Transportation and Access to Employment in City Heights

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1. Introduction

The purpose of this research is to examine accessibility to job opportunities among residents of City Heights. Our research is motivated by several decades of research on the relationship between transportation access to employment and labor market outcomes. The seminal idea in this literature is the spatial mismatch hypothesis, first conceptualized by urban economist John Kain. In the 1960s, Kain hypothesized that residential segregation isolated African Americans in inner city ghettos, distant from growing concentrations of suburban employment, and that the resulting "spatial mismatch" could help explain higher rates of African American unemployment compared to whites who were able to move near suburban jobs (Kain, 1968). As intuitive as this idea may be, whether spatial mismatch explains labor market outcomes remains unresolved almost a half century later.

Job access is only one of many factors that affect the likelihood of employment. Other factors include access to information about available jobs, being part of networks that lead to jobs (e.g. kinship relationships), and the availability of role models to develop behaviors conducive to getting and keeping jobs. Many efforts therefore have been devoted to understand the extent to which spatial mismatch explains lower labor force participation or employment rates among low income/low skill workers. The extensive literature on this topic suggests that job access can be a significant factor, but it is one of many factors that explain employment outcomes (see, e.g., Holzer, Quigley, and Raphael, 2003.)

Job access is not simply about distance. Research conducted in the 1990s demonstrated that, in the U.S. context, automobile travel provides job access that is superior to transit (Shen, 1998 and 2001; O'Regan and Quigley, 1998). These studies found that the impact of spatial mismatch in part stems from the travel mode difference between the poor, who have limited access to private vehicles, and the non-poor.

Employment access and opportunities are often first-order priorities in low income communities, and, as noted above, employment access by car can be superior to access by transit, even in places with high quality and extensive transit service, such as Boston (Shen, 2001). The City Heights context poses specific challenges. The neighborhood has a large immigrant population, and research suggests that recent immigrants have a higher propensity to use public transit (see, e.g., Valenzuela, Schweitzer, and Robles, 2005, on informal transportation). In addition, City heights is less than 10 miles from downtown and less than 15 miles from coastal job centers such as University City, but straight line distance may be deceptive, and transportation access by non-automobile modes may be weak.

Our research objectives are thus to describe transportation access among City Heights residents. The research examines access to employment opportunities by car and transit. Accessibility measures, described below, were developed for both car and transit travel modes, and the accessibility measures for City Heights were compared to (1) San Diego County averages and (2) fifteen comparison neighborhoods chosen based on demographics that were similar to City Heights. We address two questions: (1) Do City Heights residents have inferior access to jobs compared to residents of other San Diego neighborhoods?, and (2) How does job access vary across different transportation modes? Both are essential building blocks for understanding how effectively transportation in City Heights connects residents to employment opportunities, and how those connections can be improved.

The rest of this report proceeds in the following sections. In Section 2 we describe City Heights and the process for choosing comparison areas. Section 3 describes the data and methods used to measure transportation access. Section 4 gives results and Section 5 summarizes policy implications.

2. City Heights and Comparison neighborhoods

2.1 Socio-economic characteristics of City Heights

City Heights is a low-income ethnic/immigrant neighborhood in San Diego County. Table 1 shows demographic characteristics for City Heights. All data are from The U.S. Census Bureau's American Community Survey (ACS) for 2007-2011. The population-weighted median annual household income for City Heights ($35,095) is slightly greater than 50 percent of County median household income ($63,857). City Heights is extremely diverse: ethnic or racial minorities account for about 86 percent of the population. About 40% are foreign-born, and about one-third arrived in the Unites States in the 2000s. The area has a low rate of home ownership and a large share (17 percent) of households do not own a vehicle. As expected, the residents of City Heights have a higher unemployment rate than the county average of about 6%.

Table 1 Socio-economic characteristics of City Heights

City Heights profile

Variable	base	Description	
		n(census tract)	15
Population	persons	Total population	75,657
Race	persons	Non-Hispanic White (percent)	13.21
	persons	Non-Hispanic Black (percent)	12.32
	persons	Non-Hispanic Asian (percent)	15.78
	persons	Hispanic (percent)	56.33
Income		Median household income (avg, $)	35,095.27
Nativity	persons	Native : US-Born (percent)	57.85
	persons	Foreign-Born (percent)	42.15
	persons	US entry :2000s	33.49
	persons	US entry :1990s	30.45
	persons	US entry :1980s	24.11
	persons	US entry :before 1980	11.95
Employment	persons	Unemployment rate (unemployed pop/labor force, percent)	11.15
Household type	households	Tenure: Home owners (percent)	25.63
	households	Have children in household (percent)	42.33
	households	Average household size (# of people per household)	3.18
Vehicle ownership	households	zero vehicles in household (percent)	17.09
		1 vehicle in household (percent)	43.1
		2 vehicles in household (percent)	27.7
		3 vehicles in household (percent)	8
		4 vehicles in household (percent)	2.7
		5 vehicles or more in household (percent)	1.4

There is great variation in socio-demographic characteristics across the 15 census tracts within City Heights (see Table 2.) Some tracts have a much higher share of native-born populations and median household income than others. For example, median household income in tract 2502 is almost 1.5 times greater than that of other census tracts, and the minority and foreign-born population is much lower. Most census tracts located in the northern part of City Heights have lower income levels, lower rates of vehicle ownership, and higher poverty rates than tracts in the southern part of City Heights. See Figures 1-3 for maps that display the distribution of census tract characteristics within City Heights. These maps show that vehicle ownership, median household income, and poverty are spatially correlated; the northern part of City Heights is more likely to have

less vehicle ownership while it is poorer and has higher poverty rates than the rest of the City Heights.

Table 2 Socio-economic characteristics of census tracts within City Heights

Tract ID	Total population	Total households	Race					Median household income	Poverty %	Unemp. %
			White %	Black %	Asian %	Hispanic %	Other %			
2502	6066	1923	29.0	4.6	10.4	50.2	5.7	43563.0	15.0	11.2
2708	5839	1918	8.8	20.7	12.2	52.2	6.1	24294.0	42.8	9.1
2709	3248	1065	13.7	14.7	10.8	56.8	4.0	29048.0	33.3	11.6
2501	5525	1448	12.0	1.8	21.3	64.6	0.2	45179.0	23.7	6.8
1600	5710	2320	27.2	18.1	6.6	46.4	1.8	43409.0	28.7	9.8
2401	4539	1531	18.6	8.8	4.6	65.7	2.3	39620.0	37.6	7.6
2201	4187	1273	9.7	16.4	12.5	60.3	1.1	26638.0	40.1	16.2
2402	4512	1413	5.8	7.0	13.5	72.2	1.4	30012.0	25.9	9.5
2302	6383	2074	4.0	16.3	21.8	56.2	1.6	24732.0	38.1	14.3
2601	5988	1586	10.6	7.2	15.2	65.5	1.5	36042.0	34.4	11.8
2202	4665	1543	13.1	2.7	22.0	61.0	1.2	24948.0	31.3	9.7
2707	5054	1419	3.5	9.0	21.3	64.5	1.7	36955.0	31.8	11.5
2710	3699	1115	7.1	18.5	36.4	38.0	0.0	35223.0	25.0	13.8
3401	6096	1916	17.9	26.6	15.8	35.5	4.2	47500.0	10.8	15.6
2602	4146	1136	12.3	11.0	15.3	60.4	1.0	39266.0	26.7	9.9

Tract ID	Nativity						Home owner %	No vehicle %	Avg. Household size	Children %
	Native-born %	Foreign-born %	US Entry: 2000s %	US Entry: 1990s %	US Entry: 1980s %	US Entry: pre-1980s %				
2502	71.2	28.8	20.2	33.1	26.1	20.6	52.8	5.4	3.2	36.5
2708	55.8	44.2	58.2	18.4	17.1	6.3	6.4	29.9	3.0	40.7
2709	59.9	40.1	27.7	36.9	21.3	14.1	33.3	18.8	3.1	39.8
2501	55.9	44.1	26.4	23.4	36.2	13.9	50.5	9.0	3.8	42.7
1600	75.2	24.8	26.4	33.4	24.4	15.8	14.7	9.5	2.5	32.2
2401	61.6	38.4	44.9	26.7	11.9	16.5	23.1	19.0	3.0	37.2
2201	52.0	48.0	41.0	31.9	20.2	6.9	13.7	17.0	3.3	47.8
2402	50.2	49.8	27.4	38.6	22.6	11.4	10.3	24.3	3.2	50.0
2302	46.2	53.8	37.4	31.2	22.6	8.8	16.0	23.7	3.1	48.4
2601	52.6	47.4	25.5	31.0	30.3	13.3	34.7	11.5	3.8	44.5
2202	51.8	48.2	34.6	34.2	20.6	10.7	2.0	24.3	3.0	44.6
2707	45.6	54.4	37.6	32.5	20.0	9.9	10.3	27.6	3.5	46.4
2710	51.4	48.6	36.6	30.8	21.8	10.8	33.6	19.7	3.3	50.0
3401	72.9	27.1	18.5	22.2	36.5	22.8	62.1	11.0	3.1	34.6
2602	59.3	40.7	26.2	37.0	30.9	5.9	18.4	8.3	3.6	52.0

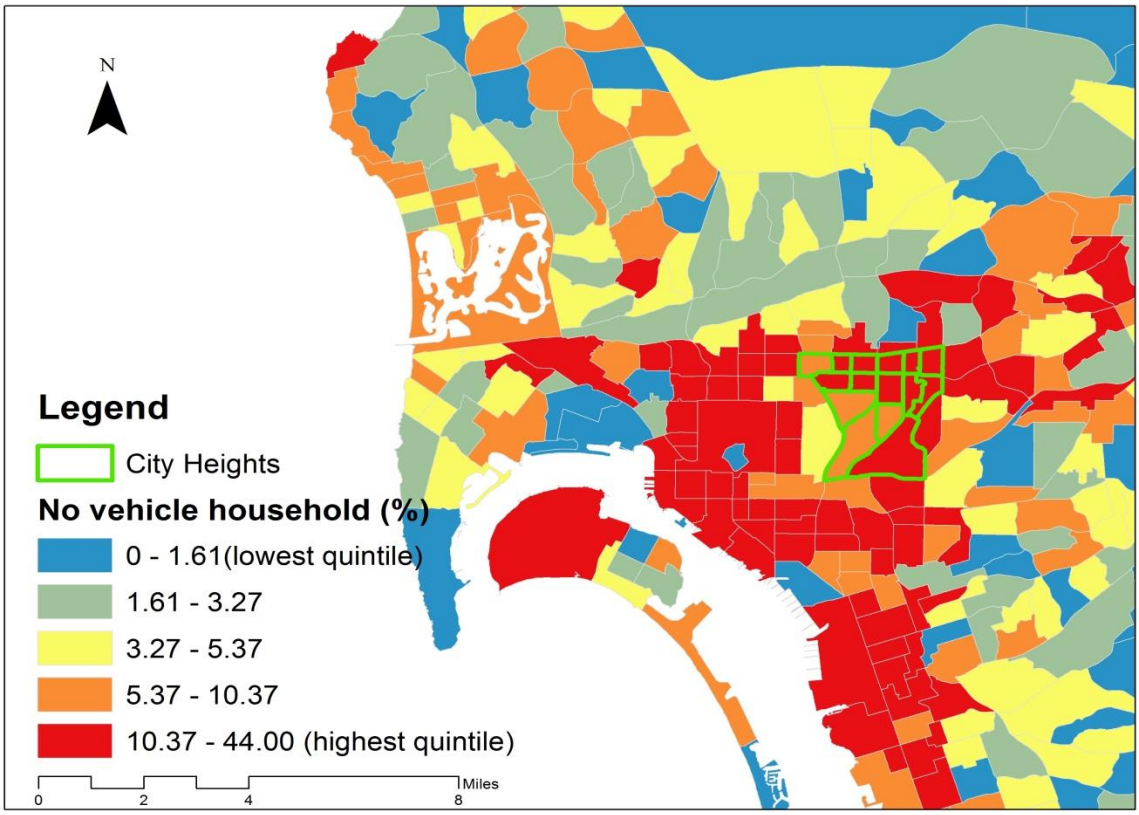

Figure 1 Percent of households without vehicle, census tracts

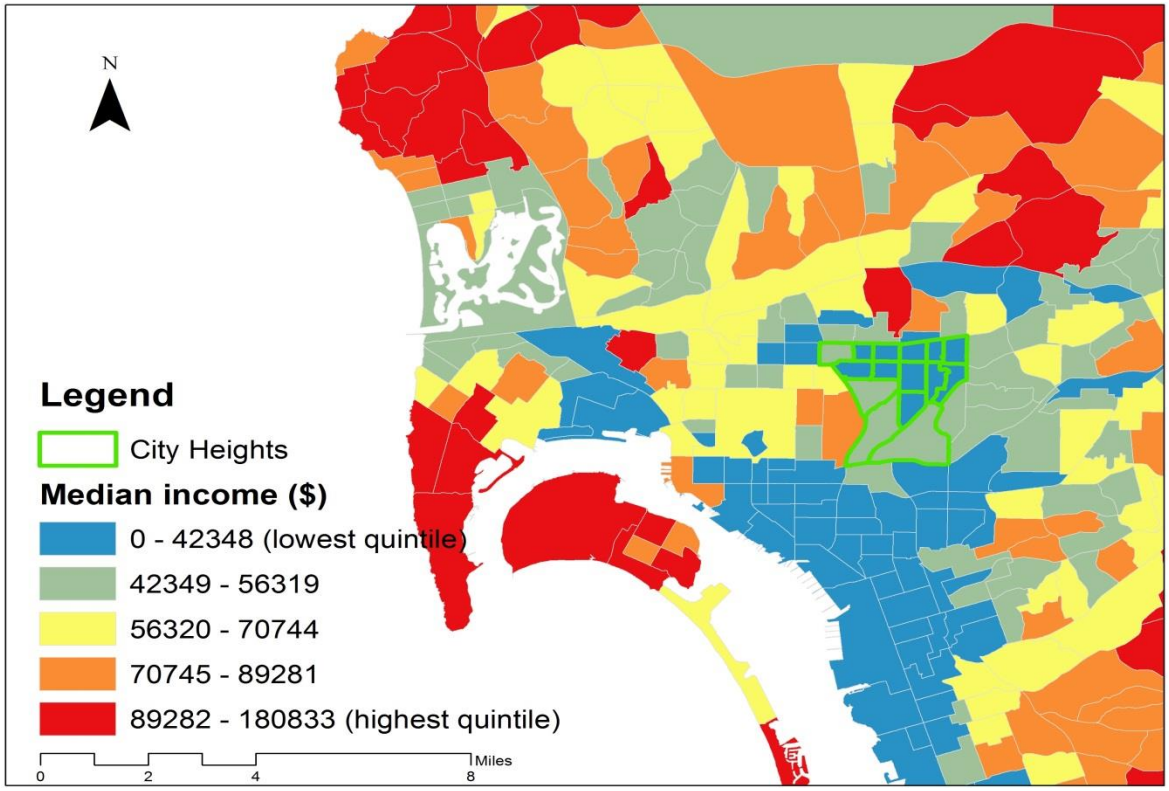

Figure 2 Median household income, census tracts

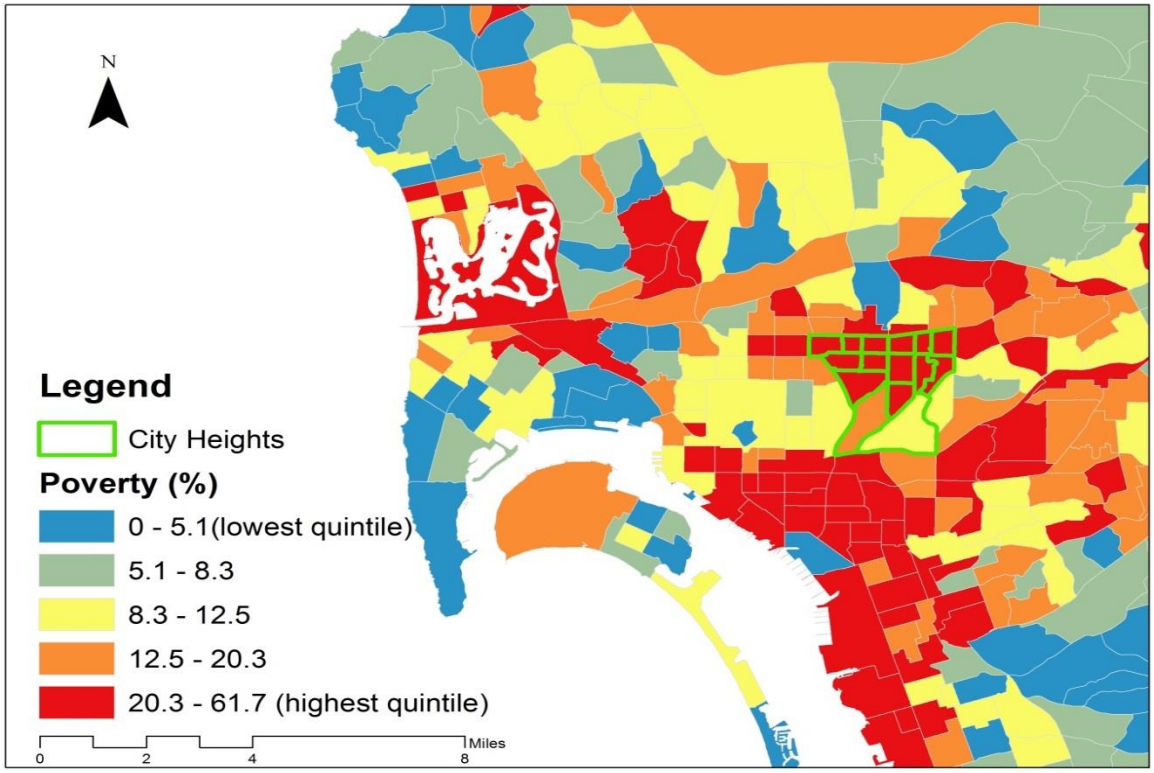

Figure 3 Poverty rates, census tracts

2.1 Identification of comparison neighborhoods

We chose comparison areas for City Heights in order to investigate whether City Heights has inferior access to jobs compared to residents of other San Diego neighborhoods with similar socio-economic characteristics. We used propensity score matching to select the 15 census tracts in San Diego County that are most similar to the 15 City Heights tracts on selected characteristics. The propensity score method first uses a binary logit model to estimate the probability that any one of San Diego County's tracts are, or are not, City Heights. The regression is shown below.

