

metro.net/regionalrail

Antelope Valley Line Study

Final Report



AVL

Final Report

Prepared for:



Metro[®]

Los Angeles County
Metropolitan Transportation Authority

Prepared by:



444 South Flower Street
Suite 800
Los Angeles, California 90071

In association with:

Pacific Railway Enterprises, Inc.
Rail Surveyors and Engineers, Inc.

October 22, 2019

Review Copy		
Originator	FNichols	9/30/19
Checker	RMarcus	10/9/19
Back Checker	TLichterman	10/10/19
Format Checker	CDavis	10/17/19
Approved by	FNichols	10/18/19

CONTENTS

EXECUTIVE SUMMARY	1
1 INTRODUCTION	1
1.1 Study Purpose	1
1.2 Objectives, Assumptions and Study Scope	2
1.3 Study Participants and Stakeholder/Public Engagement.....	3
2 EXISTING CONDITIONS.....	4
2.1 Regional Growth and Economic Development	4
2.2 Rail Service	4
2.3 Rail Infrastructure, Stations, Rolling Stock and Facilities	6
2.4 Current Operations and Performance	10
2.5 Travel Markets and Patterns	14
2.6 Capital Investment in the AVL.....	23
3 FUTURE VISION FOR THE AVL CORRIDOR	27
3.1 Demographics, Land Development and Economic Activity	27
3.2 Future Rail Ridership	28
3.3 Role and Nature of Rail Service in the AVL Corridor.....	32
4 CURRENT PLANNING CONSIDERATIONS.....	35
4.1 Rail Initiatives.....	35
4.2 Transit Initiatives	42
4.3 Local Development, Economic and Environmental Issues and Concerns.....	43
4.4 Stakeholder Input and Feedback.....	45
5 ANALYSIS FRAMEWORK AND METHODOLOGIES	51
5.1 Methods of Analysis	51
5.2 Evaluation Methodology.....	55
5.3 Decision-Making and Implementation Framework	58
6 AVL SERVICE SCENARIOS	60
6.1 Summary	60
6.2 Rail Service Characteristics.....	63
6.3 Operations and Maintenance Costs	68
6.4 Capacity-Related Infrastructure Projects and Capital Costs to Support Service Scenarios	70
6.5 Service Scenario Evaluation	77
6.6 Capital Project Evaluation	79
7 IMPLEMENTATION PRIORITIES.....	81
7.1 Phased Implementation Plan	81
7.2 Operations and Operating Costs	87
7.3 Capital Investment.....	88
7.4 Funding Strategies.....	90
7.5 Future Passenger Service with Multiple Operators in the AVL Corridor.....	92
7.6 Future Rail Freight Service in the AVL Corridor.....	102
7.7 Future Decisions and Tradeoffs	103

8 NEXT STEPS 106

8.1 Integrate AVL Study Results into Metrolink Systemwide Plans 107

8.2 Confirm Near-Term Service Improvements 107

8.3 Advance High Priority Early Capital Projects 107

8.4 Planning and Analysis to Support Future Decision-Making 108

8.5 Funding Plan for AVL Capital Investment and Service Improvement 110

8.6 Outreach and Collaboration 110

9 REFERENCES..... 111

APPENDICES..... 113

Tables

Table 2-1: AVL Segments and ROW Characteristics 7

Table 2-2: Stations Serving AVL Within the Study Area 8

Table 2-3: Antelope Valley Line Train Load Factors at Peak Load Point by Time of Day – Average by Train over First Ten Months of FY 2018 9

Table 2-4: AVL Segments, Station Groups and Catchment Areas..... 18

Table 2-5: Daily Trips Between AVL Study Area Origin and Destination Zones 21

Table 2-6: Antelope Valley Line Capital Improvements 25

Table 3-1: Projected Daily Regional Travel Volumes and AVL Boardings, 2028 and 2042..... 29

Table 3-2: Existing and Projected Total Daily AVL Boardings, by Station Group..... 31

Table 5-1: Unit Costs for Estimation of Incremental Operations and Maintenance Cost 54

Table 5-2: AVL Study Evaluation Criteria Focused on Service Scenarios 56

Table 5-3: AVL Study Evaluation Criteria Focused on Capital Projects 57

Table 6-1: Description of AVL Service Scenarios 62

Table 6-2: Rail Service Characteristics, by Scenario 63

Table 6-3: Round Trips per Day, by Scenario, for Purposes of Estimating Incremental O&M Costs 69

Table 6-4: Late Evening Round Trips, by Scenario, for Purposes of Estimating Incremental O&M Costs 69

Table 6-5: Operating Days per Year..... 69

Table 6-6: Annual Round Trips and Revenue Hours, for Purposes of Estimating Incremental O&M Costs 69

Table 6-7: Incremental Annual Operations and Maintenance Costs Compared to Existing AVL Service (Millions of 2018 dollars) 70

Table 6-8: Rough Order of Magnitude Capital Cost, by Project and Scenario 76

Table 6-9: Evaluation and Ranking of AVL Service Scenarios 78

Table 6-10: Evaluation and Ranking of AVL Capital Projects..... 80

Table 7-1: Incremental Annual O&M Cost by Scenario, Compared to Existing Service..... 88

Table 7-2: Funding Sources 90

Table 7-3: Potential Trip Time Improvements on the AVL 98

Figures

Figure 1-1: AVL Study Role..... 2

Figure 2-1: Metrolink System Map 5

Figure 2-2: AVL Segments..... 6

Figure 2-3: Existing AVL Stopping Patterns..... 10

Figure 2-4: AVL Weekday Timetable 11

Figure 2-5: AVL Operating Revenues FY 2018-19 12

Figure 2-6: AVL Operating Expenses FY 2018-19..... 12

Figure 2-7: AVL Historical On-Time Performance – Annual Averages..... 13

Figure 2-8: AVL Average Weekday Boardings at AVL Station, Excluding LA Union
Station (FY09 to FY19) 14

Figure 2-9: AVL Stations Average Weekday Boardings (FY19) 15

Figure 2-10 Metrolink System Home-Catchment Areas 16

Figure 2-11. AVL Catchment Areas 17

Figure 2-12: Annual AVL Ridership by Station Group, FY 2017 19

Figure 2-13: Total Daily Trips from AVL Origin Zones to Destination Zones 22

Figure 2-14: Total Daily Commuter Rail Trips from AVL Origin Zones to Destination
Zones..... 22

Figure 2-15: Commuter Rail Share of Total Daily Trips from AVL Origin Zones to
Destination Zones 23

Figure 3-1: LA County Population Projections 27

Figure 3-2: LA County Employment Projections 28

Figure 3-3: Metrolink Antelope Valley Line Historical and Projected Ridership 30

Figure 4-1: 2018 California State Rail Plan Southern California Service 2040 Vision 36

Figure 4-2: SCORE Target Service Levels for 2028..... 37

Figure 4-3: Link US Proposed Project - Up to 10 Run-through Shared Tracks 38

Figure 4-4: CHSRA Palmdale to Burbank Project Section Map..... 40

Figure 4-5: The High Desert Corridor Project Area..... 41

Figure 4-6: East San Fernando Valley Transit Corridor..... 42

Figure 4-7: Top Employers in the AVL Study Area 44

Figure 4-8: Survey Respondent Characteristics..... 47

Figure 4-9: Survey Responses – Boarding and Destination Stations 48

Figure 4-10: Survey Response – Timing of Potential Late Night Service 49

Figure 4-11: Survey Response – Mid-Day Service at Regular Clock-face Intervals 49

Figure 4-12: Survey Response – Peak Service Priority for Frequency or Express Service 50

Figure 4-13: Survey Response – Ranked Preferences for Improved Service 50

Figure 5-1: AVL Decision-Making Framework..... 58

Figure 5-2: Layered Approach to Incremental Service Improvements 59

Figure 6-1: Current AVL Weekday Timetable (Schematic Format)..... 65

Figure 6-2: Scenario 1 Weekday Timetable..... 65

Figure 6-3: Scenario 2 Weekday Timetable..... 66

Figure 6-4: Scenario 3 Weekday Timetable..... 66

Figure 6-5: Scenario 4 Weekday Timetable..... 67

Figure 6-6: Scenario 5 Weekday Timetable..... 67

Figure 6-7: Scenario 6 Weekday Timetable..... 68

Figure 6-8: AVL Railroad Capacity Capital Improvement Project Locations 71

Figure 6-9: Capital Investment for Rail Capacity – Scenario 2..... 72

Figure 6-10: Capital Investment for Rail Capacity – Scenario 3..... 72

Figure 6-11: Capital Investment for Rail Capacity – Scenario 4..... 74

Figure 6-12: Capital Investment for Rail Capacity – Scenario 5..... 74

Figure 6-13: Capital Investment for Rail Capacity – Scenario 6..... 75

Figure 6-14: Rough Order of Magnitude Capital Cost, by Scenario 75

Figure 7-1: AVL Short-to-Medium Term Implementation Plan 81

Figure 7-2: AVL Service Improvement Implementation Plan 85

Figure 7-3: Potential Phased Implementation Schedule..... 87

Figure 7-4: Recommended Capacity Infrastructure Projects 89

Figure 7-5: Potential AVL Connections to Intercity Rail Corridors 93

Figure 7-6: High-Speed Rail Issues and Opportunities in the AVL Corridor 96

Figure 7-7: Decision Tree – Future Long-Term Tradeoffs..... 103

ACRONYMS AND ABBREVIATIONS

AQMD	Air Quality Management District
AVL	Antelope Valley Line
AVTA	Antelope Valley Transportation Authority
BRT	Bus Rapid Transit
BUILD	Better Utilizing Investments to Leverage Development (USDOT competitive grant program)
CAFR	Comprehensive Annual Financial Reports
Metro	Los Angeles County Metropolitan Transportation Authority
Caltrans	California Department of Transportation
CDFW	California Department of Fish and Wildlife
CalSTA	California State Transportation Agency
CEQA	California Environmental Quality Act
CHSR	California High-Speed Rail
CHSRA	California High-Speed Rail Authority
CNNDB	California Natural Diversity Database
CP	Control Point (switching location on the railroad, often defining end point of double tracking)
DMU	Diesel Multiple-Unit
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMU	Electric Multiple-Unit
ESFV	East San Fernando Valley Transit Corridor Project
FTA	Federal Transit Administration
FRA	Federal Railroad Administration
HSR	High-Speed Rail
INFRA	Infrastructure for Redeveloping America (USDOT competitive grant program)
JPA	Joint Powers Authority
KPI	Key Performance Indicator
LA	Los Angeles
LAEDC	Los Angeles County Economic Development Corporation
LAUS	Los Angeles Union Station
LINK US	Capital investment initiative to expand the capacity of LAUS and convert the existing stub-end terminal to a run-through station (formerly known as Southern California Regional Interconnector Project)
LOSSAN	Los Angeles–San Diego–San Luis Obispo Rail Corridor and Joint Powers Authority
LPP	Local Partnership Program (State of California competitive grant program)
LRT	Light Rail Transit
MIRP	Metrolink Infrastructure Rehabilitation Plan
NCTC	North County Transportation Coalition
NEPA	National Environmental Policy Act
O&M	Operations and Maintenance
OTP	On-Time Performance
RCTC	Riverside County Transportation Commission
ROM	Rough order-of-magnitude (as in capital costs)
ROW	Right of way
RTP/SCS	Regional Transportation Plan/Sustainable Communities Strategy (SCAG)
SBCTA	San Bernardino County Transportation Authority
SCAG	Southern California Association of Governments
SCCP	Solutions for Congested Corridors Program (State of California competitive grant program)

ACRONYMS AND ABBREVIATIONS, continued

SCRRRA	Southern California Regional Rail Authority (owner and operator of Metrolink)
SCORE	Southern California Optimized Rail Expansion program
SIP	Strategic Implementation Plan (LOSSAN Joint Powers Authority)
SOGR	State-of-Good-Repair
SRP	State Rail Plan
SWIC	California Historical Resources Information System
TIRCP	Transit and Intercity Rail Capital Program (California State Transportation Agency)
TOD	Transit-Oriented Development
UPRR	Union Pacific Railroad
USDOT	United States Department of Transportation
USFWS	U.S. Fish and Wildlife Service's
VCL	Ventura County Line
VCTC	Ventura County Transportation Commission
VMT	Vehicle-Miles Traveled

EXECUTIVE SUMMARY

metro.net/regionalrail

Next stop: exploring options for the Antelope Valley.

ANTELOPE VALLEY LINE STUDY



Study Purpose

The Antelope Valley Line (AVL) Study (“Study”) was intended to look at increasing the frequency of regional rail service and develop a phased and prioritized approach for capital improvements based on benefits, costs and impacts.

The AVL connects North Los Angeles County, Union Station and the cities in between, and it is currently Metrolink’s third busiest line, carrying approximately 7,000 passengers per weekday. The Study, conducted by Los Angeles County Metropolitan Transportation Authority (Metro) between June 2018 and July 2019, was intended to develop recommendations that support the goals of the Metro Vision 2028 Strategic Plan:

- Goal 1: Provide high-quality mobility options that enable people to spend less time traveling. The incremental service options improve LA County’s overall transit network and assets.
- Goal 4: Transform LA County through regional collaboration and national leadership.

The AVL will play a critical role in unlocking regional mobility, as outlined in the State Rail Plan and Metrolink’s SCORE program. Metro ultimately seeks solutions to realize the full potential of the AVL, serving areas of Los Angeles County that will see strong population and employment growth over the next 20 years.

AVL Study Project Area

The AVL Study project area includes those portions of Los Angeles County where passengers begin their trip to reach an AVL station. The catchment area for a Metrolink station is defined as the area that encompasses 95 percent of the origins and destinations of trips using the station, and these catchment areas were used to define the project area

for this study. Currently, the AVL has a total of twelve stations, all served by Metrolink trains, and two of which are served by Amtrak trains. However, the Study focuses on the nine stations between Burbank and Lancaster. Los Angeles Union Station (LAUS) and the Glendale and Burbank Stations are excluded, because these stations are served by multiple train lines, including the Metrolink AVL, Metrolink Ventura County Line and Amtrak’s Pacific Surfliner. The Study area was divided into three groups of stations:

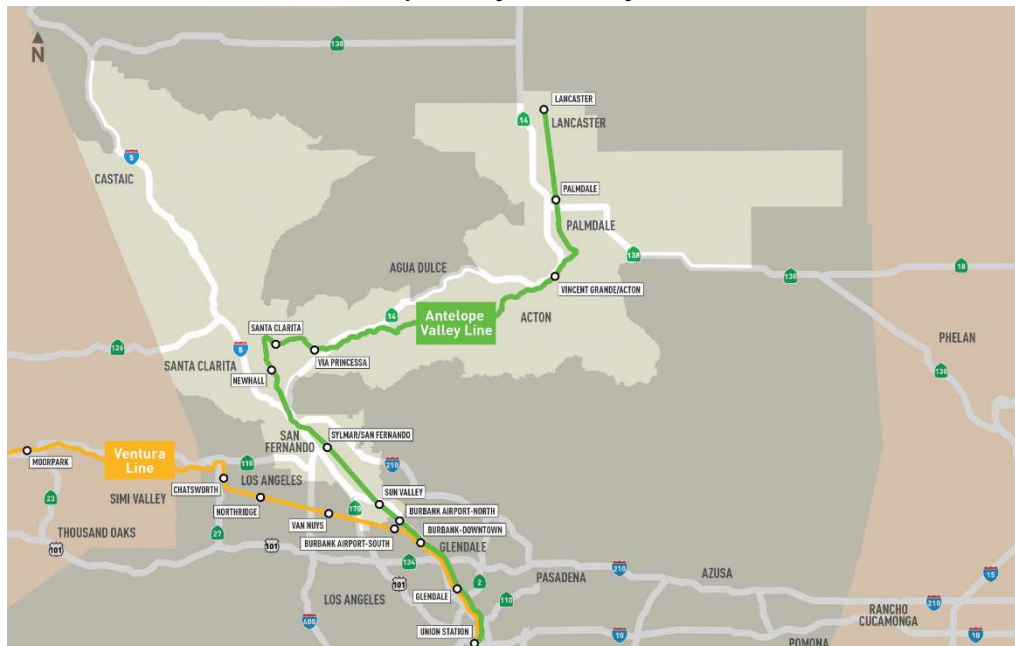
- East San Fernando Valley
Burbank Airport-North, Sun Valley, and Sylmar/San Fernando
- Santa Clarita Valley
Newhall, Santa Clarita, Via Princessa, and proposed new station at Vista Canyon
- Soledad Canyon and Antelope Valley
Vincent Grade/Acton, Palmdale, and Lancaster.

The Study analyzed travel patterns and volumes between these areas and downtown Los Angeles, Glendale and Burbank, as well as travel within the corridor among these groups of stations.

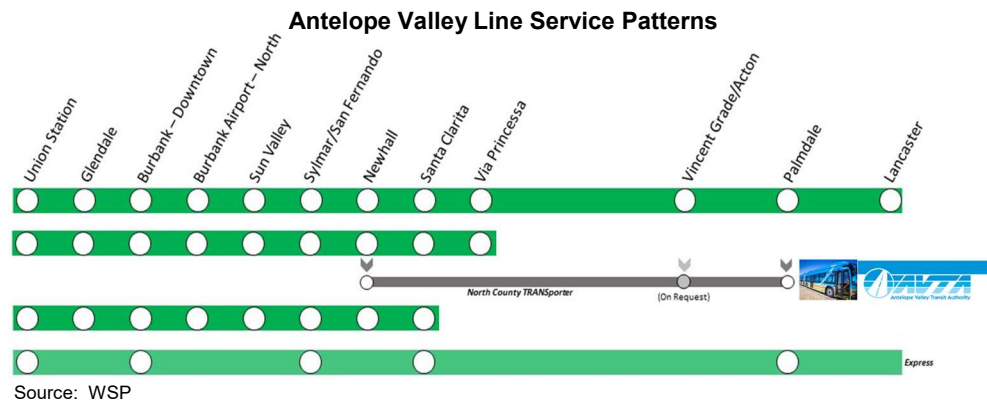
AVL Background / History

The AVL is a 76.6 mile railroad route owned by Metro and used by the Southern California Regional Rail Authority (SCRRA), which operates Metrolink commuter rail service between LAUS and Lancaster. The Union Pacific Railroad (UPRR) operates Class 1 freight service. The route is FRA Track Class 4, with a maximum speed of 79 mph. There are up to 30 Metrolink commuter trains and 12 UPRR freight trains per day on the AVL. The AVL faces a variety of physical and operational challenges, with aging infrastructure, significant grades and curves through mountainous topography. The line is 60 percent single track, which is the principal factor limiting future service expansion. Operating a single track railroad is comparable to having bi-directional traffic on a single lane roadway.

Antelope Valley Line Study Area



Source: Metro



The average speed for the AVL is approximately 40 mph, and the average passenger rail travel time between Lancaster and LAUS with 11 station stops is approximately two (2) hours and 15 minutes. Metrolink operates one weekday express train in each direction between Palmdale and LAUS, offering reduced trip times at select stations, including Burbank Downtown, Sylmar/San Fernando, Santa Clarita and Palmdale. The Antelope Valley Transit Authority runs a bus service that makes five (5) round trips between Santa Clarita and Lancaster, to supplement off-peak train service.

The AVL does not exist in isolation. It is part of the larger Metrolink regional rail system, comprising seven branch lines, including the Ventura County, San Bernardino, Riverside, 91/Perris Valley, Orange County and Inland Empire-Orange County lines in addition to the AVL. Metrolink is part of a multi-modal public transportation network that serves the five counties in the greater LA region and the northern portion of San Diego County (Oceanside).

The Metro Board of Directors passed a resolution in April 2011 to formulate an “Infrastructure Improvement Strategic Plan” for the AVL, with the directive to determine what improvements could be made to the existing line to significantly reduce the travel time between Lancaster/Palmdale and LA, as well as to enhance safety. In March 2012, the results of the Strategic Plan were presented to the Metro Board. Since the completion of this plan six years ago, at least 10 major capital improvement studies have been undertaken for the AVL corridor.

On July 19, 2017, the Metro Board authorized a study of the Metrolink Antelope Valley Line between Burbank and Lancaster and directed staff to coordinate with Metrolink and the North County Transportation Coalition (NCTC) to:

- Determine a range of frequency of service to maximize regional accessibility throughout the day;
- Assess the condition of the existing rail infrastructure (e.g. tracks, culverts, tunnels, crossings, etc.) that limits operational flexibility and service reliability;
- Recommend needed infrastructure and capital improvement costs (in level of priority) along with cost benefit analysis to support the range of frequency of service, service reliability, safety, and on-time performance including latest technologies in rail propulsion, controls and rail stock.

After a period of stagnant ridership following the economic downturn that began in 2008, Metrolink AVL ridership has shown steady year-over-year increases since 2015. This has

been the result of population growth and worsening traffic congestion within the project area and was aided by a Fare Discount Program instituted by Metro for the AVL. In April 2015, the Board approved a motion to reduce fares by 25 percent on the AVL. Since that program’s launch in July 2015, Metrolink ridership on the line has increased by 29 percent as of June 2019. Its current ridership of 7,000 weekday passengers is equivalent to the capacity of one lane of traffic on a major freeway and removes more than 1 million car trips annually from the region’s highways.

By July of 2018, fare revenue from ridership growth on the AVL surpassed Metro’s estimated cost to subsidize the Fare Discount Program. The existing net cost to operate and maintain the Antelope Valley Line is \$34.5 million, with 15 daily round trips using 6 train sets and AVTA bus support to supplement off-peak service between Newhall and Palmdale.

This study focuses on the 65.2 mile portion of the AVL between Burbank Junction and Lancaster Station, which handles 42 train trips per day – 30 Metrolink and 12 Union Pacific Railroad (UPRR) trains – on a single track. Metro is conducting a separate study called the “Glendale-Burbank-LAUS Study” that covers the 11.4 mile portion of the AVL between LAUS and Burbank Junction.

Metro, Metrolink, Amtrak, local transit systems, the California High-Speed Rail Authority (CHSRA) and Virgin Trains USA have future plans that call for increasing integration and coordination of passenger transportation services with high speed rail service proposed at specific Metrolink stations such as Palmdale and Burbank Airport to expand and increase ridership and market demands. UPRR has freight access rights to the AVL. All improvement plans for AVL passenger service considered in this study would preserve the ability of UPRR to provide and expand rail freight service in the corridor.

Stakeholder and Public Engagement

The success of the AVL Study depended on the inclusion and input of the stakeholders in the AVL corridor. The project engaged with and received input and feedback from key stakeholders, including the cities of Palmdale, Lancaster, Santa Clarita, Burbank, and Los Angeles; County of Los Angeles Public Works Department; Metrolink (SCRRA); Antelope Valley Transportation Authority (AVTA); North County Transportation Coalition (NCTC); Hollywood Burbank Airport; CHSRA; and UPRR.

The regional collaboration goal of the Metro Vision 2028 plan was achieved by partnering with SCRRA, NCTC and the

local jurisdictions to identify needed improvements to improve mobility.

Additional input and feedback was obtained from Metrolink riders, by means of an online survey, and community organizations along the corridor such as local chambers of commerce, universities, and business groups.

Alternatives Considered

The AVL Study explored and prioritized various alternatives for capital improvement using a two-step process:

1. Assess the existing conditions of the rail corridor between Burbank Junction and Lancaster Station. This includes identifying existing constraints and measures that increase capacity, reduce overall travel time, enhance the rider experience, and improve safety, reliability and community connectivity.
2. Evaluate and prioritize multiple infrastructure improvement scenarios by applying a cost/benefit approach. This includes identifying potential funding strategies that could help enhance rail operations and commuter rail service along this corridor, and developing recommended incremental service and infrastructure improvements consistent with future rail service plans in the LA region.

Additionally, the study developed and evaluated potential scenarios for improved service on the AVL, including:

- Regular and consistent clock-face scheduling in both directions of travel (i.e. trains operating at regular intervals, at the same time each hour)
- More frequent peak period service
- More frequent reverse-peak and off-peak service
- Introduction of peak express service between Los Angeles Union Station and northern LA County stations, including Palmdale and Lancaster.

Following an initial evaluation of service options, six scenarios were developed for further analysis. A daily service plan, including a hypothetical train schedule, was developed for each scenario. The infrastructure improvements needed for increased capacity were identified for each scenario.

The scenarios cover a range of service levels (i.e., daily trains), capital costs, and operating costs, with Scenario 1 providing the smallest increment of service and cost, and Scenarios 4, 5 and 6 providing the most additional capacity and service at higher levels of cost.

Scenario 1 utilizes existing available rolling stock and railroad infrastructure, adding service during periods of the day when capacity is available to augment Metrolink service. Scenarios 2 and 3 focus on more regular service in both directions of travel during off-peak periods, which is possible with a lower level of capital investment. Scenario 3 offers modest improvements in weekday peak period service.

Scenarios 4, 5 and 6 provide service at regular, repeating intervals throughout the day and include increased weekday peak service, with three trains per hour in the peak direction

of travel and regular hourly service in the reverse-peak direction.

Scenario 1

- One additional late night train from LAUS on Friday and Saturday evenings

Scenario 2

- Two additional mid-day round trips, in addition to the late night Friday and Saturday train

Scenario 3

- Expansion of mid-day off-peak service to semi-hourly between LAUS and the Santa Clarita Valley and hourly between LAUS and the Antelope Valley; plus one late night train Monday through Saturday.

Scenarios 4, 5 and 6

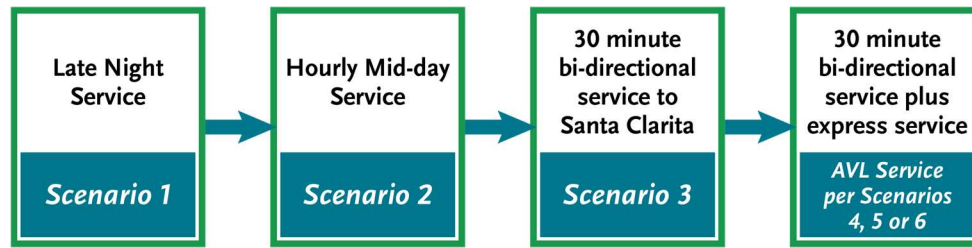
These three scenarios comprise three different service patterns that deliver the same overall level of service:

- 3 train slots per hour at regular clock face intervals during weekday peak periods – two local and one express
- Regular hourly reverse-peak service during weekday peak periods
- Weekday off-peak service at semi-hourly intervals between LAUS and the San Fernando and Santa Clarita Valleys, and hourly intervals between LAUS and the Antelope Valley
- Late night service from LAUS to the AVL, with one late night train Monday through Thursday and two late night trains on Fridays and Saturdays
- Weekend service at regular hourly intervals on Saturdays and regular bi-hourly intervals on Sundays and holidays.

During the weekday peaks, every AVL station would be served by at least two trains per hour in the peak direction and one train per hour in the reverse-peak direction. Express stations would be served by three trains in the peak direction during the weekday peaks.

The differences among Scenarios 4, 5 and 6 are as follows:

4. Intermediate turnback service at Vista Canyon; express hub at Santa Clarita; bunched outer-zone trains (local closely follows express inbound and express closely follows local outbound in the Antelope Valley and through Soledad Canyon)
5. Intermediate turnback service at Vista Canyon; express hub at Santa Clarita; spread-out outer-zone trains (local and express trains are spaced 30 minutes apart in the Antelope Valley and through Soledad Canyon)
6. Intermediate turns and express hub at Sylmar; spread-out outer-zone trains similar to Scenario 5.



Source: WSP

The scenarios imply phased implementation, with Scenario 1 as a low-cost starting point, Scenarios 2 and 3 building incrementally from Scenario 1, and Scenarios 4, 5 and 6 representing alternative concepts for the next increment beyond Scenario 3. These incremental phases provide for flexibility, allowing service expansion and capital investment to proceed as demand for rail service on the AVL builds and as funding for construction and operations is identified and made available. These scenarios offer a range of service levels to all travel markets along the AVL, in both the peak and reverse-peak directions of travel.

The service plans for the six (6) service scenarios were analyzed to determine where additional railroad capacity would be needed to enable trains running in opposite directions to pass each other, and where yard storage would need to be increased to accommodate a larger rolling stock fleet serving the AVL. The number of discrete capital projects required and total estimated costs for each scenario are shown in the table below.

Likewise, incremental annual operations and maintenance (O&M) costs are estimated, based on the low end of the range of total weekday round trips shown in the table.

Service Scenario Characteristics and Estimated Costs

Characteristic	Existing	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Weekday Total Round Trips ⁵	15	15-16	17-18	19-30	31-36	31-36	31-36
Daily Round Trips ⁵ (Trains/Hour)							
Serving San Fernando Valley	14 ² (n/a)	14-15 ² (n/a)	16-17 ² (1 ¹)	25-28 ² (2 ¹)	30-33 ² (2)	30-33 ² (2)	30-33 ² (2)
Serving Santa Clarita Valley	15 (n/a)	15-16(n/a)	17-18 (1 ¹)	27-30 (2 ¹)	33-36 (3)	33-36 (3)	18-21 (2)
Serving Antelope Valley	10 (n/a)	10-11 (n/a)	14-15 (1 ¹)	17-20 (1 ¹)	18-21 (2)	18-21 (2)	18-21 (2)
Saturday Round Trips	6	7	7	14	15	15	15
Sunday/Holiday Round Trips	6	6	6	7	7	7	7
Revenue Trainsets Required	6	6	7	8	11	11	10
Peak Service	--	Retain Existing	Retain Existing	Retain Existing	Enhanced	Enhanced	Enhanced
Off-Peak Service at Regular Clockface Intervals	--	Hourly	Hourly	Semi- ³ Hourly	Semi- ³ Hourly	Semi- ³ Hourly	Semi- ³ Hourly
Additional Late Evening Trains Outbound from LAUS Mon-Thu / Fri-Sat	--	0 / 1	0 / 1	1 / 2	1 / 2	1 / 2	1 / 2
More Frequent Peak Service	--	No	No	Yes	Yes	Yes	Yes
Additional Peak Express Service	--	No	No	No	Yes	Yes	Yes
Regular Reverse-Peak Service	--	No	No	No	Yes	Yes	Yes
Number of Required Capacity-Related Capital Projects	--	0	1	4	9	8	9
Estimated Capital Cost ⁴ (\$M 2018)	--	\$0	\$41.8	\$175.2 (\$184.2)	\$328.9 (\$340.9)	\$428.6 (\$440.6)	\$448.7 (\$457.7)
Incremental Annual Revenue-Hours	--	440	3,257	9,109	14,236	14,591	10,806
Incremental Annual O&M Cost (\$M 2018)	--	\$0.41	\$3.30	\$6.23	\$10.98	\$10.98	\$7.02

1 Regular slots exist only in off-peak hours in Scenarios 2 and 3. Peak period service in the peak direction of travel is more frequent but irregular.
 2 Does not count peak Express train(s), which stop in the San Fernando Valley only at Sylmar/San Fernando and Downtown Burbank.
 3 30-minute headways LAUS to Santa Clarita Valley; hourly headways to Lancaster.
 4 The higher capital cost figures (shown in parentheses) also include light maintenance and inspection facilities at the Lancaster Terminal.
 5 Range of daily trains accounts for potential utilization of off-peak slots by freight trains or intercity passenger trains of operators other than Metrolink.
 Source: WSP

Study Findings

The Antelope Valley Line (AVL) Study identified a logical short to mid-term program of investments in railroad capacity and improvements in rail service that can be implemented incrementally in phases. The following service improvements on the AVL are envisioned by 2030, subject to the availability of funding.

- Number of weekday round trips increased from 15 to 30
- Typical trip times reduced between the Antelope Valley and Los Angeles Union Station (LAUS) by 8-9 minutes
- Marginal peak service frequency and one additional morning express train
- Modest improvement in reverse-peak service early in the weekday AM and PM peak periods
- Greatly-expanded mid-day service, with regular 30-minute service between LAUS and Santa Clarita and regular hourly service between LAUS and the Antelope Valley
- Later evening departures from LAUS
- Increased weekend service frequency, with regular hourly service on Saturdays and bi-hourly service on Sundays and holidays

This plan is realistic and achievable. It includes two rounds of capital investment in selected key projects to increase railroad capacity, allowing tangible improvements in service to be realized in multiple steps, at a reasonable cost. At this time, no capital funds have been identified to initiate capital investment in railroad infrastructure. Metro will continue to seek Local, State and Federal funds to deliver the infrastructure investments.

Phased Implementation

While service improvements can be made gradually in incremental steps, as demand for rail service increases, the capital projects to increase AVL capacity create milestones for service growth and a framework within which service improvements can be structured. The three phases of service improvement include:

Phase 1 (within five years, depending on funding)

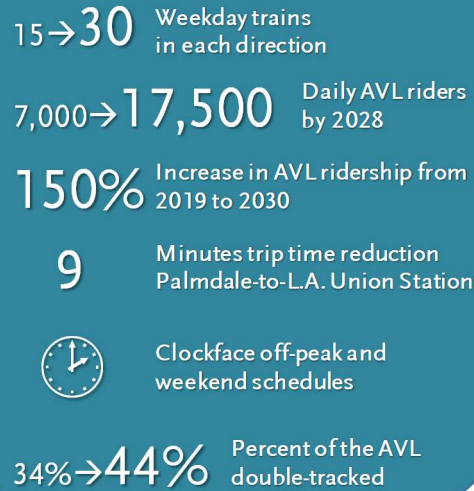
- Adds late-night train departure from LAUS at 10:30p.m. Fridays and Saturdays
- Potentially adjusts off-peak schedules to improve service frequency and reduce schedule gaps

Phase	1	2	3
Additional AVL Service	Additional Late Evening Train; Off-Peak Service Adjustments	Additional Mid-day Trains (Hourly Service)	2nd Round of Capital Projects
	Initial Capital Project		Lancaster Terminal; Canyon-Sta. Clarita Brighton-McGinley
	Balboa to Tunnel 25		Regularized 30-Minute Off-Peak Headways; Improved Peak Service
Existing: 6 Trainsets 15 daily round trips	6 Trainsets 16 Daily round trips	7 Trainsets Up to 18 Daily round trip slots	8 Trainsets Up to 30 Daily round trip slots

Source: WSP

Antelope Valley Line Study

AVL Plan By the Numbers



Phase 2 (within five to ten years, depending on funding)

- Adds two mid-day service round trips to provide hourly frequency between LAUS and the Santa Clarita Valley.
- Hourly frequency between LAUS and the Antelope Valley, including connecting bus service from Santa Clarita to the Antelope Valley every second hour by Antelope Valley Transit Authority.
- Allows for expanding late night service to remaining weekdays and adds a second frequency on selected days, based on ridership demand.

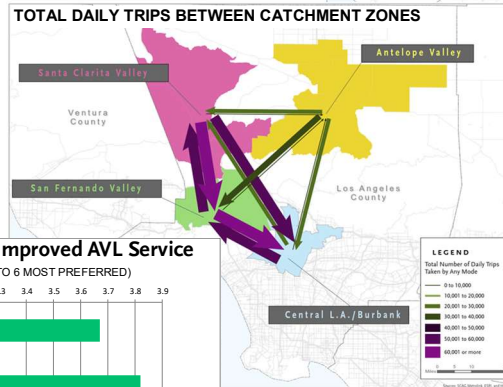
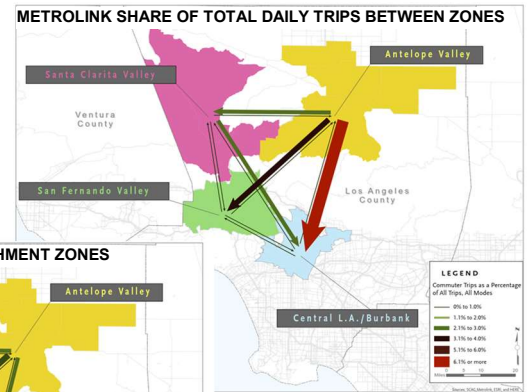
Phase 3 (within ten to twenty years, depending on funding)

- Doubles volume of daily trains compared with existing
- Marginally increases peak service frequency and adds a second morning express train to LAUS
- Provides more regular reverse-commute service
- Further increases mid-day service frequency – 30 minutes between LAUS and Santa Clarita Valley; hourly between LAUS and Antelope Valley
- Provides more frequent and regular service on weekends and holidays

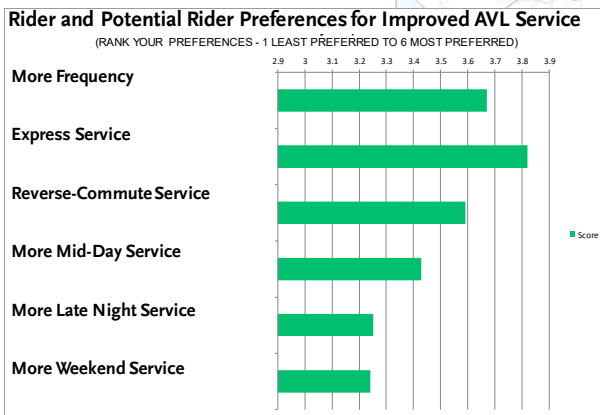
The timeline for implementation the three phases can be shortened if the pace of capital funding can be accelerated.

Travel Markets

The AVL today primarily serves commuters from the Antelope Valley and Santa Clarita Valley to central Los Angeles, with secondary commuter markets to Glendale, Burbank and other locations in the San Fernando Valley. The automobile currently is the dominant mode for trips among the four geographic areas served by the AVL – the Antelope Valley, Santa Clarita Valley, San Fernando Valley and Central Los Angeles/Burbank. The AVL will need to carry a significantly higher share of these trips in the future, as Study Area population and employment grows and AVL ridership increases at a projected rate of over 9 percent per year.



Source: SCAG daily trip data.

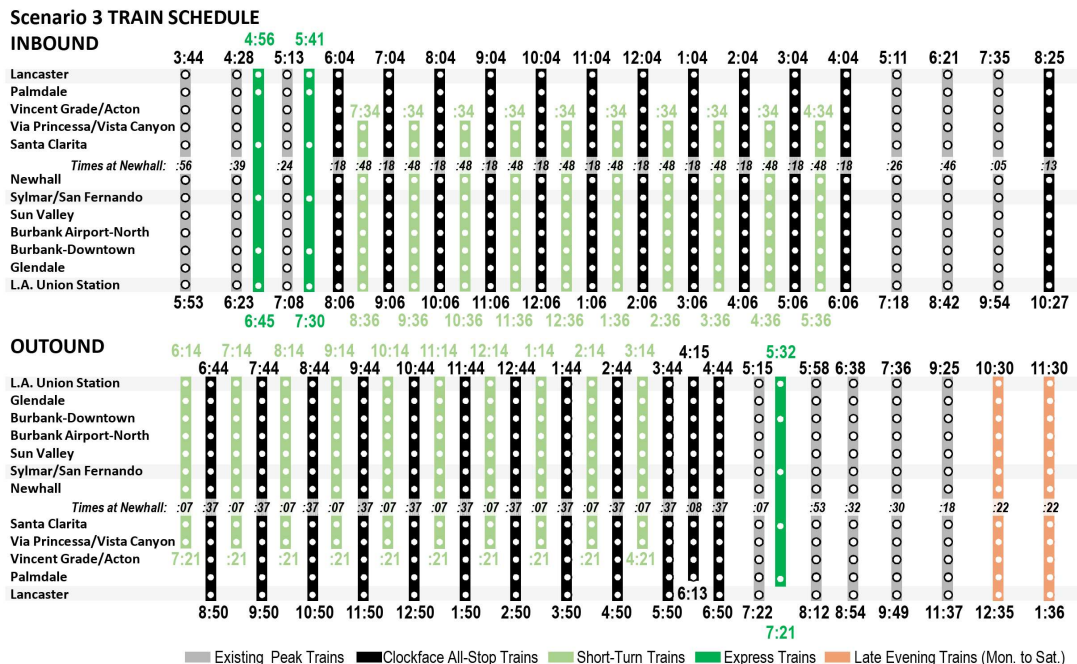


A Spring, 2019 survey of Metrolink riders and corridor residents showed strong support for improved and expanded bi-directional service for peak and off-peak travel.

Operational Characteristics

Rail service on the AVL is anticipated to double by 2030, with 30 daily round trips and trains through most of the day operating at regular time intervals each hour. The number of trainsets required to operate the service would increase from six today and in Phase 1, to seven in Phase 2, and eight in Phase 3. Requirements for train crews, diesel fuel and equipment maintenance would increase in each phase, adding to the level of annual operations and maintenance cost. These costs would be partially offset by increased fare revenue but would increase the required operating subsidy.

Hypothetical AVL Timetable – Scenario 3 Achievable by 2030



Source: WSP

future potential operators (Amtrak–Pacific Surfliner, California High Speed Rail Authority or Virgin Trains USA).

Infrastructure

Existing physical characteristics of the AVL constrain its ability to accommodate future growth in rail passenger service. These constraints include the extensive amount of single-track railroad (over 66 percent of the AVL’s total route-miles), three tunnel segments with single track and limited vertical clearance (including the 1.3-mile long Tunnel 25 between Sylmar and Santa Clarita), and multiple tight curves and steep grades resulting in relatively slow travel speeds.

The rail infrastructure capacity projects needed to deliver the track capacity necessary for the service scenarios include potential double-tracking of portions of the line that are currently single track, extension of passing sidings, additional platforms at stations, expanded train storage and maintenance facilities, and improved signaling systems. Investment to support each phase of improved service on the AVL includes the following significant projects:

Phase 1

- None

Phase 2

- Double-track extension, Balboa to Sierra Highway, extending double track by over 6,300 ft. and shortening the single track segment through Tunnel 25

Phase 3

- Double-track extension, Brighton to McGinley, including over 15,300 ft. of new double track, plus second station platforms at Burbank Airport-North and Sun Valley

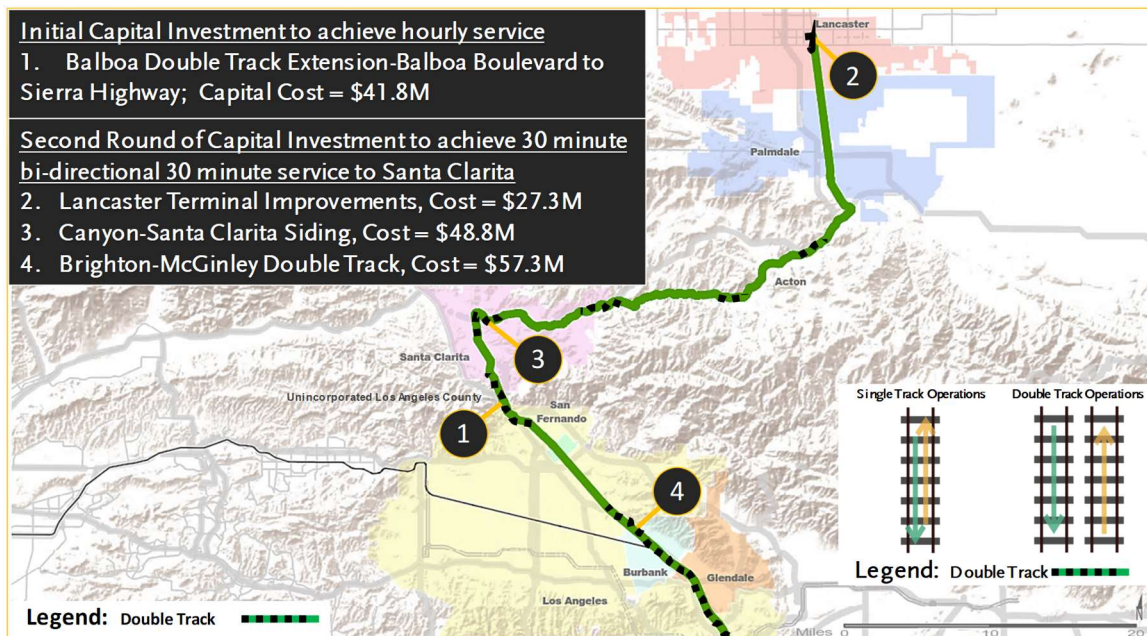
- Canyon to Santa Clarita Double Track Extension, from Soledad Canyon Road to Golden Oak Road for 8,400 ft., plus second station platform at Santa Clarita
- Lancaster Terminal Improvements, including expansion of the yard with two new 1,000 ft. long train storage tracks, plus a second station platform at Lancaster station.

The proportion of the line with single main track will be reduced from 66 percent to 58 percent, if these four capital projects are constructed.

The total estimated capital cost for the four capacity projects is \$175.2 million (in 2018 dollars). The initial capital project to support Phase 2 requires \$41.8 million and a remaining \$133.4 million will be needed to complete the projects required for Phase 3 service.

The capital projects and costs developed in the AVL Study are only those needed to increase the capacity of the railroad to support future improved rail service. Additional capital investment will be needed in the same timeframe to renew infrastructure assets and bring them to a state of good repair (SOGR), improve safety, security and operational reliability, expand and improve stations, and improve the customer experience. The AVL plan also will need to be supported by Metrolink’s system-wide program for modernizing and expanding the rolling stock fleet and facilities for rolling stock maintenance.

Examples of additional investment for other purposes that could make sense for the AVL include a light maintenance facility at Lancaster or other location along the line, safety-related improvements such as elimination of highway grade crossings or provision of grade-separated pedestrian crossings at AVL stations with multiple platforms, or capital projects to bring infrastructure assets such as bridges and tunnels up to a state of good repair.



Source: WSP

Future Potential

Passenger service today on the AVL serves regional travel markets and is focused on commuter travel between corridor communities and downtown Los Angeles. In the future, the corridor is envisioned as serving longer-distance trips within Southern California, as well as intercity trips that utilize high-speed rail connections beyond the region.

The potential AVL service improvement and capital investment program developed in the AVL Study is consistent with the longer-range vision contained in the State Rail Plan and compatible with potential future blended service with Metrolink, California High-Speed Rail (CHSRA), Virgin Trains USA and/or Amtrak. These improvements are an important first step towards a future vision of AVL service that is more transit-like in its characteristics and serves multiple markets – beyond just weekday peak commuting to workplaces in downtown LA

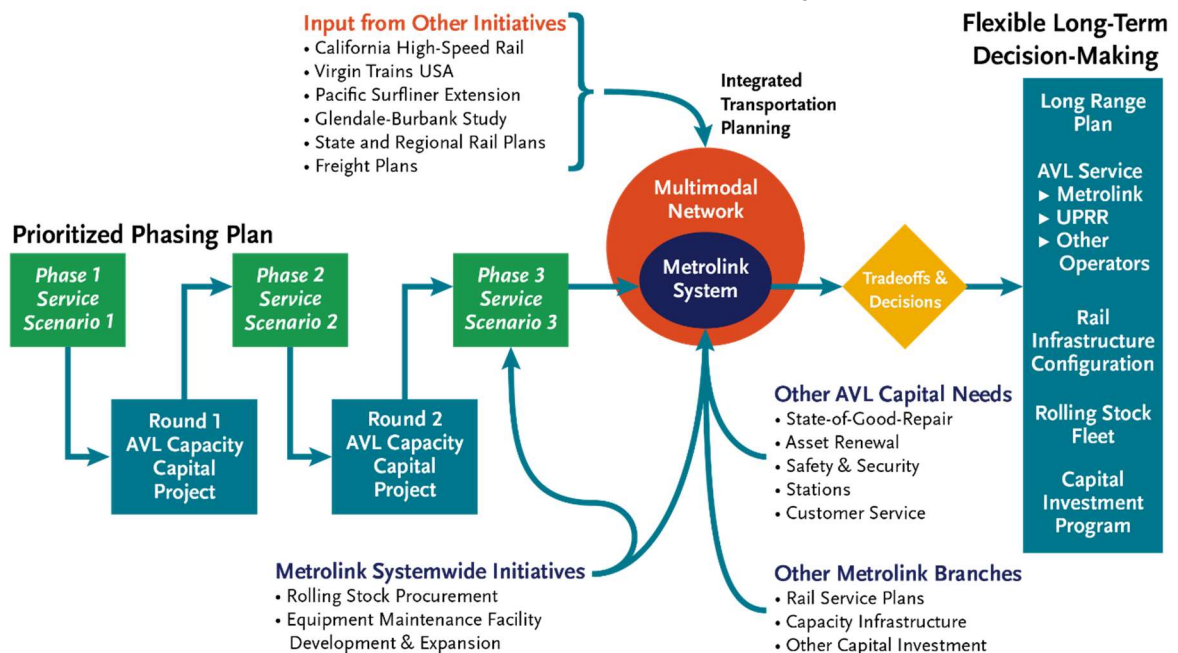
Dramatic improvements in weekday peak and reverse-peak service – including increasing the frequency of both local and express service and running trains at regular, predictable intervals – will be achievable only with more extensive capital investment in double-tracking the AVL to permit trains running in opposite directions to pass each other more frequently. This remains the longer-term goal for the AVL.

The longer-range service scenarios analyzed in the AVL Study provide one slot per hour all day long for limited-stop express trains between LAUS and Palmdale/Lancaster, which is capacity that can be used during off-peak periods by other passenger train operators and by UPRR freight trains. Capital investment on the AVL beyond the level analyzed in the AVL Study could be triggered by increased intercity demand, the potential for faster speeds and shorter trip times to benefit both intercity and regional travelers, or by a decision to upgrade the AVL rolling stock fleet to equipment with improved performance characteristics.

