Los Angeles County
Metropolitan Transportation Authority

West Santa Ana Branch Transit Corridor

Draft EIS/EIR Appendix II
Final Travel Demand Methodology and Forecasting Results Report

Metro®

WEST SANTA ANA BRANCH TRANSIT CORRIDOR PROJECT

Draft EIS/EIR Appendix II
Final Travel Demand Methodology and Forecasting Results Report

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ACRONYMS AND ABBREVIATIONS

APC	automatic passenger count
BRT	bus rapid transit
CBM18	Corridors Base Model 2018
CTPP	Census Transportation Planning Products
EIR	environmental impact report
EIS	environmental impact statement
FTA	Federal Transit Administration
HBW	home-based work
LA	Los Angeles
LAUS	Los Angeles Union Station
LRT	light rail transit
LRTP	Long Range Transportation Plan
Metro	Los Angeles County Metropolitan Transportation Authority
mph	miles per hour
MWD	Metropolitan Water District
OCTA	Orange County Transportation Authority
ROW	right-of-way
RTP	Regional Transportation Plan
SCAG	Southern California Association of Governments
SCS	Sustainable Communities Strategy
TAZ	Transportation Analysis Zone
UPRR	Union Pacific Railroad
VHT	vehicle hours traveled
VMT	vehicle miles traveled
WSAB	West Santa Ana Branch

1 INTRODUCTION

1.1 Purpose of the Report

The Los Angeles County Metropolitan Transportation Authority (Metro) is preparing a Draft Environmental Impact Statement (EIS)/Environmental Impact Report (EIR) for the West Santa Ana Branch (WSAB) Transit Corridor Project (the Project). This report supports the Draft EIS/EIR by documenting the travel forecast methodology and results. Specifically, this report presents the travel forecasting methodology applied in the WSAB study corridor and the modeling inputs and assumptions. This report also documents the validation process and how the travel forecast model was implemented for the current WSAB Study. This report then defines the alternatives analyzed and presents the results of the travel forecast analysis for each alternative.

1.2 Project Setting

1.2.1 Purpose of the Project

The WSAB Transit Corridor Project is a proposed light rail transit (LRT) line that would extend from four possible northern termini in southeast Los Angeles (LA) County to a southern terminus in the City of Artesia, traversing densely populated, low-income, and heavily transit-dependent communities (Figure 1-1).

The Project would provide reliable, fixed guideway transit service that would increase mobility and connectivity for historically underserved, transit-dependent, and environmental justice communities; reduce travel times on local and regional transportation networks; and accommodate substantial future employment and population growth.

1.2.2 Study Area Definition

The WSAB Study Area extends from Elysian Park in the north to the Los Angeles/Orange County line in the south. The Study Area is approximately 98 square miles and includes 20 individual cities – Los Angeles, Vernon, Maywood, Huntington Park, Commerce, Bell, Cudahy, Bell Gardens, South Gate, Lynwood, Compton, Downey, Paramount, Bellflower, Long Beach, Lakewood, Norwalk, Artesia, Cerritos, and Hawaiian Gardens – as well as portions of unincorporated LA County.

Figure 1-1. West Santa Ana Branch Transit Corridor Project

Source: WSP 2020

1.2.3 Corridor-Specific Demographics

1.2.3.1 Current (2017) Population and Employment

Table 1.1 presents a comparison of existing (2017) population and employment for the Study Area and LA County. Population and employment information was derived from Corridors Base Model (CBM18) inputs, which is based on the demographic information from the Southern California Association of Government's (SCAG's) 2016 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS).

Table 1.1. Existing Population and Employment Characteristics – Full Study Area

	Study Area	LA County
Population (# of persons)	1,409,100	10,593,200
Population Density (persons/square mile)	12,900	2,600
Employment (# of jobs)	618,500	4,523,600
Employment Density (jobs/square mile)	5,700	1,100

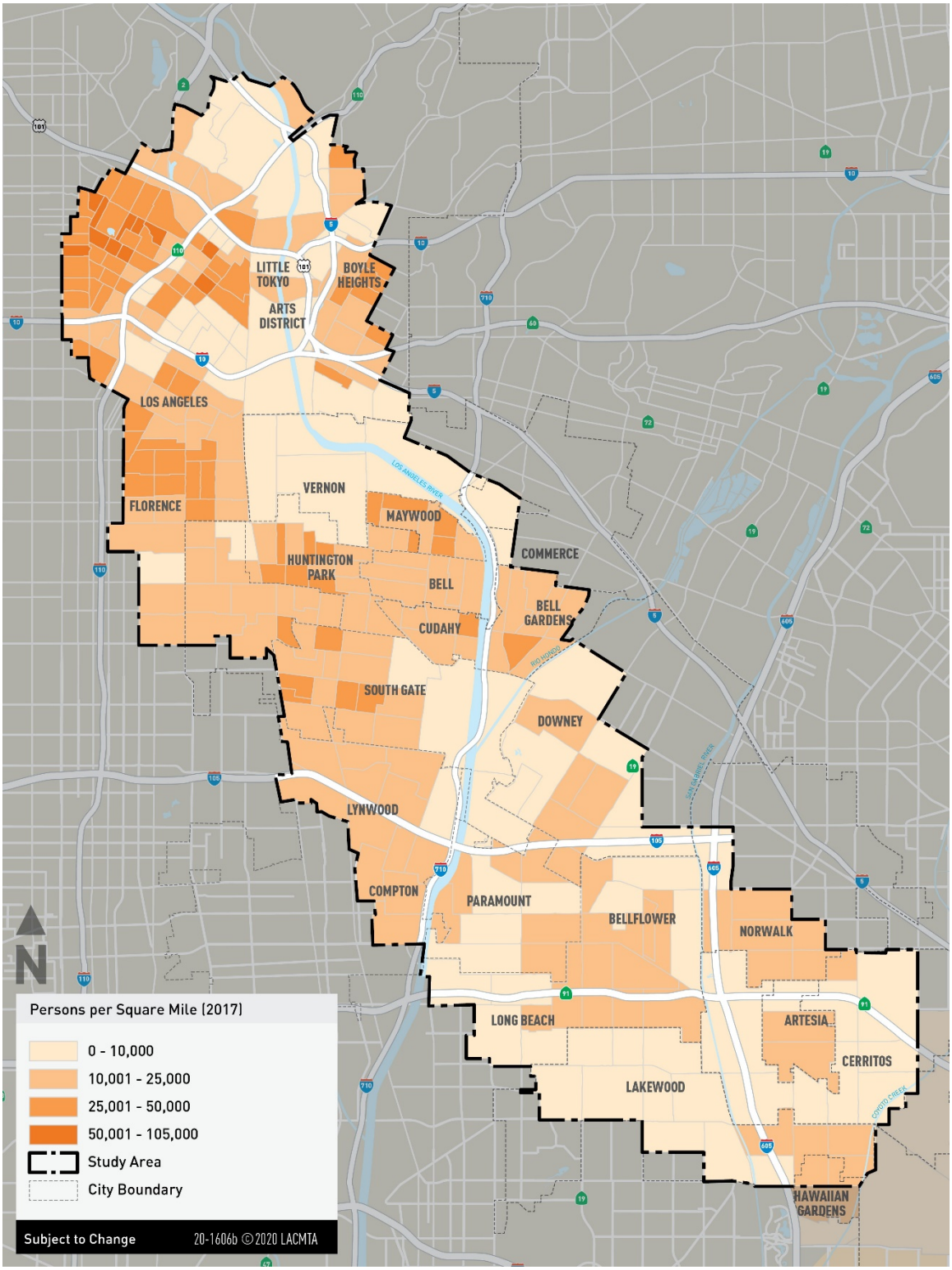
Source: Metro Travel Demand Model 2017 - 2042

Under existing conditions (2017), the Study Area has approximately 1.4 million residents, with a density of approximately 13,000 persons per square mile. The Study Area accounts for approximately 13 percent of LA County's 10.6 million residents, with average population densities almost five times higher than the county as a whole (approximately 13,000 residents per square mile compared to 2,600 residents per square mile). The high population density communities within the Study Area include downtown Los Angeles and the Cities of Maywood, Huntington Park, Cudahy, Bell, South Gate, and Lynwood. These places have some of the highest population densities in the county, with over 25,000 persons per square mile (Figure 1-2).

Jobs are mostly concentrated in the northern portion of the Study Area (between 10,000 and 250,000 jobs per square mile), primarily in downtown Los Angeles and in the industrial zones of the Cities of Vernon and Huntington Park. The southern segment of the Study Area also includes substantial employment concentrations, specifically within the City of Artesia and the commercial areas of Cerritos and Lakewood (Figure 1-3). Total employment in the Study Area is approximately 619,000 jobs, with an average density of 5,700 jobs per square mile. Approximately 14 percent of LA County jobs are located within the Study Area, resulting in job densities that are over five times higher than LA County as a whole (approximately 5,700 jobs/square-mile compared to 1,100 jobs/square mile).

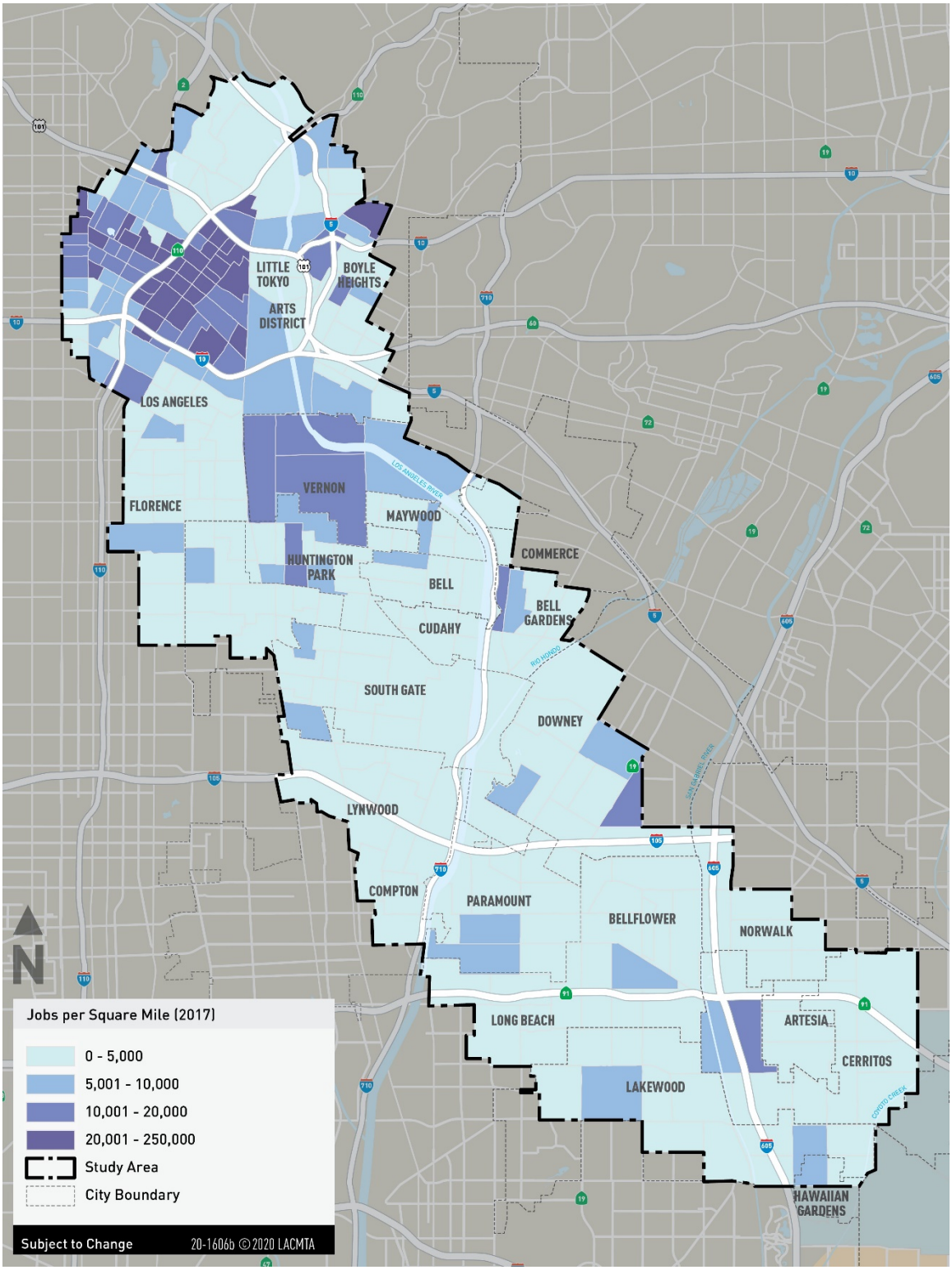
As shown in Figure 1-2 and Figure 1-3, areas with high employment densities typically do not also have high population densities with the exception of downtown Los Angeles. This population and employment imbalance creates travel demand into and out of the Study Area.

Figure 1-2. 2017 Population Density of WSAB Study Area



Source: WSP 2020

Figure 1-3. 2017 Employment Density of WSAB Study Corridor



Source: WSP 2020

1.2.3.2 Future (2042) Population and Employment

Population in the Study Area is projected to increase in the future (2042) by 16 percent (from 1.4 million to 1.6 million people). As a result, the average population density of the Study Area is anticipated to increase from 13,000 to 15,000 residents per square mile, which indicates a high rate of future infill development throughout the Study Area. In comparison, the population of LA County is projected to increase by 12 percent to a total of 12.1 million residents by 2042. Similar to 2017, the most populous areas within the Study Area are anticipated to continue to be in downtown Los Angeles, Huntington Park, and neighborhoods in Bellflower, Downey, Paramount, and South Gate. Figure 1-4 provides an illustration of the Study Area's population densities in 2042.

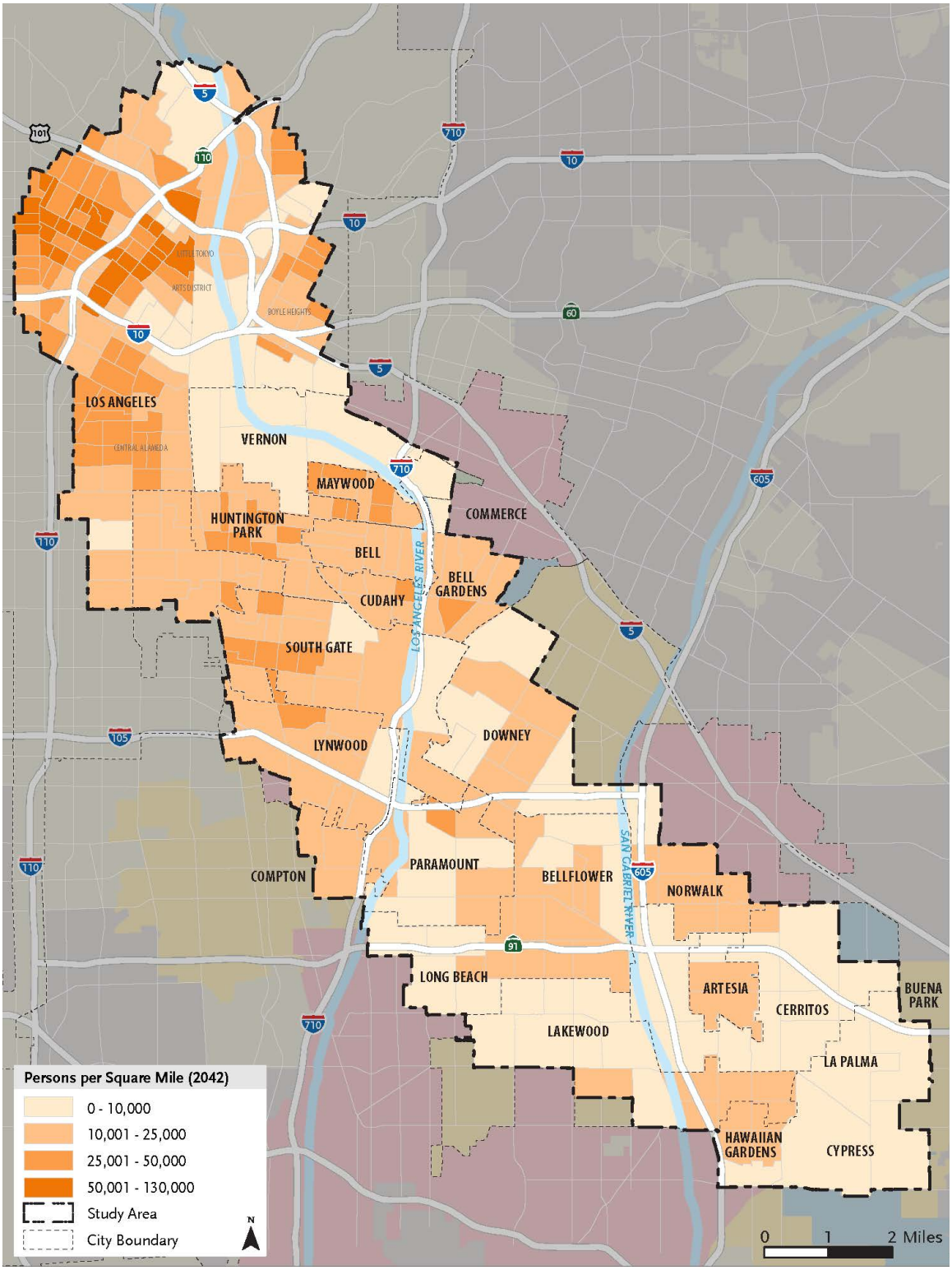
Between 2017 and 2042, employment within the Study Area is projected to have a higher growth rate than LA County as a whole (approximately 21 percent compared to a 17 percent increase by 2042). In 2042, the total number of jobs in the Study Area is expected to be approximately 746,700, with an average employment density of 6,800 jobs per square mile. Figure 1-5 provides an illustration of the Study Area's employment density in 2042. Major job growth is expected to occur near downtown Los Angeles and areas of Artesia, Downey, Lakewood, and Vernon. Table 1.2 presents a comparison of the changes between the base year and future year for population and employment.

Table 1.2. Change in Population and Employment (2017 to 2042)

	Study Area		LA County	
	2042	% Change from 2017	2042	% Change from 2017
Population (# of persons)	1,636,000	16%	12,097,900	12%
Population Density (residents/square mile)	15,000	16%	3,000	12%
Employment (# of jobs)	746,700	21%	5,427,000	17%
Employment Density (jobs/square mile)	6,800	21%	1,300	17%

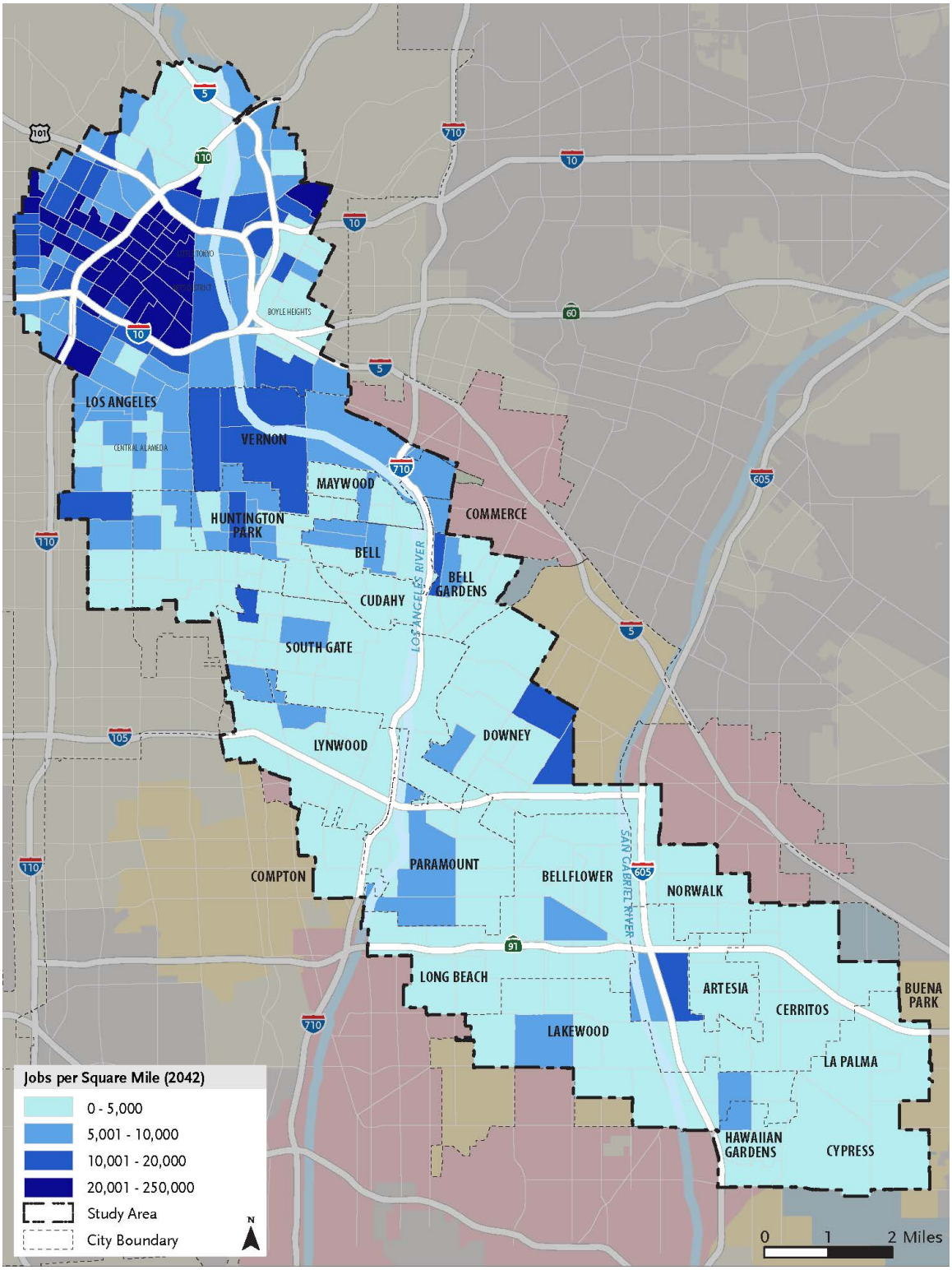
Source: Metro Travel Demand Model 2017 – 2042

Figure 1-4. Future Year (2042) Study Area Population Density



Source: Metro Travel Demand Model 2017 – 2042

Figure 1-5. Future Year (2042) Study Area Employment Density



Source: Metro Travel Demand Model 2017 – 2042

2 TRAVEL FORECASTING MODEL

The travel forecasting model used for the Project follows a traditional four-step structure: (1) trip generation, (2) trip distribution, (3) mode choice, and (4) trip assignment. Among these, trip generation and trip distribution were conducted by SCAG, and the resulting person trip tables were further processed by Metro for use in mode choice. These trip tables were kept fixed in this Project; only the mode choice and trip assignment were run for each alternative. The mode choice model (CBM18) structure and its inputs are discussed in the first two sections of this chapter. Next, the trip tables generated in the trip distribution step are summarized by travel market and discussed in the third section.

2.1 Mode Choice Model Structure

The mode choice model, CBM18, follows a nested logit structure (shown in Figure 2-1), as opposed to widely used multinomial logit structure for the mode choice model. In other words, instead of considering each mode as a separate alternative, the modes that have some common characteristics are grouped in a nest to ensure a higher degree of similarity and competitiveness among the alternatives within a nest than the alternatives in different nests. As can be observed from the figure, the auto modes with different occupancies (e.g., drive alone, shared ride 2 persons, shared ride 3 persons, and shared ride 4+ persons) are considered under one nest; all the transit modes (e.g., local bus, rapid bus, express bus, etc.) are considered under one nest and the nonmotorized modes (e.g., walk and bike) are considered under another nest. In addition, based on the similarity in using the facility types and access modes, some sub-nesting structures are also considered in the model.

CBM18 was calibrated to the year 2012 with regional on-board survey data and validated to year 2017 conditions by comparing the model results with Metro's automatic passenger counting (APC) data. It was reviewed by the Federal Transit Administration (FTA) on May 23, 2018, and endorsed for use on Metro's transit and feasibility studies. The model was used for the WSAB Project, with a base year of 2017 and a horizon year of 2042.

The CBM18 builds directly upon the 2009 version[1] and includes a few selected improvements to the model structure and formulation. These are briefly discussed next. For more details, please refer to the WSAB Calibration/Validation Report[2].

First was treatment of the representation of the bus rapid transit (BRT) mode - the Metro Orange line. Previously, the BRT was represented as a bus mode with walk and a generic drive access. In the 2018 version, BRT is represented as its own mode in the same manner as commuter and urban rail. Another change is the inclusion of bicycle as an access mode for fixed guideway modes (i.e., commuter rail, urban rail, and BRT), as shown in Figure 2-1. In this version of the model, bike and walk are combined as nonmotorized mode to access transit. In the future version (Phase II enhancements), bike mode and walk mode will be separated to generate the access information (to transit) by bike mode and walk mode separately.

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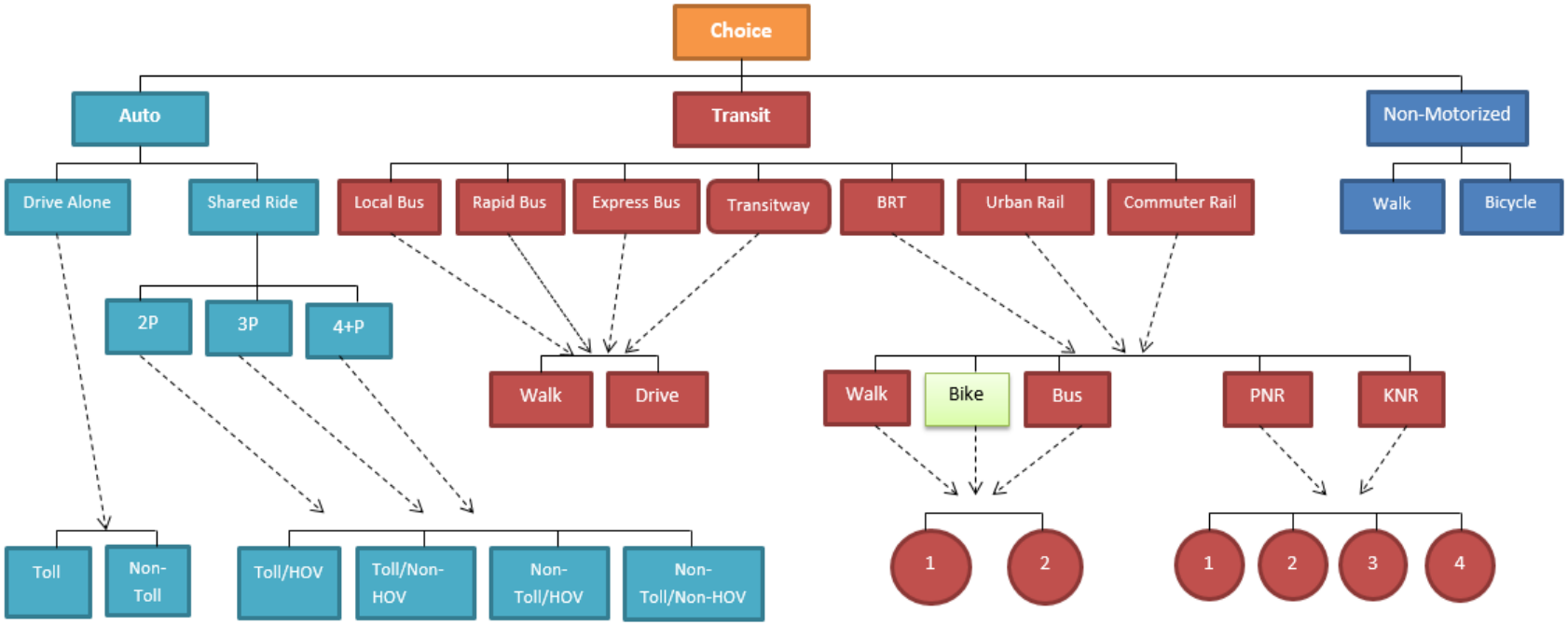
[1] "Los Angeles Mode Choice Model: Calibration/Validation Report," prepared for Metro by Parsons Brinckerhoff, September, 2010

[2] Metro Corridors Base Model Calibration and Validation Report," prepared for Metro by WSP, January, 2019

Figure 2-1. Corridors Base Model (CBM18) Model Structure



Source: WSP 2019

The second enhancement was modeling the egress mode choice (walk and public transit) as a probabilistic choice instead of relying on the path builder to select between walk and public transit.

The third and final enhancement to the model was the inclusion of a "blended" station-to-station set of paths and skims. The presence of the "blended" station-to-station skims allows the model to compare a single primary mode virtual path with a "blended" virtual path and select the option with the most positive (or best) utility.

Another important feature of the CBM18 model is the ability to track and report the rail-to-rail transfer volume at each transfer location. An additional set of transfer matrices is generated with the updated HUDPATH program during the path building process. HUDPATH is the transit path building module in TRANPLAN, the travel forecasting software used in CBM18. Based on the transfer matrices, station-to-station transfer volume at each transfer location is summarized by time period and trip purpose after the mode choice process. This new feature is especially important to the WSAB Study by developing the number of transfers between the WSAB Line and other rail lines providing insight to rider's travel patterns before and after the introduction of the Project. Because the Project provides alternatives to travel through downtown Los Angeles and parallels the North-South Line for a section of the corridor, the transfer volume summary is discussed in detail in the travel forecasting results section.

2.2 Modeling Input Data and Assumptions

In a typical travel forecasting modeling methodology, the modeling region is divided into smaller geographic units with relatively similar areas of land-use characteristics called transportation or traffic analysis zones (TAZ). They represent the origins and destinations of all travel activities in the region. Most of the socioeconomic data (e.g., employment, population) and trip tables used in the model are developed at the TAZ level.

The socioeconomic data used in the WSAB Study are based on the SCAG RTP 2016 data, with Metro's 3800 TAZ structure. The base (2017) and future (2042) year person trip tables are developed by Metro. These trip tables are taken directly from SCAG RTP 2016 and translated into Metro's TAZ system. The exception to this is for the home-based work (HBW) trip tables. These tables were adjusted, based on the Census Transportation Planning Products (CTPP) data as a seed matrix, and "fratared" to SCAG totals. Frataring adjusts a seed trip table to target totals (e.g., production and attraction totals) using factors. In this case, CTPP data were used as the seed trip table and SCAG production and attraction totals were used as the target totals.

The CBM18 model uses four trip purposes and two time periods. Trip purposes are HBW, home-based university, home-based other, and non-home-based, and time periods are peak and off-peak periods. The peak period includes 6AM-9AM and 3PM-7PM, for a total of seven hours, and the remainder of the day is represented in the off-peak period.

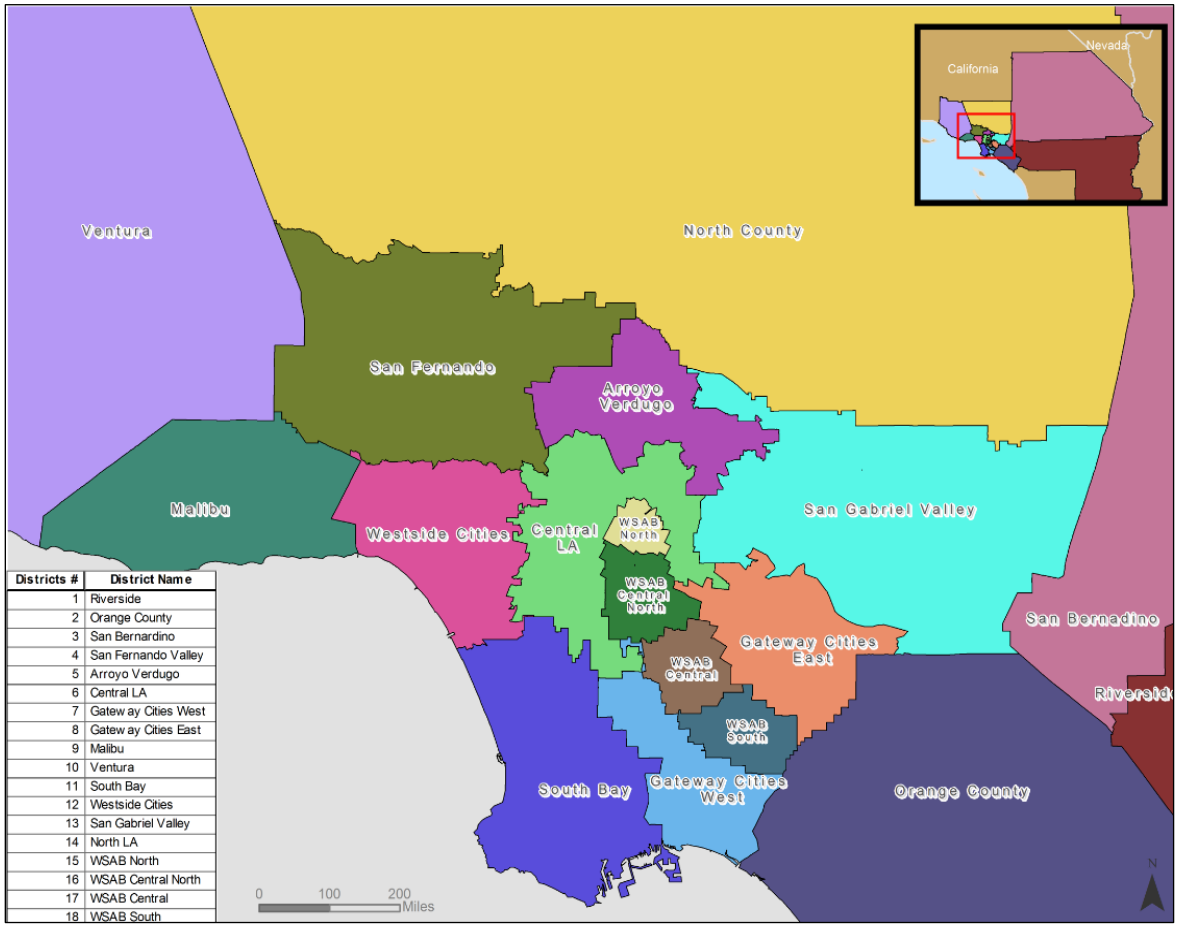
The base year transit network used in the WSAB Study Area is largely based on the CBM18 model validation network with a few modifications along the WSAB Corridor. The background bus network for horizon year is from Metro's Long Range Transportation Plan (LRTP) and validated for the WSAB Corridor. The rail network for horizon year represents the services in Metro's 2016 Measure M Expenditure Plan. The highway congestion for both base year and horizon year was provided by Metro modeling based on Metro's vehicle trip

tables. To run the CBM18 for different scenarios, the socioeconomic data and person trip tables are kept fixed; only the networks and related inputs are changed for each scenario. Note that CBM18 does not provide the capability to constrain parking demand to supply limits and, as such, the generated parking demand should be treated as guidance.