$$\Pr(y_i = 1) = F(a_1 * \text{MedIncome}_i + a_2\text{PercentAfAm}_i + a_3\text{PercentAsian}_i + a_4\text{PercentHispanic}_i + a_5\text{ShareForeignBorn}_i + a_6\text{Unemp}_i + a_7\text{PercentPoverty}_i) \quad (2\text{-}1)$$

Where y_i =1 for tract *i* located in the City Heights neighborhood, 0 otherwise
MedIncome=Tract median household income
Percent AfAm=percent of tract population that is African American
Percent Asian=Percent Asian
Percent Hispanic=Percent Hispanic
ShareForeignBorn=Percent of tract population that is foreign born
Unemp=tract unemployment rate
PercentPoverty=percent of tract population below poverty line income
And $F(\cdot)$ is the cumulative logistic distribution. $F(x) = e^z/(1 + e^z)$

We estimated a binary logit for the above regression. The predicted values from that logit model can be interpreted as the probability that each tract is in City Heights. Generally that probability is closer to one for tracts in City Heights, but because the seven variables do not perfectly predict membership in City Heights the predicted probabilities fall between zero and one for all tracts. Propensity score matching chooses tracts that are not in City Heights but whose predicted values from the logit regression are the closest to City Heights. Those tracts are, statistically, the most similar tracts to City Heights with respect to the seven independent variables in the regression. We chose the 15 census tracts with the highest predicted probability as comparison neighborhoods. The results of the binary logit regression are in Table 3. The comparison tracts are shown in Figure 4. It can be seen that they are located relatively close to City Heights.

Table 3 Binary logit model for the choice of City Heights comparison tracts

Variables	Coef.	P>z
Median household income	-0.00007	0.076
Hispanic %	0.002	0.908
African American %	0.105	0
Asian %	0.032	0.393
Foreign-born %	0.106	0.027
Unemployment rate	-0.105	0.109
% below poverty line	0.032	0.467
Constant	-5.287	0.077
Number of observations	622	
Log-likelihood at 0	-70.69101	
Log-likelihood at convergence	-39.99117	
Fraction correctly predicted	97.91%	
Pseudo R2 = 0.4343		

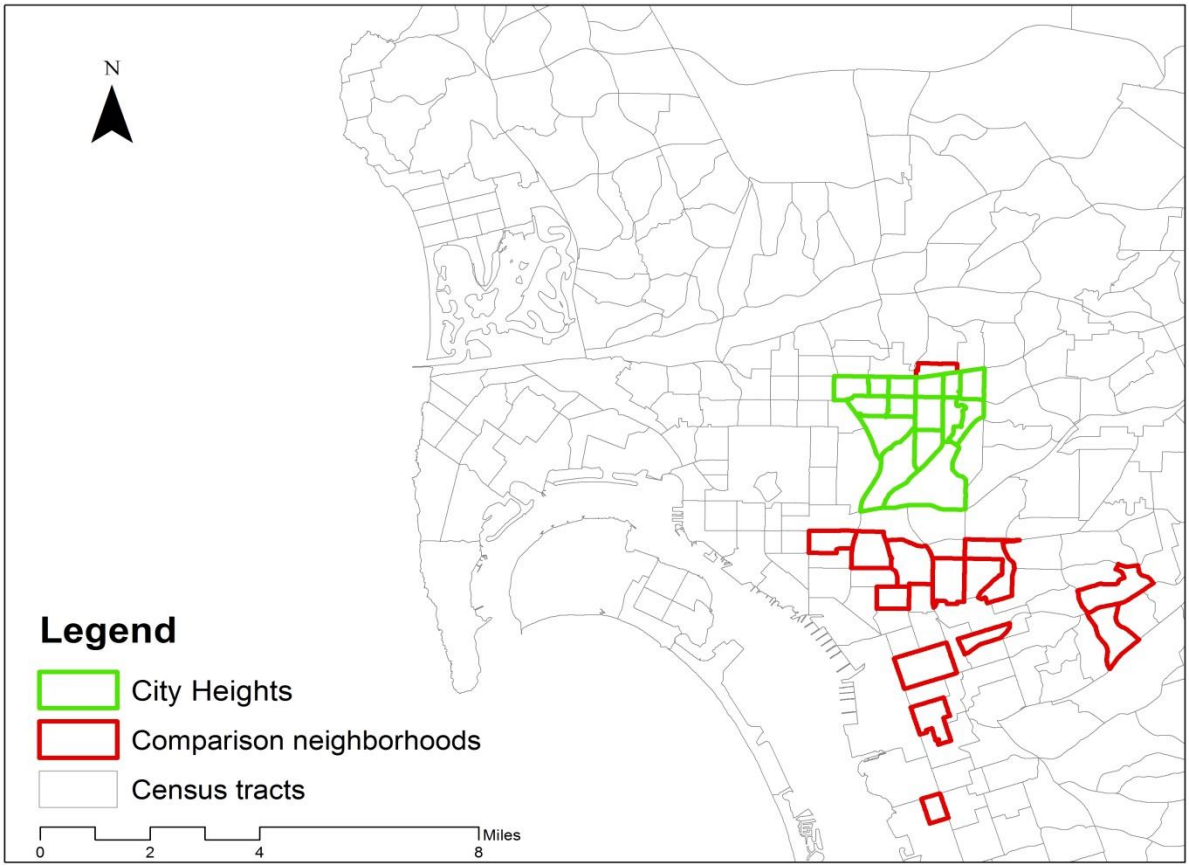

Figure 4 Comparison neighborhoods and City Heights

3. Data and Methods

3.1 Low income labor force

Our task is to measure job accessibility for the residents of City Heights. Demographic characteristics indicate that most workers are low wage workers. We therefore focus on low wage/low skill workers and jobs. There is no data source that allows us to directly identify low wage/low skill workers and jobs. In this section we describe how we estimate potential low wage/low skill workers and jobs.

Previous studies on the subject have mainly used two definitions of low income populations: the poverty threshold defined by the U.S. Census Bureau, or the Department of Housing and Urban Development (HUD)'s definition of low income. We use HUD's definition, because it is adjusted for family size and geographic location and it has been widely applied in governmental subsidy programs. The HUD definition is based on families. We use households in order to capture the population of potential workers. HUD's low income definition for San Diego County is $59,500 for a 3 person family,[1] which is approximately 80 percent of the county's median family income ($74,900).We use $50,000 (about 80 percent of the county's median household income [2]) to define low income population.

Our definition of low income applies to the household. In order to estimate the number of persons potentially in the labor force, we use the ratio of low income to total households in a census tract multiplied by the tract's civilian labor force to get tract level estimates of the low income labor force. The civilian labor force is defined as persons aged 15 to 64. The calculation is shown below,

$$low\ income\ labor\ force_i = \frac{low\ income\ households_i}{total\ households_i} * civilian\ labor\ force_i \quad (3\text{-}1)$$

where i is a census tract.

[1] The average household size of the San Diego County is about 2.75 based on ACS 2008-12 5 year estimates.
[2] The median household income of the San Diego County is about $63,373 based on ACS 2008-12 5 year estimates

3.2 Low wage jobs

To estimate job access for low wage workers, we need to identify jobs that are "available" to low wage workers. Since there is no formal definition of "low-wage" jobs, we created our own criteria by defining those jobs within each industry sector that are paid below the national median hourly wage as "low-wage jobs". We use the "National Industry-Specific Occupational Employment and Wage Estimates" from the U.S. Bureau of Labor Statistics to examine the wage distribution of each North American Industrial Classification System (NAICS) 2-digit sector as of May 2009, which include the estimated mean and median values of hourly wages, as well as estimated wage values at 10th, 25th, 75th, and 90th percentiles. Assuming that wages are normally distributed[3], we use the 90th percentile value of estimated hourly wages to calculate the standard deviation of the wage distribution for each NAICS-2 sector[4]. Then, using the mean and standard deviation of wage distribution for each sector, we are able to estimate the probability that wage levels of each sector takes on a value less than or equal to the national median hourly wage level (which is $15.95 for 2009). That estimated probability is used as the estimate of the proportion of low-wage jobs for each sector. Finally, to estimate the number of low-wage jobs within each census tract of San Diego County, we multiply the number of jobs for each NAICS 2-digit sector within each census tract by the proportion of low wage jobs in each sector and aggregate the number of low-wage jobs of all sectors within each tract[5]:

$$low\ wage\ job_i = \sum_j Emp_{i,j} * \Pr(wage_j \leq \$15.95\ per\ hour) \quad (3\text{-}2)$$

where *i* denotes tract and *j* denotes NAICS-2 sectors.

Table 4 presents the estimated fraction of low-wage jobs within each sector, using the national wage estimates by the BLS as of May 2009. The table shows that sectors such as agriculture, retail trade and accommodation services contain a large percentage of low-wage jobs, while sectors such as utilities, information, professional services and management are more highly paid. Other sectors such as manufacturing and art sectors contain roughly equal shares of low-wage and high-wage jobs.

[3] Income (and hence likely wages) of the population is distributed log-normally, not normally. So the assumption of a normal distribution is not fully accurate but was done to simplify our estimation.

[4] For a normal distribution, every random variable X can be transformed into a z score via

$$z = (X - \mu) / \sigma$$

where X is a normal random variable, μ is the mean of X, and σ is the standard deviation of X. Since the 90th percentile z score ($z_{0.9}$) in a standard normal distribution equals 1.28, we calculate the standard deviation as $\sigma = (X_{0.9} - \mu) / z_{0.9}$, where $X_{0.9}$ corresponds to the 90th percentile wage level for each NAICS-2 sector (Table 5).

[5] As we will discuss later, data on employment by NAICS-2 sectors at the establishment level are from the National Establishment Time Series (NETS) database.

Table 4 Hourly wage distribution and estimated percentage of low-wage jobs for each sector (NAICS-2), national data, 2009

NAICS	Industry	wage percentile (wage in dollars)					mean hourly wage	Std. Dev. (estimated from 90th percentile)	Percentage of jobs with wage below $15.59 per hour
		10th percentile	25th percentile	50th percentile	75th percentile	90th percentile			
11	Agriculture	8.08	8.51	9.35	12.93	18.8	11.98	5.32	77.22
21	Mining	11.85	15.35	20.96	29.28	44	25.4	14.51	25.75
22	Utilities	14.25	20.03	28.2	36.32	46.45	29.58	13.16	15.02
23	Construction	10.75	13.82	18.84	27.55	37.9	22.36	12.13	29.85
31-33	Manufacturing	9.68	12.41	17.09	25.32	38.78	21.43	13.54	34.28
42	Wholesale Trade	9.65	12.72	18.04	28.22	45.55	24	16.82	31.61
44-45	Retail Trade	7.58	8.55	10.58	15.12	22.78	13.79	7.01	62.09
48-49	Transportation and Warehousing	10	13.2	18.61	25.25	31.17	20.56	8.28	28.88
51	Information	9.91	14.59	23.61	35.92	52.57	28.4	18.86	25.46
52	Finance and Insurance	10.84	14.06	20.11	32.56	51.51	27.31	18.88	27.37
53	Real Estate	8.41	10.59	14.75	21.61	33.49	19.16	11.18	38.7
54	Professional Services	11.52	16.6	26.3	41.64	62.21	32.81	22.94	23.12
55	Management	12.28	16.89	25.91	40.94	60.54	32.39	21.97	22.71
56	Administrative Services	8.05	9.47	12.49	18.11	28.33	16.17	9.49	49.08
61	Educational Services	9.48	13.57	20.32	28.93	39.62	23.09	12.9	28.99
62	Health Care	8.76	11.13	15.96	26.16	39.08	21.84	13.45	33.08
71	Arts	7.55	8.55	11.14	17.29	27.39	15.41	9.35	52.3
72	Accommodation and Food Services	7.25	7.72	8.88	11.28	15.75	10.56	4.05	90.84
81	Other Services	7.82	9.23	13.06	19.79	29.8	16.76	10.18	46.83
99	Public Administration	10.94	15.14	21.48	30.75	42.88	24.62	14.25	27.14

Employment data

We use the National Employment Time Series (NETS) data to estimate job accessibility. This database is a proprietary data set developed from Dun and Bradstreet establishment data (see Walls and Associates,2008) and has information on all business establishments, the number of employees at each establishment, and establishment NAICS code, geocoded to street addresses using a geographic information system. The data series we received includes annual data from 1990 through 2009 for approximately 5.5 million establishments.

For this research we used the data for San Diego County during the 2007 to 2009 period, which includes 214,000 to 240,000 establishments depending on the year, with approximately 1.6 million jobs (Table 5). To estimate access to employment, we aggregate the establishment-level NETS data to the census tract level using the 2010 tract boundaries, which also facilitates the merging of NETS data with other socio-economic data derived from the 2007-2011 ACS. Since there is some variation in the total number of annual jobs and establishments due to the economic cycle, we used the 2007-2009 three year average of employment counts instead of annual employment counts (Table 5). We also eliminate all self-employed establishments (Employment=1) because they can hardly be considered opportunities for job seekers.

Table 5 Total employment and establishments in the San Diego County

	All establishments		Excluding self-employed establishments	
	Employment	Number	Employment	Number
2007	1,627,946	216,499	1,563,686	152,239
2008	1,667,352	240,630	1,591,988	165,266
2009	1,578,355	214,530	1,519,081	155,256

Using Equation (3-2), we estimate the number and density of low-wage jobs at the census tract level and present the summary statistics in Table 6. On average, approximately 40% of tract-level jobs are estimated to be low-wage jobs. There is a great deal of variation in the spatial distribution of jobs as illustrated by the large standard deviation and range of all variables in Table 6.

Table 6 Summary statistics of tract-level employment (n=627 census tracts)

	Mean	Std. Dev.	Min	Max
Employment (jobs)	2,486	5,799	3	83,855
Employment Density (jobs per acre)	4.13	9.75	0.003	201.6
Low-wage employment (jobs)	985	1,991	3	28,224
Density of low wage employment (jobs per acre)	1.74	3.6	0.001	68.4

Table 7 presents the summary statistics of tract level employment and employment density within the City Heights neighborhood. Compared with the county as a whole, the average density of all jobs and low-wage jobs is slightly lower within City Heights, implying that fewer job opportunities are available within the neighborhood compared to San Diego County. However, due to the variation in job density, these differences are not statistically significant.

Table 7 Summary statistics of tract-level employment within City Heights (n=15 census tracts)

	Mean	Std. Dev.	Min	Max
Employment (jobs)	618	424	172	1830
Employment Density (jobs per acre)	3.55	2.34	0.55	9.39
Low-wage employment (jobs)	269	182	74	721
Density of low wage employment (jobs per acre)	1.58	1.15	0.24	4.67

The spatial distribution of low-wage jobs is shown in Figure 5. As indicated in the map, low-wage jobs are mostly concentrated in the downtown area, which is approximately 4 to 5 miles away from City Heights. Within City Heights, low-wage jobs are not evenly distributed but mainly concentrated in the northern part of the neighborhood along University Avenue.