Next Steps

If funding is identified, the AVL service improvements will be able to move forward towards implementation. The following actions by SCRRA, LA Metro and AVL corridor stakeholders are recommended:

- Integrate AVL incremental capital projects and service improvements into Metrolink system-wide plans
- Identify service improvements that can be made in advance of the completion of capacity-related infrastructure projects
- Confirm high-priority early capital projects and advance these projects through project definition, design and environmental impact assessment
- Undertake further planning and analysis to enable informed future decision-making about
 - Extension of Amtrak Pacific Surfliner service onto the AVL
 - Metrolink and high-speed rail (HSR) blended service on the AVL
 - Addition of high speed intercity rail service onto the AVL
 - Reserving or acquiring right-of-way in the AVL Corridor for multiple transportation purposes, including AVL regional rail, freight, other intercity passenger services and urban transit
 - Weekday peak service patterns on the AVL
 - AVL rolling stock and fleet maintenance facilities
 - AVL stations and local and regional transit connections
- Develop a funding plan for AVL capital investment and service growth
- Continue collaboration and outreach among stakeholder organizations and with the public.



Source: WSP

Antelope Valley Line Study

In July of 2019, the Metro Board authorized the following actions, based on the findings of the Study, to implement improved service on the AVL:

- A. Support for phased implementation of Scenarios 1, 2 and 3 and prioritization of the Balboa Siding Project, to open up the expedited delivery of hourly commuter rail service between North Los Angeles County and Los Angeles Union Station
- B. Coordination with Metrolink on the phased implementation of Scenarios 1, 2 and 3 and the inclusion and prioritization of the capital projects detailed therein as part of Metrolink's SCORE program
- C. Programming of \$6.6 million in unprogrammed FY18-22 Multi-year Subregional Programming (MSP) Transit Program funds and \$6.15 million in FY23 MSP Transit Program funds from the North County Subregion, in order to bring the capital projects included in Scenarios 1 through 3 to "shovel-ready" status
- D. Coordination with Metrolink on a discretionary grant strategy, and with the North County Subregion on additional local funding options that could be leveraged, to fully fund the remaining construction costs of the capital projects included in Scenarios 1 through 3
- E. Support for implementation of a diesel, electric, battery electric, or hybrid multiple unit train pilot program on the AVL, and coordination with Metrolink in the pursuit of grant funding opportunities that focus on the offsetting of mobile source pollution in order to implement the pilot program
- F. Partnering with Metrolink to engage appropriate state agencies and the private sector on additional strategies, implementing the above directives, to unlock the service potential of the AVL in support of the integrated service goals laid out in the State Rail Plan.



Source: SCRRRA



Source: Metro

1 INTRODUCTION

The Antelope Valley Line (AVL) is the route used by the Southern California Regional Rail Authority (SCRRRA) running Metrolink commuter rail service and Union Pacific Railroad (UPRR) running freight service between Los Angeles Union Station (LAUS) and Lancaster. This 76.6-mile long commuter line is the only Metrolink route that operates entirely within Los Angeles County. The inner portion of the route, covering 11.4 miles between LAUS and Burbank Junction (Jct), is shared with Metrolink's Ventura County Line and Amtrak's Pacific Surfliner and Coast Starlight services. On the remaining 65.2-mile portion of the AVL beyond Burbank Junction, there are up to 42 train movements per day (30 Metrolink commuter trains and 12 UPRR freight trains), on a line that has only a single track along approximately two-thirds of its length. The AVL Study ("Study") focuses on the portion of the AVL between Burbank Junction and the Lancaster Station. The Regional Rail department of the Los Angeles County Metropolitan Transportation Authority (Metro) has conducted a separate study called the *Glendale-Burbank-LAUS Study* that covers the portion of the line between LAUS and Burbank Junction.

The average speed on the entire AVL is approximately 40 miles per hour (mph). Average passenger rail travel time between Lancaster and LAUS is approximately two hours, 15 minutes, for full-corridor trips. The AVL is currently Metrolink's third-busiest line and is facing a variety of service challenges due to its aging infrastructure, significant grades, curves and topography, and preponderance of single-tracking.

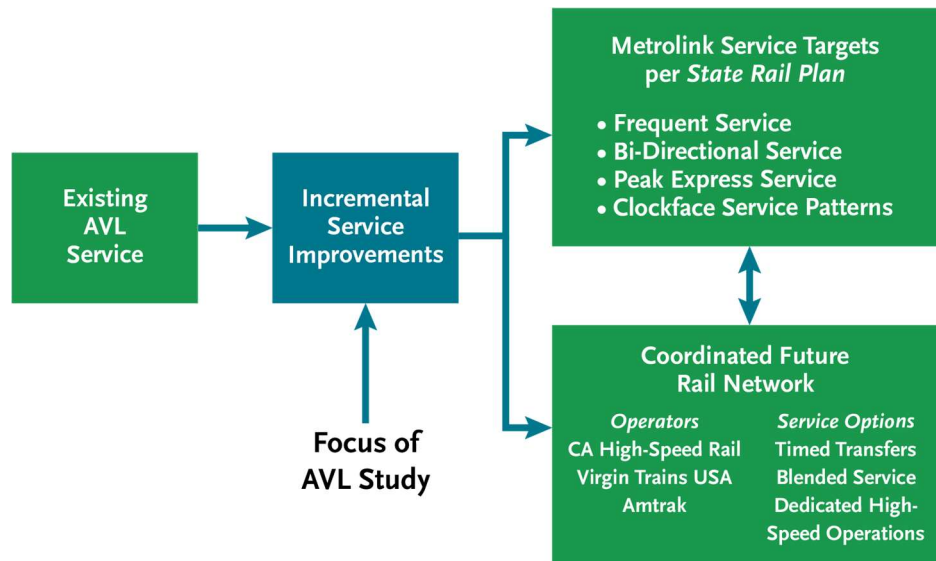
1.1 Study Purpose

The Los Angeles County Transportation Authority (Metro) sought solutions to realize the full potential of the AVL. The purpose of this study was to assess the existing conditions of the corridor between Burbank Junction and Lancaster Station, identify infrastructure improvements to enhance service frequency, travel speeds, and reliability, and evaluate a series of potential service scenarios and define the most cost-effective infrastructure investments necessary to support them. Further, this study also evaluated and prioritized multiple infrastructure improvement scenarios, developed a phased implementation plan and identified and assessed potential funding strategies.

The focus of Metro's AVL Study is on initial investments and incremental improvements to rail service on the AVL. Figure 1-1 shows where the AVL Study fits in the broader framework of corridor and regional rail system planning. The study takes a layered approach to incremental capital investment, supporting tangible incremental improvements in service as packages of capital projects are completed to increase the line's capacity. This approach offers the potential for near-term improvement in service, with a reasonable level of investment, while remaining consistent with the State Rail Plan's 2040 longer-range vision for regional rail service.

The full program of investments and set of decisions needed to achieve the 2040 long-range goals for regional and intercity rail service cannot be achieved all at once. The intent of the AVL Study is to define the initial steps, in terms of capital investment and improved rail service, that will set the AVL corridor on a trajectory to achieve the State's and region's ambitious 2040 long-term goals for rail transportation. This study defines a sequence of possible investment steps to achieve tangible benefits for travelers in the corridor. Decisions about which steps to take, and how fast to take them, will need to be made by the stakeholders involved in funding capital improvements and supporting the operation of new service for the AVL. The pace at which these steps can be taken depends primarily on the availability and magnitude of capital and operating funding – which comes from multiple sources and is not solely within the purview of Metro. This study defines reasonably small initial steps, that potentially can be implemented using available capital resources, while also moving incrementally in the direction of the 2040 long-range vision.

Figure 1-1: AVL Study Role



Source: WSP

1.2 Objectives, Assumptions and Study Scope

A primary objective of this study is to identify existing constraints that, if addressed, can reduce overall travel time and improve the ridership experience, while improving regional rail services, safety, reliability, and community connectivity. A further objective of the study is to develop priorities for incremental rail service increases and infrastructure improvements, which are consistent with the vision for rail service in the greater Los Angeles region – specifically Metrolink’s Southern California Optimized Rail Expansion (SCORE) program – as well the State’s vision for statewide intercity and regional rail service as presented in the 2018 SRP.

Key elements consistent with the vision for rail service in the region that were examined in the study include:

- Regular clock-face scheduling in both directions of travel (i.e., trains operating at regular intervals, at the same time each hour)
- Peak service frequencies on the inner portion of the line between the Burbank and Santa Clarita stations at 30 minutes by 2023, and ultimately to 15 minutes
- Regular service frequencies to the north Los Angeles County cities along the AVL, including Palmdale and Lancaster, at one hour, leading ultimately to 30-minutes, plus hourly peak express service to LAUS in the peak direction of travel
- Additional late night and weekend service
- Rail infrastructure projects to deliver capacity necessary for the above service levels.

The scope of the Study examined opportunities to enhance rail service between the Burbank and Lancaster stations along the AVL, the line’s operations with existing infrastructure and with potential enhancements, and infrastructure improvements that would mitigate existing operational constraints. The Study also examined the feasibility and relative merits of alternative service enhancements, specifying the additional capacity improvements necessary to support improved service. A phased strategy was then developed for prioritizing investments and building capacity to realize incremental service improvements, based on benefits and costs. The scope of the Study with respect to defining

capital projects was limited to those projects needed to increase capacity. This represents just one of several categories of capital investment that are important for sustaining and improving regional rail service in the AVL corridor and on the Metrolink system.

Notwithstanding the Study's focus on capacity, Metro is committed to safety as the highest priority for capital investment and operations on the AVL. Projects that invest in increased capacity will be based on design standards that reflect industry best practices with respect to safety, security, constructability and maintainability. Wherever possible, the design of capital projects will look to enhance safety and restore infrastructure assets to a state of good repair, in addition to increasing the line's capacity.

The geographic scope of capital investments considered in the AVL Study includes the portion of the rail line between Burbank Junction and Lancaster, where the only passenger trains currently operating are those of Metrolink. The portion of the line between Burbank Junction and LAUS, which is shared with Amtrak and Metrolink Ventura County Line services, is the subject of a separate study by LA Metro.

1.3 Study Participants and Stakeholder/Public Engagement

The participation of stakeholders in the Metrolink AVL corridor during the process of formulating service and infrastructure improvement strategies for the AVL Study was crucial to the success of the Study. Key stakeholders in this process included the Antelope Valley Transportation Authority (AVTA), City of Palmdale, City of Lancaster, City of Santa Clarita, County of Los Angeles Public Works Department, Metrolink and the North County Transportation Coalition (NCTC). Other stakeholders made aware of the Study included the City of Burbank, Hollywood Burbank Airport, City of Los Angeles, California State Transportation Agency (CalSTA), Los Angeles-San Diego-San Luis Obispo Rail (LOSSAN) Corridor Agency, California High-Speed Rail Authority (CHSRA) and UPRR.

From the beginning, it was recognized the success of the Study would depend on the inclusion and input of stakeholders. An engagement plan was developed at the beginning of the Study to ensure stakeholders had numerous opportunities to collaborate and provide input from early in the process, and consistently throughout the duration of the Study. Through the process of developing the Study, stakeholders received regular updates of the progress being made.

There was a kickoff meeting with the stakeholders to introduce the scope and objectives of the Study, followed by three workshops in December 2018, February and May of 2019 to share preliminary findings and seek feedback for the report. The stakeholders also received updates of the progress of the Report during NCTC Board meetings, Northern Corridor Cities meeting, San Fernando Valley Transportation of Governments' Transportation Committee meeting and on Metro's regional rail webpage. The roundtable format of the workshops allowed stakeholders to provide feedback during the meeting while materials were explained and discussed. Stakeholder feedback informed the development of the series of potential service scenarios. In addition to stakeholders, the public was engaged for feedback on the AVL through an on-board and on-line survey.

Metro, in collaboration with Metrolink, conducted a survey to gather information from riders regarding potential service changes and improvements on the AVL for two separate Metro studies. The questions sought feedback on preferences on late night, mid-day, weekend, peak express and peak service stopping at all stations types of service. Feedback was also sought on the importance of having departures at regular intervals (11:00 a.m., 12:00 p.m., etc.), and potential new station stops in the City of Glendale, and near the neighborhood of Cypress Park, in the City of Los Angeles, in support of the companion study being conducted on the southern portion of the line. The survey results were presented in a summary report.

2 EXISTING CONDITIONS

2.1 Regional Growth and Economic Development

The AVL operates entirely within Los Angeles County, and it provides access to the rest of the Southern California region with direct connections to the rest of the Metrolink system and Amtrak services, through LAUS. During the last ten years, the Southern California region, and Los Angeles County, have experienced steady economic and population growth. The five-county Los Angeles region, which overlaps with the Southern California Association of Governments (SCAG) region (minus Imperial County), has been the nation's fourth largest economy in comparison with states, ranking only behind California as a whole, Texas and New York. In addition, the larger regional area of Southern California is estimated to be the 16th largest economy in the world (SCAG 2017a). In particular, Los Angeles County has experienced exceptional growth since the great recession of 2008-2010. In the last ten years, Los Angeles County's population growth rate was 7 percent, from 9.7 million inhabitants to 10.3 million. SCAG anticipates that the county will have 11.5 million inhabitants by 2040, according to SCAG's Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

Total value of goods and services data from the California Bureau of Economic Analysis agency shows that Los Angeles County produced the largest amount of goods and services of any county in the United States, in 2015, contributing \$656 billion in gross domestic product, or 27 percent of California's economic output (Bloomberg, 2019). Los Angeles County also serves as the entertainment capital of the country, and is considered the nation's gateway for international trade, with two of the largest ports in the nation at Los Angeles/Long Beach. In addition, Los Angeles County continues to be largest manufacturing center in the U.S. with over 380,000 manufacturing jobs (SCAG 2017a). The AVL serves some of the clusters with these jobs, and offers connectivity options to reach other areas with high concentrations of jobs and economic activity.

The travel market assessment looked more closely at the travel pattern trends of markets served by the AVL, including for commuters accessing job opportunities fueling the economic growth of the region, among other general travel markets. Current physical and operating conditions on line are also reviewed in this chapter.

2.2 Rail Service

2.2.1 Role of Metrolink Commuter Rail and the Antelope Valley Line in the Regional Transportation Network

SCRRA is a joint powers authority (JPA) formed in 1991, comprising five Southern California county agencies: Metro (formerly LACTC), Orange County Transportation Authority (OCTA), Riverside County Transportation Commission (RCTC), San Bernardino County Transportation Authority (SBCTA) (formerly San Bernardino Associated Governments (SANBAG)), and Ventura County Transportation Commission (VCTC). SCRRA created Metrolink in October 1992 to fill a void in Southern California's transportation infrastructure. Currently, the Metrolink commuter rail system comprises seven routes, 61 stations, and 540 route-miles. Metrolink's passengers travel approximately 441 million passenger miles each year, making Metrolink the second busiest public transportation provider in Southern California. Metrolink is the third largest commuter rail agency in the United States based on directional route miles and the eighth largest based on annual ridership (SCRRA, 2018).

Figure 2-1 shows a map of the Metrolink network, including the AVL in the north of the system. The AVL runs between Los Angeles and Lancaster on the former Southern Pacific Valley Line, which parallels Interstate 5 (I-5), turns east, then north, to parallel State Route 14 (SR 14), connecting several cities in

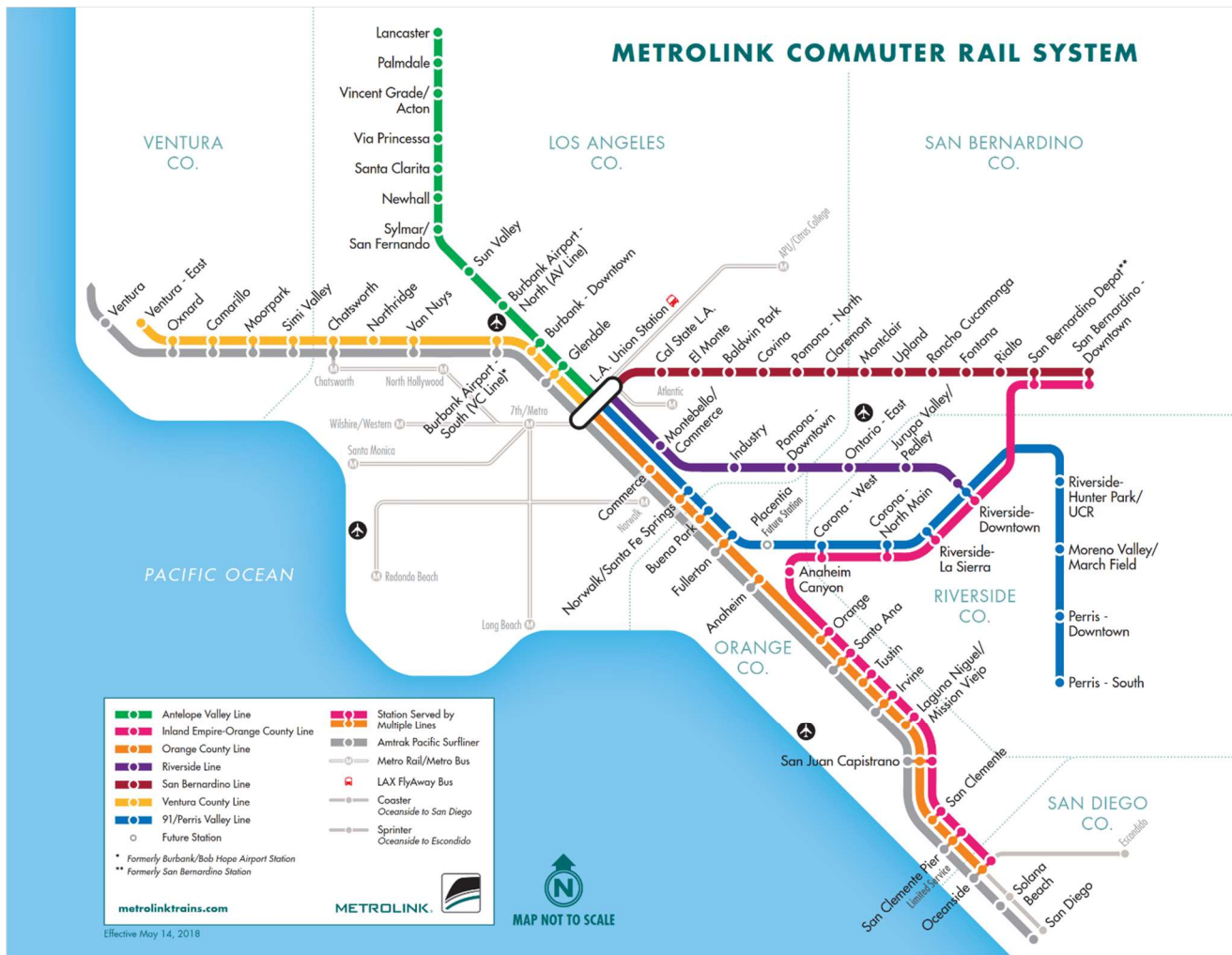
between. Revenue service began May 14, 2018 at the AVL’s Burbank Airport – North station, bringing the number of Metrolink stations on the line to 11 between LAUS and Lancaster (not including LAUS). Today, there are 30 weekday trains, 12 Saturday trains, and 12 Sunday trains serving the AVL.

Metrolink, in turn, is part of a multi-modal public transportation network that serves the greater Los Angeles region. Metrolink is the only service that spans the entire region and serves each of the five counties (and also provides a connection at Oceanside to San Diego County). Though its role and the focus of its service has been on weekday peak period commuting, primarily to downtown Los Angeles, Metrolink has the potential to serve as the spine of a regional network that connects residents with workplaces and serves other travelers across the entire region.

2.2.2 Rail Freight

In addition to Metrolink commuter service, the UPRR runs freight trains on the AVL corridor between the Central Valley and the Ports of Los Angeles and Long Beach within the Los Angeles area. This 75-mile corridor runs at-grade through the San Fernando Valley, turning east to roughly follow the SR-14 corridor to Palmdale. The route has numerous at-grade crossings, tunnels, and slower speed curves through the mountains between Sylmar and Lancaster.

Figure 2-1: Metrolink System Map



Source: SCRRR Website. About Agency Webpage. Metrolink System Map effective May 14, 2018.

2.3 Rail Infrastructure, Stations, Rolling Stock and Facilities

The AVL was purchased by Metro from the Southern Pacific Railroad (predecessor to UPRR) in 1992, and began commuter rail operations between LAUS and Santa Clarita in October of that year. Service was extended to Lancaster in 1994 following the Northridge Earthquake to help alleviate commuter traffic congestion resulting from a collapsed freeway connector of SR 14 to I-5 (SCRRA, 2018).

The AVL operates on the Metrolink River Subdivision from LAUS to CP Taylor, in the City of Los Angeles, and then on the Metrolink Valley Subdivision from CP Taylor to the City of Lancaster, for a total of 76.6 miles. Trains travel railroad west toward Lancaster and railroad east toward LAUS, based on the original Southern Pacific system orientation with San Francisco as its headquarters. An end-to-end trip takes approximately two hours, 15 minutes on the current schedule. The Study focuses on the 65.2-mile portion of the AVL between Burbank Jct and the Lancaster Station.

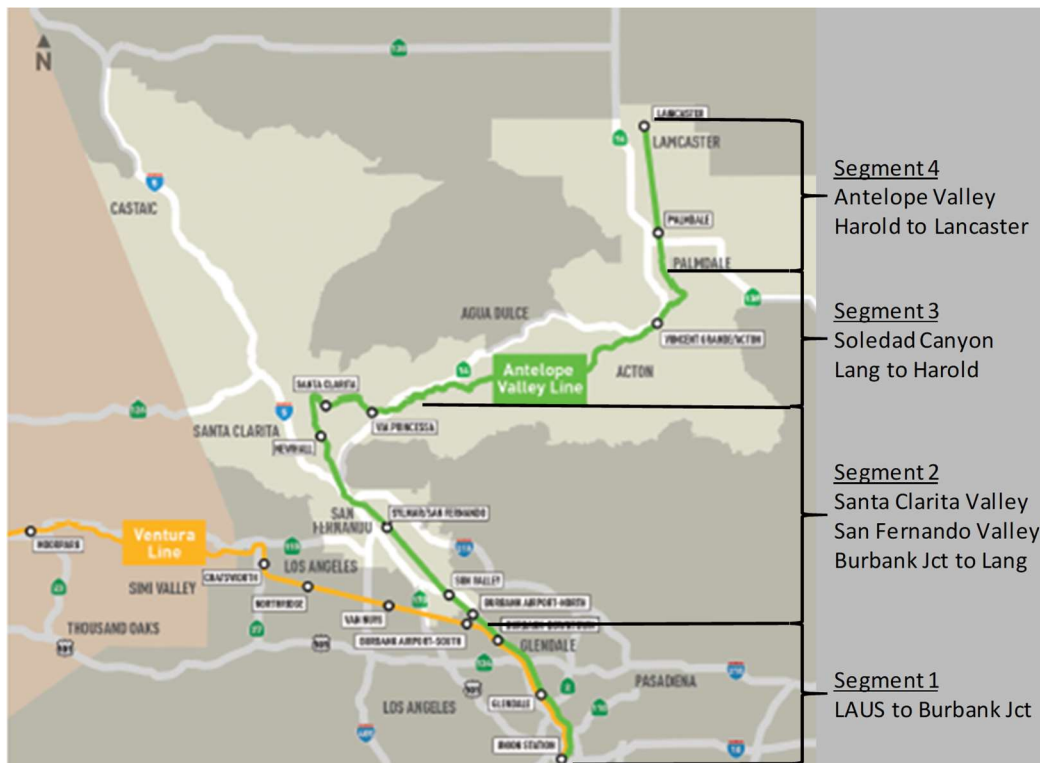


2.3.1 Right of Way and Track Configuration

The AVL is located entirely within Los Angeles County. The railroad right of way (ROW) and assets along the ROW (e.g. track and signals) are owned by Metro on both the River Subdivision and Valley Subdivision.

The track alignment is marked by significant grades, curves, and topography, with approximately two-thirds single-track that includes 57 structures, 72 public highway-rail at-grade crossings, and three single track tunnels. Due to the varied conditions and constraints of the AVL, it has been broken down into four segments for purposes of analysis, as shown in Figure 2-2. The physical characteristics of the railroad are similar within each segment but vary between segments, as noted in Table 2-1.

Figure 2-2: AVL Segments



Map Source: LA Metro

Table 2-1: AVL Segments and ROW Characteristics

Segment	Limits	Mileposts	Notable Characteristics
1	LAUS to CP Burbank Jct	0.0 – 11.4	<ul style="list-style-type: none"> Not part of the study area, but considered for informational purposes and included in the rail service and operations analysis
2	CP Burbank Jct to CP Lang (East San Fernando Valley and Santa Clarita Valley)	11.4 – 41.6	<ul style="list-style-type: none"> Speeds over 70 mph and grades less than 1% to CP Balboa 50 curves, 2/3 of which are railroad west of CP Balboa and cause reduced speeds Includes Tunnel 25: nearly 7,000 feet, or 1.3 miles, single track at 30 mph with limited vertical clearance
3	CP Lang to CP Harold (Soledad Canyon)	41.6 – 67.55	<ul style="list-style-type: none"> Significant grades Slower speeds Over 50% of curves along entire line are within this segment Reduced speeds with an average maximum authorized speed of 43 mph
4	CP Harold to Lancaster Station (Antelope Valley)	67.55 – 76.6	<ul style="list-style-type: none"> CP Harold is junction to UP; limited ROW adjacent to UPRR Majority of grade less than 2% Very few curves Speeds over 70 mph

Source: WSP

2.3.2 Stations

The AVL serves 12 Metrolink stations, including LAUS, nine of which are in the study area. The Lancaster, Palmdale, Vincent Grade/Acton, Via Princessa, and Sylmar/San Fernando stations were added after the Northridge Earthquake in January 1994 with funding from the Federal Emergency Management Agency (FEMA). These were built as emergency stations to alleviate commuter traffic congestion following the collapse of a freeway connector of SR 14 onto the I-5. The emergency stations have since been replaced with permanent stations, with the exception of the Via Princessa station. Via Princessa continues to use the same platform built for emergency purposes, with few added amenities.

The Burbank Airport–North station is the latest station to be added to the AVL. This station connects commuters on the AVL to the Hollywood Burbank Airport. Revenue service started at this station on May 14, 2018.

The AVL stations in the study area are listed in Table 2-2, starting with Burbank Airport–North and travelling railroad west to Lancaster. The table describes the milepost location, station owner, segment in which the stations are located, and the address. Operations and Maintenance agreements between host cities, Metro, and SCRRRA dictate cost shares and responsibilities for each station.

Table 2-2: Stations Serving AVL Within the Study Area

Item No.	Station	MP	Owner	Segment	Address
1	Burbank Airport – North	13.66	City of Burbank	2	3600 N. San Fernando Blvd., Burbank, CA
2	Sun Valley	15.40	City of Los Angeles, Department of Transportation	2	8360 San Fernando Road, Sun Valley, CA 91352
3	Sylmar/San Fernando	21.94	City of Los Angeles, Department of Transportation	2	12219 Frank Modugno Dr., Los Angeles CA 91342
4	Newhall	29.99	City of Santa Clarita	2	24300 Railroad Avenue, Santa Clarita, CA 91321
5	Santa Clarita	34.22	City of Santa Clarita	2	22122 Soledad Canyon Road, Santa Clarita, CA 91350
6	Via Princessa	37.87	City of Santa Clarita	2	19201 Via Princessa, Santa Clarita, CA 91351
7	Vincent Grade/Acton	61.49	City of Los Angeles, Department of Public Works	4*	730 W. Sierra Highway, Palmdale, CA 93550
8	Palmdale	69.19	City of Palmdale	4	39000 Clock Tower Plaza Drive, Palmdale, CA 93550
9	Lancaster	76.54	City of Lancaster	4	44812 N. Sierra Highway, Lancaster, CA 93534

Source: SCRRA, 2018 webpage. Rider-Info Stations webpage.

Note: MP = Actual milepost along centerline of track at the center of the station platform.

*Vincent Grade/Acton Station physically in within Segment 3, but grouped with Segment 4 for market analysis purposes.

2.3.3 Rolling Stock

Metrolink has 56 locomotives (53 owned and three leased) and 258 passenger cars (73 cab cars and 185 coaches) operating in consists of four, five, or six cars. Forty Tier 4¹ F125 locomotives have been procured by SCRRA to phase out older locomotives. As of June 1, 2018, fifteen F125 locomotives have been delivered, seven of which are in-service. Locomotives are 68 feet long and passenger cars 85 feet long, making total consist lengths between 408 and 578 feet. Forty sets of equipment are cycled throughout the system; equipment sets are not dedicated by line.

A total of 11 of these equipment sets operate on the AVL at various times over the course of a typical weekday, as well as on other branches such as the San Bernardino Line. Weekend service uses three sets of equipment that originate and terminate at the Lancaster Layover Facility. Metrolink trains along the AVL are either four-car or five-car consists powered by one locomotive. Nine of the 11 equipment sets are four-car consists and two are five-car consists, which are part of equipment cycles that originate and terminate at the Eastern Maintenance Facility (EMF) and interline with San Bernardino Line service.² If the AVL were operated as a standalone service with a dedicated fleet of trains (which is purely hypothetical), a total of six train sets would be required to operate the current weekday schedule. For purposes of analysis, as a matter of convenience, this number was defined to be the existing fleet

¹ Tier 4 refers to the current highest standard of emissions reduction available on commuter rail rolling stock.

² Heavy maintenance is performed only at the Central Maintenance Facility (CMF), which requires all train sets to cycle through the CMF on a periodic basis.

requirement and was used in the study to compare the fleet requirements associated with scenarios that deliver more service on the AVL.

2.3.3.1 Maximum Passenger Load Factors

The maximum loads and capacity utilization on a train trip are an important indicator of overall efficiency and equipment utilization. SCRRRA provided maximum load factor data for the first ten months of FY 2018, which were analyzed for maximum capacity utilization and summarized in Table 2-3. The load factor is defined to be the percentage of all passenger seats occupied at the train's peak load point.

As can be seen from Table 2-3, there is a dramatic difference in load factors between peak and off-peak periods, and also a wide variation in individual train loading with the peak and off-peak periods. Morning peak period trains in the peak direction have an average maximum load percentage of 50.9%. PM peak period trains in the peak direction have an average maximum load percentage of 52.7%. Trains operating at other times of the day have an average maximum load percentage of only 14.3%. These findings reflect a strong peak period orientation in ridership, and may indicate the potential viability of shorter train consists or use of more efficient equipment such as diesel multiple units (DMUs), especially during off-peak periods. It may also be a reflection of the current schedule, which is largely peak-direction oriented and does not accommodate reverse commute trips very effectively.

Table 2-3: Antelope Valley Line Train Load Factors at Peak Load Point by Time of Day – Average by Train over First Ten Months of FY 2018

Time Period	Trains/Weekday	Minimum	Average	Maximum
AM Peak	6	30.9%	50.9%	61.0%
PM Peak	6	20.6%	52.7%	92.5%
Reverse-Peak and Off-Peak	18	4.3%	14.3%	25.6%

Source: Departure Times per Schedule Effective October 9, 2017. Data from SCRRRA Median Load Capacity, FY-18.

2.3.4 Yards and Maintenance Facilities

The AVL has one stub-end layover facility located at the Lancaster station with a maximum capacity for six trains. This capacity allows for two trains to layover on the mainline track and four trains to layover on the siding track. Current operations utilize the full capacity to layover trains for weekday AM peak service originating from the Lancaster station. Increasing the number of trains originating at Lancaster in the morning peak will require expansion of the storage yard at Lancaster.

Metrolink has two maintenance facilities for its fleet, the Central Maintenance Facility (CMF) located near LAUS and the Eastern Maintenance Facility (EMF) located in Colton. Each facility allows for midday and overnight storage and cleaning and maintenance of any Metrolink train in the network. As Metrolink increases the quantity of service and the size of the fleet across its network, the capacity of these two facilities will be exceeded, and expansion will be needed. Distributing certain maintenance and inspection functions to outlying yards may prove to be a cost-effective strategy, in which case facilities for equipment maintenance may need to be constructed at existing or potential new locations along the AVL.

One of the two Metrolink Maintenance-of-Way (MOW) yards is located in the AVL corridor. The Lang Yard in the City of Canyon Country stores MOW on-track equipment and materials.

2.4 Current Operations and Performance

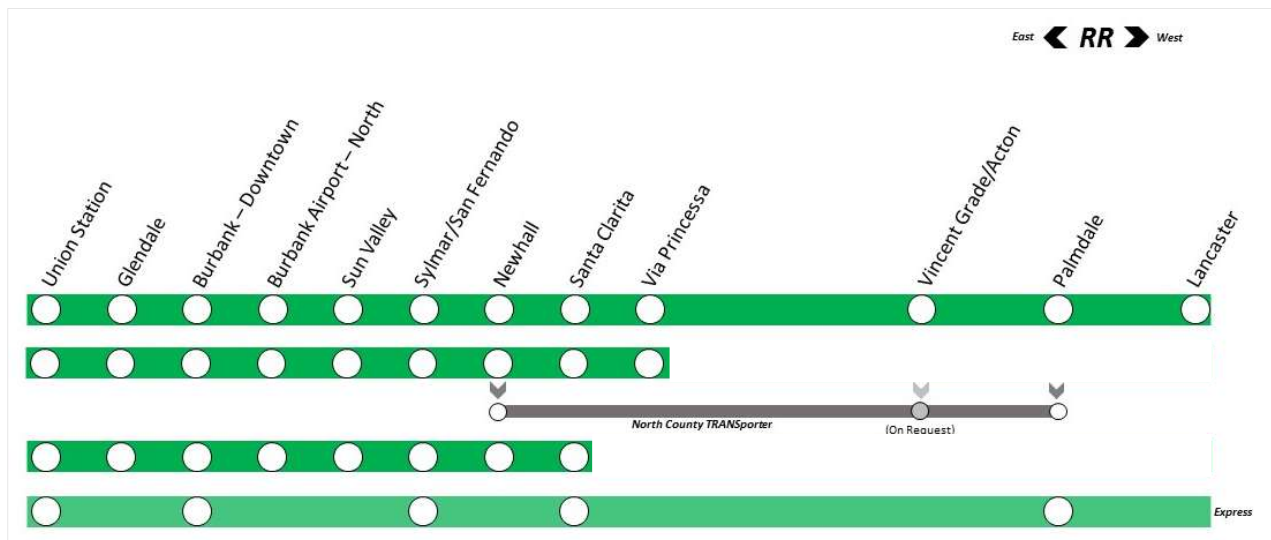
Metrolink trains can reach a top speed of 90 mph in some subdivisions, but the maximum authorized speed (MAS) in the Valley Subdivision is 79 mph. Trains typically dwell for as little as 30 seconds but can dwell for up to 90 seconds for schedule reliability. The operational analysis performed for this study assumed a 60 second dwell for planning purposes, and a 20-minute minimum scheduled turnaround time at terminal stations.

2.4.1 Existing Metrolink Train Operations

Metrolink dispatches all trains operating on the AVL corridor. Today, there are 30 weekday trains, 12 Saturday trains, and 12 Sunday trains serving the AVL. Peak direction is railroad east to LAUS in the AM and railroad west to Lancaster in the PM. Weekday service runs all day and is equally divided per direction, though peak period/peak direction service is more frequent than non-peak and midday period service.

As shown in Figure 2-3, the AVL runs four stopping patterns during the week. Eighteen trips make all stops between LAUS and Lancaster. Eight trips stop short at Via Princessa, but have timed connections to the North County TRANSporter bus at Newhall for travel to the Palmdale station. TRANSporter also stops at the Vincent Grade/Acton station by request. Two trains make all stops between LAUS and Santa Clarita in the PM, one in peak direction and one in reverse peak direction. One express service is provided during each peak period, in the peak direction to provide a trip between Palmdale and LAUS in under two hours.

Figure 2-3: Existing AVL Stopping Patterns



Source: WSP

The Spring, 2019 public timetable is shown in Figure 2-4. Peak service operates roughly every 30-60 minutes with most of the trains making all stops, and one train providing express service. Non-peak, non-peak direction service operates every 45 minutes to over two hours, and does not serve all the northern-most stations (Vincent Grade/Acton, Palmdale and Lancaster).

Weekend service operates with six trains in each direction on Saturdays and Sundays, making all stops between LAUS and Lancaster. Service frequency is uneven, varying from 90 minutes to 3 hours, 50 minutes between trains.

Figure 2-4: AVL Weekday Timetable

		MONDAY THROUGH FRIDAY													
Metrolink Train No.	200	202	204	282	206	208	210	212	214	216	218	220	222	224	226
Lancaster	3:44	4:46	5:16		5:58	6:48		9:01		11:35		1:45			6:17
Palmdale	3:54	4:56	5:26		6:08	6:58	7:50	9:11	10:30	11:45		1:55	2:00	4:00	6:26
Vincent Grade/Acton	4:06	5:08	5:38		6:21	7:10		9:23		11:57		2:07			6:39
Via Princesa	4:42	5:44	6:15	↓	6:56	7:48	↓	9:05	↓	11:26	12:34	1:51	2:43	↓	7:25
Santa Clarita	4:48	5:50	6:21	6:48	7:02	7:55	8:40	9:11	10:05	11:32	12:40	1:57	2:49	↓	7:31
Newhall	4:56	5:58	6:29	↓	7:10	8:02	8:40	9:19	9:55	10:13	11:20	11:40	12:48	2:05	7:46
Sylmar/San Fernando	5:11	6:13	6:45	7:11	7:28	8:20		9:35	10:32	11:56	1:06	2:20	3:17	↓	8:00
Sun Valley	5:18	6:20	6:56		7:36	8:27		9:43	10:40	12:04	1:14	2:29	3:25	↓	8:13
Burbank Airport - North (AV Line)	5:22	6:24	7:00	↓	7:40	8:31		9:47	10:44	12:08	1:18	2:33	3:29	↓	8:17
Burbank - Downtown	5:28	6:30	7:05	7:22	7:45	8:37		9:52	10:49	12:13	1:23	2:39	3:35	↓	8:22
Glendale	5:34	6:36	7:12	↓	7:51	8:43		9:59	10:56	12:20	1:30	2:45	3:41	↓	8:29
L.A. Union Station	5:53	6:55	7:25	7:40	8:06	8:57		10:13	11:08	12:34	1:43	3:01	3:55	↓	8:42

		MONDAY THROUGH FRIDAY													
Metrolink Train No.	201	203	205	207	209	211	213	215	217	219	285	221	223	225	227
L.A. Union Station	6:19	7:29		8:29	9:42	11:06	11:58	1:55	3:28	3:50	4:44	5:34	5:58	6:38	9:25
Glendale	6:31	7:41		8:41	9:54	11:18	12:10	2:07	3:40	4:02	4:56	↓	6:10	6:50	9:37
Burbank - Downtown	6:38	7:49		8:48	10:01	11:25	12:18	2:14	3:48	4:09	5:04	5:51	6:18	6:57	9:44
Burbank Airport - North (AV Line)	6:44	7:55		8:54	10:07	11:31	12:24	2:20	3:54	4:16	5:10	↓	6:23	7:03	9:50
Sun Valley	6:49	7:59		8:59	10:12	11:36	12:29	2:25	3:58	4:21	5:14	↓	6:28	7:08	9:54
Sylmar/San Fernando	7:01	8:08		9:08	10:21	11:45	12:38	2:36	4:10	4:30	5:24	6:05	6:37	7:17	10:03
Newhall	7:19	8:26	8:50	9:24	10:40	12:03	12:54	2:51	4:25	4:45	5:42	↓	6:52	7:32	10:18
Santa Clarita	7:26	8:33		9:32	10:48	12:11	1:02	3:00	4:32	4:52	5:49	6:25	7:00	7:43	10:26
Via Princesa	7:33	8:42		9:40	10:55	12:18	1:12	3:06	4:39		5:56	↓	7:07	7:50	10:33
Vincent Grade/Acton	8:12		10:24		12:59				5:17		6:35	↓	7:49	8:28	11:11
Palmdale	8:22	9:36	10:35	11:40	1:10		3:50	5:28	5:50	6:50	7:21	8:00	8:39	9:34	11:22
Lancaster	8:35		10:46		1:20			5:41		6:58		8:12	8:54	9:49	11:37

Source: Metrolink Timetable, Effective April 8, 2019
 Notes: Peak period trains in shown in red boxes



Source: WSP

2.4.2 Operating Budget

The Metrolink FY2018-19 Proposed Operating Budget outlines \$100.8 million in revenues, up 0.2% from the FY18 Adopted Budget. These revenues come from four sources: fares, dispatching, MOW, and other. Operating expenditures are proposed to be \$251.4 million, up 3.4% from the FY18 Adopted Budget. Operating expenses include train operations, MOW, and Insurance. The total net local subsidy from member agencies is \$150.6 million, up 5.7% from the FY18 Adopted Budget. Metro’s portion of this subsidy is proposed to be \$75.1 million, up 4.9% from the FY18 Adopted Budget.

Revenues and expenditures from the FY2018-19 Proposed Operating Budget and shown in Figure 2-5 and Figure 2-6 respectively. Metrolink is projecting \$16.6 million in operating revenue and \$46.8 million in expenses for the AVL.

Figure 2-5: AVL Operating Revenues FY 2018-19

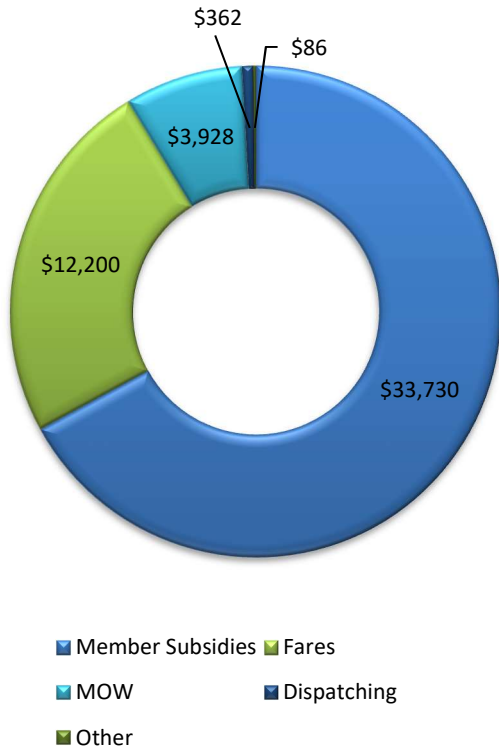
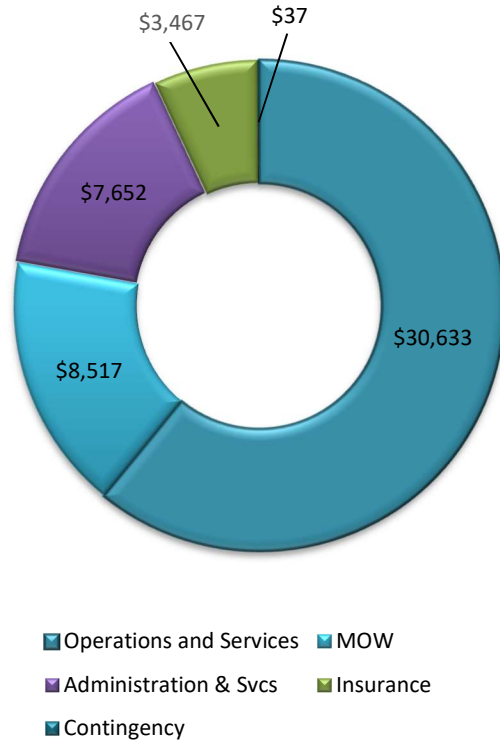


Figure 2-6: AVL Operating Expenses FY 2018-19



Note: Revenues and expenses expressed in thousands of 2018-19 dollars.
 Source: Metrolink FY2018-19 Proposed Budget, Exhibit 3.8

2.4.3 Freight Operations

UPRR holds the freight operating rights on the AVL. UP has a reserved rail freight easement for use of shared-use facilities on the line pursuant to the Shared Use Agreement (Saugus Line) between Southern Pacific Transportation Company and Los Angeles County Transportation Commission, dated December 16, 1992 (SP/LACTC, 1992). Southern Pacific was the predecessor to UPRR.

2.4.3.1 Key Shared-Use Agreement Provisions

There are several provisions of the 1992 Agreement that directly impact commuter rail operations, including the potential to expand AVL service, operate 60-minute or 30-minute headways, and/or use alternative equipment such as rail multiple units (RMUs). The key provisions with relevance to this study are summarized as follows³:

- During Peak Commuter Periods the Railroad (UPRR) shall have no right to use any portion of the shared use facilities, which has a single main line track, with certain specified exceptions.
- At times, other than the Peak Commuter Periods, the Railroad shall have the right to use any portion of the Shared Use Facilities, which has a single main line Track for Freight Trains.

³ Please see Appendix 1, *Existing Conditions*, for a more detailed discussion of the provisions of the Shared-Use Agreement and current UPRR operations.

- The Commission (Metro) and UPRR have equal priority at all times for sections of the line where there are two or more main line tracks.
- SCRR/Metro can determine Metrolink Train schedules, but they must not interfere unreasonably with UPRR's rail freight service during non-Peak Commuter Periods. This implies discussions with UPRR will be needed to establish AVL service on 60- or 30-minute headways.

2.4.4 On-time Performance and Reliability

The On-Time Performance (OTP) Policy was adopted by the SCRR Board of Directors on June 6, 2012 and states that:

“On-Time Performance, or schedule adherence, is a measure of trains that reach their final destination on time. Any train that is annulled, terminated, or more than five minutes, 59 seconds late into its final destination will be considered late.

The denominator for the OTP percentage calculation shall be the number of revenue trains scheduled during the reporting period for the appropriate line.

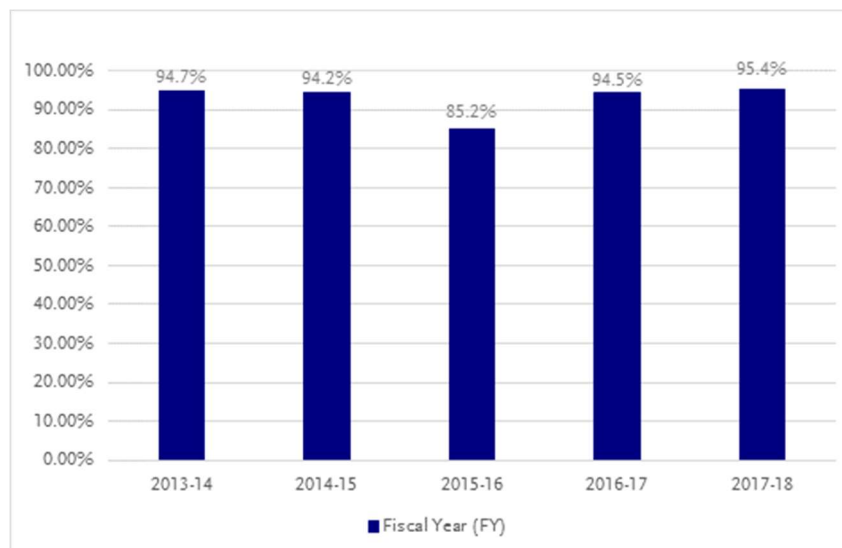
The numerator for the calculation shall be the number of scheduled trains LESS the sum of the number of trains (a) annulled, (b) terminated, and (c) more than five minutes, 59 seconds late into their final destination.

Special trains, such as extra trains, charter trains, baseball trains, and other promotional trains are excluded from the OTP calculation.

Service Standard: 95% of trains arrive at their final destination within five minutes 59 seconds of their scheduled time.” (SCRR, 2018b)

OTP is one of Metrolink's Key Performance Indicators (KPIs). The KPI Quarterly Performance Reports for fiscal year 2018, third quarter (FY18 Q3) reported that overall Metrolink system OTP is at 94.7% for FY18 Q3, just shy of the 95% target. Per Metrolink statistics, the AVL had a line-specific OTP of 96.4%, up from the previous three quarters. Figure 2.7 presents the average OTP annually over the past five years. Reliability has been relatively high and stable the line during this period, with an improving trend over the past two years.

