
- Airport users traveling to or from the hotels and other businesses along 98th Street who use the connecting shuttle buses of those establishments to travel to and from the RAC station.

The scheduled travel time between the western CTA station and the ITC would be about 7.5 minutes. Again, the train length would vary by operating period and the operating headway will remain about 2 to 3 minutes for the majority of the day. This results in an average daytime wait time of about 1 minute and a typical trip time between the ITC and western CTA station of less than 9 minutes. Headway at night could be about 7 minutes, adding 2 to 3 minutes to the average wait time and trip time.

The ITC-RAC link would have a capacity of about 9,600 pphpd as most short-term parkers at the ITC and Green Line users would have only carry-ons. The RAC-CTA link capacity would be about 8,700, as many RAC users would have more baggage and use baggage carts. Combining these numbers (weighted by percent of travelers of each type) yields an overall average capacity of about 8,900 pphpd. Operational details can be seen above in **Table S1**.

2.3 Facilities and Fleet

2.3.1 Guideway

The guideway alignments for both LAPM routes are designed to minimize interference with existing facilities and existing and planned roadways. The two routes (3 pairs of guideways) would most likely be at-grade in the CTA. The CTA-GTC guideway would tunnel under Sepulveda Boulevard, then rise up to be elevated along the rest of its alignment. This guideway would be located along the southern edge of Century Boulevard until reaching Aviation Boulevard, then turn northwest into the GTC complex. The CTA-RAC-ITC guideway would turn to the north at Sepulveda Boulevard (remaining on the west side), then turn east along 98th Street to the RAC Station. Alternately, depending on the RAC layout, the guideway could continue along 96th Street. From there, the guideway would continue along 98th Street until turning south on the east side of Aviation Boulevard. As the guideway approaches the ITC it would split into an upper and lower pair of guideways. The upper pair would go into the third level of the ITC, the location of the ITC station and the pedestrian link to the Green Line. The lower guideways would go into the basement and the LAPM maintenance and storage facility.

2.3.2 Stations

LAPM stations would generally be of the flow-through design (see **Figure S4**, Automated People Mover Typical Station Design), to separate passengers entering and exiting the trains. This is particularly important with baggage carts. It minimizes cross flows and their inevitable interference at station/train doors, and shortens the station dwell times. There would be appropriate, minimal, level changes to travel between the stations and other areas such as ticketing, baggage claim, and curbside. Elevators, escalators, and stairs would be used for these vertical transfers. Station widths would be adequate to accommodate passenger queuing at platform doors and vertical circulation elements; this is likely to put them in the 20 to 40 foot range, depending on station type and configuration. Station lengths would be based on ultimate train length, which could be up to 300 feet long.

2.3.3 Maintenance Facility

The LAPM Maintenance and Storage Facility would be in the basement of the ITC. It would contain vehicle maintenance, storage and cleaning, as well as open shops, a traction power substation, offices, central control, spare parts and tool storage, a loading dock with shipping/receiving area, some equipment shops, and staff facilities.

2.3.4 Power Substations

There would be about six traction power substations located along the guideway at approximately 5,000 feet intervals. General locations would be:

- In the Maintenance and Storage Facility;
- On Aviation Blvd, just south of Century;
- At the GTC North Station;
- At the RAC Station;
- On Century, just west of Airport Blvd; and
- At the CTA East Station.

2.3.5 Fleet

Fleet requirements will vary as ridership demand at each station changes over time. The operating fleet would be sized for the design hour peak link flow rates. The largest train would likely be five cars long and operate at about two minute headways. The APM vehicles to meet the capacity requirements of the two routes could be rubber-tired cars that are about 40 feet in length, with a cruise speed of about 45 miles per hour. These are typical of the larger airport APM systems, such as those at Denver, Dallas/Fort Worth, Chicago O'Hare, and Miami. They could also be 40 to 55 feet long, steel wheel/steel rail automated people mover vehicles, such as those in Vancouver and at JFK Airport in New York.