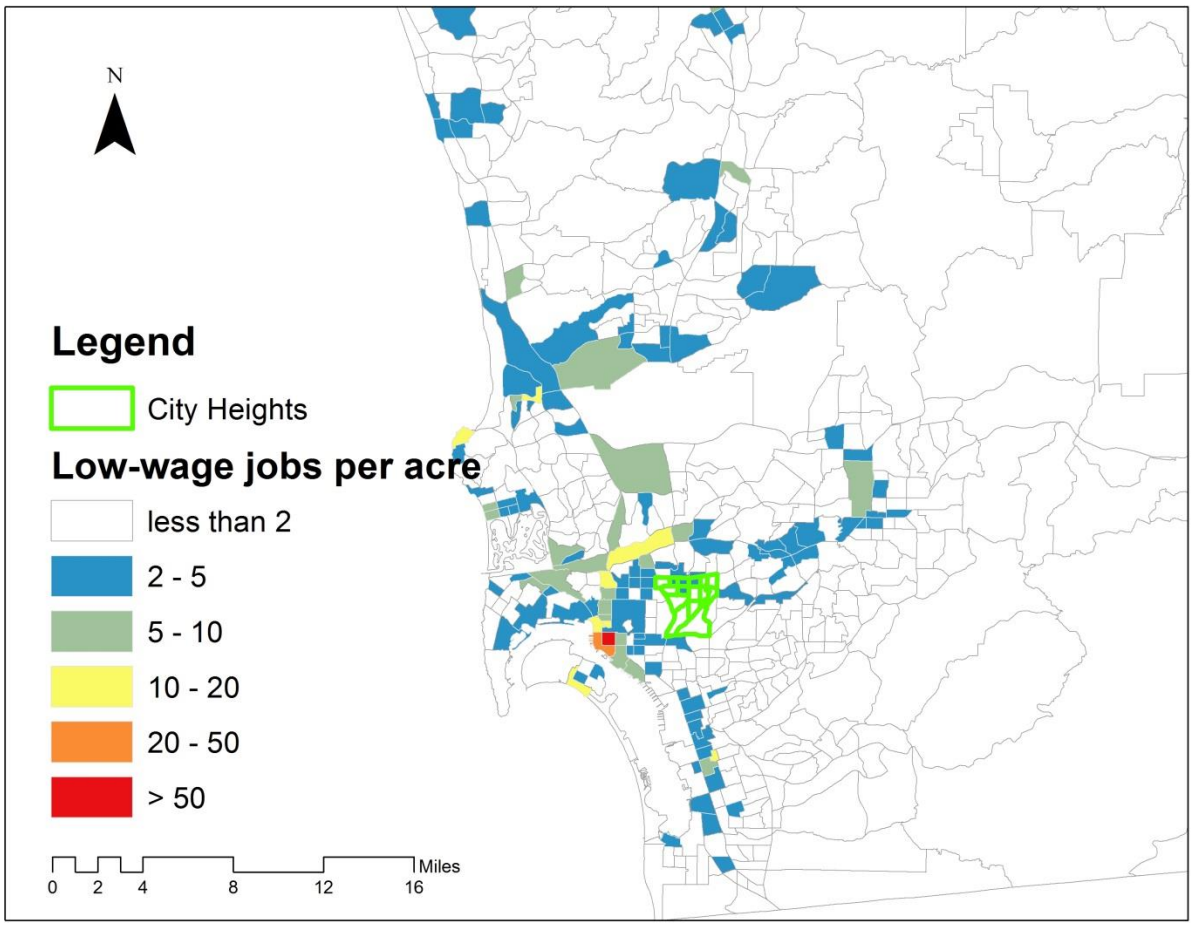

Figure 5 Spatial Distribution of low-wage jobs (2007-2009, 3-year average)

3.3 Transportation network

Road Network in the San Diego County

In order to calculate our accessibility measures, we need tract-to-tract travel times by mode (car and transit) and time of day (peak and off-peak). We obtained 2008 transportation network files for San Diego County from the San Diego Association of Governments (SANDAG[6]). The files contain detailed information for each road/highway link and node including peak and off-peak link travel time in minutes. See Figure 6. To build the travel time origin-destination (OD) matrix, the centroid of every census tract in the county is assigned to the closest network node within the tract. A few census tract centroids are distant from the nearest network node. In these cases, we create an additional link from the centroid to the nearest nodes, and assigned an average speed of zonal

[6] From here on, the term "SANDAG" always represents the " San Diego Association of Governments".

connector links (IFC, or Initial Functional Classification =10). [7] Travel time for the additional link is calculated by dividing the link length by speed. Using the shortest path algorithm, travel times for each centroid-to-centroid pair are then generated.

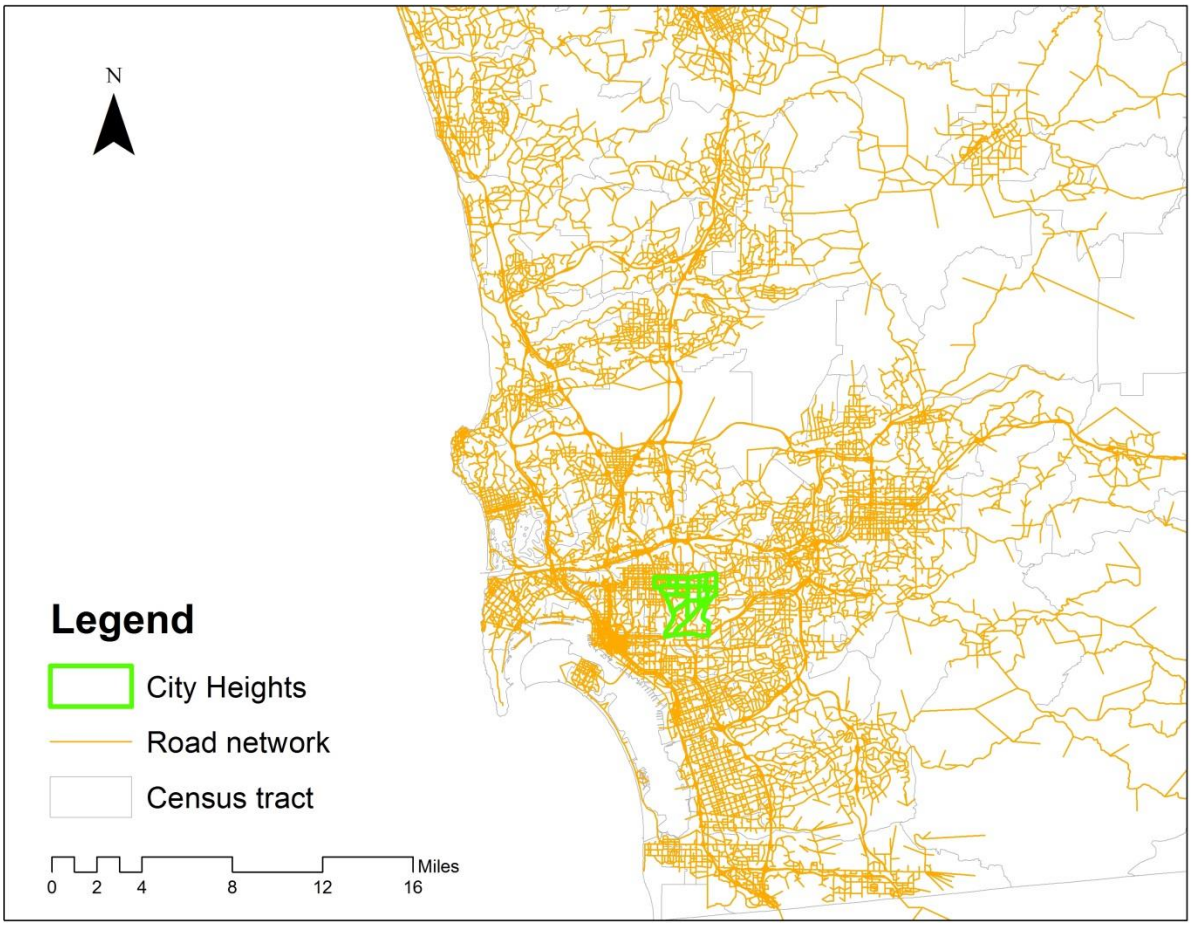

Figure 6 2008 Road Network (source: SANDAG)

Transit network in San Diego County

Our transit network data are from the SANDAG travel demand model. The transit network input for the travel demand model is the 2009 San Diego Regional Transit Survey. The transit network includes 7 types of transit modes: Commuter Rail (CR), Light Rail/Street Car (LR), Bus Rapid Transit (Regional), Rapid Bus (Corridor), Premium Express Bus, Express Bus and Local Bus (SANDAG, 2013). The first 6 types of modes are defined as "premium transit". Geographic and attribute information is attached to transit routes and nodes of each service type. (SANDAG, 2013). The spatial distribution of transit routes and stops is shown in Figure 7.

[7] SANDAG classifies a road system into 10 categories based on its functions (IFC) and we used zonal connectors, which is coded as 10, to get average speed.

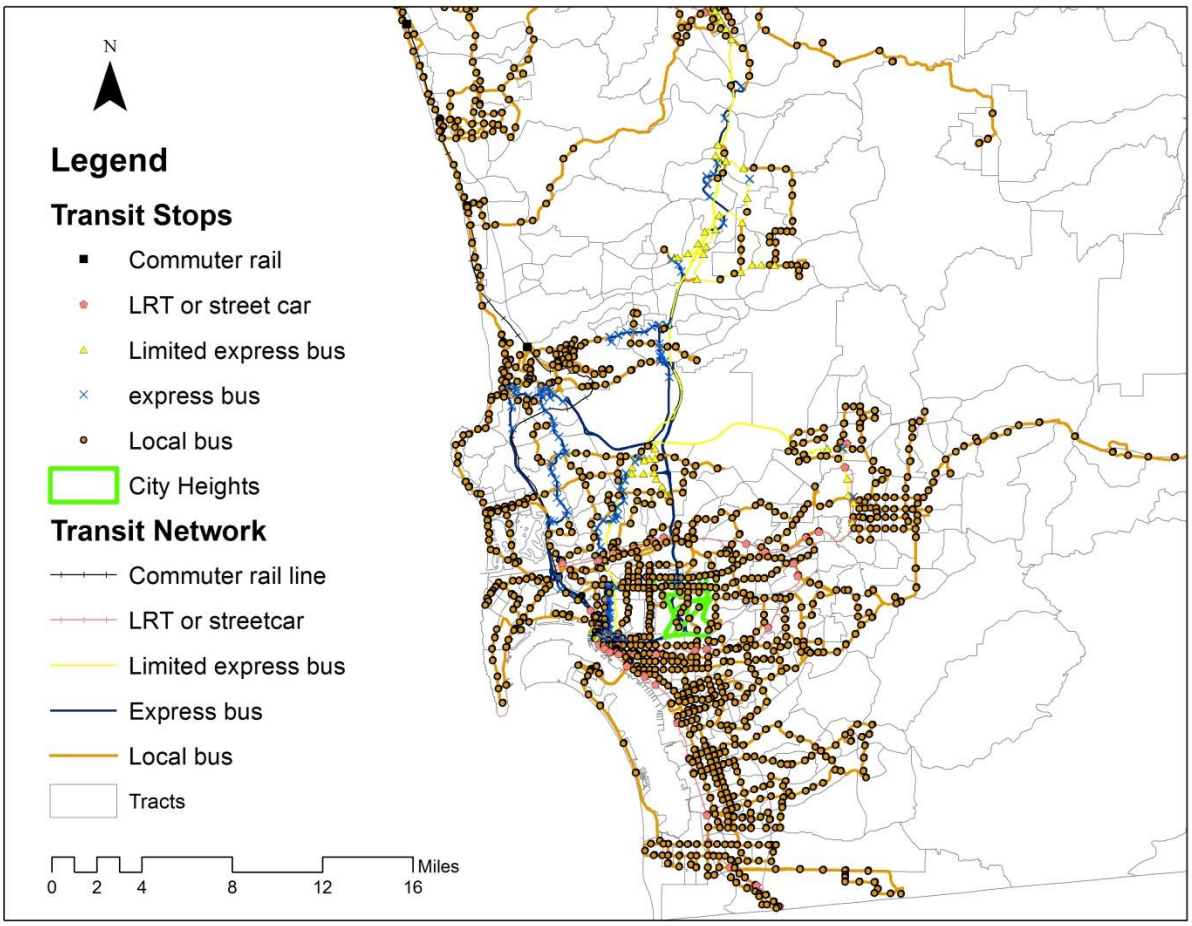

Figure 7 Spatial Distribution of transit routes and stops (source: SANDAG)

Tract-to-tract transit travel times are calculated from the SANDAG data. Here we briefly summarize the data structure of transit travel time in SANDAG's modeling system (SANDAG, 2013: p24-31):

Transit travel time is estimated between pairs of transit access points (TAP), not between spatial units, as is the case for the road network. The selected 2500 TAPs include all rail stations and BRT stops, and selected local and express bus stops that are on average 0.5 mile away from each other. The "minimum general cost path" between each TAP pair is calculated for different times of day (AM peak vs. Mid-day), using different transit modes. All transit paths are categorized into two groups: those using local bus service only and those using both local bus and any other premium service. Thus, there are four sets of paths: AM peak local bus, AM peak all modes, Mid-day local bus, Mid-day all modes. For each set of paths between each pair of TAPs, the following information is included: (1) number of transfers, (2) initial wait time, (3) transfer wait time, (4) transfer walk time, (5) in-vehicle travel time for all modes of transit, (6) the "main mode" defined as the mode

used for the longest distance. Summary statistics for all pairs of TAPs are presented in Tables 8 through 11. Total travel time is the sum of (transfer) walking time, waiting time, and in-vehicle travel time.

Table 8 Summary statistics of TAP-to-TAP transit travel time, in minutes: Local bus, AM peak

	Mean	S.D.	Min	Max
Travel time (in-vehicle, minutes)	82.33	72.92	0.33	2145.82
initial wait time (minutes)	14.58	10.28	2.00	60.00
transfer wait time (minutes)	25.76	16.43	0.00	105.00
walk time (minutes)	1.83	3.95	0.02	37.65
Total travel time (minutes)	124.51	81.61	2.63	2203.95
Number of transfers	2.03	0.92	0.00	3.00
Fare (dollars)	1.65	0.10	0.00	1.70

Pairs of TAPs: 1,904,224

Table 9 Summary statistics of TAP-to-TAP transit travel time, in minutes: Local bus, Mid-day

	Mean	S.D.	Min	Max
Travel time (in-vehicle, minutes)	80.16	69.80	0.33	2124.73
initial wait time (minutes)	15.17	11.21	2.00	60.00
transfer wait time (minutes)	26.43	18.07	0.00	150.00
walk time (minutes)	1.58	4.18	0.02	38.40
Total travel time (minutes)	123.33	79.53	2.63	2181.75
Number of transfers	1.98	0.92	0.00	3.00
Fare (dollars)	1.66	0.08	0.76	1.7

Pairs of TAPs: 1,723,729

Table 10 Summary statistics of TAP-to-TAP transit travel time, in minutes: Premium transit, AM peak

	Mean	S.D.	Min	Max
Total in-vehicle travel time (minutes)	76.91	91.31	0.33	2219.68
Percent of commuter rail in-vehicle travel time	9.8	20.50	0.00	100
Percent of light rail in-vehicle travel time	20.72	25.82	0.00	100
Percent of Express bus in-vehicle travel time	19.03	29.46	0.00	100
Percent of Local bus in-vehicle travel time	50.45	32.42	0.00	100
initial wait time (minutes)	15.72	11.15	2.00	60.00
transfer wait time (minutes)	27.61	18.22	0.00	112.50
walk time (minutes)	2.49	3.29	0.02	32.60
Total travel time (minutes)	122.74	99.75	2.63	2314.20
Number of transfers	2.06	0.85	0.00	3.00
Fare (dollars)	2.61	1.08	0.00	4.55

Pairs of TAPs: 3,037,737

Pairs of TAPs accessible by local bus only: 660,852

Table 11 Summary statistics of TAP-to-TAP transit travel time, in minutes: Premium transit, Mid-day

	Mean	S.D.	Min	Max
Total in-vehicle travel time (minutes)	79.59	95.81	0.33	2203.75
Percent of commuter rail in-vehicle travel time	3.86	13.18	0	100
Percent of light rail in-vehicle travel time	17.51	26.39	0	100
Percent of Express bus in-vehicle travel time	14.35	25.17	0	100
Percent of Local bus in-vehicle travel time	64.28	32.84	0	100
initial wait time (minutes)	16.67	12.49	2	60
transfer wait time (minutes)	31.88	24.52	0	180
walk time (minutes)	2.03	3.67	0.02	34.43
Total travel time (minutes)	130.17	108.01	2.63	2352.95
Number of transfers	2.02	0.88	0	3
Fare (dollars)	2.10	0.77	0.76	4.55

Pairs of TAPs: 2,529,091

Pairs of TAPs accessible by local bus only: 927,554

Tables 8 and 10 show that for AM peak periods, in-vehicle travel time for premium transit travel time is on average 6 minutes shorter than that for local bus service. However, after adding transfer and waiting time, the advantage for premium transit service is reduced to less than 2 minutes. Tables 9 and 11 indicate that for off-peak periods, the mean in-vehicle travel time and total travel time for local bus service is reduced slightly due to less traffic congestion, while those for premium transit service increase by 3 and 8 minutes respectively, likely due to reduced service frequency. We also observe that local bus in-vehicle transit time on average accounts for a large portion of total in-vehicle transit time for the combined transit service, reflecting the importance of local bus service in transit service provision. The mean transit fare for local bus service is $1 cheaper than that for premium transit service in the AM peak and $0.5 cheaper in the Midday.