Figure 2-7: AVL Historical On-Time Performance – Annual Averages



Source: SCAG, 2019

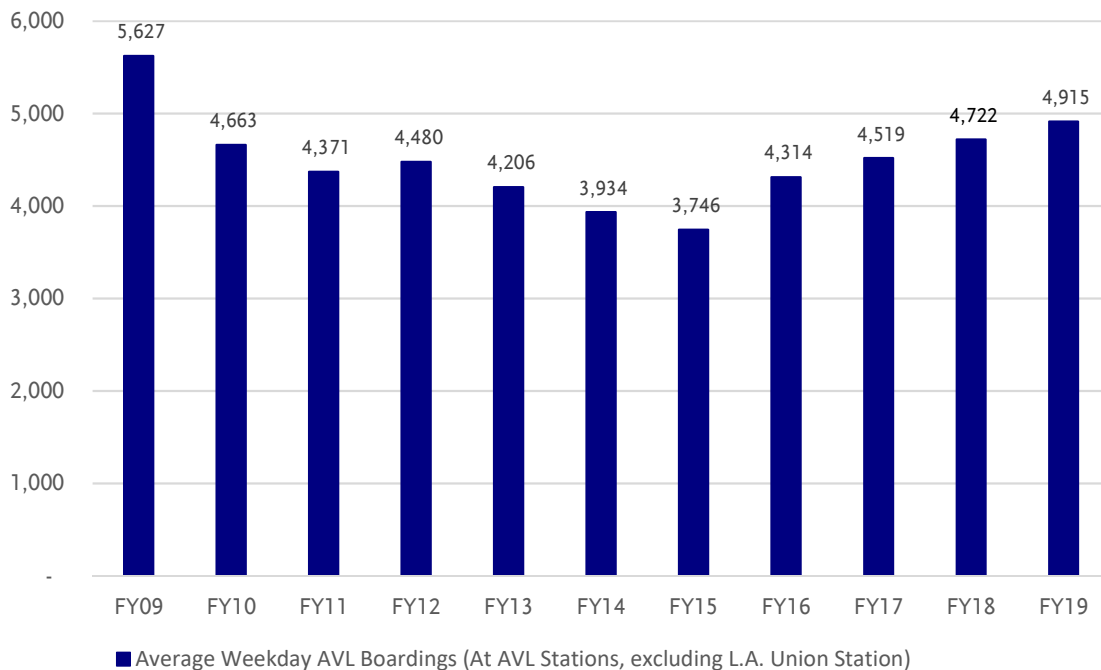
The majority of delays on the AVL are under five minutes. Most of the delays on the AVL that affect OTP are between six and 20 minutes. Causes of delays to OTP include numerous variables. The most common cause of delay on the AVL is mechanical issues with the train equipment.

2.5 Travel Markets and Patterns

The scope of the Study did not include forecasting of future ridership on the line. Instead, the Study team undertook an assessment of travel markets in the corridor, which provided information about travel patterns and trends, the needs of current and potential riders, reverse commute opportunities, and unique markets that could benefit from the service in the Study project area.

Currently, the AVL has an estimated average weekday ridership of 5,700 daily passengers during weekdays, 2,700 passengers on Saturdays, and 2,300 passengers on Sundays, making the line the third busiest in the Metrolink system during weekdays, and the second busiest during the weekends (SCRRA, 2018). Average ridership on the AVL has been in an upward trend in recent years with a proposed annual ridership for FY19 of over 1,800,000. (SCRRA, 2018b) The recent ridership growth on the line was demarcated by the July 2015 fare reduction program, which has resulted in a 26.5% increase since FY 2015 (SCRRA, 2018c). Figure 2-8 illustrates the average weekday ridership on the AVL for fiscal years 2009 through 2019 (excluding AVL boardings at LAUS). Figure 2-9 presents AVL station boardings in FY 2019, with Burbank–Downtown, Glendale, and Sylmar/San Fernando having the highest average boardings.

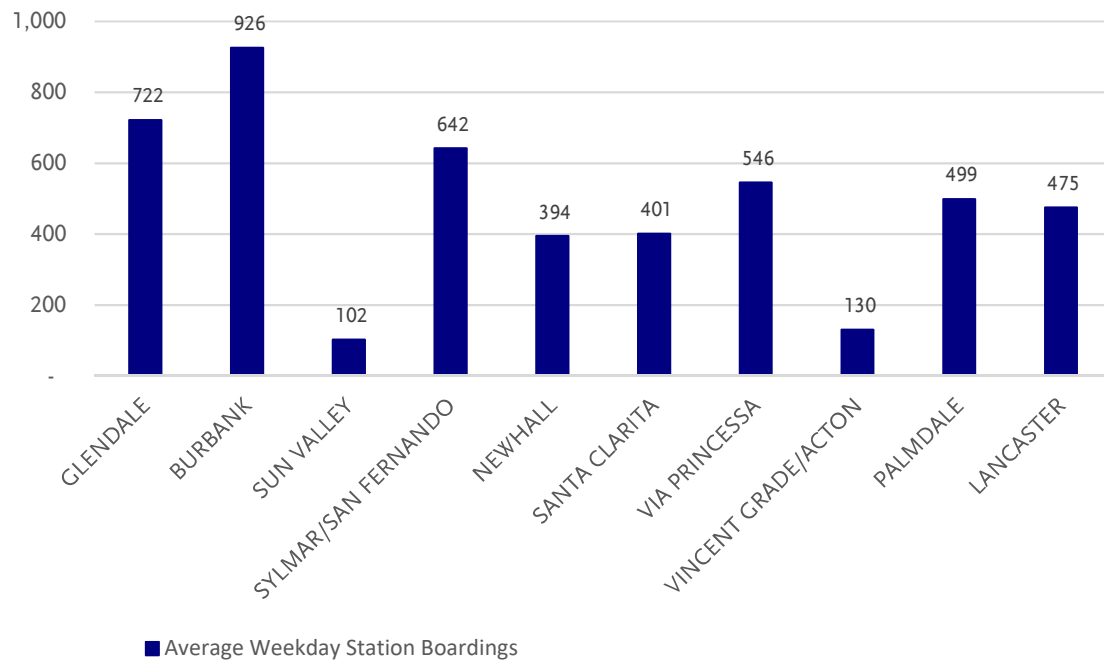
Figure 2-8: AVL Average Weekday Boardings at AVL Station, Excluding LA Union Station (FY09 to FY19)



Note: - FY19 includes the available data from July 2018 to March of 2019.
 - The average weekday boardings presented in Figure 2-8 do not include AVL boarding at LA Union Station.
 - Average weekday boardings were calculated from ticket sales data provided by SCRRA for AVL stations. These average weekday ridership estimates can vary when compared to estimates based on annual trip factors, which factor other tickets valid on working days, among other factors.

Source: SCRRA

Figure 2-9: AVL Stations Average Weekday Boardings (FY19)



Source: SCRRRA

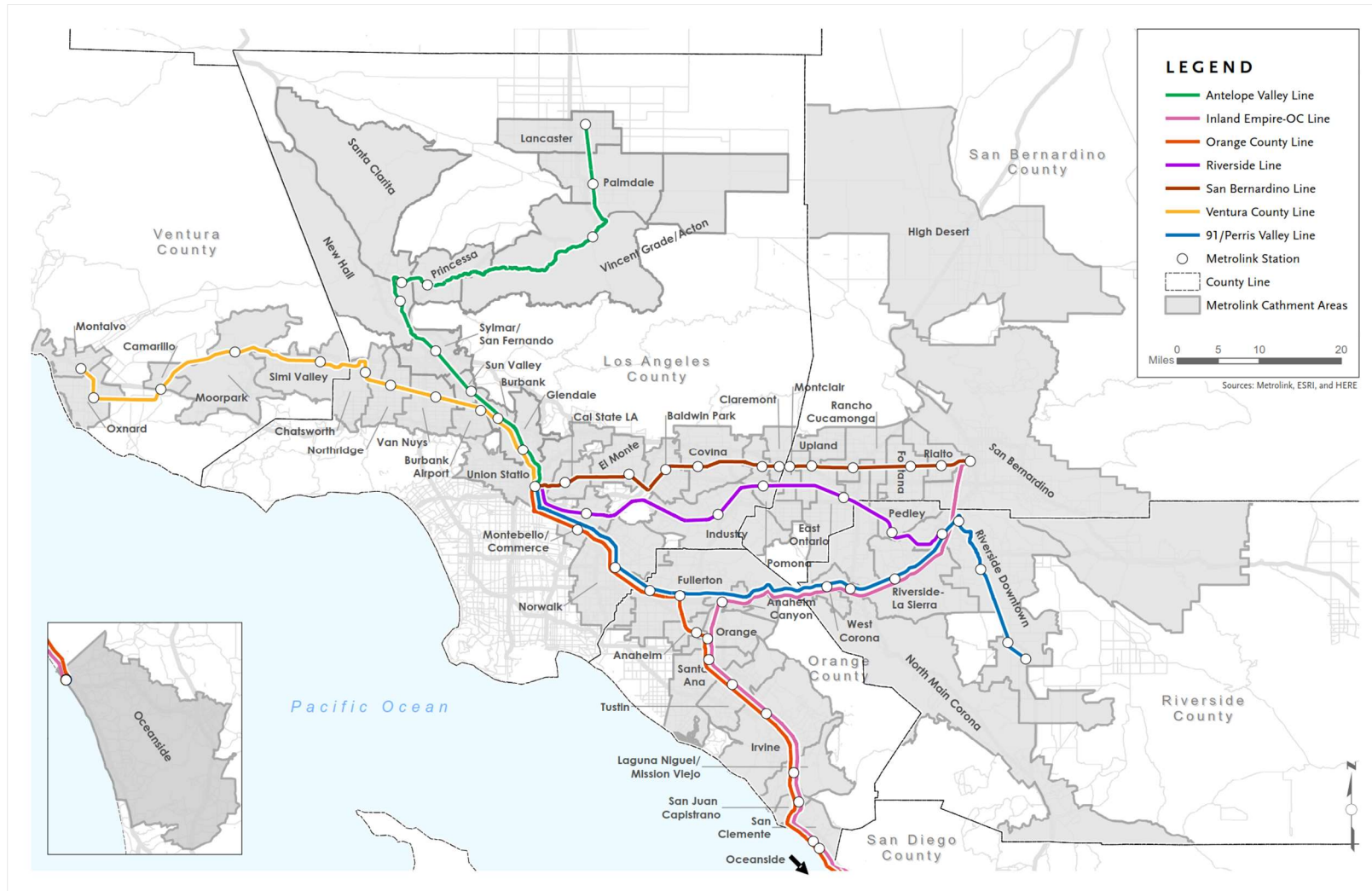
It should be noted that FY19 includes the available data from July, 2018 to March, 2019. The Metrolink system home-catchment areas, defined by SCRRRA as the geographic areas capturing 95% of the riders using each station, were utilized to define the Project Area for this AVL Study, and to examine the travel markets. Figure 2-10 shows the entire Metrolink system of home-catchment areas, and Figure 2-11 shows the catchment areas specific to the AVL Study Project Area.

Currently the AVL serves 12 Metrolink stations, but this study does not include the LAUS, Glendale, and Burbank–Downtown stations, which are the subject of the companion study of the south portion of the line, which the AVL shares with Metrolink’s Ventura County Line. Additionally, Metrolink catchment areas are updated roughly every five years when SCRRRA conducts their extensive customer surveys, therefore, the recently opened Burbank Airport–North station is not included among the catchment areas defined in this report for the market assessment.

AVL Study Segments and Station Groups

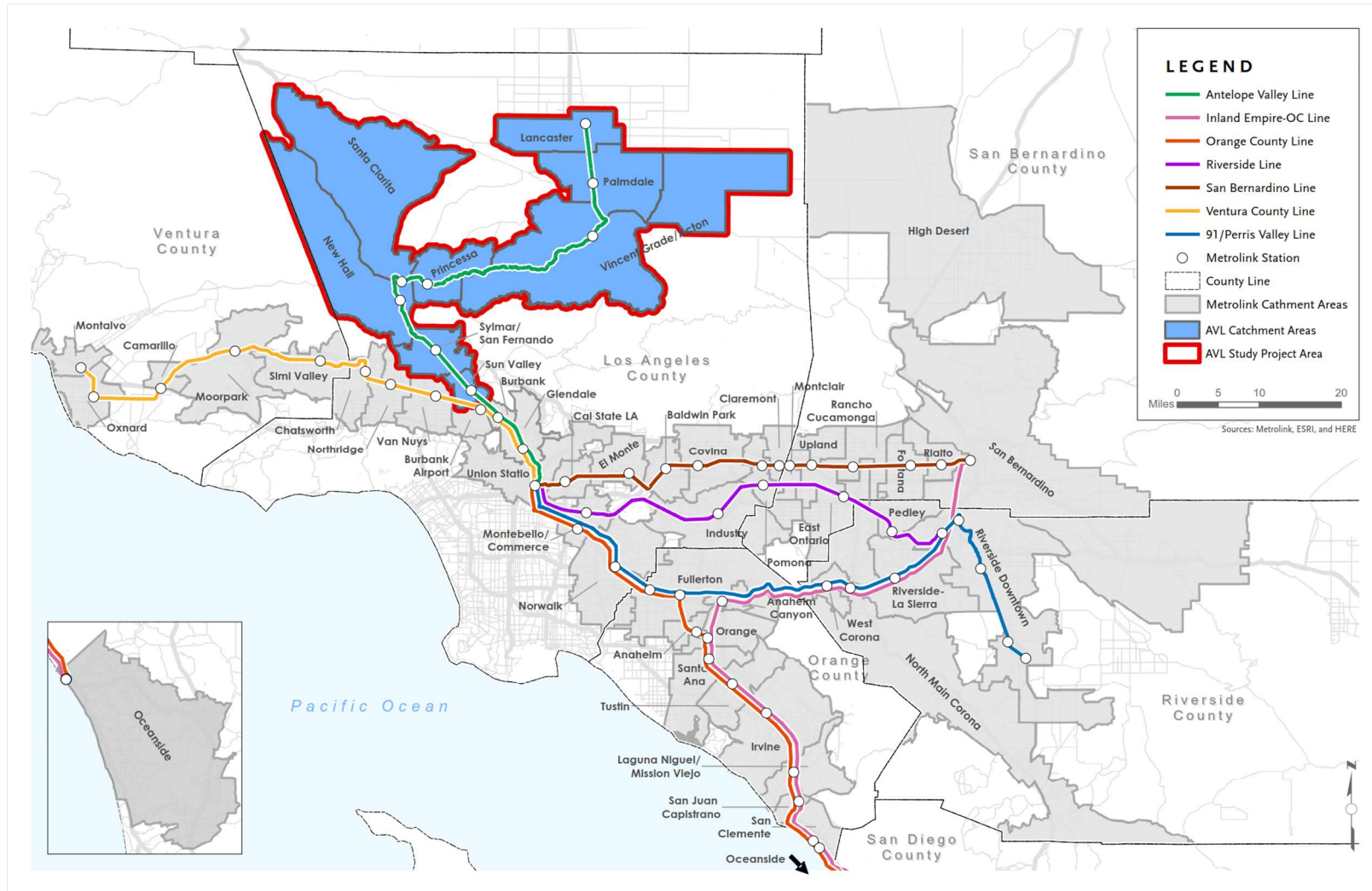
To better study the AVL, and the internal markets along the alignment, the line was broken down into four segments based on similar characteristics. Note that segment 1 is located outside the AVL Study Project Area, but it’s considered for informational purposes and for modeling assumptions. Table 2-4 presents the four AVL segments, the four primary groupings of Metrolink stations, and the corresponding station catchment areas.

Figure 2-10 Metrolink System Home-Catchment Areas



Source: SCRR, Home-Catchment Areas

Figure 2-11. AVL Catchment Areas



Source: SCRRRA, Home-Catchment Areas

Table 2-4: AVL Segments, Station Groups and Catchment Areas

Segment	Limits	Mileposts	Station Group ▪ Station Catchment Area
1	LAUS to Control Point (CP) Burbank Jct	0.0 – 11.4	<u>Glendale-Burbank</u> ▪ Glendale and Burbank–Downtown
2	CP Burbank Jct to CP Lang (East San Fernando Valley and Santa Clarita Valley)	11.4 – 41.6	<u>[A] San Fernando Valley</u> ▪ Burbank Airport–North and Sun Valley ▪ Sylmar/San Fernando
			<u>[B] Santa Clarita Valley</u> ▪ Newhall ▪ Santa Clarita ▪ Via Princessa and Vista Canyon (future station)
3	CP Lang to CP Harold (Soledad Canyon)	41.6 – 67.55	<u>[C] Soledad Canyon and Antelope Valley</u> ▪ Vincent Grade/Acton
4	CP Harold to Lancaster Station (Antelope Valley)	67.55 – 76.6	▪ Palmdale ▪ Lancaster

Source: WSP

2.5.1 Market Analysis Process

The market assessment analyzed different data sets to describe travel patterns within the region, and identify where residents within the Study project area commute and travel. The data sets consisted of the following:

1. **Station-to-Station:** This process analyzed trips of Metrolink riders between Metrolink stations by categorizing stations into geographic groups, and looking at the boardings between these groups. SCRRRA provided the station-to-station data in the form of total linked weekday trips in FY17. This station-to-station analysis focuses on the interactions of AVL Study stations (split into three groups), with other groupings of stations organized by geographical location to identify ridership markets (SCRRRA, 2017).
2. **Origin-Destination:** The origin-destination (OD) analysis utilizes data of personal trips taken for all purposes, and using all types of transportation modes, which include auto, commuter rail, urban rail, local bus, express bus, or bus rapid transit (BRT). The OD data was produced with the SCAG 2012 Model, and collected for the 52 Metrolink home-catchment areas (see Figure 2-10). This section illustrated where trips starting in the Study project area end in other Metrolink catchment areas. It documented key travel patterns of trips taken for all purposes and by different transportation modes (SCAG, 2017).
3. **Work-trip Analysis:** Utilizing the Census Bureau's web-based mapping tool OnTheMap, the work-trips analysis showed where residents of the AVL Study Project Area are employed. This information indicated where residents commute to, but it does not tell us how residents travel to their places of employment. This analysis provided information to help identify regional commuting travel patterns of Study project area residents, and to define ridership needs of the areas in and around the Project Area (United States Census Bureau, 2018).
4. **Top Employers Analysis:** With the use of a geographical information system (GIS), the major employers (more than 200 employees) within each AVL Study catchment area were identified and ranked according to their number of employees. The list of employers used in this analysis was taken from Air Quality Management District (AQMD) databases provided by the South Coast and

Antelope Valley districts. The analysis of top employers helped identify unique or special travel markets.

2.5.2 Market Analysis Takeaways

Ridership on the AVL has been increasing since the implementation of the 2015 fare reduction program. Metrolink anticipates this upward trend on ridership to continue on the line. Currently, the busiest stations along the AVL during weekdays are the Burbank–Downtown, Glendale and Sylmar/San Fernando stations, whereas the Sun Valley and Vincent Grade/Acton stations have the lowest average boardings.

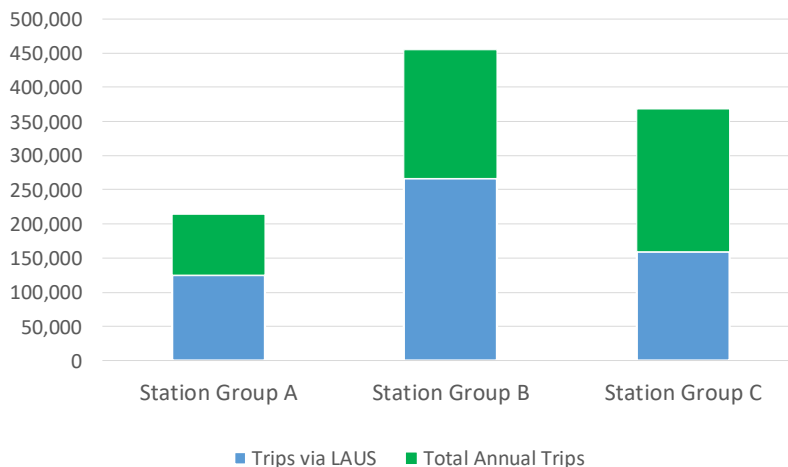
Metrolink routes generally operate in corridors parallel to highly-congested freeways. One Metrolink train removes the equivalent of 1.5 million cars annually from Southern California freeways.

Travel on Metrolink is highly oriented towards journey-to-work trips, with 98 percent of all riders traveling to work to or within LA County. A high majority of Metrolink commuters access the train at the home end of their trip by driving alone in an automobile and parking at a Metrolink station. Use of private transportation network companies (such as Uber and Lyft) as a mode of “first and last mile” station access is increasing, with 45 percent of Metrolink riders having used this mode to get to or from a train station.

2.5.2.1 Station to Station Analysis:

The station-to-station analysis of current Metrolink riders indicated strong ridership from all three catchment zones (A, B and C), with the largest being Santa Clarita Valley (B), followed by the Antelope Valley, as shown in Figure 2-12. LAUS was the predominant destination, but not overwhelmingly so, demonstrating that there are significant markets for travel to intermediate destinations along the AVL and for reverse-commuting.

Figure 2-12: Annual AVL Ridership by Station Group, FY 2017



Source: SCRRRA

The data showed that 34 percent of weekday riders boarding at a Group A station (Sun Valley, and Sylmar/San Fernando) travel to other stations served by the AVL, and that 59 percent of Group A riders end their trips at LAUS. All other regional station groupings receive less than three percent of trips from these two stations. One station of interest for Group A is at the California State University–Los Angeles (Cal State LA) on the **San Bernardino Line**. This station alone receives two percent of the trips originating at a Group A station, and it serves more than half of the trips that transfer to the San Bernardino Line from Group A.

The station-to-station analysis also shows that LAUS is the most important destination for riders boarding in a station in Group B (Newhall, Santa Clarita, Via Princessa/Vista Canyon), and that one third of the estimated 455,000 annual Group B trips end at another station served by the AVL. In comparison to other geographical areas, the Orange County Line area received the most riders from Group B stations, with the Santa Ana and Tustin stations receiving the most weekday annual trips.

The analysis showed that Group C had an estimated 370,000 annual weekday trips originate from its stations: Vincent Grade/Acton, Palmdale, and Lancaster. Approximately 51 percent of these riders travel to other stations served by the AVL. LAUS captured 43 percent of riders starting their trips at a Group C station. Other significant destinations for Group C included the Burbank Airport South, Cal State LA, San Bernardino Depot, and Fullerton stations. The San Bernardino Depot is of interest for Group C, since it represents an important destination only for this group of stations, and not for the other AVL Study station groups. Overall, the station-to-station analysis showed that LAUS is the largest destination for riders boarding at a station served by the AVL, and that there is a significant amount of intra-AVL line travel. It also showed that a significant number of AVL riders transfer to other Metrolink lines to reach their destination – in particular, the stations of Northridge, Cal State LA, and Fullerton, among others served by the Orange County Line (Santa Ana, Tustin, and Irvine).

2.5.2.2 Origin-Destination Analysis:

The OD analysis of daily trips taken for all kinds of purposes, via all transportation modes, showed that trips starting in the eight AVL Study catchment areas account for eight percent of all trips generated in the 52 Metrolink catchment areas. The top five destination catchment areas (from the 52 Metrolink station catchment areas) account for 61 percent for all total daily trips generated in the Study project area. Consistent with the observations from the station-to-station analysis, the origin-destination analysis showed that there is a significant amount of intra-project area travel, and that the LAUS catchment-area serves as major destination for trips initiated in the eight AVL Study catchment areas.

To better visualize and understand travel patterns on the AVL, the individual AVL station catchment areas were aggregated into four large zones, which are largely created by the topography along the corridor:

- Antelope Valley
- Santa Clarita Valley
- San Fernando Valley
- Central LA and Burbank

All daily trips crossing a boundary from one of these large zones to another zone were tallied and ranked in terms of the size of the travel market, the size of the rail market, and rail's modal share of all trips. Trips occurring entirely within a single zone were not considered good candidates for commuter rail and were therefore ignored. The results of this ranking are shown in Table 2-5, where the zone pairs are sorted in order of the volume of total daily zone-to-zone trips, and also classified into three categories of travel that relate to rail service: peak travel to Central LA and Burbank, peak-direction travel to intermediate locations along the AVL (i.e., to San Fernando Valley and Santa Clarita Valley destinations), and reverse-peak direction travel (i.e., away from Central LA in the morning and towards Central LA in the evening). These three sets of data are mapped graphically in Figure 2-12 (total daily trips), Figure 2-13 (modeled total daily commuter rail trips), and Figure 2-14 (commuter rail share of total daily trips). The table and figures demonstrate the dispersed nature of total trip-making in the region, where the largest single market is for travel from the Santa Clarita Valley to the San Fernando Valley.

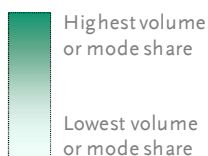
The origin-destination zone pairs can be logically divided into three tiers, based on the volume of daily Metrolink ridership. Tier 1, with the largest volumes of Metrolink riders (between 1,400 and 2,750 daily trips), include commuters to Central LA and Burbank from the Antelope Valley and Santa Clarita, which

is not surprising given that Metrolink delivers better and more frequent service to these commuter markets. The Antelope Valley to San Fernando Valley intermediate market also falls into this tier. Tier 2 (between 390 and 580 daily between pairs of origin and destination zones), includes the East San Fernando Valley to Central LA market and the Antelope Valley-to-Santa Clarita Valley and Santa Clarita Valley-to-San Fernando Valley intermediate markets. The third and lowest tier for zone-to-zone commuter rail travel (less than 150 daily trips) comprise all of the reverse-commute markets, such as from Central LA and the San Fernando Valley to the Santa Clarita and Antelope Valleys. This too is unsurprising, since the quantity and quality of reverse-peak service on the AVL is much lower than in the peak direction – a consequence of the largely single-track railroad.

The highest Metrolink mode share is in the longest-distance peak direction market from the Antelope Valley to Central LA – approximately 12 percent, which is a high transit share compared to other Los Angeles transit corridors but still with plenty of opportunity to increase mode share with improved rail service in corridors with heavily-congested freeways. The next highest rail mode share is only 4 percent. These market data indicate that the AVL has the potential to serve significant volumes of travelers in all three of the geographic travel categories: commuting to Central LA, travel to intermediate destinations along the line, and reverse-commute travel, provided rail service is improved in both directions of travel during both peak and off-peak travel periods.

Table 2-5: Daily Trips Between AVL Study Area Origin and Destination Zones

<u>Origin Zone</u>	<u>Destination Zone</u>	<u>Dir</u>	<u>All-Mode Total Trips</u>	<u>Rail Trips</u>	<u>Rail Share</u>
Santa Clarita Valley	San Fernando Valley	Int	147,300	390	0.3%
San Fernando Valley	Central L.A. / Burbank	Pk	146,041	579	0.4%
Santa Clarita Valley	Central L.A. / Burbank	Pk	58,060	1,715	3.0%
Central L.A. / Burbank	San Fernando Valley E.	Rev	53,500	40	0.1%
San Fernando Valley	Santa Clarita Valley	Rev	51,900	140	0.3%
Antelope Valley	San Fernando Valley	Int	35,100	1,410	4.0%
Central L.A. / Burbank	Santa Clarita Valley	Rev	26,900	140	0.5%
Antelope Valley	Central L.A. / Burbank	Pk	23,396	2,750	11.8%
Antelope Valley	Santa Clarita Valley	Int	22,300	570	2.6%
San Fernando Valley	Antelope Valley	Rev	7,300	30	0.4%
Santa Clarita Valley	Antelope Valley	Rev	6,700	70	1.0%
Central L.A. / Burbank	Antelope Valley	Rev	2,000	10	0.5%



Directionality:

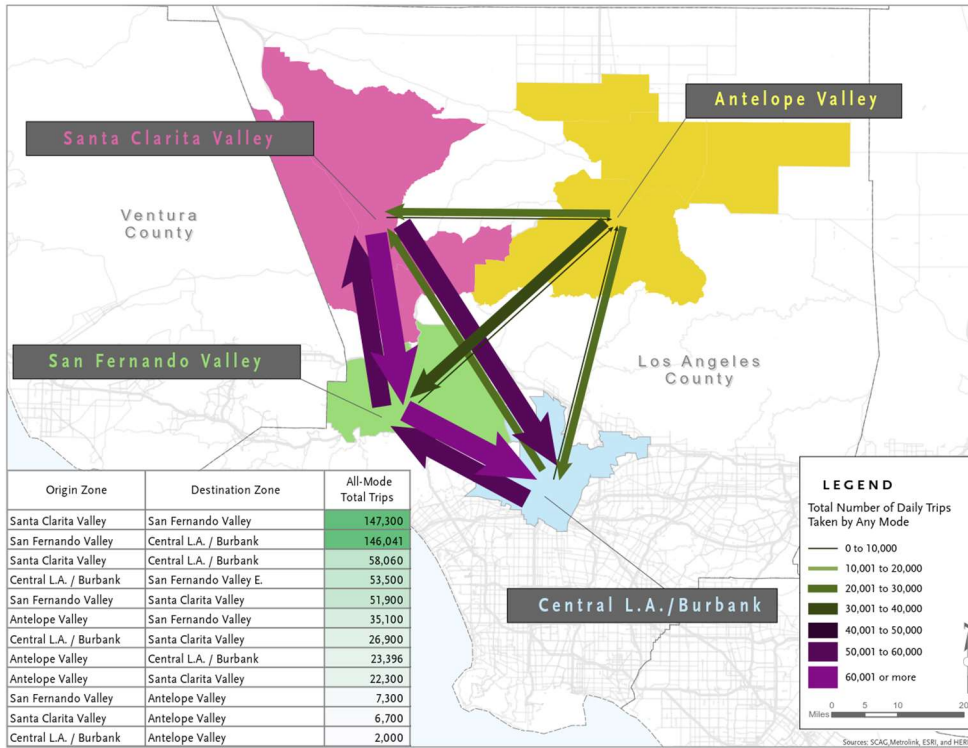
Pk=Peak direction travel to or through Central L.A.

Int=Peak direction travel to intermediate points within AVL Corridor

Rev=Reverse-peak direction travel

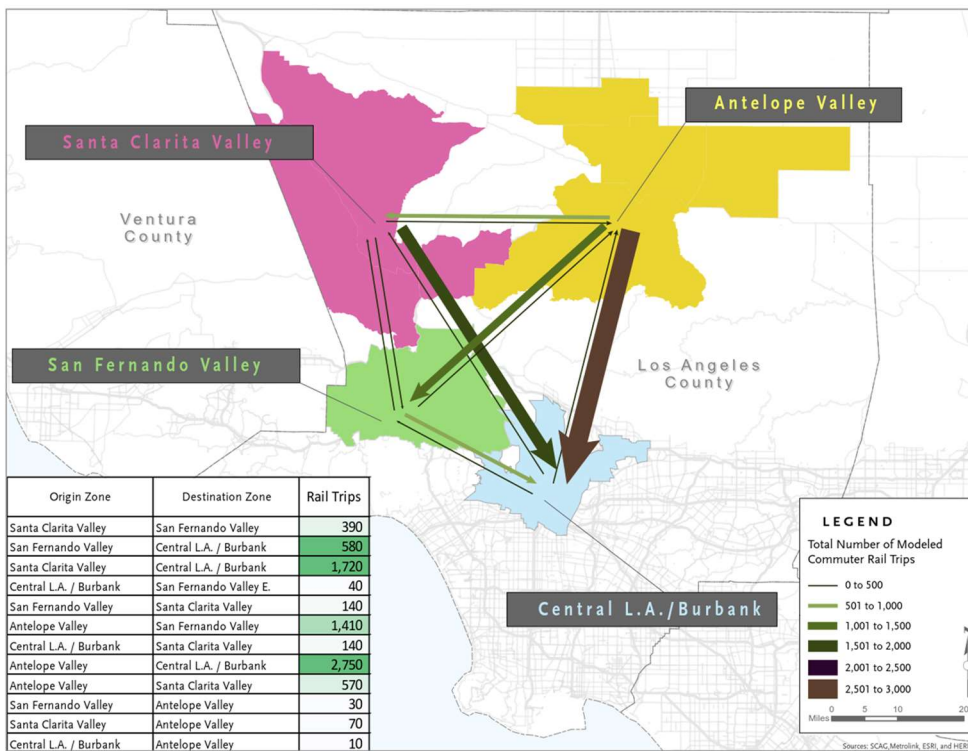
Source: SCAG daily trip data for 2012, from regional travel demand model

Figure 2-13: Total Daily Trips from AVL Origin Zones to Destination Zones



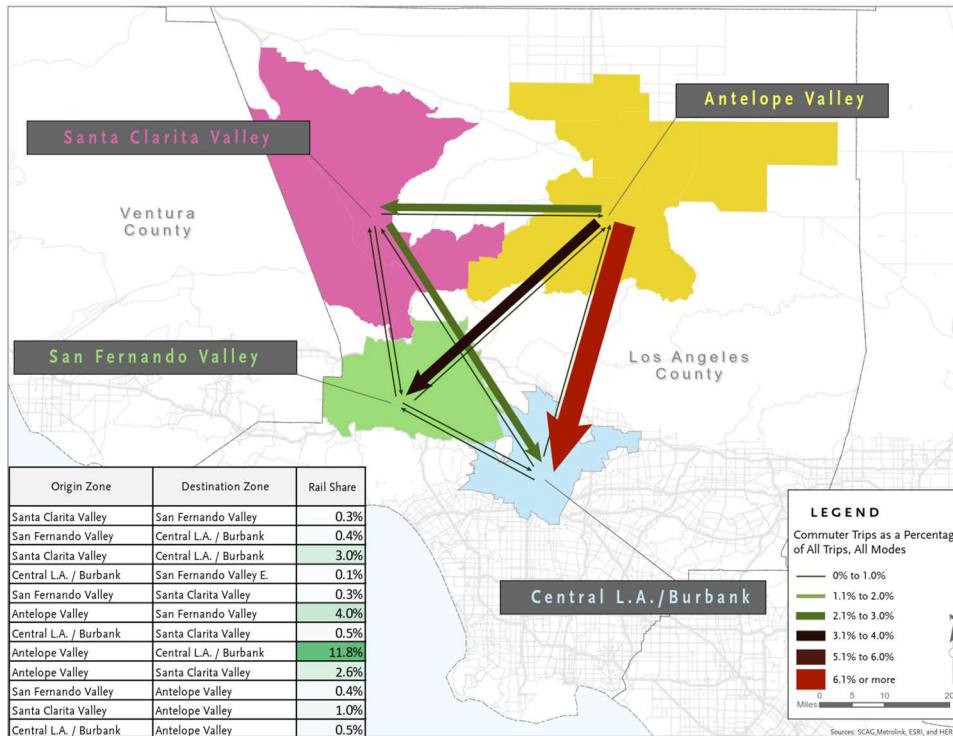
Source: SCAG daily trip data for 2012, from regional travel demand model.

Figure 2-14: Total Daily Commuter Rail Trips from AVL Origin Zones to Destination Zones



Source: SCAG daily trip data for 2012, from regional travel demand model.

Figure 2-15: Commuter Rail Share of Total Daily Trips from AVL Origin Zones to Destination Zones



Source: SCAG daily trip data for 2012, from regional travel demand model.

2.5.2.3 Work Trip Analysis:

The work-trip analysis data extracted for the Study project area’s catchment areas suggested there is a substantial amount of commute travel among cities along the AVL, and that the majority of the top five cities where employees live in the eight AVL Study catchment areas work are served by an existing AVL station (the cities of Los Angeles, Burbank, Glendale, Pasadena, Santa Clarita, Palmdale, Lancaster and San Fernando). Other cities identified as major commuting destinations not served by an AVL station are Culver City and Pasadena, which can be reached via LA Metro’s light rail EXPO and Gold lines. The only top five city of employment not served by fixed-guideway transit service is Quartz Hill, located about six miles east from the Palmdale and Lancaster AVL stations. The work-trip analysis also showed that there seemed to be higher employment travel among the cities in the northern-portion of the AVL; as one gets closer to the LAUS catchment-area, the percentage heading into the center of the City of Los Angeles rises.

2.6 Capital Investment in the AVL

2.6.1 Current/Planned Capital Improvements

SCRRA’s overall Proposed Capital Program Budget consists of three major components. The Rehabilitation component comprises \$93.8 million in carry forward from prior years and the amount adopted for the FY19 program. The Special Projects component has no carry forward, so will consist of the adopted FY19 amount. The New Capital component comprises \$233.8 million in carry forward from prior years, and the amount adopted for the FY19 program. The funding of the Capital Program Budget by SCRRA member agencies has been reconciled with approved member agency funding by their boards for a total of \$125.9 million, of which \$62.8 million is for rehabilitation, \$62.0 million is for special

projects, and \$1.1 million is for special projects. Funding was provided for design and immediate repairs to Tunnel 25. The budget for new projects included \$1 million for design of a new passing siding at Palmdale.



Tunnel 25 – Source: Metro (WSP)



Capital Improvements

Metro has identified capital projects necessary to enhance mobility and improve safety, OTP, and service along the AVL. These are listed in Table 2-6.

SCRRA was awarded \$876 million by CalSTA to implement the first phase of the SCORE program. SCRRA has identified system-wide and corridor-based projects that will allow for 30-minute service. These projects have been grouped into Service Wave 1, essential to enable 30-minute service, and Service Wave 2, projects to complement and improve upon those schedules (SCRRA, 2018c). Two projects were identified on the AVL as part of Service Wave 1:

- Burbank Jct. Speed Improvements
- Signals: Burbank to LAUS (not part of the study area, but considered for informational purposes and for modeling assumptions).

Two Metrolink system-wide projects that affect service on the AVL were identified as part of Service Wave 2:

- Link US Early Operational Phase
- Supplemental Fleet.



Source: WSP

Table 2-6: Antelope Valley Line Capital Improvements

No	Capital Project	Mileposts	Description	Status
1	Link Union Station (Link US) Project	LAUS 0.0 to CP Chavez (1.0) in the north and LAUS (0.0) to CP Olympic (142.6) in the south	This project is essential to providing the increased rail and transit capacity that is needed to serve the growing Southern California region, and is required to successfully deliver California HSR service to the Los Angeles Basin. Link US is the centerpiece of the SCRRA SCORE Program, providing critical capacity increases that are required to realize over 26 percent of the significant reductions in Basin-wide vehicle miles traveled and greenhouse gas emissions that will result from the SCORE Program.	Environmental & PE
2	Doran Street and Broadway/Brazil Grade Separation Project	7.51 and 7.99	The two grade separated structures will result in the at-grade crossing closure at Doran Street and Broadway/Brazil to improve safety and mobility for the area while implementing the needed infrastructure capacity enhancements.	Environmental
3	Burbank Jct Speed Improvements	11.4	These improvements will assist with commuter and freight rail movement between the Ventura and Valley subdivisions and accommodate a 30-minute headway for service.	Fully funded via SCRRA TIRCP Grant (Metrolink is lead agency)
4	Burbank Airport – North Metrolink Station Project	13.66	Project provides the first train to plane connection for the Valley Line and will assist in reducing vehicle trips on the I-5 freeway and surrounding streets with new Metro and local bus connections at this station.	Completed (In Operation)
5	Brighton to Roxford Double Track Project	12.8 to 23.6	The Project includes 10.9 miles of new second mainline track. The project allows for express service capability and improved mobility, on-time performance and enhances safety at 16 at-grade crossings within the project limits.	Final Design 4 construction phases were approved by the Metro Board
6	Balboa Siding Project	25.3 to 26.5	This siding extension project would extend double track capability to control point Balboa to improve rail mobility and capacity leading up to Tunnel 25.	Environmental & Preliminary Engineering
7	Saugus to Hood Double Track Project (pending Board approval)	30.25 to 32.3	The second mainline track completes capacity enhancements through most of the City to allow for improved frequency of service.	TBD (Subject to funding)
8	Canyon to Lang Railroad Improvements (pending Board approval)	33.4 to 38.6 and 40.3 to 41.6	These capacity improvements will double track two separate gaps between control point Canyon in Santa Clarita and Lang in the County of Los Angeles.	TBD (Subject to funding)
9	Ravenna to Russ Siding Extension (pending Board approval)	47 to 52.5	This siding extension project would improve rail mobility and capacity while addressing SCRRA SOGR needs parallel to the Santa Clara River.	TBD (Subject to funding)
10	Palmdale to Lancaster Double Track (pending Board approval)	67.6 to 76.2	The Project includes 8.6 miles of new second mainline track. The project allows for improved service capability and mobility, on-time performance and enhances safety at 7 at-grade crossings within the project limits.	TBD (Subject to funding)

Source: Capital Project List provided by Metro, dated May 24, 2018

2.6.2 Rehabilitation Needs

The railroad purchased from Southern Pacific in 1992 was over 100 years old at the time of purchase, and some of the infrastructure still in existence on the line today is up to 100 years old and in serious need of rehabilitation. Southern Pacific undoubtedly conducted track upgrades and replacements over the course of their ownership of the line, but many of the bridge, culvert, and tunnel structures currently in use are 75 to 100 years old or older. The need for significant rehabilitation on the line has become a major focus for both SCRRRA and Metro, as owner of the entire line. In 2016, SCRRRA began prioritizing railroad infrastructure on the line which, if not rehabilitated, was projected to potentially result in slow orders being instituted on AVL service. Metro initiated a Rehabilitation and Renovation Study to assist the agency with assessing and prioritizing the critical infrastructure needs on all four of the Metro-owned Metrolink corridors, including the AVL. WSP USA is the consultant supporting Metro on the Rehabilitation Study.

SCRRRA undertook preparation of a programmatic rehabilitation plan, *the Metrolink Infrastructure Rehabilitation Plan* (MIRP), which was issued in draft form in December, 2017. That plan is very comprehensive in the coverage of railroad assets, and describes each element's function and major issues for State-of-Good-Repair (SOGR) considerations. Separate sub-plans are provided for Track Rehabilitation (including rail, ties, crossings, special trackwork), Structures Rehabilitation (including bridges, culverts, tunnels), Systems Rehabilitation (including signal systems, positive train control, communications, centralized train control), Specialized MOW Equipment, and Vehicles Rehabilitation (including hi-rail vehicles, track maintenance equipment).

The MIRP divides rehab needs into "Backlog", i.e., rehab needs which need to be addressed to bring the system up to a state-of-good-repair, and on-going SOGR needs, which would be annualized funding required to maintain the SOGR. Metro's total "backlog" for all four of its railroad corridors was estimated to be \$204 million, and its annual SOGR funding need was projected to be \$31.5 million (SCRRRA, 2017, Table 14). A breakdown by subdivision for Metro's assets was not provided in the MIRP. However, Table 32 in the MIRP indicates that 96.71 track miles (accounting for double-tracking) out of the total 202.6 track miles for which Metro has financial responsibility are on the AVL, so a substantial portion of the projected total rehab backlog and on-going SOGR cost relates to the AVL (SCRRRA, 2017)⁴.



Track Replacement at CP Soledad
Source: Metro (WSP)



Culvert Replacement at AVL MP 66
Source: Metro (WSP)

⁴ Please see Appendix 1, *Existing Conditions*, for further details on AVL rehabilitation needs.

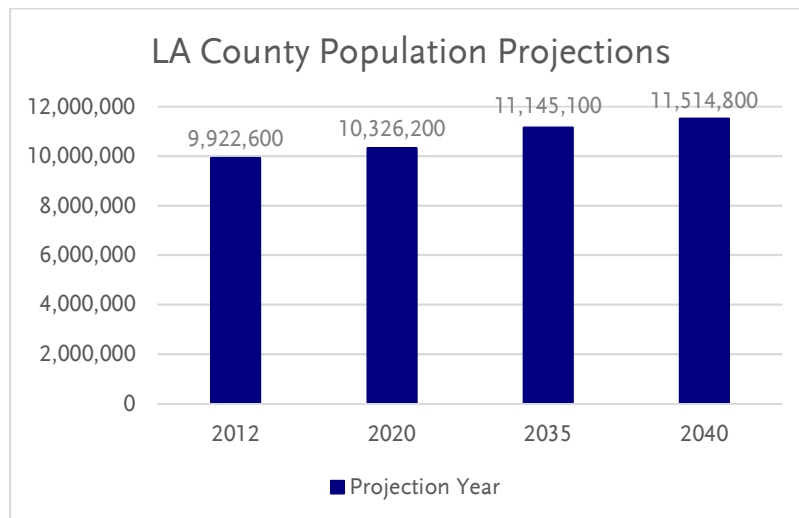
3 FUTURE VISION FOR THE AVL CORRIDOR

3.1 Demographics, Land Development and Economic Activity

LA County is expected to continue to experience population and economic growth, which will drive demand for housing and transportation options to access employment and economic opportunities for its residents. The future for the AVL corridor should anticipate the changes the region will face in the near and long term future. This includes changes like the concentration and distribution of employment and housing opportunities thought the region, and, in particular, the northern region of LA County.

SCAG develops, refines and maintains the Southern California regional and small area socio-economic forecasting/allocation models. The projections from these models help regional and local jurisdictions with their long-range planning effort mandated by federal and state regulations, one of which is the RTP/SCS. The 2016/2040 RTP/SCS shows an estimated 11 percent increase in the population of LA County over the next two decades, to 11.5 million inhabitants in 2040. The percent increase over the same period of time for the cities that comprise the Study Area (Lancaster, Palmdale, Santa Clarita, San Fernando Valley, and Los Angeles) is estimated to be higher than for the County as a whole, at 16 percent. Figure 3-1 presents the population growth for LA County for the years 2020, 2035 and 2040, as compared with the observed 2012 population estimates.

Figure 3-1: LA County Population Projections

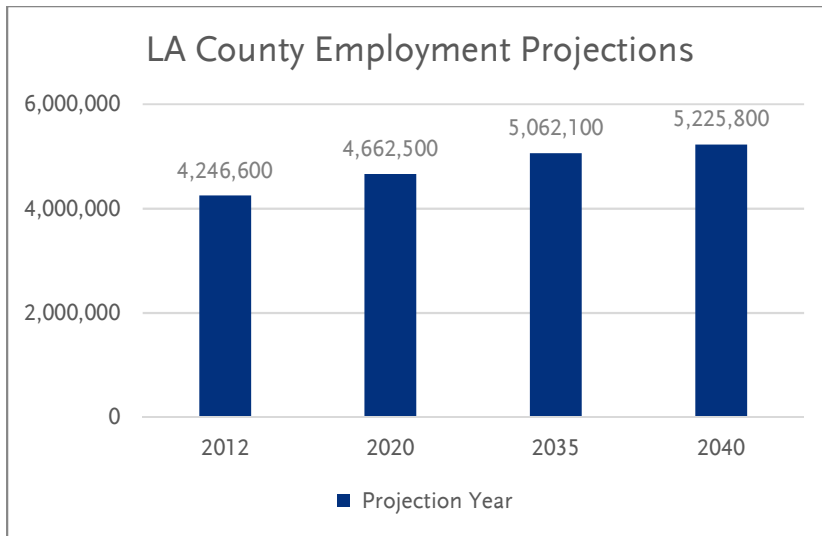


Source: SCAG 2016/2040 RTP/SCS Final Growth Forecast by Jurisdiction, 2016.

Similarly, the employment projections in the 2016/2040 RTP/SCS for LA County as a whole, over the next two decades, show an increase of 12 percent of jobs, from 4.6 million to 5.2 million in 2040, whereas for the cities in the Study Area it shows a 15 percent increase in employment (SCAG, 2017). Figure 3-2 shows the employment growth for LA County for the years 2020, 2035 and 2040 as they compare to the observed 2012 estimates. Not only are population and employment expected to grow for

the region. The California Department of Transportation's (Caltrans) Transportation Economics Branch's annual county long-term socio-economic forecast estimates an 82 percent increase in taxable retail sales, and a 44 percent increase in industrial output for LA County in the next 20 years (Caltrans, 2018).

Figure 3-2: LA County Employment Projections



Source: SCAG 2016/2040 RTP/SCS Final Growth Forecast by Jurisdiction, 2016.

The anticipated population and employment growth will accelerate demand for an already tight housing market in LA County. Future housing and commercial development in the Antelope Valley is expected to alleviate some of the housing pressure from the rest of the LA County, resulting in a higher demand for transportation options within the valley, and to reach other areas with concentrations of economic opportunities. At the same time, the Antelope Valley is expected to experience its own economic development driven by investments in manufacturing, defense, aerospace, aviation, and logistic operations.

Land development in the southern portions of the Study Area, in the San Fernando Valley, is more conducive to densification given the lack of undeveloped land available for new developments. The City of Los Angeles, along with the state government are currently developing legislation to encourage densification in already-developed areas, particularly near transit stops (State of California, 2019). In contrast, the anticipated land development in the Santa Clarita and Antelope valleys is expected to be driven by low density developments in land parcels previously undeveloped. While local governments encourage the development of higher density mixed-used types of development near transit, the planned developments are anticipated to cater to the low-density housing and commercial markets (Los Angeles Economic Development Corporation (LAEDC), 2019).

3.2 Future Rail Ridership

The population of the six-county LA region is projected to grow by 16 percent between 2017 and 2042, from 16.0 million to 18.5 million. Total weekday person-trips within the metropolitan area are projected to grow from 65.5 million to 77.7 million over the same period, an 18 percent increase. Given the market assessment findings for bi-directional travel demand on the AVL reviewed in Chapter 2, and the substantial population and economic growth projections, the AVL study anticipates there will be a growing need for both peak period/peak direction commuter service frequency, and for reverse-commute service and frequency, over the next 20 years. The scope of the AVL Study did not encompass travel demand forecasting. As part of the companion study being conducted on the south portion of the line between LAUS and Burbank Jct., the Glendale-Burbank Corridor study team modeled ridership

projections for the entire AVL for horizon years of 2028 and 2042, using a Metro ridership projection model.⁵ Projected population growth within the study area will be a major driver of future demand for rail service on the AVL, even before the effects of improved rail service and regional transit connections are taken into account.

The anticipated effects of the extensive planned regional transit investments, plus improvement in Metrolink service on the AVL based on Service Scenario 3 as an example, are shown in Table 3-1. Metrolink boardings at AVL stations are projected to increase at an annual rate of about 10 percent per year through 2028, if Scenario 3 were to be implemented. Ridership is expected to continue to grow between 2028 and 2042 at a rate of over 6 percent per year.