2.3 Travel Market Analysis (2017 and 2042)

To understand the trip flows for the Study Area, the overall region was divided into 18 districts, including four districts for the Study Area. The number of trips produced in a district is partially a function of the district's size. Since one of the main objectives of this travel market analysis is to understand the number of trips coming from and going to the Study Area, the districts close to the Study Area were kept smaller compared to the districts farther from the Study Area. In general, the LA County districts roughly represent the sub-regions, and the larger outer areas represent the other counties in the region. Figure 2-2 shows the boundary of the 18 districts, including four Study Area districts (i.e., WSAB North, WSAB Central North, WSAB Central, and WSAB South).

Figure 2-2. District Boundaries



Districts #	District Name
1	Riverside
2	Orange County
3	San Bernardino
4	San Fernando Valley
5	Arroyo Verdugo
6	Central LA
7	Gatew ay Cities West
8	Gatew ay Cities East
9	Malibu
10	Ventura
11	South Bay
12	Westside Cities
13	San Gabriel Valley
14	North LA
15	WSAB North
16	WSAB Central North
17	WSAB Central
18	WSAB South

Source: WSP 2019

Table 2.1 shows the base year (2017) district-to-district daily person trip flows. The districts in the rows and columns indicate production and attraction districts, respectively. For example, the corridor total in column 6 indicates that 460,000 trips were produced by the WSAB Corridor (corridor total includes Districts 15-18) and attracted to Central LA, and the corridor total in row 6 indicates that 745,000 trips were produced by Central LA and attracted to the WSAB Corridor. In addition, as indicated in the table are 2.012 million trips produced by the Study Area and attracted to the Study Area. This intra-corridor trip flow and other major flows associated with the Study Area are presented in Figure 2-3 and Figure 2-4. As can be observed from the figures, the top three flows were "from" and "to" Central LA, Gateway Cities West, and Gateway Cities East Districts. Further, the total flows from/to the districts west of the Study Area were larger than the flows from/to the east districts.

Table 2.2 shows the future year (2042) district-to-district daily person trip flows. One of the largest trip flows is projected to be from (produced by) the Central LA District to the corridor with 890,000 trips, and 539,000 trips are attracted to LA Central from the corridor. As in 2017, one of the major trip flows is the 2.273 million trips produced by the Study Area and attracted to the Study Area. This intra-corridor trip flow and other major flows associated with the Study Area are easily visualized in Figure 2-5 and Figure 2-6. As shown in the figures, the top three attraction districts would remain the same in 2042, but the top three production districts would differ slightly from 2017. The top three production districts in 2042 would be Central LA, Gateway Cities West, and San Gabriel Valley. The pattern of the flows would remain the same in 2042 – the total flows from/to the west would be larger than those from/to the east of the Study Area.

To understand the travel markets better, the above trip flows are summarized into four markets:

1. Travel within the Study Area (i.e., both origin and destinations are within the Study Area)
2. Travel from the Study Area to destinations outside the Study Area (i.e., only origin is in the Study Area)
3. Travel to the Study Area from origins outside the Study Area (i.e., only destination is in the Study Area)
4. Travel through the Study Area (both origins and destinations are outside the Study Area)

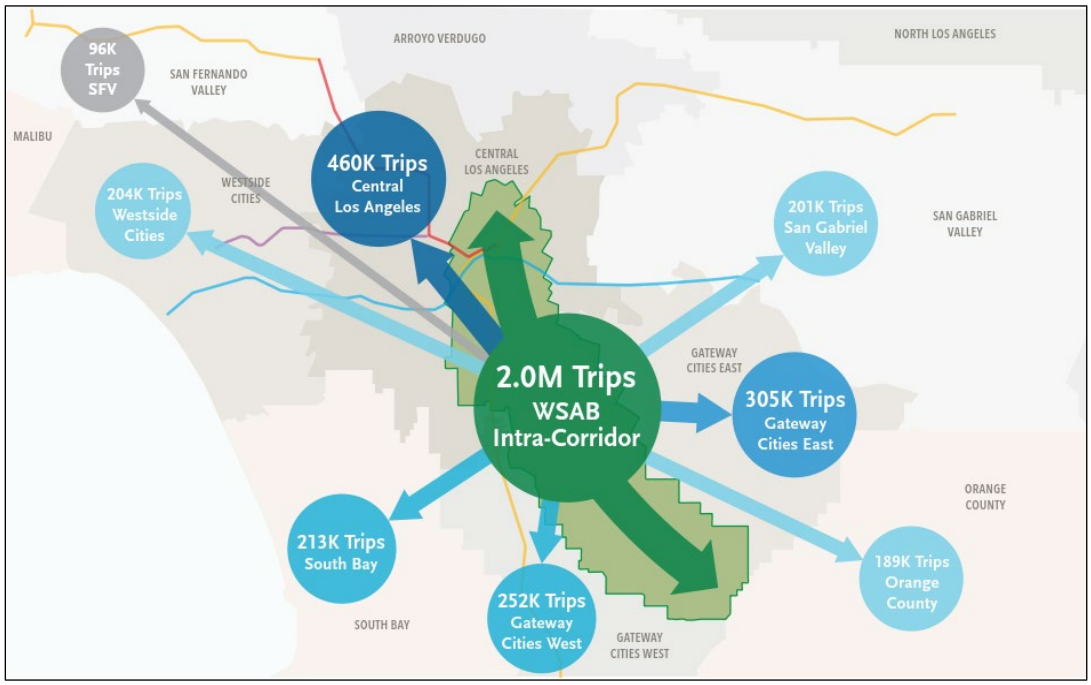
Table 2.3 summarizes the 2017 and 2042 daily person trips by the four travel markets. As shown, about 65.5 million daily person trips occurred in the region in 2017. Among these, the Study Area had approximately 6.4 million-person trips, including 2.01 million traveled within the Study Area, 2.10 million produced by the Study Area, and 2.28 million attracted to the Study Area. These trips accounted for about 10 percent of the total daily person trips in the region. In the second and third market segments, the largest movements were from and to districts west of the Study Area (i.e., Central LA, Gateway Cities West, South Bay, and Westside Cities), which accounted for approximately 38 percent of the 6.4 million Study Area trips; another 16 percent of the trips were comprised of movements associated with the districts that lie to the east of the Study Area (i.e., Gateway Cities East and San Gabriel Valley). In the fourth market segment, there were about 106,000 daily person trips traveled between Orange County and the districts north of the Study Area (i.e., Westside and San Fernando Valley).

Table 2.1. Base Year (2017) Daily Person Trips (in thousands)

	District	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Corridor Total	Regional Total
1	Riverside	7,576	284	417	12	10	16	13	16	2	6	28	19	69	9	6	10	5	6	**26**	**8,505**
2	Orange County	115	10,294	83	21	24	51	165	151	3	8	98	48	167	10	18	30	28	88	**165**	**11,403**
3	San Bernardino	354	162	6,212	19	23	26	11	27	2	8	17	24	316	19	13	16	6	5	**39**	**7,260**
4	San Fernando Valley	12	21	10	3,649	318	218	17	24	86	118	61	367	69	142	44	45	9	6	**104**	**5,215**
5	Arroyo Verdugo	5	14	7	189	1,184	196	10	23	7	9	25	76	170	24	43	35	8	5	**90**	**2,029**
6	Central LA	28	61	16	258	321	2,300	88	150	24	16	303	715	288	51	269	385	63	28	**745**	**5,362**
7	Gateway Cities West	11	181	7	26	23	80	1,062	62	4	3	268	69	56	9	18	48	75	138	**279**	**2,140**
8	Gateway Cities East	11	190	15	22	34	87	54	858	2	3	50	50	187	6	25	57	94	93	**268**	**1,836**
9	Malibu	1	1	1	52	5	9	1	1	151	54	4	30	2	2	2	2	0	0	**6**	**319**
10	Ventura	5	7	4	112	18	17	3	3	96	2,663	9	35	9	27	5	5	1	1	**12**	**3,020**
11	South Bay	54	85	7	65	40	213	193	47	11	7	2,482	304	57	16	37	66	37	36	**176**	**3,756**
12	Westside Cities	21	16	4	130	45	310	17	18	19	9	132	2,100	35	17	31	41	9	6	**86**	**2,958**
13	San Gabriel Valley	64	243	274	82	347	236	48	236	8	11	71	134	3,334	19	88	93	36	33	**250**	**5,357**
14	North LA	18	13	23	163	57	45	6	7	8	43	18	76	21	1,746	13	13	2	2	**30**	**2,273**
15	WSAB North	3	8	2	24	32	135	6	16	2	2	16	35	41	5	209	112	5	3	**329**	**656**
16	WSAB Central North	7	25	6	43	37	229	35	67	6	3	71	94	74	11	111	533	72	13	**729**	**1,437**
17	WSAB Central	6	51	5	20	20	71	92	126	3	2	76	54	54	5	15	94	326	65	**501**	**1,085**
18	WSAB South	5	105	4	9	10	24	119	96	1	1	50	22	32	3	7	15	61	371	**453**	**935**
Corridor Total		**22**	**189**	**17**	**95**	**98**	**460**	**252**	**305**	**12**	**8**	**213**	**204**	**201**	**25**	**343**	**754**	**464**	**451**	**2,012**	**4,112**
Regional Total		**8,295**	**11,761**	**7,095**	**4,895**	**2,545**	**4,263**	**1,940**	**1,929**	**435**	**2,968**	**3,778**	**4,253**	**4,982**	**2,121**	**956**	**1,598**	**836**	**898**	**4,288**	**65,546**

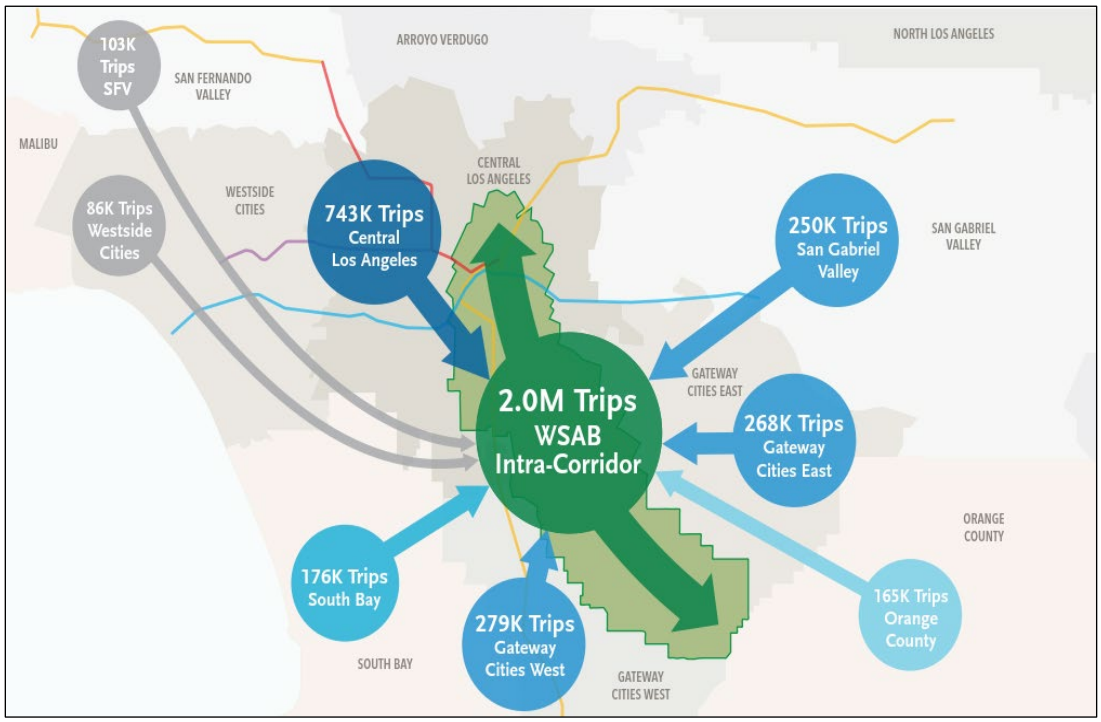
Source: WSP 2019

Figure 2-3. 2017 Daily Person Trip Flows from Study Area to Major Travel Markets



Source: Metro Travel Demand Model 2017-2042 (adapted from the SCAG Regional Travel Demand Model); prepared by Cityworks Design

Figure 2-4. 2017 Daily Person Trip Flows into Study Area from Major Travel Markets



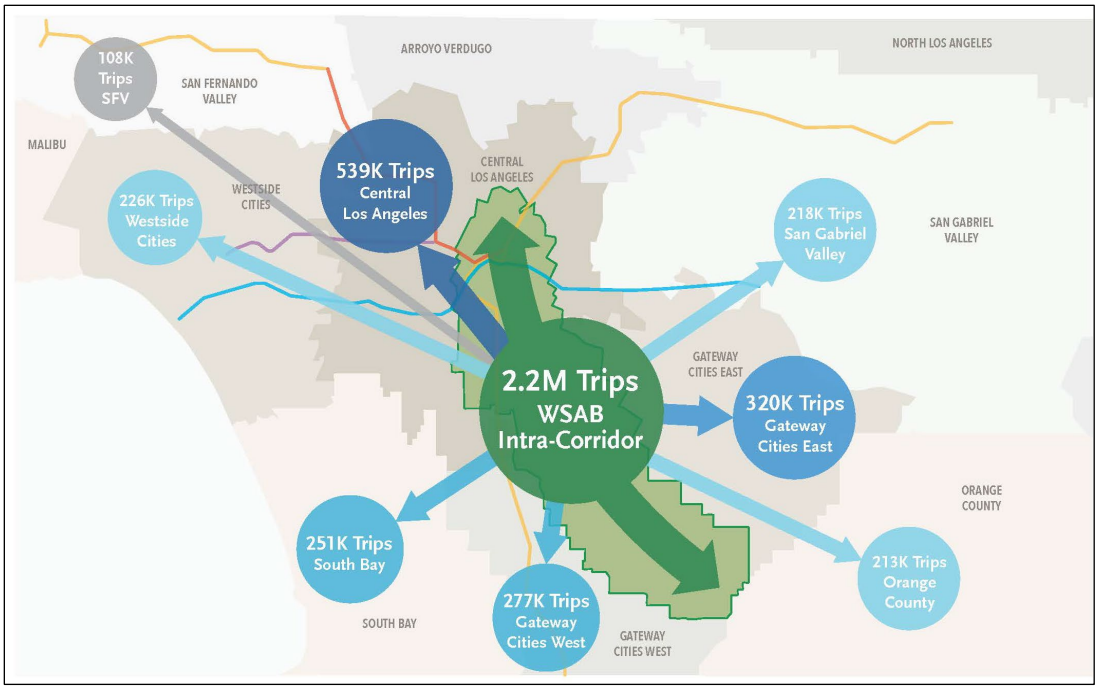
Source: Metro Travel Demand Model 2017-2042 (adapted from the SCAG Regional Travel Demand Model); prepared by Cityworks Design

Table 2.2. Future Year (2042) Daily Person Trips (in thousands)

District		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	Corridor Total	Regional Total
1	Riverside	10,808	323	556	14	12	20	16	17	2	9	25	20	75	16	7	12	5	7	**30**	**11,942**
2	Orange County	157	11,537	106	23	26	59	186	159	3	10	114	52	178	18	20	35	31	93	**180**	**12,808**
3	San Bernardino	534	201	8,168	21	27	31	13	30	2	10	22	28	348	28	14	19	6	6	**45**	**9,510**
4	San Fernando Valley	15	28	16	4,072	382	264	22	27	89	139	84	404	79	170	54	67	10	7	**137**	**5,927**
5	Arroyo Verdugo	6	16	8	204	1,291	215	11	24	7	9	30	80	178	26	46	41	8	5	**100**	**2,205**
6	Central LA	18	79	26	287	360	2,613	104	162	25	18	377	786	316	60	301	488	70	31	**890**	**6,122**
7	Gateway Cities West	7	191	8	27	24	87	1,119	64	4	3	286	71	57	10	19	52	77	141	**289**	**2,247**
8	Gateway Cities East	10	212	18	23	37	97	61	898	2	3	57	53	196	7	27	65	97	97	**286**	**1,961**
9	Malibu	1	1	1	56	6	10	1	1	156	59	5	32	3	2	3	3	0	0	**7**	**341**
10	Ventura	11	11	7	131	23	21	4	4	100	3,074	13	39	11	37	7	7	1	1	**16**	**3,503**
11	South Bay	8	95	8	68	43	246	212	49	11	8	2,735	326	60	18	41	78	40	37	**196**	**4,085**
12	Westside Cities	8	22	7	140	52	349	21	20	20	10	175	2,253	39	19	36	55	10	6	**107**	**3,242**
13	San Gabriel Valley	88	295	360	90	396	274	57	253	8	13	87	148	3,608	26	99	115	38	36	**289**	**5,992**
14	North LA	35	23	49	226	87	66	10	9	11	65	32	97	29	2,348	19	24	3	3	**49**	**3,134**
15	WSAB North	5	12	4	30	39	157	8	18	2	2	23	40	49	7	242	143	7	4	**396**	**791**
16	WSAB Central North	9	31	9	48	43	274	41	72	6	3	86	106	81	14	130	660	76	14	**879**	**1,702**
17	WSAB Central	5	59	7	21	22	83	103	132	3	2	88	58	56	6	17	106	341	68	**533**	**1,176**
18	WSAB South	4	111	5	9	10	26	125	98	1	1	54	22	33	3	7	16	63	381	**466**	**969**
Corridor Total		**23**	**213**	**24**	**108**	**114**	**539**	**277**	**320**	**12**	**9**	**251**	**226**	**218**	**31**	**397**	**924**	**486**	**466**	**2,273**	**4,638**
Regional Total		**11,730**	**13,248**	**9,360**	**5,489**	**2,881**	**4,891**	**2,113**	**2,037**	**454**	**3,439**	**4,295**	**4,614**	**5,395**	**2,815**	**1,091**	**1,986**	**883**	**935**	**4,895**	**77,657**

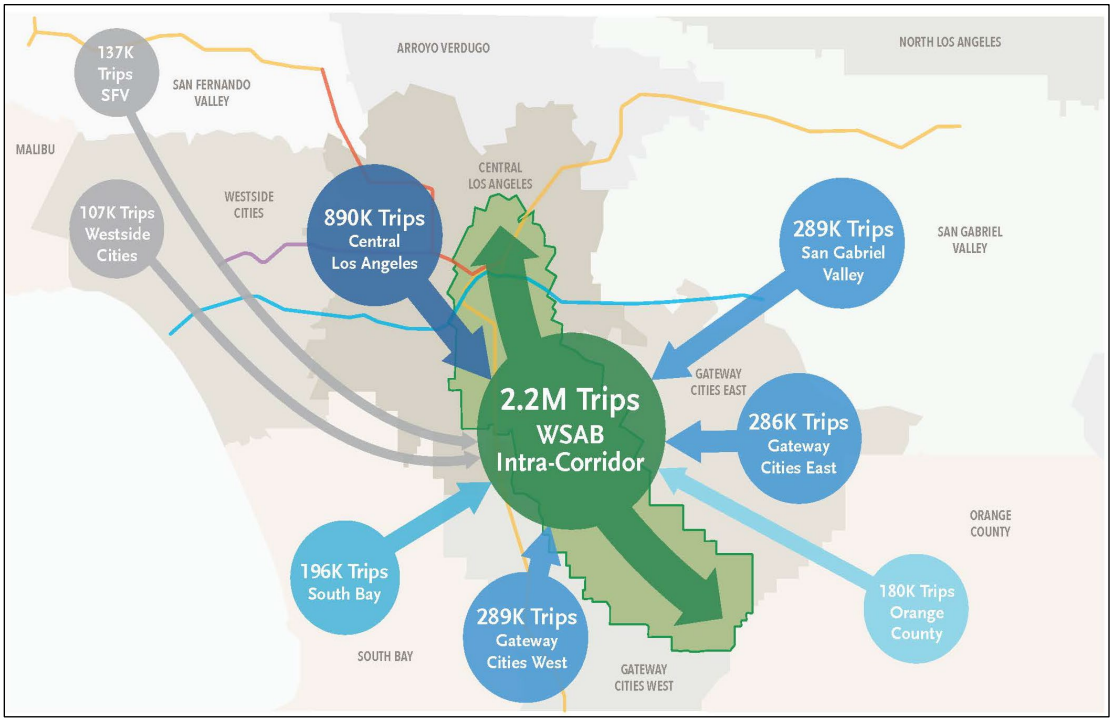
Source: WSP 2019

Figure 2-5. 2042 Daily Person Trip Flows from Study Area to Major Travel Markets



Source: Metro Travel Demand Model 2017-2042 (adapted from the SCAG Regional Travel Demand Model); prepared by Cityworks Design

Figure 2-6. 2042 Daily Person Trip Flows into Study Area from Major Travel Markets



Source: Metro Travel Demand Model 2017-2042 (adapted from the SCAG Regional Travel Demand Model); prepared by Cityworks Design

As shown in Table 2.3, by 2042, the region-wide daily person trips are projected to increase by 18 percent to 77.7 million and the Study Area trips are projected to increase by 14 percent to approximately 7.26 million. The distributions of the Study Area trips by market segment would be similar to those in 2017 – 31 percent trips within the Study Area, 33 percent trips from the Study Area to destinations outside the Study Area, and 36 percent trips into the Study Area from points outside the Study Area.

Table 2.3. Base Year (2017) and Future Year (2042) Daily Person Trips by Travel Market

Market	To or From	Daily Trips (2017)	Daily Trips (2042)	%Increase (from 2017 to 2042)
Travel within the Study Area	Within the Study Area	**2,011,800**	**2,273,200**	**13%**
Travel from the Study Area to Destinations Outside the Study Area	To districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities)	1,129,000	1,292,500	14%
	To districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	505,900	538,600	6%
	To districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	193,200	221,600	15%
	To districts south of the Study Area (Orange County)	188,800	212,700	13%
	To all other districts	83,400	99,300	19%
	Total	**2,100,300**	**2,364,700**	**13%**
Travel to the Study Area from Origins Outside the Study Area	To districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities)	1,285,700	1,482,500	15%
	To districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	518,200	574,900	11%
	To districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	193,400	237,600	23%
	To districts south of the Study Area (Orange County)	165,000	179,800	9%
	To all other districts	113,300	146,700	29%
	Total	**2,275,600**	**2,621,500**	**15%**
Study Area Subtotal		**6,387,700**	**7,259,400**	**14%**
Travel Outside the Study Area	Between Orange County and Westside + San Fernando Valley	106,300	124,900	17%
	To and from other districts outside the Study Area	59,052,000	70,272,700	19%
	Total	**59,158,300**	**70,397,600**	**19%**
Regional Total		**65,546,000**	**77,657,000**	**18%**

Source: WSP 2019

The primary movements would still be from and to districts west of the Study Area (i.e., Central LA, Gateway Cities West, South Bay, Westside Cities), and east of the Study Area (i.e., Gateway Cities East, San Gabriel Valley), which would account for 38 percent and 15 percent of the 7.3 million Study Area person trips. The trips between Orange County and the districts north of the corridor are projected to increase by 17 percent to 124,900 trips. These trips would travel through the WSAB Corridor and could utilize the proposed LRT line.

Among different trip purposes, HBW trips typically contribute the most to transit ridership. Further, the contribution in the peak period is larger than the off-peak period. Therefore, the HBW peak trips are discussed separately in this section. Table 2.4 presents the HBW peak trips by travel market for the base and future years.

Table 2.4. Base Year (2017) and Future Year (2042) Home-Based Work Peak Trips by Travel Market

Market	To or From	HBW PK Trips (2017)	HBW PK Trips (2042)	%Increase (from 2017 to 2042)
Travel within the Study Area	Within the Study Area	**148,200**	**178,900**	**21%**
Travel from the Study Area to Destinations Outside the Study Area	To districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities)	149,000	176,900	19%
	To districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	78,000	85,900	10%
	To districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	40,000	47,600	19%
	To districts south of the Study Area (Orange County)	45,400	54,900	21%
	To all other districts	20,400	29,700	46%
	Total	**332,800**	**395,000**	**19%**
Travel to the Study Area from Origins Outside the Study Area	To districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities)	195,100	232,800	19%
	To districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	91,300	100,500	10%
	To districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	50,700	61,900	22%
	To districts south of the Study Area (Orange County)	30,000	30,900	3%
	To all other districts	45,200	53,900	19%
	Total	**412,300**	**480,000**	**16%**
Study Area Subtotal		**893,300**	**1,053,900**	**18%**

Market	To or From	HBW PK Trips (2017)	HBW PK Trips (2042)	%Increase (from 2017 to 2042)
Travel Outside the Study Area	Between Orange County and Westside + San Fernando Valley	24,900	31,500	27%
	To and from other districts outside the Study Area	6,700,800	8,262,600	23%
	Total	**6,725,700**	**8,294,100**	**23%**
Regional Total		**7,619,000**	**9,348,000**	**23%**

Source: WSP 2019

As can be observed from Table 2.4, about 7.6 million HBW peak trips occurred in 2017, which is about 12 percent of the total daily person trips in the region. Among these, about 0.89 million trips were related to the Study Area, of which 0.15 million traveled within the Study Area, 0.33 million trips were produced by the Study Area, and 0.41 million were attracted to the Study Area. This indicates that a significant amount of the trips produced in the Study Area remained within the Study Area (i.e., intra-corridor trips). Further, more HBW trips entered the Study Area than left the Study Area. Segmentation of the markets suggests that the primary movements for HBW peak trips followed the same patterns as daily person trips – the largest movements were "from" and "to" districts west of the Study Area (i.e., Central LA, Gateway Cities West, South Bay, and Westside Cities) followed by the movements associated with the districts east of the Study Area (i.e., Gateway Cities East and San Gabriel Valley).

By 2042, in the LA region, HBW peak trips are projected to increase by 23 percent to 9.3 million, and the Study Area trips are projected to increase by 18 percent to 1.05 million. All three markets associated with the Study Area are projected to have increased trips in 2042, with the highest percent increase in intra-corridor trips (21 percent) followed by trips from the Study Area (19 percent) and trips into the Study Area (16 percent). As with the base year, a significant number of HBW trips would be intra-corridor trips (0.18 million) and there would be more trips entering the Study Area (0.48 million) than leaving the Study Area (0.39 million). Further, the largest movements will be from and to districts west of the Study Area (i.e., Central LA, Gateway Cities West, South Bay, and Westside Cities).

In summary, there would be a significant number of intra-corridor trips in 2042 and the Study Area would attract (and send) trips from (and to) all over the region. However, the largest flows associated with the Study Area would be from/to the districts west of the Study Area. The same patterns are expected for both the daily person trips and HBW peak trips. Therefore, depending on the alignment of the proposed line in the WSAB Corridor, their performances might vary. For example, the alternatives/scenarios that would provide travel time savings for the trips from/to the districts west of the Study Area might attract more trips than the other alternatives. The details are investigated and discussed in the travel forecasting results section.

3 MODEL VALIDATION UNDER EXISTING CONDITIONS (2017)

Before using a travel demand model for forecasting, it is important to investigate if the model can replicate the current or base year condition. This chapter discusses the procedure used to review the performance of the CBM18 in replicating the base year (2017) transit ridership in the WSAB Corridor. Specifically, the procedure used to review the base year transit routes in the corridor and the modifications made to the transit network are discussed. In addition, the model validation results for the WSAB Corridor are presented and discussed in this chapter.

3.1 Transit Network Validation

As described in the previous chapter, the CBM18 builds directly upon the CBM09 and includes some new features. With these new features, the CBM18 was calibrated and validated for the entire region using the most recently available on-board travel survey and count data. During this process, the region-wide transit networks were reviewed and adjusted to ensure the coverage and level-of-service reflected existing conditions. This was undertaken as a part of the WSAB Study.

The CBM18 validation for the WSAB Corridor began by reviewing the transit networks in the Study Area. The Study Area is served by multiple bus, rail, and commuter rail services. Approximately 120 bus routes are operated in the Study Area by different agencies. Metro operates the majority of the bus services, with approximately 70 bus routes within the corridor. The remainder of the buses are operated by the Los Angeles Department of Transportation, Orange County Transportation Authority (OCTA), Long Beach Transit, Montebello Bus, and 13 other municipal/local bus service providers. The northern end of the corridor has a rich network of buses as it includes downtown Los Angeles. However, most of these buses do not travel through the length of the WSAB Corridor and many are in the Study Area for only a short segment of the entire route.

As a part of the network review, the headways and the patterns of the above bus routes in the 2017 model network were reviewed against their most recent schedules and modified to ensure the coverage and level-of-service reflected existing conditions. Major modifications, including bus alignment, headway, and travel time updates, to the bus network were as follows:

- Reduced headways on Metro Local 66, 105, 111, 117, 127, 128, 251, 258, 260, 266
- Reduced headways on Metro Rapid 720
- Updated bus alignment on Metro Local 66
- Extended Metro Local 18 from downtown to Montebello via Whittier Boulevard
- Extended Metro 120 from Compton to Whittier via Florence Avenue and Telegraph Road
- Removed Metro 251
- Added Metro Local 30 and 66

Table 3.1 through Table 3.7 show the headways of the buses in the corridor. The transit services in the Metro network are represented by mode codes. In this coding system, the modes are classified by their service type (local, express, urban rail, and commuter rail, etc.) and operating company (Metro, OCTA, Foothill Transit, etc.). The "Mode" column in the tables shows the mode code used for the transit services in the network. For example, Metro Local, Express, and Rapid buses were coded as Mode 11, 12, and 24 respectively.

Table 3.1. Metro Local Bus Headways

Metro Local Bus				
Route	Mode	Line	Headway (Min) Peak	Headway (Min) Off-Peak
18 - Montebello to Wilshire Center	11	250	11	16
	11	255	15	20
30 - East Los Angeles to West Hollywood	11	257	11	30
	11	616	26	40
	11	617	30	36
40 - Downtown LA to Redondo Beach	11	49	20	15
	11	50	20	-
60 - Downtown LA to Compton	11	64	8	12
62 - Downtown LA to Hawaiian Gardens	11	212	30	60
	11	229	60	60
66 - Montebello to Wilshire Center	11	67	26	30
	11	71	11	-
	11	280	60	45
105 - Vernon to West Hollywood	11	94	15	17
108 - Marina Del Rey to Pico Rivera	11	99	16	24
	11	208	16	24
110 - Playa Vista to Bell Gardens	11	100	15	20
111 - LAX to Norwalk	11	102	20	28
115 - Playa Del Ray to Norwalk	11	104	15	-
	11	107	15	28
	11	108		28
117 - LAX to Downey	11	109	15	18
120 - LAX to Whittwood Town Center	11	113	30	30
125 - El Segundo to Norwalk	11	215	23	30
127 - Compton to Downey	11	117	60	50
128 - Compton to Cerritos	11	221	30	60

Metro Local Bus				
Route	Mode	Line	Headway (Min)	
			Peak	Off-Peak
130 - Redondo Beach to Cerritos	11	119	30	45
251 - Lynwood to Cypress Park	11	270	16	20
254 - Watts to East Los Angeles	11	177	60	72
258 - Paramount to Altadena	11	180	36	40
260 - Compton to Altadena	11	182	45	120
	11	245	20	28
265 - Lakewood to Pico Rivera	11	184	36	51
266 - Lakewood to Pasadena	11	186	20	30
611 - Huntington Park Shuttle	11	628	36	60
612 - South Gate Shuttle	11	273	60	60

Source: WSP 2019

Table 3.2. Metro Express Bus Headways

Metro Express Bus				
Route	Mode	Line	Headway (Min)	
			Peak	Off-Peak
577 -Long Beach to El Monte	12	48	36	40
	12	49	36	40

Source: WSP 2019

Table 3.3. Metro Rapid Bus Headways

Route	Mode	Line	Headway (Min)	
			Peak	Off-Peak
705 - West Hollywood to Vernon	24	63	15	23
	24	64	10	28
720 - Santa Monica to Commerce	24	69	18	19
	24	70	6	19
	24	80	18	19
	24	81	6	19
751 - Huntington Park to Cypress Park	24	53	14	16
	24	54	13	16

Route	Mode	Line	Headway (Min)	
			Peak	Off-Peak
760 - Lynwood to Downtown LA	24	35	11	19
	24	36	15	18
762 - Pasadena to Compton	24	15	26	26
	24	16	20	28

Source: WSP 2019

Table 3.4. Metro Transitway Bus Headways

Route	Mode	Line	Headway (Min)	
			Peak	Off-Peak
460 - Anaheim to Los Angeles	25	79	23	26
	25	80	23	26

Source: WSP 2019

Table 3.5. OCTA Service Headways

Transit Service	Route	Mode	Line	Headway (Min)	
				Peak	Off-Peak
Local	30 - Cerritos to Anaheim	20	55	60	60
		20	56	60	60
	38 - Lakewood to Anaheim Hills	20	60	30	30
		20	61	30	30
		20	62	15	30
Transitway	701 - Huntington Beach to Los Angeles	25	76	30	-
	721 - Fullerton to Los Angeles	25	77	30	-
		25	78	30	-

Source: WSP 2019

Table 3.6. Long Beach Transit Service Headways

Transit Service	Route	Mode	Line	Headway (Min)	
				Peak	Off-Peak
Local	91 - Transit Gallery to Bellflower	16	31	60	60
	92 - Transit Gallery to Woodruff	16	32	30	30
	93 - Transit Gallery to Clark	16	33	60	60
	172 - Transit Gallery to Palo Verde	16	43	30	30
	173 - Transit Gallery to Studebaker	16	52	30	30
	192 - Santa Fe Ave. to South Street	16	41	30	30

Source: WSP 2019

Table 3.7. Other Transit Service Headways

Transit Agency	Route	Mode	Line	Headway (Min)	
				Peak	Off-Peak
Norwalk Transit	1 - Rio Hondo College to Bellflower	16	55	28	28
	2 - Norwalk Square to Pioneer/Alondra	16	122	30	30
Bellflower	Bellflower North	15	112	30	30
	Bellflower South	15	113	30	30
GATE	Southgate East	15	114	24	24
GATE	Southgate West	15	115	24	24
DASH	Local Bus	15	77	30	30
Huntington Park	Huntington Park Express Routes	16	131	25	25

Source: WSP 2019

The rail services in the WSAB Corridor include Metrolink and several Metro urban rail lines – the B (Red) and D (Purple) Lines, the A (Blue) and L (Gold) Lines (which will be joined together via the Regional Connector as the North-South Line), the E (Expo) Line (which will become a portion of the East-West Line), and the C (Green) Line. The commuter rail (Metrolink) lines are long regional lines. Only two lines (Orange County and 91 Lines) serve the corridor via Commerce, Norwalk, and Los Angeles Union Station (LAUS), and they are in the corridor for a small portion of their routes. LAUS, in addition to being the terminus for the Orange County and 91 Line, is also the terminus for the San Bernardino, Antelope Valley, Ventura County/Burbank, and Riverside Lines, which provides an opportunity for riders to transfer from Metrolink to the WSAB and other urban rail lines. The B (Red), D (Purple), L (Gold), and E (Expo) Lines serve downtown Los Angeles at the northern end of the corridor. The A (Blue) Line travels within the Study Area from Florence to downtown Los Angeles and would parallel the proposed WSAB alignment in that section. The C (Green) Line travels across the Study Area from Lynwood to Norwalk. Review of these rail services (against the

Metro and Metrolink schedules) suggests that all these services exist in the model network with proper service frequency.