Transit travel time

Our estimation of transit travel time between pairs of tracts is based on the 2500×2500 transit matrix for TAPs from the process described above. To make the results comparable to highway travel time, we estimate the minimum transit travel time for both AM peak and Mid-day periods. Because the difference in transit travel time and fares for different types of transit is not very large, we use the shorter travel time of the two transit modes as the minimum transit travel time for any pair of TAPs. Next, to convert the TAP-to-TAP travel time to tract-to-tract travel time, we considered assigning the TAPs to census tracts and adding the estimated walking time from the centroids of each tract to the TAP location to account for transit walk access within the tract. However, census tracts are usually large so that the estimated walking time may not accurately specify transit access opportunities. Thus, we decided to assign TAPs to census block groups (BGs) first and use the minimum block group-to-block group travel time within each pair of tracts as the tract-to-tract travel time.

Using the spatial join method in ArcGIS, we assign each TAP to a unique block group. To avoid the bias caused by the definition of statistical boundary, we also assign each TAP to those block groups that are within the 0.5 mile of the TAP but do not have any TAP falling within them. In total, 1,457 out of 1,800 block groups are assigned to at least one TAP, corresponding to 573 out of 627 census tracts. We then calculate the straight-line distances from the centroid of each block group to all the TAPs assigned to it and divide the distance by an average walking speed of 3 miles per hour to estimate the "initial walking time" for transit access. Thus, there would be multiple sets of total transit travel time for each pair of block groups computed as the sum of TAP-to-TAP travel time and

of initial walking times at the origin and destination (See Figure 8). We choose the shortest total travel time for each pair of block groups as the block group-to-block group travel time. Finally, the tract-to-tract travel time is defined as the short travel time between the block groups it contains. This method favors transit, so our access measures are an upper bound estimate of transit access.

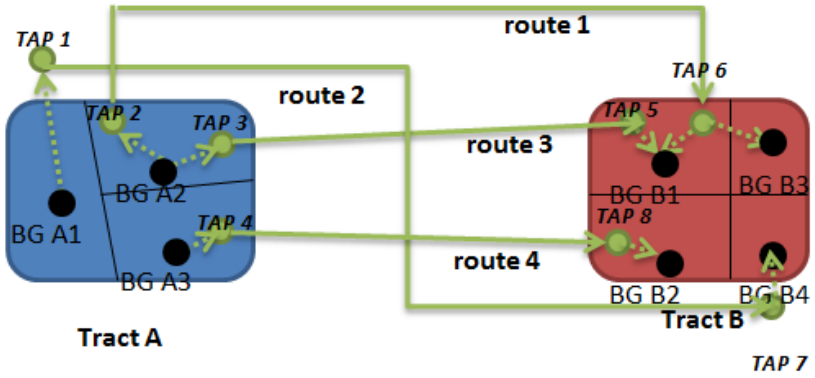

Figure 8 Estimation of tract-to-tract travel time

Description:

1) The green dots represent TAPs and the black dots represent the centroids of each BG. The dotted green line represents walking time between TAPs and BG centroids estimated from straight-line distance, while the solid green line represents different transit routes between the TAPs.
2) According to our rule, BG A1 does not contain any TAPs but would be assigned TAP1 if the straight line distance between them is less than 0.5 mile, corresponding to approximately 10 minutes' walk. Similarly, TAP6 is contained within BG B1 but would also be assigned to BG B3 if the straight line distance between them is less than 0.5 mile.

We calculate transit travel times using 3 different access/egress modes: walk, bike and car. Summary statistics of estimated transit travel time for all pairs of tracts under different scenarios are reported in Table 12. A 100 minute travel time threshold is used, which is about twice the average transit travel time for San Diego County[8], and all pairs of tracts with a transit travel time more than 100 minutes are considered "inaccessible" by transit. Table 12 shows that on average total transfer times (including waiting time and walking time between transit stops) is about 24-25 minutes, taking approximately 35% to 39% of the total travel time for all the three scenarios. Because accessing and egressing transit stops account for a relatively small portion of total travel time, changing the access/egress mode has a small effect on average total travel time.

[8] According to the 2007-2011 ACS, the average transit travel time for the San Diego County is 50.5 minutes.

Table 12 Summary statistics of tract-to-tract transit travel time

1) walk+transit+walk

	Peak hours (Pairs of Tracts: 121,474)				Off-peak hours (Pairs of Tracts: 110,611)			
	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
wait time (minutes)	23.79	10.02	2.02	75.02	24.37	10.27	2.52	76.57
Percent of total trip that is wait time	34.68	10.94	5.99	87.42	35.64	11.17	7.69	87.42
walk time (minutes)	9.73	4.8	0.74	70.2	9.69	4.86	0.99	69.04
Percent of total trip that is walk time	15.49	8.99	0.8	84.52	15.53	9.13	1.08	83.37
Total Travel time (minutes)	69.19	20.47	6.67	100	69.05	20.71	7.04	100

2) bike+transit+bike

	Peak hours (Pairs of Tracts: 139,171)				Off-peak hours (Pairs of Tracts: 126,417)			
	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
wait time (minutes)	25.06	10.65	2.02	75.02	25.65	10.89	2.52	84.07
Percent of total trip that is wait time	38.67	12.56	6.84	92.85	39.76	12.82	8.25	92.85
walk time (minutes)	3.76	2.23	0.24	42.48	3.76	2.38	0.32	42.48
Percent of total trip that is walk time	6.54	4.99	0.26	80.99	6.58	5.1	0.44	78.15
Total Travel time (minutes)	66.45	21.79	4.54	100	66.26	22	5.32	100

3) car+transit+car

	Peak hours (Pairs of Tracts: 133,306)				Off-peak hours (Pairs of Tracts: 121,097)			
	Mean	S.D.	Min	Max	Mean	S.D.	Min	Max
wait time (minutes)	24.63	10.47	2.02	75.02	25.21	10.69	2.52	76.57
Percent of total trip that is wait time	37.23	11.99	5.13	93.4	38.27	12.23	7.94	93.4
walk time (minutes)	5.82	3.62	0.48	73.25	5.8	3.63	0.5	53.92
Percent of total trip that is walk time	9.73	7.01	0.52	81.64	9.77	7.08	0.54	82.48
Total Travel time (minutes)	67.42	21.36	5.34	100	67.24	21.57	5.34	100

Note: We define "walk+transit+walk" as walk access to and egress from the transit station, based on an assumed walking speed of 3 miles per hour. Similarly "bike+transit+bike" assumes 9.3 miles per hour bicycle access/egress to stations. The "car+transit+walk" assumes car travel, using road travel speeds, to stations and walking egress. The same definition is used all the following tables about transit travel times.

3.4 Measuring access to low-wage jobs

We measure job accessibility in two ways. The first is a simple "cumulative opportunities" measure, which is calculated by summing up the number of jobs that can be reached within 30 minute and 60 minute commuting thresholds using any mode of travel. The second is a relative accessibility measure developed by Shen (1998), which considers competition for job positions among laborers. The construction of the relative accessibility variable is illustrated in Figure 9. Tract i is the residence location for a given number of low wage/low skill potential workers. Tract j is one of the (low-wage) job locations that are within a 30 minute commuting time of Tract i by either transit or car. Tracts k1 and k2 are residence locations of other potential workers within the 30 min commuting time of Tract j; k1 is within 30 minutes by car or transit; k2 is within 30 minutes only by car. The larger circles in the graph represent the car commuting shed, and the smaller circles represent the transit commuting shed.

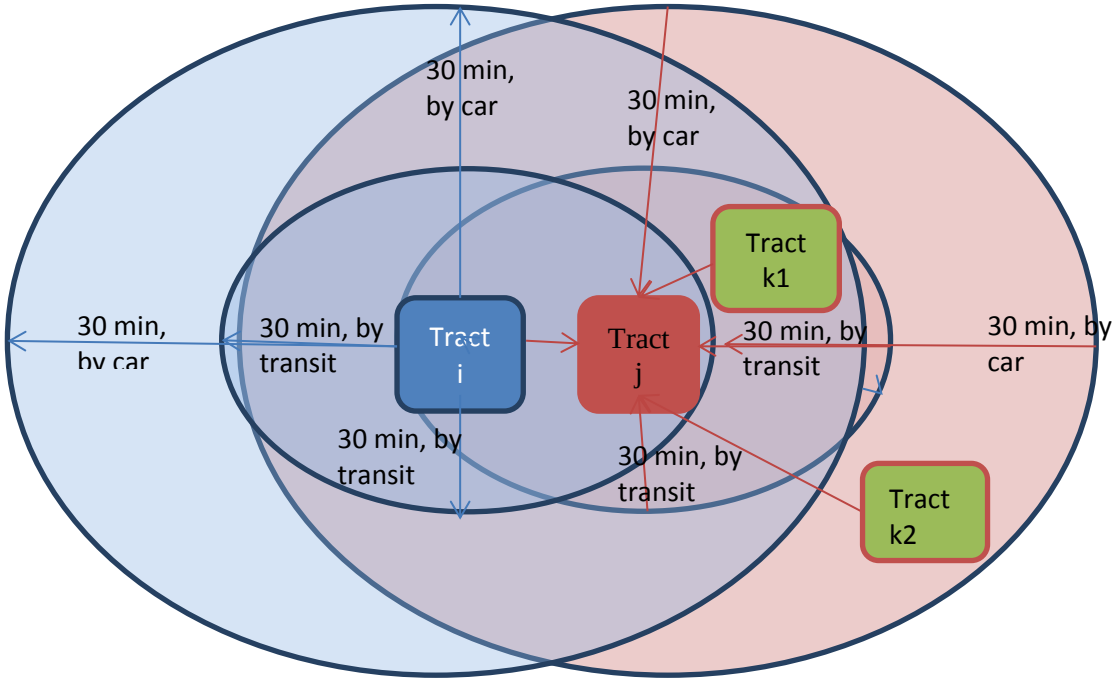

Figure 9 Relative accessibility measure

Following Shen (1998), we assume that each potential (low-income) worker locating in Tract i is competing for job opportunities in Tract j with other job seekers residing within the 30 min commuting shed of Tract j by either transit (like those in Tract k1) or car (like those in Tract k1 and k2). Thus, a "demand potential" can be calculated for each job location(j) that is the weighted

sum of job seekers within the 30 minute commuting threshold traveling by either car or transit, weighted by the percentage of workers traveling by each mode at each place of residence:

$$D_j = \sum_{k1} L_{k1} * \alpha_{k1} + \sum_{k1} L_{k1} * (1 - \alpha_{k1}) + \sum_{k2} L_{k2} * (1 - \alpha_{k2}), \quad (3\text{-}3)$$

where $k1 \in \{T_{k1,j}$ by transit or car ≤ 30 min$\}$,

$k2 \in \{T_{k2,j}$ by car ≤ 30 min$\}$,

α_{k1}, α_{k2}: percentage of workers travel by transit at tract k1,k2

L_{k1}, L_{k2}: number of workers at tract k1,k2

Every job seeker looking for jobs at location j are facing the same number of potential competitors with a commuting time to j less than 30 minutes using either car or transit. In other words, the demand potential (D_j) for each job location would be the same for all (low-wage) job seekers, regard less of their mode choice.

Relative job accessibility for workers using different modes at each place of residence (i) can be specified by summing up the ratio of "supply potential" (number of jobs, E_j) and "demand potential" at each job location that are accessible within 30 minutes by transit or by car:

$$A_i^{transit} = \sum_j \frac{E_j}{D_j}, \text{ where } j \in \{T_{i,j} \text{ by transit or car } \leq 30 \text{ min}\} \quad (3\text{-}4)$$

$$A_i^{car} = \sum_j \frac{E_j}{D_j}, \text{ where } j \in \{T_{i,j} \text{ by car} \leq 30 \text{ min}\} \quad (3\text{-}5)$$

The relative accessibility score equals "the ratio of the total number of opportunities to the total number of opportunity seekers" within the boundary of the 30 or 60 minute commuting shed by car or by transit.

4. Results

In this section we present our results for the three accessibility measures, travel time, cumulative access to jobs, and relative access to jobs. We compare the City Heights results to those of our comparison tracts, as well as to the County. We also examine variations in accessibility within City Heights.

4.1 Network accessibility

Our first accessibility measure, network accessibility, is simply the geographic area that can be covered within specified time intervals. This measure illustrates the travel time differences between modes.

Road network

Figures 10 and 11 show the area that can be accessed by car from City Heights within various travel time boundaries, for peak and off-peak hours respectively. For the 30 minute car commute boundary, about 73 percent of census tracts located in the County are accessible. For the 60 minute car commute boundary, almost the entire county is accessible. This simple measure suggests that car access is very good: most of the built-up area of the county (and by implication most of the jobs) is accessible within a 60 minute commute.

While the travel time bands during off-peak hours are larger than those during peak hours, the difference is small. For example, 461 tracts are accessible within 30 minutes during peak period, and 472 are accessible during the off-peak. Tables 13 and 14 show why: average travel times do not vary much between peak and off-peak.

Tables 13 and 14 also compare City Heights to the comparison tracts and to the county. It can be seen that for the road network, City Heights is the most accessible location. The comparison tracts have a somewhat higher average travel time, and the county has a notably higher travel time, because the county includes outlying areas with generally low access. The pattern is the same for both peak and off-peak. Note that, in Table 13 and in many of the tables that follow, percentiles are indicated by p25 for the 25th percentile value and similarly for p50 and p75.

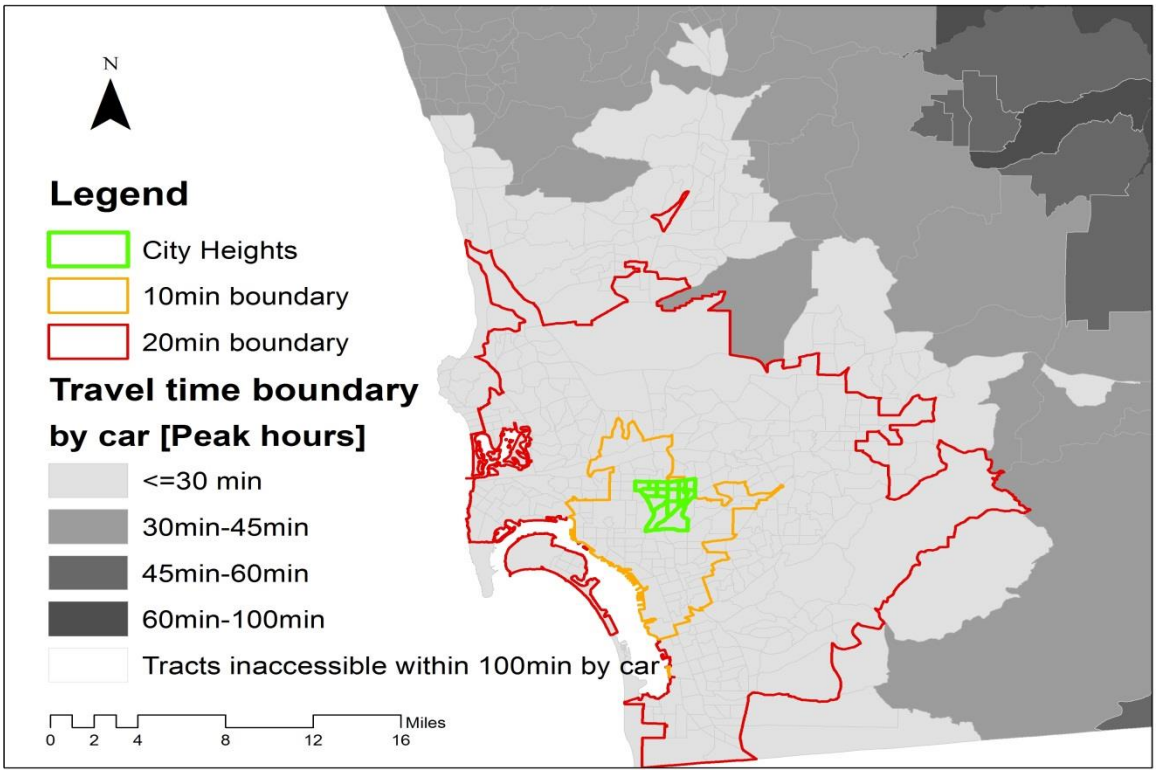

Figure 10 Maximum travel time boundary for City Heights by car (Peak hours)