Table 3-1: Projected Daily Regional Travel Volumes and AVL Boardings, 2028 and 2042

	2028			2042	
	Existing AVL & Transit Svc.	With Funded Transit Projs. ¹	With AVL Scenario 3 ^{1,2}	With Funded Transit Projs. ¹	With AVL Scenario 3 ^{1,2}
Regional Person-Trips	70.9 million			77.7 million	
Regional Transit Trips – All Modes	1,296,000	1,552,000	1,556,000	1,729,000	1,732,000
Metrolink Boardings – System-wide	— ⁴	72,000	80,000	104,900	112,800
Metrolink Boardings – AVL Stations ³	5,870	16,700	17,500	36,000	41,600

¹Assumes completion by 2042 of the following regional transit improvement projects: Purple Line extension, Gold Line extension to Claremont, Green Line extension to Torrance, Crenshaw/LAX transit, Regional Connector project, East San Fernando light rail transit (LRT), North San Fernando Valley BRT, Sepulveda Transit Corridor, West Santa Ana Branch LRT, SR 60 North Side LRT, Vermont Corridor BRT and North Hollywood to Pasadena BRT. A subset of these projects is assumed to be completed by 2028.

²Includes improved Metrolink service per Scenario 3, which corresponds with Enhanced Metrolink Service Scenario M Option 30 in the Glendale-Burbank Study (Metrolink semi-hourly off-peak service).

³Includes Antelope Valley Line train boardings at Los Angeles Union Station (LAUS).

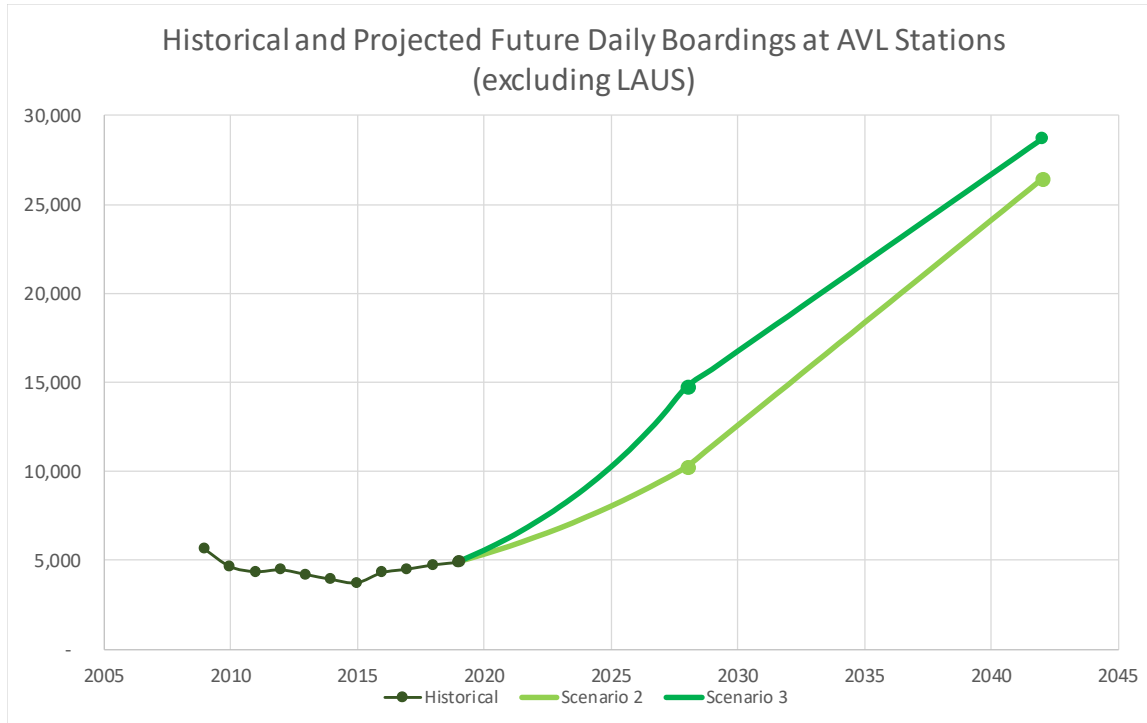
⁴Data not provided in report.

Source: LA Metro, *Ridership Forecast Summary 2028 and 2042*, RSG in cooperation with Mott MacDonald, August 28, 2019, Tables 3 and 4, Figures 5.2 and 5.4.

Figure 3-3 shows the past ten years of historical average daily AVL ridership, based on Metrolink ticket data, as well as projected future daily ridership in 2028 and 2042 for AVL Service Scenarios 2 and 3. The trend in AVL ridership had been one of gradual decline from 2009 through 2015. In April of 2015, the LA Metro Board approved a motion to implement the AVL Fare Discount Pilot Program, reducing Metrolink fares by 25 percent on the AVL. Since that program’s launch in July 2015, the AVL has seen steady ridership growth. As of June 2019, daily boardings on the AVL had increased approximately 29 percent over 2015 levels. Weekday ridership on the AVL is projected to continue to grow dramatically over the next 25 years.

⁵ Los Angeles County Metropolitan Transportation Authority, *Ridership Forecast Summary 2028 and 2042*, by RSG in cooperation with Mott MacDonald, dated August 28, 2019. Prepared as part of the Glendale-Burbank Corridor Study.

Figure 3-3: Metrolink Antelope Valley Line Historical and Projected Ridership



Sources:

Historical data: Appendix 1, *Existing Conditions*, Figure 6-1; Average weekday boardings calculated from ticket sales data provided by SCRRA.

Future Projections: LA Metro, *Ridership Forecast Summary 2028 and 2042*, RSG in cooperation with Mott MacDonald, August 28, 2019, Tables 8 and 9.



Source: SCRRA

Future AVL ridership growth will be driven by three factors:

- Strong population and employment growth in the AVL Corridor study area
- Improved Metrolink AVL rail service, with more frequent service, increased average speeds and a high level of on-time performance
- Improved regional transit connections at several stations along the AVL.

The long-range projections indicate the potential for the AVL to serve a ridership market that is on the order of five times greater than existing ridership levels. The projected increase in ridership is driven largely by population and employment growth in the corridor. It also reflects future assumptions about the increased frequency of rail service, the projected increase in traffic congestion, and improvements in transit connectivity that accrue from the expansion of light rail service adjacent to portions of the corridor.

Strong ridership growth is expected within all four of the groups of station catchment areas identified in Section 2 (Table 2-4). Growth in average daily boardings for these four groups of stations is shown in Table 3-2. If AVL service is improved according to Scenario 3, for example, AVL ridership can be expected to grow at an average rate of 7.4 percent per year for the corridor as a whole over the period from 2017 through 2042. Average annual growth at stations within the East San Fernando Valley and Antelope Valley is projected to be on the order of 10 percent per year.

To support the projected increases in population, employment, and commuter rail travel demand, the AVL must make steady improvements in infrastructure capacity to support increases in service frequency in both peak and reverse-peak directions. Later chapters of this report present a plan of incremental service improvement, supported by the required infrastructure capacity improvements on the line, to move the AVL toward the ability to operate 30-minute bi-directional service or better in the long-run.

Table 3-2: Existing and Projected Total Daily AVL Boardings, by Station Group

AVL Station Groupings	2017	2028 Scenario 2 ¹	2028 Scenario 3 ²	2042 Scenario 3 ²	Average Annual Rate of Growth, 2017-2042
Glendale and Burbank Downtown	1,650	1,900	3,280	4,450	4.0%
East San Fernando Valley	740	2,010	3,810	7,330	9.6%
Santa Clarita Valley	1,340	2,350	3,623	5,210	5.6%
Antelope Valley and Soledad Canyon	1,100	3,990	4,030	11,710	9.9%
TOTAL	4,840	10,260	14,750	28,700	7.4%

¹Corresponds with Scenario M Option 60 (Metrolink hourly off-peak service).

²Corresponds with Scenario M Option 30 (Metrolink semi-hourly off-peak service).

These figures exclude passenger boardings at LAUS.

Source: LA Metro, *Ridership Forecast Summary 2028 and 2042*, RSG in cooperation with Mott MacDonald, August 28, 2019, Tables 8 and 9.

3.3 Role and Nature of Rail Service in the AVL Corridor

3.3.1 General Vision for Metrolink Rail Service

Metrolink currently carries only a relatively small share of all travelers in the corridor paralleling the rail line, which also includes the SR 14 and I-5 freeways. There are an estimated 580,000 daily trips in the corridor that are potentially able to be served by the AVL, after discounting short-distance trips or areas not served by rail. The AVL captures an estimated 1.4 percent of those trips. By adding tracks, upgrading signaling, grade-separating crossings and junctions, trains will be able to operate more frequently and reliably, thereby making rail more competitive with driving in terms of travel time and convenience. Coupled with expectations that traffic congestion in the corridor will remain severe and may increase over time, high-quality rail service is expected to capture a significantly higher share of total trips. Assuming that total corridor travel grows proportionally with regional population growth (11 percent growth over 20 years), the estimated five-fold increase in ridership by 2042 will result in a four-fold increase in rail mode share, from 1.4 percent to an average of six percent across the entire study area.

The general benefits to the region of improved rail service, as articulated by Metrolink, include:

- Increased ridership (to 35 million trips per year for the entire system)
- Decreased regional vehicles-miles travelled (3.4 billion vehicle-miles removed from the road)
- Decreased regional greenhouse gas emissions
- Increased active transportation – e.g., enhanced walking and biking access to rail stations
- Reduced train idling time
- Reduced freight train delays
- Grade crossing improvements to increase safety and facilitate Quiet Zone implementation.

3.3.2 Long Term, Medium Term and Near Term Vision for the AVL

The vision for future rail service in the AVL corridor includes more than just traditional commuter rail service. The rail line is part of a larger network of well-connected transportation services, including regional transit and state-wide and inter-state long-distance travel. The vision is aspirational and not artificially constrained by specific limits on the availability of funding. As a practical matter, the vision will need to be achieved through investment decisions that will require significant funding and consensus among multiple agencies and levels of government.

Long-Term

Future Metrolink AVL service, 20 years from today, is envisioned as part of an integrated rail network that carries people seamlessly and conveniently across the region and state. The rail line forms the spine of a regional transit network, offering timed connections with local transit at rail stations. The rail line is expected to carry substantially higher ridership volumes than the current AVL, and rail is anticipated to capture a significantly greater share of the market for travel in the corridor. The future AVL will offer good service to a broad range of trip purposes: traditional commuting, non-traditional work-related travel (not necessarily to and from the urban central business district, not necessarily every weekday, and at times of day other than 9-to-5). The AVL will provide more frequent and faster bi-directional service among all of the geographic market areas: Antelope Valley, Santa Clarita Valley, San Fernando Valley and Central LA/Burbank. It also will serve all three market categories identified in the market assessment: peak direction travel to Central LA, peak direction travel to intermediate locations in the Santa Clarita Valley and San Fernando Valley, and reverse-peak or reverse-direction markets.

The AVL will feed LAUS as the region’s major transportation hub, with capabilities greatly enhanced by the LINK US project. The AVL will be part of a network of through-running regional rail lines at LAUS, with one-seat rides to points south and/or east of downtown LA. Other major hubs will exist at Palmdale and Burbank Airport, as well as local transit hubs at other AVL stations.

Travelers in the corridor will have a choice of available rail services: local service with the characteristics of transit (relatively high frequency); fast regional express service; connections to state-wide and interstate HSR services – to the Bay Area and Central Valley, Las Vegas, San Bernardino, Riverside, Orange County and San Diego.

This long-term vision is consistent with the longer-range vision contained in the State Rail Plan for 2040 and compatible with potential future blended service/operations with Metrolink, CHSRA, Virgin Trains USA and/or Amtrak. It also is consistent with Metro’s plans for rail network integration with the East San Fernando Valley Transit Corridor.

Ideally, express service between the Antelope Valley and LAUS and Burbank, using a new dedicated high-speed line, will offer dramatically shortened trip times. However, construction of the dedicated high-speed line could be a long time coming, and it would be wise for the region to have a back-up plan for providing some portion of the speed and capacity benefits of the dedicated line on the legacy AVL corridor – where further incremental investments in time savings and capacity could prove to be cost-effective and deliverable in a shorter timeframe than full dedicated high-speed rail.

The long-term vision for the AVL is flexible with respect to rolling stock technology and could entail evolution of the fleet to suit the differing types and sizes of travel markets and respond to opportunities for cleaner, more energy-efficient and more cost-effective technologies (e.g. zero-emissions, biodiesel, or hydrogen-battery hybrid⁶). The long-term future could entail use of electric multiple-unit equipment if the line is electrified, or the use of efficient diesel multiple units or new bio-diesel fueled locomotive technology.

The long-term vision for the AVL assumes substantially higher ridership, in response to a high level of rail system performance in terms of service frequency, travel time and convenience.

Medium-term

The vision for AVL rail service in the 10-year time horizon includes significant improvement in both the quantity and quality of rail service on the line. The State Rail Plan calls for half-hourly service between Santa Clarita and Los Angeles, and hourly service to and from the Antelope Valley. This service will be provided at regular, repeating intervals every hour – referred to as “clockface” schedules. In addition to more frequent local all-stop service focused on rush hour travel to downtown Los Angeles, the medium-term vision calls for introducing regular reverse peak service at 60-minute headways, and express service during peak periods in the peak direction of travel.

Train running times on the AVL will be significantly shorter than they are today, through a combination of express service, reductions in time waiting for train meets at limited passing sidings, and a reduction in the amount of recovery time built into train schedules reflecting the ability to deliver service more reliably. By bringing infrastructure assets to a state of good repair, providing sufficient rail capacity to support the service, and carefully managing the railroad’s operations, on-time performance is expected to be maintained between 95 and 100 percent.

The medium-term vision embraces the concept of blended service – with Las Vegas intercity trains, Amtrak service and eventually high-speed rail trains from the Central Valley sharing the AVL with Metrolink regional rail trains, as long as the blended service can be delivered cost-effectively. Since the financial viability and cost-effectiveness of through running of intercity trains on the AVL remains to be

⁶ The San Bernardino County Transit Authority (SBCTA) is testing hydrogen-battery hybrid multiple-unit technology on its Arrow line between San Bernardino and Redlands, CA.

proven, the medium-term vision also embraces the potential for convenient and well-coordinated transfer connections between AVL and intercity services at Palmdale.

The AVL will offer convenient transfer connections to the planned East San Fernando Valley light rail line at Sylmar, with the Ventura County Line at downtown Burbank, and with local transit services at multiple stations, making the AVL part of an integrated regional transit system. AVL stations will offer a broader array of access choices, including transit, pedestrian and bicycle, ride-sharing and on-demand services, and first/last mile options other than drive-and-park.

The AVL will accommodate UPRR freight trains operating in designated time slots that will exist throughout the day. This will be a significant change from current operations but will increase the number and regularity of opportunities for operating freight trains on the corridor. The AVL in the medium-term future will provide the transportation capacity and connectivity needed to support the 2028 Summer Olympics and Paralympics in Los Angeles.

Near-term

Improvements to rail service within the next five years will be limited by operational and financial resource constraints. However, Metro will continue to work towards regional consensus to seek local, federal and state funding sources for a program of incremental capital investment and rail service improvement.

Service improvements in the near term can focus on changes that are not capital-intensive, such as expanding the service day with later evening departures from LAUS, or increasing off-peak service frequency. There is spare seating capacity on most peak period trains, which can accommodate growth in ridership demand in the immediate future. On the relatively few peak trains that are routinely crowded, lengthening train consists is a possibility, which would have implications for station platform lengths, yard capacity and rolling stock, but which could defer the need or reduce the scope of major investment in double-tracking of the rail line.



Source: SCRRRA

4 CURRENT PLANNING CONSIDERATIONS

Future plans by Metro, Metrolink, the State of California and the CHSRA call for increasing integration and coordination of passenger transportation services. As those services expand to accommodate increasing ridership and meet new market demands, the Metrolink network, which forms the transit spine of the southern California region, will also need significant investment to keep pace. Coordinated investment in a better integrated overall transit network will leverage the investments in the individual component parts and compound the transportation, environmental and economic benefits generated by improvements to the entire transportation network.

The most significant other planning processes and investment initiatives that affect and will be affected by the AVL are summarized below.

4.1 Rail Initiatives

4.1.1 State Rail Plan

The California 2018 SRP serves as a framework for planning and implementation of operations and capital investment strategies for the state's rail network for the next 20 years, and beyond.

The mission of the 2018 SRP is to provide a safe, sustainable, integrated and efficient California rail network that successfully moves people and goods while enhancing the state's economy and livability (State of California, 2018). The vision of the SRP is focused on moving people and goods, both of which have implications on how the AVL will be operated.

With the goal of moving people more efficiently, this latest revision to the Rail Plan focuses on the planning and investments needed to integrate the rail system with local and regional light rail and commuter rail, and with the station communities served by the entire network. The SRP calls for the rail system to provide reliable 30-minute service at a station in denser urban areas, or at least every 60-minutes at any station in the rest of the state, with the ultimate goal of frequent single-seat passenger rail service between northern and southern California.

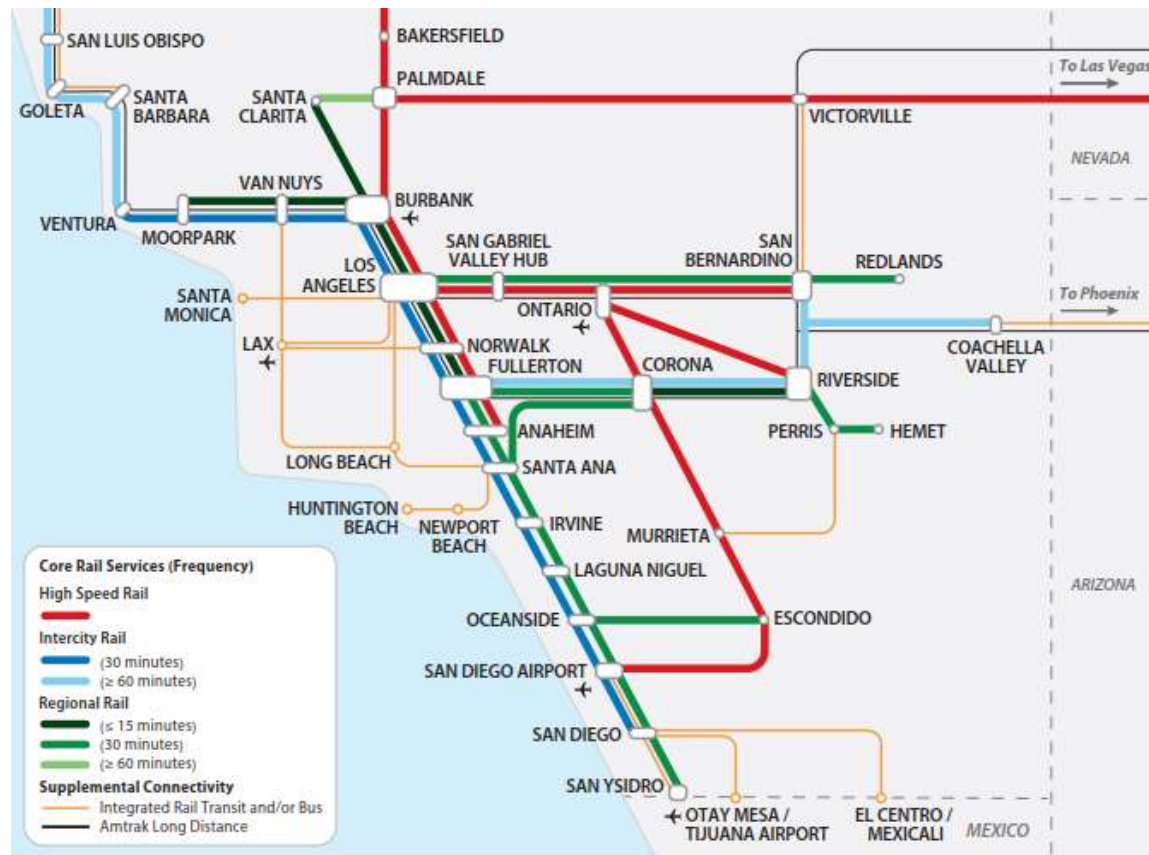
For freight users of the state rail network, the SRP calls for greater system wide reliability through incremental investments to achieve more capacity. Freight volumes are expected to outpace personal travel demand increases between now and 2040. As freight increases its capacity and demand to utilize rail corridors, passenger rail services, including the AVL, will need to anticipate more complex service arrangements, and the need for additional infrastructure investments to accommodate both personal travel and goods movement.

Identified investments of relevance to this Study are those associated with the North LOSSAN⁷ and Antelope Valley service area in the SRP, which call for providing 30-minute service frequencies between the Santa Clarita and San Fernando Valley communities and Los Angeles, to ensure connectivity and provide access to the statewide network, including HSR services. The SRP also specifies service

⁷ The LOSSAN Corridor, linking Los Angeles and San Diego, is the rail route over which Amtrak Pacific Surfliner trains operate. The northern portion of the corridor extends from Los Angeles Union Station (LAUS) to San Luis Obispo, via Glendale, Burbank, the western San Fernando Valley, Ventura and Santa Barbara. Between LAUS and Burbank Junction, the AVL operates on the LOSSAN Corridor, sharing tracks with Amtrak and Metrolink Ventura County Line trains, as well as UPRR freight trains.

frequencies of 60-minutes or better between Los Angeles and Chatsworth along the LOSSAN corridor (State of California, 2018).

Figure 4-1: 2018 California State Rail Plan Southern California Service 2040 Vision



Source: State of California Website. 2018 California State Rail Plan Webpage. 2018.

4.1.2 Metrolink SCORE Program

The Southern California Optimized Rail Expansion (SCORE) program is an initiative of Metrolink, to upgrade the regional rail system to meet the current and future needs of the traveling public. By adding tracks, grade separations, and upgrading signal systems across the entire Metrolink system, trains will operate more frequently reliably, and with more regular schedules, making regional travel by train easier, integrating the system with better connections, and creating an even more appealing alternative to driving. The crossings will also be upgraded so the majority of the system will be Quiet Zone-ready, enabling cities to apply for a designation so trains horns aren't routinely blown. Communities throughout Southern California will also benefit from a reduction in vehicle miles traveled, which will reduce greenhouse gas (GHG) emissions by 51.6 million metric tons. To the extent additional funding is received, the full set of projects could be complete as soon as 2028, just in time for the 2028 Summer Olympics.

The multi-year SCORE program is pursuing funding from several grant programs. In April, 2018, the California State Transportation Agency (CalSTA) awarded state grants to Metrolink and Southern California regional rail totaling \$1.175 billion. Metrolink will receive \$876 million from the State's Transit and Intercity Rail Capital Program (TIRCP). Nearly half of that grant will be used to extend run-through tracks at Los Angeles Union Station as part of the Link Union Station (Link US) project. The balance of the TIRCP funds will be used for significant investments in infrastructure called for in the SCORE plan, such as adding track, signals, and additional station platforms so that Metrolink can provide more

reliable, frequent service throughout Southern California. These funds will help provide at least 30-minute service in both directions on key Metrolink corridors that serve Los Angeles, including portions of the AVL. Additionally, improvements at grade crossings will be funded to help ensure cities can implement Quiet Zones.

Metrolink prepared future rail service plans and analyzed them using an operations planning model to determine where on the AVL new capacity is required. The initial modeling considered only Metrolink service and did not explicitly identify time slots for other operators on the corridor, including the freight railroad UPRR. The analysis revealed that projects could be grouped into packages that promote progressively improved service on the line. Early investments focus are generally:

- Located primarily in the existing rail ROW
- Requiring minimal environmental clearance
- Enabling early service increases and transition to network with pulsed service at regular clock-face intervals

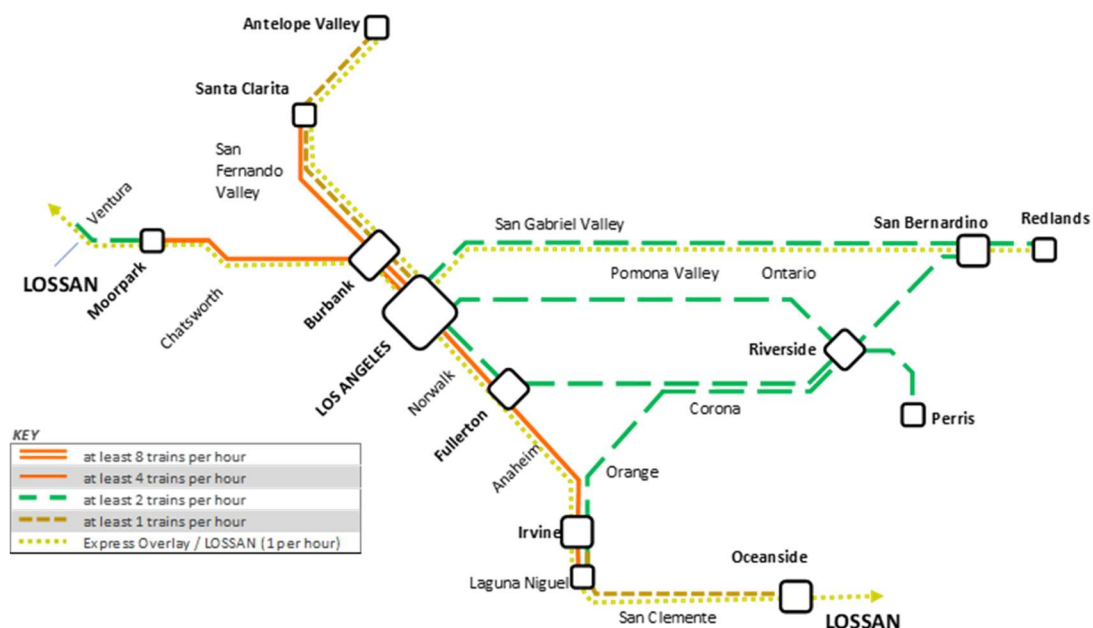
These early projects would promote operational efficiency, unlock capacity, and lay a critical foundation for later construction. One early operational scenario depends upon additional investment and would enable a mix of Metrolink services, including at least two trains per hour between LAUS and Santa Clarita and one train per hour between Santa Clarita and Lancaster, with one additional express train per hour between LAUS and Lancaster, operating in the peak periods in the peak direction of travel.

Later phases of the SCORE program would:

- Include projects requiring right-of-way expansion/acquisition or environmental approval
- Enable robust, all-day and all-direction, region-wide service, including a true pulsed network
- Fulfill the 2040 State Rail Plan Vision in Southern California

The System-wide service concept for 2028 is shown in Figure 4-2. On the AVL, the full 2028 SCORE plan would increase base service frequencies to four trains per hour between LAUS and Santa Clarita, and two trains per hour between Santa Clarita and Lancaster, including a local train and an express service.

Figure 4-2: SCORE Target Service Levels for 2028



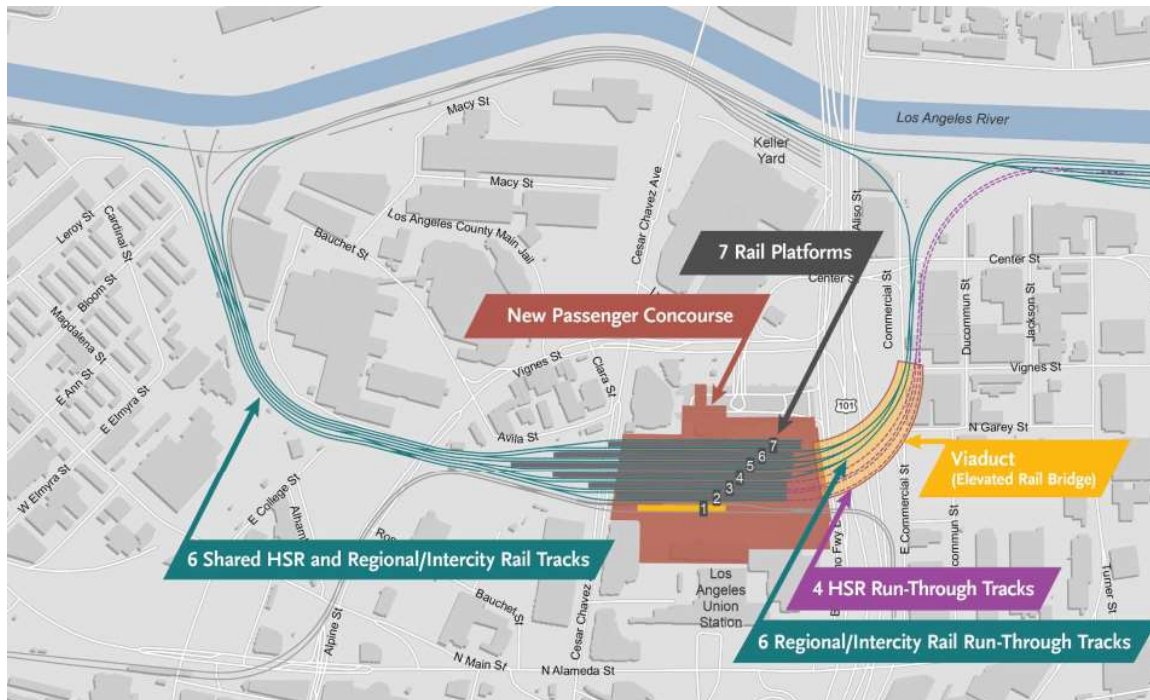
Source: SCRRRA Website. SCORE: The Vision for the Future of Regional Rail Webpage. 2018.

4.1.3 Link US

The Link US project is intended to address the operational and capacity constraints stemming from the current “stub-end” track configuration, which require trains to stop and turn at LAUS. The Link US project will reconfigure the “throat” and elevation of the rail yard, construct a loop track and provide run-through tracks over the US-101 freeway. The reconfiguration will potentially allow regional one-seat trips from Ventura County and the Antelope Valley, to San Bernardino and San Diego counties. The project will also provide capacity to meet demand from the future California High-Speed Rail project. New platforms, along with a redesigned concourse with expanded retail amenities, will upgrade the passenger experience as befits a major regional destination (Metro 2018).

The completion of the Link US project will facilitate the operation of 30-minute service on the Metrolink system, including the AVL, enabling more efficient operations for all rail passenger services. The Link US Team comprises a number of agency partners, including Metro, FRA, CHSRA, SCRRRA, Amtrak, LOSSAN, Caltrans, and the City of Los Angeles.

Figure 4-3: Link US Proposed Project - Up to 10 Run-through Shared Tracks



Source: Metro Website. Link Union Station (Link US) Webpage. 2018.

4.1.4 Burbank-Glendale-Los Angeles Corridor Study

The Burbank-Glendale-Los Angeles Corridor feasibility study examines the possibilities of adding new stations in the City of Glendale and in the City of Los Angeles. The feasibility study also considered opportunities to provide more frequent passenger rail service throughout the day from LAUS to the City of Burbank, and ultimately to the Antelope Valley, in the form of enhanced Metrolink service, Rail Multiple Units (Electric Multiple Unit/Diesel Multiple Unit) and/or LRT for the corridor between Los Angeles and Burbank Airport. The feasibility study also address possible options for increasing the City of Glendale’s access to the Regional Transit System within the context of the existing Metrolink and Amtrak system, North Hollywood to Pasadena BRT and future High Speed Rail service (Metro 2019).

The AVL Study and the Burbank-Glendale feasibility study were undertaken at the same time and in collaboration with one another, to ensure efficiency in the planning and development of improvements along the AVL corridor.

4.1.5 LOSSAN Corridor Planning

The LOSSAN Agency completed the *LOSSAN Corridorwide Strategic Implementation Plan (SIP)* in April 2012 to support the new Corridorwide vision of passenger rail services and focuses on expanding and enhancing the integration of the Corridor’s passenger rail services. This SIP includes the establishment of a 20-year service objective for the entire corridor and identifies a range of infrastructure improvements required to support this objective (LOSSAN 2012)

The purpose of the SIP was to collectively provide, in a strategic document, a roadmap to identifying “the infrastructure to allow more peak period trains, faster through-express trains and additional service improvements that meet current and future conventional and high-speed intercity, commuter and freight demands.” Specific long-term goals were also identified and included:

- Additional commuter and intercity service including all-stop, “cross-county”, commuter service between Los Angeles and San Diego.
- New San Diego stops at the San Diego International Airport Intermodal Transportation Center and the San Diego Convention Center.
- Conversion of peak period intercity service to limited stop express.

The LOSSAN Rail Corridor Agency is required to submit an annual business plan to the State of California by April 1st of each year. The *LOSSAN Rail Corridor Agency Business Plan FY2018-19 to FY2019-20* includes operating plans and strategies new to the Agency since the publication of the 2012 LOSSAN SIP. (LOSSAN 2019)

4.1.6 California High-Speed Rail Considerations

The ultimate vision for California’s HSR system is to provide service from San Francisco to the Los Angeles basin in under three hours at speeds capable of exceeding 200 miles per hour. The HSR system will eventually extend to Sacramento and San Diego, totaling 800 miles with up to 24 stations. The Palmdale to Burbank project section, originally part of the Phase 1 HSR network (CHSRA, 2018) currently is not fully funded, and its implementation currently is deferred in favor of completing the Central Valley portions of the system.

According to the original system plan, CHSRA intends to utilize the AVL Corridor, running parallel to the AVL between Lancaster and Palmdale, and then re-entering the corridor in the vicinity of the new Burbank Airport – North Metrolink Station. Although the horizontal and vertical alignments have not been fully defined, CHSRA’s Alternative Analysis identifies the potential for significant track realignments within the 100-foot Metro-owned railroad ROW to allow for two dedicated HSR tracks within the Corridor. The track alignment and ROW configuration will need to be developed in collaboration with CHSRA, recognizing the planned shared or adjacent utilization of the Metro-owned ROW. Track and rail systems also will need to be designed in accordance with SCRRRA engineering standards.

Once HSR is implemented, the potential will exist for service coordination between Metrolink and HSR. With the clock-face schedules that will be enabled by the SCORE investments, timed connections between AVL and high-speed trains will be possible at each of the stations that they are expected to jointly serve – LAUS, Burbank Airport – North, and Palmdale.

In light of the constraints on funding and the uncertain timing of the full build-out of the dedicated high-speed line, consideration is being given to investment in an interim solution for the Palmdale to Los Angeles portion of the network, utilizing the AVL. This potential alternative would operate high-speed

trains and Metrolink AVL trains in blended service along the AVL, similar to the proposed operation between San Jose and San Francisco. The blended service solution would have implications on AVL infrastructure and operations and also could affect AVL fleet composition and requirements. Though not studied explicitly in the AVL Study, this concept will require further analysis to determine its operational and physical feasibility, requirements for infrastructure investment for capacity and trip time, cost-effectiveness and financial feasibility.

Figure 4-4: CHSRA Palmdale to Burbank Project Section Map



Source: State of California Website. California High-Speed Rail Project Webpage. 2019.

4.1.7 Virgin Trains USA

Virgin Trains USA is currently the United States' only privately owned and operated intercity passenger railroad. Virgin Trains USA, formerly known as Brightline and originally as XpressWest, intends to build

and operate a high-speed rail line between Southern California and Las Vegas, and as well other parts of the western U.S. Brightline purchased the private venture XpressWest, which originally put forward the idea to develop rail service between Los Angeles County and Las Vegas.

The current plan for this service is to initially develop the corridor from Las Vegas to Victorville using the XpressWest line concept, and then reach the City of Palmdale utilizing the proposed High Desert Corridor, an approximately 63 mile-long route connecting SR-14 and the Palmdale Transportation Center in LA County, and State Route 18 (SR-18) in San Bernardino County. Virgin Trains is interested in reaching the Los Angeles basin from Palmdale, by utilizing the planned CHSRA alignment, or the existing AVL corridor on an interim basis. To the extent that construction of a dedicated high-speed line between Palmdale and Los Angeles may be deferred for a considerable period of time, this service would be a candidate for running via the AVL in a blended service with Metrolink trains and eventually California high-speed trains, as described above for the CHSRA project.

Figure 4-5: The High Desert Corridor Project Area



Source: County of San Bernardino Website. High Desert Corridor Joint Power Authority Webpage. 2018

4.1.8 Union Pacific Railroad

The UPRR runs freight trains on the AVL corridor between the Central Valley and the Ports of Los Angeles and Long Beach within the Los Angeles area. This 75-mile corridor runs at-grade through the San Fernando Valley, turning east to roughly follow the SR-14 corridor to Palmdale. The UPRR holds the freight operating rights on the AVL. UPRR has a reserved rail freight easement for use of shared-use facilities on the line.

UPRR's Unified Plan 2020 will serve as an operating plan for a phased implementation of Precision Scheduled Railroading principles in their entire rail network (UPRR, 2019). UPRR has expressed plans to expand their operations, including along the AVL corridor.

4.2 Transit Initiatives

4.2.1 East San Fernando Valley Transit Corridor

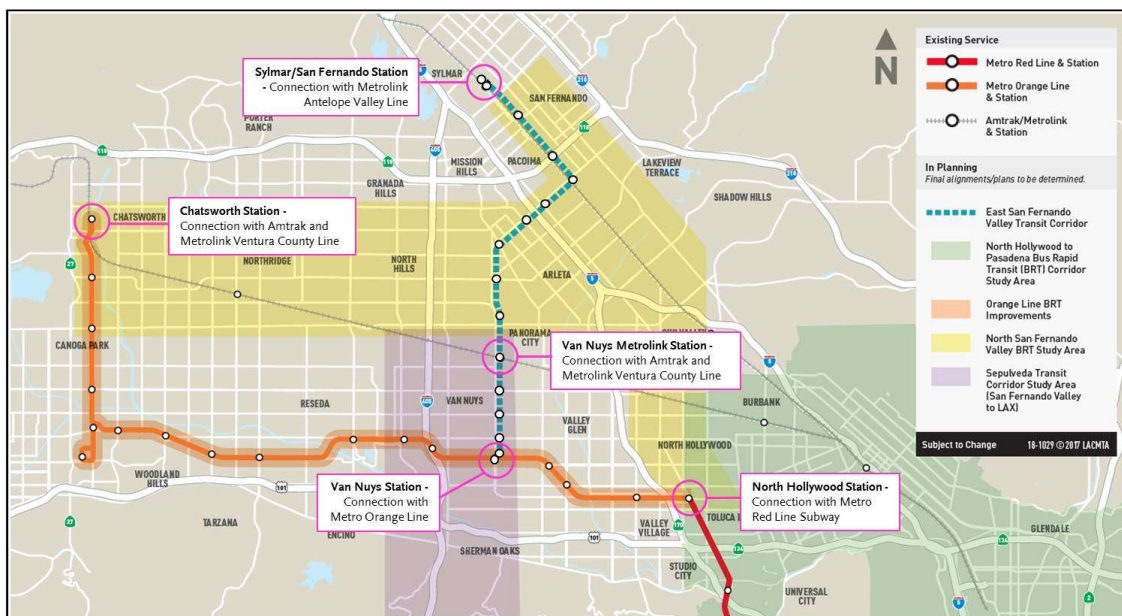
The Metro Board has approved a light rail line along Van Nuys Boulevard as the preferred alternative for the East San Fernando Valley (ESFV) Transit Corridor project. The line will run for 9.2 miles between the Orange Line's Van Nuys Station and the Sylmar/San Fernando Metrolink Station. The line is projected to have 14 stations, with an end-to-end travel time of 31 Minutes (Metro, 2018). The new light rail line would run mostly in the median of Van Nuys Boulevard. Its northern end, however, parallels the AVL and San Fernando Road between Van Nuys Boulevard and Sylmar.

The ESFV rail line will offer transfers to/from Metrolink trains at both Sylmar and Van Nuys stations. Connecting bus service is available at all of Metrolink's AVL stations, provided by eleven different bus operators. With the existing irregular schedule of Metrolink trains, tight schedule coordination is difficult. As train schedules are regularized and service frequencies increased, it will become easier to operate trains and buses on clock-face pulses that repeat regularly once, twice, or multiple times an hour.

In the San Fernando Valley, plans are advancing to create a network of high-capacity, high-performance bus and light rail transit lines that interconnect and also serve Metrolink stations at several locations. In addition to the Van Nuys Boulevard line noted above, there is a potential east-west BRT corridor and a transit corridor extending southward via Sepulveda Pass. Coupled with the Orange Line and the Metrolink AVL and Ventura County Line, these high-performance transit corridors potentially link together to form a network that can serve a much wider array of trip origins and destinations than the individual corridors that now exist.

The project is slated to break ground in fiscal year 2021-22 and open in 2027. This project is also part of Metro's Twenty-Eight by '28 Plan, which seeks to ensure that 28 major projects are completed in time for the 2028 Summer Olympics and Paralympics in the Los Angeles area.

Figure 4-6: East San Fernando Valley Transit Corridor



Source: Metro, 2018. Metro staff recommendation for June 28 meeting of the agency's Board of Directors.

4.2.2 Glendale-Burbank transit options

Planning considerations to develop transit options for the Glendale-Burbank areas are part of local and regional plans. Metro is conducting the Burbank-Glendale-Los Angeles Corridor Study to examine increased rail connectivity and additional rail stations. Metro is also looking at future BRT corridors with their North Hollywood to Pasadena Transit Corridor and North San Fernando Valley Transit Corridor projects, as well as improving the existing Orange Line BRT corridors, with grade separations and operation improvements (Metro, 2019).

The City of Burbank is working on implementation of their Link Burbank Transportation Project, which goal is to develop ground transportation improvements that will allow Bob Hope Airport to serve as a multimodal regional transportation hub (City of Burbank, 2014). The Link Burbank project transportation improvements included improving regional connectivity to the airport, better Metro rail and busway connections, consolidation of all rail and bus connections, coordination of flights and transit operation and schedules, and enhancements to multimodal options.

The CHSRA will also play a major role in the development of transit options in the Glendale-Burbank transit options with their Burbank Station. The Burbank Airport Station will be located adjacent to the Hollywood Burbank Airport in Burbank and the recently opened Burbank Airport–North Metrolink Station. The station will have intermodal connections to the airport and the newly opened Regional Intermodal Transit Center.

4.2.3 NextGen Bus Study

Metro is in the process of overhauling its bus network through the NextGen Bus Study. The study is a four-step process, with the goals of assessing the service of the current bus system, understanding the transit market demand in LA County, and making recommendations to redesign Metro's bus system. Metro is looking to adjust speed, distance, frequency, time of day, reliability as well as quality of service and safety of its current bus services, to create an attractive and competitive world-class bus system (Metro 2019).

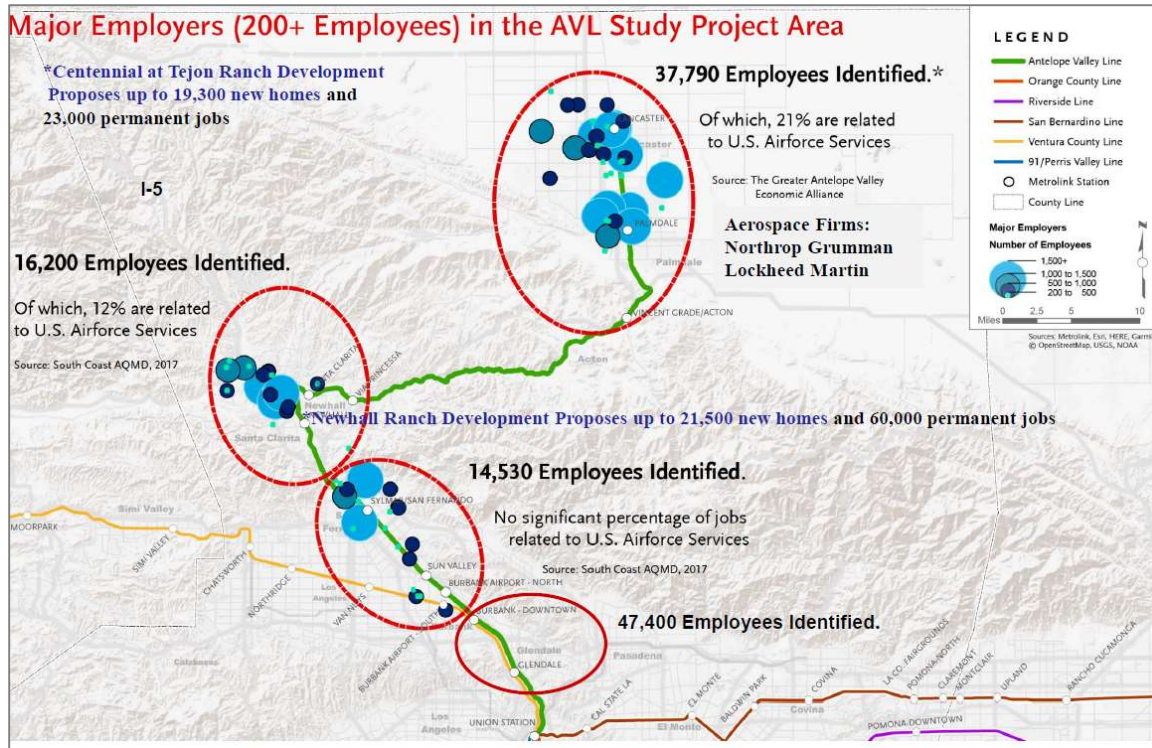
4.3 Local Development, Economic and Environmental Issues and Concerns

4.3.1 Local Development and Employment

Local development in the eastern portion of the San Fernando Valley, consists mainly of apartment and townhome buildings, some of which are mixed used developments, in highly developed areas. In comparison, the planned developments in the Santa Clarita Valley mainly consists of single family homes, and multi-family units, in land that has not been previously developed. Within the Santa Clarita Valley, the Vista Canyon Development is envisioned to be a TOD, which will consist of more than 1,000 residential units, nearly 1,000,000 square feet of commercial space, and more than 21 acres of recreational areas. The anticipation of a station serving the CHSRA and the High Desert Corridor, and the expansion of manufacturing facilities in responds to the expansion of military contracts, have influence the planned development in the Antelope Valley, with planned developments around transportation centers.

Figure 4-6 identifies major employers (those with more than 200 employees) and employment levels along the AVL corridor. Shows significant concentrations in all sections of the corridor, the Antelope Valley, Santa Clarita Valley, East San Fernando Valley and Glendale/Burbank. This reinforces the notion that the AVL needs to function in the future more as a regional transit line than a traditional commuter rail service focused primarily on bringing suburban workers to jobs in the region's central business district.

Figure 4-7: Top Employers in the AVL Study Area



Source: LA Metro

4.3.2 Environmental

When considering the construction of improvements in the corridor, environmental research and data collection is necessary to assist in the determination of preliminary environmental constraints within the project study area. It is anticipated that the main environmental constraints will be related to biological resources, jurisdictional waters/floodplains, cultural resources, and hazardous materials, although an overall assessment should be conducted on other pertinent resources such as pedestrian access, geotechnical, and other human environment and land use planning considerations. These environmental constraints include:

- **Biological Data Collection:** The biological data collection will include searches of the California Department of Fish and Wildlife's (CDFW) California Natural Diversity Database (CNNDDB), the U.S. Fish and Wildlife Service's (USFWS) quadrangle species list, and the California Native Plant Society's Online Inventory as background information to determine whether any special status (federal or state) plant and animal species are documented to occur in the vicinity of the project corridor.
- **Jurisdictional Waters and Flood Plains:** Much of the corridor from MP 24 to 56 is within the FEMA designated floodplains of Placeritas Creek and the Santa Clara River. Proposed improvements in the floodplain must be designed to avoid alteration of floodplain flows. While there is no jurisdictional wetland delineation available for the corridor, the presence of Placeritas Creek and the Santa Clara River would indicate that a hydrologic nexus exists to any seasonal wetlands, and therefore Federal jurisdiction is likely (Metro, 2012).
- **Preliminary Cultural/Historical Resources Report:** To obtain information regarding the potential to impact prehistoric or historic cultural resources along the project alignment during construction, a record search will be conducted at the Southwest Information Center of the California Historical Resources Information System (SWIC). This record search will identify

cultural resources and previous studies that might be applicable within one-half mile of the project alignment. This will include an archival research and review of their maps and literature on file. Structures along the corridor will be evaluated for historical significance.

- **Initial Site Assessment:** Conduct a record search for known hazardous materials along the corridor including any parcel that will be impacted in accordance with ASTM Standard Practice 1527-00 and the Caltrans Project Development Manual to determine if the proposed project area has been compromised by hazardous materials or wastes. Field samples and laboratory analysis are not proposed, although they will be recommended where appropriate.
- **Permits:** Once the corridor evaluation and conceptual design is complete, a list of required permits and potentially required is suggested.

Research and existing field studies information will be utilized to determine the general environmental setting of the project alignment, and for the analysis of potential impacts to determine needed studies and level of environmental document required pursuant to the California Environmental Quality Act (CEQA) and/or the National Environmental Policy Act (NEPA), as well as any required permits.

All the capacity expansion capital projects identified for this study would be constructed alongside existing tracks in areas that have already been disturbed, which would help to minimize environmental impacts. However, many of the double-track improvements would cross existing drainages or waterways and those projects would require hydrology analyses to ensure the improvements would be able to handle anticipated storm flows. Five of the track projects will also require retained cut or retained fill, which could trigger environmental analysis requirements.