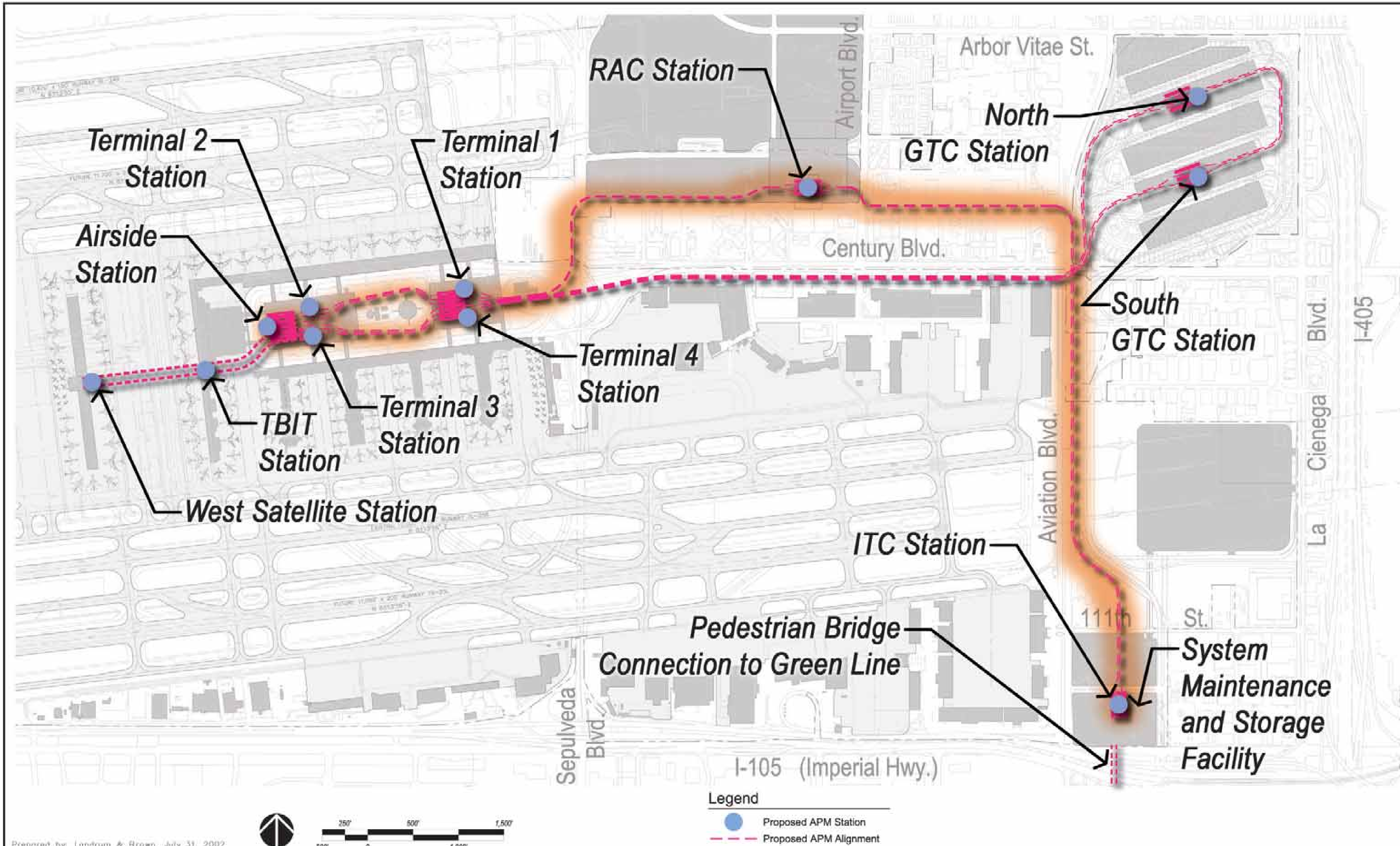
With the number of spare vehicles set at the largest of either 20 percent of the peak operating fleet or the number of vehicles required to limit each vehicle to a maximum of 85,000 miles annually, the ultimate fleet size would be 189 vehicles, including spares. This assumption is based on 40 foot rubber tired vehicles; using the larger steel wheel vehicles would result in fewer vehicles.

2.4 Capital Cost

Planning level capital cost estimates have been performed. These estimates include:

- Vehicles;
- System elements, such as vehicle control and communications;
- Maintenance facility elements (not including the building around the maintenance facility, which is assumed to be part of the ITC, whose construction costs are being counted elsewhere);
- Stations (similar caveat applies);
- Power substations as described above;
- Contractor soft costs; and
- Owner soft costs, though it is assumed that a portion of these will be LAWA responsibility.