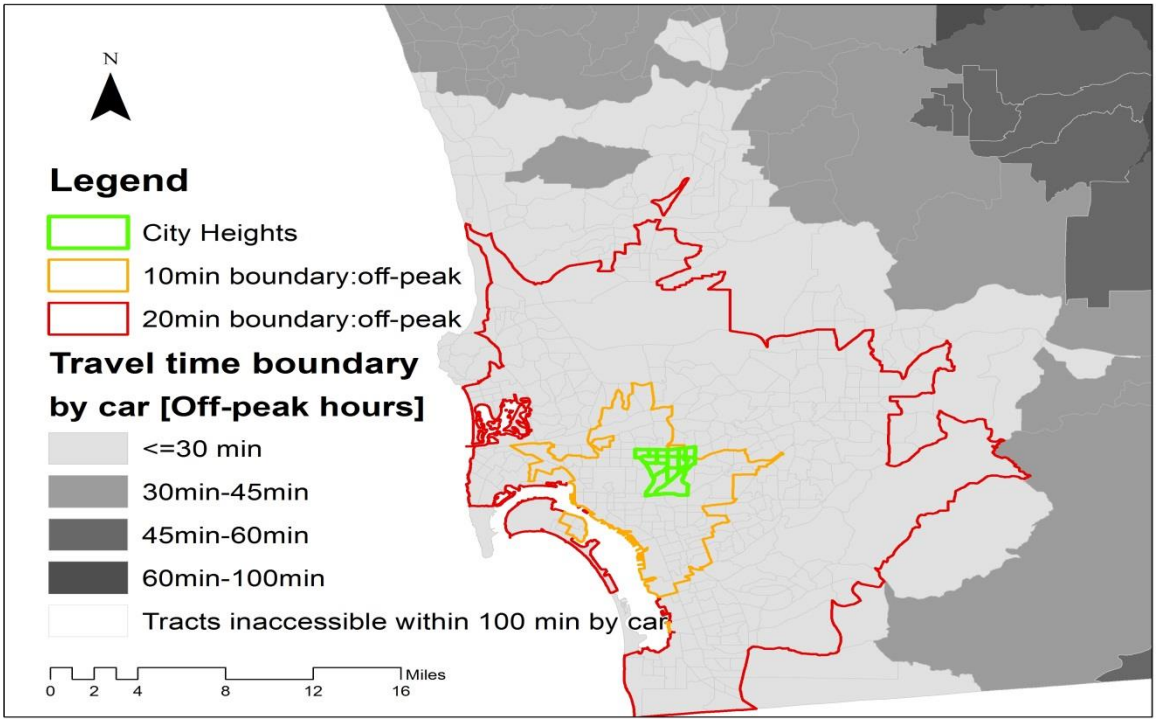

Figure 11 Maximum travel time boundary for City Heights by car (Off-peak hours)

Table 13 Average tract-to-tract travel time by road network, in minutes (Peak hours)

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	22.65	1.3	20.98	21.78	22.44	23.84	25.15
San Diego County	627	29.13	6.58	20.33	24.4	27.07	32.16	52.57
Comparison neighborhoods	15	24.89	3.45	22.02	22.84	23.86	25.31	34.43

Table 14 Average tract-to-tract travel time by road network, in minutes (Off-peak hours)

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	21.71	1.39	21.71	20.71	21.43	23	24.33
San Diego County	627	28.13	6.6	19.3	23.41	26.02	31.01	52.55
Comparison neighborhoods	15	23.92	3.27	23.92	21.79	22.96	24.14	32.76

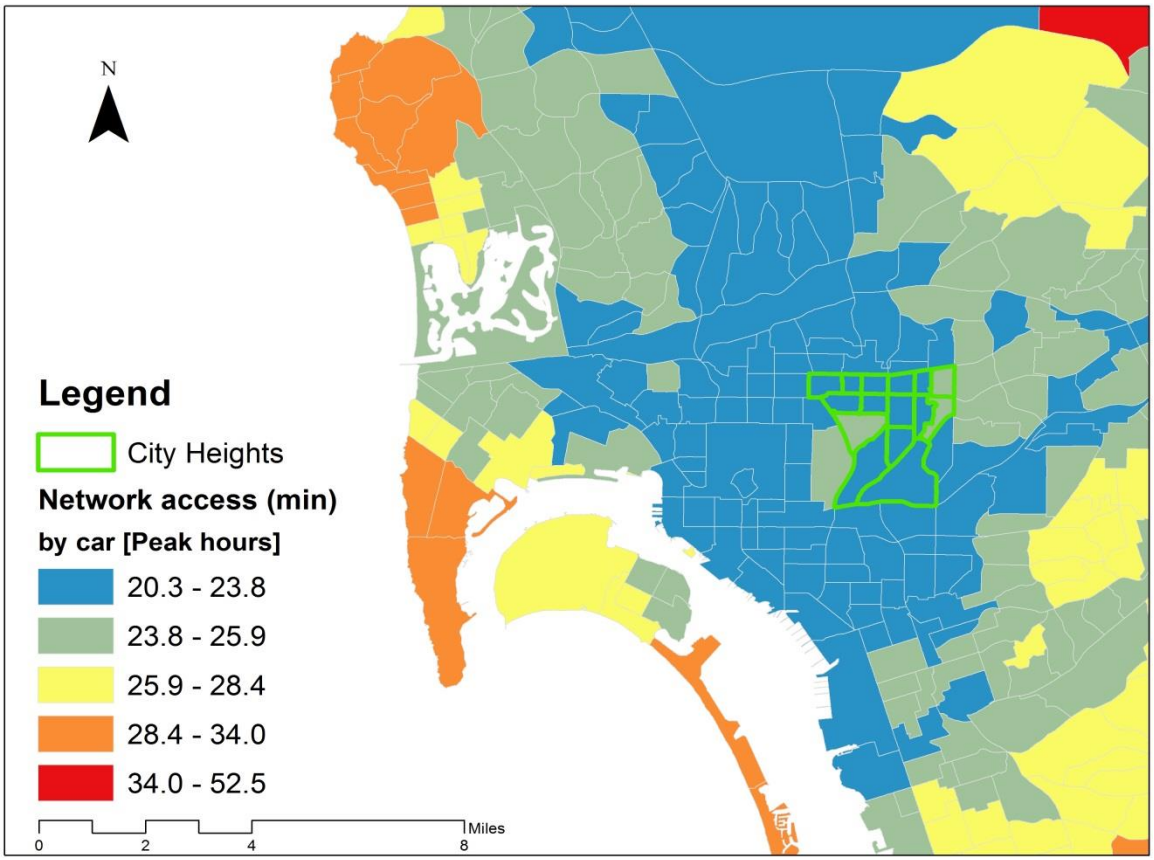

Figure 12 Average tract-to-tract travel time by road network (Peak hours)

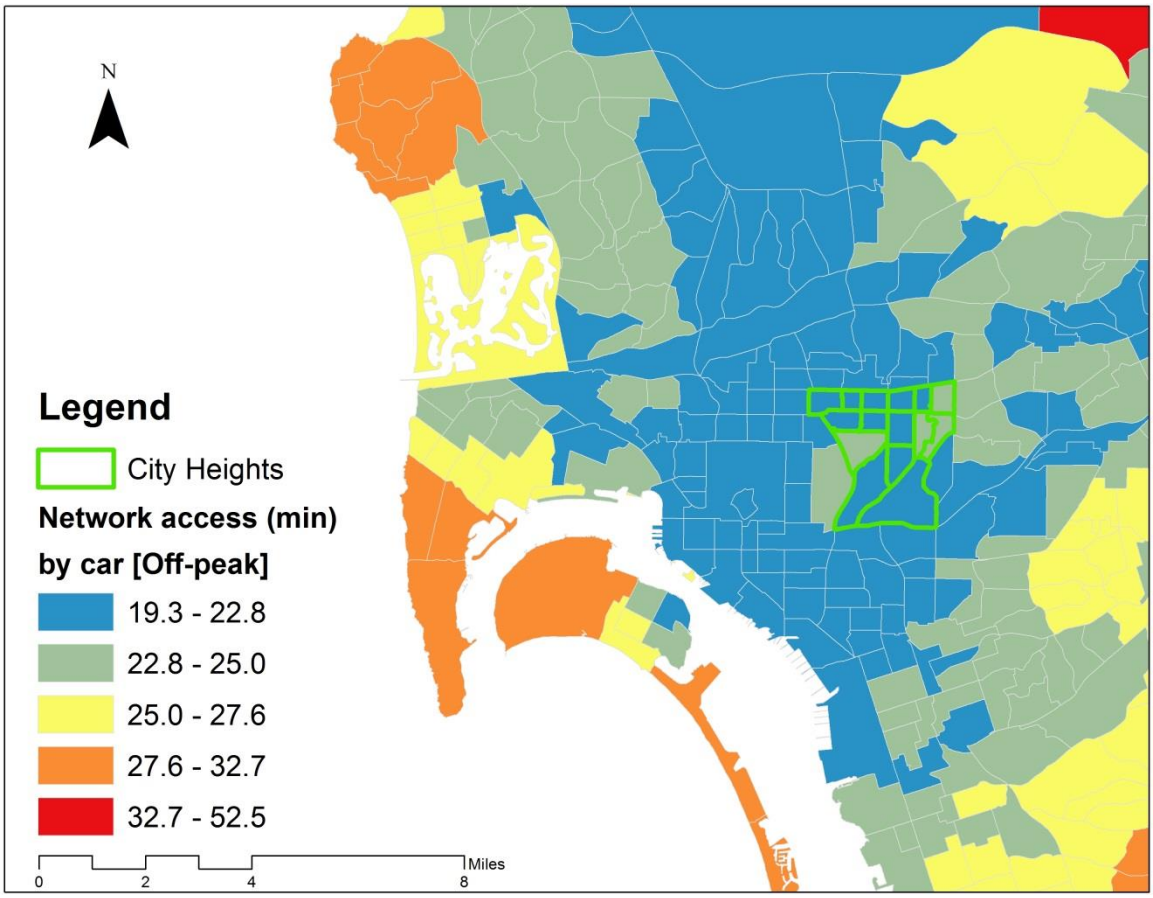

Figure 13 Average tract-to-tract travel time by road network (Off-peak hours)

Transit network

Figures 14 and 15 show the area that can be accessed by transit with walk access/egress from City Heights within various travel time boundaries, for peak and off-peak hours respectively. Comparing Figures 14 and 15 to Figures 10 and 11 reveals a very large difference in accessibility. The 30-minute travel time band from City Heights by car is larger than the 100 minute travel time band from City Heights by transit (Figures 14 and 15). These differences are extreme: for the 30 minute boundary, 73.5% of census tracts in the county are accessible by car, and less than 10% by transit.

The area accessible from City Heights in a 30-minute travel time is very limited, confined to an area within no more than 5 miles from City Heights. Even if we extend the travel time threshold to 60 minutes, the most remotely accessible tract is only about 18 miles away, far from covering the whole county. The access bands do not vary much across peak and off-peak hours.

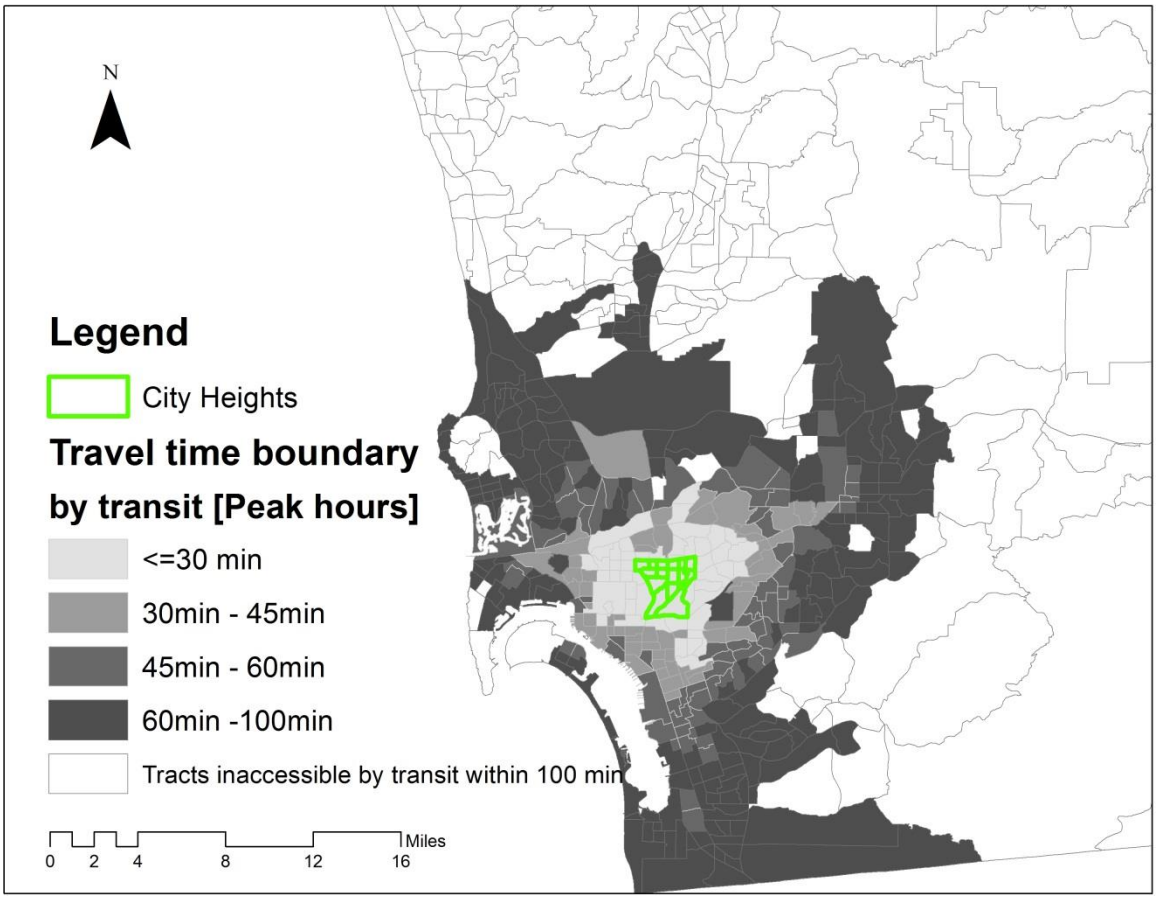

Figure 14 Maximum travel time boundary for City Heights by transit + walk (peak hours)

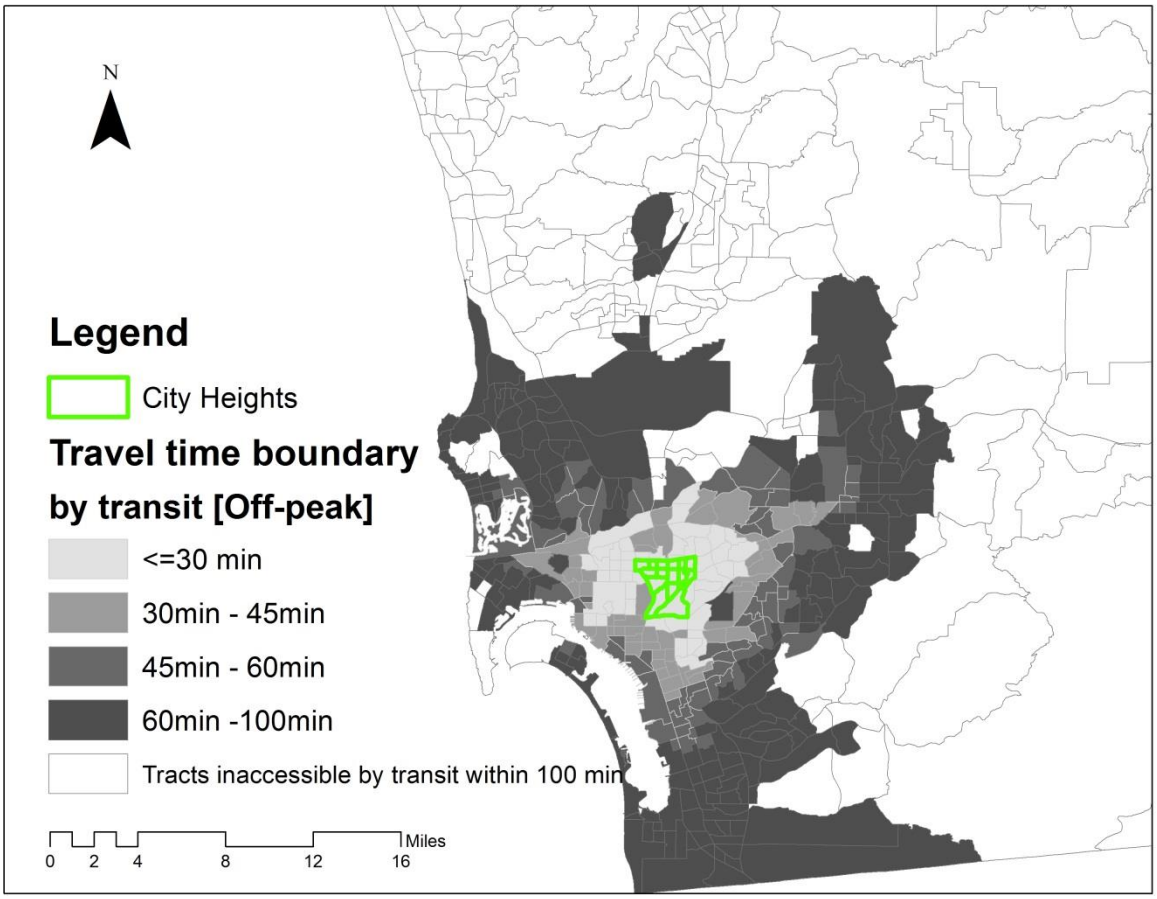

Figure 15 Maximum travel time boundary for City Heights by transit + walk (Off-peak hours)

Tables 15 and 16 show summary statistics for tract level transit network accessibility for each access/egress mode. The average travel time is in the range of 60 – 70 minutes, about three times longer than for car. It should be noted that these averages are an underestimate, given that we eliminated all TAP to TAP pairs that exceeded 100 minutes. Transit travel time is directional. Here we consider all census tracts as origins of commuting trips; we do not consider return trips.