4.4 Stakeholder Input and Feedback

4.4.1 Preliminary Stakeholder Feedback

Valuable comments and input were received from Stakeholders and Metro staff in workshop sessions held to describe the preliminary study findings. The discussion and responses helped shape the refinement of the service scenarios and recommendations for phased implementation. Highlights of the stakeholder feedback and suggestions include:

- The scenarios should be viewed as an incremental service improvement continuum, rather than any one scenario being an end-all objective.
- There was a strong desire to achieve some level of service improvement as soon as possible, with the knowledge that the more substantial service increases will take longer to implement.
- There was a strong desire to maintain the existing peak period frequency of service, albeit without clock-face headways initially. Given the substantial capital cost involved in operating the full-corridor local, short-turn local, and express service all on clock-face headways, and the lengthy time-period it would take to fund the projects in Scenarios 3, 4, and 5, it was preferred to strive for earlier improvements to the existing service, with the higher-numbered scenarios serving as potential longer-term goals.
- There was a strong desire expressed for late-night service on weeknights and Saturdays, with a preference for a departure at 10:30PM from LAUS⁸.

⁸ Compared with the alternative departure at 11:30 pm, the 10:30 time slot would minimize intrusion into the overnight hours that are used for track and right-of-way maintenance.

- Clock-face hourly service would be a good goal for weekday mid-day periods, to the extent near-term capital funding for the Balboa siding project is sufficient to enable that service level.
- Hourly Saturday service, and bi-hourly Sunday service, on clock-face headways, would also be good near-term goals. Bi-hourly clock-face weekend service is feasible with the existing infrastructure, but hourly weekend service requires the Balboa siding extension near Tunnel 25 to be completed.



Source: Metro

4.4.2 Public Survey Feedback

A survey of Metrolink riders and potential riders was conducted during April 2019, addressing topics of interest for both the AVL Study and the Los Angeles- Glendale-Burbank Corridor Study. The survey was undertaken by the Glendale-Burbank study team and included questionnaires placed on Metrolink train seats on both the AVL and Ventura County Lines, as well as an on-line survey accessed via website or social media. Survey results relevant to the AVL study are summarized below.

The several parts of Question 1 (Figures 4-7 and 4-8) defined the characteristics of the survey respondents. Over three-quarters of the respondents were Metrolink riders, but a significant number of responses were also received from non-riders. Three-quarters of the Metrolink riders were commuters, with 50 percent of Metrolink users riding five or more days per week. Survey responses were well distributed among users of stations on the AVL, with responses from riders starting their trips in the Antelope Valley, Santa Clarita Valley and San Fernando Valley, as well as reverse commuters or off-peak travelers originating at LAUS. Not surprisingly, a large majority of riders had LAUS as their destination station, with significant numbers of riders alighting at Burbank-Downtown and Glendale.

Question 2 (Figure 4-9) asked about preferred departure times for a potential late evening AVL train from LAUS to Lancaster, with train departure times at either 10:30, 11:00 or 11:30 pm. There was no clear consensus on a single preferred time, but a plurality of the respondents favored the 10:30 pm time slot.

Question 3 (Figure 4-10) enquired about mid-day off-peak service patterns. Over 85 percent of all respondents indicated that offering regularized mid-day service at regular clock face intervals (train departures at the same time every hour) was somewhat or very important.

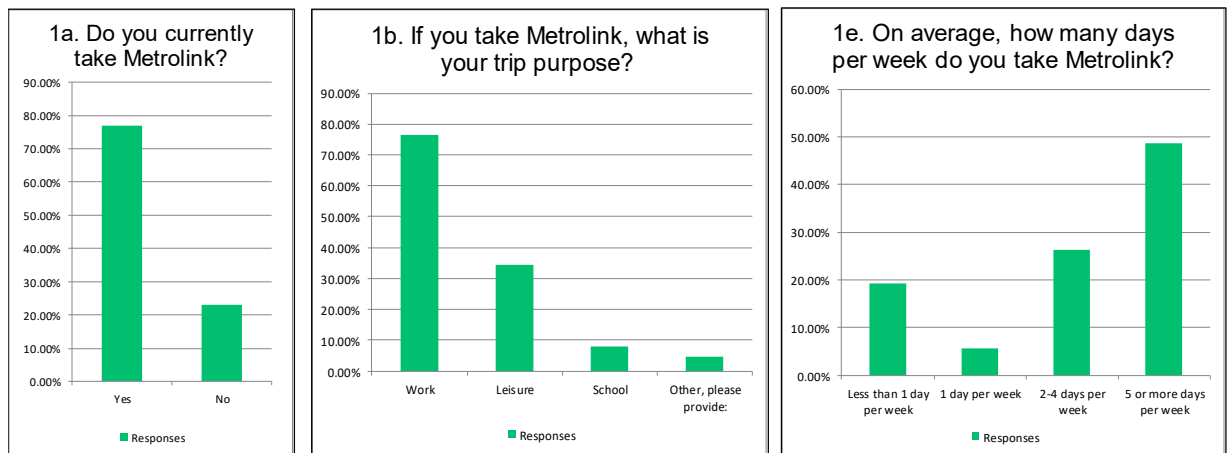
Question 4 (Figure 4-11) asked about preferences for improved service during the weekday peak periods, between more frequent service and additional express service – in the major direction of travel towards LAUS in the morning peak and towards Lancaster in the evening peak. Express service would provide faster trip times from express stations, with the most significant improvement at express stations in the Santa Clarita and Antelope Valleys. More frequent local service would benefit all stations but not reduce trip times. Opinion was relatively divided between these two choices, with 57 percent favoring express service and 43 percent favoring frequency.

Question 5 (Figure 4-12) asked people to rank their preferences for improved service, in six different categories, on a scale from 1 to 6. Topping the list were more frequent service, more express service and better reverse-peak service. Lower down on the priority list, but with significant favorable responses, were improved off-peak, late evening and weekend service.



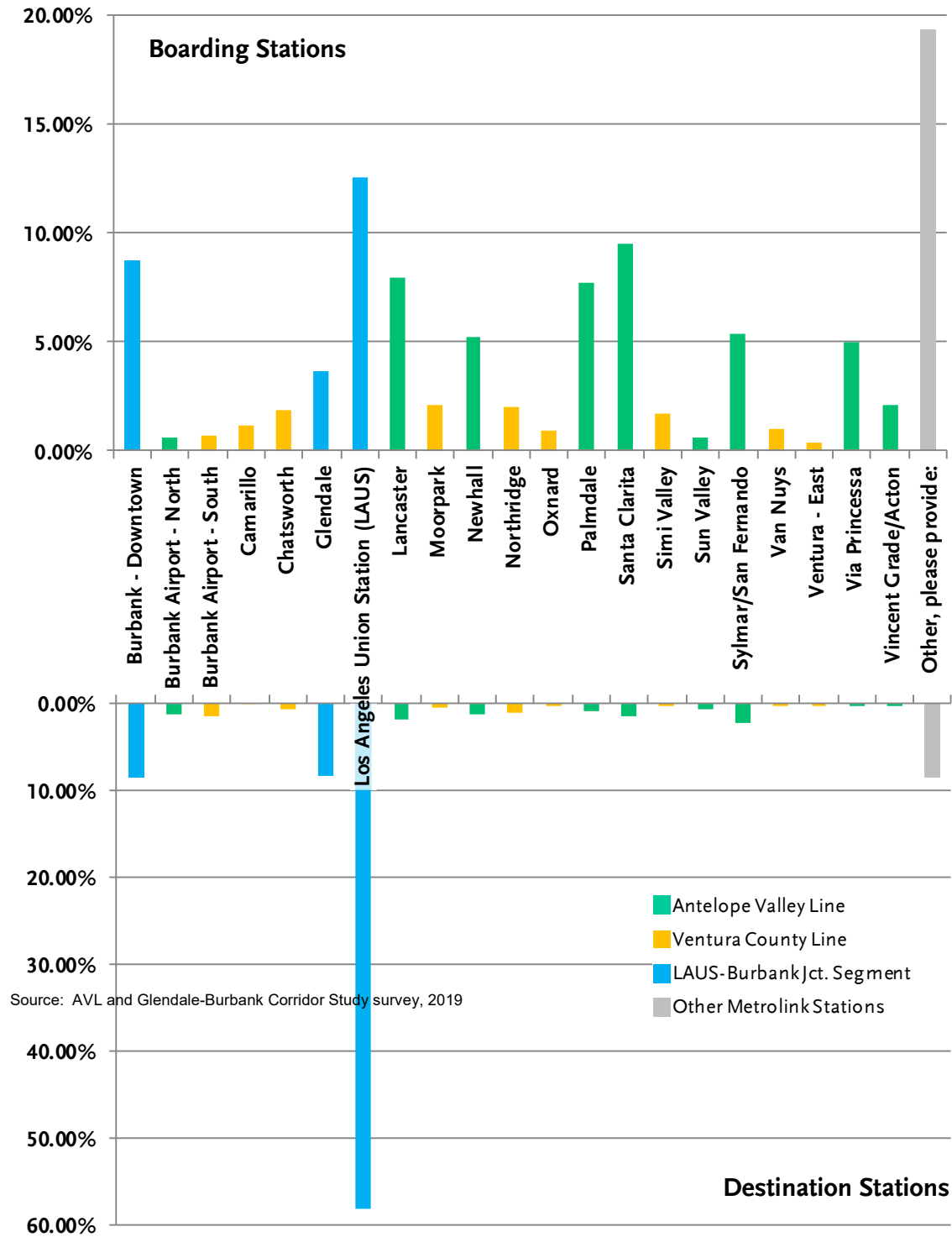
AVL and Glendale-Burbank Corridor Survey Poster
Source: Metro

Figure 4-8: Survey Respondent Characteristics



Source: AVL and Glendale-Burbank Corridor Study survey, 2019

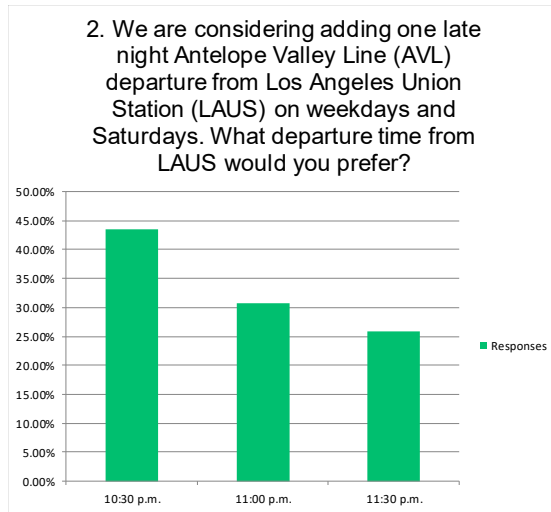
Figure 4-9: Survey Responses – Boarding and Destination Stations



Source: AVL and Glendale-Burbank Corridor Study survey, 2019

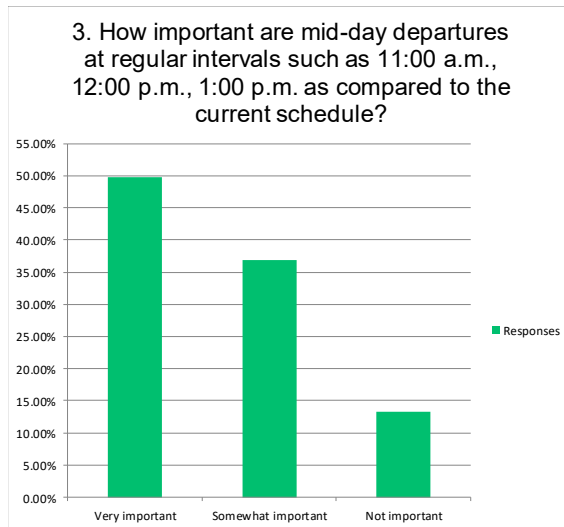
Source: AVL and Glendale-Burbank Corridor Study survey, 2019

Figure 4-10: Survey Response – Timing of Potential Late Night Service



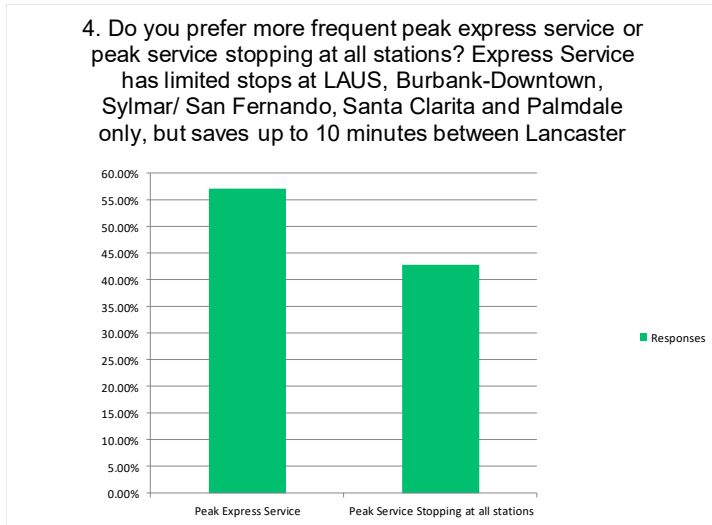
Source: AVL and Glendale-Burbank Corridor Study survey, 2019

Figure 4-11: Survey Response – Mid-Day Service at Regular Clock-face Intervals



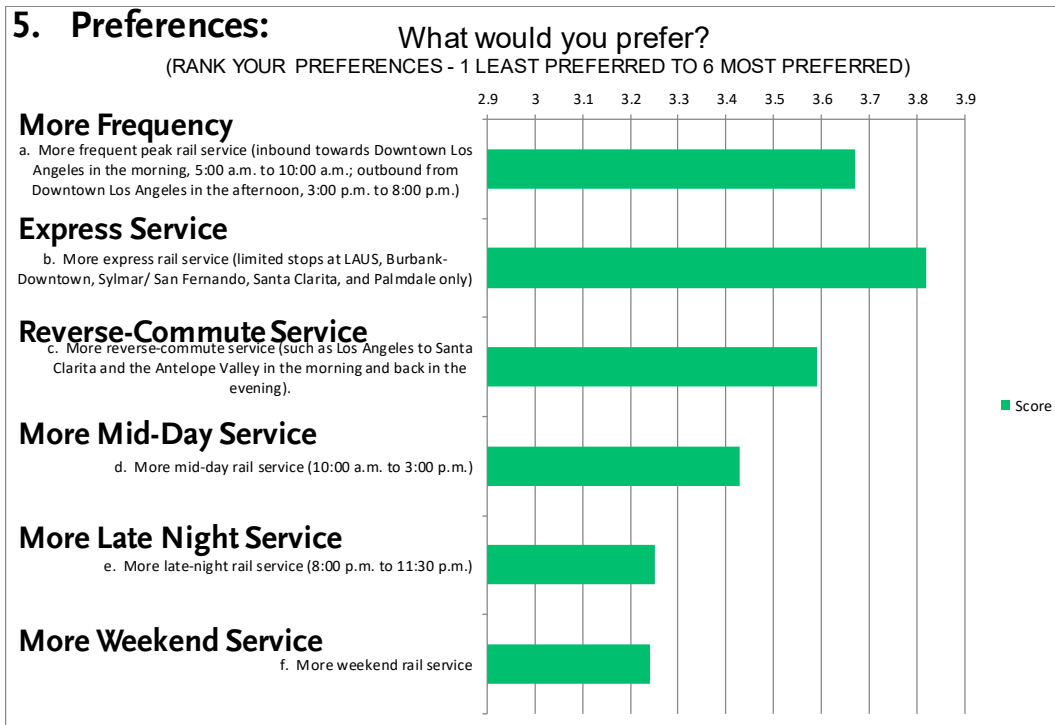
Source: AVL and Glendale-Burbank Corridor Study survey, 2019

Figure 4-12: Survey Response – Peak Service Priority for Frequency or Express Service



Source: AVL and Glendale-Burbank Corridor Study survey, 2019

Figure 4-13: Survey Response – Ranked Preferences for Improved Service



Source: AVL and Glendale-Burbank Corridor Study survey, 2019

5 ANALYSIS FRAMEWORK AND METHODOLOGIES

5.1 Methods of Analysis

As scenarios were defined, they were analyzed from the standpoint of rail operations and infrastructure requirements. Adjustments were made to the service plans or the locations and extent of infrastructure investment to achieve balanced use of infrastructure by the trains in the service plan. After two rounds of refinement, estimates were prepared of the incremental annual operations and maintenance costs and total capital costs for required capacity-related infrastructure. The potential capital projects were then prioritized, creating the opportunity to incrementally improve rail service in phases, as groups of capital projects are completed.

5.1.1 Rail Service Planning

The foundation for the technical analysis of scenarios was the development of rail service plans for each scenario developed in the study. A service plan essentially is a train timetable, showing when trains would operate on the line and at what stations they would stop. The types of service to be operated, the mix of station stopping patterns, and the frequency of service by time of day and day of the week for each service pattern are generated as inputs to the service plan for a scenario, based on service objectives and information about travel market demand.

The considerations that guided the development and analysis of service plans included:

- Provide improved service in response to anticipated future travel demand
- Provide for safe and reliable service
- Make efficient use of infrastructure capacity
- Build towards consistency with State Rail Plan
- Distribute benefits equitably among markets within the AVL corridor
- Seek solutions that are mutually beneficial in locations where other operators will use or adjoin the AVL
- Verify physical and operational feasibility
- Preserve flexibility to account for future uncertainty.

Service plans incorporated the following elements:

- Specification of rail service types and stopping patterns
 - Service frequency – peak, reverse-peak and off-peak
 - Local, express and limited patterns
 - Regularity of service intervals

- Rail infrastructure configuration, including track configuration, signaling concept, traction power assumptions, bridges and other structures, and ROW requirements
- Location of stations and functional classification of stations, including assumptions about multi-modal connectivity
- Rolling stock fleet and requirements for storage/maintenance facilities.

Each AVL service plan was represented graphically in a time-distance or “stringline” diagram, where the progress of each train was mapped as it travels along the route, with distance measured on the vertical axis of the graph and elapsed time on the horizontal axis. These scenarios were then modeled using the Viriato train scheduling software, and stringlines were prepared which identified locations where double tracking would be needed for trains meets or additional infrastructure (station improvements, train storage areas) would be needed to support each scenario. The stringline diagrams enabled visualization of the patterns of service, particularly how trains that operate at different speeds or have different station stopping patterns can fit on the line without operating conflicts. The diagrams were used to identify where new rail infrastructure would be required. The initial service scenarios and scenario evaluation process are documented in Appendix 2, *Modeling and Evaluation of Initial Service Scenarios*.

The purpose of the service scenario analysis was to test the feasibility of discrete improvements in service and provide a basis for determining required capital investment in capacity. The Study did not look closely at the existing train schedule to identify minor schedule adjustments or look at augmenting service while optimizing the deployment of rolling stock and train crews on the AVL. Such analysis would have required more detailed analysis than was possible with the relatively coarse analytic tools used in the Study. Metrolink continually seeks to improve and optimize its schedules, and such schedule adjustments are not mutually-exclusive with the Study’s service scenarios. Improvements to the timing and performance of AVL trains, particularly trains during off-peak periods and on the shoulders of the weekday peak periods, can be expected in tandem with the kinds of discrete changes included in the AVL service scenarios.

5.1.2 Capacity Infrastructure Projects and Capital Costs

Using the stringline diagrams prepared for each service scenario, the locations were identified where double tracking would be needed for trains running in opposite directions to meet and pass each other, as well as additional infrastructure (station improvements, train storage areas) needed to support each scenario. In the case of additional double tracking, the precise locations and estimated lengths of the passing track segments were identified, based on a goal to provide reliable service under the scenario. The required extent of double tracking was estimated conservatively, in recognition of the uncertainties that exist at this high level of preliminary planning, and to account for potential future rolling stock choices that could result in equipment with different performance characteristics operating on the AVL. Concepts for new infrastructure were based on design standards that reflect industry best practices with respect to safety, security, constructability and maintainability. Where new construction is proposed, the capital projects were conceptualized to enable other needs and opportunities to be addressed at the same locations, such as enhancing safety or restoring infrastructure assets to a state of good repair.

The consultant team then developed schematics showing the areas of improvements, using the Metrolink 2018 Track Charts (1”=500’) as the base. After review and concurrence of the team, the proposed improvements were then overlaid on alignment drawings using the Metrolink 2018 Track Chart Aerial Mapping (1”=200’) to show the improvements in the context of the local areas. These drawings were reviewed and checked in accordance with the project’s Quality Assurance/Quality Control

procedures. More detailed documentation of the capital projects is provided in Appendix 3, *Infrastructure Improvements and Cost Estimates for Modeled Service Scenarios*.

The combination of the schematics and alignment drawings were then used to develop rough-order-of-magnitude cost estimates for each element of each location's capital project. The cost estimate started with a cost template for standard capital elements and unit costs, and applied these unit costs to the take-offs from the schematics and drawings to arrive at a subtotal for estimated construction cost for each location's capital project. Where available, unit costs came from the *2018 Metrolink Infrastructure Rehabilitation Plan (MIRP)*; if a unit cost for a specific element was not available in the MIRP, a unit cost was derived from other recent capital projects with which the team is familiar.

Separate from the civil improvements, each of the capital projects was reviewed for signal-related required work, and separate signal drawings were prepared, showing those improvements. Capital cost estimates also were prepared for the signaling elements and incorporated into a consolidated construction cost estimate for each project.

A contingency of 35 percent was added to this construction cost subtotal. A soft cost estimate of 60 percent was added on top of the combined construction cost plus contingency, to arrive at a total rough order-of-magnitude (ROM) capital cost, in 2018 dollars. The soft cost mark-up includes all non-construction costs, including project development, planning, environmental documentation and permitting, design, construction management and project administrative costs. This total capital cost estimate was cross-checked against the schematics/drawings for consistency. The ROM capital costs did not include ROW acquisition costs or additional rolling stock costs. Since a second track can be accommodated within the existing railroad ROW at most locations, the quantity of property required for ROW expansion is expected to be relatively modest,⁹ relating mostly to requirements for station platform expansion at Palmdale and Lancaster, and potentially at Via Princessa.

The capital projects included in the capital cost estimates for each scenario include only those projects needed for railroad capacity. They represent only a subset of the total capital needs for the AVL, which also include investments in improved safety and security, asset renewal and state-of-good-repair, rolling stock, rolling stock maintenance facilities, new stations and station upgrades, and customer service amenities.

5.1.3 Operations and Maintenance Costs

Increasing the number of Metrolink trains operating on the AVL will increase costs for operations and maintenance. These costs will be partially offset by fare revenues generated from increased ridership. Estimates of annual operations and maintenance (O&M) costs for Metrolink service on the AVL were prepared for six rail service scenarios. These estimates consider the expected incremental cost associated with increasing train service, over and above the cost of delivering the existing AVL service. The incremental costs are primarily associated with train crews and train operations, fuel, and rolling stock maintenance.

Two different methods were used, to generate a range of estimated incremental costs for each service scenario. Using a range of costs reflects the underlying uncertainty of estimating costs in the early phase of planning, uncertainties about how operations and maintenance will be contracted by Metrolink in the future, and uncertainties about how operational characteristics will change in the future as service grows. The two methodologies and the results they generate are described more fully in Appendix 2, *Modeling and Evaluation of Initial Service Scenarios*. The estimates at the low end of the range of potential costs are presented in this report, so as not to imply a commitment to funding operations larger than what may be needed or supportable. More detailed analysis of operations, O&M costs and fare revenues will be needed to support decision-making about future increases in service and the associated levels of O&M funding that will be required.

⁹ ROW requirements for each capital project are estimated in Appendix 3, although property acquisition costs are not estimated.

The estimates of incremental O&M costs presented in Section 6.3 for the six service scenarios were prepared using cost factors derived by Metrolink for diesel fuel, train crews and equipment maintenance based on operations data, similar to a method used in a recent Metrolink study of the San Bernardino Line. The estimates were developed by applying unit cost factors to service quantities derived from the service plans for each scenario. The cost categories and cost drivers included:

- Diesel fuel, based on train-miles
- Other transportation costs, based on the number of train crews utilized, with different cost factors for crews that operate on a regular shift versus those that operate on a split shift (with mid-day layover period)
- Rolling stock maintenance, based on the number of revenue train sets in operation on the line

Unit costs were provided by Metrolink based on historical experience. The unit costs for each cost driver are shown in Table 5-1. Train-miles were taken directly from the scenario timetables. Allowances were made in these estimates for selected off-peak slots to be utilized by UPRR freight trains, running in place of passenger trains. The number of required train crews also was derived from the timetables, making reasonable assumptions about crew assignments, layovers and overtime. A contingency of 20 percent was applied to the total incremental O&M cost to reflect elements of variable cost not included in the estimates generated by the four primary cost drivers.

Table 5-1: Unit Costs for Estimation of Incremental Operations and Maintenance Cost

Cost Driver	Unit Cost
Fuel	\$6.75 per train-mile
Train crew – straight shift	\$1,752 per crew per day
Train crew – split shift	\$2,134 per crew per day
Equipment maintenance	\$2,000 per revenue trainset per day

Source: SCRRRA

These factors produce incremental cost estimates consistent with what Metrolink would expect in terms of the incremental cost of adding trains to an existing line. Metrolink, however, is in the process of changing the way it contracts for its operations, moving towards a single contract covering all operations and maintenance activities. This will affect how Metrolink estimates operations cost in the future, and could affect the incremental cost per unit of service.

5.2 Evaluation Methodology

The AVL Study employed a two-stage evaluation process for determining the recommended service improvements and supporting capital projects to increase service on the line. The rail service modeling and operations analysis led to the identification of required capital projects for each scenario, and that information was used as part of the Stage 1 multi-variable evaluation process to identify which service scenario provided the best overall service improvement, considering cost and other factors. Based on the Stage 1 evaluation findings and sensitivity analysis, and input from Stakeholders and Metro staff, it became clear that improvements to service on the AVL (and the capital projects needed to support those improvements) should be viewed as an incremental service improvement continuum as funding permits, rather than any one scenario being an end-all objective.

The Stage 1 evaluation resulted in the identification of a set of six refined service scenarios. Rail service plans were prepared and capacity-related capital projects were defined for each scenario, and capital and incremental O&M costs were estimated. A Stage 2 evaluation then was undertaken to identify the preferred service scenario and prioritize the capital projects needed to deliver the rail service for the preferred scenario.

5.2.1 Stage 1 – Evaluation of Preliminary Service Scenarios

The Stage 1 evaluation was a high-level assessment of improved levels of rail service in each preliminary scenario. Five overall evaluation categories were developed, including:

- Operations
- Regional Connectivity
- Costs and Financial Performance
- ROW Impacts
- Applied Technology

The criteria, sub-criteria and evaluation metrics used in Stage 1, and weighting factors applied to each high-level criterion, are presented in Table 5-2. The Stage 1 evaluation process and results is described more fully in Appendix 2, *Modeling and Evaluation of Initial Service Scenarios*.

5.2.2 Stage 2 – Evaluation of Final Service Scenarios and Capital Projects

The purpose of the Stage 2 evaluation process was to focus on prioritizing the capital projects to determine the best project phasing plan, commensurate with the near- and mid-term service scenarios that can be funded.

As a starting point, the Stage 1 service scenario evaluation was repeated – for the six revised service scenarios. This process used the same criteria but adjusted the relative weights of criteria and sub-criteria to reflect the objectives and priorities of LA Metro and other AVL corridor stakeholders that emerged from process of evaluating the preliminary scenarios.

With a focus on capital projects in addition to service scenarios, a set of evaluation criteria was developed to assess each individual capital project on five factors related to their contribution to improving AVL corridor service. These criteria are displayed in Table 5-3. Each capital project was rated on each of the five criteria, on a scale of 10 points to 50 points. After consideration of criteria category weighting, the maximum possible score in the evaluation for any one project was 50 points. The Stage 2 evaluation process and results is described more fully in Appendix 4, *Second Stage Evaluation of Capital Projects*.

Table 5-2: AVL Study Evaluation Criteria Focused on Service Scenarios

Category #	Criterion	Category Weight	Sub-Criterion	Metric/Measure
1	Operations	35%	Capacity Improvement	Percent increase in trains
			Travel Time Improvement	Average percent reduction in overall train trip time (wait time plus on-board time)
			Compatibility with Local Transit and Development Plans	Consistency with plans for future transit networks, route, and station area development plans
			Flexibility for Future Growth in Long Term	Assessment of support for long-term service level increases
			Quality of the Passenger Experience	General assessment of the overall improvement in service frequency, multi-modal connectivity, amenities, on-time performance
			Compatibility with Clockface Schedule Patterns	Pass/fail assessment based on service plan slot schedule
2	Regional Connectivity	25%	Travel Markets Served	Percent increase in number of train trip stops at AVL stations (or station pairs)
			Multimodal Connectivity	Headway/Travel Pattern synchs or can be made to synch with local transit operators
			Regional Network Connectivity	Headway/trip pattern synchs with SCORE program connections in LAUS, Palmdale, Burbank Airport North
			Rail Mode Share Potential	Projected percent increase in corridor mode share
3	Costs and Financial Performance	20%	Total Capital Cost	ROM capital cost estimate
			Relative Impact on Annual Operating Cost of AVL service	Percent increase in annual AVL operating cost
4	ROW Impacts	10%	ROW takes	Extent of ROW acquisition required from UPRR or other ROW owners
			Indirect Property (noise barriers, etc.)	Extent to which impacts to adjacent properties can be mitigated (i.e., with noise barriers, landscaping)
			Sensitive Areas (historic, endangered species, etc.)	Extent to which proposed construction affects sensitive areas or communities
5	Applied Technology	10%	VMT Reduction	Number of vehicular miles travelled reduced (1000's)
			Clean Vehicle Technology (e.g., DMUs, Electrification)	Supports cleaner vehicle technology
			Compatibility with Future High Speed Rail	Extent to which the service and infrastructure plan supports future development of HSR in the corridor

Source: WSP

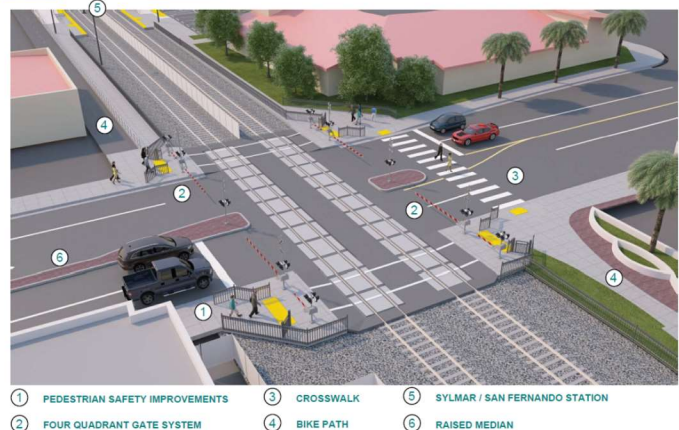
Table 5-3: AVL Study Evaluation Criteria Focused on Capital Projects

Category #	Criterion	Category Weight	Explanation
1	Degree to which Capital Project supports sequential service scenario improvements	40%	The concept was to evaluate each project in terms of how many, and which, Service Scenarios, it supports, with higher points assigned to projects that support the earlier service scenarios in the phasing plan.
2	Total Capital Cost of Project	20%	Evaluates each capital project in terms of its overall cost (as identified in Tasks 5 and 6), and assigns points based on which quintile the projects fall within, with highest points awarded to lowest-cost projects.
3	Independent Utility of the Project	20%	Rates each project in terms of its value to AVL operations, independent of the service scenarios. Higher points were assigned to projects that yielded independent benefits, regardless of service scenario.
4	Environmental or Community Impact Issues	10%	Evaluates each project in terms of its relative impact on the local environment or community. All the projects occur within the disturbed railroad ROW, but some require work over sensitive habitat such as waterway crossings, or may occur near developed residential communities, which could require additional mitigation measures. Projects with more impacts were scored lower.
5	Required ROW Acquisitions	10%	Three of the projects required acquisition of ROW to construct, including from Union Pacific Railroad. Projects with such required acquisitions were scored lower on this criterion.

Source: WSP



Source: Metro



- ① PEDESTRIAN SAFETY IMPROVEMENTS
- ③ CROSSWALK
- ⑤ SYLMAR / SAN FERNANDO STATION
- ② FOUR QUADRANT GATE SYSTEM
- ④ BIKE PATH
- ⑥ RAISED MEDIAN

Source: Metro

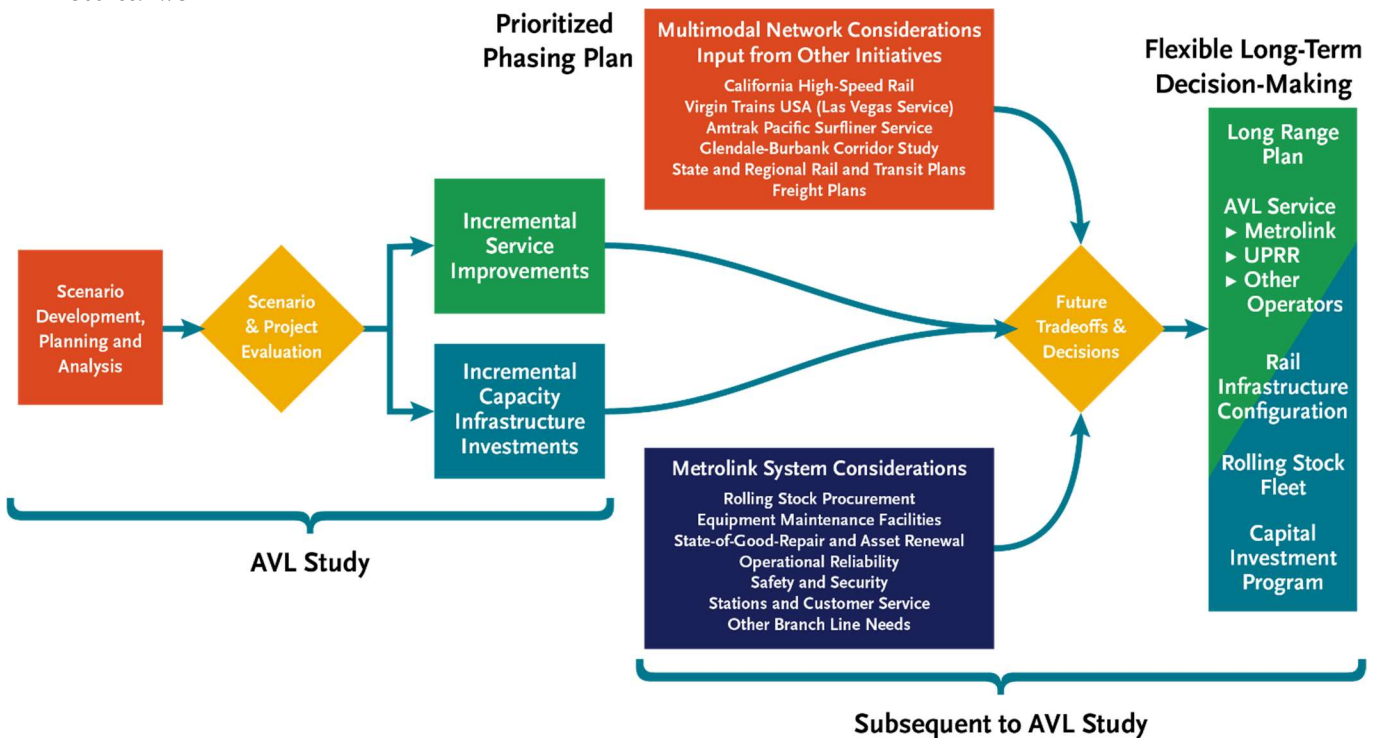
5.3 Decision-Making and Implementation Framework

Informed by the evaluation of initial scenarios and input received from study stakeholders, a framework was developed for capital investment and service enhancement decision-making. This framework, depicted in Figure 5-1, identifies choices that can be made by the LA Metro Board and other AVL stakeholders following the AVL Study, based on information available at the time of the study, to guide capital investment and service expansion for the next ten years. The framework also identifies longer-term future decision-making involving tradeoffs that require input from other sources and planning processes beyond the AVL study area.

The analytic work of the AVL Study was focused on the activities listed in the boxes on the left side of the Figure 5-1 diagram. Capital investment in capacity-related infrastructure over the initial period of incremental investment (nominally ten years but potentially longer or shorter based on commitment of funding) was prioritized based on its ability to deliver tangible improvements to AVL travel markets at relatively limited cost. The service improvements, similarly, were prioritized in favor of those that can be delivered with relatively small, incremental investments in new infrastructure and additional rolling stock. These initial investments and incremental service improvements also were evaluated in terms of their flexibility to support future growth and expansion of service, which could evolve in different ways and for which multiple longer-range scenarios were developed.

Figure 5-1: AVL Decision-Making Framework

Source: WSP



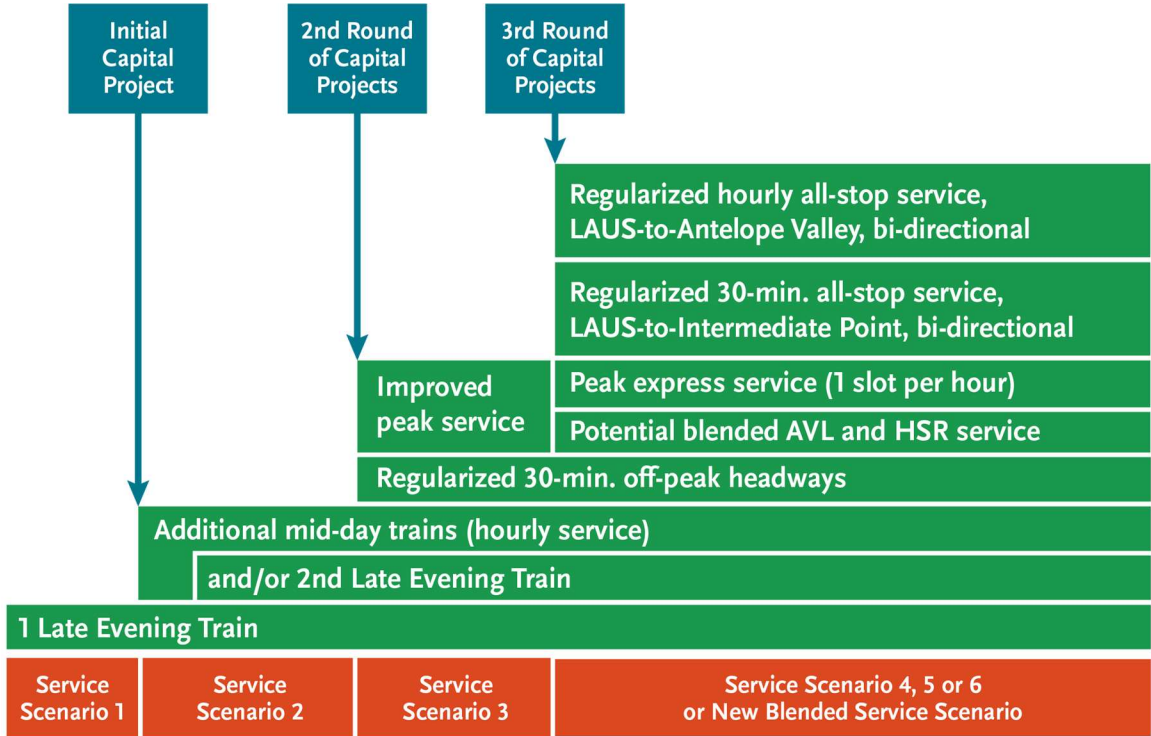
The initial incremental capital projects provide good value for money, are implementable at reasonable capital cost and achievable within a reasonable time frame if funding is made available. Service improvements can be realized in incremental steps over time, including specific service patterns enabled by the completion of capital projects, along with adjustments to train schedules to optimize service within the available capacity, fleet and train crew resources. The potential exists to complete the

capital projects in less than ten years, if there is consensus among the interested parties on the phasing plan, and if decisions are made, public engagement occurs, and funding is made available in a timely fashion. Conversely, if funding is not made available or is significantly delayed, the implementation timeframe also could be longer. These initial projects can be implemented in phases, so that incremental benefits can be realized in a series of steps.

Over the longer term, considerations beyond the AVL Corridor itself come into play. The long term physical configuration and operational characteristics of the AVL will need to be determined through a future process of analysis, evaluation and decision-making that is broader in scale. The AVL is part of the full Metrolink regional rail system and doesn't operate in a vacuum. Trains, train crews and passengers utilize other branches of the Metrolink network, as well as the AVL. Integration of the network, with through-running services at LAUS, is expected to become more prevalent following completion of the Link-US project, which will enable AVL trains to run through LAUS directly to other branches to the south and east of downtown Los Angeles. Also, Metrolink regional rail will be part of a multi-modal transportation network that is intended to be better integrated and coordinated in the future.

The incremental nature of the prioritized phasing plan is illustrated in Figure 5-2, which shows a layered approach to capital project implementation and service improvement. It provides for multiple rounds of capital investment and incremental service growth. Each round builds upon the previous one. The diagram also relates the layered investment and service growth framework with the six service scenarios that were analyzed in detail in the AVL Study.

Figure 5-2: Layered Approach to Incremental Service Improvements



Source: WSP

6 AVL SERVICE SCENARIOS

6.1 Summary

Early in the AVL Study, multiple rail service scenarios for the AVL were developed and analyzed using operations planning tools to confirm the operational feasibility of the service concepts, and to identify the capital projects required to increase railroad capacity to support the level of service provided in each scenario. These alternative scenarios then were evaluated in terms of performance, capital costs, operations and maintenance costs, benefits and impacts. Subsequent to the initial evaluation, adjustments were made to the scenarios to better align incremental ridership benefits with expected costs. Stakeholder feedback on the initial scenarios also was taken into account in the refinement process.

Six refined service scenarios were developed and analyzed in terms of their cost and performance. Three of the scenarios were short-to-medium term in nature, with total capital investment less than \$200 million. These first three scenarios build on existing peak period service and would make adjustments primarily to off-peak service, including additional late night service from LAUS to AVL stations and mid-day off-peak service at regular clock face intervals.

Requirements for new capacity infrastructure would be limited, as is the need for additional rolling stock. Operations and maintenance costs also would increase incrementally from existing levels in these scenarios. Scenarios 1, 2 and 3 were as follows:

1. One additional late night train from LAUS on Friday and Saturday evenings
2. Two additional mid-day round trips, in addition to the late night Friday and Saturday train
3. Expansion of mid-day off-peak service to semi-hourly between LAUS and the Santa Clarita Valley and hourly between LAUS and the Antelope Valley; plus one late night train Monday through Saturday.

The remaining three scenarios were longer-term in nature, with total capital costs for infrastructure above \$300 million and higher annual operations and maintenance costs. Scenarios 4, 5 and 6 each would provide a comparable level of service, consistent with the levels and types of rail service in the State Rail Plan, with:

- 3 train slots per hour at regular clock face intervals during weekday peak periods:
 - Full length local (LAUS – Lancaster)
 - Full length express (LAUS – Lancaster)
 - Intermediate local (LAUS – Intermediate short-turn station)
- Regular hourly reverse-peak service during weekday peak periods
- Weekday off-peak service at semi-hourly intervals between LAUS and the San Fernando and Santa Clarita Valleys, and hourly intervals between LAUS and the Antelope Valley
- Late night service from LAUS to the AVL, with one late night train Monday through Thursday and two late night trains on Fridays and Saturdays
- Weekend service at regular hourly intervals on Saturdays and regular bi-hourly intervals on Sundays and holidays.

During the weekday peaks, every AVL station would be served by at least two trains per hour in the peak direction and one train per hour in the reverse-peak direction. Express stations would be served by three trains in the peak direction during the weekday peaks.

The differences among Scenarios 4, 5 and 6 were as follows:

4. Intermediate turns at Vista Canyon; express hub at Santa Clarita; bunched outer-zone trains (local closely follows express inbound and express closely follows local outbound in the Antelope Valley and through Soledad Canyon)
5. Intermediate turns at Vista Canyon; express hub at Santa Clarita; spread-out outer-zone trains (local and express trains are spaced 30 minutes apart in the Antelope Valley and through Soledad Canyon)
6. Intermediate turns and express hub at Sylmar; spread-out outer-zone trains similar to Scenario 5.

The key elements of the six refined service scenarios are summarized in Table 6-1. The scenarios are modular in nature, enabling them to be layered with each other in an incremental development process. Scenario 1 represents a small increment of improved service above existing levels. Scenarios 2 and 3 each build incrementally on the previous scenario. Scenarios 4, 5 and 6 are variations of the same level of service, representing the medium-term target for service growth. Each of these scenarios would build incrementally from Scenario 3.



Source: Metro



Source: SCRRA

Table 6-1: Description of AVL Service Scenarios

Characteristic	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Peak Service	Existing Peak Service	Existing Peak Service	Existing Peak Service with Modest Improvement	Half-Hourly Local Service to Santa Clarita Valley; Hourly Local Service to Lancaster; Hourly Exp. Service to Lancaster	Half-Hourly Local Service to Santa Clarita Valley; Hourly Local Service to Lancaster; Hourly Exp. Service to Lancaster	Half-Hourly Local Service to Santa Clarita Valley; Hourly Local Service to Lancaster; Hourly Exp. Service to Lancaster
Peak Headway in Antelope Valley	Irregular 30-50 min	Irregular 30-50 min	Irregular 20-40 min	Regular 10-50 min ¹	Regular 30 min	Regular 30 min
Peak Headway in Santa Clarita Vly	Irregular 30-50 min	Irregular 30-50 min	Irregular 20-40 min	Regular 10-30 min	Regular 10-30 min	Regular 10-30 min
Intermediate Turnback Station	Not applicable	Not applicable	Not applicable	Vista Canyon/ Via Princessa	Vista Canyon/ Via Princessa	Sylmar
Reverse-Peak Service	Current Schedule (limited service)	Current Schedule (limited service)	Current Schedule with Modest Improvement	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster
Weekday Off-Peak Service	Current Schedule	2 additional mid-day round trips	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster	Half-Hourly Svc to Santa Clarita Valley; Hourly Svc to Lancaster
Late Night Service, Monday-Thursday	None	None	1 late night trip, LAUS-Lancaster	1 late night trip, LAUS-Lancaster	1 late night trip, LAUS-Lancaster	1 late night trip, LAUS-Lancaster
Late Night Service, Friday and Saturday	1 late night trip, LAUS-Lancaster	1 late night trip, LAUS-Lancaster	1 late night trip, LAUS-Lancaster	2 late night trips LAUS-Lancaster	2 late night trips LAUS-Lancaster	2 late night trips LAUS-Lancaster
Saturday Daytime Service	Current Schedule	Current Schedule	Current Schedule	Hourly Service	Hourly Service	Hourly Service
Sunday and Holiday Service	Current Schedule	Current Schedule	Current Schedule	Bi-Hourly Service	Bi-Hourly Service	Bi-Hourly Service
Capital Investment Impact	None	1 Project	4 Projects	9 Projects	8 Projects	9 Projects

¹ Express and local trains are bunched together in the Antelope Valley in Scenario 4 (and spread 30 minutes apart in Scenarios 5 and 6)

Source: WSP

6.2 Rail Service Characteristics

Table 6-2 compares the service characteristics of the six scenarios. The number of daily weekday trains increases with each scenario, with Scenarios 4, 5 and 6 offering the highest quantity of service. Late night service from LAUS to Lancaster is added in Scenarios 1 and 2 on Friday and Saturday evenings. Late train service is expanded to Monday-through-Saturday in Scenario 3, and a second late night train on Fridays and Saturdays is added in Scenarios 4, 5 and 6.

Weekday service during the peak periods in the peak direction of travel is retained at existing levels in Scenarios 1 and 2, increased slightly in Scenario 3, and significantly increased with the introduction of local service at regular 30-minute headways and hourly express service in Scenarios 4, 5 and 6.

Increasing reverse-peak service is capital-intensive, because of the need for more and longer passing sidings on the largely single-tracked AVL. Therefore, regular hourly reverse-peak service is only provided in Scenarios 4, 5 and 6.

Table 6-2: Rail Service Characteristics, by Scenario

Characteristic	Existing	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Weekday Total Round Trips ⁵	15	16 ⁴	18 ⁴	30	36	36	36
<u>Daily Round Trips (Slots⁵/Hour)</u>							
Serving San Fernando Valley	14 ² (n/a)	15 ²⁴ (n/a)	17 ²⁴ (1 ¹)	28 ² (2 ¹)	33 ² (2)	33 ² (2)	33 ² (2)
Serving Santa Clarita Valley	15 (n/a)	16 ⁴ (n/a)	18 ⁴ (1 ¹)	30 (2 ¹)	36 (3)	36 (3)	21 (2)
Serving Antelope Valley	10 (n/a)	11 ⁴ (n/a)	15 ⁴ (1 ¹)	20 (1 ¹)	21 (2)	21 (2)	21 (2)
Saturday Round Trips	6	7	7	14	15	15	15
Sunday/Holiday Round Trips	6	6	6	7	7	7	7
Revenue Trainsets Required	6	6	7	8	11	11	10
Peak Service	--	Retain Existing	Retain Existing	Retain Existing	En-hanced	En-hanced	En-hanced
Off-Peak Service at Regular Clockface Intervals	--	Hourly	Hourly	Semi- ³ Hourly	Semi- ³ Hourly	Semi- ³ Hourly	Semi- ³ Hourly
Additional Late Evening Trains Outbound from LAUS	--						
Mon-Thu / Fri-Sat		0 / 1	0 / 1	1 / 2	1 / 2	1 / 2	1 / 2
More Frequent Peak Service	--	No	No	Yes	Yes	Yes	Yes
Additional Peak Express Service	--	No	No	No	Yes	Yes	Yes
Regular Reverse-Peak Service	--	No	No	No	Yes	Yes	Yes

- 1 Regular slots exist only in off-peak hours in Scenarios 2 and 3. Peak period service in the peak direction of travel is more frequent but irregular.
- 2 Does not count peak Express train(s), which stop in the San Fernando Valley only at Sylmar/San Fernando and Downtown Burbank.
- 3 30-minute headways LAUS to Santa Clarita Valley; hourly headways to Lancaster.
- 4 Fridays only, including late night train; train count on Monday-through-Thursday is reduced by one.
- 5 Note that this table identifies slots for trains in the daily timetable. Not all slots are expected to be filled with Metrolink trains, especially in scenarios that significantly increase the total number of daily slots. Some slots may remain unfilled, most likely during off-peak periods, due to insufficient ridership demand to justify operating costs, or to preserve capacity for rail freight trains or the intercity passenger trains of operators other than Metrolink.