The total Landside APM planning level cost estimate is $957 million (2002 dollars). Systems costs are estimated at $589 million, while fixed facilities are estimated at $368 million.

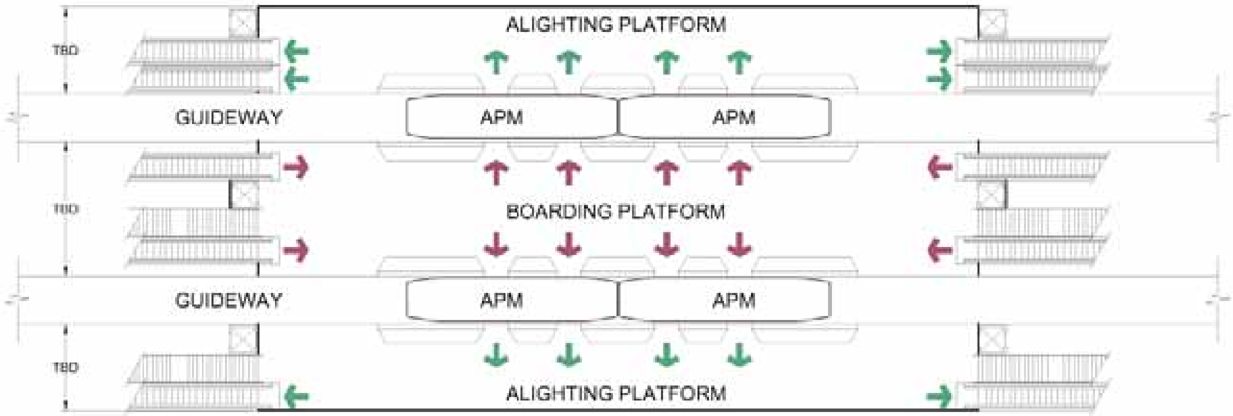


LAX Master Plan - Supplement to the Draft EIS/EIR

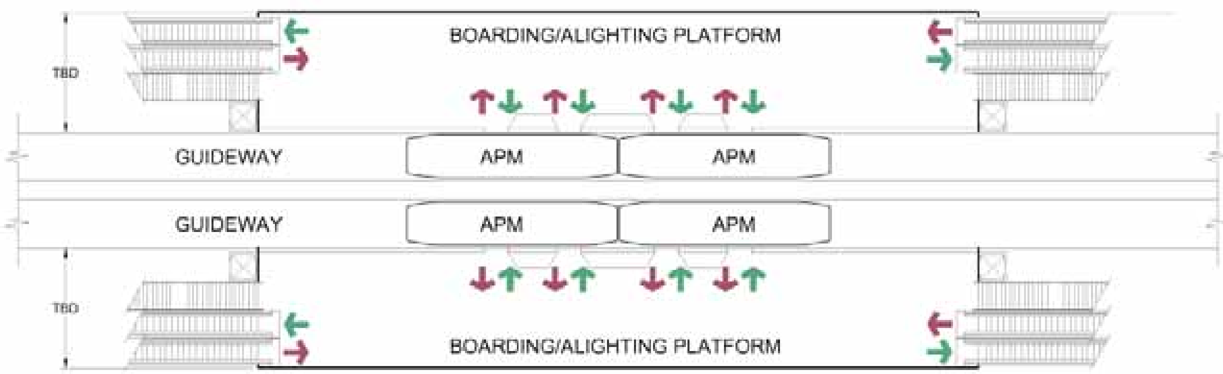
Alternative D Landside APM System
CTA-RAC-ITC Route

Figure
S3

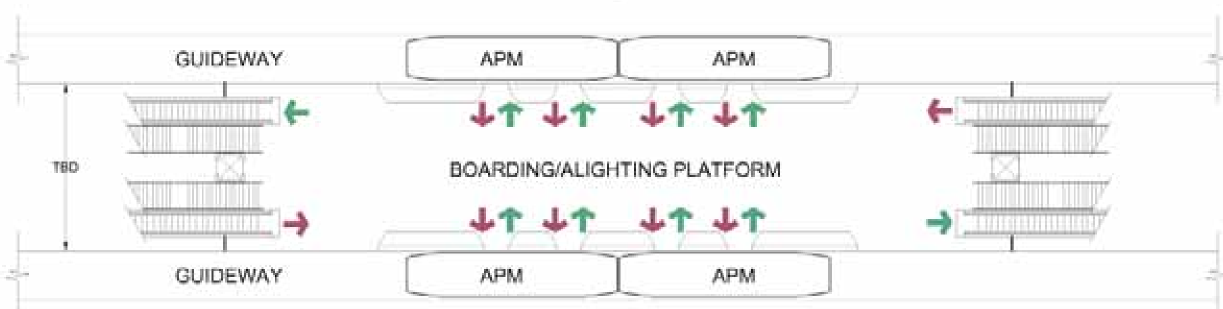
Flow-Through (Center-Side Platform) Configuration - CTA Stations