3.2 Corridor-Specific Model Validation Results

This section presents the corridor-specific model validation results. First, bus speeds (in the AM peak period) estimated by the model were compared against their observed speeds. For the observed speed, the travel time in the current schedule available on the website of major transit agencies (e.g., Metro, OCTA, and Long Beach Transit) was used. Next, the estimated ridership out of the model was compared against the observed ridership to evaluate the performance of the model in replicating the base year ridership in the Study Area. In both the comparisons, it is not expected that the estimated data will exactly match the observed data, but it should be within a reasonable limit. For example, the estimated ridership at the corridor should match the observed within about 10 percent.

Table 3.8 through Table 3.13 show the observed and estimated speed comparison for the routes reviewed for headways in Table 3.1 through Table 3.7. As can be seen from the Metro bus tables (Table 3.8 to Table 3.11), the estimated speed matches well with the observed speed for most of the routes, except a few local bus routes (e.g., Route 117, 120, and 128) and shuttle services (e.g., 611), but they are within five miles per hour (mph) of the observed speeds. Similar comparison for the OCTA and Long Beach Transit buses (Table 3.12 and Table 3.13) show that the differences between the estimated and observed speeds are also within 6 mph. The scatter plot between the estimated and observed speeds of all the buses shows a R-squared value of 0.7473 (Figure 3-1), indicating a reasonable representation of the actual in-vehicle bus travel time in the model networks.

In addition, the estimated speeds of some of the bus routes (e.g., Rapid 760, Local 60, Local 66, Local 108) were compared against the highway speeds calculated for some major arterials (e.g., Olympic Boulevard, Slauson Avenue) in the Study Area using Google Maps. The comparison shows that the bus speeds are within the range of the arterial speeds (6 to 37 mph). Refer to the Final Transportation Impact Analysis Report[3] for details on how the arterial speeds were calculated.

Table 3.8. Speed (AM Peak) Comparison for Metro Local Bus Services

Transit Service	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
18 - Montebello to Wilshire Center	11	250	9.7	10.3	0.6
	11	255	9.2	10.3	1.1
30 - East Los Angeles to West Hollywood	11	257	8.4	9.0	0.6
	11	616	8.3	9.1	0.8
	11	617	8.6	9.7	1.1
40 - Downtown LA to Redondo Beach	11	49	10.1	12.7	2.6
	11	50	9.6	11.6	2.0

[3] *West Santa Ana Branch Transit Corridor Project Final Transportation Impact Analysis Report*, prepared for Metro by WSP and Jacobs, April, 2021

Transit Service	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
60 - Downtown LA to Compton	11	64	11.3	11.9	0.7
62 - Downtown LA to Hawaiian Gardens	11	212	12.4	13.3	0.9
	11	229	12.0	12.4	0.4
66 - Montebello to Wilshire Center	11	67	8.9	11.1	2.2
	11	71	10.2	11.3	1.2
	11	280	9.5	10.8	1.3
105 - Vernon to West Hollywood	11	94	10.6	11.2	0.6
108 - Marina Del Rey to Pico Rivera	11	99	12.3	12.3	0.0
	11	208	16.5	12.0	-4.5
110 - Playa Vista to Bell Gardens	11	100	12.5	12.5	0.0
111 - LAX to Norwalk	11	102	12.6	14.6	2.0
115 - Playa Del Ray to Norwalk	11	104	13.8	14.6	0.8
	11	107	15.7	15.1	-0.5
117 - LAX to Downey	11	109	10.7	15.3	4.6
120 - LAX to Whittwood Town Center	11	113	11.9	16.9	5.0
125 - El Segundo to Norwalk	11	215	13.0	16.0	3.1
127 - Compton to Downey	11	117	12.8	15.3	2.6
128 - Compton to Cerritos	11	221	12.5	17.6	5.1
130 - Redondo Beach to Cerritos	11	119	13.4	17.0	3.6
251 - Lynwood to Cypress Park	11	270	9.8	12.3	2.5
254 - Watts to East Los Angeles	11	177	11.5	14.5	3.0
258 - Paramount to Altadena	11	180	10.5	13.3	2.9
260 - Compton to Altadena	11	182	15.6	14.8	-0.8
	11	245	11.3	15.0	3.7
265 - Lakewood to Pico Rivera	11	184	13.7	17.4	3.6
266 - Lakewood to Pasadena	11	186	13.7	16.4	2.6
611 - Huntington Park Shuttle	11	628	10.2	14.9	4.7
612 - South Gate Shuttle	11	273	13.0	16.0	3.1

Source: WSP 2019

Table 3.9. Speed (AM Peak) Comparison for Metro Express Bus Services

Route	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
577 -Long Beach to El Monte	12	48	28.0	25.7	-2.3
	12	49	19.1	18.8	-0.3

Source: WSP 2019

Table 3.10. Speed (AM Peak) Comparison for Metro Rapid Bus Services

Transit Service	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
705 - West Hollywood to Vernon	24	63	15.0	16.6	1.6
	24	64	15.2	12.8	-2.4
720 - Santa Monica to Commerce	24	69	15.6	14.6	-1.0
	24	70	13.7	11.8	-1.9
	24	80	15.1	14.6	-0.6
	24	81	12.9	10.8	-2.2
751 - Huntington Park to Cypress Park	24	53	11.0	12.4	1.4
	24	54	13.5	13.9	0.3
760 - Lynwood to Downtown LA	24	35	16.0	13.2	-2.8
	24	36	17.3	15.4	-2.0
762 - Pasadena to Compton	24	15	15.8	17.4	1.6
	24	16	14.7	17.0	2.3

Source: WSP 2019

Table 3.11. Speed (AM Peak) Comparison for Metro Transitway Bus Services

Transit Service	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
460 - Anaheim to Los Angeles	25	79	23.5	21.1	-2.4

Source: WSP 2019

Table 3.12. Speed (AM Peak) Comparison for OCTA Bus Services

Transit Service	Route	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
Local	30 - Cerritos to Anaheim	20	55	13.3	18.5	5.2
	38 - Lakewood to Anaheim Hills	20	60	15.0	18.8	3.8
		20	61	15.7	18.2	2.5
		20	62	14.5	18.7	4.2
Transitway	701- Huntington Beach to Los Angeles	25	76	22.9	20.1	-2.8
	721 - Fullerton to Los Angeles	25	77	29.5	29.2	-0.3
		25	78	30.5	29.4	-1.1

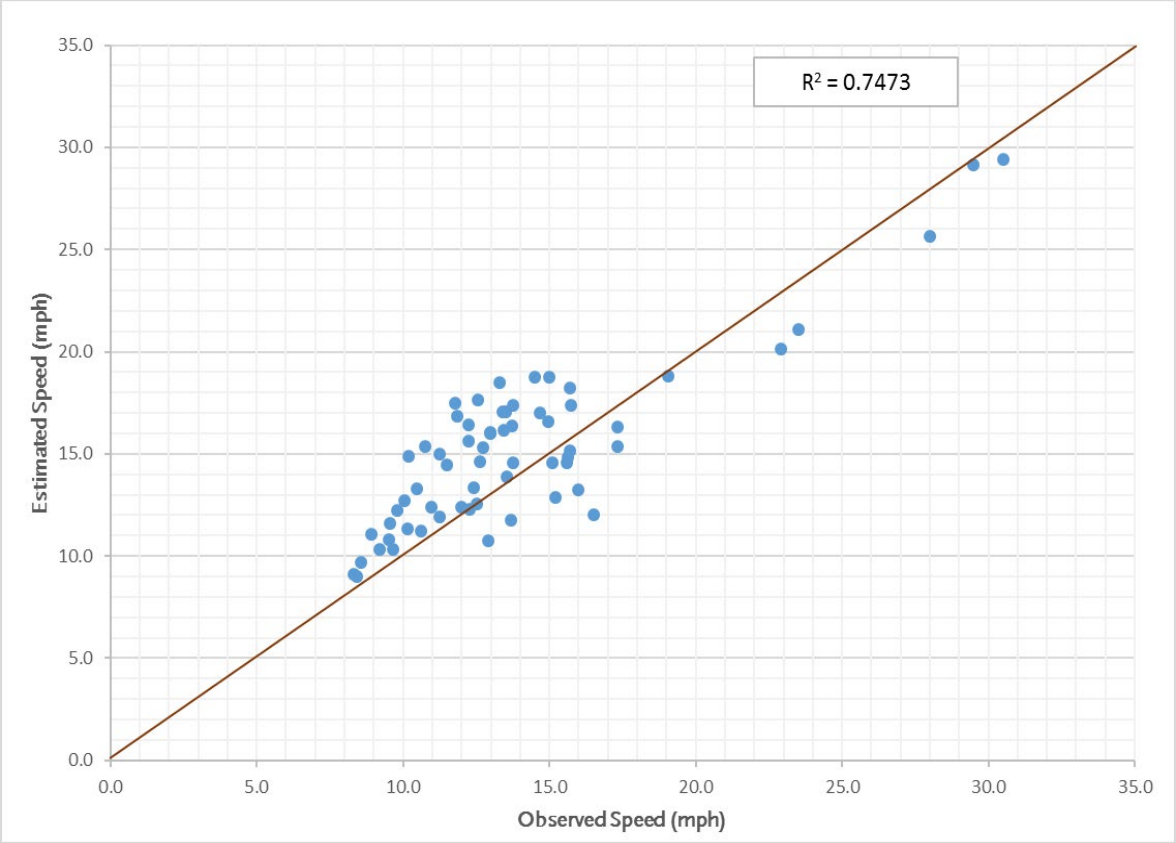
Source: WSP 2019

Table 3.13. Speed (AM Peak) Comparison for Long Beach Transit Services

Transit Service	Route	Mode	Line	Observed Speed (mph)	Estimated Speed (mph)	Difference
Local	91 - Transit Gallery to Bellflower	16	31	12.3	16.4	4.2
	92 - Transit Gallery to Woodruff	16	32	13.5	16.1	2.7
	93 - Transit Gallery to Clark	16	33	12.2	15.6	3.4
	172 - Transit Gallery to Palo Verde	16	43	17.3	16.3	-1.0
	173 - Transit Gallery to Studebaker	16	52	13.5	17.1	3.6
	192 - Santa Fe Ave. to South Street	16	41	11.8	17.5	5.7

Source: WSP 2019

Figure 3-1. Estimated vs Observed AM Speeds



Source: WSP 2019
Note: Run times from the current schedules were used to calculate the observed speeds

Table 3.14 shows a comparison between the daily observed and estimated boardings for urban rail lines within the Study Area. As shown, the estimated boardings in the corridor are fairly similar to the observed boardings and are within approximately 2 percent of the observed boardings. The B (Red) and D (Purple) Line boardings were compared as a combined total because separate observed boardings were not available for these two lines, given they share six stations.

Table 3.14. Ridership Comparison for the Urban Rail Lines (2017)

Rail Line	Observed Boardings	Estimated Boardings	Difference	% Difference
B (Red) + D (Purple) Lines	139,075	131,705	-7,370	-5%
A (Blue) Line	73,250	71,360	-1,890	-3%
C (Green) Line	34,105	33,890	-215	-1%
E (Expo) Line	58,800	61,425	2,625	4%
L (Gold) Line	52,635	51,730	905	-2%
Total Rail	357,865	350,110	-7,755	-2%

Source: WSP 2019

Table 3.15 and Table 3.16 show the daily ridership comparison for buses that run across or along the WSAB Corridor. Only the routes for which the observed data are available were included in the tables. The estimated boardings were summarized from the model run, and the observed boardings were obtained from Metro's APC data. Although there are some significant differences between the estimated and observed boardings by individual route, the total estimated boardings are within 8 percent and 7 percent of the observed boardings in these tables.

Table 3.15. Ridership Comparison for Transit Routes Across the Corridor

Operator	Route	Description	Observed Boardings	Estimated Boardings	Difference	% Difference
Metro	18	Wilshire to Montebello	18,697	17,650	-1,047	-6%
	30	Hollywood to Arts District	13,071	8,145	-4,926	-38%
	40	South Bay Galleria to Downtown Los Angeles	15,761	14,400	-1,361	-9%
	66	Wilshire to Montebello	12,064	7,772	-4,292	-36%
	105	West Hollywood to Vernon	10,829	7,826	-3,003	-28%
	108	Marina del Rey to Pico Riviera	16,214	15,335	-879	-5%
	110	Playa Vista to Bell Gardens	8,887	4,713	-4,174	-47%
	111	LAX City Bus Center to Norwalk	16,670	16,677	7	0%
	115	Playa del Rey to Norwalk	15,473	15,395	-78	-1%
	117	LAX City Bus Center to Downey	9,084	7,175	-1,909	-21%
	120	LAX to Whittwood	4,144	3,749	-395	-10%
	125	El Segundo to Norwalk	5,271	5,815	544	10%
	127	Compton to Downey	874	90	-784	-90%
	128	Compton to Cerritos	1,339	1,378	39	3%
	130	Redondo to Los Cerritos	3,158	3,158	0	0%
	254	Boyle Heights to Watts	803	125	-678	-84%
	258	Altadena to Paramount	2,882	509	-2,373	-82%
	260	Altadena to Artesia	10,823	12,875	2,052	19%
	265	Pico Riviera to Lakewood	1,565	215	-1,350	-86%
	266	Sierra Madre Villa to Lakewood	5,057	5,158	101	2%
	577	El Monte to Long Beach	943	193	-750	-80%
	705	West Hollywood to Vernon	5,897	4,058	-1,839	-31%
	720	Santa Monica to Commerce	28,790	42,628	13,838	48%
	762	Pasadena to Artesia	3,938	1,542	-2,396	-61%
Total			212,234	196,581	-15,653	-7%

Source: WSP 2019

Table 3.16. Ridership Comparison for Transit Routes Within or Along Corridor

Operator	Route	Description	Observed Boardings	Estimated Boardings	Difference	% Difference
Metro	60	Artesia to Downtown LA	14,372	15,203	831	6%
	62	Hawaiian Gardens to LA Dt.	4,376	4,902	526	12%
	251	Cypress Park to Lynwood	9,028	6,761	-2,267	-25%
	751	Cypress Park to Huntington Park	4,911	2,370	-2,541	-52%
	760	Long Beach to Downtown LA	4,354	4,882	528	12%
	460	Disneyland to Downtown LA	4,843	5,785	942	19%
	611	Huntington Park Shuttle	1,572	749	-823	-52%
	612	South Gate Shuttle	1,260	438	-822	-65%
Total			44,716	41,090	-3,626	-8%

Source: WSP 2019

Note that the model is not expected to get the individual route correct, but for the corridor, it should do a reasonable job of reflecting the travel patterns and characteristics. As shown in Table 3.17, the total estimated boardings for bus and rail services are within 4 percent of their observed boardings, indicating the model understands the travel patterns in the Study Area and should be good to use for forecasting.

Table 3.17. Ridership Comparison for Metro Bus and Rail Services in the Corridor

Description	Observed Boardings	Estimated Boardings	Difference	% Difference
Bus and Rail Services	614,815	587,781	-27,034	-4%

Source: WSP 2019

4 ALTERNATIVE DEFINITION

This section provides a description of the No Build Alternative and the Build Alternatives (including their design options) analyzed in this study. The alternatives were developed through a comprehensive alternative screening process and they meet the Purpose and Need of the Project.

4.1 No Build Alternative

The National Environmental Policy Act and California Environmental Quality Act require the Build Alternatives be evaluated against existing transportation facilities in the Project Study Area and other capital transportation improvements and/or transit and highway operational enhancements that are reasonably foreseeable. Therefore, the No Build Alternative, against which the Build Alternatives' impacts are identified and evaluated, does not include the Project. The No Build Alternative in this study represents the Project Study Area in the year 2042 if the Project is not built and includes funded transportation improvements specified in the SCAG 2016 RTP/SCS and the financially constrained element of Metro's 2009 LRTP. The No Build transit network includes the bus and rail system programmed in Measure M by 2042 without the WSAB Line. The alignment and headway assumptions used for the urban rail lines and BRT in the No Build are shown in Table 4.1.

Table 4.1. Urban Rail and BRT Line Headways and Alignments in No Build

Urban Rail Line	Alignment	Headway (Min)	
		Peak	Off-Peak
D (Purple) Line	LAUS – VA Hospital	4	10
B (Red) Line	LAUS – North Hollywood	4	10
C (Green) Line	Norwalk – Expo/Crenshaw	5	10
	LAX 96th St – Torrance	5	10
North-South Line	Long Beach – Claremont	10	10
	Willow St. – Azusa	10	-
East-West Line	Santa Monica – Lambert	10	10
	Santa Monica – Peck Rd.	10	-
	Pomona/Atlantic – Peck Rd.	-	10
East SFV Line	Sylmar – Metro Orange Line (Van Nuys)	5	10
Sepulveda Line (HRT)	Orange Line Van Nuys – Expo Line	4	10
G (Orange) Line BRT	Del Mar – Chatsworth	8	16
	Del Mar – Canoga	8	16
Vermont BRT	Sunset Blvd. – 120th Street	5	10
North SFV BRT	North Hollywood - Chatsworth	6	12

Source: WSP 2019
Notes: BRT = bus rapid transit; HRT = heavy rail transit; LAUS = Los Angeles Union Station; SFV = San Fernando Valley; VA = Veterans Affairs

4.2 Build Alternatives

To develop the Build Alternatives in this study, the WSAB LRT Line is added to the No Build Alternative discussed above. The background network of transit remains the same as in the No Build Alternative, with no changes made to the bus network or urban rail headways and remains the same across the Build Alternatives. The WSAB LRT Line would be operated in the peak period with a 5-minute headway and the off-peak period with a 10-minute headway. Riders would be able to transfer at one or more of the following locations: to the A (Blue) Line at Slauson/A Line Station, to the B (Red)/D (Purple) Lines at the 7th Street/Metro Center Station or LAUS, and to the C (Green) Line at the I-105/C Line Station. This section briefly discusses the alternatives, including their station locations and operation plans (e.g., travel time, distance, and average speed).

Note that five of the Build Alternatives were previously studied as part of the Northern Alignment Options Screening Report. The alternatives selected for further analysis in that report followed a similar alignment to those currently being studied in the EIS/EIR process. Various refinements to the Project Definition have occurred as part of the refinement of operating plans and alignment during the current EIS/EIR process, including the removal of the Washington, Vernon, and 183rd/Gridley WSAB stations. Refer to the WSAB Travel Demand Forecast Technical Memorandum [4] for further information. Two additional shorter length alternatives (3 and 4) are also discussed in this report.

The Project has four Build Alternatives and two design options – Alternative 1, with the northern terminus at LAUS, Alternative 2, with the northern terminus at 7th Street/Metro Center Station, Alternative 3, with the northern terminus at the Slauson/A Line Station, and Alternative 4, with the northern terminus at the I-105/C Line Station. For Alternative 1, two design options are considered: (1) moving the northern terminus to east of the Metropolitan Water District (MWD) building instead of the Forecourt, and (2) adding the Little Tokyo Station. Therefore, the following seven Build Alternatives are analyzed in this report:

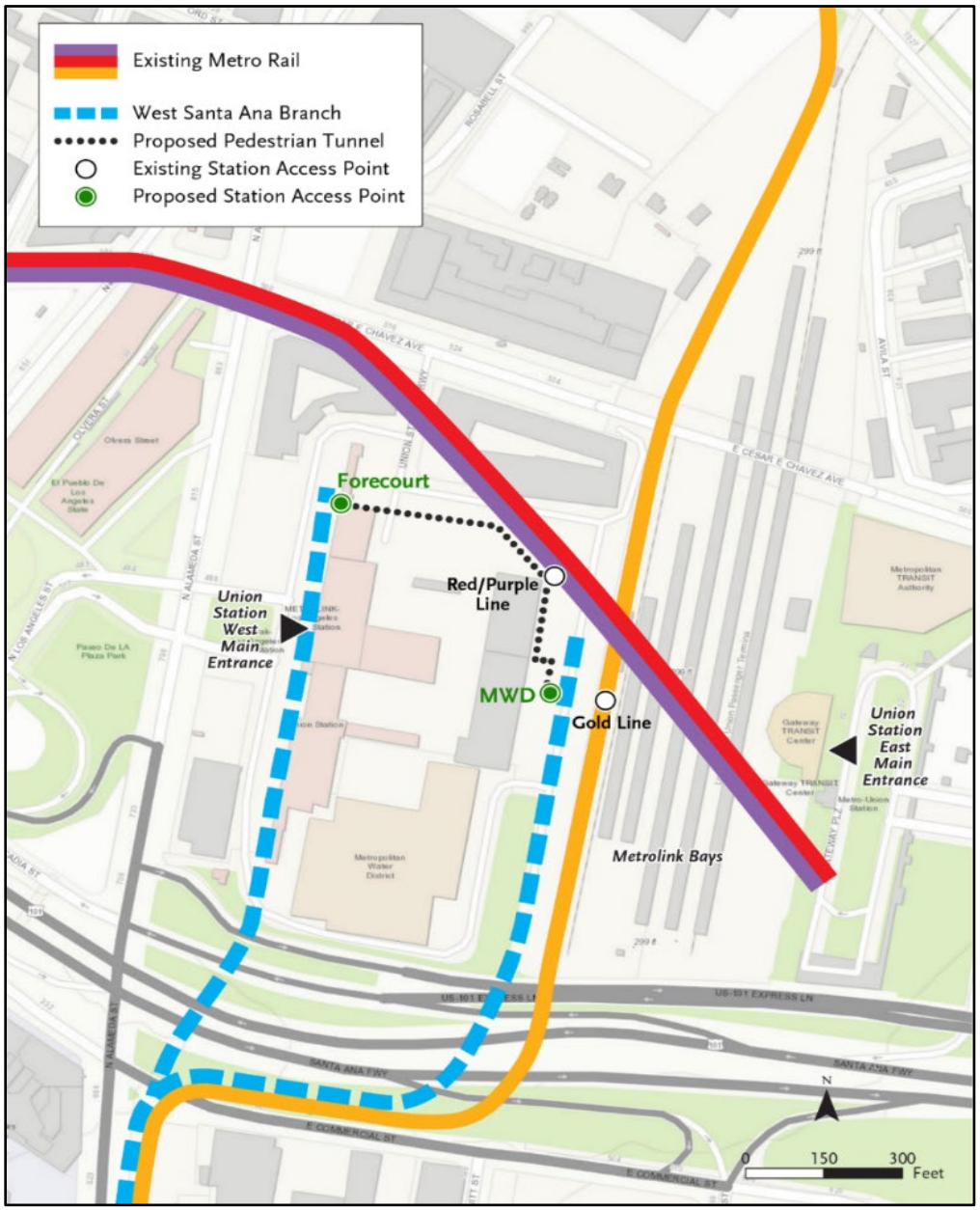
1. Alternative 1 (LAUS – Forecourt) without Little Tokyo Station
2. Alternative 1 with Design Option 1 (LAUS – MWD) without Little Tokyo Station
3. Alternative 1 (LAUS – Forecourt) with Design Option 2 – with Little Tokyo Station
4. Alternative 1 with Design Option 1 (LAUS – MWD) and Design Option 2 – with Little Tokyo Station
5. Alternative 2
6. Alternative 3
7. Alternative 4

The primary difference among the Build Alternatives is in the northern section of the alignment. Alternative 1 would start at LAUS and primarily run south beneath Alameda Avenue to the proposed Arts/Industrial District Station. Alternative 2 would start near the existing 7th Street/Metro Center Station in the Downtown Transit Core and would primarily run beneath 8th Street east to the proposed Arts/Industrial District Station. Neither Alternative 3 nor 4 extend into this northern section. Within Alternative 1, the main differences among the proposed options are the location of the northern terminus at LAUS (Forecourt vs. MWD) and whether Little Tokyo Station is included as a station on the WSAB Line.

[4] *Travel Demand Forecasting Results Technical Memorandum*, prepared for Metro by WSP, October 2018

As discussed earlier, LAUS is one of the major transit hubs in the Los Angeles transit system and provides connection to different urban rail lines. Figure 4-1 shows the proposed locations of the northern terminus under Alternative 1 (i.e., Forecourt and MWD) and the urban rail lines that would connect at LAUS. As can be observed from the figure, depending on the location of the WSAB station at LAUS, the transfer walk time between the WSAB and other urban rail lines would vary. Specifically, the Forecourt option would have a longer transfer walk time than the MWD option. To represent this in the transit network, adjustments were made in the travel demand model inputs. Table 4.2 shows the coded transfer walk times among the WSAB and urban rail lines at LAUS.

Figure 4-1. Proposed Forecourt and MWD Locations of the WSAB LAUS



Source: WSP 2019

Table 4.2. Transfer Walk Time between WSAB and Other Urban Rail Lines at Forecourt and MWD Stations

Transfer Walk Between	Walk Time (Forecourt)	Walk Time (MWD)
WSAB and North-South Lines	3.0 minutes	0.8 minutes
WSAB and B (Red) / D (Purple) Lines	2.8 minutes	1.8 minutes
WSAB and Commuter Rail Lines	3.8 minutes	3.0 minutes

Source: WSP 2019
Notes: MWD = Metropolitan Water District; WSAB = West Santa Ana Branch

Figure 4-2 presents the northern geographic section of the alternatives in downtown LA. As discussed previously and shown in this figure, the northern section of the alignment would vary across Alternatives 1 and 2. Therefore, the northern section is discussed separately by alternative. Since the southern section (from the Arts/Industrial District Station to Pioneer Station) would share the same alignment under each of the alternatives, it is discussed only once in this section.

Figure 4-2. Northern Section of the Build Alternatives

Source: WSP 2020

4.1.1 Alternative 1 LAUS – Forecourt without Little Tokyo Station

In the north, this alternative would begin at a proposed underground station at LAUS beneath the LAUS Forecourt. At LAUS, an existing parking facility with 200 spaces is assumed in this alternative. From LAUS, the alignment would continue underground crossing under the US-101 freeway and the existing Metro L (Gold) Line aerial structure. The alignment would continue underground to the Arts/Industrial District Station primarily beneath Alameda Street. The Little Tokyo Station would not be constructed and, thus, there would be no direct connection from the WSAB Line to the Regional Connector Station in the Little Tokyo community. In the north, it would serve two stations: LAUS and the Arts/Industrial District Station. The detailed station-to-station travel time and distance are discussed later in this section.

4.1.2 Alternative 1 LAUS – MWD without Little Tokyo Station (Design Option 1)

This alternative is the same as the alternative discussed above except for the location of the WSAB station at LAUS. The WSAB LAUS in this alternative would be located east of LAUS and the MWD building, below the baggage area parking facility. The alignment would proceed underground directly from LAUS MWD to the Arts/Industrial District Station primarily beneath Alameda Street. In the north, it would serve two stations: LAUS and the Arts/Industrial District Station.

4.1.3 Alternative 1 LAUS – Forecourt with Little Tokyo Station (Design Option 2)

This alternative is the same as the first alternative discussed above except that the Little Tokyo Station is included with a direct connection from the WSAB Line to the Regional Connector Station in the Little Tokyo community. From LAUS, the alignment would continue underground south beneath Alameda Street to the Little Tokyo Station between Traction Avenue and 1st Street. From the Little Tokyo Station, the alignment would continue underground beneath Alameda Street to the proposed Arts/Industrial District Station. In the north, it would serve three stations: LAUS, Little Tokyo, and the Arts/Industrial District Station.

4.1.4 Alternative 1 LAUS – MWD (Design Option 1) with Little Tokyo Station (Design Option 2)

This alternative is the same as the MWD option discussed above except that the Little Tokyo Station is included with a direct connection from the WSAB Line to the Regional Connector Station in the Little Tokyo community. The alignment would continue underground from the Little Tokyo Station to the Arts/Industrial District Station primarily beneath Alameda Street. In the north, it would serve three stations: LAUS, Little Tokyo, and the Arts/Industrial District Station.

4.1.5 Alternative 2 Downtown Core – 7th Street/Metro Center

In the north, Alternative 2 would begin at the proposed WSAB 7th Street/Metro Center Station, which would be located underground beneath 8th Street between Figueroa Street and Flower Street. A pedestrian tunnel would provide connection to the existing 7th Street/Metro Center Station. Tail tracks, including a double crossover, would extend approximately 1,100 feet beyond the station, partially crossing the I-110 freeway underground. From the 7th Street/Metro Center Station, the underground alignment would proceed southeast beneath 8th Street to the South Park/Fashion District Station, which would be located west of Main Street beneath 8th Street.

From the South Park/Fashion District Station, the underground alignment would continue under 8th Street to San Pedro Street, where the alignment would turn east toward 7th Street, crossing under privately owned properties. The tunnel alignment would cross under 7th Street and then turns south at Alameda Street. The alignment would continue south beneath Alameda Street to the Arts/Industrial District Station located under Alameda Street. In the north, it would serve three stations – 7th Street/Metro Center, South Park/Fashion District, and Arts/Industrial District.

4.1.6 Southern Section of the Build Alternatives

Alternatives 3 and 4 only include the southern section of the alignment, with Alternative 3 extending as far north as the Slauson/A Line Station and Alternative 4 covering a shorter portion to the I-105/C Line Station. All alternatives share the same southern terminus at the Pioneer Station. Figure 4-3 shows the alignment of the WSAB alternatives, including the southern section from south of the Arts/Industrial District Station to Pioneer Station. As shown in the figure, the southern section contains nine stations – in sequential order, from north to south, they are: Slauson/A Line, Pacific/Randolph, Florence/Salt Lake, Firestone, Gardendale, I-105/C Line, Paramount/Rosecrans, Bellflower, and Pioneer Stations. Six of the seven alternatives would include all nine southern section stations with Alternative 4 being the exception with only the four most southern stations.

Specifically, from the Arts/Industrial District Station, the alignment would continue south under Alameda Street to 8th Street where it would curve to the west under the Alameda Tower property between 8th Street and Olympic Boulevard. The alignment would transition to an aerial alignment south of Olympic Boulevard just north of 15th Street, crossing over the I-10 freeway south in an aerial configuration. The alignment would continue south parallel to the Metro A (Blue) Line. One aerial station would serve as transfer point to the Metro A (Blue) Line at the Slauson/A Line Station.

Just south of the Slauson/A Line Station, the alignment would turn east along the La Habra Branch right-of-way (ROW) along Randolph Street and transition to at-grade at Alameda Street. The alignment would serve the at-grade Pacific/Randolph Station just east of Pacific Boulevard.

From the Pacific/Randolph Station, the alignment would continue at-grade to the San Pedro ROW, where it would turn south in an aerial structure, returning to an at-grade configuration at Gage Avenue. The alignment would continue at-grade within the San Pedro ROW to the intersection of Salt Lake Avenue and Florence Avenue, where the Florence/Salt Lake Station would be located.

From the Florence/Salt Lake Station, the alignment would continue southeast with at-grade crossing improvements at Otis Avenue, Santa Ana Street, and Ardine Street. South of Ardine Street, the alignment would rise to an elevated structure over the existing Union Pacific Railroad (UPRR) track (south of Patata Street) and Atlantic Avenue. The elevated structure would be supported by a retained fill embankment with columns to bridge over the UPRR track and Atlantic Avenue before connecting to an elevated Firestone Station.

The alignment would continue south along the San Pedro Subdivision, crossing over the Los Angeles River, under the I-710 freeway, and over the Rio Hondo River. The alignment would then descend on retained fill to an at-grade configuration then connect to a proposed at-grade station on the north side of Gardendale Street.

Figure 4-3. Alignment of the WSAB Alternatives

Source: WSP 2019

From the Gardendale Station, the alignment would proceed south and cross over the I-105 freeway to include the I-105/C Line Station. The proposed station would allow passengers to transfer to the Metro C (Green) Line via a new in-line C (Green) Line Station. South of the proposed station, the at-grade alignment would follow the existing rail ROW, then rise to an aerial configuration. The alignment would then turn southeast and transition onto Metro-owned ROW and connect to a proposed aerial station west of Paramount Boulevard. The aerial alignment would continue southeast, then descend at-grade where an existing pedestrian bridge connecting Paramount High School and its West Campus baseball field would be reconstructed as an undercrossing.

The alignment then rises to an aerial configuration to cross over Downey Avenue. One of the adjacent storage tracks would be relocated north to connect with the World Energy facility. South of Somerset Boulevard is the entrance to the existing Bellflower Bike Trail that runs along the south side of the rail ROW. The alignment would continue at-grade with improvements for crossings at Clark Avenue and Alondra Boulevard. Northwest of Bellflower Boulevard the alignment would connect to a proposed at-grade station. To avoid an existing historic building located within the rail ROW, the LRT alignment would need to shift north.

The alignment would continue southeast within the rail ROW crossing Flower Street and Woodruff Avenue in an aerial configuration, then descend at-grade south of Woodruff Avenue. Continuing east, the at-grade alignment would approach SR-91 crossing under the freeway in an existing overhead. Approaching I-605, the alignment would continue under the freeway. Southeast of the underpass, the alignment would continue at-grade until the intersection of 183rd Street and Gridley Road where the alignment would be aerial. The alignment would then continue southeast at-grade before connecting to a proposed at-grade station located northwest of Pioneer Boulevard.

4.3 Station-to-Station Travel Distance and Time

Table 4.3 through Table 4.7 show station-to-station travel time, distance, and speed for the Build Alternatives. Among these, the first two tables represent Alternative 1 (with and without the Little Tokyo Station) and the third table represents Alternative 2. Since the travel times for the WSAB LAUS options (i.e., Forecourt and MWD) are assumed to be the same, separate tables are not presented for Forecourt and MWD options.

As can be observed from Table 4.3 and Table 4.5, both Alternative 1 and Alternative 2 would be about 19 miles in length. The end-to-end travel time would be approximately 31 minutes in both the southbound and northbound directions, with an average speed of nearly 37 mph. The elimination of Little Tokyo Station would reduce the travel time from 31 minutes to 30 minutes and increase the overall speed from 37 mph to 38 mph, as shown in Table 4.4. It is important to note that although the elimination of Little Tokyo Station would provide travel time savings of about one minute, the transfer opportunity between the WSAB and other urban rail lines at Little Tokyo Station would no longer be available in this alternative, which would impact the ridership of the line. Details are discussed in the travel forecasting results section.