Source: WSP

Weekday off-peak service remains at existing levels in Scenario 1. With the addition of two mid-day round trips in Scenario 2, it becomes possible to introduce regular clockface schedules during the mid-day period, with trains operating hourly within the San Fernando and Santa Clarita Valleys and bi-hourly within the Antelope Valley and Soledad Canyon – with trains stopping at all stations at the same time each hour. Alternating trains from LAUS operate either all the way to Lancaster, or turn back at an intermediate location – either Via Princessa or the proposed new station at Vista Canyon. Scenario 3 approximately doubles the volume of mid-day off-peak service, with local trains operating every 30-minutes between LAUS and the Santa Clarita Valley and once per hour to and from the Antelope Valley. These clockface off-peak patterns are retained in Scenarios 4, 5 and 6.

Weekend daytime service is retained at existing levels for Scenarios 1, 2 and 3. Service frequency is improved to hourly on Saturdays and bi-hourly on Sundays and holidays for Scenarios 4, 5 and 6. Late evening service is added gradually. Scenarios 1 and 2 add a single late evening train on Saturdays and Sundays. Scenario 3 expands late evening service to the other weeknights. Scenarios 4, 5 and 6 add a second late night departure from LAUS on Fridays and Saturdays.

The requirements for revenue trainsets were based on a methodology that allocates train sets to individual branch lines, even though the actual Metrolink fleet operates on multiple branches and cycles to and from the major maintenance facilities on a routine basis. This simplification, for purposes of analysis only, is appropriate for estimating the additional fleet required to operate increased service on the AVL. Scenario 1 utilizes the existing equipment and adds one round trip to one of the existing trainsets. Scenario 2 requires one additional trainset to support the planned increase in mid-day off-peak service. Scenario 3 requires a second additional trainset. The medium-term scenarios 4, 5 and 6 would increase the fleet requirement yet again by two or three trainsets, depending on the service plan.

The service plans assume that Palmdale is a major hub station, along with Santa Clarita, Sylmar and downtown Burbank. These stations would be served by peak express trains, when they are introduced in Scenarios 4, 5 and 6. Hypothetical timetables were prepared for the six scenarios. For comparison purposes, the existing AVL timetable is shown schematically in Figure 6-1. The assumed timetables for Scenarios 1 through 6 are shown in the same schematic format in Figures 6-2 through 6-7. The increase in the quantity of service, as well as the introduction of regular clockface service intervals – only during off-peak periods in the lower numbered scenarios and all-day in Scenarios 4, 5 and 6 – can be visualized by comparing these schematic timetables.

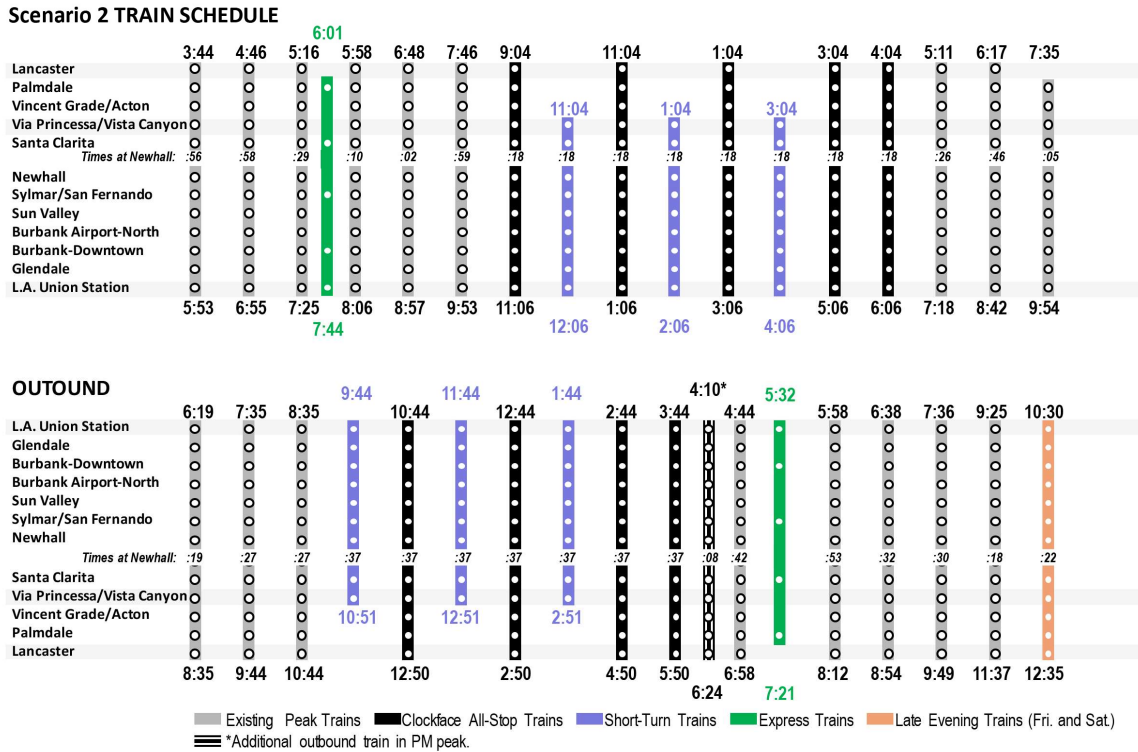


Source: WSP



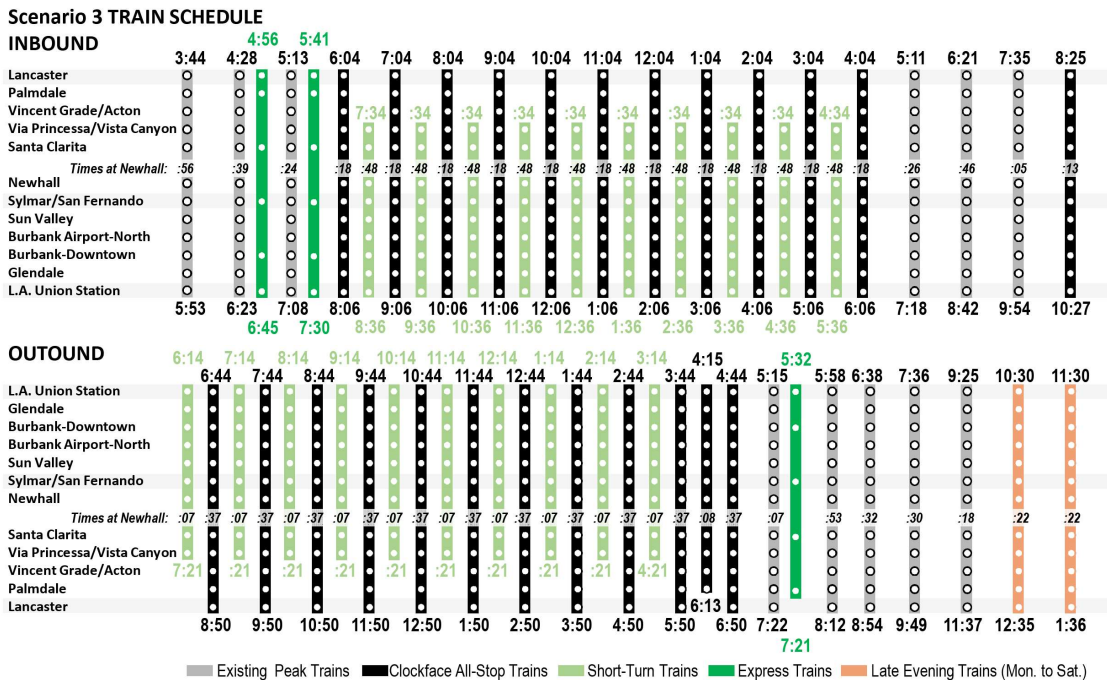
Source: Metro

Figure 6-3: Scenario 2 Weekday Timetable



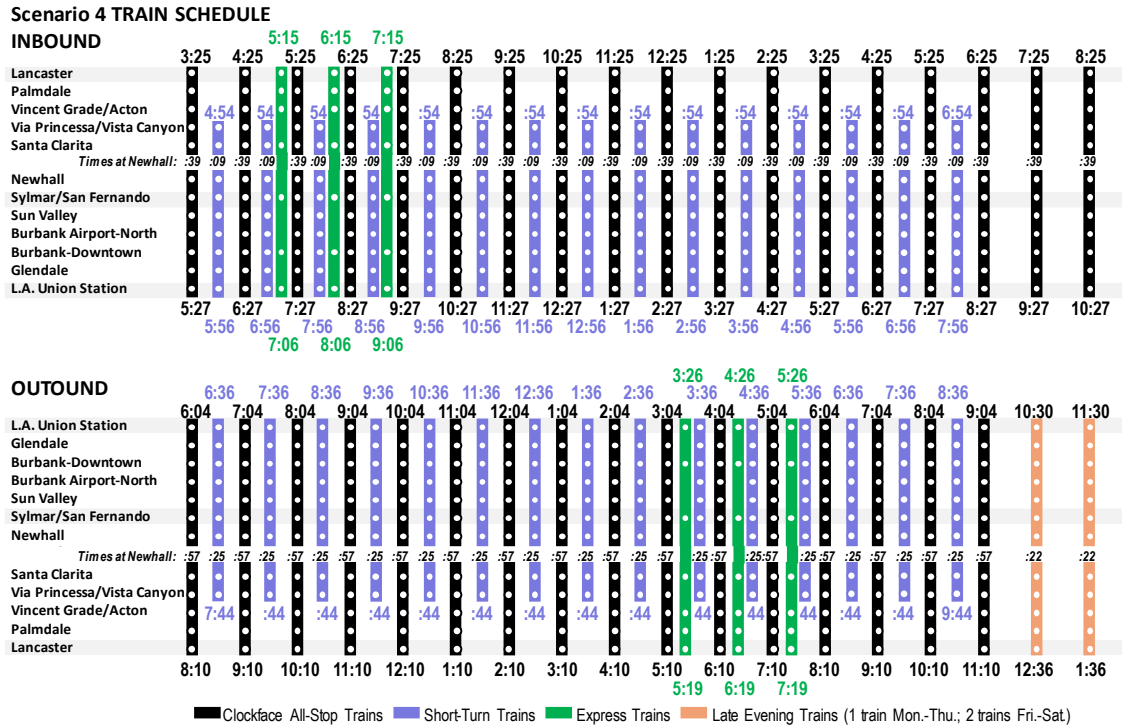
Source: WSP

Figure 6-4: Scenario 3 Weekday Timetable



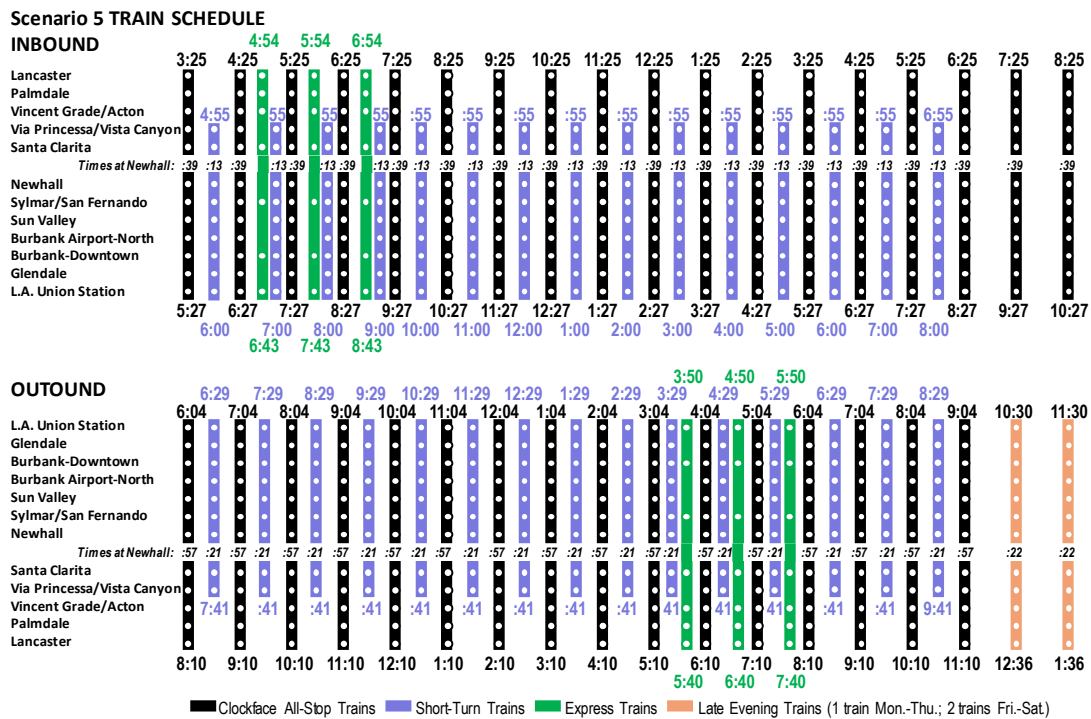
Source: WSP

Figure 6-5: Scenario 4 Weekday Timetable



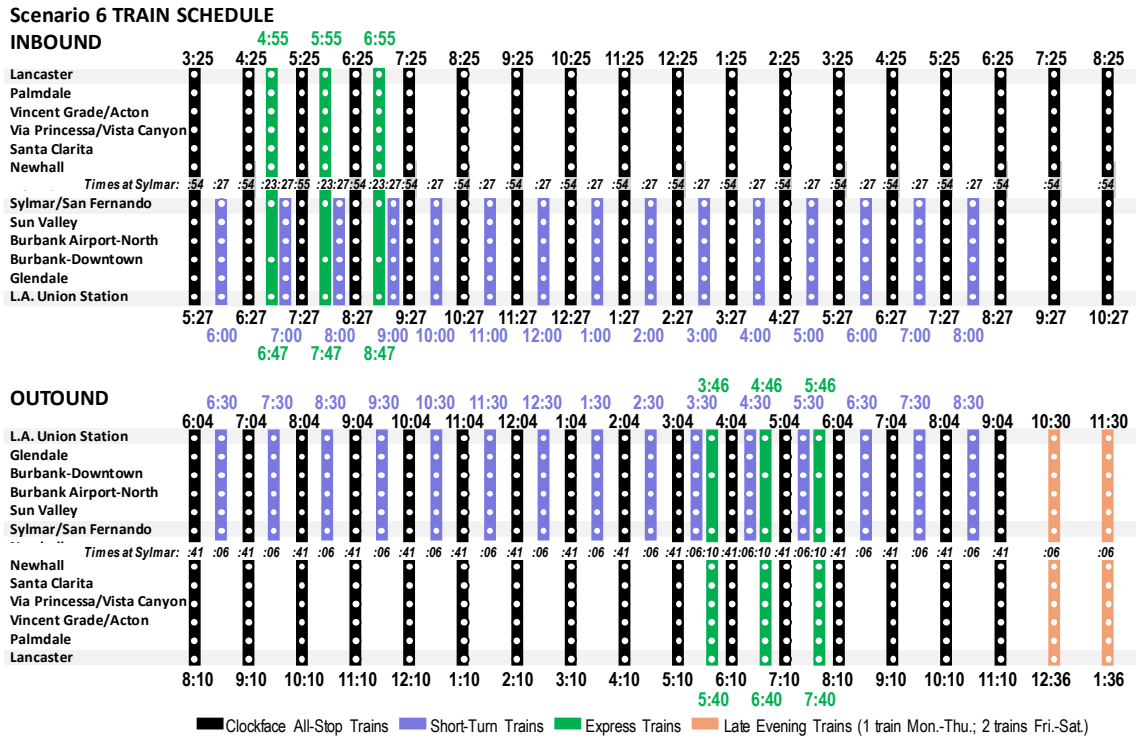
Source: WSP

Figure 6-6: Scenario 5 Weekday Timetable



Source: WSP

Figure 6-7: Scenario 6 Weekday Timetable



Source: WSP

6.3 Operations and Maintenance Costs

6.3.1 Level of Service Inputs

The six service scenarios propose a series of incremental increases in weekday train service on the AVL. In order to derive estimates of annual O&M costs, assumptions were made about the level of service on weekends and holidays in all scenarios. In addition, the scenarios assume introduction of late evening service on different days of the week – either only on Friday and Saturday nights, or on Monday through Saturday nights. Service levels, therefore, were developed for Mondays-through-Thursdays, Fridays, Saturdays and Sundays/holidays.

Table 6-3 presents the number of daily round trip trains on each day of the week, for the existing service and the six scenarios. In Scenarios 1 and 2, existing weekend service is assumed to be retained (with the addition of a late-night train on Saturdays). Scenarios 3 through 6 assume weekend service is increased to hourly service on Saturdays and bi-hourly service on Sundays and holidays. In Scenarios 3 through 6, the hypothetical train schedules shown in the previous section include slots at frequent, regular, repeating intervals during off-peak periods. Demand may not be sufficient to warrant filling all of these slots with passenger trains, given financial constraints on the level of operating subsidy. The analysis therefore assumes that two or three off-peak round trip slots remain unfilled by Metrolink trains in Scenarios 3 through 6, and this reduced level of service is reflected in Table 6-3 and the estimated incremental O&M costs. Unfilled slots could be utilized for rail freight trains during off-peak periods or could be available for use in the future by intercity passenger trains.

In Scenarios 1 and 2, a late evening round trip is added on Friday and Saturday nights. In Scenario 3, late night service is extended to all days of the week except Sundays and holidays. Scenarios 4, 5 and 6 add a second late evening train on Fridays and Saturdays, and the opportunity also exists to add this

second train in Scenario 3. The assumed number of late evening trains, by day of the week, is shown in Table 6-4 for each scenario. Table 6-5 presents the number of days in a typical 365-day year falling into each day-of-week category.

Table 6-3: Round Trips per Day, by Scenario, for Purposes of Estimating Incremental O&M Costs

Days	Existing	Scenario 1	Scenario 2	Scenario 3 ¹	Scenario 4 ¹	Scenario 5 ¹	Scenario 6 ¹
Mon-Thu	15	15	17	26	33	33	33
Fri	15	16	18	26	34	34	34
Sat	6	7	7	12	13	13	13
Sun & Hol	6	6	6	7	7	7	7

¹ Assumes reduced level of service with 2-3 daily round trip slots not filled with passenger trains (and available for use by UPRR freight trains). The number of daily round trips with full utilization of scheduled slots is presented in Appendix 2, Table 4-3.

Source: WSP

Table 6-4: Late Evening Round Trips, by Scenario, for Purposes of Estimating Incremental O&M Costs

Days	Existing	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Mon-Thu	--	--	--	1	1	1	1
Fri	--	1	1	1 ²	2	2	2
Sat	--	1	1	1 ²	2	2	2
Sun & Hol	--	--	--	--	--	--	--

²A second round trip slot is available in this scenario but is assumed to be not utilized for O&M cost estimating purposes.

Source: WSP

Table 6-5: Operating Days per Year

Days	Existing
Mon-Thu	203
Fri	52
Sat	52
Sun & Hol	58
Total	365

Source: WSP

The total quantity of annual service on the AVL is presented in Table 6-6 for each scenario. The total number of revenue round trips and total quantity of revenue service hours are compared with the existing AVL level of service.

Table 6-6: Annual Round Trips and Revenue Hours, for Purposes of Estimating Incremental O&M Costs

Days	Existing	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Round Trips	4,485	4,589	5,099	7,660	9,549	9,549	9,549
Revenue Hours	16,781	17,221	20,038	25,890	31,017	31,372	27,587

Note: Based on round trips per day as presented in Table 6-4. Assumes reduced level of service for Scenarios 3 through 6 with 2-3 daily round trip off-peak slots not filled with passenger trains (and available for freight train movements).

Source: WSP

6.3.2 Results

Applying the unit cost factors to the service quantities for each scenario, using the costing method described in Section 5, yields the estimated incremental annual O&M costs shown in Table 6-7. Scenario 1, adding a late evening train on Fridays and Saturdays, is projected to increase O&M costs by approximately \$400,000 per year. Adding two additional daily off-peak round trips would increase annual costs by approximately \$3.3 million, compared with existing service. Scenario 3 dramatically increases the number of off-peak trains and marginally increases peak service, resulting in a relatively large increase in annual costs, on the order of \$6.2 million. Scenarios 4, 5 and 6 increase peak and reverse-peak service and would result in increased O&M costs in the range of \$7 to \$11 million per year.

Table 6-7: Incremental Annual Operations and Maintenance Costs Compared to Existing AVL Service (Millions of 2018 dollars)

Days	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
Incremental Annual Round Trips	104	614	3,175	5,064	5,064	5,064
Incremental Annual Revenue Hours	440	3,257	9,109	14,236	14,591	10,806
Incremental Annual O&M Cost (\$M 2018)	\$0.41	\$3.30	\$6.23	\$10.98	\$10.98	\$7.02

Note: Based on annual revenue hours presented in Table 6-6. Assumes reduced level of service for Scenarios 3 through 6 with 2-3 daily round trip off-peak slots not filled with passenger trains (and available for freight train movements).

Source: WSP

6.4 Capacity-Related Infrastructure Projects and Capital Costs to Support Service Scenarios

The service plans for the six scenarios were analyzed to determine where additional railroad capacity would be needed to enable trains running in opposite directions to pass each other, and where yard storage would need to be increased to accommodate a larger rolling stock fleet serving the AVL. The locations of these 14 projects are shown in Figure 6-8. Additional information on the elements of these projects and their estimated capital cost is provided in Appendix 3. Each scenario requires a subset of these projects, most of which extend or add a second track in portions of the line that currently have only a single track. The subsequent figures show the capital projects required to support each scenario.

Scenario 1 can be implemented on the existing rail infrastructure and does not require prior investment in increased capacity.

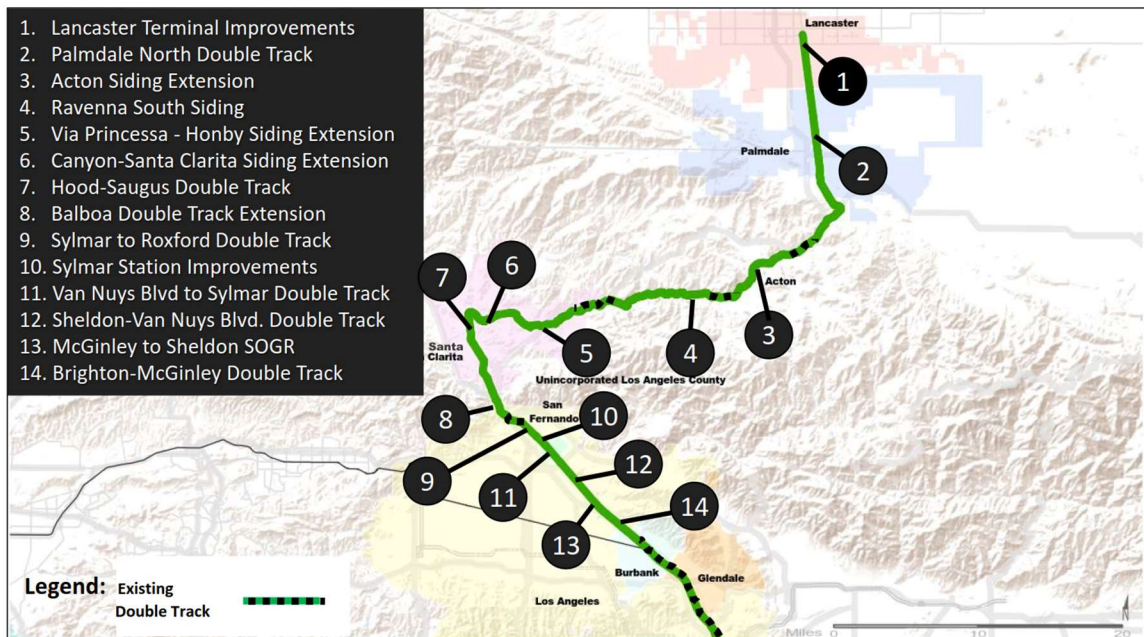
Scenario 2 requires a project to extend the Sylmar Siding from Balboa Blvd to the north for an additional 6,336 linear feet, or 1.2 miles, as close as feasible to the south portal of Tunnel 25. This minimizes the length of the single-track segment through Tunnel 25 and also sets up the ability to run hourly local service patterns between LAUS and Lancaster at regular clockface intervals in both directions. Local trains running in opposite directions would meet each other at three locations along the AVL between Lancaster and Burbank Junction: at the existing passing sidings at Acton and Lang, and near CP Balboa, utilizing the extended double-track. A fourth meet would occur on the 2-track main line near Glendale.

The regular bi-directional hourly pattern would only be operated during off-peak hours in Scenario 2, because the need for more frequent peak direction service during weekday rush hours limits the ability to run reverse-direction trains.

Scenario 3 requires three projects in addition to the Balboa-to-Tunnel 25 project. These three projects, totaling \$133.4 million in capital costs, include:

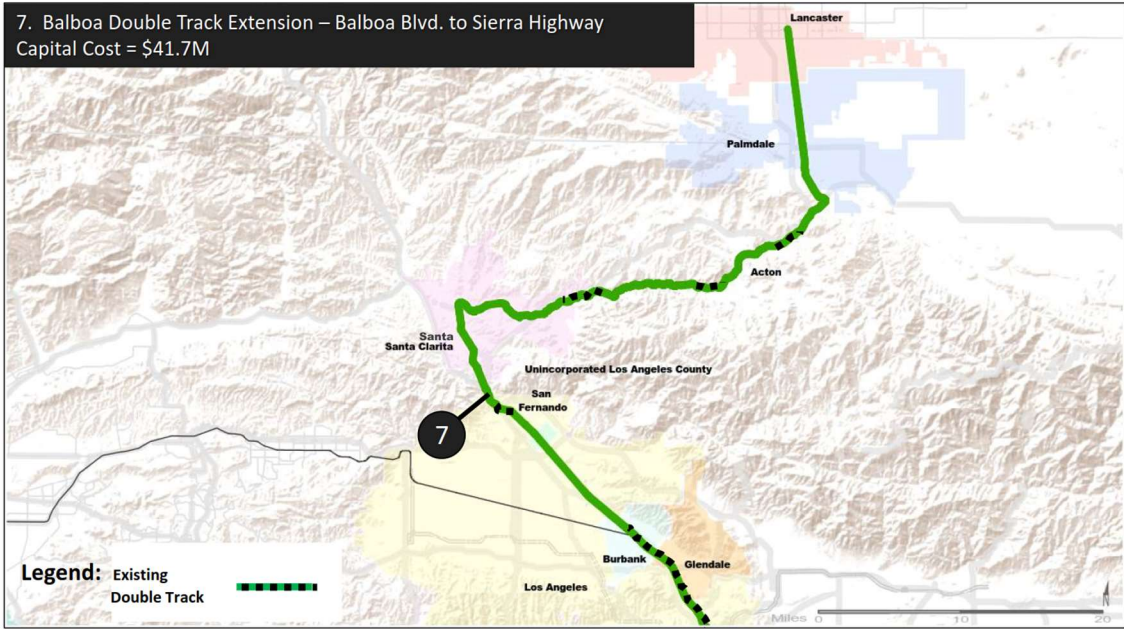
- [#1] New double track and second station platform face at Lancaster Station, plus expansion of yard to include two new 1,000' storage tracks
- [#5] Extension of existing siding near Soledad Canyon Road by 8,448' to Golden Oak Road; second platform at Santa Clarita station.
- [#10] Extension of existing siding from Brighton Street to Penrose Street for 15,312'; second platforms at Burbank Airport-North and Sun Valley stations.

Figure 6-8: AVL Railroad Capacity Capital Improvement Project Locations



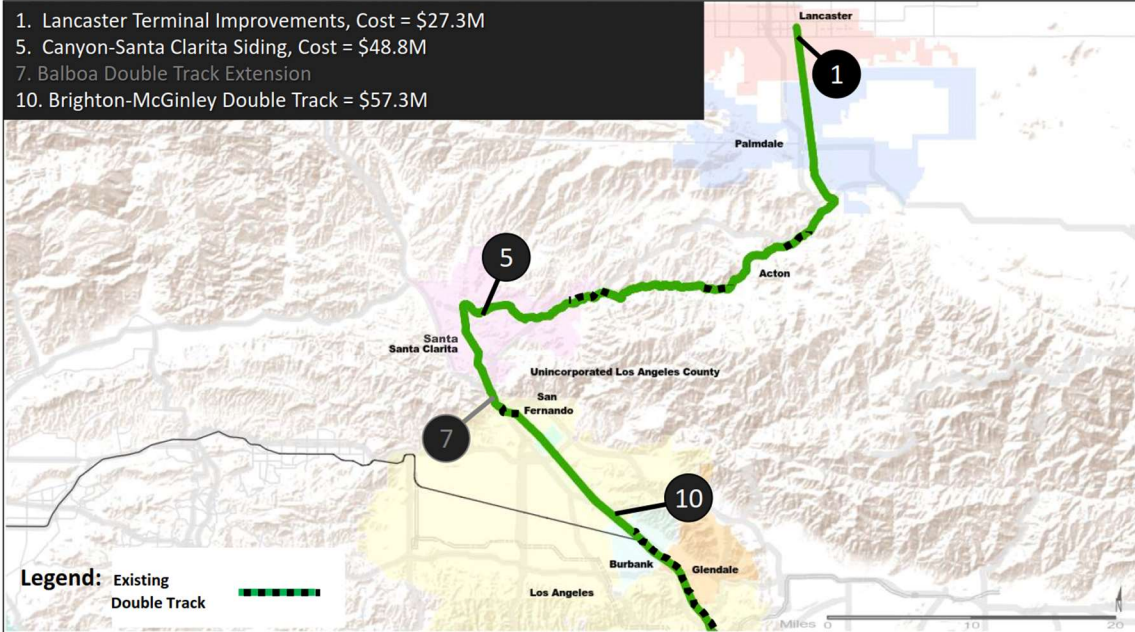
Source: WSP

Figure 6-9: Capital Investment for Rail Capacity – Scenario 2



Source: WSP

Figure 6-10: Capital Investment for Rail Capacity – Scenario 3



Source: WSP

Scenarios 4, 5 and 6 build upon Scenario 3 and include the four Scenario 3 capital projects, as well as additional capacity-related projects to accommodate the more frequent train service in these scenarios.

Scenario 4 includes the following additional projects, at an incremental cost of \$153.7 million above the cost for Scenario 3:

- [#1] One additional 1,000' storage track within the expanded yard at Lancaster
- [#3] New 10,560' siding in the vicinity of Acton, from Arrastre Canyon Road to Wisconsin Street
- [#4] New 5,808' siding in the vicinity of Via Princessa, from White's Canyon Road to Canyon Park Boulevard; includes reconstruction of the station at Via Princessa with two side platforms, it this station is to be retained following opening of the planned Vista Canyon station
- [#6] Additional 11,616' of double track to fill the gap in the Santa Clarita Valley from Lyons Avenue to just north of Oak Ridge Drive.
- [#8] Extension of double track from Sylmar Station to Roxford Street for 8,976'; incorporates a two-track station at Sylmar.

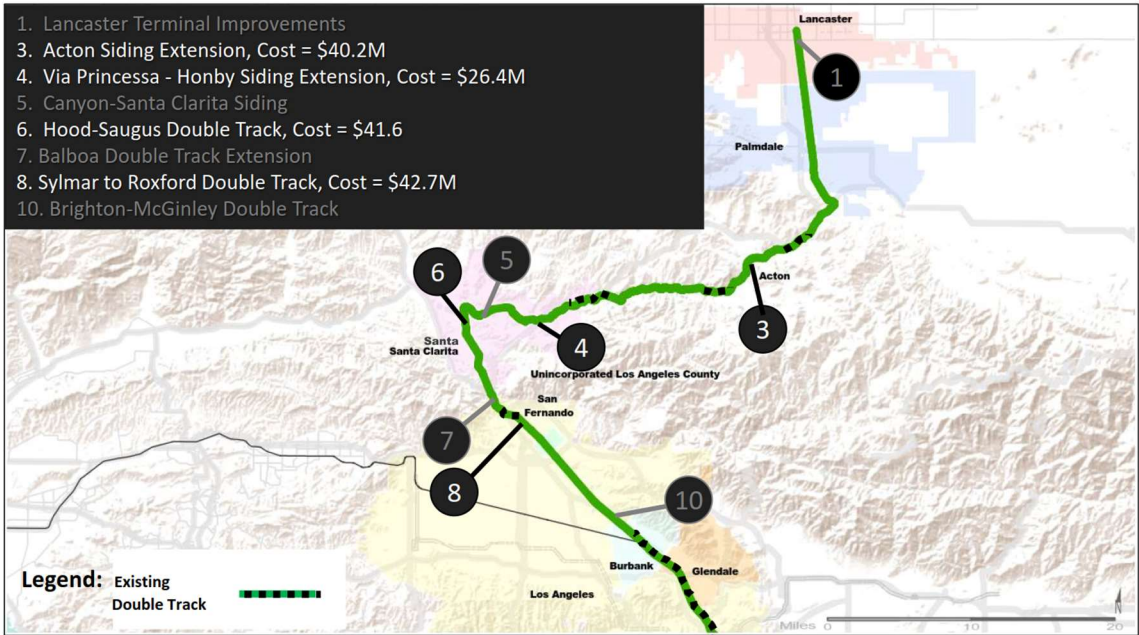
Scenario 5 spaces the express and local trains differently than Scenario 4 and therefore requires new double tracking at different locations, at an incremental cost above Scenario 3 of \$253.4 million:

- [#2] North of Palmdale Station, 18,480' of double track; includes reconstruction of the station at Palmdale to provide a 2-track station with center island platform within the limited ROW.
- [#3] Extension of the Ravenna siding in Soledad Canyon to the south by 13,200'; this project could incorporate minor alignment modifications to improve operating speeds
- [#9] Extension of double track by 13,200' from CP Sheldon to Van Nuys Blvd.



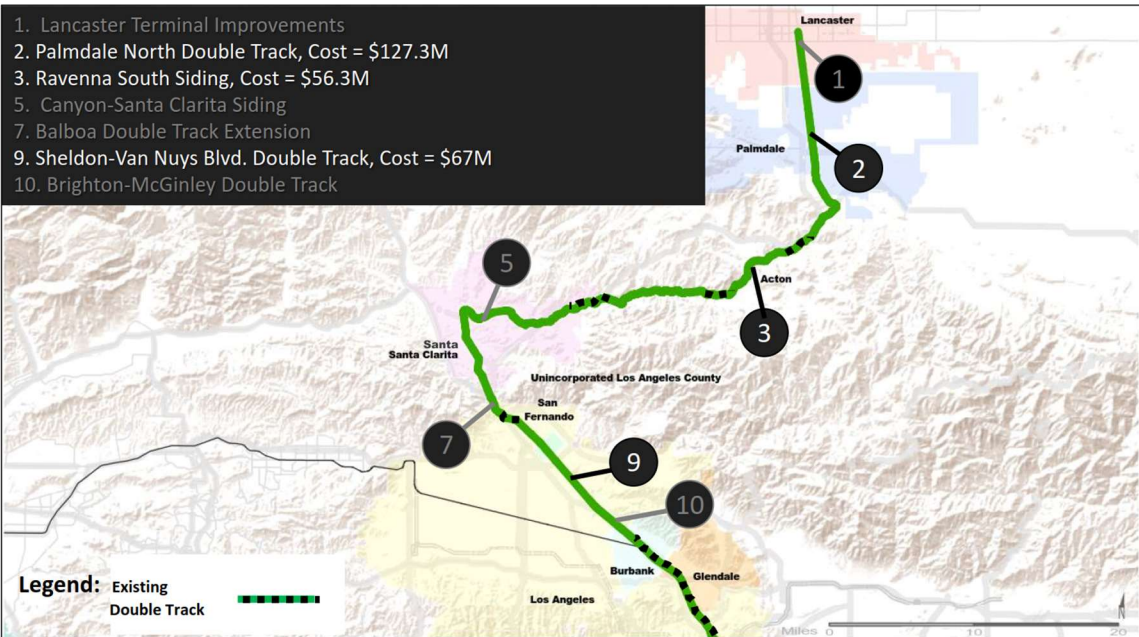
Soledad Canyon
Source: Metro

Figure 6-11: Capital Investment for Rail Capacity – Scenario 4



Source: WSP

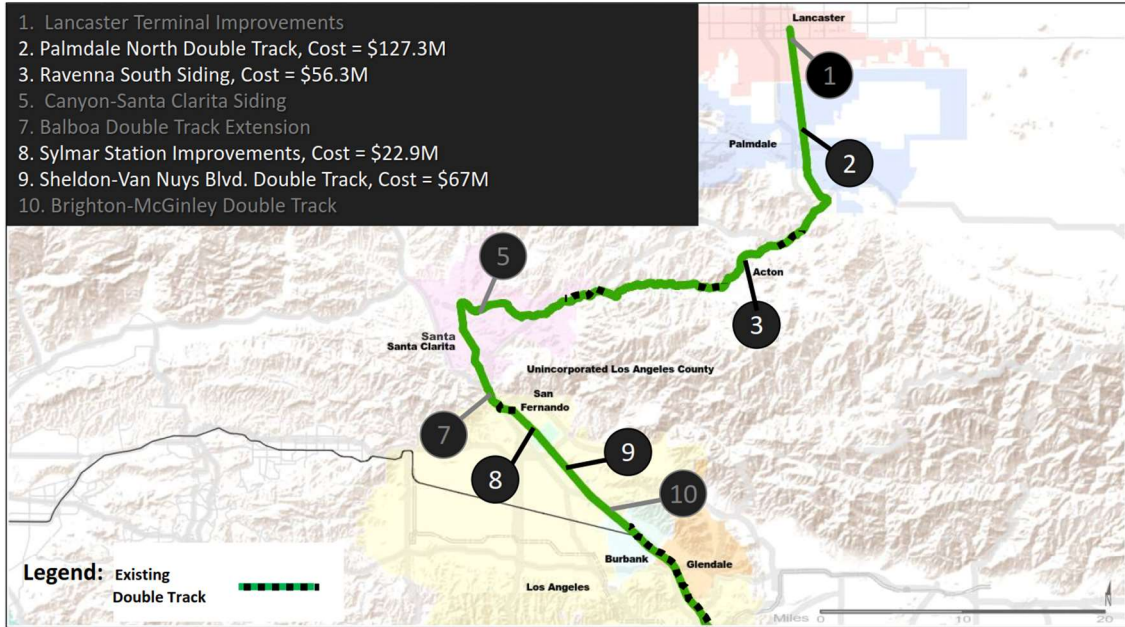
Figure 6-12: Capital Investment for Rail Capacity – Scenario 5



Source: WSP

Scenario 6 is a variation of Scenario 5, requiring the same three additional double tracking projects at Palmdale North, Ravenna South and Sheldon-Van Nuys. An additional capital investment is required at Sylmar to provide a double-track station and a pocket track for turning back inner zone local trains (Project #8). The incremental capital cost of this scenario, over and above Scenario 3, is \$273.5 million.

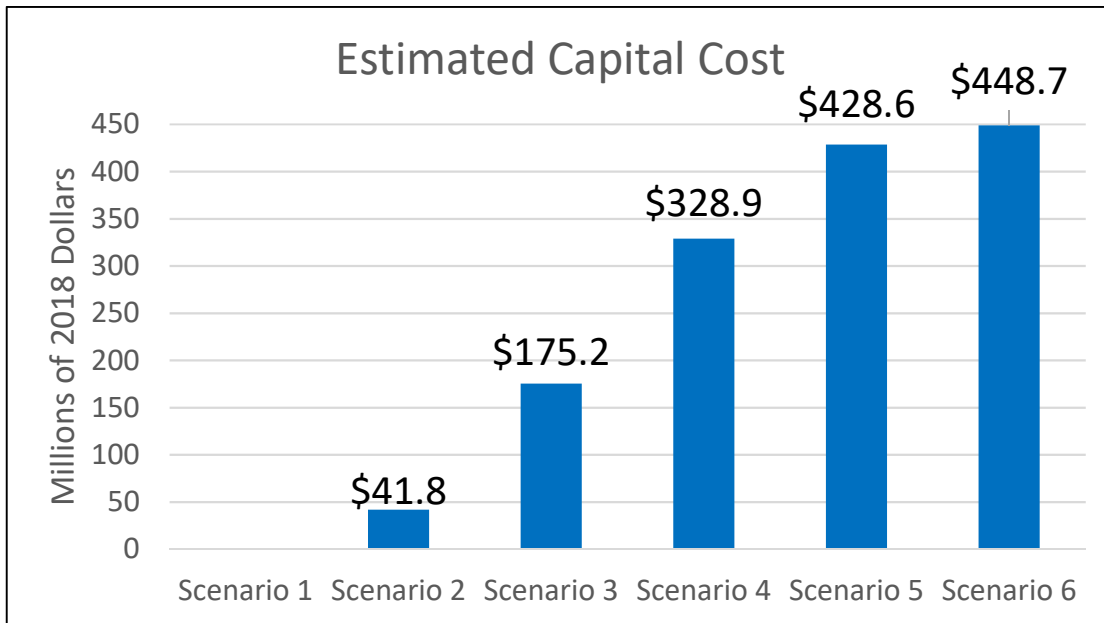
Figure 6-13: Capital Investment for Rail Capacity – Scenario 6



Source: WSP

The estimated total cumulative capital cost for each scenario is shown in Figure 6-14. A summary of the scope and estimated cost for each individual capital project is presented in Table 6-8, which also identifies the projects that are required prerequisites for each service scenario.

Figure 6-14: Rough Order of Magnitude Capital Cost, by Scenario



Source: WSP

Table 6-8: Rough Order of Magnitude Capital Cost, by Project and Scenario

Mile-post	ID	Project	Track-Foot	Description	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6	Estimated Rough Order-of-Magnitude Capital Cost ^{1,2} (\$M)
76.1 - 76.6	1a	Lancaster Terminal – 6 trainsets	3,440	New double track and second station platform face, plus two new 1,000' storage tracks ³			X			X	\$27.3 ³ (\$36.3 ⁴)
76.1 - 76.6	1b	Lancaster Terminal – 8 trainsets	4,300	New double track and second station platform face, plus three new 1,000' storage tracks ⁴				X	X		\$30.1 ³ (\$42.1 ⁴)
68.5- 72.0	2	Palmdale North	18,480	New double track and 2 station platform tracks (integrated with HSR)					X	X	\$ 127.3
55.0- 57.5	3	Acton Siding	13,200	New siding				X			\$ 40.2
50.0- 52.5	4	Ravenna South	13,200	Extend existing siding (new double track)					X	X	\$ 56.3
37.5- 38.6	5	Via Princessa-Honby	5,808	Extend existing siding (new double track)				X			\$ 26.4
33.4- 35.0	6	Canyon-Santa Clarita	8,448	Extend existing siding (new double track)			X	X	X	X	\$ 48.8
30.2- 32.4	7	Hood-Saugus	11,616	Connect sidings and convert to double track				X			\$ 41.6
25.3- 26.5	8	Balboa-Tunnel	6,336	Extend double track		X	X	X	X	X	\$ 41.8
21.9- 23.6	9	Sylmar-Roxford	8,976	New double track				X			\$ 42.7
21.5- 22.1	10	Sylmar Station	3,168	Second track at station (Costs included in Van Nuys - Sylmar)						X	\$ 22.9
19.5- 21.9	11	Van Nuys Blvd-Sylmar	12,672	New double track							\$ 47.4
17.0- 19.5	12	Sheldon-Van Nuys Blvd	13,200	New double track					X	X	\$ 67.0
12.7- 15.6	13	Brighton-McGinley	15,312	Extend and connect double track sections			X	X	X	X	\$ 57.3
		LAUS-Hollywood ⁵	TBD ⁵	Additional main track				X	X	X	TBD ⁵
		TOTAL³			\$ --	\$41.8	\$175.2	\$328.9	\$428.6	\$448.7	n.a.

Notes: All capital costs are expressed in millions of 2018 dollars.

1. ROM Cost Estimate per RSE Antelope Valley CIP Project Cost Estimates, and PRE Cost Estimates for Signal-Related work

2. All Costs include 35% Contingency on top of Base Construction Cost, and 60% Soft Cost rate added to Base Construction Costs AND Contingency.

3. Capital cost figures include only storage tracks and station improvements at Lancaster.

4. Higher capital cost figures (shown in parentheses) also include light maintenance and inspection facilities (not included in totals).

5. Capital cost estimate for this project developed for Los Angeles-Glendale-Burbank Feasibility Study (Mott-MacDonald)

Source: WSP

6.5 Service Scenario Evaluation

The six service scenarios described in Sections 6.1 and 6.2 were evaluated following the Stage 2 process described in Chapter 5, using multiple criteria that fall within the following five categories:

- Operations
- Regional Connectivity
- Costs and Financial Performance
- ROW Impacts
- Applied Technology

The specific criteria and performance measures within each of these categories were retained from the Stage 1 evaluation. The overall category weights also were retained from Stage 1, with the highest weights and greatest importance given to operational considerations and regional connectivity benefits – together accounting for 60 percent of the evaluation score. The next highest priority was given to costs, at 20 percent. Right-of-way impacts and technology considerations accounted for the remaining 20 percent of the score.

The relative weights and value of the criteria weights within the five broad categories were adjusted to reflect refinements in the objectives that emerged from stakeholder discussions following the Stage 1 evaluation. In particular, *Flexibility for Future Growth in Long Term* was given the greatest weight among the operations-related criteria, with a maximum score of 30 as opposed to 15 for the other criteria in the category. This reflected the recognized need to consider the potential for future passenger service operators on the AVL beyond Metrolink, such as Amtrak Pacific Surfliner, interim high-speed service to and from the Central Valley and Bay Area, Virgin USA train service to and from Las Vegas, or express service connecting with high-speed trains or running through to points beyond the AVL.

Scenarios that provided infrastructure that would be useful for supporting multiple potential service concepts for express passenger service scored highly, such as Scenario 3 and Scenario 2. Scenarios that provide new double tracking on portions of the AVL that is necessary to support service patterns that are unique to a specific scenario, but which would not be utilized in other scenarios, were rated lower in terms of future flexibility. Scenarios 4, 5 and 6 fall into this latter category, with rail capacity infrastructure customized for specific service patterns.

Cost also was an important distinguishing factor in the evaluation. The scoring guidance from Stage 1 was retained in Stage 2, which favored scenarios that could be implemented within a capital budget of \$200 million, assumed to be a reasonable estimate of the maximum level of funding that could be obtained from currently available sources. Scenarios with a total cost below the \$200 million threshold received a full score of 30 points, whereas scenarios with a total estimated cost greater than the threshold received 10 points. With respect to estimated operating costs, scenarios that offered only limited additional service, up to hourly service off-peak, received a full score of 30 points. Scenarios that largely retained existing peak service and focused on increasing off-peak service, up to semi-hourly, received 20 points. Scenarios that significantly increased peak service, requiring additional trainsets and crews, received 10 points.

Table 6-9 presents the comparative evaluation of the six refined service scenarios in matrix form, showing the criteria and scores for each scenario. Based on all evaluation criteria, Service Scenario 3 provides the greatest value for money and the highest level of benefit resulting from improvements to service on the AVL (and the capital projects needed to support those improvements).

Table 6-9: Evaluation and Ranking of AVL Service Scenarios

No.	Category and Overall Category Weight	Max Score	Evaluation Criteria	Scenario 1	Scenario 2	Scenario 3	Scenario 4	Scenario 5	Scenario 6
1	Operations 35%	15	Capacity Improvement	5	5	9	13	10	13
		15	Travel Time Improvement	8	10	13	15	13	15
		15	Compatibility with Local Transit and Development Plans	5	5	13	15	15	15
		30	Flexibility for Future Growth in Long Term	17	25	30	20	20	20
		15	Quality of the Passenger Experience	5	5	9	10	10	13
		15	Compatibility with Clockface Schedule Patterns	5	8	13	15	15	15
2	Regional Connectivity 25%	19	Travel Markets Served	6	6	13	16	16	19
		19	Multimodal Connectivity	6	6	10	16	16	19
		19	Regional Network Connectivity	6	6	13	13	19	19
		19	Rail Mode Share Potential	9	9	13	19	19	19
3	Costs and Financial Performance 20%	30	Total Capital Cost	30	30	30	10	10	10
		30	Relative Impact on Annual Operating Cost of AVL service	30	30	20	10	10	10
4	ROW Impacts 10%	10	Right-of-Way Takes	10	10	7	3	3	3
		10	Indirect Property Impacts (noise, etc.)	10	10	10	3	7	7
		10	Sensitive Area Impacts (historic, endangered species, etc.)	10	10	7	7	3	3
5	Applied Technology 10%	8	VMT Reduction	3	3	5	8	8	8
		8	Clean Vehicle Technology (e.g., DMUs, Electrification)	8	8	8	8	8	8
		8	Compatibility with Future Intercity & High Speed Rail	3	3	8	5	5	5
		8	Serves DAC s and Low Income Households/ Communities	4	4	6	6	8	6
TOTAL SCORE		303		180	193	237	212	215	227
RANK				6	5	1	4	3	2

Note: Green shading denotes highest-priority project.