Side Platform Configuration - GTC Stations



Center Platform Configuration - ITC Stations



Source: Leo+Elliot - 2000

LAX Master Plan Supplement to the Draft EIS/EIR	Automated People Mover Typical Station Design	Figure S4

3. AIRSIDE APM

3.1 General System Description

The Airside APM system, or AAPM, route is shown in **Figure S5**, Alternative D Subterranean Airside APM System. It would run from an underground station in the vicinity of landside Terminals 2 and 3, to an intermediate station underneath the Tom Bradley International Terminal (TBIT), and end at a new West Satellite Concourse. The AAPM would be a dual lane shuttle system, with two trains connecting the three stations. This could be a sterile system (i.e., passengers and baggage have undergone security screening), at least in part, depending on the location and configuration of Federal Inspection Service (FIS) facilities.

Riders of this system would include:

- Air passengers arriving at/departing from gates in the TBIT and new West Satellite Concourse.
- Airport/airline employees working at these facilities.

The two trains making up this dual lane shuttle could be up to up to six cars long, depending on peak ridership. Three or four cars per train are more likely given initial expected airline assignments, but this could change with different locations of airlines. The travel time and headway would both be approximately 2.7 minutes long, resulting in an average wait time of about 1.4 minutes and a trip time just over four minutes from one end to the other.

During off-peak and night operations, only one of the two trains would be in operation, allowing maintenance to be performed on the other. This would double average wait time to about 2.7 minutes, giving an overall average trip time of about five and a half minutes.

3.2 Facilities and Fleet

3.2.1 Guideway

The guideway alignment is generally described in Section 3.1 of this *Supplemental Automated People Mover Technical Report*. Leaving the CTA station, the alignment is generally heading west. Shortly after, it makes a slight turn to the south, then turns back to the west. This alignment was selected in order to line up with preferred station locations at the TBIT and West Satellite Concourse.

The depth of the tunnel will be determined as the design is further developed.

3.2.2 Stations

The AAPM will include three underground stations. An entirely underground system will demand significant vertical circulation elements. Elevators, escalators, and stairs would be required at every station. Station widths would be sized to accommodate passenger queuing at platform doors and the vertical circulation elements, and could be 30 to 35 feet. Station platform lengths would be determined by train length, but would likely be about 200 feet long. The AAPM would have center platform stations, as its passengers will have checked their bags and thus require less space on the platform and in the vehicles. If part of the system were sterile, such as one or two cars on each train or alternate trains, sterile side platform stations would also be provided. General station layouts are shown in **Figure S4**.

3.2.3 Maintenance Facility

An underground maintenance facility would be located at the west end of the guideway, underneath the west side of the new West Satellite Concourse. The maintenance facility would be functionally similar to that of the LAPM, though much smaller in scale, given the much smaller fleet size.

3.2.4 Power Substations

A maximum of two power distribution substations would be required by this system. One would be located at the maintenance facility while the other could be at either the TBIT or CTA station. If a cable-propelled system is used, the cable drive system would be at the maintenance facility, and would obviate the need for traction power substations. However, guideway power distribution for climate control and other housekeeping functions would still be required, so there would be at least one power substation. It would be located at the maintenance facility.