Table 4.6 and Table 4.7 include the station-to-station travel time and distance for the two alternatives without a northern section. Alternative 3 would be over 14 miles in length with an average of about 37 mph, while Alternative 4, the shortest line at 6.3 miles, would have the fastest speed at about 39.4 mph.

Table 4.3. Alternative 1 (LAUS – Forecourt/MWD) with Little Tokyo Station to Pioneer Station

From Station	To Station	Southbound			Northbound		
		Distance (mile)	Time (min)	Speed (mph)	Distance (mile)	Time (min)	Speed (mph)
LAUS	Little Tokyo	0.6	1.5	23.5	0.6	1.5	23.5
Little Tokyo	Arts/Industrial District	0.8	1.7	28.8	0.8	1.7	28.8
Arts/Industrial District	Slauson/A Line	3.3	4.6	43.0	3.3	4.6	43.0
Slauson/A Line	Pacific/Randolph	1.2	2.3	29.6	1.2	2.3	29.8
Pacific/Randolph	Florence/Salt Lake	2.1	3.5	36.2	2.1	3.5	36.0
Florence/Salt Lake	Firestone	1.9	2.9	38.9	1.9	2.9	39.2
Firestone	Gardendale	2.2	3.3	41.0	2.2	3.3	41.0
Gardendale	I-105/C Line	0.6	1.5	24.3	0.6	1.6	23.7
I-105/C Line	Paramount/Rosecrans	0.8	2.0	23.4	0.8	2.0	23.4
Paramount/Rosecrans	Bellflower	2.4	3.4	41.6	2.4	3.4	41.6
Bellflower	Pioneer	3.1	4.2	44.2	3.1	4.2	44.2
Overall		18.8	30.8	36.7	18.8	30.8	36.7

Source: Connetics Transportation Group (CTG) 2018 and WSP 2019
Notes: LAUS = Los Angeles Union Station; min = minutes; mph = miles per hour; MWD = Metropolitan Water District

Table 4.4. Alternative 1 (LAUS – Forecourt/MWD) without Little Tokyo Station to Pioneer Station

From Station	To Station	Southbound			Northbound		
		Distance (mile)	Time (min)	Speed (mph)	Distance (mile)	Time (min)	Speed (mph)
LAUS	Arts/Industrial District	1.4	2.4	35.8	1.4	2.4	35.8
Arts/Industrial District	Slauson/A Line	3.3	4.6	43.0	3.3	4.6	43.0
Slauson/A Line	Pacific/Randolph	1.2	2.3	29.6	1.2	2.3	29.8
Pacific/Randolph	Florence/Salt Lake	2.1	3.5	36.2	2.1	3.5	36.0
Florence/Salt Lake	Firestone	1.9	2.9	38.9	1.9	2.9	39.2
Firestone	Gardendale	2.2	3.3	41.0	2.2	3.3	41.0
Gardendale	I-105/ C Line	0.6	1.5	24.3	0.6	1.6	23.7
I-105/C Line	Paramount/Rosecrans	0.8	2.0	23.4	0.8	2.0	23.4
Paramount/Rosecrans	Bellflower	2.4	3.4	41.6	2.4	3.4	41.6
Bellflower	Pioneer	3.1	4.2	44.2	3.1	4.2	44.2
Overall		18.8	30.0	37.7	18.8	30.0	37.7

Source: Connetics Transportation Group (CTG), 2018 and WSP 2019
Notes: LAUS = Los Angeles Union Station; min = minutes; mph = miles per hour; MWD = Metropolitan Water District

Table 4.5. Alternative 2 (7th Street/Metro Center to Pioneer Station)

From Station	To Station	Southbound			Northbound		
		Distance (mile)	Time (min)	Speed (mph)	Distance (mile)	Time (min)	Speed (mph)
7th Street/Metro Center	South Park/Fashion District	0.6	1.5	24.5	0.6	1.5	24.5
South Park/Fashion District	Arts/Industrial District	1.0	2.0	30.1	1.0	2.0	29.6
Arts/Industrial District	Slauson/A Line	3.2	4.4	42.8	3.2	4.4	42.8
Slauson/A Line	Pacific/Randolph	1.2	2.3	29.6	1.2	2.3	29.8
Pacific/Randolph	Florence/Salt Lake	2.1	3.5	36.2	2.1	3.5	36.0
Florence/Salt Lake	Firestone	1.9	2.9	38.9	1.9	2.9	39.2
Firestone	Gardendale	2.2	3.3	41.0	2.2	3.3	41.0
Gardendale	I-105/C Line	0.6	1.5	24.3	0.6	1.6	23.7
I-105/C Line	Paramount/Rosecrans	0.8	2.0	23.4	0.8	2.0	23.4
Paramount/Rosecrans	Bellflower	2.4	3.4	41.6	2.4	3.4	41.6
Bellflower	Pioneer	3.1	4.2	44.2	3.1	4.2	44.2
Total		18.9	31.0	36.7	18.9	31.0	36.6

Source: Connetics Transportation Group CTG 2018 and WSP 2019

Table 4.6. Alternative 3 - Slauson/A (Blue) Line to Pioneer Station

From Station	To Station	Southbound			Northbound		
		Distance (mile)	Time (min)	Speed (mph)	Distance (mile)	Time (min)	Speed (mph)
Slauson/A Line	Pacific/Randolph	1.2	2.3	29.6	1.2	2.3	29.8
Pacific/Randolph	Florence/Salt Lake	2.1	3.5	36.2	2.1	3.5	36.0
Florence/Salt Lake	Firestone	1.9	2.9	38.9	1.9	2.9	39.2
Firestone	Gardendale	2.2	3.3	41.0	2.2	3.3	41.0
Gardendale	I-105/C Line	0.6	1.5	24.3	0.6	1.6	23.7
I-105/C Line	Paramount/Rosecrans	0.8	2.0	23.4	0.8	2.0	23.4
Paramount/Rosecrans	Bellflower	2.4	3.4	41.6	2.4	3.4	41.6
Bellflower	Pioneer	3.1	4.2	44.2	3.1	4.2	44.2
Total		14.3	23.1	37.1	14.3	23.2	37.0

Source: Connetics Transportation Group (CTG) 2018 and WSP 2019
Notes: min = minutes; mph = miles per hour

Table 4.7. Alternative 4 - I-105/C (Green) Line to Pioneer Station

From Station	To Station	Southbound			Northbound		
		Distance (mile)	Time (min)	Speed (mph)	Distance (mile)	Time (min)	Speed (mph)
I-105/C Line	Paramount/Rosecrans	0.8	2.0	23.4	0.8	2.0	23.4
Paramount/Rosecrans	Bellflower	2.4	3.4	41.6	2.4	3.4	41.6
Bellflower	Pioneer	3.1	4.2	44.2	3.1	4.2	44.2
Total		6.3	9.6	39.4	6.3	9.6	39.4

Source: Connetics Transportation Group (CTG) 2018 and WSP 2019
Notes: min = minutes; mph = miles per hour

5 TRAVEL FORECASTING RESULTS

5.1 Future Year Model Inputs

To develop future year forecasts, the 2042 socio-demographic data and person trips tables were used to reflect future year demand. In addition, transit and highway networks were updated to reflect the future year supply side. Using these data, CBM18 was run to forecast future year travel patterns for the No Build and Build Alternatives discussed in the previous section. The next sections discuss the travel forecasting results, including the urban rail boardings by line, project boardings, region-wide daily transit trips, new transit trips, and daily user benefits for all seven alternatives.

5.2 Boarding Summary by Urban Rail Lines

Table 5.1 shows a comparison of the daily boardings for each of Metro's existing and proposed urban rail lines (in Measure M by 2042) across the alternatives considered in this study. The columns in the table were arranged in the order the alternatives were defined in the previous section – first, the No Build and then the Build Alternatives, beginning with Alternative 1 followed by the other three scenarios under Alternative 1, which include the design options, and Alternatives 2 through 4.

As can be observed from Table 5.1, depending on the WSAB Line alignment and the presence of the Little Tokyo Station on the WSAB Line, the systemwide urban rail boardings and the boardings on individual rail lines would vary by alternative. Among the alternatives, Alternative 2 would have the most systemwide urban rail daily boardings with 1,069,300, followed by 1,062,400 for Alternative 1 – Forecourt with Little Tokyo Station (Design Option 2) and 1,055,700 Alternative 1 – MWD with Little Tokyo Station (Design Options 1 and 2). The elimination of the Little Tokyo Station from Alternative 1 would decrease the systemwide boardings for both the design options – by 21,100 in the Forecourt option and 3,100 in the MWD option. Alternatives 3 and 4 have the least urban rail boardings with 1,024,400 and 1,009,100, respectively.

Also of importance in Table 5.1 are the boardings on the WSAB Line because this is the change to the system across the alternatives. Among the alternatives, Alternative 2 would have the most WSAB Line boardings with 82,800, followed by Alternative 1 – with Design Options 1 and 2 (MWD with Little Tokyo Station) with 72,200, and Alternative 1 with Design Option 2 only (with Little Tokyo Station) with 68,800. The WSAB Lines with the Little Tokyo Station would have more boardings than those without the Little Tokyo Station because the Little Tokyo Station would provide an additional opportunity for riders to transfer among different urban rail lines in the system.

To create the Build Alternatives, the Project is added to the No Build urban rail system. Therefore, to evaluate the performance of the Build Alternatives in terms of boardings/ridership, they are compared to the No Build Alternative. Table 5.2 shows the boarding difference between the Build Alternatives and No Build Alternative boardings. To understand the differences better, the change in boardings are displayed by a stacked bar chart in Figure 5-1. The figure is interesting as it clearly shows the competition and synergy among the urban rail lines in Los Angeles' Metro system.

For example, the ridership on the North-South Line, one of the busiest lines in the system, would decrease in all the Build Alternatives with a northern section, indicating that the WSAB Line provides relief for the North-South Line in those alternatives. This is the result of the WSAB providing a faster travel time through downtown LA than the North-South Line, and since they share a station at Slauson Avenue, there is an easy means of transfer between the two lines. Traveling on the WSAB Line from the Slauson/A Line Station to 7th Street/Metro Center in Alternative 2 would be 11 minutes faster than traveling on the North-South Line between the same stations. Similarly, the WSAB Line would provide about 19 minutes in-vehicle travel time savings from the Slauson/A Line Station to LAUS. Because of these travel time savings and the overlapping coverage areas of these two lines between the Slauson/A Line Station and downtown Los Angeles, some riders would shift from the North-South Line to the WSAB Line. As can be observed from Figure 5-1, the highest shift (17,600) would occur in Alternative 2, followed by Alternative 1 without the Little Tokyo Station (11,400) and Alternative 1 with Design Options 1 and 2 (6,700). Because Alternatives 3 and 4 do not extend into the northern section, both alternatives have a slight increase in boardings on the North-South Line. Since Alternative 3 terminates at the Slauson/A Line Station, riders desiring to go farther north on rail would have to transfer to the North-South Line. In Alternative 4, riders would also have access to the North-South Line; however, it would take two transfers, one at the I-105/C Line Station and again at the A (Blue) Line Willowbrook/Rosa Parks Station.

Further, the figure shows that the ridership on some of the urban rail lines (e.g., B (Red) and D (Purple) Lines) would increase in the Build Alternatives, indicating the synergy among the urban rail lines in the system. Among the alternatives, the ridership would increase the most in Alternative 2, specifically on the D (Purple), B (Red), and Sepulveda Pass Lines. This is because the WSAB Line in this alternative would create a faster trip for riders traveling from the Study Area to the Westside (and vice versa) through the connection with the B (Red) and D (Purple) lines at the 7th Street/Metro Center Station. In Alternative 1, some of these riders would transfer from the WSAB Line to the East-West Line at the Little Tokyo Station and then travel to 7th Street/Metro Center on the East-West Line to transfer to the B (Red)/D (Purple) Line. Because of this travel pattern, the boardings on the East-West Line would increase in these alternatives. The elimination of Little Tokyo Station from Alternative 1 would exclude the opportunity to transfer from the WSAB Line to the East-West Line at this station and shift these riders to LAUS (Forecourt/MWD). These paths and travel times are discussed in more detail in Section 5.5, Travel Time Savings/Efficiency of Transfer.

Table 5.1. Daily Boarding Summary by Urban Rail Lines

Urban Rail Line	Headway		No Build	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3	Alternative 4
	Peak	Off-Peak								
D (Purple) Line (Union Station - VA Hospital)	4	10	214,500	216,600	216,000	214,200	213,700	223,100	215,700	214,900
B (Red) Line (Union Station - North Hollywood)	4	10	122,100	122,300	121,600	119,900	119,600	126,400	122,500	122,200
C (Green) Line (Norwalk - Expo/Crenshaw)	5	10	91,500	89,300	89,600	89,100	89,400	87,900	90,200	95,900
C (Green) Line (LAX 96th St - Torrance)	5	10	21,100	21,400	21,500	21,400	21,400	21,100	21,200	21,200
N-S Line (Long Beach - Claremont) - NB	10	10	72,600	66,500	67,400	66,900	66,700	63,800	73,600	72,900
N-S Line (Long Beach - Claremont) - SB	10	10	91,000	89,400	92,200	93,400	91,900	88,000	90,600	91,100
N-S Line (Willow St - Azusa)	10	-	48,900	45,200	47,700	49,400	47,200	43,100	49,700	49,300
E-W Line (Santa Monica - Lambert)	10	10	92,800	90,800	90,800	96,600	93,700	92,100	91,700	92,700
E-W Line (Santa Monica – SR-60/Peck Road)	10	-	39,400	39,200	39,200	43,100	40,300	39,300	39,300	39,400
E-W Line (Pomona/Atlantic - Peck Road)	-	10	3,100	3,100	3,100	3,100	3,100	3,100	3,100	3,100
East SFV Line (Sylmar - Van Nuys)	5	10	76,900	77,100	77,100	77,100	77,100	77,700	77,100	77,000
Sepulveda Pass HRT (Van Nuys - Expo)	4	10	118,100	119,600	119,700	119,400	119,400	120,900	118,700	118,300
West Santa Ana Branch Line	5	10	-	60,800	66,800	68,800	72,200	82,800	31,000	11,100
Total			**992,000**	**1,041,300**	**1,052,700**	**1,062,400**	**1,055,700**	**1,069,300**	**1,024,400**	**1,009,100**

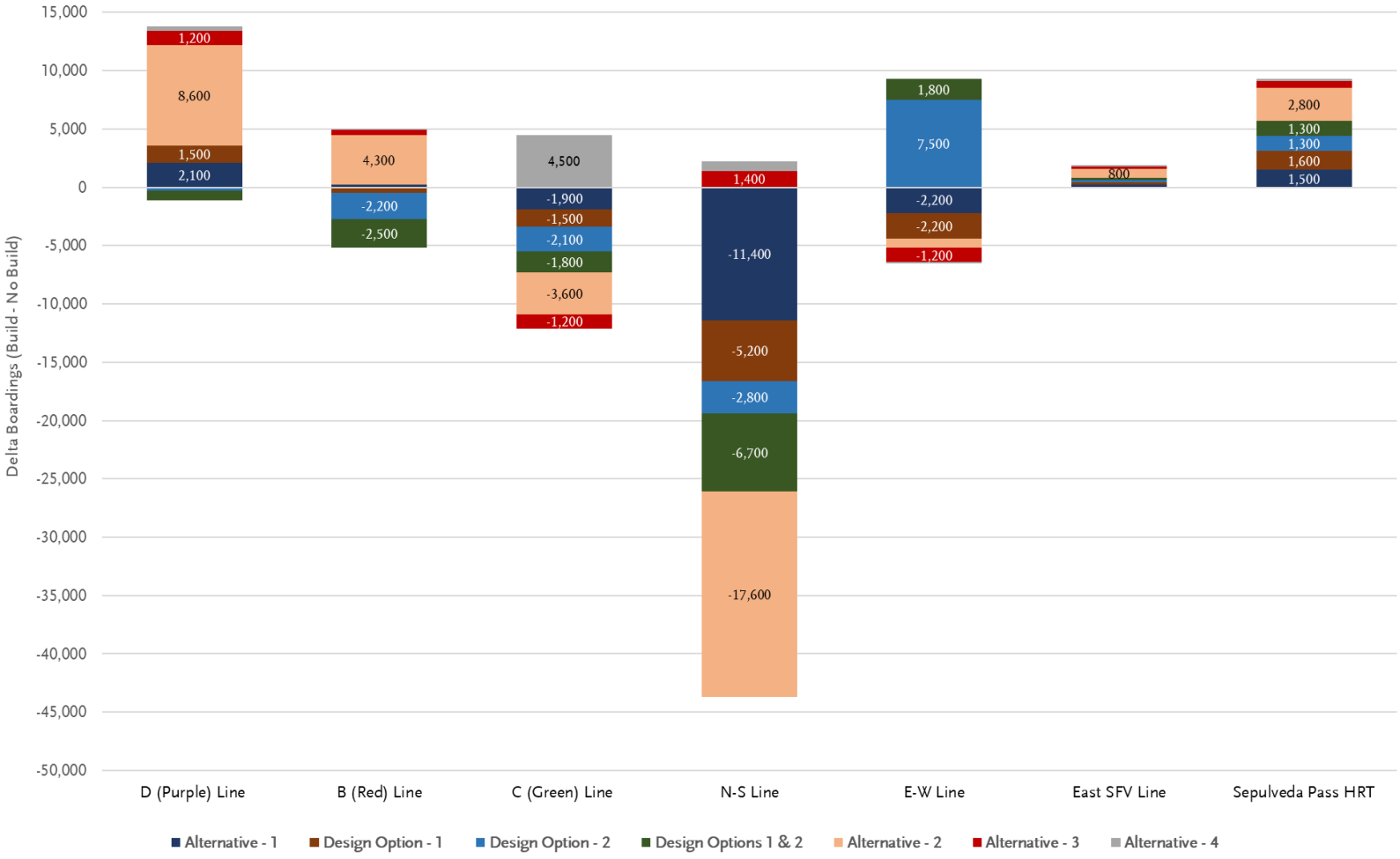
Source: WSP 2019
Notes: E = east; HRT = heavy rail transit; LAX = Los Angeles International Airport; N = north; NB = northbound; S = south; SB = southbound; SFV = San Fernando Valley; W = west; VA = Veterans Affairs

Table 5.2. Change in Boardings Summary by Urban Rail Lines

Urban Rail Line	Difference (Build - No Build)						
	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3	Alternative 4
D (Purple) Line	2,100	1,500	-300	-800	8,600	1,200	400
B (Red) Line	200	-500	-2,200	-2,500	4,300	400	100
C (Green) Line	-1,900	-1,500	-2,100	-1,800	-3,600	-1,200	4,500
N-S Line	-11,400	-5,200	-2,800	-6,700	-17,600	1,400	800
E-W Line	-2,200	-2,200	7,500	1,800	-800	-1,200	-100
East SFV Line	200	200	200	200	800	200	100
Sepulveda Pass HRT	1,500	1,600	1,300	1,300	2,800	600	200

Source: WSP 2019
Notes: E = east; HRT = heavy rail transit; N = north; S = south; SFV = San Fernando Valley; W = west

Figure 5-1. Change in Boardings (Build – No Build) Summary by Urban Rail Lines



Source: WSP 2019
Note: Patterns (e.g., short and long) were combined for the Green, North-South and East-West Lines

5.3 Project Boardings

Project boardings are the boardings that are directly associated with the Project. In this study, the WSAB Line has been added to the No Build network as a stand-alone line to develop the networks for the Build Alternatives. Therefore, the daily project boardings are simply daily boardings on the WSAB Line.

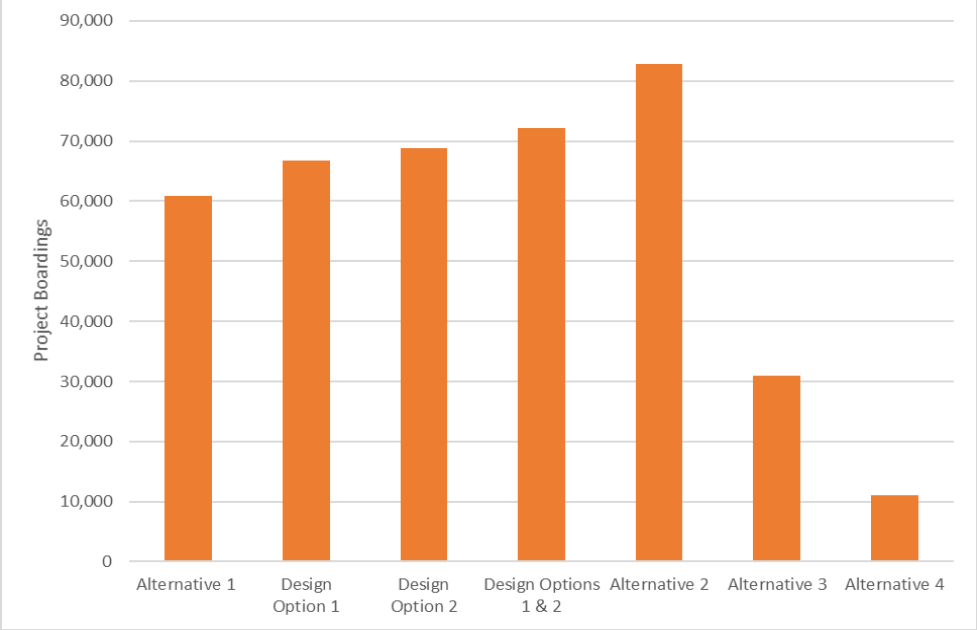
Table 5.3 and Figure 5-2 present the daily project boardings for all the Build Alternatives. Among the alternatives, Alternative 2 would have the most daily project boardings (82,800), followed by alternatives with Design Option 2 having 72,200 and 68,800 boardings. Alternatives 3 and 4 have the fewest project boardings (31,000 and 11,100, respectively), primarily because these two lines are shorter in length and lack a connection to a major activity center or transit hub.

Table 5.3. Project Boardings by Alternative

Alternative	Project Boardings
Alternative 1	60,800
Design Option 1	66,800
Design Option 2	68,800
Design Options 1 and 2	72,200
Alternative 2	82,800
Alternative 3	31,000
Alternative 4	11,100

Source: WSP 2019

Figure 5-2. Project Boardings by Alternative



Source: WSP 2019

The project station boardings and alightings by time period are presented in Table 5.4 through Table 5.10 for all the alternatives. During the trip assignment, the transit trips are assigned to two networks. The trips in the peak periods are assigned to the AM peak period (6AM to 9AM) network, which also serves as a proxy for the PM peak (3PM to 7PM), and the off-peak trips are assigned to the mid-day (9AM to 3PM) network, which also represents all remaining off-peak service. For the peak period, the assumption is made that half of the peak trips occur in the AM and the other half in the reverse direction occur in the PM peak. For example, if a rider takes the train to work in the morning peak, they take the reverse trip home in the PM peak, and the same assumption is made for the off-peak service. Therefore, to calculate the "Total Peak" and "Total Off-peak" boardings and alightings at a station, the boardings and alightings in the southbound and northbound directions are added together and divided by two. The "Daily" column represents the total boardings in the peak and off-peak periods. The peak period includes 6AM to 9AM and 3PM to 7PM, for a total of seven hours, and the remainder of the day is represented in the off-peak period.

As can be observed from the tables, the total boardings in the peak period would be higher than those in the off-peak period in all the alternatives. Further, within the peak period, the total boardings in the northbound direction (i.e., from Pioneer Station to LAUS or 7th Street/Metro Center Station) would be higher than the total boardings in the southbound direction because the northbound direction is the peak direction in the system. Further, among the project stations, the stations that would provide an opportunity to transfer to other urban and/or commuter rail lines (and vice versa) would have more boardings than the other stations on the alignment. Among the 12 stations of Alternative 1 with Design Option 2 shown in Table 5.6, Little Tokyo Station would have the most daily boardings with 16,000, followed by Slauson/A Line Station (10,400) and LAUS (9,600). In this alternative, the Little Tokyo Station would have more boardings than LAUS because the longer transfer walk times between the LAUS Forecourt and other urban rail lines would discourage some riders from traveling to LAUS to transfer to other urban rail lines (and vice versa). Instead, the riders would have a faster trip by transferring at the Little Tokyo Station. Because of this, the transfer volumes at Little Tokyo would be significantly higher in this alternative. The elimination of the Little Tokyo Station would shift some of these riders to LAUS, as can be observed for Alternative 1 without Little Tokyo Station. LAUS in this alternative would have the most ridership (20,400 boardings/day), followed by the Slauson/A Line Station (8,400 boardings/day) and the I-105/C Line Station (5,800 boardings/day).

In the alternatives with the WSAB LAUS at MWD (Design Option 1) in Table 5.5 and Table 5.7, LAUS would have the most boardings in both the alternatives, regardless of the presence of the Little Tokyo Station on the alignment. In Alternative 2 (Table 5.8), the 7th Street/Metro Center Station would have the most boardings (31,000 boardings/day) followed by the Slauson/A Line Station (15,100 boardings/day) and the I-105/C Line Station (6,400 boardings/day). Alternative 3, the northernmost station, the Slauson/A Line Station has the most boardings (8,000 boardings/day), followed by the I-105/C Line Station (4,500 boardings/day) (Table 5.9). Alternative 4 has the most boardings at the termini of the line with over 4,500 boardings/day at the I-105/C Line Station and 3,400 boardings/day at the Pioneer Station (Table 5.10).

Table 5.4. Station-to-Station Boardings Alternative 1

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
Union Station (Forecourt)	11,633	0	0	19,655	15,644	15,644	2,380	0	0	7,084	4,732	4,732	20,376	20,376
Arts/Industrial District	118	1,714	253	956	1,520	1,520	111	386	193	618	654	654	2,174	2,174
Slauson/A Line	1,050	4,939	5,838	1,218	6,522	6,522	893	526	1,465	947	1,915	1,915	8,437	8,437
Pacific/Randolph	210	1,479	1,233	618	1,770	1,770	307	809	891	644	1,325	1,325	3,095	3,095
Florence/Salt Lake	716	815	2,540	538	2,304	2,304	698	535	1,871	574	1,839	1,839	4,143	4,143
Firestone	1,053	790	4,245	314	3,201	3,201	662	535	1,990	293	1,740	1,740	4,941	4,941
Gardendale	289	400	546	159	697	697	321	247	427	154	574	574	1,271	1,271
I-105/C Line	1,672	1,910	2,971	1,271	3,912	3,912	1,036	884	1,175	674	1,884	1,884	5,796	5,796
Paramount/Rosecrans	339	911	1,435	119	1,402	1,402	279	601	658	147	842	842	2,244	2,244
Bellflower	422	914	1,726	147	1,604	1,604	392	700	872	125	1,044	1,044	2,648	2,648
Pioneer	0	3,630	4,208	0	3,919	3,919	0	1,856	1,718	0	1,787	1,787	5,706	5,706
Total	**17,502**	**17,502**	**24,995**	**24,995**	**42,495**	**42,495**	**7,079**	**7,079**	**11,260**	**11,260**	**18,336**	**18,336**	**60,831**	**60,831**

Source: WSP 2019

Table 5.5. Station-to-Station Boardings Design Option 1

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
Union Station (MWD)	15,177	0	0	21,327	18,252	18,252	2,712	0	0	7,635	5,173	5,173	23,425	23,425
Arts/Industrial District	113	1,946	297	893	1,624	1,624	107	454	224	610	697	697	2,321	2,321
Slauson/A Line	1,038	7,820	6,761	1,205	8,412	8,412	880	608	1,614	939	2,020	2,020	10,432	10,432
Pacific/Randolph	209	1,620	1,304	617	1,875	1,875	306	850	940	644	1,370	1,370	3,245	3,245
Florence/Salt Lake	714	851	2,640	530	2,367	2,367	696	560	1,945	573	1,887	1,887	4,254	4,254
Firestone	1,051	805	4,386	319	3,280	3,280	661	545	2,059	290	1,777	1,777	5,057	5,057
Gardendale	289	400	565	165	709	709	318	258	444	157	588	588	1,297	1,297
I-105/C Line	1,657	1,996	3,099	1,275	4,013	4,013	1,033	886	1,245	677	1,920	1,920	5,933	5,933
Paramount/Rosecrans	340	933	1,479	120	1,436	1,436	280	609	675	148	856	856	2,292	2,292
Bellflower	422	931	1,767	146	1,633	1,633	392	717	893	125	1,063	1,063	2,696	2,696
Pioneer	0	3,708	4,299	0	4,003	4,003	0	1,898	1,759	0	1,828	1,828	5,831	5,831
Total	**21,010**	**21,010**	**26,597**	**26,597**	**47,604**	**47,604**	**7,385**	**7,385**	**11,798**	**11,798**	**19,179**	**19,179**	**66,783**	**66,783**

Source: WSP 2019

Table 5.6. Station-to-Station Boardings Design Option 2

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
Union Station (Forecourt)	8,498	0	0	3,822	6,160	6,160	2,011	0	0	4,889	3,450	3,450	9,610	9,610
Little Tokyo	7,061	811	428	17,998	13,149	13,149	1,419	378	51	3,858	2,853	2,853	16,002	16,002
Arts/Industrial District	100	1,815	273	668	1,428	1,428	87	565	253	477	691	691	2,119	2,119
Slauson/A Line	1,001	7,644	6,650	1,107	8,201	8,201	866	683	1,994	867	2,205	2,205	10,406	10,406
Pacific/Randolph	204	1,552	1,308	614	1,839	1,839	305	894	1,038	643	1,440	1,440	3,279	3,279
Florence/Salt Lake	708	854	2,625	530	2,358	2,358	688	575	2,077	571	1,955	1,955	4,313	4,313
Firestone	1,049	782	4,361	310	3,251	3,251	660	554	2,164	288	1,833	1,833	5,084	5,084
Gardendale	278	399	563	166	703	703	321	263	463	153	600	600	1,303	1,303
I-105/C Line	1,658	1,946	3,055	1,250	3,954	3,954	1,030	912	1,276	658	1,938	1,938	5,892	5,892
Paramount/Rosecrans	340	938	1,449	119	1,423	1,423	279	611	687	147	862	862	2,285	2,285
Bellflower	423	908	1,744	146	1,610	1,610	392	716	899	126	1,066	1,066	2,676	2,676
Pioneer	0	3,671	4,274	0	3,972	3,972	0	1,907	1,775	0	1,841	1,841	5,813	5,813
Total	**21,320**	**21,320**	**26,730**	**26,730**	**48,048**	**48,048**	**8,058**	**8,058**	**12,677**	**12,677**	**20,734**	**20,734**	**68,782**	**68,782**

Source: WSP 2019

Table 5.7. Station-to-Station Boardings Design Options 1 and 2

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
Union Station (MWD)	15,115	0	0	17,448	16,281	16,281	2,759	0	0	5,941	4,350	4,350	20,631	20,631
Little Tokyo	1,923	1,329	511	5,779	4,771	4,771	992	513	61	3,079	2,322	2,322	7,093	7,093
Arts/Industrial District	99	1,997	302	663	1,530	1,530	87	588	262	477	707	707	2,237	2,237
Slauson/A Line	1,008	8,182	7,325	1,109	8,812	8,812	856	770	2,055	869	2,275	2,275	11,087	11,087
Pacific/Randolph	205	1,606	1,379	617	1,903	1,903	304	895	1,064	641	1,452	1,452	3,355	3,355
Florence/Salt Lake	705	883	2,734	533	2,427	2,427	687	594	2,113	574	1,984	1,984	4,411	4,411
Firestone	1,048	797	4,519	309	3,336	3,336	659	570	2,204	286	1,859	1,859	5,195	5,195
Gardendale	278	416	582	162	719	719	319	265	472	155	605	605	1,324	1,324
I-105/C Line	1,663	1,996	3,147	1,247	4,026	4,026	1,024	915	1,312	657	1,954	1,954	5,980	5,980
Paramount/Rosecrans	339	941	1,493	119	1,446	1,446	279	624	697	148	874	874	2,320	2,320
Bellflower	423	923	1,789	146	1,640	1,640	392	716	914	125	1,073	1,073	2,713	2,713
Pioneer	0	3,736	4,351	0	4,043	4,043	0	1,908	1,798	0	1,853	1,853	5,896	5,896
Total	**22,806**	**22,806**	**28,132**	**28,132**	**50,934**	**50,934**	**8,358**	**8,358**	**12,952**	**12,952**	**21,308**	**21,308**	**72,242**	**72,242**

Source: WSP 2019

Table 5.8. Station-to-Station Boardings Alternative 2

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
7th Street/Metro Center	13,452	0	0	35,936	24,694	24,694	2,666	0	0	9,755	6,210	6,210	30,904	30,904
South Park/Fashion District	129	914	384	1,071	1,249	1,249	170	168	351	757	723	723	1,972	1,972
Arts/Industrial District	117	1,441	469	680	1,353	1,353	98	590	346	478	756	756	2,109	2,109
Slauson/A Line	978	6,307	18,441	890	13,308	13,308	856	223	1,858	716	1,826	1,826	15,134	15,134
Pacific/Randolph	208	1,365	1,643	616	1,916	1,916	303	906	1,266	639	1,557	1,557	3,473	3,473
Florence/Salt Lake	707	820	3,070	530	2,563	2,563	695	573	2,350	565	2,091	2,091	4,654	4,654
Firestone	1,051	740	4,932	323	3,523	3,523	658	558	2,388	295	1,949	1,949	5,472	5,472
Gardendale	279	389	668	157	746	746	320	252	521	155	624	624	1,370	1,370
I-105/C Line	1,665	1,912	3,884	1,249	4,355	4,355	1,029	911	1,523	654	2,058	2,058	6,413	6,413
Paramount/Rosecrans	341	895	1,634	119	1,494	1,494	279	632	752	148	905	905	2,399	2,399
Bellflower	424	921	1,930	147	1,711	1,711	392	716	982	125	1,107	1,107	2,818	2,818
Pioneer	0	3,647	4,663	0	4,155	4,155	0	1,937	1,950	0	1,943	1,943	6,098	6,098
Total	**19,351**	**19,351**	**41,718**	**41,718**	**61,067**	**61,067**	**7,466**	**7,466**	**14,287**	**14,287**	**21,749**	**21,749**	**82,816**	**82,816**

Source: WSP 2019

Table 5.9. Station-to-Station Boardings Alternative 3

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
Slauson/A Line	2,957	0	0	8,184	5,570	5,570	1,550	0	0	3,282	2,416	2,416	7,986	7,986
Pacific/Randolph	213	736	704	638	1,145	1,145	309	602	461	642	1,007	1,007	2,152	2,152
Florence/Salt Lake	731	511	1,634	536	1,706	1,706	716	393	1,166	577	1,426	1,426	3,132	3,132
Firestone	1,277	521	2,756	355	2,454	2,454	697	471	1,276	314	1,379	1,379	3,833	3,833
Gardendale	293	295	319	160	533	533	331	207	263	157	479	479	1,012	1,012
I-105/C Line	1,714	1,439	1,020	1,561	2,867	2,867	1,043	810	616	750	1,609	1,609	4,476	4,476
Paramount/Rosecrans	343	739	898	118	1,049	1,049	279	542	437	147	702	702	1,751	1,751
Bellflower	425	797	1,215	148	1,292	1,292	392	662	610	125	894	894	2,186	2,186
Pioneer	0	2,915	3,154	0	3,034	3,034	0	1,630	1,165	0	1,397	1,397	4,431	4,431
Total	**7,953**	**7,953**	**11,700**	**11,700**	**19,650**	**19,650**	**5,317**	**5,317**	**5,994**	**5,994**	**11,309**	**11,309**	**30,959**	**30,959**

Source: WSP 2019

Table 5.10. Station-to-Station Boardings Alternative 4

Station	Peak Period						Off-peak Period						Daily	
	Southbound (Read Down)		Northbound (Read Up)		Total Peak		Southbound (Read Down)		Northbound (Read Up)		Total Off-Peak			
	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off	On	Off
I-105/C Line	2,758	0	0	3,574	3,166	3,166	1,502	0	0	1,223	1,362	1,362	4,528	4,528
Paramount/Rosecrans	375	558	597	123	826	826	308	431	279	152	585	585	1,411	1,411
Bellflower	431	682	846	148	1,053	1,053	399	545	406	126	738	738	1,791	1,791
Pioneer	0	2,324	2,402	0	2,363	2,363	0	1,233	816	0	1,024	1,024	3,387	3,387
Total	**3,564**	**3,564**	**3,845**	**3,845**	**7,408**	**7,408**	**2,209**	**2,209**	**1,501**	**1,501**	**3,709**	**3,709**	**11,117**	**11,117**

Source: WSP 2019

5.4 Daily Transit Trips and New Transit Trips

This section discusses transit trip related results. A transit trip includes the entire journey as one trip, even if there is a transfer in the middle. The region-wide daily transit trips and the new transit trips are discussed, and then the new transit trips by travel markets are discussed for all the alternatives considered in the analysis.