Similar to the results for road network accessibility, average travel time for City Heights is slightly shorter than comparison tracts in both the peak and off-peak period, and notably shorter (about 8 minutes) compared to the entire county. Again this reflects the location of City Heights close to the urban core. Finally, Tables 15 and 16 show that access/egress mode makes little difference to the average travel times.

Table 15 Average tract-to-tract travel time by Transit, in minutes (Peak hours)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	64.0	4.2	60.7	61.6	62.0	64.7	73.8
San Diego County	567	71.7	7.2	53.7	66.4	71.6	76.6	99.6
Comparison neighborhoods	15	65.0	6.9	58.1	61.0	61.8	67.4	83.9

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	60.0	5.0	56.2	57.1	58.1	61.3	71.9
San Diego County	571	68.6	7.8	50.1	62.8	68.7	73.7	91.8
Comparison neighborhoods	15	61.5	7.5	55.9	56.6	58.8	64.1	82.0

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	61.5	4.6	58.4	59.1	59.8	62.7	72.4
San Diego County	571	69.6	7.5	52.2	64.0	69.7	74.5	99.5
Comparison neighborhoods	15	62.8	7.6	57.0	58.2	59.6	65.0	84.4

Table 16 Average tract-to-tract travel time by Transit, in minutes (Off-Peak hours)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	64.4	3.6	60.5	61.9	63.9	64.8	72.8
San Diego County	560	71.3	7.0	54.4	65.6	70.6	75.8	99.7
Comparison neighborhoods	15	65.5	6.1	59.2	61.6	63.5	68.2	83.3

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	61.0	4.2	57.1	58.5	59.6	61.3	70.8
San Diego County	565	68.3	7.3	50.2	62.5	67.9	72.8	92.6
Comparison neighborhoods	15	62.0	6.7	56.4	57.7	59.9	64.4	82.7

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	62.3	4.0	58.3	59.8	61.3	63.1	71.5

San Diego County	565	69.3	7.1	52.4	63.6	69.0	73.4	99.5
Comparison neighborhoods	15	63.4	6.9	57.5	59.3	60.9	65.5	85.0

Figure 16 and 17 show the County pattern of transit network accessibility in quintiles of average tract to tract travel time, peak and off-peak respectively. The highest quintile (longest average travel time) is in red, and the lowest quintile (shortest average travel time) is in blue. Those in white are not accessible by transit within 100 minutes. For comparison purposes, the same legend is used for both peak-hour and off-peak hour maps. The figures reflect the data in Tables 16 and 17; City Heights has a relatively high level of transit accessibility. The figures also show significant internal variation within City Heights. Not all tracts belong to the lowest quintile of average travel time. For example, two tracts in City Heights are in the 4th quintile of average travel time in the peak hours and the 3rd quintile of average travel time in off-peak hours, implying network accessibility is relatively low for these two tracts. City Heights is more transit accessible in the northern part of the neighborhood, including along University Avenue.

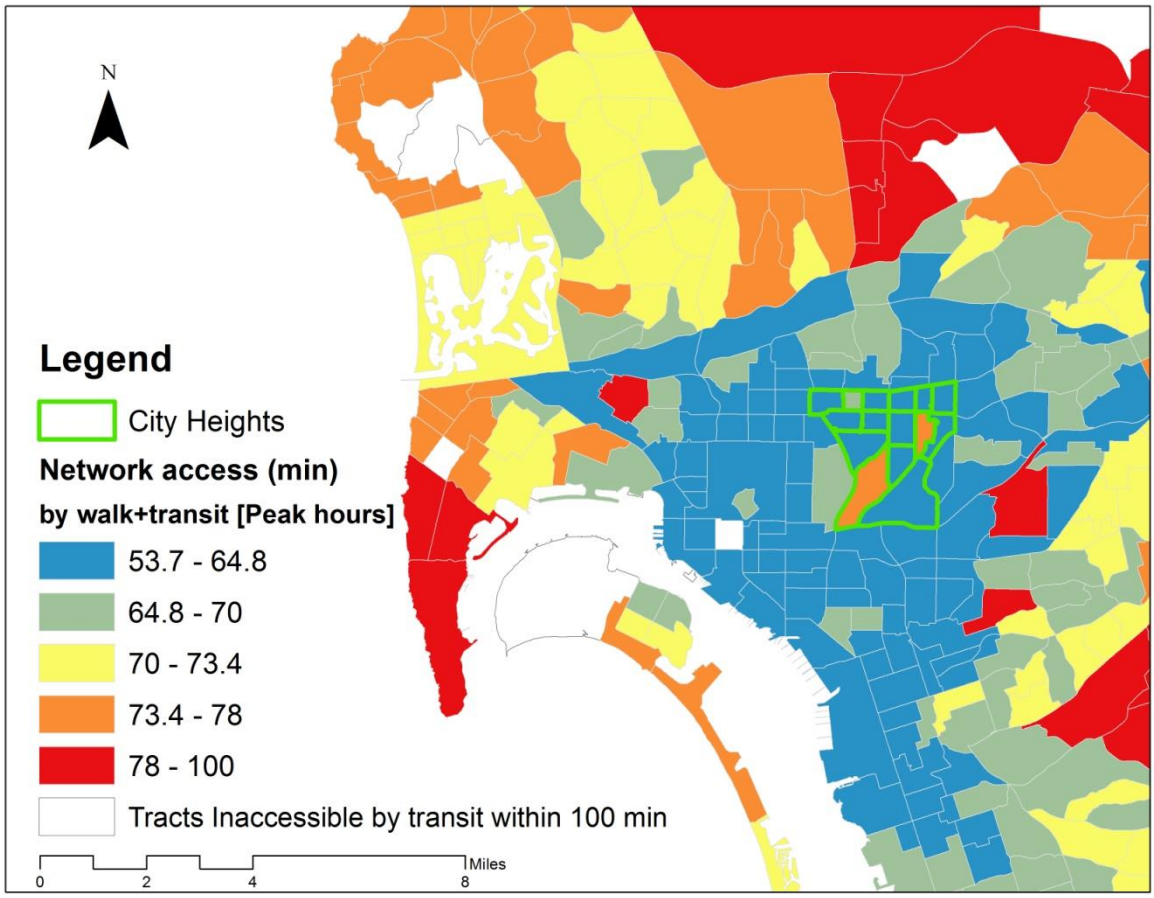

Figure 16 Average tract-to-tract travel time by Transit+ walk (Peak hours)

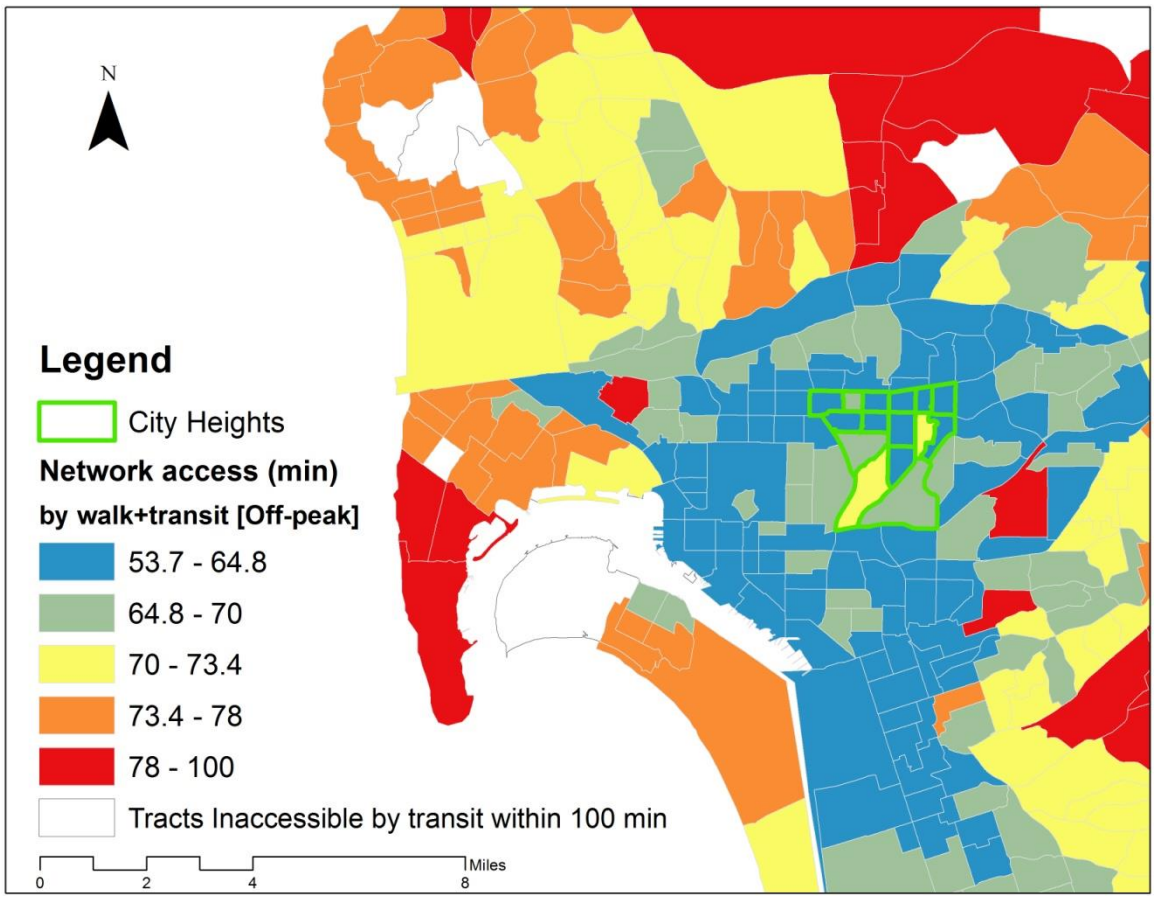

Figure 17 Average tract-to-tract travel time by Transit+ walk (Off-Peak hours)

4.2 Low income labor force access

Before discussing results for employment access, we present results for accessibility to low-income labor force from City Heights. The low-income labor force accessibility measure illustrates how many other laborers might be competing for jobs in the City Heights area.

Road network

Table 17 presents descriptive statistics for the number of low income workers accessible within 30 minutes by car from City Heights, from all tracts within the County, and from the comparison tracts, for the peak period. Table 18 shows the same information for off-peak hours. It can be seen that City Heights has the highest average value in both cases, suggesting that low-income labor force competition is more intense in City Heights than other low-income neighborhoods.

Table 17 Low income labor force access during peak hours, number of workers

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	447,806	8,818	441,208	445,490	452,813	434,357	463,655
San Diego County	627	342,382	128,002	211,390	406,083	438,706	551.5373	507,146
Comparison neighborhoods	15	400,442	83,199	419,134	431,928	439,534	178,234	447,556

Table 18 Low income labor force access during off-peak hours, number of workers

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	457,019	11,184	447,852	455,705	464,144	440,108	475,640
San Diego County	627	357,864	127,581	261,651	419,200	447,634	551.5373	525,630
Comparison neighborhoods	15	410,179	80,821	426,797	439,775	450,398	183,787	455,639

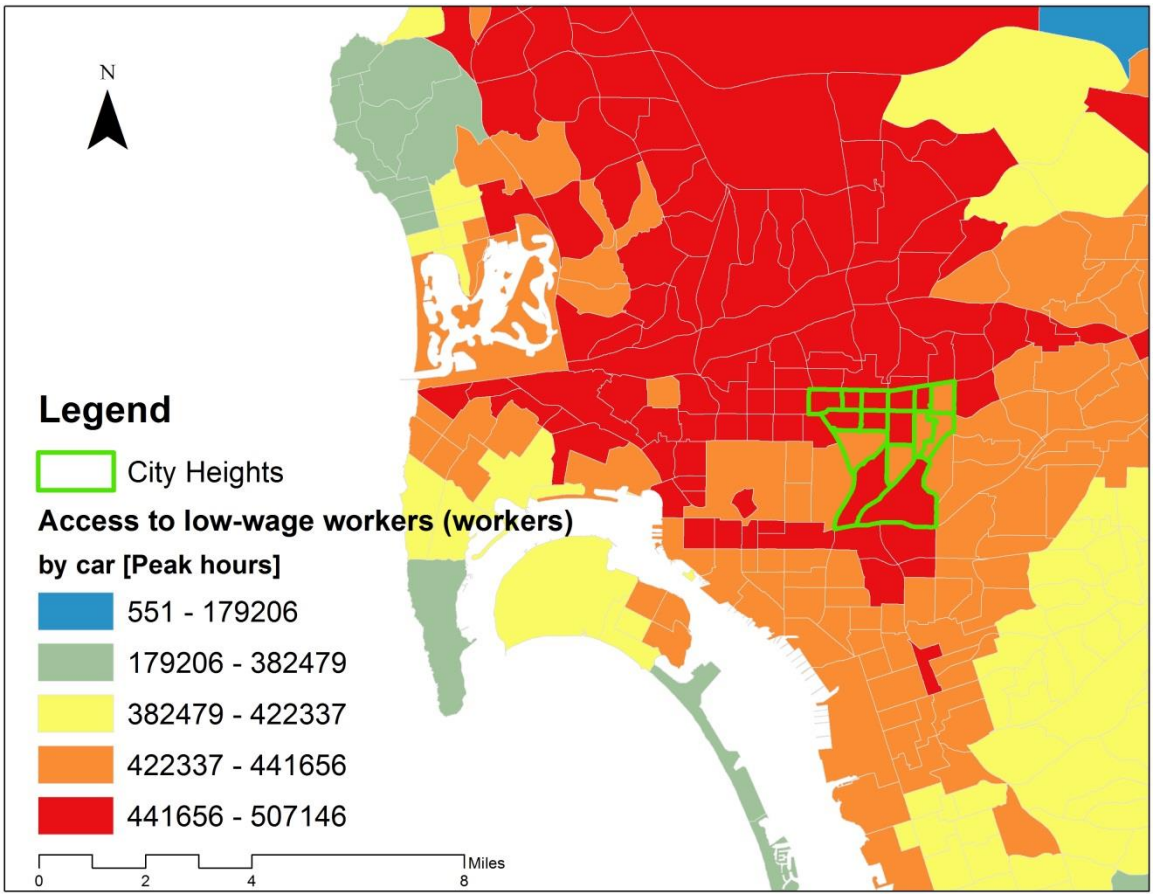

Figure 18 Access to low-wage workers by car (Peak hours, 30 min)