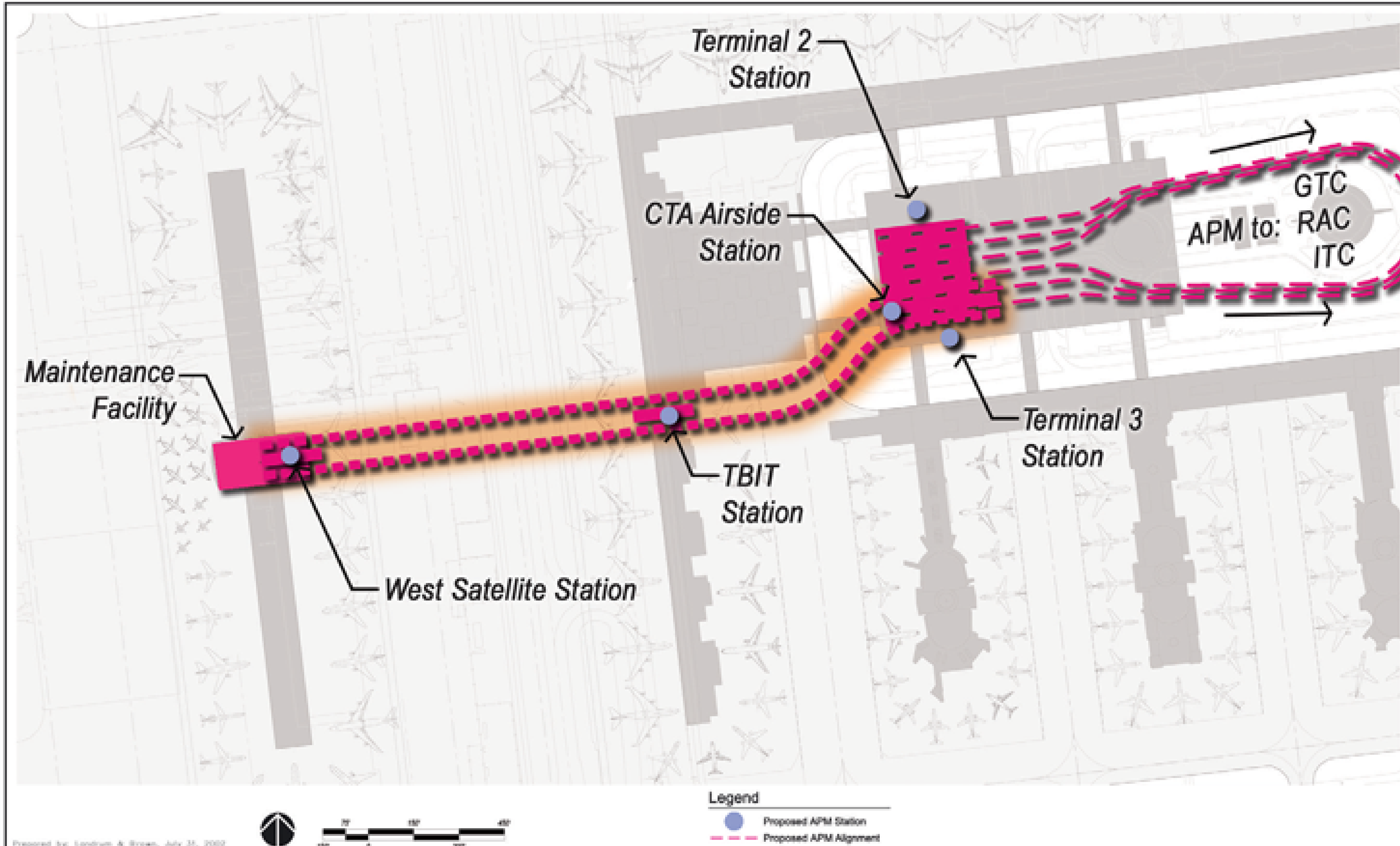
3.2.5 Fleet

With this relatively short alignment and shuttle operations, cable systems might be a viable alternative to self-propelled vehicles. An operating speed of 25 to 30 mph has been assumed, which is within the range of both cable-propelled systems and lower-speed self-propelled systems. The system and facilities could be designed to accommodate either. Self-propelled vehicles would be similar to those described in Section 2.3.5, though likely lower in speed. Cable-propelled vehicles would be comparable to those in operation at U.S. airports in Detroit and Minneapolis, and at Narita in Tokyo.

Fleet size has not yet been determined. Trains could be up to six cars in length, but this capacity would probably not be necessary. Three to four car trains are more likely.

3.3 Capital Cost

The Airside APM preliminary cost estimate, in 2002 dollars, is $158 million. Systems costs are estimated at $61 million, while fixed facilities are estimated at $97 million. The included elements are similar to those described in Section 2.4 of this *Supplemental Automated People Mover Technical Report*.



LAX Master Plan - Supplement to the Draft EIS/EIR	Alternative D Subterranean Airside APM System	Figure S5