Based on the future year demand (e.g., population and employment) and supply (e.g., highway and transit networks) used in the No Build Alternative, the Los Angeles metropolitan region is forecast to have over 1.74 million daily transit trips in 2042. In general, adding transit supply in the Build Alternatives increases the number of transit trips. Therefore, total daily transit trips are predicted to increase with the addition of the WSAB Project. Table 5.11 shows the 2042 region-wide daily and new transit trips by alternative.

Table 5.11. Daily Transit Trips and New Transit Trips (2042)

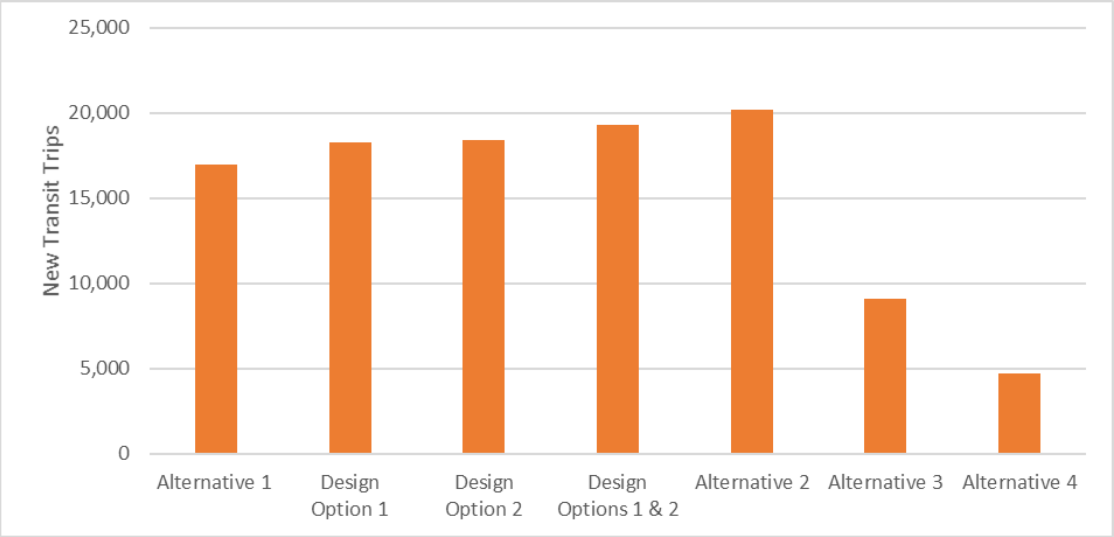
Alternative	Transit Trips	New Transit Trips
No Build	1,745,500	
Alternative 1	1,762,500	17,000
Design Option 1	1,763,800	18,300
Design Option 2	1,763,900	18,400
Design Options 1 and 2	1,764,800	19,300
Alternative 2	1,765,700	20,200
Alternative 3	1,754,600	9,100
Alternative 4	1,750,200	4,700

Source: WSP 2019

To evaluate the performance of the Build Alternatives, new transit trips were calculated. The new transit trips are the trips that shift from auto in the No Build Alternative to a transit mode in the Build Alternative as a result of building the Project. These new trips on the WSAB Line may also use other transit lines in the network as a part of their trip. New transit trips are an important measurement because they represent the people who would likely take transit rather than drive a car to reach their destination if a convenient, reliable transit option were available. As shown in Table 5.11, depending on the alternative, the number of transit trips would vary from over 1.750 million for Alternative 4 to over 1.765 million for Alternative 2. The increase in daily transit trips would vary from nearly 4,700 for Alternative 4 to over 20,200 for Alternative 2, as shown in Table 5.11 and Figure 5-3.

To understand the travel markets of the new transit trips, these trips were divided into the same four travel markets discussed previously: (1) travel within the corridor (i.e., both origin and destination are in the Study Area), (2) travel from the corridor to destinations outside the corridor (i.e., only origin is in the Study Area), (3) travel to the corridor from origins outside the corridor (i.e., only destination is in the Study Area), and (4) travel outside the corridor (i.e., both origin and destination are outside the Study Area).

Figure 5-3. Daily New Transit Trips (2042)



Source: WSP 2019

Table 5.12 and Figure 5-4 show the new transit trips by travel market. Among the four travel markets, the most new transit trips would occur within the corridor for all the alternatives except Alternative 2. For Alternative 2, the new transit trips travel from the corridor to destinations outside the corridor, mainly because of 4,100 trips in the submarket "to districts west of the Study Area (Central LA, Gateway Cities West, South Bay, and Westside Cities)." Further segmentation of this submarket shows that the number of trips from the Study Area to Central LA and Westside Cities would be higher in Alternative 2 (than other alternatives) and make the difference across the alternatives. The 7th Street/Metro Center Station at the northern end of this alternative would create a faster trip (compared to other alternatives) for the riders traveling from the Study Area to the districts west of the Study Area and, therefore, attract more riders in this submarket. The detailed travel time savings for this trip are discussed in Section 5.5.

In the third market (travel to the corridor from origins outside the corridor), the three Alternative 1s with design options would have more new transit trips than Alternative 2, mainly because of attracting some longer Metrolink trips (produced in North County and San Bernardino District) to the corridor via LAUS. This can be observed from the user benefit map comparison of Alternative 1 and Alternative 2 discussed in Section 5.7.

Since a substantial number of daily person trips are anticipated to occur between Orange County and Westside Cities plus San Fernando Valley and pass through the corridor, the fourth market "travel outside the corridor" was divided into two submarkets to separate the new transit trips in this segment. As can be observed from the table, Alternative 2 would have about 300 more new pass-through transit trips than Alternative 1. This can also be attributed to the advantage of the 7th Street/Metro Center Station in Alternative 2 discussed above.

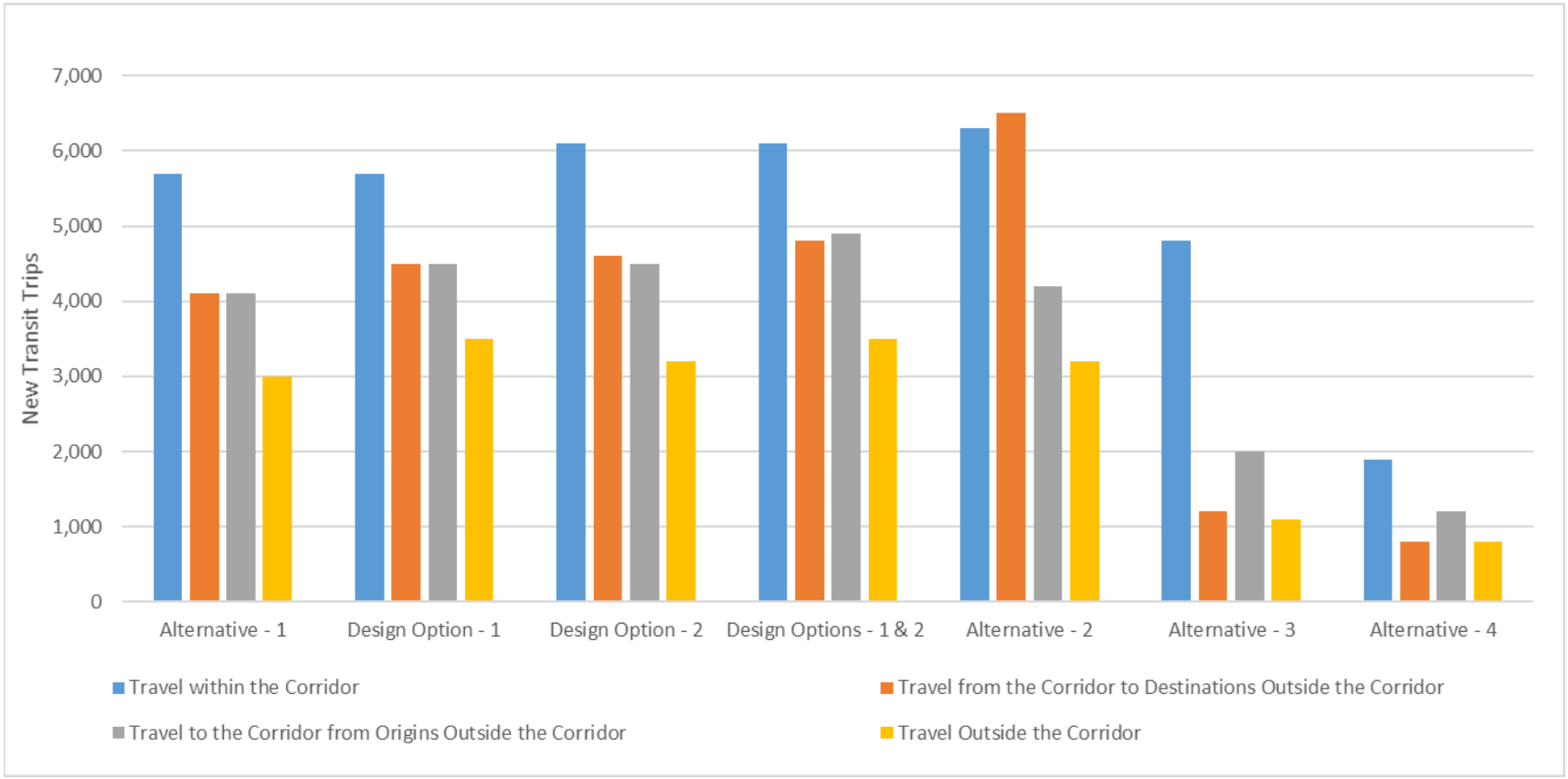
Table 5.12. Daily New Transit Trips by Travel Market (2042)

Market	To or From	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3	Alternative 4
Travel within the Corridor	Within the Study Area	**5,700**	**5,700**	**6,100**	**6,100**	**6,300**	**4,800**	**1,900**
Travel from the Corridor to Destinations Outside the Corridor	To districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities) (Segmented Trips: Central LA + Gateway Cities West + South Bay + Westside Cities)	2,100	2,200	2,300	2,400	4,100	600	500
		(600 + 100 + 100 + 1,300)	(600 + 150 + 150 + 1,300)	(700 + 100 + 100 + 1,400)	(700 + 150 + 150 + 1,400)	(1,400 + 100 + 100 + 2,500)	(100 + 100 + 100 + 300)	(100 + 100 + 100 + 200)
	To districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	400	600	800	800	500	200	100
	To districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	1,100	1,200	1,000	1,100	1,400	100	0
	To districts south of the Study Area (Orange County)	400	400	400	400	400	300	200
	To all other districts	100	100	100	100	100	0	0
	Total	**4,100**	**4,500**	**4,600**	**4,800**	**6,500**	**1,200**	**800**

Market	To or From	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3	Alternative 4
Travel to the Corridor from Origins Outside the Corridor	From districts west of the Study Area (Central LA, Gateway Cities West, South Bay, Westside Cities)	1,600	1,700	1,800	1,900	2,000	1,000	600
	From districts east of the Study Area (Gateway Cities East, San Gabriel Valley)	700	800	800	900	700	500	300
	From districts north of the Study Area (San Fernando Valley, Arroyo Verdugo)	500	600	500	600	700	200	100
	From districts south of the Study Area (Orange County)	400	400	500	500	500	300	200
	From all other districts	900	1,000	900	1,000	300	0	0
	Total	**4,100**	**4,500**	**4,500**	**4,900**	**4,200**	**2,000**	**1,200**
Study Area Subtotal		**13,900**	**14,700**	**15,200**	**15,800**	**17,000**	**8,000**	**3,900**
Travel Outside the Corridor	Between Orange County and Westside Cities + San Fernando Valley (through Study Area)	700	700	700	700	1,000	400	200
	To and from other districts outside the Study Area	2,300	2,800	2,500	2,800	2,200	700	600
	Total	**3,000**	**3,500**	**3,200**	**3,500**	**3,200**	**1,100**	**800**
Regional Total		**17,000**	**18,300**	**18,400**	**19,300**	**20,200**	**9,100**	**4,700**

Source: WSP 2019

Figure 5-4. Daily New Transit Trips by Travel Market (2042)



Source: WSP 2019

5.5 Travel Time Savings/Efficiency of Transfer

The WSAB Line in the five Build Alternatives with the northern section would provide a direct ride from the Slauson/A Line Station to LAUS or the 7th Street/Metro Center Station Even with a transfer to North-South or East-West Line, the travel time in the Build Alternatives would be shorter than riding the North-South Line and transferring to other lines to get to the destinations. This section discusses three examples of how the travel patterns would change in the Build Alternatives with the addition of the WSAB Line to the transit networks and result in travel time savings compared to the No Build Alternative. Table 5.13 shows the paths and travel times (by alternative) for three interchanges in the system: (1) Slauson/A Line Station to UCLA, (2) Slauson/A Line Station to Sepulveda (Sepulveda Station on the East-West Line), and (3) Slauson/A Line Station to Del Mar. These interchanges were selected during the evaluation of the northern section and were not updated with the inclusion of Alternatives 3 and 4.

To understand the travel time differences across the alternatives, travel times are segmented by different components (e.g., rail in-vehicle travel time, transfer walk time, and transfer wait time). In addition, the total travel time, which includes the above segmented travel times and walk access/egress times from/to the TAZs plus wait time at the first urban rail station, are also included in the table. Since the walk access and egress times and wait time at the first urban rail station (for an interchange) remain the same across the alternatives, they are not presented separately in the table.

As can be observed from Table 5.13, the WSAB Line would provide some travel time savings for all three interchanges presented, but the savings would differ by alternative and interchange. For example, in the first interchange from the Slauson/A Line Station to UCLA, Alternative 1 scenarios would save about three to four minutes in total travel time whereas Alternative 2 would save about 11 minutes compared to the No Build Alternative. This is because the 7th Street/Metro Center Station at the end of the WSAB Line in Alternative 2 would provide an opportunity for riders to directly transfer from the WSAB Line to the D (Purple) Line at the 7th Street/Metro Center Station and save about 11 minutes of rail in-vehicle travel time.

Further, within Alternative 1, the travel time saving would vary depending on whether Design Option 1 is chosen and the presence of the Little Tokyo Station on the WSAB Line. As shown in the "path" row of the table, with the Little Tokyo Station on the WSAB Line, the riders in the Forecourt option would transfer from the WSAB Line to the East-West Line at the Little Tokyo Station and travel to the 7th Street/Metro Center to transfer to the D (Purple) Line, whereas in the MWD option, the riders would travel to LAUS and transfer to the D (Purple) Line. Because of the longer transfer walk time (one minute) between the WSAB Line and D (Purple) Line at Forecourt LAUS (compared to MWD LAUS), riders would transfer to the East-West Line at Little Tokyo Station instead of traveling to LAUS. This explains why the boardings on the East-West Line would increase noticeably with the Alternative 1 – Forecourt option with the Little Tokyo Station (see Section 5.2). Without the Little Tokyo Station on the WSAB Line, the riders would travel to LAUS even in the Forecourt option. As shown in the table, elimination of Little Tokyo Station would save about half a minute total travel time from the Slauson/A Line Station to UCLA.

Similar to the first interchange, Alternative 2 would provide the most travel time savings in the second interchange from the Slauson/A Line Station to the Sepulveda Station on the East-West Line. The paths and the corresponding travel times for the Slauson/A Line Station

to Sepulveda would be the same as those for the Slauson/A Line Station to UCLA except for the last component of the trip where riders would transfer from the D (Purple) Line to the Sepulveda Pass Line to travel to a TAZ close to Sepulveda Station on the East -West Line. Since this last component of the trip would be same for all the alternatives for this interchange, the path and travel time differences across the alternatives would essentially be the same as those for the Slauson/A Line Station to UCLA, with time savings of about three to four minutes in Alternative 1 and about 11 minutes in Alternative 2.

The paths and travel times for the third interchange (Slauson/A Line Station to Del Mar) show that transferring from the WSAB Line to the North-South Line at Little Tokyo Station or at LAUS in the Build Alternatives would be more efficient than a one-seat ride from the Slauson/A Line Station to Del Mar on the North-South Line (see No Build). The travel time savings are about 9 to 13 minutes for Alternative 1 and about four minutes for Alternative 2.

Table 5.13. Travel Time Savings

Interchanges	Attributes	No Build	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2
Slauson/A Line to UCLA	Path (Rail Lines)	N-S -> Purple	WSAB -> Purple	WSAB -> Purple	WSAB -> E-W/N-S -> Purple	WSAB -> Purple	WSAB -> Purple
	Transfer station	7th/Metro	Union Station (Forecourt)	Union Station (MWD)	Little Tokyo, 7th/Metro	Union Station (MWD)	7th/Metro
	No. of transfer	1	1	1	2	1	1
	Rail in-vehicle time (min)	19.0 + 23.0 = 42.0	7.0 + 28.0 = 35.0	7.0 + 28.0 = 35.0	6.3 + 5.1 + 23.0 = 34.4	7.8 + 28.0 = 35.8	7.9 + 23.0 = 30.9
	Transfer walk time* (min)	0.8	4	3.4	2.0 + 0.8 = 2.8	3.4	0.8
	Transfer wait time* (min)	4.0	4	4.0	2.5 + 4.0 = 6.5	4.0	4.0
	Total Time (min)**	**73.6**	**70**	**69.4**	**70.7**	**70.2**	**62.7**
	Travel Time Savings (min) (No Build - Build)	**-**	**3.6**	**4.2**	**2.9**	**3.4**	**10.9**
Slauson/A Line to Sepulveda (E-W Line)	Path (Rail Lines)	N-S -> Purple -> Sepulveda	WSAB -> Purple -> Sepulveda	WSAB -> Purple -> Sepulveda	WSAB -> E-W/N-S -> Purple -> Sepulveda	WSAB -> Purple -> Sepulveda	WSAB -> Purple -> Sepulveda
	Transfer station	7th/Metro, UCLA	Union Station, UCLA	Union Station, UCLA	Little Tokyo, 7th/Metro, UCLA	Union Station, UCLA	7th/Metro, UCLA
	No. of transfer	2	2	2	3	2	2
	Rail in-vehicle time (min)	19.0 + 23.0+ 3.3 = 45.3	7.0 + 28.0 + 3.3 = 38.3	7.0 + 28.0 + 3.3 = 38.3	6.3 + 5.1 + 23. 0 + 3.3 = 37.7	7.8 + 28.0 + 3.3 = 39.1	7.9 + 23.0 + 3.3 = 34.2
	Transfer walk time* (min)	0.8 + 2.0=2.8	4.0 + 2.0 = 6.0	3.4 + 2.0 = 5.4	2.0 + 0.8 + 2.0 = 4.8	3.4 + 2.0 = 5.4	0.8 + 2.0 = 2.8
	Transfer wait time* (min)	4.0 + 4.0 = 8.0	4.0 + 4.0 = 8.0	4.0 + 4.0 = 8.0	2.5 + 4.0 + 4.0 = 10.5	4.0 + 4.0 = 8.0	4.0 + 4.0 = 8.0

Interchanges	Attributes	No Build	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2
	Total Time (min)**	**101.5**	**97.9**	**97.3**	**98.6**	**98.1**	**90.6**
	Travel Time Savings (min) (No Build - Build)	**-**	**3.6**	**4.2**	**2.9**	**3.4**	**10.9**
Slauson/A Line to Del Mar	Path (Rail Lines)	N-S	WSAB -> N-S	WSAB -> N-S	WSAB -> N-S	WSAB -> N-S	WSAB -> N-S
	Transfer station	N/A (one-seat ride)	Union Station (Forecourt)	Union Station (MWD)	Little Tokyo	Union Station (MWD)	7th/Metro
	No. of transfer	0	1	1	1	1	1
	Rail in-vehicle time (min)	46.3	7.0 + 19.0 = 26.0	7.0 + 19.0 = 26.0	6.3 + 22.2 = 28.5	7.8 + 19.0 = 26.8	7.9 + 27.3 = 35.2
	Transfer walk time* (min)	N/A (one-seat ride)	6.0	1.6	2.0	1.6	1.6
	Transfer wait time* (min)	N/A (one-seat ride)	5.0	5.0	5.0	5.0	5.0
	Total Time (min)**	**78.3**	**69.2**	**64.8**	**67.7**	**65.6**	**74.0**
	Travel Time Savings (min) (No Build - Build)		**9.1**	**13.5**	**10.6**	**12.7**	**4.3**

Source: WSP 2019
Notes:
* Out-of-vehicle time (e.g., transfer walk time and transfer wait time) is weighted by two.
** Total time includes walk access and egress time from/to TAZ, wait time at the first urban rail station, rail in-vehicle time, transfer walk time, and transfer wait time.
E-W = east-west; min = minutes; MWD = Metropolitan Water District; N/A = not applicable; N-S = north-south; UCLA = University of California, Los Angeles; WSAB = West Santa Ana Branch

5.6 Transfer Volumes at Major Project Stations

In addition to the model outputs discussed above, the CBM18 also provides transfer volumes at urban rail and commuter rail stations. Reviewing transfer volumes provides insight to the travel patterns in different alternatives. As described earlier, the WSAB Line stations that provide an opportunity to transfer to other urban and/or commuter rail lines (and vice versa) would have more boardings than the other stations on the alignment and play an important role on the ridership of the system. Therefore, only the transfer volumes at major WSAB Line stations are discussed in this section.

Table 5.14 shows the transfer volumes at four WSAB Line stations: (1) Slauson/A Line, (2) Little Tokyo, (3) LAUS, and (4) 7th Street/Metro Center. As can be observed from the table, a substantial number of riders would transfer from the North-South Line to the WSAB Line (and vice versa) at the Slauson/A Line Station. This is because of the faster travel time on the WSAB Line and their overlapping coverage areas from the Slauson/A Line to downtown LA discussed earlier. Further, among the seven alternatives, Alternative 2 would have the most transfers. This can be partially attributed to the previous discussion that the WSAB Line in Alternative 2 would create a faster trip (than other WSAB Lines) for riders traveling from the Study Area to the Westside (and vice versa) and attract more riders.

At the Little Tokyo Station, the Forecourt option in Alternative 1 would have more transfers than the MWD option because of a longer transfer walk time at LAUS in this option. As discussed in the previous section, riders traveling from the Study Area to the Westside (and vice versa) with the Forecourt option would transfer from the WSAB Line to the North-South/East-West Line (and vice versa) at Little Tokyo Station instead of traveling to LAUS. With the MWD option, these riders would travel to LAUS. Therefore, the pattern would be opposite at LAUS – the MWD option would have more urban rail transfers than the Forecourt option, as shown in the LAUS summary.

It is important to note that the LAUS would provide an opportunity for commuter rail riders to transfer to the WSAB Line (and vice versa) to get to their destinations. As shown in the table, on average, about 10,000 riders would transfer between commuter rail and the WSAB Lines at LAUS. In general, the commuter rail trips are longer than the urban rail trips. Further, LAUS which is the most important transit hub in the LA transit system, provides connections to different bus lines as well. Therefore, the WSAB Line connection with other transit modes at LAUS would have the potential to serve some new longer trips.

Among the seven alternatives, only Alternative 2 has 7th Street/Metro Center Station on the WSAB Line. Since this is one of the end stations of the WSAB Line and would provide connection to other urban rail lines, a substantial number of riders would transfer at this station as well. As shown in the table, the most transfers would occur between the B (Red)/D (Purple) and WSAB Lines. This is because of the travel time savings and travel pattern from the Study Area to the Westside (and vice versa) discussed above for this alternative.

Table 5.14. Transfer Volumes at Major Project Stations[1, 2]

Transfer at	From	To	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3
Slauson/A Line	North-South Line	WSAB Line	4,560 + 660 = 5,520	5,315 + 975 = 6,290	5,125 + 1,215 = 6,340	5,675 + 1,225 = 6,900	16,045 + 565 = 16,610	2,385 + 1030 = 3,415
	WSAB Line	North-South Line	5,080 + 1,010 = 6,090	7,790 + 1,040 = 8,830	7,635 + 1,055 = 8,690	8,040 + 1,080 = 9,120	6,405 + 505 = 6,910	7,920 + 2,995 = 10,915
			9,640 + 1,670 = 11,610	**13,105 + 2,015 = 15,120**	**12,760 + 2,270 =15,030**	**13,715 + 2,305 =16,020**	**22,450 + 1,070 = 23,520**	**10,305 + 4,025 = 14,330**
Little Tokyo	North-South/Expo Line	WSAB Line	-	-	7,395 + 1,395 = 8,790	2,355 + 965 =3,320	-	-
	WSAB Line	North-South/Expo Line	-	-	17,755 + 3,665 = 21,420	5,840 + 2,980 = 8,820	-	-
			-	**-**	**25,150 + 5,060 = 30,210**	**8,195 + 3,945 = 12,140**	**-**	**-**
LAUS	Red/Purple Line	WSAB Line	2,335 + 1,105 = 3,440	2,430 + 1,040 = 3,470	155 + 835 = 990	2,090 + 890 = 2,980	-	-
	North-South/Expo Line	WSAB Line	1,380 + 450 = 1,830	4,310 + 720 = 5,030	35 + 35 = 70	3,725 + 535 = 4,260	-	-
	WSAB Line	Red/Purple Line	13,170 + 4,910 = 18,080	13,550 + 5,050 = 18,600	730 + 3,830 = 4,560	10,745 + 3,965 = 14,710	-	-
	WSAB Line	North-South/Expo Line	3,125 + 825 = 3,950	4,455 + 1,205 = 5,660	10 + 0 = 10	3,465 + 875 = 4,340	-	-
			20,010 + 7,290 = 27,300	**24,745 + 8,015 = 32,760**	**930 + 4,700 = 5,630**	**20,025 + 6,265 = 26,290**	**-**	**-**
	Commuter Rail Line	WSAB Line	7,370 + 570 = 7,940	7,820 + 630 = 8,450	7,100 + 550 = 7,650	7,800 + 610 = 8,410	-	-

Transfer at	From	To	Alternative 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alternative 2	Alternative 3
	WSAB Line	Commuter Rail Line	1,585 + 335 = 1,920	1,660 + 350 = 2,010	1,745 + 355 = 2,100	1,850 + 370 = 2,220	-	-
			8,955 + 905 = 9,860	**10,460**	**8,845 + 905 = 9,750**	**9,650 + 980 = 10,630**	**-**	**-**
7th Street/Metro Center	Red/Purple Line	WSAB Line	-	-	-	-	10,535 + 1,485 = 12,020	-
	North-South/Expo Line	WSAB Line	-	-	-	-	2,730 + 1,020 = 3,750	-
	WSAB Line	Red/Purple Line	-	-	-	-	29,420 + 6,410 = 35,830	-
	WSAB Line	North-South/Expo Line	-	-	-	-	5,310 + 2,680 = 7,990	-
			-	**-**	**-**	**-**	**47,995 + 11,595 = 59,590**	**-**

Source: WSP 2019
Note: 1) The table only presents transfer volumes at major WSAB Line stations. Thus, "No Build" is not included in the table.
2) Alternative 4 does not have the project stations presented in the first column of the table; therefore, Alternative 4 was not included in the table.
LAUS = Los Angeles Union Station; WSAB = West Santa Ana Branch

5.7 Transportation System User Benefits

User benefits are similar to travel time savings but are more comprehensive, as their calculation includes travel time savings and cost savings that new riders and existing riders would experience with the addition of a new transit alternative. User benefits are estimated from mode choice in CBM18 and input to FTA's Summit program for each of the Build Alternatives versus a No Build. User benefits (or dis-benefits) are assumed to arise from changes in mobility for individual travelers that result from implementation of a project (or policy) and are measured in hours of benefits, aggregated over all travelers. For this Project, each Build Alternative would provide user benefits in terms of faster and more reliable service compared to that provided by the No Build Alternative.

Table 5.15 shows the daily hours of user benefits by trip purpose and time period for the Build Alternatives compared to the No Build. As can be observed from the table, their distribution by trip purpose and time period is very similar, with approximately two-thirds of the daily user benefits in the peak period and the remaining one-third in the off-peak period. The Home-based Work purpose (peak & off-peak) accounts for about 60 percent of the daily user benefits and the home-based other purpose (peak & off-peak) accounts for approximately 22 percent of the daily user benefits, the second most among the four purposes. Among the alternatives, Alternative 2 has the most user benefits with 19,700 daily hours, followed by Alternative 1 with Design Options 1 and 2 with 17,600 daily hours. Alternative 4 has the least user benefits with 4,000 daily hours, as shown in Table 5.15 and Figure 5-5.

User benefit maps are a helpful tool in understanding and analyzing which areas would benefit from the Project and which areas would be worse off compared to the No Build. Therefore, these maps were developed for all of the Build Alternatives and all trip purposes. For each trip purpose, two user benefit thematic maps were developed, one showing user benefits in the zones where the trips are produced and the other showing user benefits in the zones where the trips are attracted. The maps show three shades of green that were used for coloring the zones with benefits and three shades of red for zones with dis-benefits. The darker color shows the more user benefits (or dis-benefits) in the zone. Figure 5-6 through Figure 5-9 show the Daily and HBW peak user benefit maps for Alternative 1 with Design Option 2. The user benefit maps (Daily and HBW peak) for Alternative 1 with both Design Options 1 and 2 and Alternatives 2, 3, and 4 are presented in the Appendix. Since the user benefit maps remain about the same after eliminating the Little Tokyo Station from the WSAB Line, they are not presented in the report. As can be observed from the following maps, most of the benefits are along the study corridor.

For every alternative, some zones experience loss of user benefits and most of these zones are around downtown Los Angeles. To investigate the reason, one of the interchanges from downtown Los Angeles (TAZ 1288) to Montebello (TAZ 1357) was selected. It was found that the additional transfer walk/sidewalk links created around the WSAB Line stations in the Build Alternative changes a local bus path in the Build Alternative and creates dis-benefits. Therefore, TAZ 1288 is red in the production user benefit maps. However, the loss of user benefits due to this issue is generally minimal and only affects a few zones. The limitation of the mode choice model could also contribute to the dis-benefits in the maps. The model makes some simplifications to prevent calculations from exceeding computer limits. For example, the program considers only the 10 closest stations for every potential rider. On rare occasions, the traveler would do better to pick a station farther away.

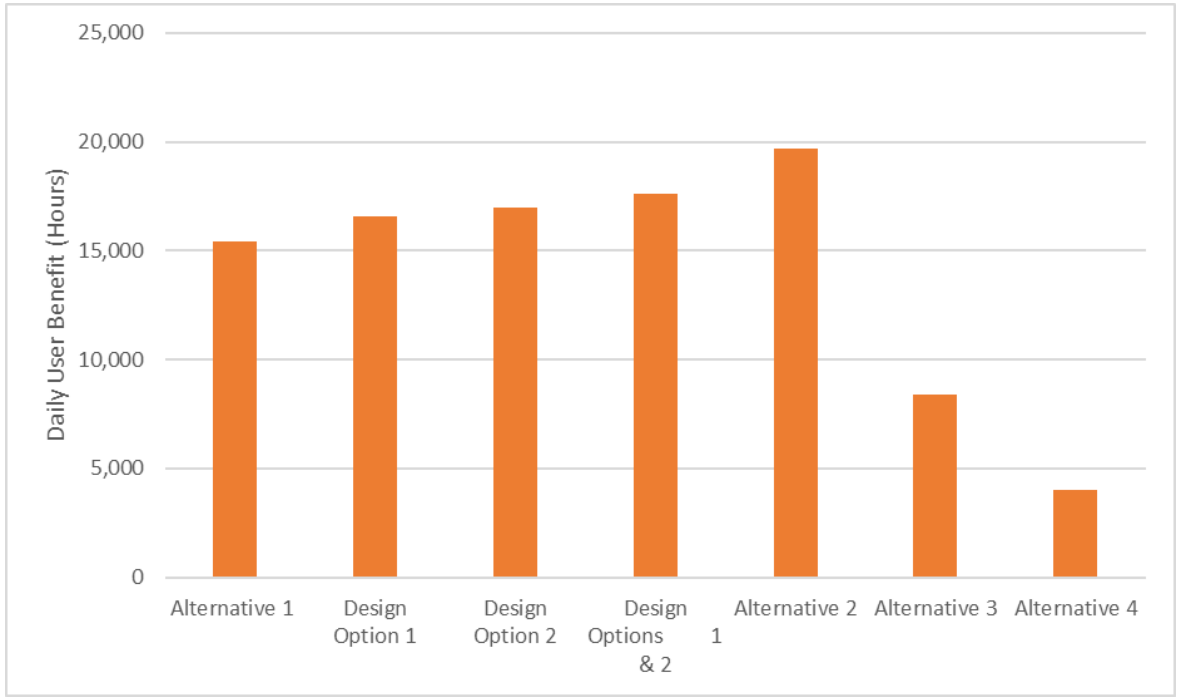
In addition, two user benefit maps (HBW peak production and Daily attraction) were developed to compare Alternative 1 with Design Option 1 and Alternative 2. Three shades of blue are used for coloring the zones that benefit with Alternative 1 with Design Option 1, and three shades of orange are used for coloring the zones that benefit with Alternative 2 (Figure 5-10 and Figure 5-11). These maps clearly show that Alternative 1 with Design Option 1 would benefit more for remote HBW peak trips from North County and San Bernardino County via Metrolink, and Alternative 2 would benefit more for daily trips attracted to the Westside and San Fernando Valley Districts.