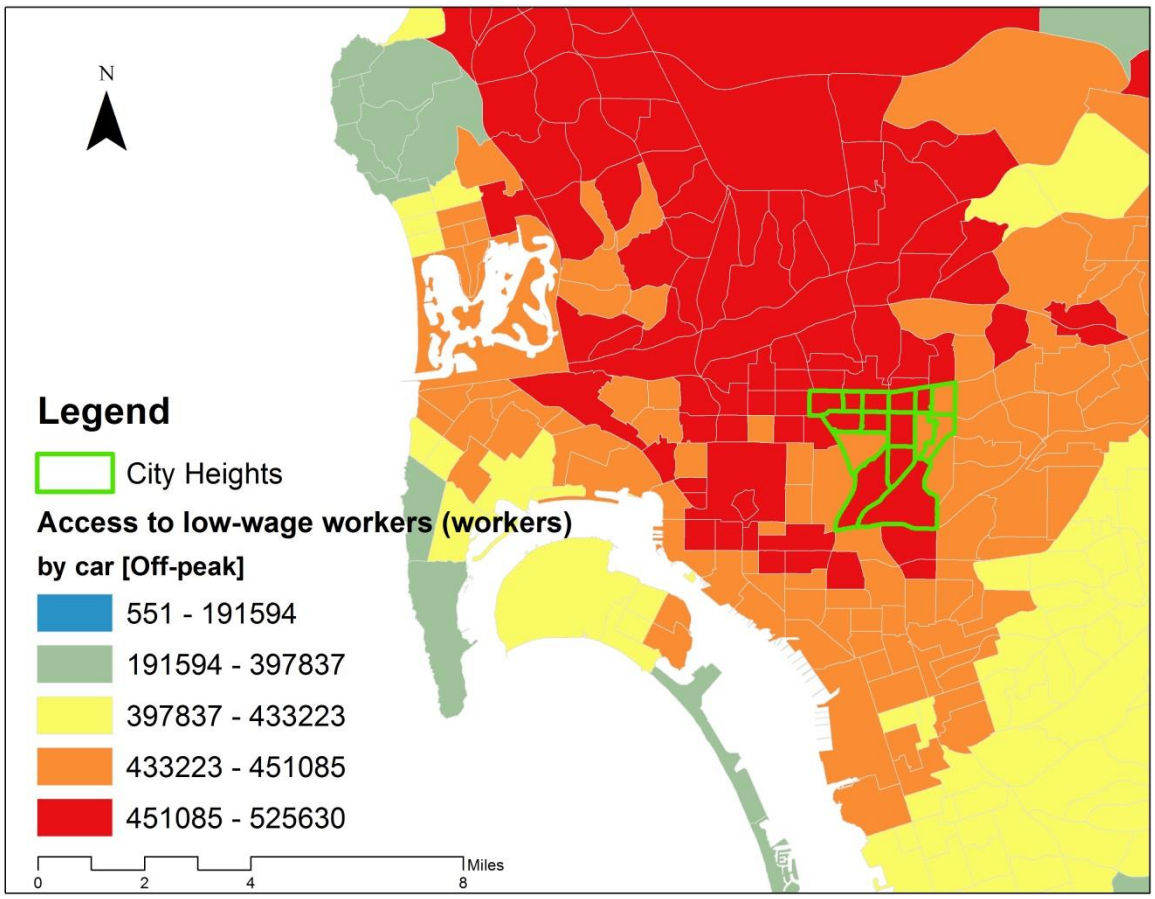

Figure 19 Access to low-wage workers by car (Off-Peak hours, 30 min)

Transit network

Tables 19 and 20 show the same summary statistics, this time for public transit travel. Once again, the difference between car and transit access is striking – about tenfold. The average number of potential workers within 30 minutes of City Heights is higher than for the comparison tracts or the county as a whole, again indicating more potential competition for local jobs.

Table 19 Low-income labor access, peak hours, number of workers

1) walk+transit+walk

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	37,980	17,490	2,429	28,031	39,838	53,457	59,769
San Diego County	466	13,856	13,525	169	3,770	9,156	18,940	59,769
Comparison neighborhoods	14	25,441	13,405	3,468	18,787	21,235	33,837	54,861

2) bike+transit+bike

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	55,778	20,739	4,149	55,597	59,154	69,035	75,649
San Diego County	517	21,452	19,142	193	6,951	14,364	31,394	76,663
Comparison neighborhoods	14	42,222	19,142	7,365	27,704	41,614	56,657	71,786

3) car+transit+walk

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	48,354	18,799	4,149	44,272	53,138	60,319	67,350
San Diego County	513	18,475	16,752	270	5,556	13,367	26,373	71,248
Comparison neighborhoods	14	35,163	16,387	7,365	23,853	33,202	48,691	59,975

Table 20 Low-income labor access, off-peak hours, number of workers

1) walk+transit+walk

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	37,318	17,168	2,429	28,031	40,244	51,512	59,769
San Diego County	442	13,928	12,967	270	4,258	9,633	18,940	59,769
Comparison neighborhoods	14	24,027	12,428	3,468	16,256	20,004	31,234	54,861

2) bike+transit+bike

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	55,279	21,049	4,149	55,973	60,948	66,765	73,598
San Diego County	497	21,305	18,342	169	7,365	14,638	30,262	78,217
Comparison neighborhoods	14	39,897	18,381	7,365	24,872	37,068	53,857	67,416

3) car+transit+walk

	n	mean	sd	min	p25	p50	p75	max
City Heights	15	48,056	18,676	4,149	44,272	53,045	60,303	66,015
San Diego County	494	18,308	16,116	169	5,732	13,651	25,737	69,997
Comparison neighborhoods	14	33,010	16,252	7,365	20,985	30,847	43,717	62,853

Figures 20 and 21 show low-wage worker (who are labor market competitors) access during peak and off-peak hours, respectively. Similar to the access pattern by car, most of City Heights tracts are in the upper quintiles of access. The only exception are the two tracts that also have the longest average tract-to-tract travel time. This implies that potential low-wage workers in City Heights are facing a larger number of job competitors within 30 minutes commuting time by transit.

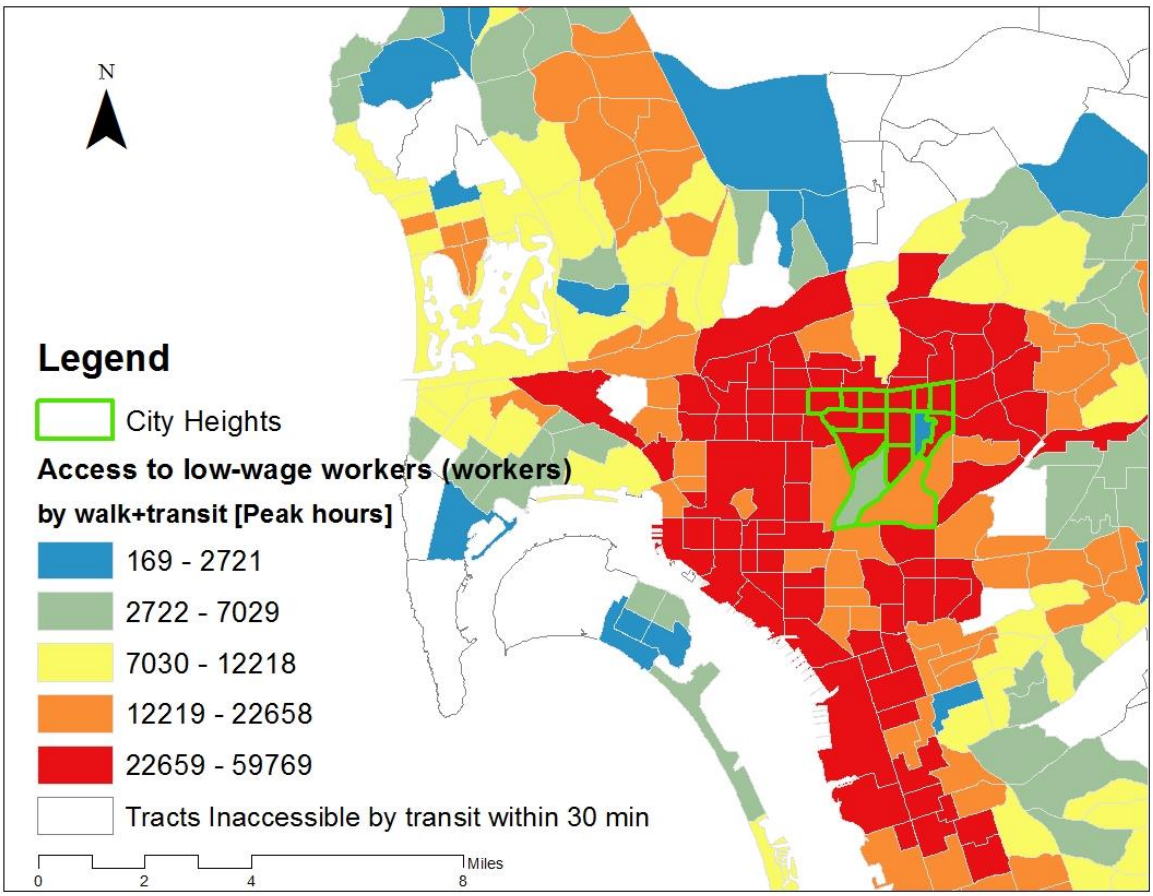

Figure 20 Access to low-wage workers by transit + walk (Peak hours, 30 min)

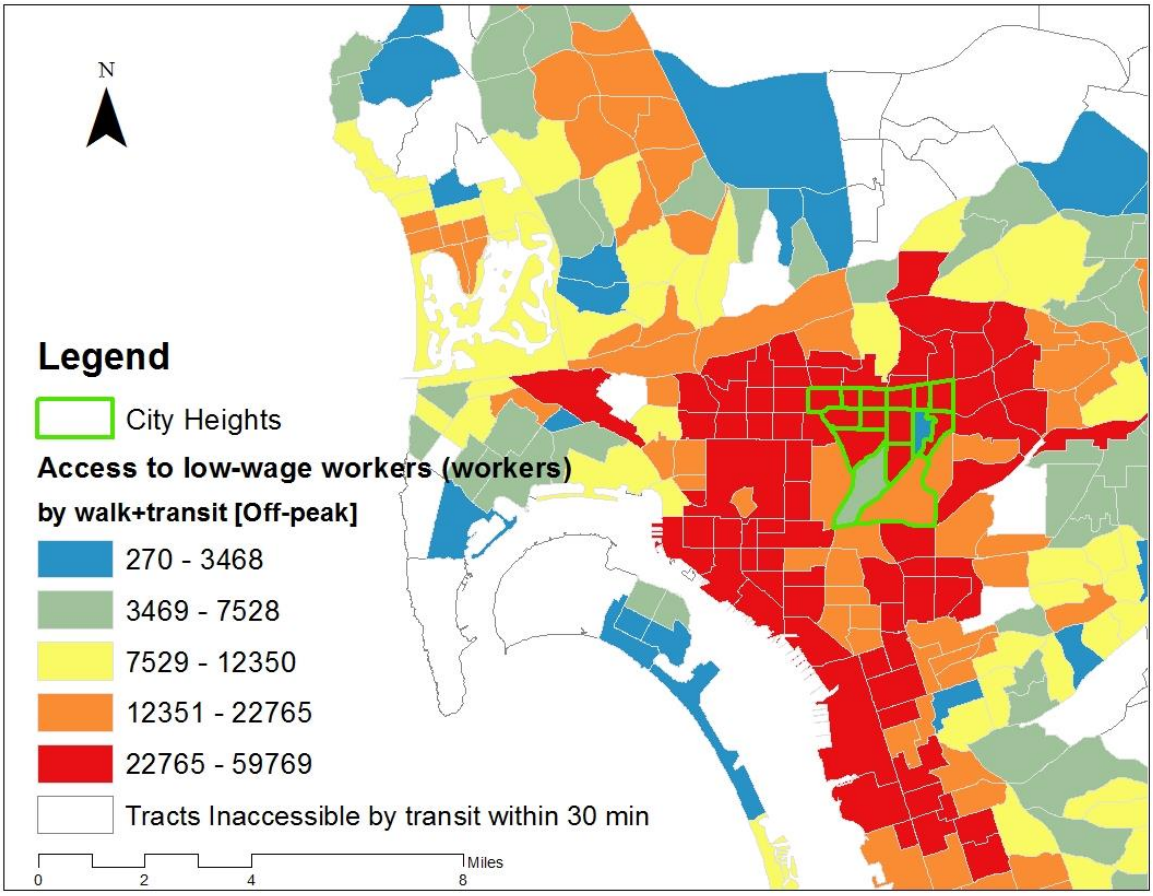

Figure 21 Access to low-wage workers by transit + walk (Off-peak hours, 30 min)

4.3 Low-wage job access (Cumulative opportunities measures)

Road network

Table 21 gives descriptive statistics for the number of low-wage jobs accessible by car within 30 minutes for City Heights, comparison neighborhoods, and San Diego County during peak hours. The average number of low wage jobs accessible from City Heights is greater than the county-wide average and the comparison neighborhoods. Results are similar for off-peak hours (Table 22).

When we expand the commute time boundary to 60 minutes, nearly all jobs in the County are accessible, whether in City Heights or other tracts (see Tables 23 and 24). Almost all jobs in County are reachable from every point in the County within 60 minutes.

Table 21 Low-wage job access during peak hours, number of jobs (30 min)

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	469,142	9,624	464,127	467,470	474,067	450,174	484,485
San Diego County	627	361,831	132,217	290,822	423,278	462,630	370	546,435
Comparison neighborhoods	15	416,591	79,428	425,519	449,203	462,423	181,706	469,379

Table 22 Low-wage job access during off-peak hours, number of jobs (30 min)

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	479,213	10,236	469,991	479,434	485,784	462,658	494,778
San Diego County	627	380,253	132,503	321,219	437,959	473,994	370	556,219
Comparison neighborhoods	15	435,218	67,612	432,234	461,469	474,053	227,341	477,890

Table 23 Low-wage job access during peak hours, number of jobs (60 min)

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	634,783	4,430	633,962	637,374	637,374	624,222	637,374
San Diego County	627	616,643	56,192	616,296	628,520	636,019	1,676	637,891
Comparison neighborhoods	15	628,287	8,382	618,054	633,962	634,236	614,675	637,374

Table 24 Low-wage job access during off-peak hours, number of jobs (60 min)

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	637,347	104	637,374	637,374	637,374	636,970	637,374
San Diego County	627	621,221	52,996	618,328	634,236	636,970	1,676	637,891
Comparison neighborhoods	15	632,540	7,192	632,305	635,299	637,374	618,328	637,374

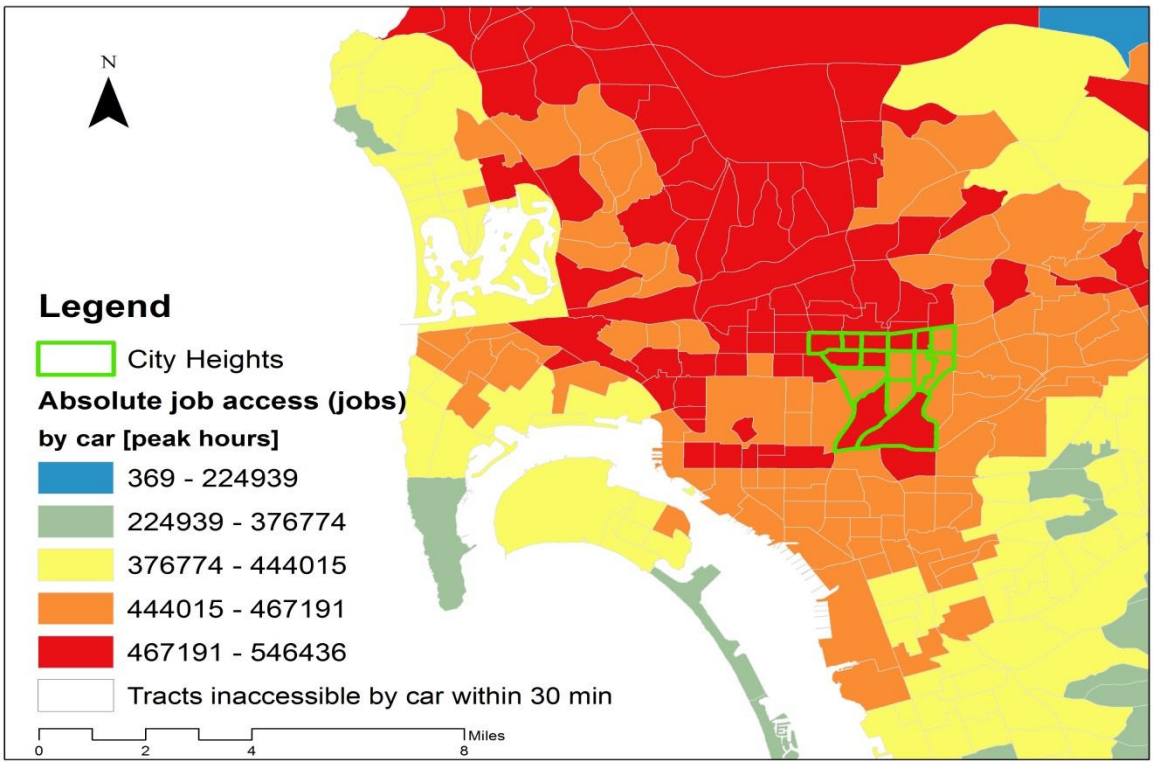

Figure 22 Absolute low-wage job accessibility by car (Peak hours, 30 min)