Source: WSP

6.6 Capital Project Evaluation

The fourteen capital projects listed in the previous table were evaluated following the Stage 2 process described in Chapter 5, using the following five criteria:

1. Capital project supports sequential service improvements
2. Total capital cost of project
3. Independent utility of the project
4. Extent of potential environmental or community impact issues
5. Extent of required ROW acquisitions.

The first three criteria were deemed important for projects intended for early implementation. The first criterion favors projects that preserve future flexibility to increase service according to a variety of possible service scenarios. Given limited available funding and widespread needs for capital investment across the entire rail network, projects with relatively low capital costs will be easier to fund and implement quickly. The independent utility criterion assesses the ability of a project to directly support improved rail service and deliver ridership benefits. The impact and ROW criteria measure the degree of risk associated with a project, favoring early action projects that minimize these risks.

The resulting evaluation scores are presented in Table 6-10. Appendix 4 provides more detailed documentation of the performance metrics and ratings developed during the evaluation.

The top scoring project is the CP Balboa to Tunnel 25 double-track extension (Project #8), which is required by Scenarios 2 through 5. The regular, repeating hourly service pattern on the AVL that this project enables is expected to be the backbone of any long-term future service plan on the AVL. As a result, this project is robust and logical for the first round of investment.

The three additional projects that comprise the second round of investment also score high in the evaluation, because they support multiple future service scenarios, are relatively straightforward in terms of construction and are not expected to have significant negative impacts. They include double-tracking two portions of the AVL – between Burbank Airport-North and Sun Valley, and through Santa Clarita Station – and increasing the train-handling capacity at the Lancaster station and train storage yard. These capital projects also support Scenario 3, the top-rated scenario emerging from the service scenario evaluation. Taken together, these four capital projects can be implemented for a capital cost less than \$200 million and can deliver tangible incremental improvements in rail service up to and including the level of service in the preferred Scenario 3.

Table 6-10: Evaluation and Ranking of AVL Capital Projects

Mile-post	ID	Project Name	Track-feet	Description	Estimated Rough Order-of-Magnitude Capital Cost	Total Weighted Score
76.1 - 76.6	1a	Lancaster Terminal -- 6 trainsets	3,440	New double track and second station platform face, plus two new 1,000' storage tracks	\$ 27,300,000	37
76.1 - 76.6	1b	Lancaster Terminal -- 8 trainsets	4,300	New double track and second station platform face, plus three new 1,000' storage tracks	\$ 30,100,000	33
68.5-72.0	2	Palmdale North	18,480	New double track and 2 platform tracks at station (integrated with HSR)	\$ 127,300,000	16
55.0-57.5	3	Acton Siding	13,200	New siding	\$ 40,200,000	24
50.0-52.5	4	Ravenna South	13,200	Extend existing siding (new double track)	\$ 56,300,000	23
37.5-38.6	5	Via Princessa-Honby	5,808	Extend existing siding (new double track)	\$ 26,400,000	25
33.4-35.0	6	Canyon-Sta. Clarita	8,448	Extend existing siding (new double track)	\$ 48,800,000	40
30.2-32.4	7	Hood-Saugus	11,616	Connect sidings and convert to double track	\$ 41,600,000	24
25.3-26.5	8	Balboa-Tunnel	6,336	Extend double track	\$ 41,800,000	49
21.9-23.6	9	Sylmar-Roxford	8,976	New double track	\$ 42,700,000	23
21.5-22.1	10	Sylmar Station	3,168	Second track at station (Costs included in Van Nuys - Sylmar)	\$ 22,900,000	29
19.5-21.9	11	Van Nuys Blvd-Sylmar	12,672	New double track	\$ 47,400,000	21
17.0-19.5	12	Sheldon-Van Nuys Blvd	13,200	New double track	\$ 67,000,000	24
12.7-15.6	13	Brighton-McGinley	15,312	Extend and connect double track sections	\$ 57,300,000	43
Total ROM Capital Cost					\$ 677,100,000	

Note:

Green shading denotes highest-priority project; blue shading denotes second-highest priority projects. Cost estimates for Lancaster terminal projects exclude train servicing and inspection facilities.

Source: WSP

7 IMPLEMENTATION PRIORITIES

7.1 Phased Implementation Plan

The AVL Study suggests a series of **incremental rail service improvements** over a period of time, and **associated capital investments in railroad capacity** that are needed to enable the service improvements. A phased program of investment in selected key projects allows tangible improvements in service to be realized in a series of steps. Keeping the steps relatively small and incremental will allow for a reasonable level of investment that can utilize available local funding and potentially leverage those funds to obtain additional State and Federal funding from existing grant programs. The suggested program is consistent with the longer-range vision contained in the State Rail Plan and compatible with potential future blended service with Metrolink, CHSRA, Virgin Trains USA and/or Amtrak. When presented initially to AVL stakeholders in February, 2019, most NCTC stakeholders advised to move forward with short-to-medium term solutions rather than long term options.

The implementation plan has three phases of service improvement and two rounds of capital investment, as illustrated in Figure 7-1. The level of rail service would increase in each phase, building upon the previous phase and taking advantage of the capacity provided by the capital projects. The size of the required rolling stock fleet also would increase, with one additional revenue train set required in each of Phases 2 and 3. The Phase 3 level of service would be consistent with State Rail Plan objectives for half-hourly service between Santa Clarita and Los Angeles and hourly service to the Antelope Valley.

The AVL Study findings will enable the 2040 Integrated Network Vision for Los Angeles County, as articulated in the 2018 California State Rail Plan. The proposed AVL capital projects to enable regular hourly and 30 minute service are consistent with the overall goals of the Southern California Optimized Rail Expansion (SCORE) Program to provide 30 minute service to Santa Clarita and hourly bi-directional service to Palmdale and Lancaster with additional express peak service.

Figure 7-1: AVL Short-to-Medium Term Implementation Plan

Phase	1		2		3
Additional AVL Service	Additional Late Evening Train; Off-Peak Service Adjustments	Initial Capital Project Balboa to Tunnel 25	Additional Mid-day Trains (Hourly Service)	2nd Round of Capital Projects Lancaster Terminal; Canyon-Sta. Clarita Brighton-McGinley	Regularized 30-Minute Off-Peak Headways; Improved Peak Service
Existing: 6 Trainsets 15 daily round trips	6 Trainsets 16 Daily round trips		7 Trainsets Up to 18 Daily round trip slots		8 Trainsets Up to 30 Daily round trip slots

Source: WSP

In July of 2019, the Metro Board authorized the following actions towards implementation of a phased program of AVL infrastructure and service improvements:

- A. Support for phased implementation of Scenarios 1, 2 and 3 and prioritization of the Balboa Siding Project, to open up the expedited delivery of hourly commuter rail service between North Los Angeles County and Los Angeles Union Station
- B. Coordination with Metrolink on the phased implementation of Scenarios 1, 2 and 3 and the inclusion and prioritization of the capital projects detailed therein as part of Metrolink’s SCORE program
- C. Programming of \$6.6 million in unprogrammed FY18-22 Multi-year Subregional Programming (MSP) Transit Program funds and \$6.15 million in FY23 MSP Transit Program funds from the North County Subregion, in order to bring the capital projects included in Scenarios 1 through 3 to “shovel-ready” status
- D. Coordination with Metrolink on a discretionary grant strategy, and with the North County Subregion on additional local funding options that could be leveraged, to fully fund the remaining construction costs of the capital projects included in Scenarios 1 through 3
- E. Support for implementation of a diesel, electric, battery electric, or hybrid multiple unit train pilot program on the AVL, and coordination with Metrolink in the pursuit of grant funding opportunities that focus on the offsetting of mobile source pollution in order to implement the pilot program
- F. Partnering with Metrolink to engage appropriate state agencies and the private sector on additional strategies, implementing the above directives, to unlock the service potential of the AVL in support of the integrated service goals laid out in the State Rail Plan.

The service characteristics for each phase of incremental service improvement, and the capital projects required to support the service, are described below. The timing and duration of each phase are variable, depending on the availability of capital and operating funding and decisions by AVL stakeholder agencies to allocate funding for AVL improvements. The nominal timeframe for implementing Phases 1, 2 and 3 is approximately ten years, based on reasonable assumptions about funding availability from currently-identified sources and the time typically required to bring capital projects from inception to a “shovel-ready” state. If funding is delayed or prioritized for other uses than AVL capacity, then the time needed to realize the benefits of each phase could be extended. On the other hand, a concerted effort by AVL stakeholders to prioritize investment in the corridor, potentially coupled with new or enhanced sources of funds, could accelerate the pace at which improvements can be achieved. This Study does not take a position or make explicit assumptions about funding priorities and decisions that extend beyond the corridor and the purview of Metro. It attempts to strike a balance between appropriate aspirations and reasonable expectations and sets the stage for future informed decision-making.

7.1.1 Phase 1

Phase 1 includes changes to the existing AVL timetable that add or improve service in ways that respond to market demand and can be operated on the existing railroad infrastructure, without the need for prior capital improvements to add track capacity. Because no prior capital investment is necessary, this first phase of improved service can be accorded a high priority and implemented relatively quickly.

Types of improvements that potentially are implementable in the near term include minor adjustments to peak and off-peak schedules, extension of Metrolink’s hours of service through the introduction of late night trains, and increased weekend service. There is greater flexibility during off-peak hours than during the weekday peaks for adding service and reducing the time intervals between trains. There is relatively little flexibility to increase the frequency of peak trains or the number of trains that operate during peak periods in the reverse-peak direction – since these types of improvements generally depend upon the creation of new double-track segments to permit trains running in opposite directions to pass each other. Similarly, significant reductions in trip times or increases in the frequency of peak express

service also would likely require capacity-related investment to increase the number of required meet points and change their locations along the AVL.

The initial action to improve rail service on the AVL could be to add a late evening train on Friday and Saturday nights, departing from LAUS at or after 10:30 pm and making all local stops to Lancaster. This train would enable residents in the AVL corridor to use the train to get to activities or events in Central Los Angeles, such as a concert, baseball game or dinner, with the opportunity to return home by train. Adding late night service will have the effect of reducing the window available for track and right-of-way maintenance on days when the late train runs. Maintenance work is scheduled for the overnight hours, when the track can be taken out of service without impacting passenger trains. In this scenario, maintenance can still be scheduled for the entire overnight periods on Sunday through Thursday. During seasons when the late train is not heavily utilized, bus service can substitute for the late train, to allow for maintenance work when needed. This improvement was developed and analyzed in the AVL Study as Scenario 1 and is considered to be the service plan for Phase 1.

The existing railroad has sufficient capacity to be able to add this train, without the need for additional capital projects. It also can be accommodated with the existing rolling stock fleet, with the equivalent of six train sets serving the AVL. The evening express train that now runs to Palmdale in the 5:00 pm hour and then heads to the yard at Lancaster would instead turn at Palmdale and run back to LAUS, departing Palmdale a little after 7:30 pm and arriving at LAUS around 10:00 pm. This turnback train would not be a fast trip, since it would have to utilize existing passing sidings to meet four outbound trains on the way back to Lancaster; its primary purpose would be to set up the late evening trip. The number of weekday round trips on the AVL would increase from 15 to 16.

An additional train crew would be required to operate the late night service, which, along with diesel fuel, would be the primary contributors to increased operating costs. For late service on two nights per week, the incremental annual operations and maintenance cost is estimated to be on the order of \$400,000.

The greatest demand for a late train is expected to be on weekends, and running the train only on Fridays and Saturdays would keep operating costs relatively modest. Service could be expanded to six or seven days a week relatively easily if sufficient demand exists and the resources are available to cover the net increase in operating costs.

Other service enhancements are potentially possible within Phase 1. Metrolink regularly reviews its train schedules and looks for opportunities to make improvements. They have identified the potential for improvements to AVL service, especially during the mid-day off-peak period, that could be realized in the relative near term, with existing rail infrastructure. The AVL Study utilized relatively coarse data and planning tools did not analyze rail operations at the level of detail and precision necessary to confirm the feasibility of small incremental adjustments to existing service. Therefore, these kinds of adjustments were not included in Scenario 1. Further study by Metrolink would be needed to define the specific improvements that are possible, develop proposed changes or additions to the AVL timetable, and identify any impacts on fleet and train crew requirements and operating costs.

7.1.2 Phase 2

Phase 2 of the AVL Plan would deliver the service improvements included in Scenario 2. It would provide hourly off-peak Metrolink service frequency on the AVL, require \$42 million of capital investment in new capacity infrastructure, employ one new train set and increase annual operations and maintenance costs by approximately \$3.3 million.

In addition to the late night train provided in Phase 1, the second phase would provide two additional mid-day off-peak trains, increasing the number of daily AVL round trips from 16 to 18. These additional trains would allow for mid-day off-peak service on the AVL to be converted to regular hourly clock face schedules, with train departures and arrivals at LAUS and stations along the line at the same time every hour. During the mid-day, alternating trains would turn back at an intermediate point (either Via

Princessa or Vista Canyon). This would result in regular hourly off-peak service between LAUS and the Santa Clarita Valley and regular bi-hourly service to the Antelope Valley – a significant improvement over the existing schedule, which has large gaps in service during the middle of the day. The alternating short turns would be responsive to the anticipated market demand and help to minimize rolling stock requirements and operating costs. To the extent there is demand for hourly off-peak service to Palmdale and Lancaster, service could be extended without requiring additional line capacity infrastructure.

One capital project would be required before Phase 2 service can be initiated. Project #8 would extend existing double track by 1.2 miles from CP Balboa to a point just south of the south portal of Tunnel 25, between Sylmar and Newhall, at an estimated capital cost of approximately \$42 million. This project would allow trains to operate at their full speed in both directions of travel, spaced exactly one-hour apart, and passing each other at three locations along the route – the existing sidings within Soledad Canyon at Acton and Lang, and in the vicinity of CP Balboa, taking advantage of the extended double track. This project also would improve the overall reliability of the line, minimizing the impact of train delays, by reducing the length of the single-track bottleneck at Tunnel 25.

While the regular clock face hourly pattern enabled by the Balboa-Tunnel 25 project represents a significant improvement for off-peak service, it would not help weekday peak or reverse-peak service, which needs to support two or three trains per hour in the peak direction of travel. Consequently, this phase would need to retain the existing weekday peak service levels and patterns.

The project can be advanced and built using available, largely local, capital funds, so a decision to proceed can be made relatively quickly. The design and environmental documentation studies can be initiated within the next year, leading to the completion of construction and initiation of new service within approximately five years, based on realistic assumptions about the time required to complete design, obtain environmental approvals and assemble capital funding.

7.1.3 Phase 3

Phase 3 of the AVL Phased Implementation Plan would build from Phases 1 and 2 and would enable the level of service provided in Scenario 3. It would almost double the volume of off-peak service on the line, with hourly train slots between LAUS and Lancaster, and slots at 30-minute intervals between LAUS and the Santa Clarita Valley. It would require an additional \$133 million of new capital infrastructure improvements with the need for one additional train set, increase the number of weekday round trips on the AVL from 18 to 30, and increase annual O&M costs by an estimated \$7.5 million – over and above Scenario 2.

The storage capacity of the rail yard at Lancaster would need to be expanded to accommodate the eight revenue trainsets that would operate on the AVL in Phase 3. Two additional double-tracking projects also would be required, to support 30-minute headway service on the line between Burbank Junction and Santa Clarita. One project would extend double tracking from CP Canyon to Santa Clarita. The other project would construct the southern portion of the line in the San Fernando Valley, between CP Brighton and CP McGinley. The Scenario 3 service plan would have train meets occurring in these locations.

The three additional capacity infrastructure projects in this phase would provide the opportunity to adjust weekday peak train schedules to improve the frequency of service and add a second morning express train.

Weekend service could be regularized and increased – to the same frequencies as weekday off-peak service – at any point along the Phase 3 timeline. For purposes of analysis, the Implementation Plan assumes that regular hourly service would be provided on Saturdays, and regular bi-hourly service on Sundays and holidays. The late evening train from LAUS would operate six days a week, Monday-through Saturday.

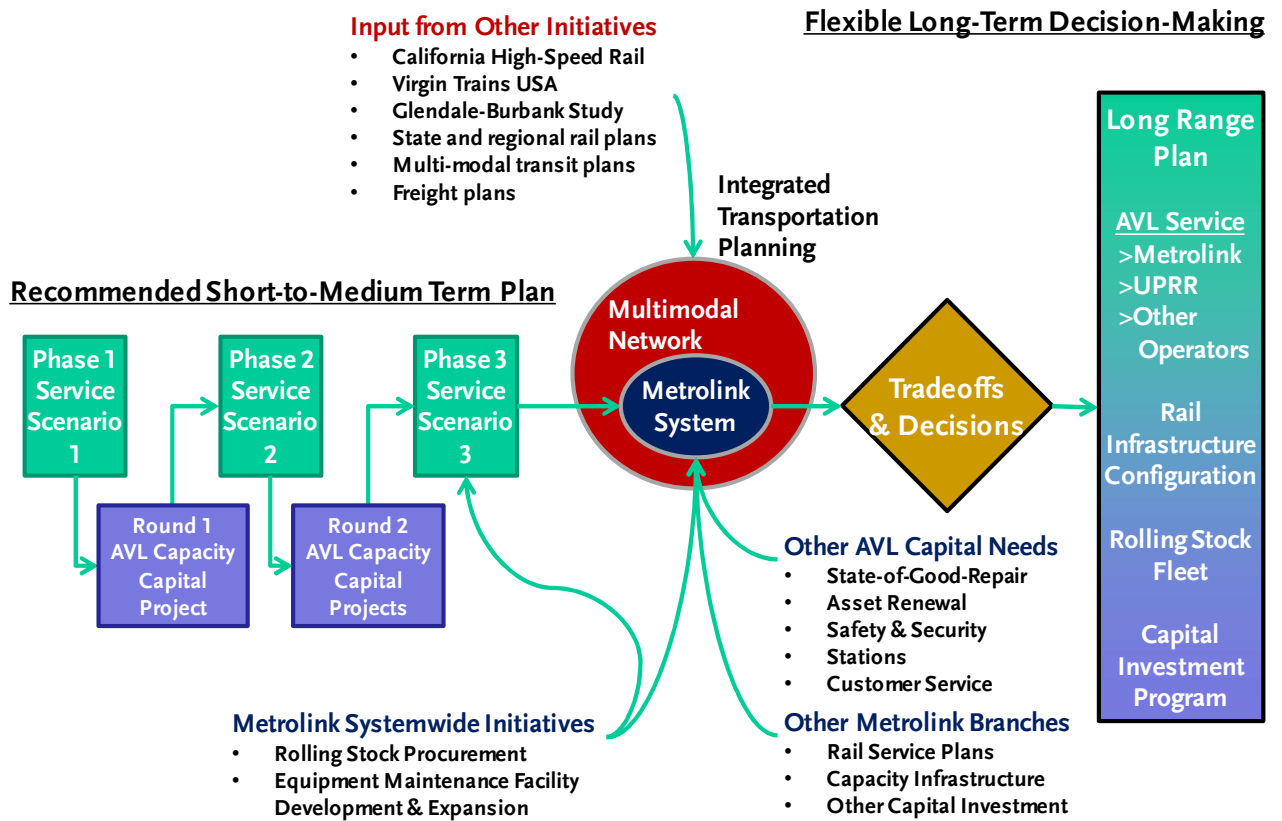
7.1.4 Framework for Planning and Decision-Making Beyond the Recommended Plan

The phasing plan is part of a larger framework for planning and implementing AVL improvements over the long term, as Figure 7-2 shows. The three-phase plan of prioritized AVL improvements is shown on the left side of the diagram. The remainder of the diagram illustrates the other factors that will need to be considered in planning for the future of the AVL beyond the ten-year time horizon of the three-phase plan.

The first three phases of service improvement are flexible with respect to continuing future growth and expansion, allowing for multiple future scenarios. The high-priority capital projects have independent utility, enhancing operational reliability and allowing for reductions in scheduled running times, in addition to providing capacity for more frequent service. As a result, this phased implementation plan can proceed independent of other rail network considerations, prior to the establishment of an agreed-upon long-range vision for rail service in the corridor.

Figure 7-2 expands shows the specific elements of the implementation planning process within the same decision-making framework that was illustrated in Figure 5-1. Several issues beyond the AVL itself will need to be considered in decision-making about longer-term investment and service growth. They include factors related to the full Metrolink system, of which the AVL is one component, as well as factors external to Metrolink affecting the broader multi-modal transportation network.

Figure 7-2: AVL Service Improvement Implementation Plan



Source: WSP

These additional factors are brought into play in the decision-making about investment and service improvement for the long term. These decisions need to be made in the context of the entire Metrolink regional rail system and the multi-modal transportation network of Southern California, not just based on conditions within the AVL corridor itself. Continued capital investment in AVL capacity will need to be justified based on benefits to the AVL corridor as well as broader contributions to the full Metrolink

regional rail system and the transportation network that encompasses all modes of passenger transportation and extends to regional and intercity travel markets beyond the AVL corridor.

Metrolink System Factors

The rolling stock and fleet maintenance capacity needed to support increased AVL service will be part of Metrolink's overall fleet and equipment maintenance strategy. Current plans appear to be sufficient to support Phase 1 and Phase 2 AVL operations. Additional fleet-related investment may be needed in parallel with the Round 2 projects to support the Phase 3 service plan. It would be logical to augment the scope of the Lancaster Terminal project to include a servicing and inspection capability for the trainsets that are stored overnight at Lancaster. Such a facility would allow for sanding, cleaning, consumables storage, toilet servicing, water service and locomotive fueling by truck at Lancaster, functions that must be handled at existing shops that have reached their capacity. Investments at Lancaster would be part of a wider equipment maintenance plan for the Metrolink system.

Full Metrolink system capital needs, based on an updated strategic network plan for Metrolink, will need to factor into the tradeoffs and decisions for the long-term service, infrastructure and fleet plans for the AVL. This is where the capacity-related investments identified in the AVL Study are brought into the development of a long-term capital program for Metrolink, including other important capital needs such as investments in state of good repair, life-cycle asset renewal, and operational reliability, safety and security improvements, station-related projects and capital initiatives related to customer service.

External Factors

The longer-range plan for the AVL is expected to be guided by the long-range vision contained in the State Rail Plan for 2040. It also will need to consider the changing landscape with respect to the likely timing of investment in high-speed rail in Southern California and address potential opportunities and challenges associated with interim or long-term investment in blended service/operations along the AVL for both regional and high-speed trains. This includes the possibility of multiple operators of passenger trains on the AVL, including Amtrak, CHSRA and/or Virgin Trains USA.

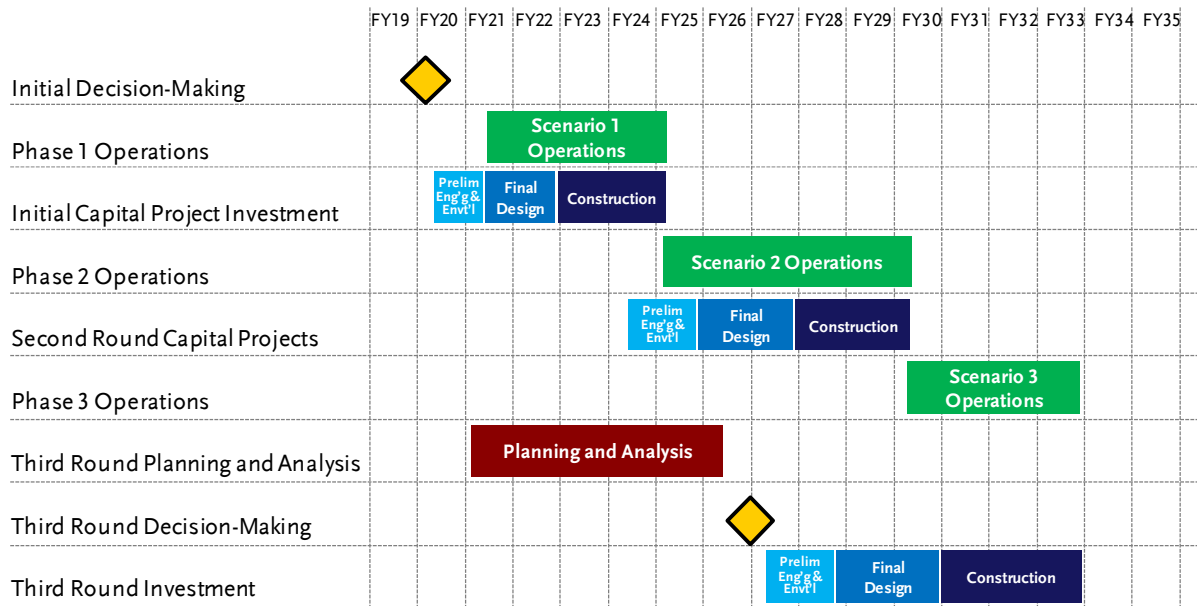
Regional transit initiatives that potentially affect the AVL ROW, rail service patterns and travel markets also will need to be taken into account. Among these initiatives are the East San Fernando Valley Transit Corridor project and the Glendale-Burbank corridor study, both of which were progressing in parallel with the AVL Study.

7.1.5 Implementation Schedule and Timing

The implementation schedule for the prioritized phasing plan depends primarily on the timing and amount of funding devoted to investment in the AVL. One example of an implementation schedule is shown in Figure 7-3. Each round of capital investment would include three sub-phases: preliminary engineering and environmental approvals; final design; and construction. Following a decision to proceed and development of a funding plan, a period of five to six years is assumed for implementation of each round of investment, after which the next increment of improved service can be placed into operation.

This schedule attempts to strike a balance between appropriate aspirations and reasonable expectations. It is illustrative and not prescriptive. Commitment of funding resources from multiple sources, including local sources, will be needed to advance and implement the capital projects. None of these funds currently are committed, and decisions will need to be made to allocate scarce funds to AVL improvements, if this program is to proceed in a timely manner. Delay in funding, or commitment of funds at a lower level than needed, will delay the implementation schedule. There also are opportunities to advance implementation more rapidly, particularly the second and third phases. A limited amount of compression of the design and construction timeframes could be possible, and the phases of design and construction could overlap by a greater amount – but only with an increased amount of annual funding over the shorter overall implementation period.

Figure 7-3: Potential Phased Implementation Schedule



Notes – assumptions for purposes of illustration only (depends on availability of funding):
 Initial capital project investment timing: Preliminary Engineering and Environmental Approvals: 1 year; Final Design: 1.5 years; Construction: 2.5 years.

Second round capital project timing: Preliminary Engineering and Environmental Approvals: 1 to 1.5 years; Final Design: 1.5 to 2.5 years; Construction: 2.5 to 3 years.

Third round timing is shown for purposes of illustration only – can be accelerated or deferred depending on demand and funding availability.

The schedule diagram shows a third round of investment, preceded by a planning and analysis phase, indicating the intent for continuing improvement in AVL service. At this point in time, there is no specific scope suggested by the AVL Study for this third round of projects – the project locations and extents will need to be determined in the ongoing planning process. The third round of investment could be designed to support Scenario 4, 5 or 6, or another service plan that could emerge from the planning and evaluation process based on new information or factors not considered in the AVL Study.

After Phases 1, 2 and 3, the implementation process for subsequent phases can overlap, which is a way to shorten the overall implementation timeframe, to the extent that funds are made available.

7.2 Operations and Operating Costs

The Phase 1 service improvement would add a late evening round-trip on Friday and Saturday nights, implementing Service Scenario 1. It would utilize the existing AVL fleet of six train sets but require deployment of an additional train crew on days when these trains operate. Total daily round trips on Fridays and Saturdays would increase from 15 to 16. The service would remain the same on other days of the week, and during the weekday peak and mid-day periods.

Phase 2 (Scenario 2) would add two mid-day round trips, providing hourly off-peak service between LAUS and the Santa Clarita Valley, and regular bi-hourly off-peak service to and from the Antelope Valley. The late evening round trip on Friday and Saturday would continue to operate in this phase. The number of required train sets would increase from six to seven, and the number of required train crews

would increase by two, compared with Scenario 1, for operation of the additional mid-day trains. Daily round trips would increase from 16 to 18 on Fridays and from 15 to 17 on other weekdays.

Phase 3 (Scenario 3) essentially would double off-peak service frequency compared with Scenario 2. Off-peak service between LAUS and the Santa Clarita Valley would be provided at 30-minute intervals, and service to and from the Antelope Valley would be increased to regular hourly intervals. The number of required revenue train sets would increase again by one, from seven to eight. An additional six weekday train crews would be required, compared with Scenario 2, to support the increased off-peak service. The late evening round trip would be extended to six days a week (excluding Sundays), and total weekday round trips would increase from 17 or 18 to 29 or 30. Weekend service is assumed to increase in this phase – to regular bi-directional hourly service on Saturdays and bi-hourly service on Sundays.

Table 7-1 presents the estimated incremental annual O&M cost of each increment of service, over and above existing O&M costs. In general, the magnitude of cost would increase proportionally with the increase in total annual train round-trips and annual revenue hours. A range of costs is shown, based on using two different estimation methods, and reflecting the uncertainty of the estimates at this early stage of planning.

It is worth noting that the capacity-related capital projects create “slots” on the railroad in which passenger trains can operate without conflict with other passenger trains, based on a service plan or train schedule. When the improvements are implemented, these slots can be filled to the extent appropriate, based on ridership demand and support for the required operating subsidy. Scenarios 1 and 2 add relatively few schedule slots, so all of the additional slots are assumed to be filled. Scenario 3, however, allows for significantly more off-peak service. If off-peak demand does not justify such extensive off-peak service, particularly in the early years of implementation of this phase, then it would be possible to leave some of the off-peak slots unfilled in order to reduce operating costs and subsidy. This would leave selected mid-day slots empty, which would provide increased opportunities for UPRR to run mid-day freight trains in the corridor. As an exercise, a variation on Scenario 3 was analyzed (Scenario 3A in Table 7-1), with three fewer off-peak round trips on weekdays and two fewer round trips on Saturdays. This leaner service plan would reduce annual revenue hours and O&M costs.

Table 7-1: Incremental Annual O&M Cost by Scenario, Compared to Existing Service

Scenario	Round Trips per Day				Annual Round Trips	Annual Revenue Hours	Incremental Annual O&M Cost (\$M/yr)
	Mo-Th	Fr	Sa	Su-Hol			
Existing	15	15	6	6	4,485	16,781	--
Scenario 1	15	16	7	6	4,589	17,221	\$0.41
Scenario 2	18	19	7	6	5,458	20,466	\$3.30
Scenario 3	29	30	14	7	10,163	32,948	\$10.79
*Scenario 3A	26	27	12	7	7,660	25,890	\$6.23

* Scenario 3A is a variation of Scenario 3, utilizing the same railroad infrastructure, but operating three fewer off-peak round trip trains on weekdays and two fewer round trips on Saturdays. This variation represents a potential lower-cost interim for service growth beyond Scenario 2.

Note: Incremental O&M costs expressed in millions of 2018 dollars, compared to existing service. Source: WSP

7.3 Capital Investment

The capital projects included in the AVL phasing plan are shown in Figure 7-4. They include three double-tracking projects to allow for bi-directional train meets and improve operational reliability, along with expansion of the overnight train storage capacity at the Lancaster terminal. The total estimated capital cost of these improvements would be \$175.2 million. The initial project, extending double track

from CP Balboa to near the south portal of Tunnel 25, has an estimated capital cost of \$41.8 million. The second round of investment, including the other three projects, has an estimated capital cost of \$133.4 million.

Figure 7-4: Recommended Capacity Infrastructure Projects



Source: WSP

These projects, all of which are deemed necessary to increase railroad capacity to support service growth, do not represent the full capital needs in the AVL corridor. Metrolink system-wide investment must progress in parallel with AVL capacity investment.

Two important elements of the plan to increase service are rolling stock and rolling stock maintenance facilities. As the size of the fleet grows, new locomotives and passenger coaches will need to be acquired, and the facilities where this equipment is maintained will need to be expanded, since the existing facilities are sized for the current fleet composition and have limited spare capacity. It would be extremely inefficient for fleet to be procured and facilities constructed at the individual branch line level. These are system-wide resources that SCRRA manages and plans for at the scale of the full Metrolink network.

While overnight and mid-day storage of trainsets at outlying and intermediate locations along a regional rail line relates directly to the quantity and patterns of service on the line, equipment maintenance functions and requirements are determined through analysis of the full regional rail network. It would be logical for some of these functions, such as light maintenance, to be located at Lancaster or perhaps elsewhere on the AVL. Future planning and decision-making about new or expanded layover yards should be undertaken in the context of the overall system-wide rolling stock maintenance program.

The current Metrolink capital program includes funding for incremental fleet expansion, including \$10 million for rehabilitation of ten cab cars (passenger coaches with control cabs to enable trains to operate bi-directionally with a locomotive only on one end of the train), funded as part of Metrolink's State-of-Good-Repair program, and \$14 million for procurement of two new locomotives, using TIRCP/Metro funds. The AVL Study assumes that this fleet program can provide the one additional

trainset required for the Phase 2 service plan, an assumption that will need to be verified by SCRRA, which also has plans for expansion of Metrolink's fleet maintenance capability.

On top of these initiatives, other important ongoing capital needs for Metrolink, which will require capital investment over the same timeframe, include the following types of projects:

- State-of-good-repair and asset renewal
- Operational reliability
- Safety and security, including grade crossing upgrading or elimination
- New stations, improvement or expansion of existing stations, and improved station access
- Customer amenities and customer service initiatives including ticketing and information systems

7.4 Funding Strategies

The Study does not recommend a particular implementation and funding plan for AVL improvements and does not intend to imply a specific commitment of resources from any particular agency or level of government. Alternative sources of state and federal funding were researched for a potential multi-phase program of capital improvements to increase capacity on the AVL. The purpose of the exercise was to establish the potential financial feasibility of such a program and provide an indication of the sources that could be tapped.

Of the numerous local, state, and federal discretionary grant funding sources that could be sought to cover pre-construction and construction costs for projects identified and prioritized as part of Metro's AVL Study, eight were identified for consideration:

Table 7-2: Funding Sources

AGENCY	GRANT PROGRAM	TOTAL PROGRAM FUNDING	TIMING	DESCRIPTION
Federal Transit Administration	Capital Investment Grants – Small Starts	\$527 million in FY 2019	Requests for entry into Project Development accepted on a rolling basis.	<ul style="list-style-type: none"> • Provides funding for capital projects with total costs under \$300 million that are seeking less than \$100 million in federal funding.
Federal Transit Administration	Capital Investment Grants – Core Capacity	\$635 million in FY 2019	Requests for entry into Project Development accepted on a rolling basis.	<ul style="list-style-type: none"> • Provides funding for projects that will increase the capacity of existing systems that are already at full capacity, or will be in five years, by at least 10%.
Federal Transit Administration	Expedited Project Delivery Pilot Program	\$100 million in FY 2019	Not yet known. Expressions of Interest for the FY 2018 round were due in Nov. 2018.	<ul style="list-style-type: none"> • Provides funding for eight projects that are eligible for any of the three CIG programs, seek no more than a 25% federal share, and are supported, in part, by a public-private partnership

AGENCY	GRANT PROGRAM	TOTAL PROGRAM FUNDING	TIMING	DESCRIPTION
U.S. Department of Transportation	Better Utilizing Investments to Leverage Development (BUILD; formerly TIGER)	\$900 million in FY 2019	NOFO to be published no later than April 15, 2019 with applications due within 90 days	<ul style="list-style-type: none"> The maximum award for any project is \$25 million. Demand for BUILD grants has historically far exceeded available funds. During the previous ten rounds, USDOT received 8,000 applications requesting over \$146 billion for transportation projects across the country, but provided just \$7.1 billion to 554 projects.
U.S. Department of Transportation	Infrastructure for Redeveloping America (INFRA; formerly FASTLANE)	\$1 billion for FY 2020	Not yet known. Applications for the FY 2019 round were due in March 2019.	<ul style="list-style-type: none"> INFRA awards are generally larger than BUILD awards with the largest grant during the prior INFRA round totaling \$184.1 million. Like BUILD, INFRA is highly competitive. In the last FY 17-18 round, USDOT received 234 applications and awarded 26.
California Transportation Commission	Local Partnership Program Competitive Program	\$100 million annually; \$309 million awarded for Cycle 1 (FY 2017-18 to FY 2019-20)	Not yet known. Applications for Cycle 1 were due in January 2018.	<ul style="list-style-type: none"> CTC received 90 project nominations during Cycle 1, seeking over \$900 million. Improvements to transit facilities are eligible projects.
California Transportation Commission	Solutions for Congested Corridors Program	\$250 million annually; \$1 billion awarded for Cycle 1 (FY 2017-18 to FY 2020-21)	Not yet known. Applications for Cycle 1 were due in February 2018.	<ul style="list-style-type: none"> CTC received 32 project nominations seeking over \$2.5 billion in funding. Improvements to transit facilities are eligible projects.
California State Transportation Agency	Transit and Intercity Rail Capital Program	For Third Round, \$2.65 billion in FY 2018-19 to FY 2022-23 SB1 and Cap-and-Trade funding and \$1.68 billion of multi-year funding agreement funding)	Not yet known. Applications for Third Round were due in January 2018.	<ul style="list-style-type: none"> For the Third Round, 28 projects were recommended for funding. All were located within disadvantaged communities or low-income communities.

Source: WSP

To completely fund the various service scenarios, funding strategies that combine state and federal sources and leverage local funds were assessed. Each strategy assumed a local match for the federal and state funds. For federal and state grant programs that are competitive, the likelihood of receiving funds was increased with a higher local match. One possibility among many would be for locally-available capital funds to be used to fund the highest priority project, the Balboa-Tunnel double-track extension, which is the sole capital project required to support Scenario 2. This project is an essential component of all of the other service scenarios that were analyzed. Each funding strategy also would

make use of one of the three FTA programs described above (Capital Investment Grants – Small Starts, Capital Investment Grants – Core Capacity, or Expedited Project Delivery Pilot Program).

The strategies are grouped by service scenario. Service scenario 3 (semi-hourly off-peak service) consists of four projects totaling \$175.2 million, scenario 4 (semi-hourly plus express) consists of eight projects totaling \$328.9 million, scenario 5 (semi-hourly plus express hub at Santa Clarita) consists of seven projects totaling \$428.6 million, and scenario 6 (semi-hourly plus express hub at Sylmar/San Fernando) consists of eight projects totaling \$448.7 million. Service scenarios 1 and 2 were not considered for this analysis due to scenario 1 not requiring a capital project and scenario 2 requiring only the Balboa-Tunnel project, which could be funded solely with local NCTC funding.

Because service scenario 3 is estimated to cost less than \$300 million, it would be eligible for FTA’s Capital Investment Grants – Small Starts program. Because they total more than \$300 million, service scenarios 4, 5, and 6 would have to seek FTA Capital Investment Grants – Core Capacity funds (New Starts would not apply because the service scenarios are not creating new fixed guideway transit systems). For each of the scenarios, FTA’s Expedited Project Delivery Pilot Program could be sought, but, due to its 25 percent federal share limitation, its buying power is diminished as the scenarios’ total costs increase.

Further decision-making will be needed to determine the preferred service scenario and funding strategy within the particular scenario, as well as the amount of local matching funds that is considered appropriate and financially feasible given local priorities. However, Metro should take advantage of leveraging opportunities for the local contribution and should also make sure to tell a compelling story when it pursues state and federal grant funding. It could be argued that all of the projects recommended within the preferred service scenario will help prepare the region for the 2028 Summer Olympics and Paralympics and meet the transportation needs of the growing residents and workforce in communities along the AVL. These investments also provide capacity that potentially could support intercity rail service in addition to Metrolink AVL trains.

7.5 Future Passenger Service with Multiple Operators in the AVL Corridor

The AVL is an asset that offers the potential for serving passenger travel markets beyond just the regional and commuter markets currently served by Metrolink. The AVL’s location to the north of central Los Angeles places it in the path of travel between Los Angeles and the Central Valley, northern California and the High Desert Corridor heading in the direction of Las Vegas. It parallels the I-5 and SR 14 freeways for most of its length. This corridor represents a “missing link” in the state’s passenger rail network, where buses operated by Amtrak currently provide service connecting the San Joaquin trains in Bakersfield with the Antelope Valley, the Los Angeles basin and the rail hub at LAUS. The bus link entails long travel times and is subject to freeway congestion. Several ideas exist for utilizing the AVL to shorten or close the gap in rail service. These ideas, which are illustrated in Figure 7-5, all propose introducing intercity passenger trains onto the AVL, where they would share track capacity with Metrolink regional trains and UPRR freight trains.

The long-range vision for California’s rail network, as articulated in the State Rail Plan, calls for a new dedicated high-speed rail line between the Antelope Valley and LAUS, separate from and parallel to the AVL, which would continue to provide Metrolink regional passenger service and offer convenient transfer connections to high-speed trains at LAUS, Burbank Airport and Palmdale. The line would follow a mostly new alignment between Palmdale and the approach to LAUS and would be used by high-speed trains from the Central Valley and northern California and potentially could be used by high-speed trains from Las Vegas.

Given the current shortage of capital funding and prioritization of initial investment on the portion of the route in the Central Valley, the investments in new ROW within LA County are likely to be a long

time coming. The high cost of a dedicated alignment with extensive tunneling makes funding of such an improvement unlikely for the foreseeable future, if the current institutional and national political environment remains in place. The opportunity exists to consider investments in the AVL beyond those contemplated solely for Metrolink commuter rail service – to support the operation of intercity trains, potentially including high-speed trains – in blended service with Metrolink trains along all or portions of the AVL. This could include either the extension of selected Amtrak Surfliner trains from LAUS to the Santa Clarita Valley, or the operation of either California high-speed trains or the proposed Las Vegas service of Virgin Trains USA into LAUS, once these systems have been built as far as Palmdale.

Figure 7-5: Potential AVL Connections to Intercity Rail Corridors



Base map source: California State Rail Plan; source of overlay content: WSP.

An upgraded AVL could serve as an extended interim solution until such time as a new dedicated high-speed line can be funded and built, or it could possibly serve as an acceptable alternative long-term solution. Further analysis is required to determine the level of additional capital investment warranted to support blended service on the AVL.

Possible concepts for blended regional and intercity passenger service on the AVL were identified relatively late in the course of the AVL Study. These concepts include:

- Extension of selected Amtrak Pacific Surfliner trains from LAUS to the Santa Clarita Valley via the AVL, with connecting bus service to Bakersfield
- Operation of CHSRA trains between Palmdale and LAUS in blended service with Metrolink trains on the AVL, once the CHSRA route is completed between Bakersfield and Palmdale

- Operation of high-performance trains between Las Vegas and Los Angeles via Palmdale, as proposed by Virgin Trains USA, in blended service with Metrolink trains on the AVL between Palmdale and LAUS, once the rail connection in the High Desert corridor between Victorville and Palmdale has been completed.

These blended service options were not analyzed as part of the AVL Study, because high-speed intercity rail services were assumed to operate on the new dedicated high-speed alignment, which was originally to be built as part of Phase 1 of the CHSRA project.

Amtrak Pacific Surfliner Extension

The State is considering a concept for intercity passenger service on the AVL that would extend selected Amtrak Pacific Surfliner trains from LAUS to a point on the AVL in the Santa Clarita Valley, where a coach bus connection would be available to Bakersfield – the existing southern terminus of the Amtrak San Joaquin service and the proposed interim terminus of the initial operating segment of CHSRA. The bus transfer could occur either at Santa Clarita or the proposed new AVL station at Vista Canyon. This bus service would replace the current Amtrak Thruway bus connection between LAUS and Bakersfield. The new system would significantly shorten the length of the bus connection and provide shorter and more reliable trip times between Bakersfield and Los Angeles, since Amtrak trains would operate on the AVL at speeds higher than buses and would not be subject to traffic delays on the congested portion of the I-5 freeway through the San Fernando Valley. Extended Pacific Surfliner service, when coupled with Amtrak bus service between Santa Clarita and Bakersfield, could reduce the trip time between LAUS and Bakersfield from the current 3 hours to about 90 minutes.

Pacific Surfliner trains currently operate entirely on the LOSSAN rail corridor between San Diego and San Luis Obispo. Most of these trains run between San Diego and LAUS, with a relatively limited number of trains continuing to the north of LAUS. Future plans for the LOSSAN Corridor call for increasing the number intercity trains both north and south of Los Angeles, with some San Diego trains continuing to originate and terminate at LAUS. These originating and terminating trains potentially could be extended to the AVL, branching off of the LOSSAN Corridor at Burbank.

This concept has not been part of LOSSAN Corridor planning to date and would require more detailed study to confirm its feasibility, value and cost-effectiveness. Alternative service patterns would need to be analyzed, and requirements for capacity-related infrastructure determined, over and above the capital needs identified in the AVL Study for Metrolink regional service.

HSR Blended Service

The AVL Study findings allow for and support future blended operations for Metrolink and intercity passenger trains on the AVL between Palmdale and Los Angeles, with some limitations. A concept envisioning blended intercity and regional service on the AVL would utilize the AVL as the rail route for long-distance high-speed trains running between LAUS and Palmdale, in lieu of or in advance of building a new dedicated high-speed line. The original high-speed rail plan for a dedicated alignment between Palmdale and Los Angeles entails extensive tunneling and would be extremely costly. It is unlikely that funding for the dedicated alignment will be obtained in the short to medium term. While rail trip times along via the AVL would be considerably longer than via a new, more direct, high-speed route, significant investment in the AVL to increase capacity and average speeds, for the mutual benefit of both regional and intercity high-speed service, could be cost-effective relative to separate investments in parallel corridors. AVL improvements also are likely to be implementable much sooner than a new dedicated high-speed line, offering the potential for earlier introduction of HSR service to central Los Angeles.

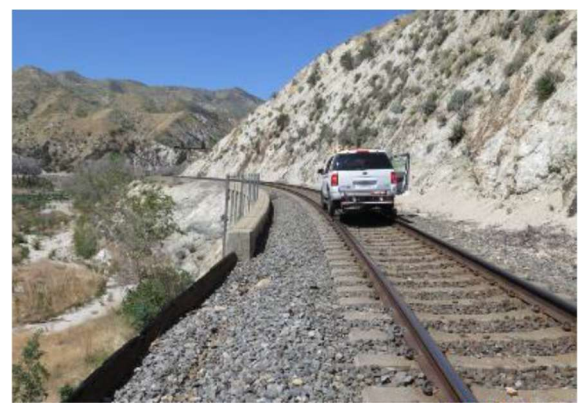
The AVL offers a potentially attractive route to Los Angeles for either the CHSR system or the proposed Virgin Trains USA service between Los Angeles and Las Vegas – or both services operating in tandem with Metrolink regional trains.

AVL Infrastructure and Right-of-Way Constraints

Improving the AVL to support blended intercity and regional passenger train service is expected to require capital investment above and beyond what otherwise would be needed to support only Metrolink regional service. The existing line poses a number of significant physical and operational challenges, but the level of investment needed to overcome or mitigate these challenges is expected to be considerably less than the cost of the new dedicated route, which would be largely in tunnel between the Antelope Valley and San Fernando Valley.