Table 5.15. User Benefit Hours by Trip Purpose and Time Period (Build Alternatives vs. No Build)

Trip Purpose and Time Period		Alternative 1		Design Option 1		Design Option 2		Design Options 1 and 2		Alternative 2		Alternative 3		Alternative 4	
		Hours	Pct	Hours	Pct	Hours	Pct	Hours	Pct	Hours	Pct	Hours	Pct	Hours	Pct
Peak Period	Home-Based Work	7,100	46%	7,900	48%	7,600	45%	8,100	46%	7,900	40%	3,000	36%	1,500	37%
	Home-Based University	600	4%	700	4%	700	4%	700	4%	1,300	7%	200	3%	200	5%
	Home-Based Other	1,600	10%	1,700	10%	1,800	11%	1,900	11%	2,200	11%	1,200	14%	500	12%
	Non-Home Based	700	5%	800	5%	800	5%	800	5%	1,000	5%	600	7%	300	7%
	Total Peak Period	**10,000**	**65%**	**11,100**	**67%**	**10,900**	**64%**	**11,500**	**65%**	**12,400**	**63%**	**4,900**	**59%**	**2,500**	**62%**
Off-peak Period	Home-Based Work	2,400	16%	2,500	15%	2,700	16%	2,700	15%	3,000	15%	1,500	17%	600	15%
	Home-Based University	400	3%	400	2%	500	3%	500	3%	800	4%	100	1%	100	3%
	Home-Based Other	1,700	11%	1,700	10%	1,900	11%	1,900	11%	2,300	12%	1,200	15%	500	13%
	Non-Home Based	900	6%	900	5%	1,000	6%	1,000	6%	1,200	6%	700	8%	300	7%
	Total Off-peak Period	**5,400**	**35%**	**5,500**	**33%**	**6,100**	**36%**	**6,100**	**35%**	**7,300**	**37%**	**3,400**	**41%**	**1,600**	**38%**
	Daily Total	**15,400**	**100%**	**16,600**	**100%**	**17,000**	**100%**	**17,600**	**100%**	**19,700**	**100%**	**8,400**	**100%**	**4,000**	**100%**

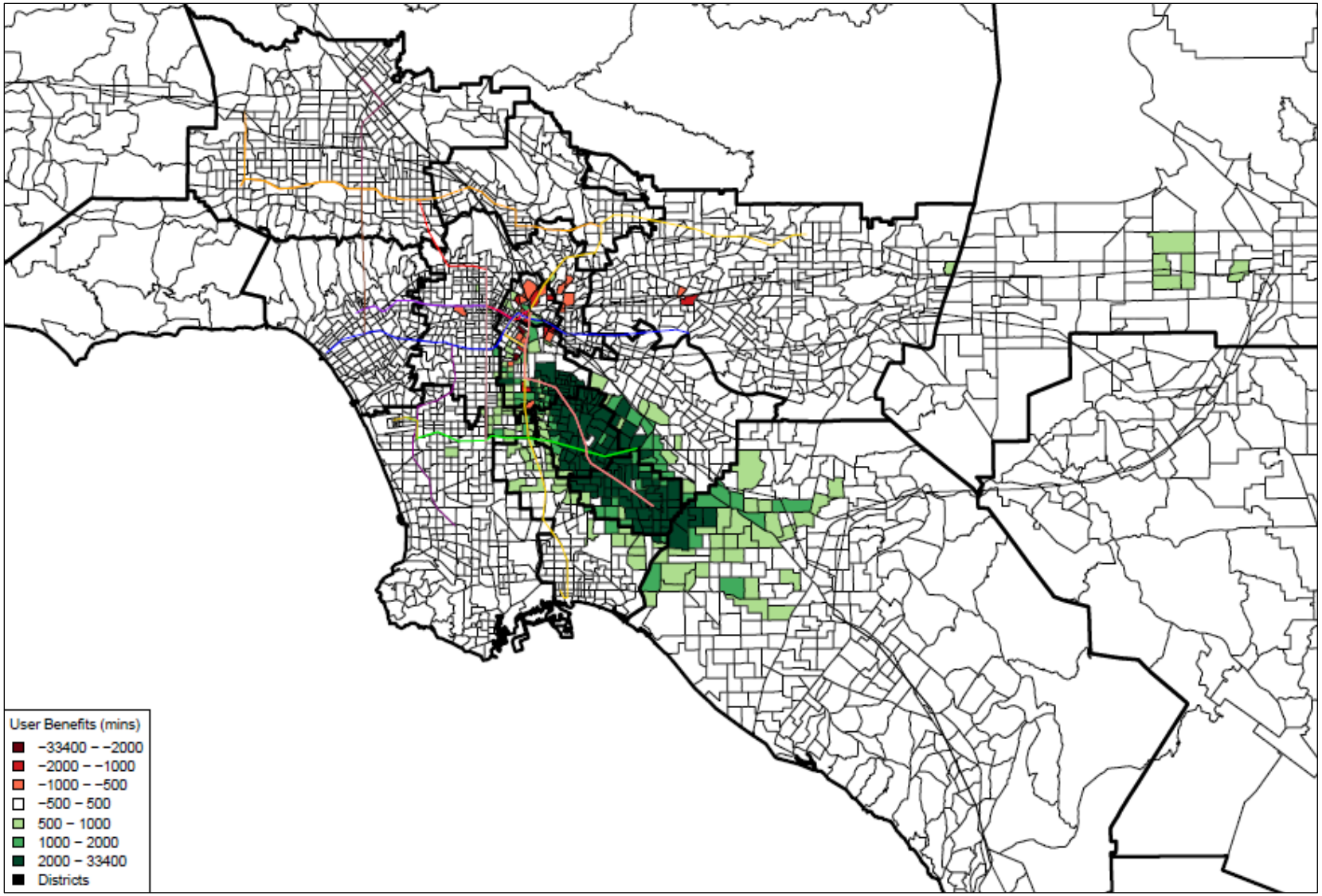
Source: WSP 2019

Figure 5-5. Daily User Benefit Hours (Build Alternatives)



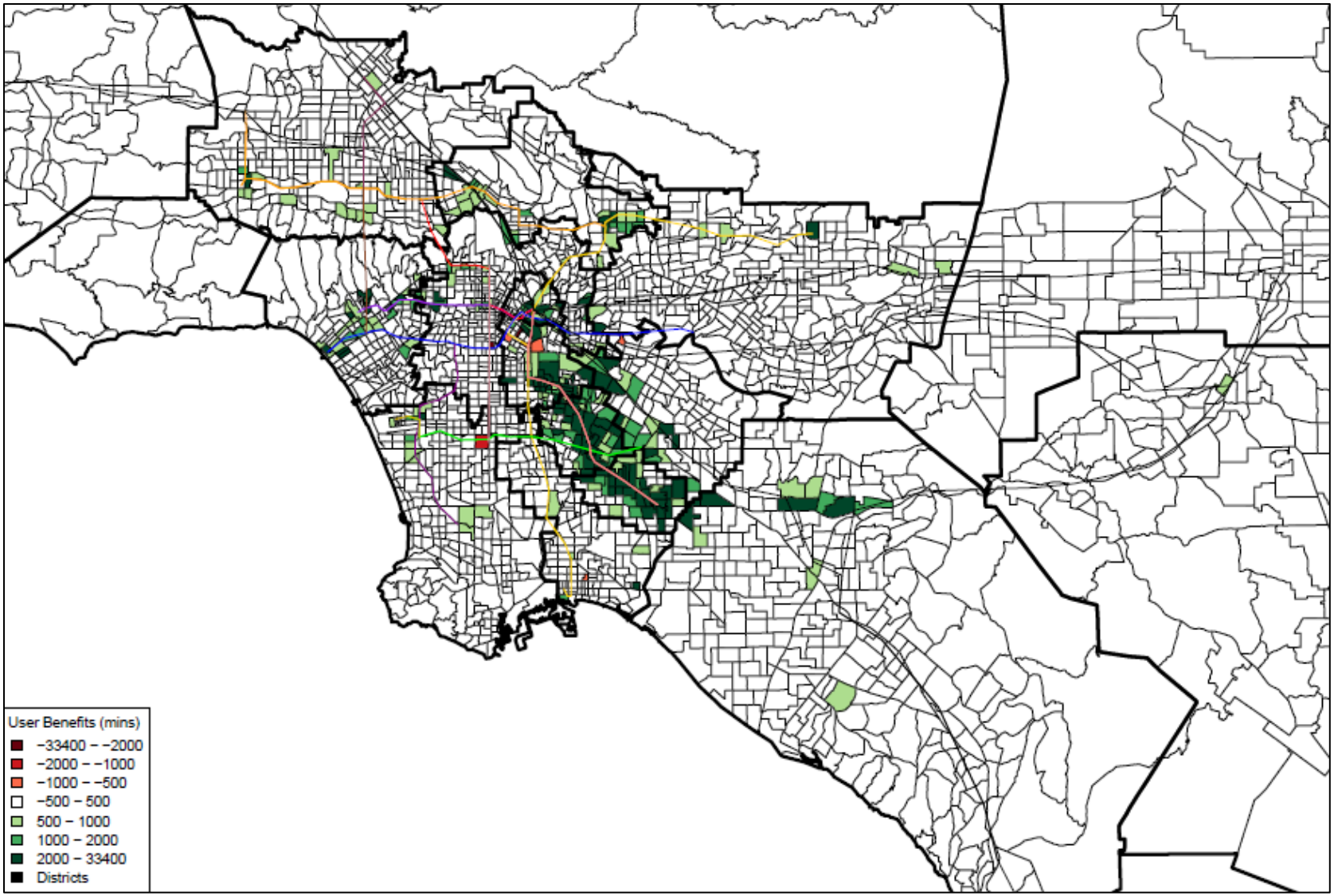
Source: WSP 2019

Figure 5-6. Daily User Benefit Map (Production), Design Option 2



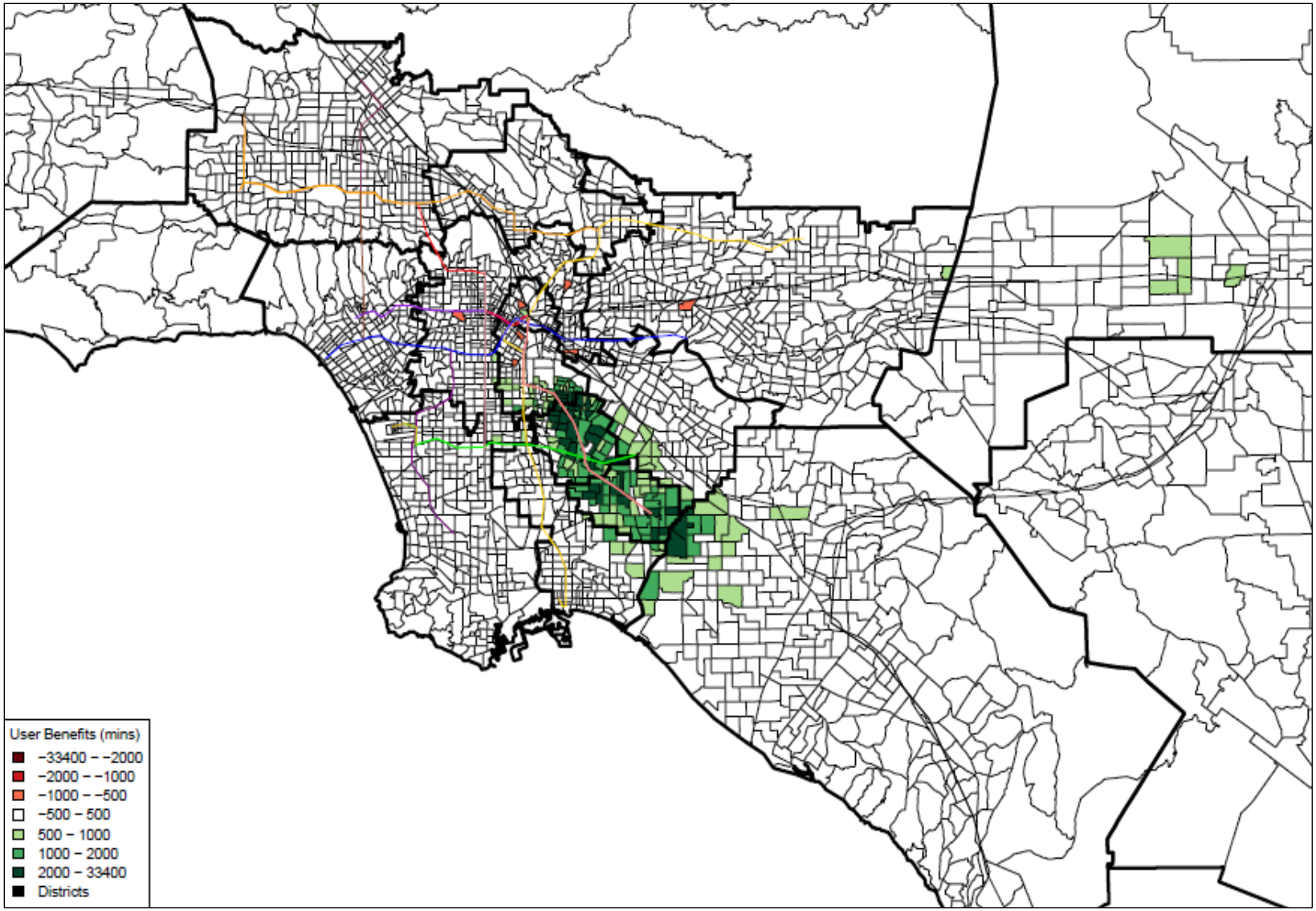
Source: WSP 2019

Figure 5-7. Daily User Benefit Map (Attraction), Design Option 2



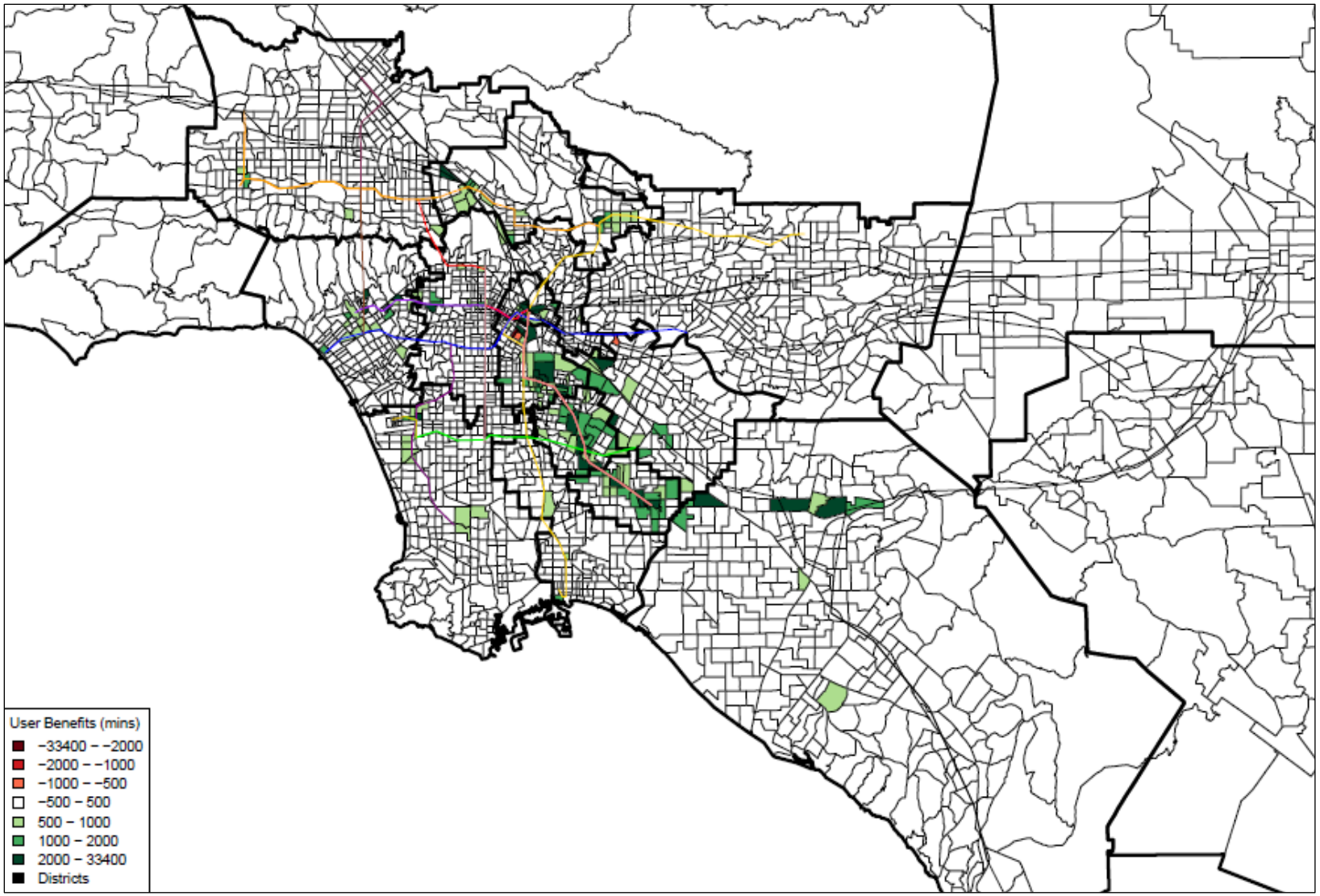
Source: WSP 2019

Figure 5-8. Home-based Work Peak User Benefit Map (Production), Design Option 2



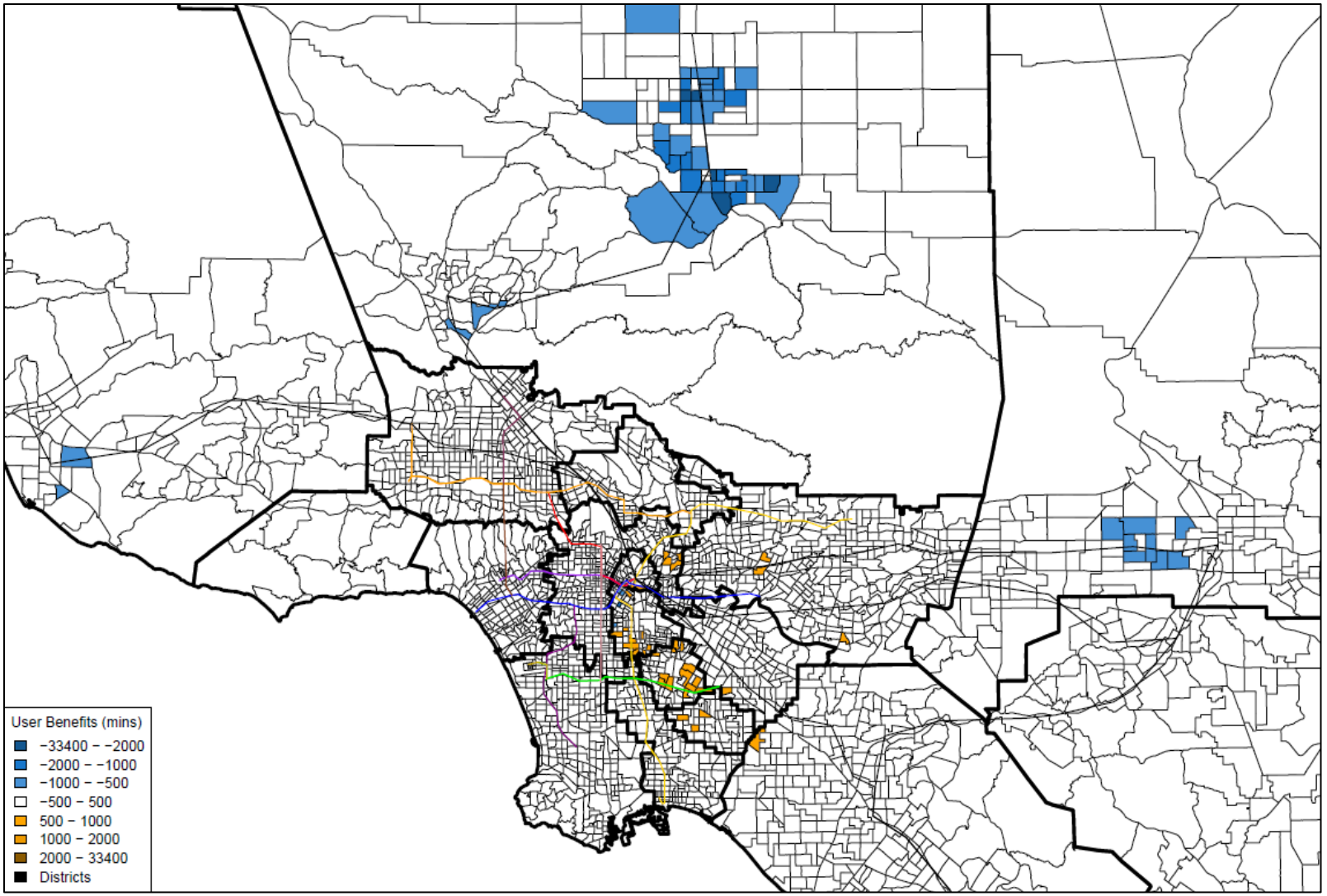
Source: WSP 2019

Figure 5-9. Home-based Work Peak User Benefit Map (Attraction), Design Option 2



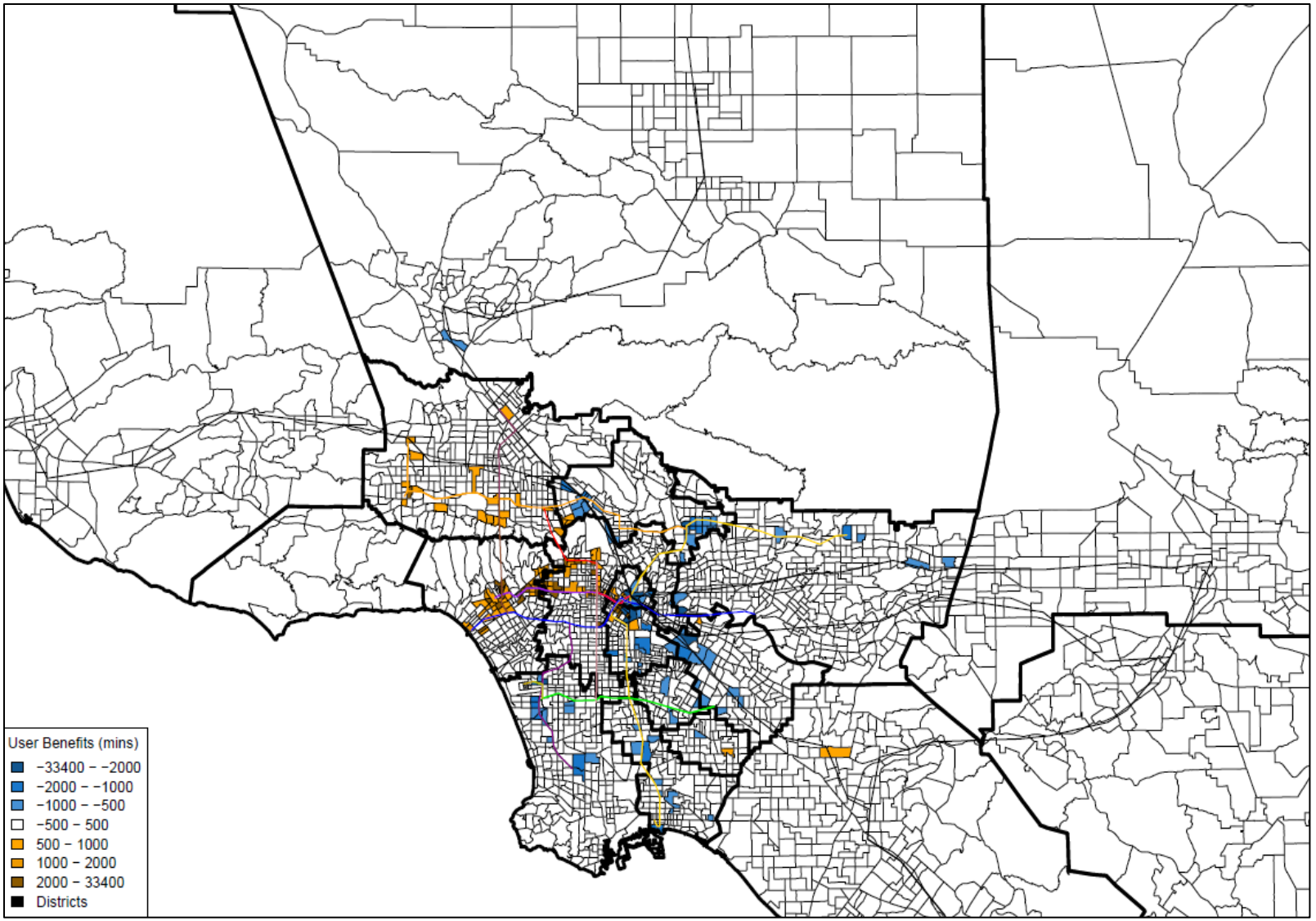
Source: WSP 2019

Figure 5-10. Home-based Work Peak User Benefit Map (Production), Design Option 1 vs Alternative 2



Source: WSP 2019

Figure 5-11. Daily User Benefit Map (Attraction), Design Option 1 vs Alternative 2



Source: WSP 2019

5.8 Vehicle Miles Traveled and Vehicle Hours Traveled Reductions

The analysis of emissions reductions with implementation of a new transit system is based on vehicle miles traveled (VMT). According to Metro's Countywide Sustainable Planning Policy and Implementation Plan (2012), reductions in VMT would result in a multitude of benefits, including but not limited to, reduced greenhouse gas emissions, reduced emissions of pollutants, increased physical activity, and increased use of active transportation and transit.

The systemwide VMT reduction was calculated for each of the Build Alternatives against the No Build Alternative. VMT is an indicator of the amount of highway travel. In general, a lower VMT for the system indicates that there will be fewer highway trips but more transit trips on the system with a project alternative. Therefore, in the Build Alternatives, if the transit trips increase and the highway trips decrease, it is expected that there will be a reduction in the VMT over the No Build Alternative.

The FTA's guidance assumes the increase in transit trips in a Build Alternative is equal to the reduction of auto trips for that alternative. Based on the guidance, the VMT reduction was calculated for each of the alternatives considered in this study. The VMT reduction is a matrix-based calculation. The number of transit trips for each alternative is multiplied by the zone-to-zone highway travel distance to obtain the VMT for both the Build and No Build Alternatives. The difference between the two matrices is considered as the VMT reduction from the No Build Alternative to the Build Alternative.

A common indicator to measure the level of congestion on the highway network is vehicle hours traveled (VHT). Similar to the VMT reduction calculation, the VHT reduction calculation assumes that the increased number of transit trips is equal to the number of auto trips reduced in the system. It is also a matrix-based calculation, and the number of transit trips for each alternative is multiplied by the zone-to-zone highway congested travel time to obtain the VHT for both the Build and No Build Alternatives. The difference between the two matrices is considered as the VHT reduction from the No Build Alternative to the Build Alternative.

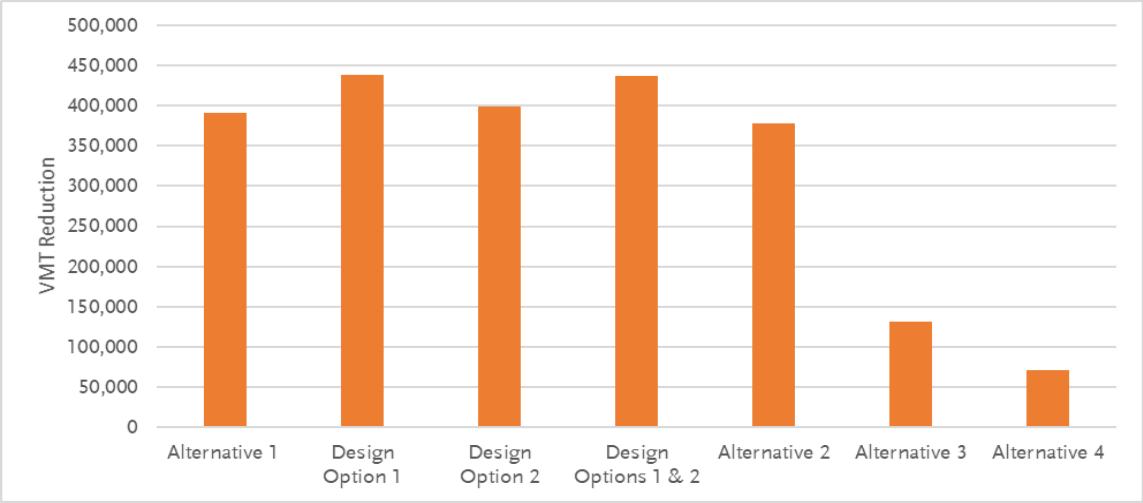
The matrix-based calculations discussed above would result in more VMT and VHT reduction for a longer trip than a shorter trip. Therefore, depending on the origin and destination of the new transit trips, a Build Alternative with more new transit trips could have less VMT and VHT reduction than other alternatives. For example, Alternative 2 has more new transit trips than Alternative 1, but it does not provide an easy transfer for new transit trips that arrive at LAUS via Metrolink, which are longer as they are arrive via commuter rail. The new commuter rail transit trips for the alternatives make the average new transit trip lengths longer for the alternatives with LAUS (23 miles) than the alternative with 7th Street/Metro Center (19 miles) and play an important role in the variations of the VMT and VHT across the alternatives. Because of this, as shown in Table 5.16, Figure 5-12, and Figure 5-13, Alternative 2 has the least VMT and VHT reduction among all the alternatives with a northern section. In general, alternatives that provide the greatest VMT savings would result in a greater reduction in emissions and other sustainability benefits pursuant to Metro's Countywide Sustainable Planning Policy and Implementation Plan. As shown in the following table and figures, among all the alternatives, Alternative 1 with Design Option 1, where the WSAB LAUS stop is at MWD, would have the most VMT and VHT reduction, followed by Alternative 1 with Design Options 1 and 2. Alternative 4 with the fewest transit trips would have the least VMT/VHT reduction.

Table 5.16. Reduction in Daily Vehicle Miles Traveled (VMT) and Vehicle Hours Traveled (VHT)

Concept	Reduction (over the No Build) in:	
	Vehicle Miles Traveled (Miles)	Vehicle Hours Traveled (Hours)
Alternative 1	391,500	21,000
Design Option 1	437,800	23,400
Design Option 2	398,400	21,200
Design Options 1 and 2	436,800	23,300
Alternative 2	377,400	19,600
Alternative 3	130,900	6,100
Alternative 4	70,800	3,200

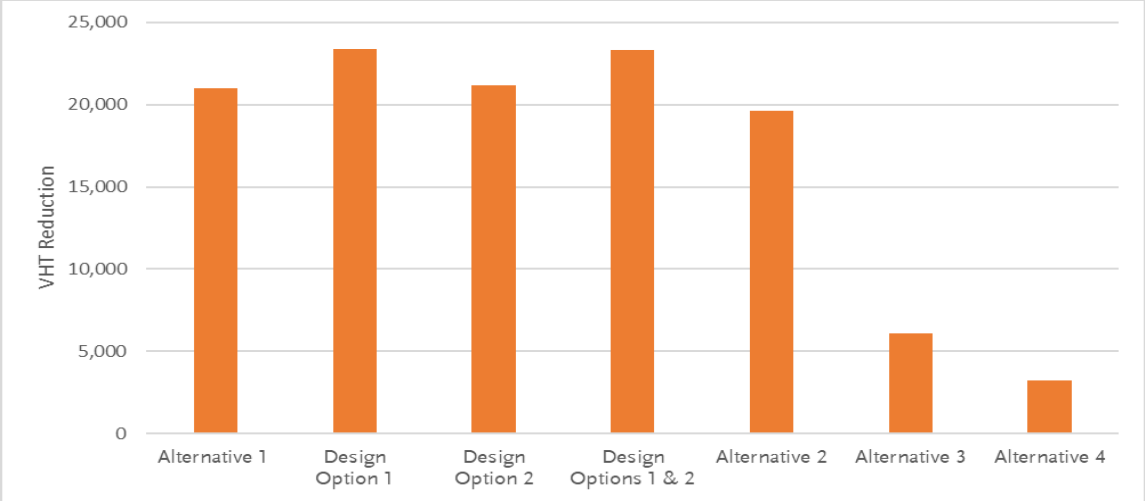
Source: WSP 2019

Figure 5-12. VMT Reduction



Source: WSP 2019

Figure 5-13. VHT Reduction



Source: WSP 2019

5.9 Other Results

This section discusses the parking demand and peak load on the WSAB Line summarized from the analysis conducted for the alternatives.

5.9.1 Parking Demand

As described earlier, parking was allowed at several WSAB stations, but the demand was not constrained. Table 5.17 shows the daily parking demand at the WSAB stations by alternative. As observed from the table, among all the Build Alternatives, Alternative 2 would have the highest parking demand at all the stations. This can be attributed to more boardings/ ridership on this alternative (than other alternatives), and to the high parking costs in downtown LA. Further, in all the alternatives, the demand at the end station (i.e., Pioneer) would be significantly higher than the demand at other stations on the WSAB Line, and it would gradually decrease from the end station to the I-105/C Line Station. Firestone Station is projected to have the second-highest demand in all the alternatives that have a station at Firestone. This is likely a result of being the last station to have parking on the line until LAUS.

Table 5.17. Daily Parking Demand at West Santa Ana Branch Stations

West Santa Ana Branch Stations	Alt. 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alt. 2	Alt. 3	Alt. 4
LAUS	10	10	10	10	-	-	-
Firestone	910	940	940	970	1,060	640	-
I-105/C Line	360	370	370	380	430	230	90
Paramount/Rosecrans	430	440	440	450	500	290	200
Bellflower	540	550	540	560	610	400	280
Pioneer	1,380	1,410	1,410	1,430	1,570	1,030	740
Total	**3,630**	**3,710**	**3,710**	**3,790**	**4,170**	**2,590**	**1,310**

Source: WSP 2019
Note: Parking was not allowed at other stations on the WSAB Line.

5.9.2 Peak Load Point on the Urban Rail Lines in the Study Area

The peak-load point is the busiest segment in the peak direction for a selected transit route. It is used to check the operational feasibility of a project. The current operational assumptions for the WSAB are that it will run 12 trains per hour with 3 cars each and will have a capacity of approximately 133 passengers per car. Thus, the maximum peak-hour capacity of the WSAB Line with five-minute headways would be approximately 4,800/hour, and the peak load should not exceed that. Table 5.18 shows the peak-hour load point on the WSAB Line by direction for all the alternatives. In the peak direction (northbound), the maximum load point would occur at the same location (i.e., between the Slauson/A Line Station and the Arts/Industrial District Station) in all the alternatives (with a northern section), but the volume would vary from 3,420 to 6,060, with the lowest for Alternative 1 without the Little Tokyo Station and the highest for Alternative 2. Note that the northbound maximum peak-hour volume (i.e., 6,060) with Alternative 2 would exceed the maximum peak-hour capacity of 4,800/hour for the WSAB Line and thus would warrant attention. Since Alternatives 3 and 4 do not extend north of the Slauson/A Line Station, the peak load is considerably less, and the highest volume points are at Pacific/Randolph and Slauson/A Line Station for Alternative 3 and Paramount/Rosecrans and I-105/C Line for Alternative 4.

In the southbound direction, none of the alternatives come close to exceeding the peak-hour capacity. The maximum load volume would range from 440 to 2,710, with the lowest for Alternative 4 and the highest for Alternative 1 with Design Options 1 and 2 (MWD and with Little Tokyo Station). The peak load point would occur between Little Tokyo and the Arts/Industrial District Stations in the alternatives with the Little Tokyo Station. The elimination of the Little Tokyo Station from the WSAB Line would shift the maximum load point to between LAUS and the Arts/Industrial District Station for both Alternative 1 – Forecourt and Design Option 1 (MWD).

Table 5.18. Peak-Hour Maximum Load on the WSAB Line

Alternative	Northbound		Southbound	
	Load	Location Between	Load	Location between
Alternative 1	3,420	Slauson/A Line and Arts/Industrial District	2,020	LAUS and Arts/Industrial District
Design Option 1	3,670	Slauson/A Line and Arts/Industrial District	2,620	LAUS and Arts/Industrial District
Design Option 2	3,630	Slauson/A Line and Arts/Industrial District	2,540	Little Tokyo and Arts/Industrial District
Design Options 1 and 2	3,840	Slauson/A Line and Arts/Industrial District	2,710	Little Tokyo and Arts/Industrial District
Alternative 2	6,060	Slauson/A Line and Arts/Industrial District	2,360	7th Street/Metro Center and South Park/Fashion District
Alternative 3	1,350	Pacific/Randolph and Slauson/A Line	610	I-105/C (Green) Line and Paramount/Rosecrans
Alternative 4	600	Paramount/Rosecrans and I-105/C Line	440	I-105/C (Green) Line and Paramount/Rosecrans

Source: WSP 2019
Note: LAUS = Los Angeles Union Station

In addition, the Urban Rail Lines that interact with the WSAB Line (e.g., North-South Line, East-West Line, B (Red) Line, and D (Purple) Line) were examined for their peak-hour volumes. Among these, the North-South Line that crosses the corridor and runs parallel with the WSAB Line would slightly exceed its peak-hour capacity of 4,800 passengers in Alternative 1 with Design Option 1. Specifically, in the southbound direction, the N-S line would have a peak-hour volume of 4,820 and 4,860 between Chinatown and LAUS in Alternative 1 with Design Option 1 and Alternative 1 with Design Options 1 and 2, respectively, which is about 200 more than the peak-hour volume of the same line for the No Build Alternative. Similar investigation on the East-West Line suggests that the peak-hour volume on the line would be below its peak-hour capacity (i.e., 4,800/hour) in both the eastbound and westbound directions.

Further, all the alternatives with a northern section connect directly to the B (Red) and D (Purple) Lines at either LAUS or the 7th Street/Metro Center Station. The peak-hour volume investigation on these two lines suggest that the volumes would be within their peak-hour capacity of 12,000 passengers per hour, assuming 15 trains per hour with 6-car trains and approximately 133 passengers per car.

6 SUMMARY

The Project is expected to increase mobility in the region by reducing transit travel times on local and regional transportation networks. For example, riders traveling from the Slauson/A Line Station (in the study corridor) to UCLA would save nearly 11 minutes of rail in-vehicle time with Alternative 2. With Alternative 1, riders traveling from the Slauson/A Line to Del Mar would save about 9 to 14 minutes of total travel time depending on the design options and the presence of Little Tokyo Station on the line. This time savings results in an increased number of transit trips and user benefits.

To evaluate the systemwide performance of the alternatives, travel forecasting results are summarized by four performance measures: (1) project boardings, (2) new transit trips, (3) user benefit hours (daily), and (4) reduction in VMT, as shown in Table 6.1.

Table 6.1. Travel Forecasting Results by Performance Measures

Performance Measures	Alt. 1	Design Option 1	Design Option 2	Design Options 1 and 2	Alt. 2	Alt. 3	Alt. 4
Project Boardings	60,800	66,800	68,800	72,200	82,800	31,000	11,100
New Transit Trips	17,000	18,300	18,400	19,300	20,200	9,100	4,700
User Benefit Hours (Daily)	15,400	16,600	17,000	17,600	19,700	8,400	4,000
Reduction in VMT	391,500	437,800	398,400	436,800	377,400	130,900	70,800

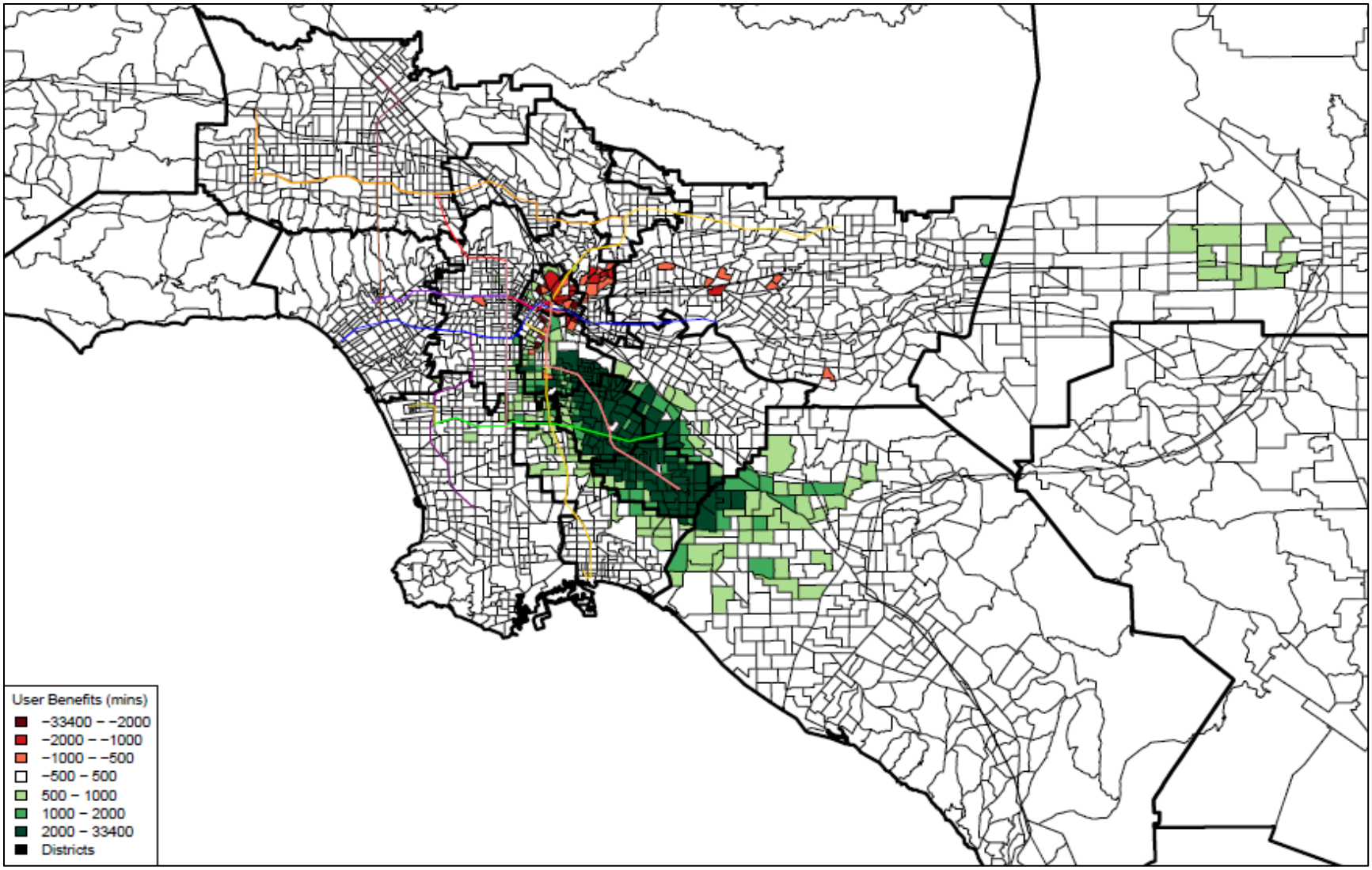
Source: WSP 2019
Note: VMT = vehicle miles traveled

Alternative 2 would result in the highest number of project boardings, the highest number of new transit trips, and the greatest amount of user benefits. This is due to the direct connection to the 7th Street/Metro Center Station, which is in the heart of downtown Los Angeles and a transfer point to the D (Purple)/B (Red) Line, which riders can use to travel to destinations west and north. Alternative 1 would result in a greater reduction in VMT due to the direct transfer opportunities to commuter rail lines, which would result in longer transit trips and therefore a greater reduction in the number of VMT. Of the Alternative 1 design options, Alternative 1 with LAUS at MWD and inclusive of the Little Tokyo Station provides the greatest benefits. The MWD location provides a more direct transfer to the B (Red)/D (Purple) Lines and Little Tokyo Station provides a direct transfer to the East-West Line.

In addition to the above measures, the peak-hour load on the WSAB Line was summarized and compared against the capacity of the WSAB Line to investigate if the proposed rail line would be able to handle the load in the peak hour. Results suggest that the peak-hour load for Alternative 1 (both Forecourt and MWD options) would be below the capacity of the line (4,800/hour), but the load on Alternative 2 between the Slauson/A Line Station and the Arts/Industrial District Station (6,060/hour) would exceed the capacity of 4,800/hour, which would require further evaluation.

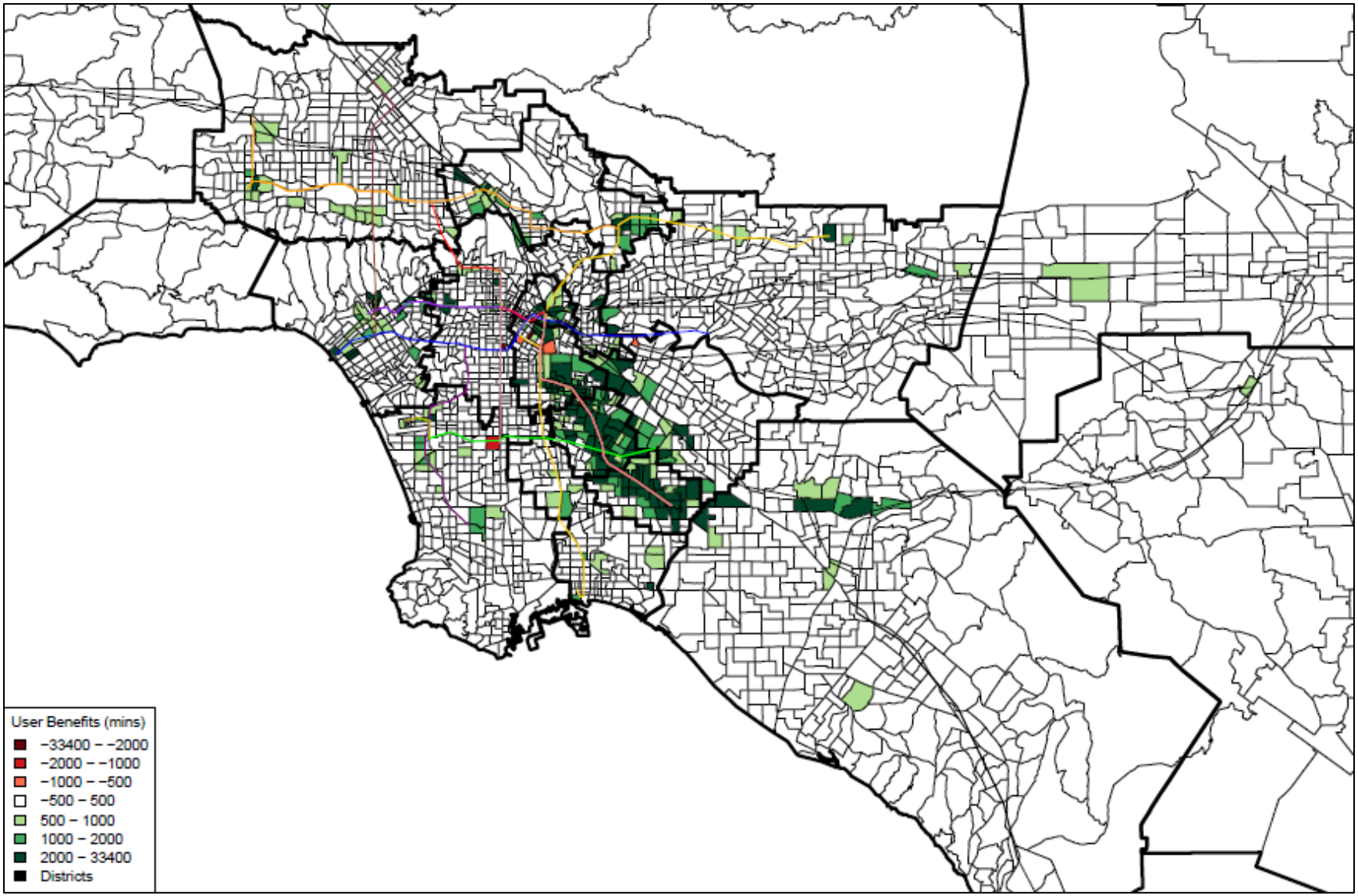
APPENDIX A – USER BENEFIT MAPS

Figure A-1. Daily User Benefit Map (Production), Design Options 1 and 2



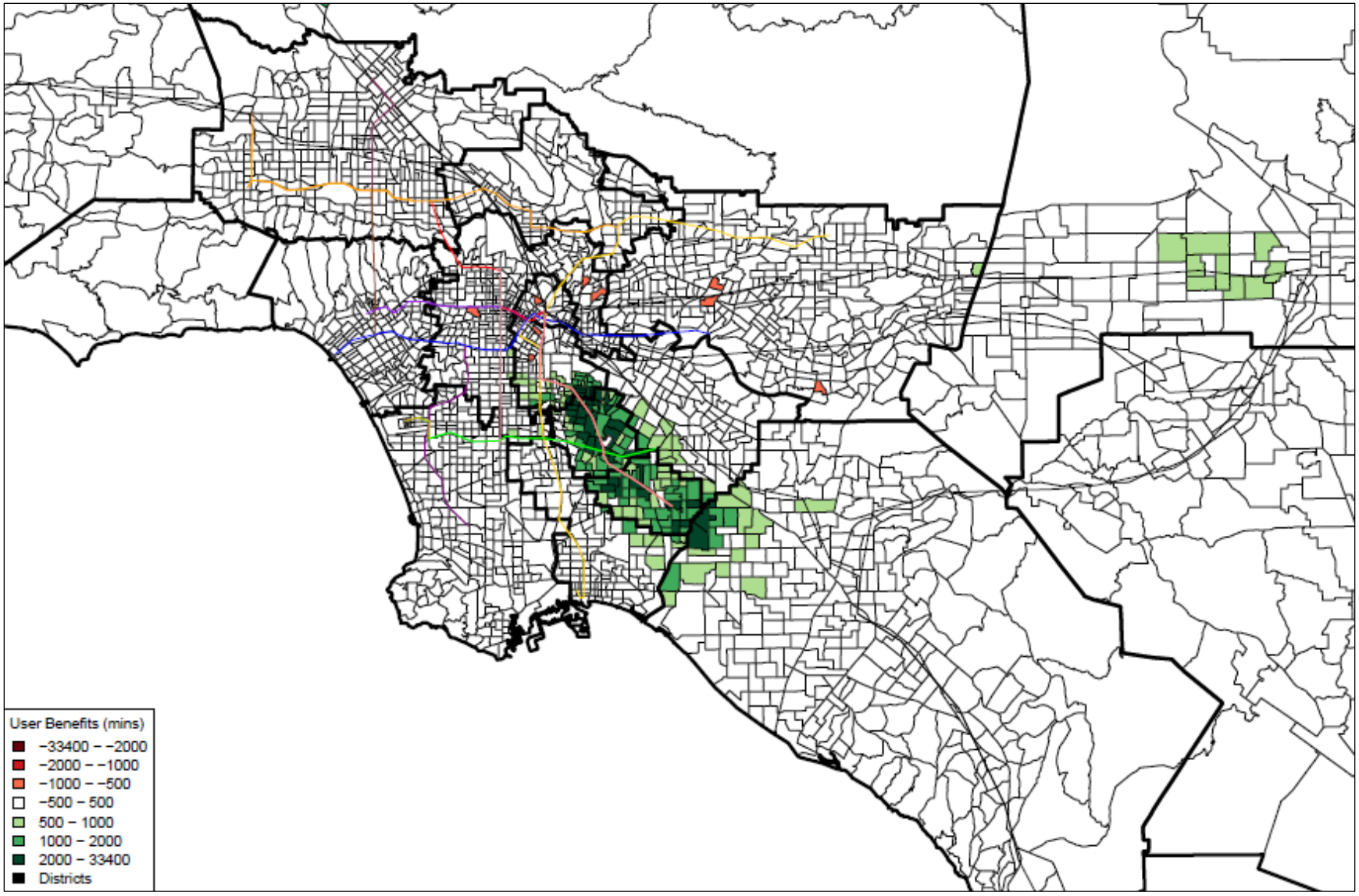
Source: WSP 2019

Figure A-2. Daily User Benefit Map (Attraction), Design Options 1 and 2



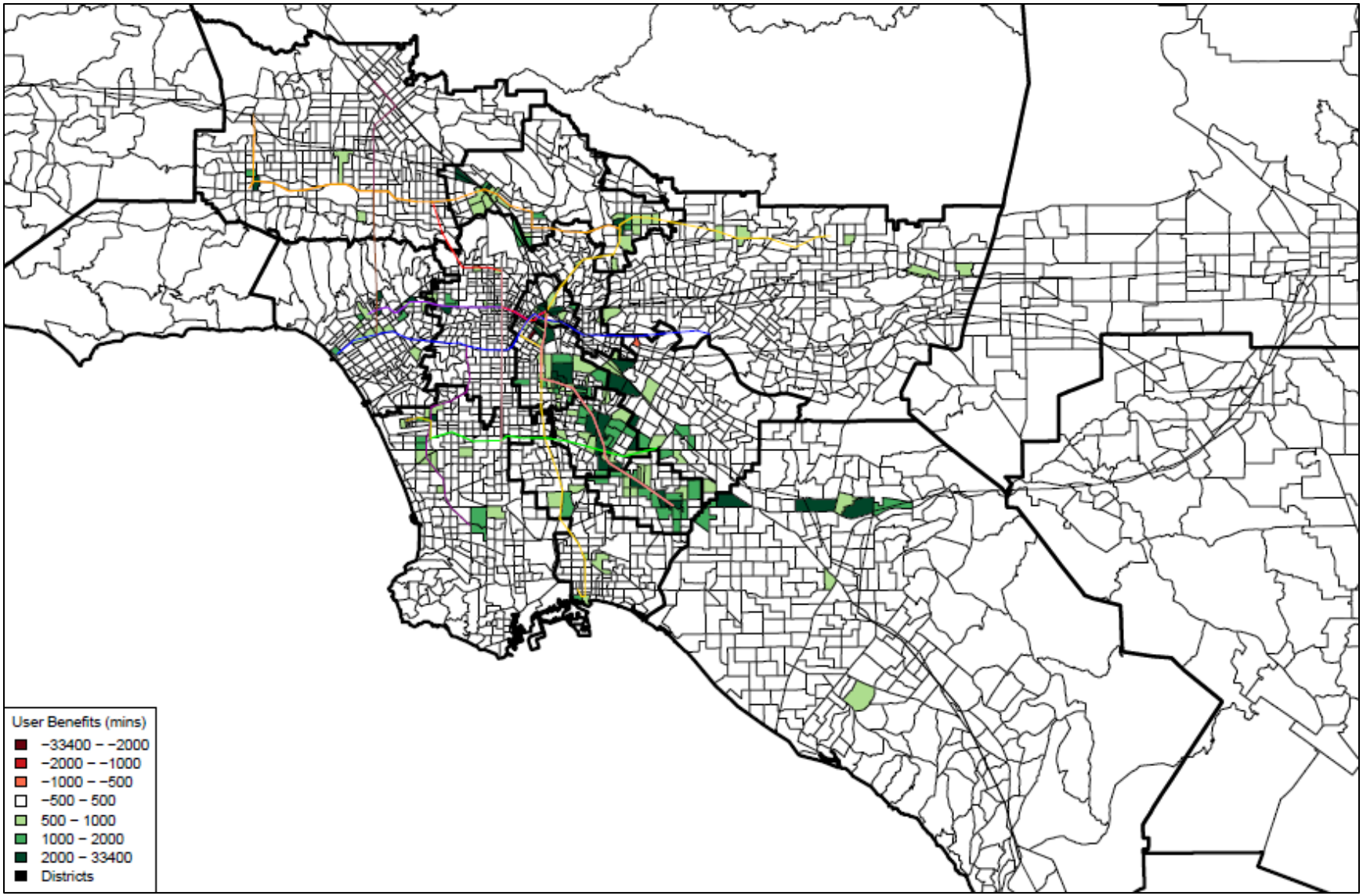
Source: WSP 2019

Figure A-3. Home-based Work Peak User Benefit Map (Production), Design Options 1 and 2



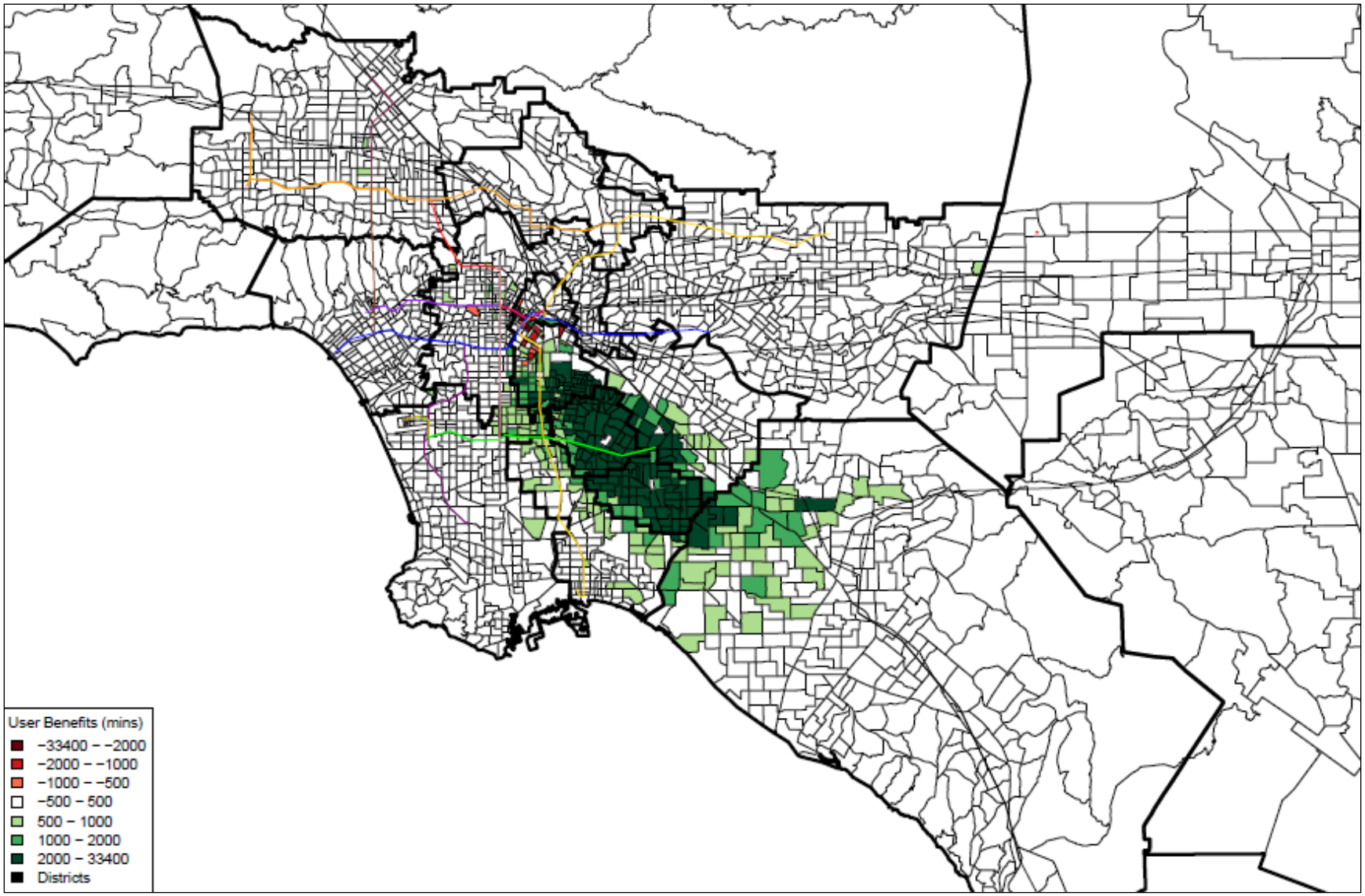
Source: WSP 2019

Figure A-4. Home-based Work Peak User Benefit Map (Attraction), Design Options 1 and 2