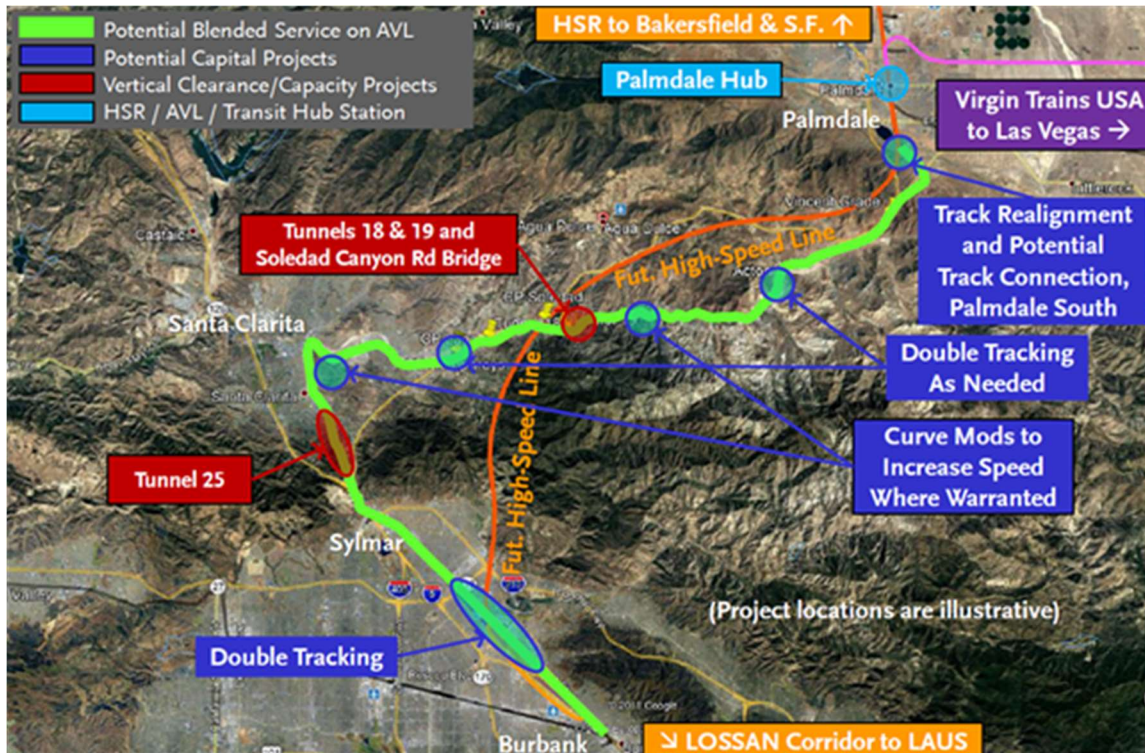
Figure 7-6 shows the existing AVL alignment, the current preferred long-term route for a dedicated high-speed line, and the locations where the high-speed line and AVL cross each other (within Soledad Canyon) and run parallel to each other (in the Antelope Valley and on a portion of the line in the San Fernando Valley between Sylmar and Burbank). The figure also highlights some of the ROW constraints that would need to be dealt with, such as tunnels with low vertical clearances, which limit the potential for electrification, and opportunities for capital investment to increase capacity and reduce trip time. The types of additional capital investment that are likely to be necessary to support blended service with multiple high-speed trains or express intercity trains per hour include:

- Additional double tracking to create more slots for non-stop express services on the AVL
- Modification of the existing rail alignment at the locations of speed-limiting curves, to reduce the degree of curvature and increase the maximum allowable speed for passenger trains
- Improved signaling to permit closer train spacing (shorter headways)
- Potential electrification of the AVL, or use of rolling stock that is inter-operable between the electrified high-speed line north of Palmdale and the non-electrified AVL
- Track connections between the AVL and high-speed alignments at both ends of the AVL
- Station improvements to facilitate platforming of high-speed trains and to offer convenient train-to-train transfers at hub stations such as Palmdale.



Source: Metro (WSP)

Figure 7-6: High-Speed Rail Issues and Opportunities in the AVL Corridor



Source: WSP

7.5.1 Capacity Assessment

Intercity service could be provided on the AVL with the infrastructure associated with Scenarios 4, 5 and 6, each of which includes one express train slot per hour in each direction of travel during off-peak hours, and in the peak direction of travel during weekday peak periods. The express slots could be utilized by Metrolink regional express trains or by intercity trains. During weekday peak periods, express slots are expected to be utilized by Metrolink regional express trains. Express slots would not be available in the reverse-peak direction during peak periods without additional double-tracking beyond the projects assumed for Scenarios 4, 5 or 6. Therefore, capacity for intercity service in these scenarios is expected to exist only during weekday off-peak hours and on weekends – and only at a level of one train per hour. Scenario 3 also could support off-peak intercity service, but only by limiting the frequency of off-peak Metrolink trains and using some Scenario 3 regional slots for intercity trains.

In the above scenarios, off-peak slots for intercity trains would exist at existing AVL track speeds, which support an express trip time of one hour, 40 minutes between LAUS and Palmdale. These off-peak express slots also provide windows within which UPRR freight trains can operate on the AVL. Enough slots need to be held in reserve to allow for future freight traffic in the corridor.

One off-peak slot per hour may be sufficient for an initial or “starter” HSR service from the Central Valley and/or Las Vegas. However, demand may exist for greater service frequency (i.e., multiple trains per hour) or for service into and out of Los Angeles coinciding with the commuter peak periods. This would trigger the need for additional express slots in the service plan, which, in turn, would require investment in double tracking beyond the level assumed in the AVL Study for Scenarios 4, 5 or 6.

One concern with the blending of short-haul regional service with long-distance intercity service will be the reliability and on-time performance of intercity trains traveling long distances to reach the AVL

corridor from the north. Since the proposed CHSR and Palmdale-Las Vegas corridors are proposed to be used exclusively by high-performance passenger trains, these services are expected to operate with a high degree of reliability, with trains normally able to operate within a scheduled time slot on the AVL. This is analogous to assumptions made about HSR train performance for the proposed blended service on the Peninsula Corridor between San Jose and San Francisco.

Any of the potential concepts for blended service would require further analysis to determine the most appropriate service concept and investment program. Ridership estimates will need to be generated for both intercity and regional service at various levels of frequency and trip time performance and a range of service patterns and scenarios developed that respond to the projected market demand. The alternative service patterns then will need to be analyzed to determine requirements for capacity-related infrastructure to support the proposed service patterns and maintain reliable operations, utilizing the same methods as were employed in the AVL Study to develop and test the six service scenarios documented in this report.

7.5.2 Trip Time Assessment

Minimizing rail trip times and making them more competitive with flying and driving is a critical objective of the California high-speed rail program. New dedicated ROWs offer the best opportunity for maintaining high-speed operations, and the original legislated Los Angeles-to-San Francisco trip time target of 2 hours, 40 minutes necessitated new construction on the approach to Los Angeles. Consequently, high-speed rail system planning did not seriously consider the potential feasibility and cost-effectiveness of improving trip times along the existing AVL route to support high-speed intercity service – either as an interim step while construction of the high-speed line is completed into Los Angeles, or as an alternative long-term solution.

Reducing trip times on the train is also an objective for regional rail service, but the primary need for regional markets is for more capacity to support increased service frequency. Relatively modest improvements in trip time can be achieved by removing bottlenecks that make current service unreliable (and where extra time needs to be built into train schedules to maintain reliable service), introducing limited-stop express service during peak periods, and modifying slow-speed curves in a limited way to marginally increase train speeds. Key questions that need to be answered include:

- What trip time between Palmdale and Los Angeles is necessary for high-speed rail to be time-competitive with air travel for trips between the Bay Area/Central Valley and Los Angeles?
- What mix of capital investments on the existing AVL route and segments of new track on new alignment is needed to deliver a competitive trip time?
- Does blended service on the existing AVL with only minor trip time improvements offer an acceptable interim solution for HSR service into greater Los Angeles?
- Can a business case be made for additional trip time investment in the AVL as a long-term solution, as opposed to eventually completing the dedicated high-speed line as originally planned?

The range of Palmdale-LAUS trip times that have been identified by the AVL Study and prior studies in the corridor for regional rail along the AVL ROW are presented in Table 7-8 – and compared with both existing Metrolink scheduled trip times and the aspirational 30-minute trip time referenced in the State Rail Plan. There is a very large gap between the aspirational HSR time and the best AVL trip times with express service and relatively modest investment in curve modifications – a difference of more than an hour. Answering the trip-time related questions, and establishing the value of trip time savings for the combined regional and intercity/HSR markets will entail developing and evaluating service and investment scenarios that aim for HSR trip times that fit somewhere within that gap.

Table 7-3: Potential Trip Time Improvements on the AVL

Potential Trip Time Improvements	Palmdale to LAUS (Hrs:Mins)	LAUS to Palmdale (Hrs:Mins)
Existing AVL Local Service	1:59	2:04
<u>AVL Study Scenarios</u>		
AVL Local Train	1:50	1:56
AVL Express Train	1:41	1:45
With Moderate Curve Modifications	1:39	1:41
Potential Blended Service with More Extensive Alignment Modifications to increase Average Speed*	?	?
Future Dedicated High-Speed Line** (SRP vision)	0:30	0:30

* Service and infrastructure alternatives not analyzed in the AVL Study; Trip time performance to be determined in future study.

** Aspirational trip time for high-speed train service.

Sources: 2018 AVL public timetable, California State Rail Plan, and WSP

7.5.3 Opportunities for Blended AVL and High-Speed Rail Service and Line Electrification

The rationale for blended service on the AVL parallels the arguments that support blended service in the Caltrain corridor between San Jose and San Francisco: Delivering a level of rail service for both the intercity and regional travel markets that is sufficient to meet service goals and more cost-effective than investing in the intercity and regional markets separately.

The AVL Study briefly looked at opportunities for high-speed trains to use a portion of the line, however, these scenarios were considered as HSR construction phasing options rather than potential alternative longer-term or permanent solutions. There may be some opportunities to introduce high-speed trains onto the AVL for an extended period of time, with a higher level of investment and higher level of performance, potentially justified by the benefits to the regional and intercity travel markets collectively. In this case, portions of the dedicated alignment could be built early, where they could be connected to and leverage the conventional rail system during an extended period of operations before (or in lieu of) completion of the fully-dedicated high-speed line. For purposes of this review, the AVL was divided into several segments, and each segment was considered in terms of its opportunities and constraints for capital investment in capacity, improved trip time, and line electrification.

Electrification of the AVL tracks in this segment could be part of a program to electrify the entire regional rail network feeding LAUS. It would enable introduction of rolling stock using electric traction, with better acceleration and braking performance than the current Metrolink fleet – reducing trip times and facilitating operation at closer headways. It also would provide greater compatibility with HSR operations through this area and provide redundant capacity for all rail services using the corridor.

The major impediments to electrification are the three tunnels on the AVL, which do not have sufficient clearance for double stack freight and overhead catenary. There also are three overhead bridges with vertical clearances above top of rail that are less than 23 ft. These potentially would need special attention in the design of the electrification to accommodate the catenary and could potentially require either reconstructing bridges or lowering the profile of the railroad to achieve sufficient clearance. Major modifications to the existing tunnels could exacerbate existing problems, such as water intrusion

and track degradation, and would severely impact existing passenger and freight operations during construction.

A segment-by-segment review of physical characteristics and options related to HSR potential follows. The segments include:

1. Lancaster-Palmdale
2. Palmdale-Soledad (includes Tunnels 18 and 19)
3. Soledad-Santa Clarita/Newhall
4. Newhall-Sylmar (the Tunnel 25 segment)
5. Sylmar-Burbank Airport
6. Burbank-LAUS

Lancaster-Palmdale

MP 76.6 to MP 66.0

In this segment, the future HSR tracks will be parallel to and within the same ROW as the AVL. The plan for the overall ROW is to provide two tracks each for HSR, AVL (Metrolink) and UP freight traffic, with all roadway grade crossings eliminated by providing overhead bridges. The potential exists to electrify the HSR and AVL tracks at the time that HSR is constructed. The HSR design for grade separations will provide clearance for catenary beneath the overhead bridges. Double-stack freight would be confined to the parallel UP tracks. HSR design standards call for slightly higher catenary positioning for shared-use segments with passenger trains other than high-speed trainsets (18' 8.4") versus dedicated HSR tracks (17' 4.7"), so design of new roadway bridge crossings would need to protect the higher catenary elevation on the AVL tracks.

The station at Palmdale should be configured flexibly to serve as a transfer point for intercity and regional trains, as well as multi-modal transit hub.



Source: WSP

Palmdale-Soledad

MP 66.0 to MP 44.3

This segment includes the eastern portion of the AVL route through Soledad Canyon, which has significant grades and curves, has relatively slow speed limits and is mostly single track. It includes three locations with restrictive vertical clearances: two short tunnels and one overhead bridge. Tunnel 18, at MP 45.4, is 266 ft. long and has approximately 1 ft. of vertical clearance along the centerline of the

tunnel between the top of high local freight envelope (20.5 ft.) and the crown of the tunnel structure. Tunnel 19, at MP45.0, is 328 ft. long and has approximately 1.8 ft. of vertical clearance above the high clearance envelope.

Train speeds are relatively slow due to track curvature. This would be a portion of the corridor where selective track realignment might allow for higher maximum speeds. To support electrification, it is likely that both tunnels would need to be enlarged to provide for overhead catenary, or daylighted to support full double-tracking.

Soledad-Santa Clarita/Newhall

MP 44.3 to MP 30.0

This segment of the AVL includes the western portion of Soledad Canyon and the Santa Clarita valley. Electrification of this portion of the AVL would be feasible without major clearance impediments. The AVL service scenarios identified potential capital projects to extend double track through most of this zone, where there are no tunnels or severe ROW constraints. Train speeds are relatively slow due to track curvature. This would be a portion of the corridor where selective track realignment might allow for higher maximum speeds.

Newhall-Sylmar

MP 30.0 to MP 22.0

The major feature in this segment is Tunnel 25, located between MP26.6 and MP 27.9, which is a 6,976 ft. long single-track tunnel. The tunnel accommodates double-stack freight traffic, with a high-clearance envelope extending to 20.5 ft. above top of rail. There appears to be approximately one foot of additional clearance between this envelope and the crown of the tunnel, which is assumed to not support the introduction of overhead catenary electrification.

Electrification and/or double-tracking of this segment would require dealing with Tunnel 25 and its restrictive overhead and horizontal clearances. It would require either constructing a parallel tunnel or enlarging the existing tunnel. The latter option would not be possible without closing the tunnel for an extended period, which would eliminate both AVL Metrolink service and freight service on the line during the construction period. As a result, electrification of this portion of the line is considered problematic and would not be a viable low or moderate-cost option.

Sylmar-Burbank Airport

MP 22.0 to MP 14.0

This segment of the AVL is planned for two main tracks (the Brighton to Roxford double track project), providing capacity for Metrolink and UPRR, and potentially for future blended service with HSR. The segment has three different ROW cross-sections. The northern portion of the route, north of Van Nuys Blvd., includes the East San Fernando Valley transit line paralleling the AVL. The central portion of the segment is solely occupied by the AVL, and the southern portion of the segment, south of CP Sheldon, is intended to have the future high-speed line running parallel to the AVL. The only potential vertical constraint is in the central segment, where the SR 118 freeway bridge passes over the AVL at MP 20.12. The freeway bridge has a vertical clearance of 22.47 ft. above top of rail, which may be sufficient to support overhead catenary. All other existing overhead bridges have at least 23 ft. of clearance above top of rail. Completion of the planned double-tracking of the AVL in this segment would offer the greatest capacity and flexibility for blended service on the AVL.

Burbank-LAUS

MP 14.0 to MP 0.0

Though not part of the AVL study area, this portion of the rail line is expected to see the greatest increase in total rail traffic, since it combines the AVL with the Metrolink Ventura County Line and Amtrak's Pacific Surfliner service. In most of this segment, the future HSR alignment is planned to be within the LOSSAN rail corridor, operating parallel to the AVL and Ventura County Line tracks. All

existing overhead bridges have at least 23 ft. of clearance above top of rail. Significant volumes of high-speed intercity traffic will likely trigger the need for increased track capacity through this zone, connecting to the increased station capacity at LAUS that will be provided by the LINK US project. The need for future capacity to meet multiple transportation needs in the corridor will likely require expansion of the ROW and could result in an ultimate rail configuration with multiple tracks for express and local passenger trains, as well as freight trains. Coordination of planning and project implementation efforts will be needed to develop an optimized plan for the ROW configuration and any required ROW expansion.



Source: WSP

7.5.4 Additional Analysis Needs

Additional analysis is needed to address critical issues and questions:

1. Identify and evaluate capital projects to further reduce AVL trip times, and determine the appropriate target for trip time reduction on the AVL, considering both ridership benefits and capital costs for improving the rail alignment
2. Develop an integrated rail service plan for blended regional and high-performance intercity rail service on the AVL
3. Identify and evaluate additional capacity projects needed to support the blended service plan
4. Determine signal system requirements for blended operations, which will require shorter headways than are needed solely for Metrolink commuter rail service, due to the greater differential in operating performance between high-speed and traditional trainset equipment
5. Evaluate rolling stock options for AVL service, including both electric and diesel multiple-unit equipment, and including requirements along the AVL for trainset storage and maintenance facilities
6. Evaluate rolling stock options for HSR service, including dual-mode trainset equipment to avoid the need for electrifying the AVL and the use of tilting equipment to permit higher operating speeds through speed-limiting curves along the AVL
7. Determine the feasibility, cost and cost-effectiveness of AVL electrification, versus alternatives such as using dual-mode equipment, adding diesel locomotives to trainsets operating on the AVL, or the developing a well-designed transfer hub at Palmdale
8. Identify investment requirements at stations, including the potential need for alternative station platform heights
9. Confirm feasibility of continuing to operate freight trains on the AVL and identify capital investment requirements to support freight service and enable its growth
10. Determine ROW preservation requirements, so as not to preclude future investment in HSR parallel to the AVL

7.6 Future Rail Freight Service in the AVL Corridor

At present, UPRR typically operates five trains per day on the AVL: an intermodal train in each direction, a rock unit train in each direction, and a local train serving industries along the Valley Subdivision (AVL). UPRR has plans to grow future rail freight traffic across their entire rail network, including along the AVL corridor. However, no specific forecasts of future freight traffic were available for use in the AVL Study. For purposes of the AVL Study, future freight trains were assumed to have characteristics similar to existing freight trains operating on the line, and freight traffic levels and patterns were assumed to be similar to current traffic. However, the scenarios for future capacity and train operations on the AVL preserve opportunities for UPRR to increase the level of freight traffic in the future, consistent with state and regional objectives for shifting goods movement in favor of rail and away from over-the-road trucking.

As the passenger operation transitions to a service plan with defined “slots” at regular “clockface” intervals that repeat every hour, the operating and dispatching procedures for freight trains on the AVL will need to change. At the present time, freight trains are excluded from the weekday peak periods. During off-peak periods, however, UPRR has the ability to operate freight trains at any time, and freight and passenger trains are accorded equal priority by train dispatchers.

In the future, freight traffic will continue to be excluded during weekday peak periods, when passenger traffic will consume the capacity of the AVL and all capacity “slots” on the railroad are expected to be filled by passenger trains. As passenger traffic thins out during off-peak periods, there will not be demand to utilize all of the capacity slots, and some of these slots will become available for use by freight trains. During the overnight period, passenger traffic is lighter and tends to be uni-directional (mostly inbound in the early morning hours and mostly outbound in the late evening hours, which allows the AVL sidings and double track segments to be used by freight trains. On weekends, as during weekday off-peak periods, unused passenger train slots are available for freight train movements.

Future service plans for the AVL, including those represented by AVL Study Scenarios 3, 4, 5 and 6, provide slots that would be available for freight trains during most off-peak hours. This will create opportunities, over the course of a day, for moving more freight trains than currently operate on the AVL.

Intermodal trains typically operate at average speeds that are similar to those of local commuter trains, which will allow them to utilize unfilled local slots during off-peak periods. Bulk unit trains such as the rock trains typically operate at slower average speeds and may require more than one passenger slot to traverse the AVL territory between Burbank Junction and CP Harold in the Antelope Valley. These trains will have opportunities to utilize available double slots during late evening, overnight and early morning periods on weekdays, or on Saturdays and Sundays when passenger service is operating at only hourly or bi-hourly intervals. During weekday off-peak periods, these trains will be able to utilize sidings on the AVL that are not being used for passenger train meets to allow faster passenger trains to pass.

Even with these allowances for freight trains operating in available slots on the AVL, the presence of rail freight demand on the corridor will constrain the flexibility of the passenger operators to schedule off-peak service fill these slots as demand grows. In the busy operating territory between Burbank and Santa Clarita, the planning double-tracking projects or other projects (such as LRT or HSR) to expand the ROW should consider the costs and incremental flexibility benefits of allowing for additional track capacity that can be used by freight trains without constraining passenger train scheduling.

The daily local train that originates on the Ventura County Line and serves freight customers along the AVL between Burbank and Santa Clarita is assumed to continue to operate. As bi-directional passenger traffic increases on the AVL, the ability of the local freight train to occupy one of the two main AVL tracks for extended periods will diminish. During times of the day when bi-directional passenger traffic is occurring, the local train will need to clear the main tracks while serving local industries, which may require investment in side tracks and mainline turnouts at certain locations – or shifting of the local train to a time period where passenger traffic is light or not present. The local train also occupies track

space on the main line south of Burbank Junction as it moves between the AVL and Ventura County Line. As traffic grows on the busy LOSSAN corridor, freight capacity may need to be augmented in this area.

With the possible introduction of intercity service (HSR, Virgin and/or Amtrak) operating in blended service on the AVL utilizing express train slots during off-peak hours, opportunities for running through freight trains will be more limited. As long as the additional intercity trains do not operate every hour, slots for intermodal and unit freight trains will continue to be available. Construction of additional sidings for freight may be necessary in future scenarios that have both AVL local trains and intercity express trains operating every hour or half-hour. Additional future study will be needed to confirm operational feasibility and identify any required additional infrastructure investment.

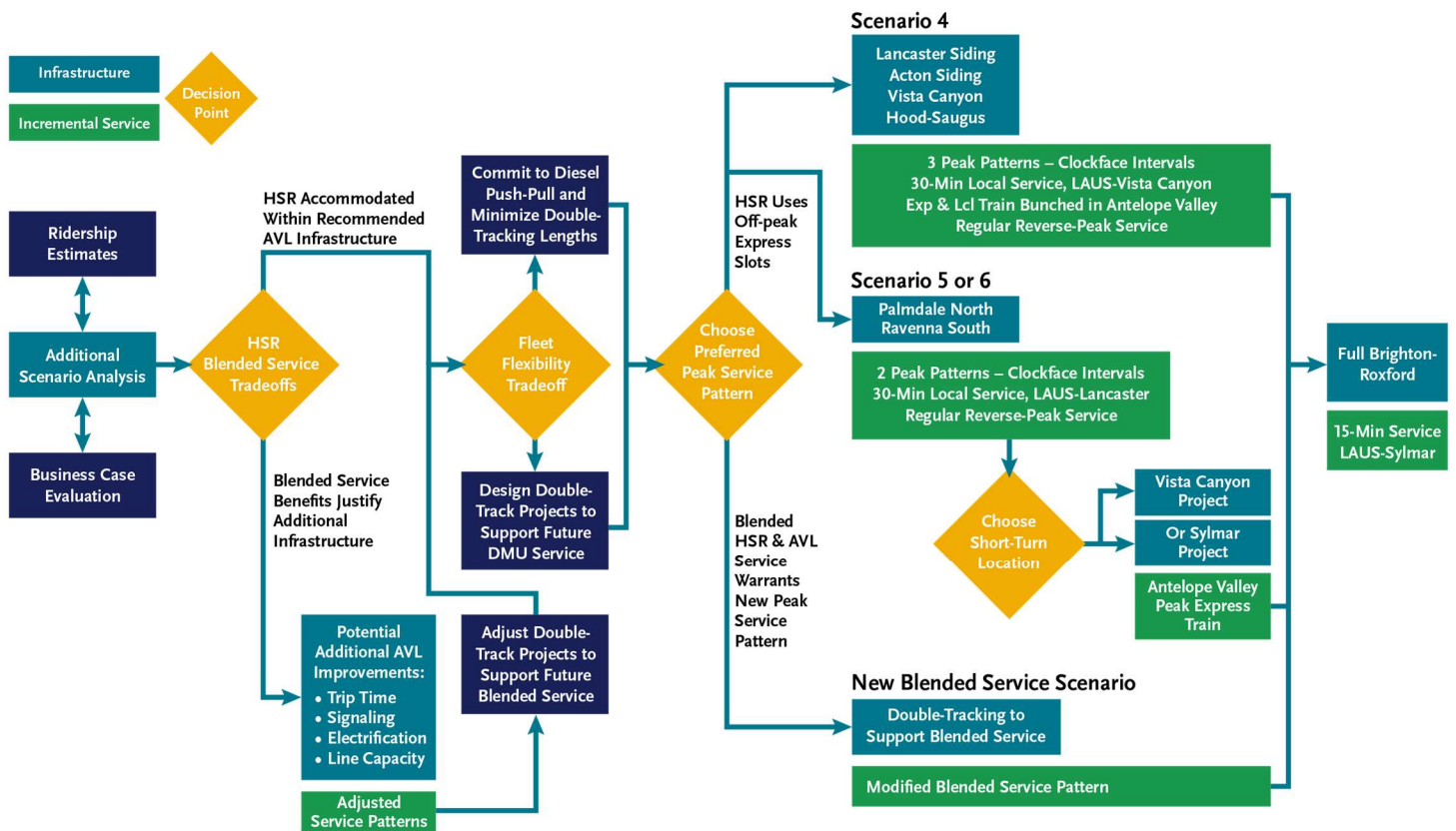
7.7 Future Decisions and Tradeoffs

Following implementation of the recommended three-phase improvement program, the decisions facing Metro, SCRRA and other rail stakeholders become more complex and the way forward less clear. Figure 7-7 is intended to array some of the key tradeoffs that will need to be assessed and decisions made to determine further improvements in rail service and investment in capacity-related rail infrastructure.

A wider set of alternative future service scenarios will be need to be assessed, using similar analytic techniques to the ones used to test the short and medium-term scenarios in the AVL Study. These scenarios should be developed in response to travel market needs and tested by estimating the effects of the scenarios on regional and intercity ridership demand.

Four specific service-related decisions are highlighted in the diagram, represented by the diamond boxes. Several of the key tradeoffs that will need to be made are described in the sections below.

Figure 7-7: Decision Tree – Future Long-Term Tradeoffs



Source: WSP

7.7.1 Blended Service Tradeoffs

The value of additional trip time improvements on the AVL will need to be ascertained through analysis of blended service scenarios that utilize various improved alignments. If some level of capital investment in trip time reduction proves to be warranted, then the rail service patterns will need to be adjusted, which will likely change the locations of train meets along the corridor and change the location and extent of double-tracking required. Trip times along segments of the AVL will dictate where train meets need to occur on the line, which in turn will define where existing sidings can be used and where new double-tracking projects will be needed.

Based on the anticipated size of the market for HSR rail service via the AVL to Los Angeles, additional express train slots may need to be provided, beyond the one slot per hour that is provided in Scenarios 4, 5 and 6. Increasing allowances for express train slots to two or more per hour will increase the number of train meet points and likely trigger the need for additional double tracking along the corridor.

7.7.2 Fleet Flexibility Tradeoffs

MetroLink is developing a Fleet Modernization Plan (Fall 2020) to plan for a zero emissions future. MetroLink will be investigating the potential for cost savings associated with utilizing types of rolling stock different from the current fleet of passenger coach trains hauled by diesel locomotives. One such option is the use of diesel multiple-unit (DMU) equipment, which consumes less fuel and is less expensive to operate than traditional trainsets on routes where passenger demand can be accommodated on relatively small trains (typically four cars or less).

To the extent that line electrification is justified, conversion of AVL rolling stock to electric multiple-unit trainsets (EMUs) is also a future possibility. In addition, new technology options such as biodiesel-fueled trains or trains operated with hybrid hydrogen-battery technology are under consideration and potentially future applicable for certain kinds of territory and service needs. Generally, these equipment technology options all involve self-propelled trainsets with multiple powered axles, and they can be grouped together and classified as “rail multiple-unit” (RMU) options. RMU technology allows for tilting train capability to handle existing tight curves at higher speeds. Modern RMUs also accelerate and decelerate more quickly than locomotive-hauled trains, so RMUs present an opportunity for further reductions in train running times. Use of RMUs would allow for MetroLink and other operators to consider increasing the maximum authorized speed for passenger trains.

In terms of trainset performance, the DMU and EMU technologies analyzed in the AVL Study likely represent the highest level of performance and the greatest difference from existing locomotive-hauled trainsets. Other RMU variations are likely to fall somewhere in-between in terms of performance. Protecting the future adoption of faster RMUs, however, would require building longer passing sidings and portions of double track, since the meet locations for trains running in opposite directions would be different with trains that have different operating characteristics. The price of preserving this future flexibility would be an increase in the capital cost of double-tracking projects.

There are alternatives to longer and more expensive double-tracking projects that also protect future fleet options. First, it would be possible to operate RMUs at the same level of performance as today’s locomotive-hauled trains, forcing train meets at the same locations. That would economize on track construction costs and would provide the operating cost savings, but would forego the potential for incremental trip time savings.

Another choice would be to combine a shift in rolling stock with a change in train stopping patterns – perhaps adding one or more intermediate stations on the line where a travel market exists. One possibility would be to couple conversion to DMUs with the construction of the new Vista Canyon station on the AVL, thereby permitting the existing station at Via Princessa to be retained. Alternatively, if diesel locomotive-hauled trains are retained, the new Vista Canyon station could replace the existing station at Via Princessa. Both options would maintain train meets at the same points along the AVL.

7.7.3 Peak Service Pattern Tradeoffs

A third decision involves the patterns of peak service to be offered on the AVL. The State Rail Plan calls for high-speed service on a dedicated route, and regional/commuter service along the AVL, which would be a mix of all-stop local and limited-stop express trains during peak periods. The AVL Study developed three potential medium-term service scenarios that provide three peak train slots per hour on the southern portion of the line (one express and two local) and two slots per hour on the northern portion of the line (one express and one local). The AVL Study analyzed the characteristics of these scenarios but did not establish a preference for one scenario over the other two.

None of the three scenarios accommodates blended service on the AVL at faster speeds or with a frequency of express service (for either regional or intercity trains) greater than one train per hour. If HSR service via the AVL is viable without extensive trip time improvements, then a tradeoff analysis will be needed to evaluate Scenarios 4, 5 and 6 and recommend the most appropriate one for implementation as a fourth phase of incremental AVL service growth. If the trip time analysis indicates that investment is warranted in the AVL to modify curves and realign the railroad in places to reduce trip times, then one or more additional service scenarios will need to be developed and evaluated, encompassing the trip time and additional rail capacity projects that would be needed.

7.7.4 Intermediate Short-Turn Location Tradeoffs

The fourth tradeoff and decision concerns the location at which “inner zone” local trains terminate and turn back towards LAUS. This is a significant decision, since the AVL on the south side of this location will have significantly more train service than the north side and will undoubtedly require more extensive double-tracking. Placing the turnback point in the Santa Clarita Valley would provide for 30-minute headway local service between LAUS and Santa Clarita, supplemented by peak express service. This level of service, however, would result in a high level of occupancy of the single-track Tunnel 25, creating potential service reliability concerns. Placing the turnback point at Sylmar would reduce the level of traffic through Tunnel 25 but also would reduce the number peak trains per hour serving the Santa Clarita Valley from three to two. These trains could still be spaced 30-minutes apart on regular clockface schedules and also could provide peak express service to all stations in the Santa Clarita Valley as opposed to just Santa Clarita station. The Sylmar station also would be the terminus of the proposed East San Fernando Valley light rail line, making this location an important hub for both transit and regional rail service.



Source: WSP

8 NEXT STEPS

In light of the Study findings, the Metro Board authorized the following actions to advance the improvement of rail service in the AVL corridor:

- A. Support implementation of Scenarios 1 through 3, as detailed in the Antelope Valley Line Study, and prioritize the Balboa Siding Project so as to open up the expedited delivery of hourly commuter rail service between North Los Angeles County and Los Angeles Union Station;
- B. Direct the Metro CEO and staff to coordinate with Metrolink on the implementation of Scenarios 1 through 3 and the inclusion and prioritization of the capital projects detailed therein as part of Metrolink's SCORE program;
- C. Authorize the programming of \$6.6 million in unprogrammed FY18-22 Multi-year Subregional Programming (MSP) Transit Program funds and \$6.15 million in FY23 MSP Transit Program funds from the North County Subregion, in order to bring the capital projects included in Scenarios 1 through 3 to "shovel-ready" status, and direct the CEO to report back to the Board in October, 2019 with project development plans, cash flow considerations, and associated operating costs;
- D. Direct the Metro CEO to coordinate with Metrolink on a discretionary grant strategy, and with the North County Subregion on additional local funding options that could be leveraged, to fully fund the remaining construction costs of the capital projects included in Scenarios 1 through 3, and include an update in the October report back to the Board;
- E. Support the implementation of a diesel, electric, battery electric, or hybrid multiple unit train pilot program on the Antelope Valley Line and direct the Metro CEO to coordinate with Metrolink in the pursuit of grant funding opportunities that focus on the offsetting of mobile source pollution in order to implement the pilot program, and;
- F. Direct the Metro CEO to work in partnership with Metrolink to engage appropriate state agencies and the private sector on additional strategies in order to implement the above directives and unlock the service potential of the Antelope Valley Line, in support of the integrated service goals laid out in the State Rail Plan.

The results and recommendations of the AVL Study have been presented to and discussed with stakeholder organizations. Based on Board direction, there are several follow-on actions that would need to be undertaken to implement incremental improvements in rail service on the AVL. These actions include:

- Integrating AVL Study results into Metrolink system-wide plans
- Confirming near-term service improvements that can be made in advance of the completion of capacity-related infrastructure projects
- Advancing high-priority early capital projects
- Further planning and analysis to support future decision-making
- Developing a funding Plan for AVL capital investment and service growth
- Ongoing collaboration and outreach.

8.1 Integrate AVL Study Results into Metrolink Systemwide Plans

The AVL Study defined the capital investments that would be needed to increase the capacity of the line to support three phases of incremental service improvements. From the point of view of travel markets within the AVL Corridor, this three-phase program prioritizes service improvements by identifying those improvements that serve market needs and which can be implemented with relatively limited capital investment – enabling them to be implemented with funds from existing identified local, state and federal sources.

The AVL Study, however, was not able to place these AVL-specific priorities in the context of the broader program for growth and expansion of the full Metrolink regional rail network. Integrating the results of the AVL Study into the Metrolink's systemwide plan, and incorporating the high-priority capital projects into the Metrolink capital program, are critical next steps on the path to implementation of AVL improvements.

Phased implementation of improvements also depends on timely investment in the acquisition of new rolling stock and the expansion of rolling stock maintenance capacity across the Metrolink system. Since the fleet is a system-wide asset, planning and programming of fleet and maintenance facility requirements must be undertaken for the Metrolink system as a whole. The AVL Study has estimated the fleet and fleet storage requirements for future service on the AVL, which can be taken into account in Metrolink's system planning.

The capital program for AVL capacity improvements will need to be integrated into the overall Metrolink capital program, which includes investments for other purposes, including bringing under-performing assets to a state-of-good-repair, normal asset life cycle renewal, improving operational reliability, safety and security, expanding and improving station facilities, and customer service initiatives.

8.2 Confirm Near-Term Service Improvements

Further study by SCRRA is needed to define the specific near-term improvements to the existing train schedule that may be possible with limited or no capital investment, to develop proposed changes or additions to the AVL timetable, and to identify any associated impacts on fleet and train crew requirements and operating costs. This would include making decisions about the early action priorities, including the relative benefits and costs of adding a late-night train departure from LAUS, or augmenting mid-day off-peak service.

8.3 Advance High Priority Early Capital Projects

The four capital projects identified in this study to enable the level of service described in Section 6.4 for Scenario 3 offer the potential for tangible short to medium-term improvement in AVL service. They are all consistent with multiple future longer-term scenarios, and are recommended for implementation. These projects have only been defined at a high level in the AVL Study. Activities to advance the development of these four projects should include:

- Scope and Cost Refinement – confirm limits of double tracking; update and refine capital cost estimates and implementation schedules; prepare Project Study Reports
- Environmental Review – determine the extent of any impacts that need to be mitigated and obtain regulatory approvals
- Funding Plan – identify the mix of funding sources to be used, building upon the preliminary analysis of funding strategies; update projected cash flow; prepare grant applications as appropriate

- Public Engagement – continue to keep the public informed about the progress of the AVL improvements and obtain feedback as the program progresses.

8.4 Planning and Analysis to Support Future Decision-Making

The phased program of capacity-related capital projects provides a clear path forward for incremental improvement in rail service over the next five-to-ten year period. However, there are choices that need to be made with respect to continued subsequent expansion of service. The AVL Study was limited in its scope to relatively near-term improvements and did not address long-term multi-modal network opportunities and alternatives.

The AVL Study however, provides data that should be useful as inputs to subsequent analysis of broader issues and longer-term opportunities. Several planning and analysis activities should be undertaken in parallel with implementation of the recommended short-to-medium term plan. These activities should generate data that can support future decision-making about the direction of AVL service growth beyond Phase 3 and the subsequent rounds of capital investment needed to continue growth.

Ridership Market Analysis

Further development and analysis of future service scenarios should include estimating the effects of any service improvements on rail ridership, and measuring the extent to which rail service benefits the various geographic and trip purpose travel markets identified in the AVL Study. Ridership estimates will be important for quantifying the benefits of improved service, evaluating the effectiveness of alternative service levels and patterns, and generating fare revenue estimates for use in evaluating financial performance.

Extension of Amtrak Service onto the AVL

The concept to extend selected Amtrak Pacific Surfliner trains to the Santa Clarita Valley via the AVL, and shorten and improve the existing bus link between rail hubs in Los Angeles and Bakersfield, should be analyzed to determine its viability, merits, and cost-effectiveness. This analysis should be undertaken in the context of planning for both the AVL Corridor and the LOSSAN Corridor. Further analysis of service patterns on the AVL Corridor portion of the route would help define any additional requirements for capacity-related infrastructure on the AVL and on the portion of the LOSSAN Corridor between LAUS and Burbank Jct.

High-Speed Rail Integration

The AVL Study assumed that future high-speed rail would operate on separate dedicated tracks in Southern California. Options for blended service on the AVL between Palmdale and LAUS, therefore, were not analyzed. Blended service may offer benefits to both regional and intercity travel markets that justify a level of capital investment on the AVL greater than what would be supportable for regional rail service by itself. Those investments would be for a combination of additional line capacity and alignment modifications to increase train speeds and reduce trip times on the corridor. Specific projects could include curve modifications and track realignment, additional double tracking, signal system improvements, track upgrades, line electrification and elimination of vertical clearance constraints at Tunnels 18,19 and 25 and at the Soledad Canyon Road bridge. Prior studies have identified selected projects that would reduce trip times by a few minutes. Additional alternatives should be investigated that aim to bridge the wide gap in Palmdale-LAUS trip times between the current AVL alignment (approximately 1 hour, 40 minutes for express trains) and the dedicated high-speed alignment (approximately 30 minutes). The ridership-generation potential of these alternatives, both regional and intercity, should be weighed against the construction costs and impacts to determine the appropriate trip time target and set of capital projects whose costs are commensurate with the benefits.

Service Pattern Analysis

Service Scenarios 4, 5 and 6 provide three different ways of delivering the same level of peak service on the AVL, with two local and one express train in the peak direction. These three scenarios would support the introduction of Amtrak LOSSAN Corridor trains, or high-speed trains from the Central Valley or High Desert Corridor, using available off-peak express train slots on the AVL – at one train per hour with a 1 hour, 40 minute trip time between Palmdale and LAUS. Other variations of blended service with different trip times and numbers of hourly express train slots will need to be analyzed and compared with the AVL Study scenarios, to determine whether or not additional investment to support blended service is warranted.

Station Planning

The ridership market analysis should be used to make assessments concerning rail stations along the AVL, including evaluating which stations should be served by express trains, identifying the most appropriate location for the intermediate turn-back point, and evaluating options for adding new stations or eliminating existing stations.

At several AVL stations, double tracking will drive the need to add a second station platform. These locations include Burbank Airport-North, Sun Valley, Sylmar, Santa Clarita, Via Princessa, Palmdale and Lancaster. Rail passengers at these stations will need a safe way to cross the tracks. Where train speeds are relatively slow or where virtually all passenger trains make a station stop, pedestrian channelization and crossing protection systems may be appropriate. At locations that may see future intercity non-stopping trains, grade-separated bridges or tunnels may be warranted. An AVL-wide study of station access from a safety and railroad operations perspective would establish appropriate policy and design standards, based on the projected type and level of rail traffic.

ROW Preservation

In light of potential changes in the timing of future high-speed rail development, and the progress of regional transit plans, the potential competing transportation uses for the AVL corridor in general, and the AVL ROW in particular, should be evaluated. Based on comprehensive corridor-wide analysis of all potential future plans, recommendations should be developed for ROW preservation and, where needed, for ROW acquisition to support future needs. This will ensure that future rail transportation options are protected. The most sensitive portions of the AVL route in this regard are in the San Fernando and Antelope Valleys, as well as the rail route between Burbank and LAUS.

Rolling Stock Options

As Metrolink's system-wide assessment of future rolling stock options progresses, the specific options for regional service on the AVL should be further developed and analyzed. The alternatives should include RMU equipment, and a mix of traditional and RMU equipment, based on projected ridership levels. The HSR blended service analysis is likely to yield additional fleet options for regional rail service in the corridor that will be worthy of analysis.

Systemwide fleet planning also should encompass equipment maintenance needs. Projects to expand train storage capacity, such as at Lancaster, should be considered as opportunities to also provide maintenance capabilities that cost-effectively support a growing Metrolink fleet and are consistent with the overall Metrolink plan for rolling stock maintenance.

Business Case Analysis

All of the above issues should be rolled into a comprehensive assessment of the business case for medium-to-long-term investment in the AVL. This assessment should evaluate capital projects and rolling stock options to support long-term AVL service improvements in response to travel market demand, as well as capital projects that support future blended regional and intercity rail service on the AVL. The business case should consider comprehensive benefits related to travel, energy use, environmental quality and economic growth, as well as costs and local environmental and property

impacts. The business case should consider strategic issues, program delivery issues and financial feasibility and performance. The purpose of the business case analysis is to enable decision-makers at all levels of government to make informed decisions about future investment in the AVL rail corridor.

8.5 Funding Plan for AVL Capital Investment and Service Improvement

This study explored several potential strategies for assembling capital funding for the AVL capital investment program. Since authority for funding decisions is spread among multiple agencies and levels of government, this study did not prescribe a single recommended approach. A specific funding plan will need to be developed as part of the overall implementation plan. The opportunity exists to leverage available local funding to obtain Federal and State funds for the high-priority short-to-medium term program of AVL capacity-related capital improvements. Achieving consensus within the region on a funding plan is essential for the timely implementation of AVL capital improvements.

As more detailed ridership and revenue projects become available, the expected level of annual operating subsidy associated with the phased program of incremental service improvements can be estimated. This will enable informed decisions to be made about the extent and pace of increased rail service on the AVL.

8.6 Outreach and Collaboration

Ongoing stakeholder agency and public engagement will be needed to successfully implement the phased improvement program in a timely fashion, and to make decisions about longer-term investments and future rail service. The AVL improvements will need to fit within Metrolink's overall capital program and system plan for regional rail in Southern California. The Metrolink system plan, in turn, will need to be integrated within a regional rail network plan that includes the intercity services of CHSR, Virgin Trains USA and Amtrak, as well as UPRR freight service. Close coordination with local transit operators also will be essential to providing convenient and seamless regional transit for travelers within the greater Los Angeles region. This would entail coordination of schedules to provide convenient transfer connections based on regular clockface service intervals and could also include coordinated or integrated trip planning and ticketing. This type of integrated multi-modal transportation is a key principle of the California State Rail Plan.

LA Metro should continue to utilize the methods of collaboration employed on the AVL Study, including regular stakeholder agency meetings, newsletters, and opportunities for rider and public input such as the Spring 2019 survey.

9 REFERENCES

Section 2 References

(Bloomberg, 2019) <https://www.bloomberg.com/news/articles/2019-04-06/hollywood-s-home-is-america-s-biggest-economic-contributor>

South Coast Air Quality Management District (SC AQMD). 2018. *Public Record Request: Major employers in District*. Requested on July 2018.

Southern California Association of Governments (SCAG). 2017. *Trip-Based Transportation Transit Model – 2012/2040 base model*. Model runs and data processed on December 2017.

Southern California Regional Rail Authority (SCRRA). 2017. *Metrolink Station to Station Sum of weekday Boardings for Fiscal Year 2019*. October 2018.

(SCAG 2017 a) <http://www.scag.ca.gov/documents/losangelescounty/p.pdf>

(SCAG, 2017 b). <http://www.scag.ca.gov/dataandtools/pages/growthforecasting.aspx>

(SCAG RTP/SCS) Southern California Association of Governments (SCAG), *2016/2040 Regional Transportation Plan /Sustainable Communities Strategy*.

Southern California Regional Rail Authority (SCRRA). 2018. *Facts and Numbers Webpage*. Accessed at (<https://www.metrolinktrains.com/about/agency/facts--numbers/>) July 2018.

Southern California Regional Rail Authority (SCRRA). 2018b. Proposed FY2018/19 SCRRA Budget Presentation.

Southern California Regional Rail Authority (SCRRA). 2018c. Key Performance Indicators Quarterly Performance Report – Quarter Ended March 31, 2018

The Greater Antelope Valley Economic Alliance. 2018. Our Industries Webpage. Accessed at <http://socalleadingedge.org/industries/>, July 2018.

U.S. Census Bureau. 2018. LODES Data. Longitudinal-Employment Household Dynamics Origin-Destination Employment Statistics (2002-2015) [Shapefile]. Program Accessed at <https://onthemap.ces.census.gov> on June 2018

Section 3 References

(CALTRANS, 2018) http://www.dot.ca.gov/hq/tpp/offices/eab/socio_economic.html

(California Legislature, 2019).

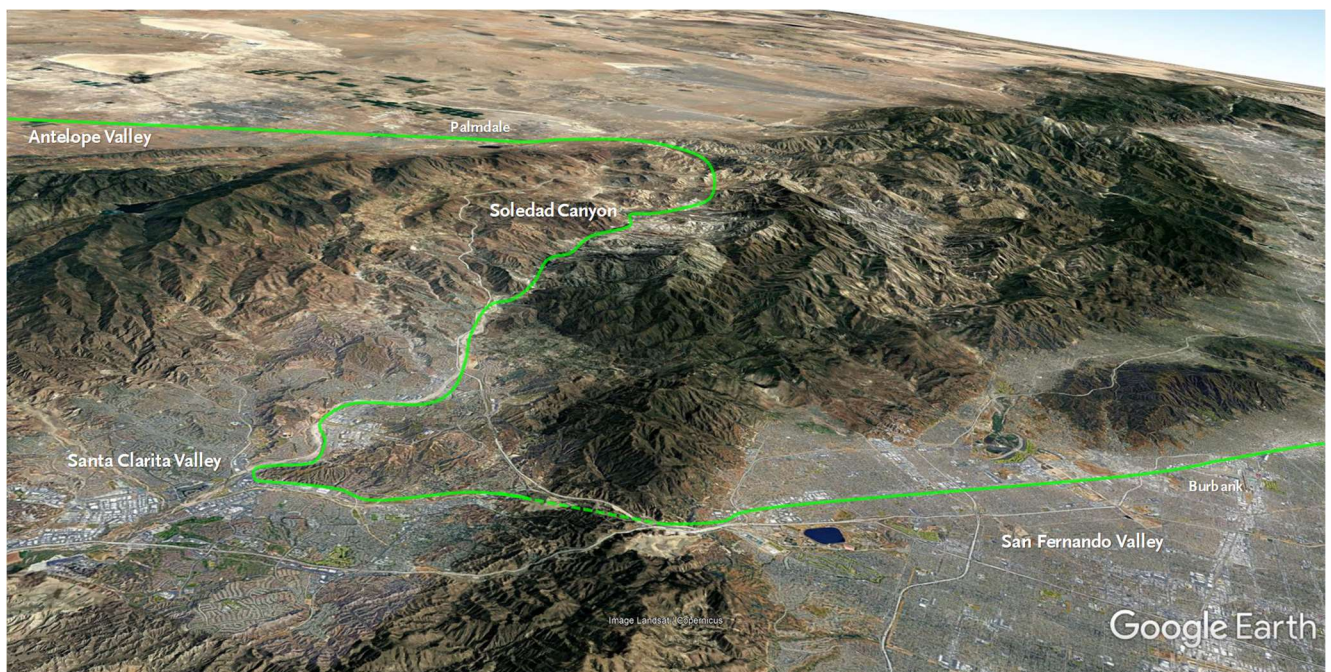
https://leginfo.legislature.ca.gov/faces/billTextClient.xhtml?bill_id=201920200SB50

(LAEDC, 2019) <https://laedc.org/wtc/chooselacounty/regions-of-la-county/antelope-valley/>

(SCAG, 2017 b). <http://www.scag.ca.gov/dataandtools/pages/growthforecasting.aspx>

Section 4 References

- (State of California, 2018) <http://www.dot.ca.gov/californiarail/>
http://www.dot.ca.gov/californiarail/docs/CSRP_Final_rev121818.pdf
- (SCRRA, 2019) <https://metrolinktrains.com/score>
- (Metro 2019) http://media.metro.net/projects_studies/regionalrail/ppitem9.pdf
- (Metro, 2019) <https://www.metro.net/interactives/datatables/project/>
- (Metro, 2018) <https://www.metro.net/projects/east-sfv/>
- (LOSSAN 2019) http://www.octa.net/pdf/LOSSAN_Business_Plan_FY_18-19_and_FY_19-20.pdf
- (LOSSAN 2012) http://www.octa.net/pdf/projectid_260_14371.pdf
- (CHSRA 2018). http://www.hsr.ca.gov/About/Business_Plans/index.html
- (UPRR, 2019) <https://www.up.com/media/releases/180917-unified-plan-2020.htm>



Imagery source: Google Earth; overlay source: WSP

APPENDICES

The following appendices are presented in separate volumes. They document the work performed for the AVL Study in greater detail and supplement the information in this Final Report.

Appendix 1 – Technical Memorandum - Existing Conditions

Appendix 2 – Technical Memorandum -- Modeling and Evaluation of Service Scenarios

Appendix 3 – Technical Memorandum – Infrastructure Improvements and Capital Cost Estimates for Modeled Service Scenarios

Appendix 4 – Technical Memorandum – Evaluation of AVL Capacity-Related Capital Projects