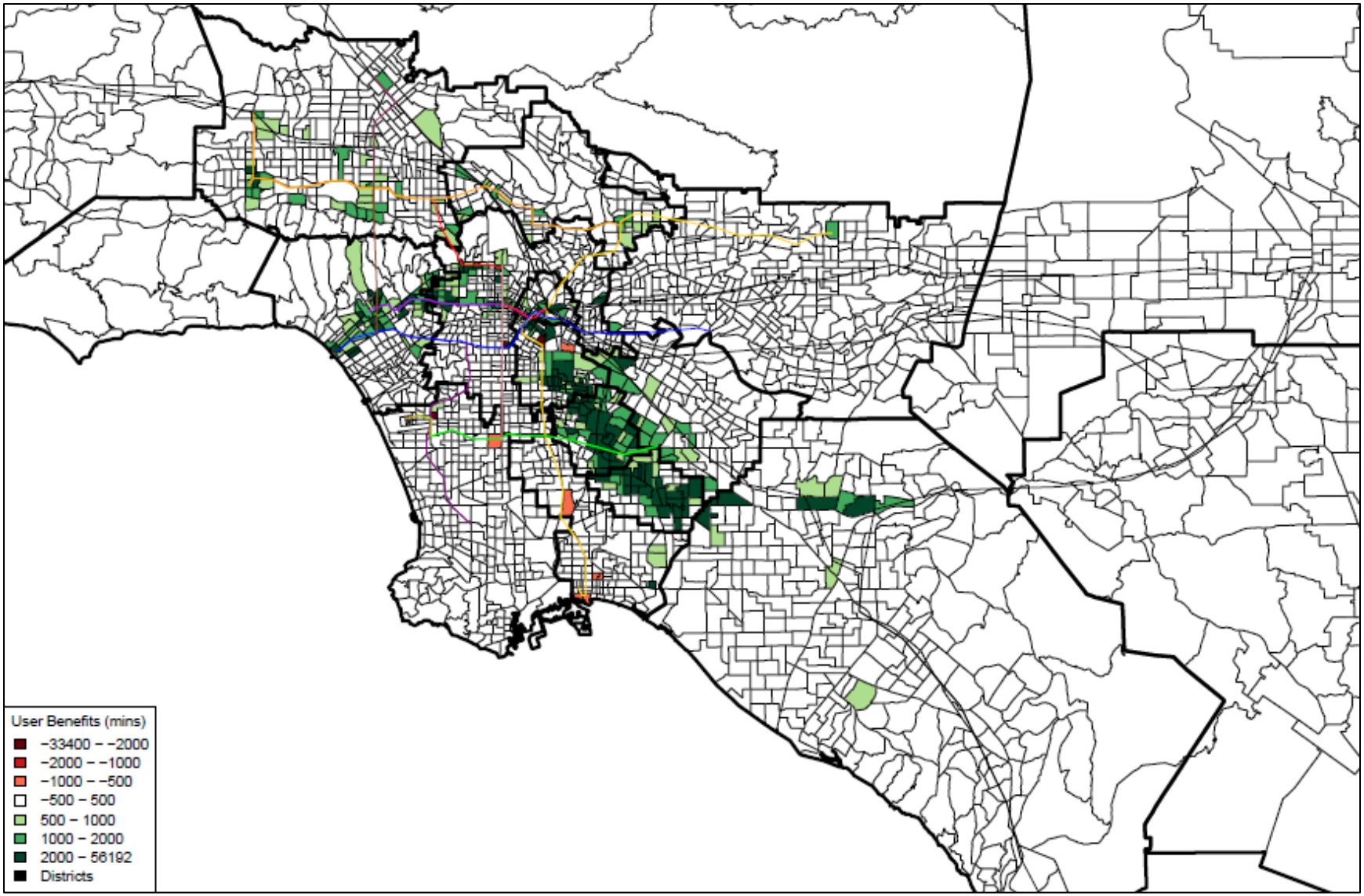
Source: WSP 2019

Figure A-5. Daily User Benefit Map (Production), Alternative 2



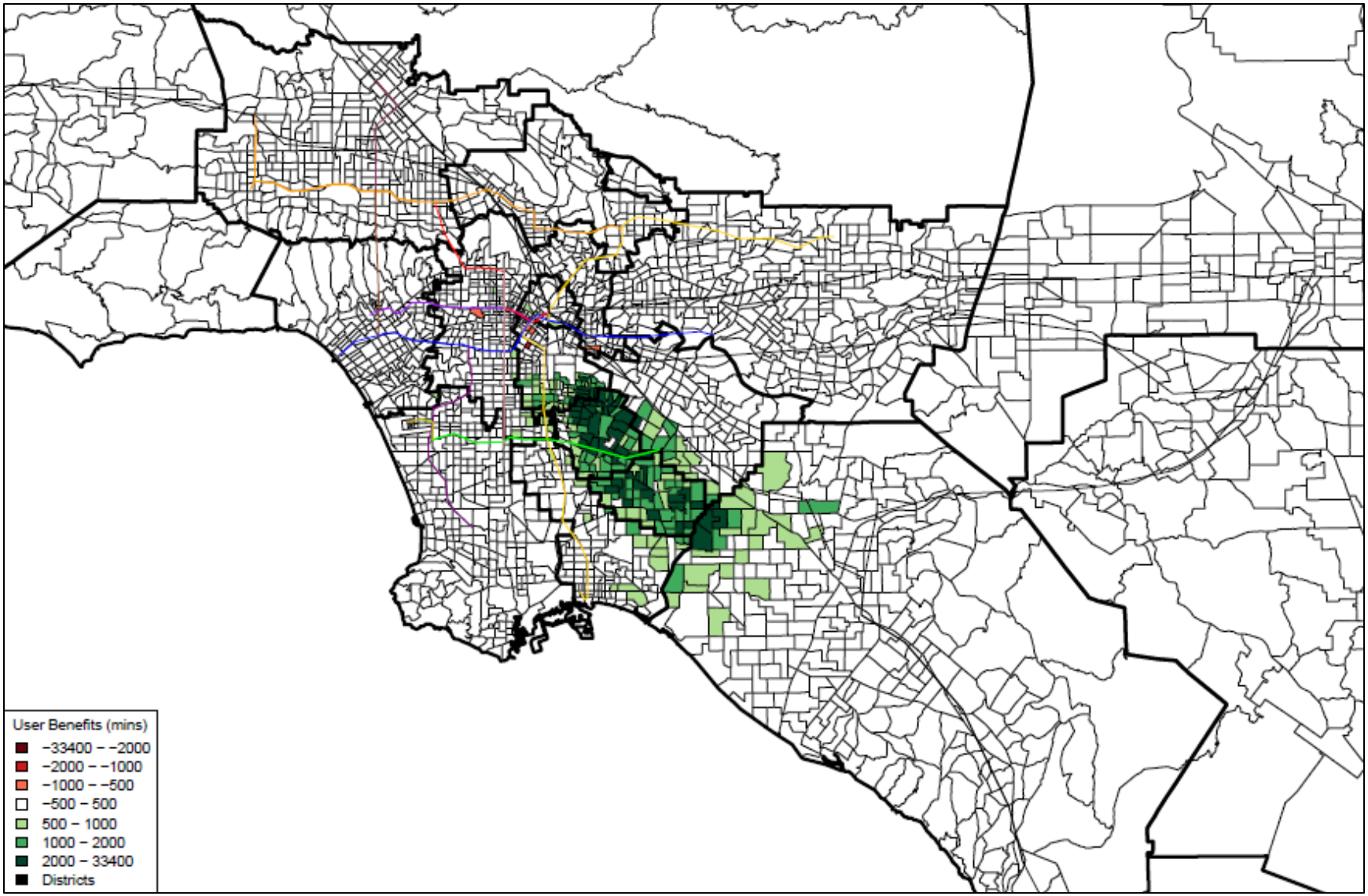
Source: WSP 2019

Figure A-6. Daily User Benefit Map (Attraction), Alternative 2



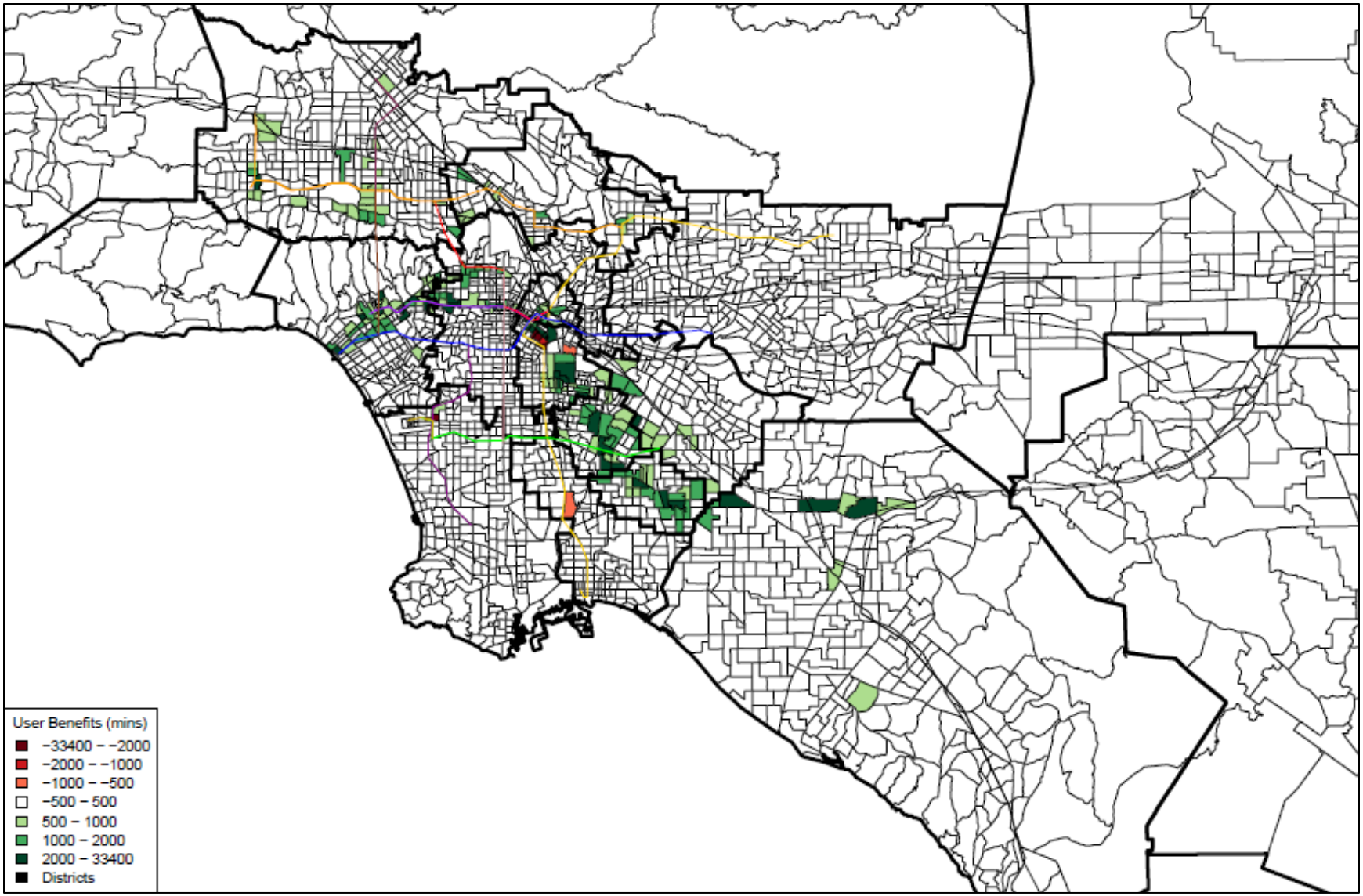
Source: WSP 2019

Figure A-7. Home-based Work Peak User Benefit Map (Production), Alternative 2



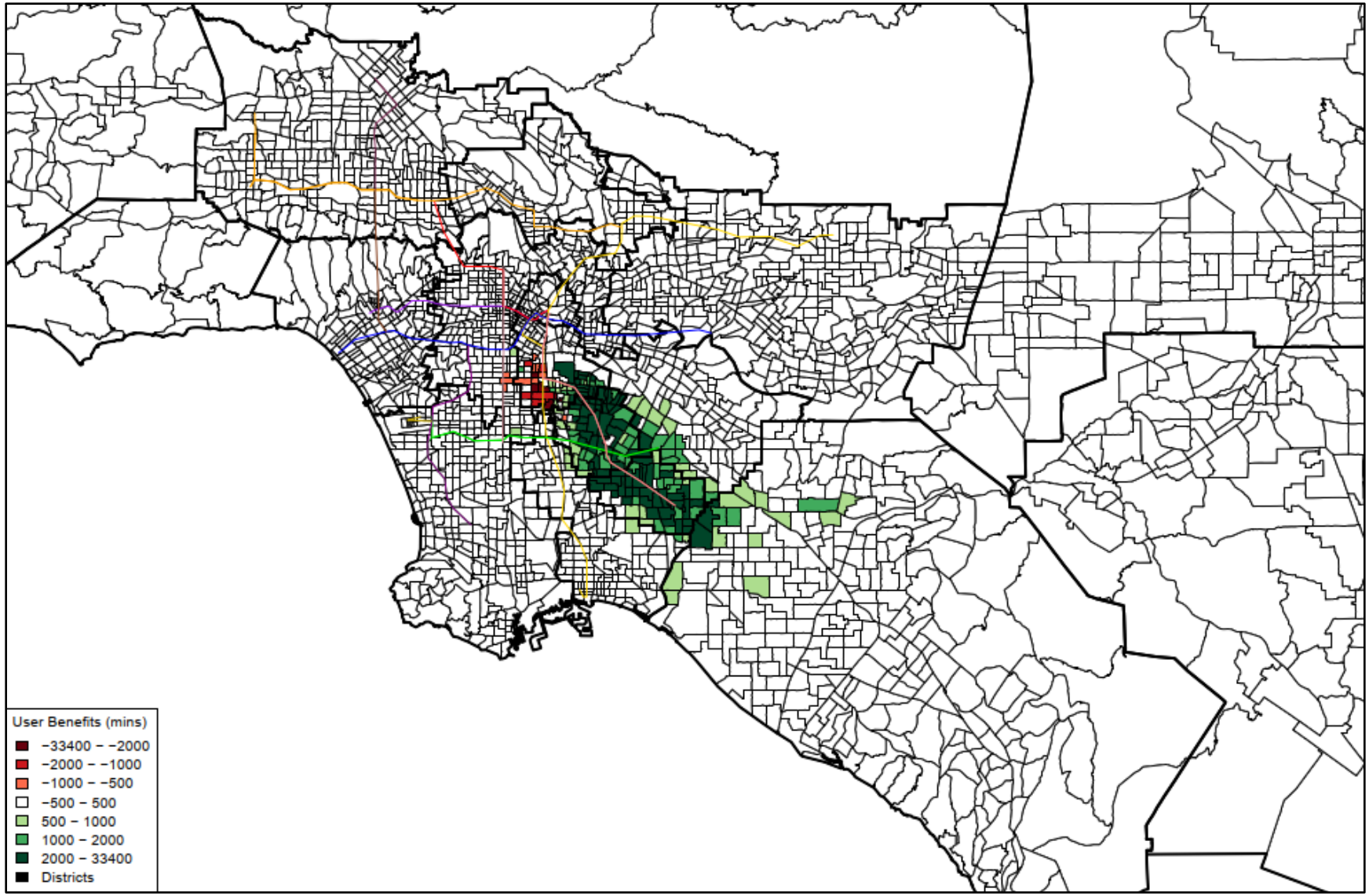
Source: WSP 2019

Figure A-8. Home-based Work Peak User Benefit Map (Attraction), Alternative 2



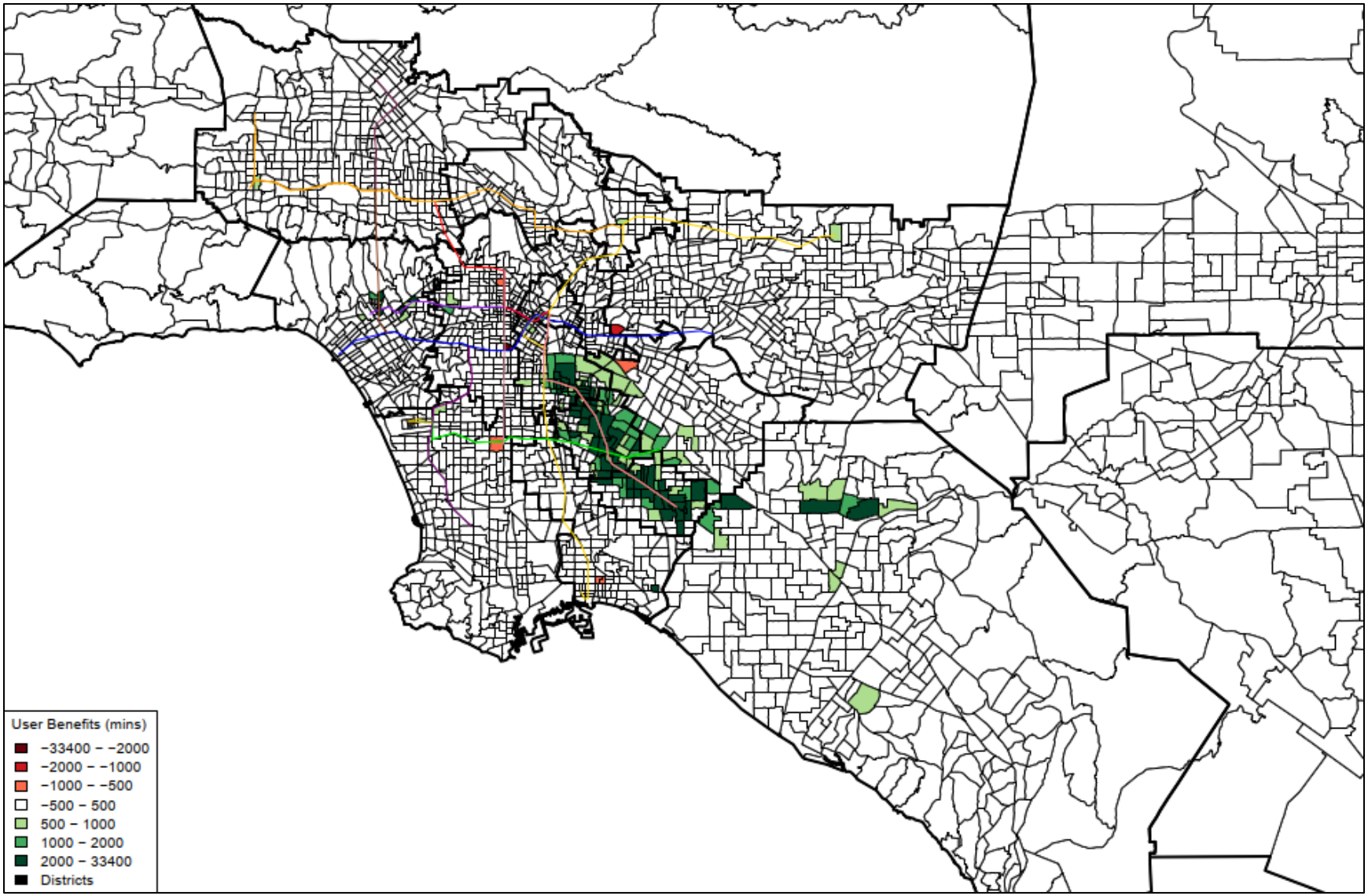
Source: WSP 2019

Figure A-9. Daily User Benefit Map (Production), Alternative 3



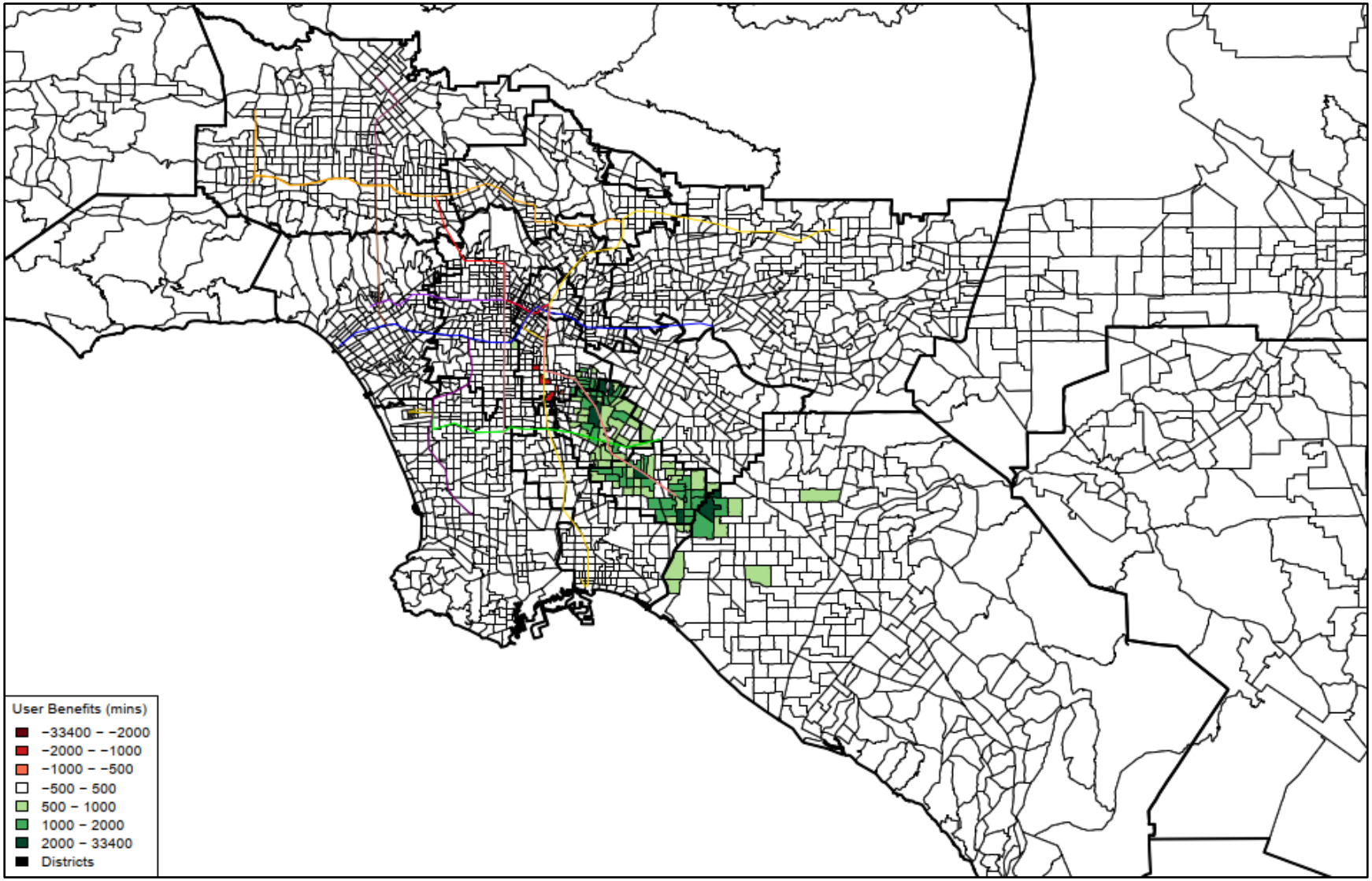
Source: WSP 2019

Figure A-10. Daily User Benefit Map (Attraction), Alternative 3



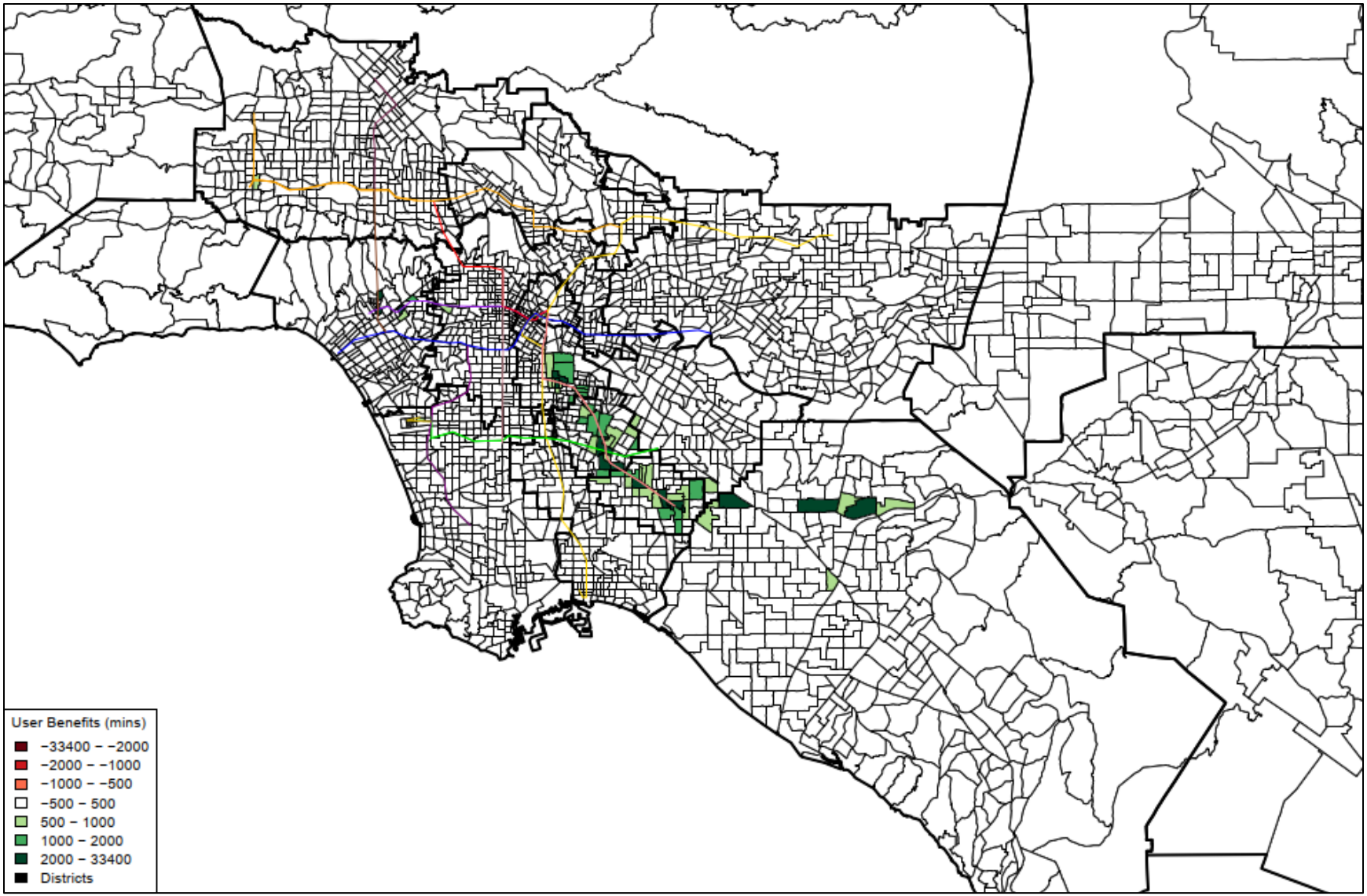
Source: WSP 2019

Figure A-11. Home-based Work Peak User Benefit Map (Production), Alternative 3



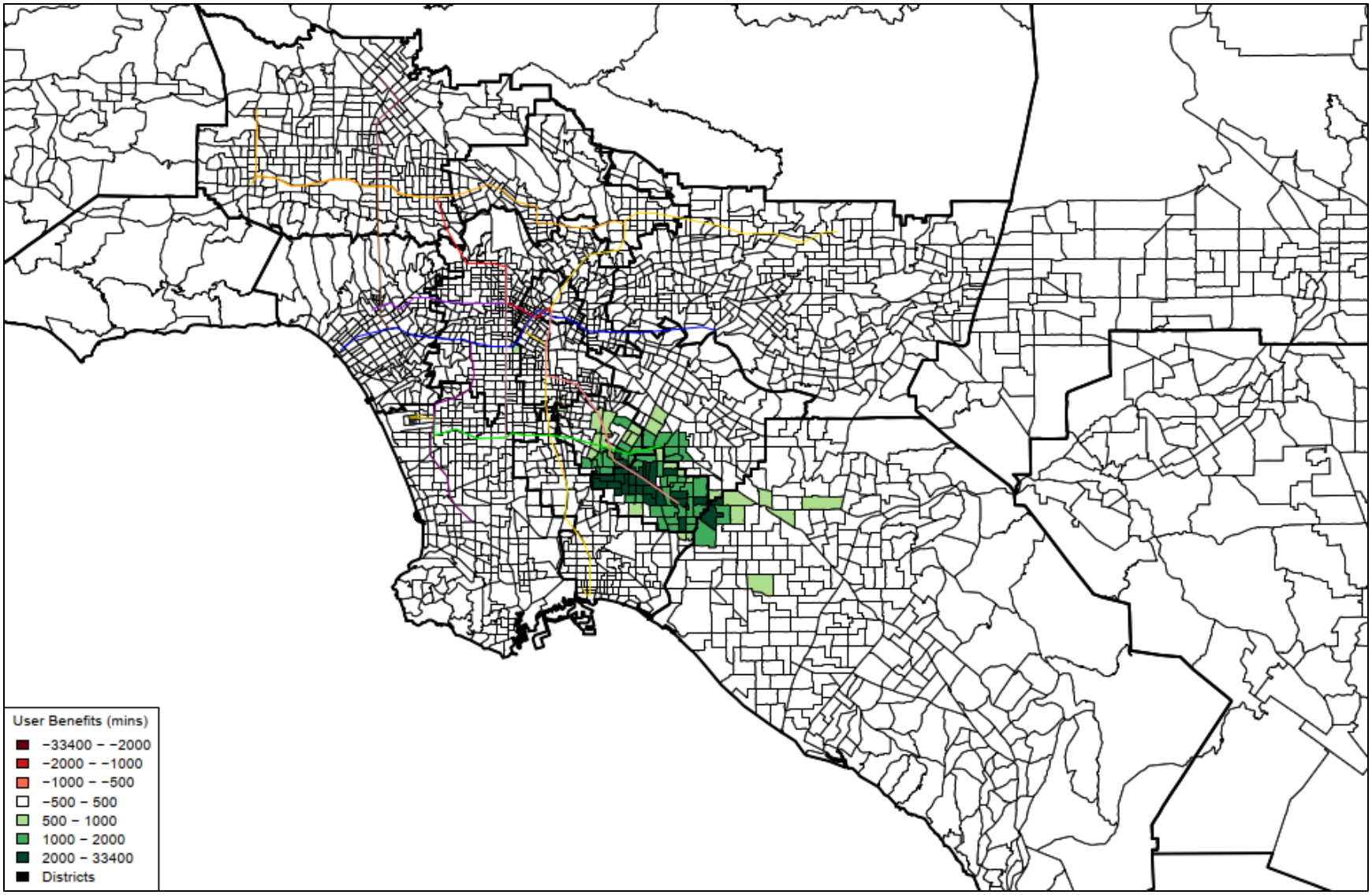
Source: WSP 2019

Figure A-12. Home-based Work Peak User Benefit Map (Attraction), Alternative 3



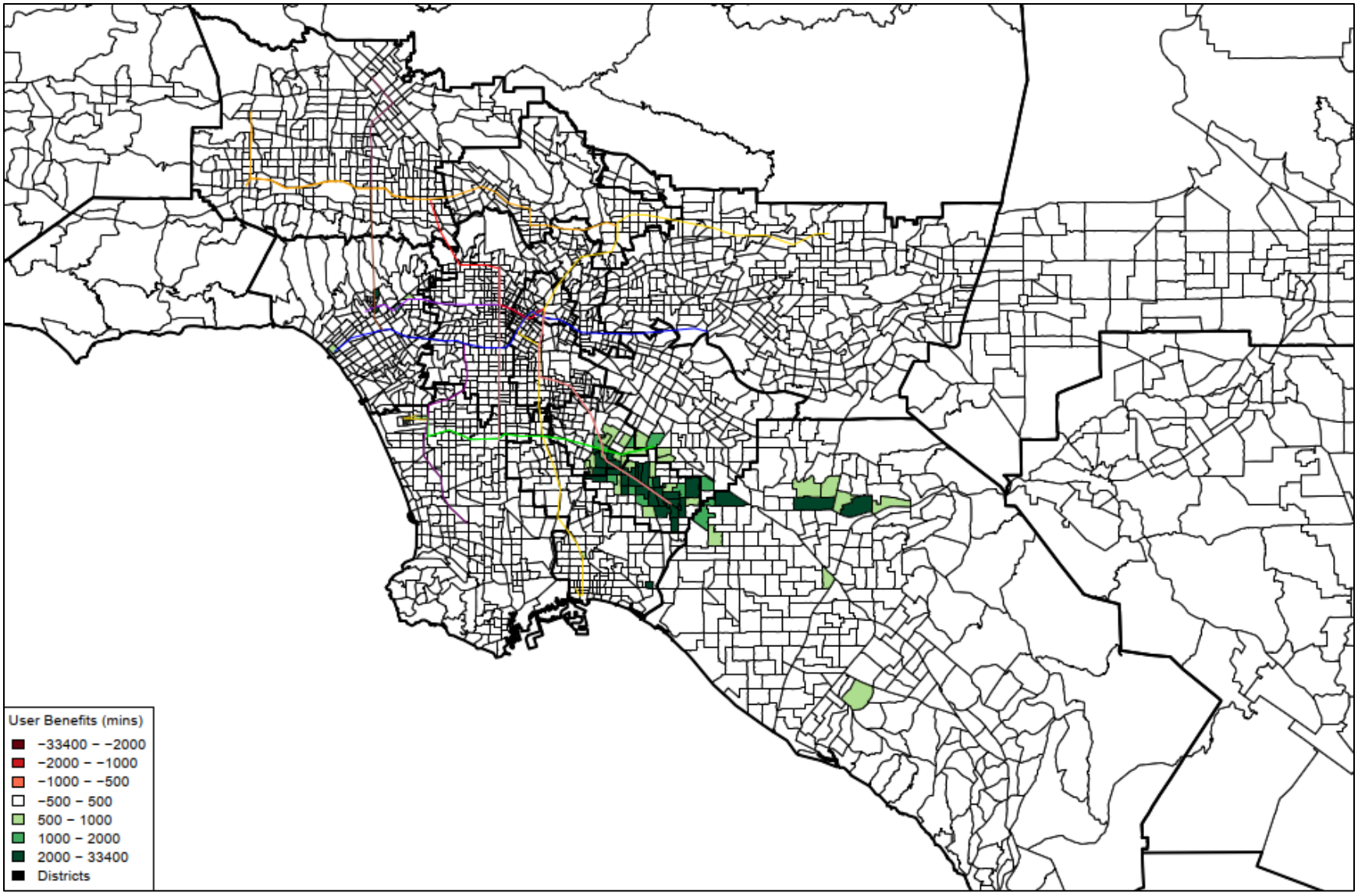
Source: WSP 2019

Figure A-13. Daily User Benefit Map (Production), Alternative 4



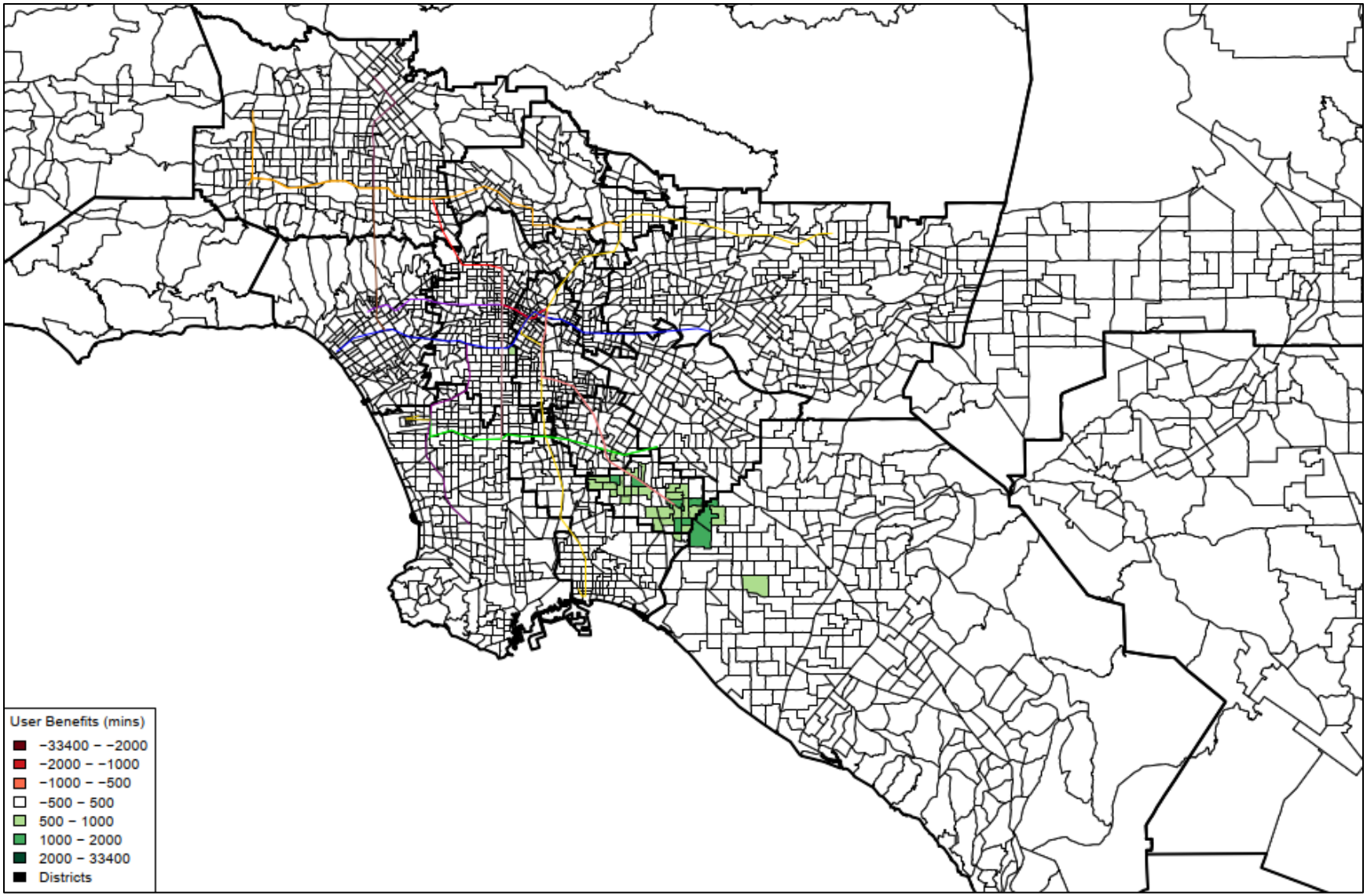
Source: WSP 2019

Figure A-14. Daily User Benefit Map (Attraction), Alternative 4



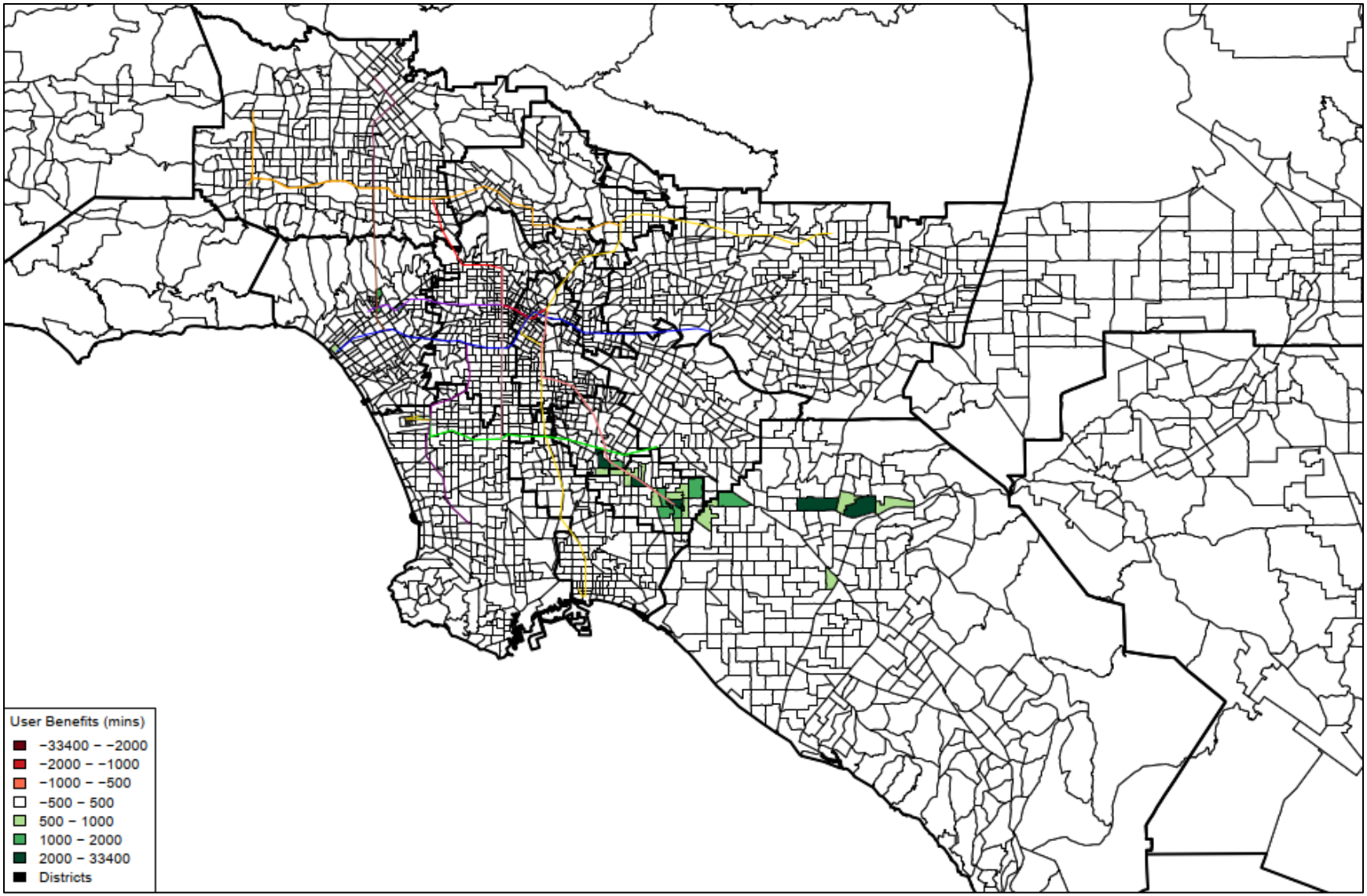
Source: WSP 2019

Figure A-15. Home-based Work Peak User Benefit Map (Production), Alternative 4



Source: WSP 2019

Figure A-16. Home-based Work Peak User Benefit Map (Attraction), Alternative 4



Source: WSP 2019