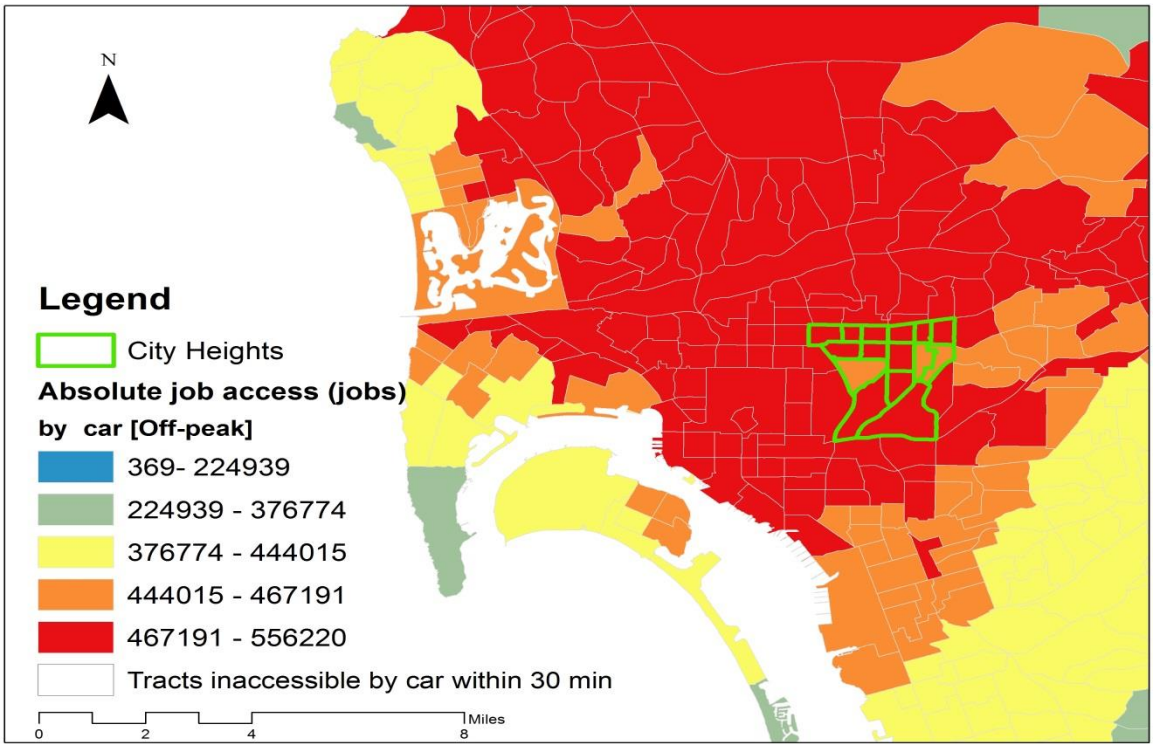

Figure 23 Absolute low-wage job accessibility by car (Off-peak hours, 30 min)

Transit network

We turn now to potential job accessibility by public transit. We use the same 30 minute travel time boundary, peak and off-peak. Tables 25 and 26 give results. As with the previous access measures, transit access is much lower than car access, and the same pattern of greater accessibility for City Heights relative to the County and comparison neighborhoods is observed. There are some small differences in access depending on the transit access mode.

Table 25 Low-wage job access during peak hours, number of jobs (30 min)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	14,527	10,212	747	7,522	11,567	22,095	38,543
San Diego County	466	12,820	16,243	58	2,694	6,109	15,850	89,960
Comparison neighborhoods	14	14,561	12,162	433	7,170	11,292	20,903	48,986

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	27,346	18,636	1,082	18,702	22,052	33,711	62,569
San Diego County	517	22,168	22,337	133	6,697	13,608	31,103	129,941
Comparison neighborhoods	14	27,192	16,290	2,302	17,602	26,896	33,616	70,951

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	22,549	16,875	1,082	12,974	20,624	26,696	58,258
San Diego County	513	17,704	18,968	177	5,172	10,019	22,114	102,642
Comparison neighborhoods	14	21,631	12,668	2,302	12,968	22,663	26,364	53,443

Table 26 Low-wage job access during off-peak hours, number of jobs (30 min)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	15,335	12,853	747	7,522	12,026	20,864	53,366
San Diego County	442	12,505	15,455	58	3,021	6,178	15,032	82,938
Comparison neighborhoods	14	12,674	7,905	433	6,943	11,114	18,727	25,482

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max

City Heights	15	27,170	17,496	1,082	18,621	22,052	46,393	62,223
San Diego County	497	21,485	21,206	151	7,089	13,534	28,312	123,691
Comparison neighborhoods	14	23,418	13,393	2,302	14,058	23,925	28,159	55,069

	3) car+transit+walk							
	N	mean	sd	min	p25	p50	p75	max
City Heights	15	21,498	14,896	1,082	12,974	20,624	25,234	57,547
San Diego County	494	17,127	17,955	151	5,239	10,045	21,329	95,320
Comparison neighborhoods	14	19,081	10,573	2,302	11,968	19,809	24,613	38,200

Figures 24 and 25 show the pattern of absolute job accessibility by transit for peak and off-peak hours, respectively. Unlike the results of labor access (see Figures 20 and 21), we find that there is large variation in job accessibility within City Heights and only a few tracts in the northern part of the neighborhood belong to the highest quintile.

Compared to the results of job accessibility by car, the number of jobs accessible by transit + walking for City Heights is about 30 times smaller in both peak hours and off-peak hours. The gap between access by car and by transit is narrowed, however, when the walk access/egress to transit is replaced by bike or combined car and walk transit access/egress. For example, when the combined mode of bike and transit is used, the ratio of absolute job accessibility by car and by transit for City Heights in peak hours shrinks to about 17, while the use of combined mode of car and transit and walk reduces the ratio to about 20 for City Heights. This result indicates that transit access to jobs could be improved when access to the transit network is improved at the origin and the destinations, though it does not fundamentally change the large gap between car and transit access to jobs.

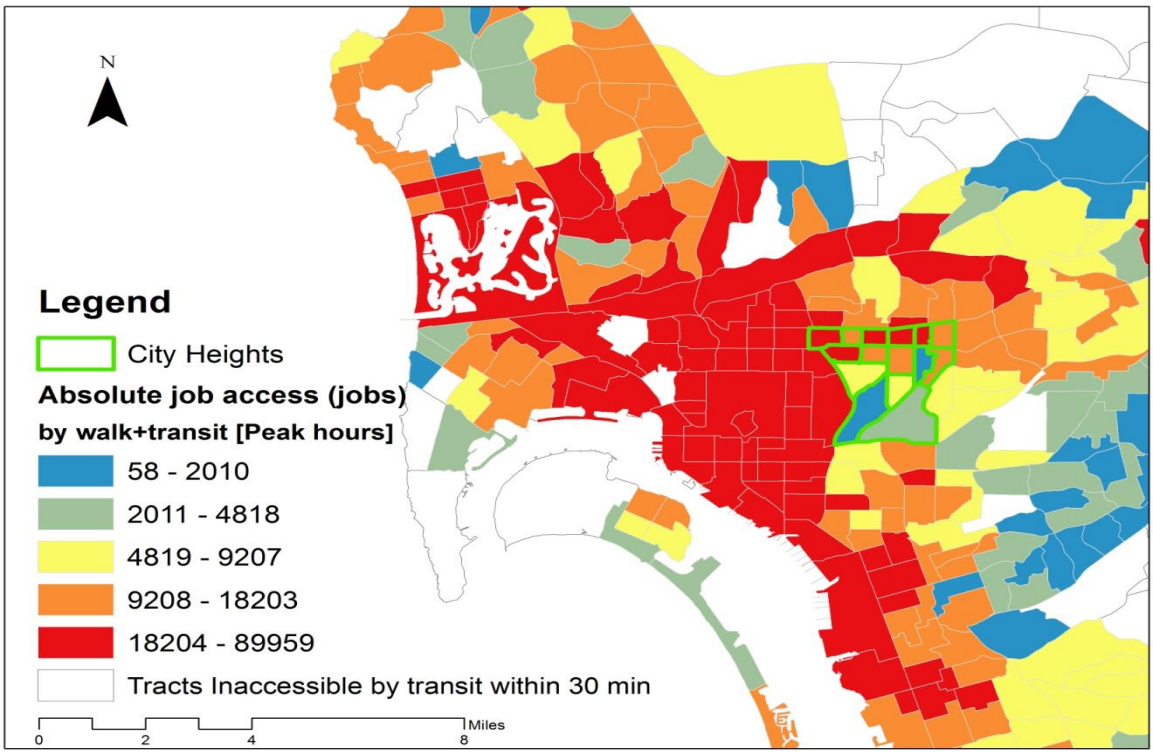

Figure 24 Absolute low-wage job accessibility by transit + walk (Peak hours, 30 min)

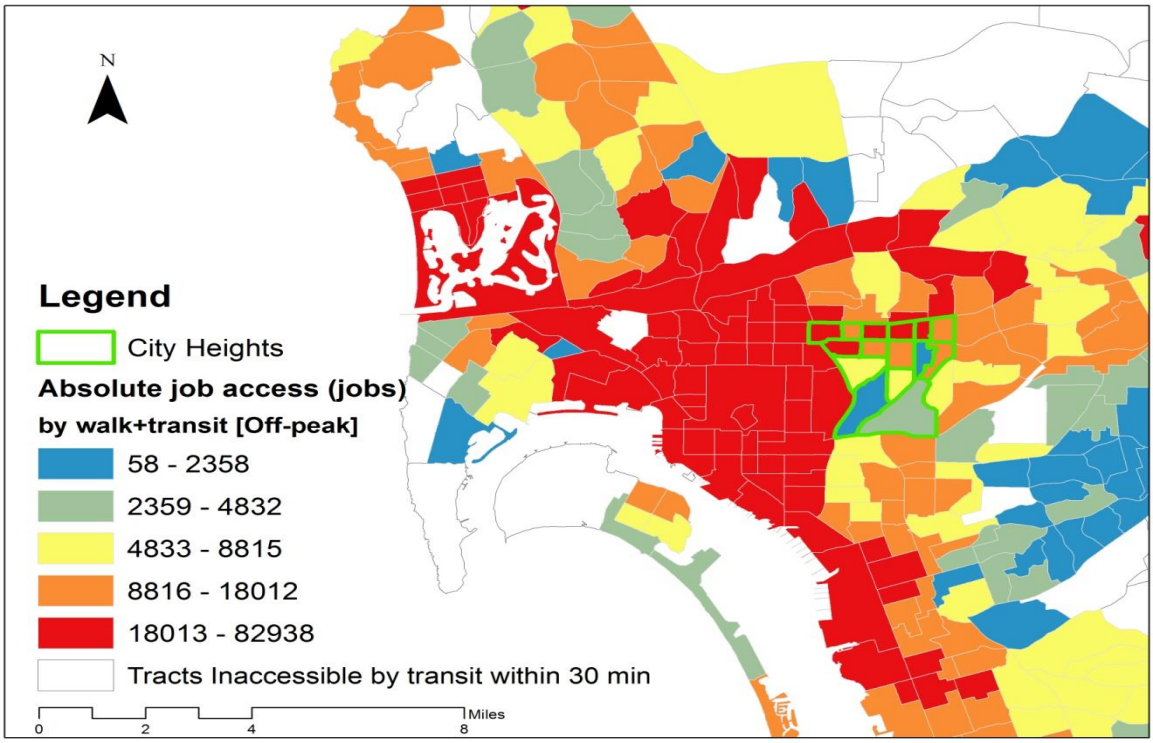

Figure 25 Absolute low-wage job accessibility by transit + walk (Off-peak hours, 30 min)

Tables 27 and 28 report the number of jobs accessible within 60 minutes by transit for peak hours and off-peak hours, respectively. The results show that when the commuting shed extends to 60 minutes, the number of job accessible by transit increases greatly. For example, the number of jobs accessible from City Heights by transit + walking within 60 minutes is more than 10 times the number jobs accessible within 30 minutes in peak hours and 9 times in off-peak hours. When the combined mode of transit + bicycle or transit + car is used, the ratio of transit job accessibility within 60 minutes to that within 30 minutes is approximately 7 to 8.

The gap between car and transit access is also much smaller when the 60 minutes boundary is applied. For example, during the peak hours, the number of jobs accessible by car on average is about 4 times larger than that by transit + walking from City Heights and about 7 times larger for the average of all census tracts within the county. Similarly, the gap between access by car and by transit is even smaller when combined modes of transit and bicycle or car station access are used. We caution that the improved competitiveness of transit job access for 60-minute travel times (compare to car access also for 60-minute travel times) does not indicate that transit travel compares favorably to car travel. A 60-minute travel time is a long one-way commute. In San Diego County, only 6 percent of all residents commute 60-minutes or more to work, according to the 2007-2011 ACS. Average commute time in San Diego County is 24.1 minutes, closer to the 30-minute commute time, and for 30-minute comparisons job accessibility by car is far superior to job accessibility by transit.

Table 27 Low-wage job access during peak hours, number of jobs (60 min)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	155,957	49,822	25,994	146,800	168,668	187,831	198,973
San Diego County	556	83,396	67,792	81	25,276	60,795	136,917	270,392
Comparison neighborhoods	15	123,174	55,812	9,836	76,931	139,004	157,617	196,763

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	189,888	44,436	58,065	182,847	207,412	211,420	223,193
San Diego County	566	108,782	78,494	981	40,254	87,158	184,517	297,462
Comparison neighborhoods	15	161,382	70,249	19,913	99,998	204,136	216,193	219,495

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	173,782	44,598	55,327	167,009	193,896	198,752	208,092
San Diego County	567	98,447	73,203	981	34,853	80,554	161,104	278,466
Comparison neighborhoods	15	142,862	63,041	10,972	95,536	162,661	195,255	207,639

Table 28 Low-wage job access during off-peak hours, number of jobs (60 min)

1) walk+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	136,983	39,682	25,541	134,979	148,775	157,508	165,645
San Diego County	543	77,885	62,414	292	25,541	56,450	127,804	263,331
Comparison neighborhoods	15	114,107	52,514	9,836	62,858	129,577	150,366	178,035

2) bike+transit+bike

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	159,760	39,196	51,653	160,436	170,039	177,446	220,882
San Diego County	552	100,483	71,439	981	40,220	83,089	163,191	279,915
Comparison neighborhoods	15	141,544	59,506	19,267	93,076	170,058	179,047	204,531

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	150,077	35,052	50,071	151,361	160,634	169,244	178,669
San Diego County	553	91,749	66,838	981	35,458	77,552	146,502	268,747
Comparison neighborhoods	15	128,763	55,760	10,972	89,734	146,535	168,840	192,609

4.4 Relative low-wage job accessibility

Road network

We now discuss *relative* low-wage job accessibility, which accounts for both availability of potential jobs and potential competition from other local workers. Tables 29 and 30 give results for relative accessibility by car, peak and off-peak.

While City Heights has greater absolute access to low-income labor force and low-wage jobs, it is still not clear whether residents of City Heights have a higher level of accessibility to low-wage jobs relative to the number of people competing for those jobs. After considering both demand and supply for low-wage labor, City Heights seems to have some advantage in the relative accessibility of low-wage jobs by automobile. That is, if low-income workers living in

City Heights travel by car, they have better relative job access to low-wage jobs compared to their counterparts living in comparison neighborhoods or other neighborhoods of the county. In addition, other comparison neighborhoods have a slightly higher average level of relative accessibility to low-wage jobs than the county average. This trend does not change during off-peak hours, while the difference in low-wage job accessibility between City Heights and other neighborhoods slightly decreases (Table 30). These results are consistent with previous findings (Shen, 2001). We also conducted analysis whenever the definition of competitors using transit changes, but the value of relative low-wage job access does not change. Meanwhile, Figure 25 to 26 illustrate the variation in relative low-wage job accessibility by car within the County. Neighborhoods that fall in to the fifth quintile of relative job accessibility by car (e.g. high relative low-wage job access by car) are located in the north of San Diego, which is in part attributed to job suburbanization. Within City Heights, areas designated by Price Charities have relatively good accessibility of low-wage jobs compared to the rest of City Heights.

Table 29 Relative job accessibility by car during peak hours

1) competitors using walk+transit+walk

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.34	0.05	1.31	1.33	1.36	1.25	1.42
San Diego County	627	1.2	0.28	1.06	1.25	1.36	0.08	1.99
Comparison neighborhoods	15	1.25	0.12	1.19	1.26	1.31	1.01	1.53

2) competitors using bike+transit+bike

variable	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.34	0.05	1.31	1.33	1.36	1.25	1.42
San Diego County	627	1.2	0.27	1.06	1.25	1.36	0.08	1.98
Comparison neighborhoods	15	1.25	0.12	1.19	1.26	1.3	1.01	1.53

3) competitors using car+transit+walk

variable	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.34	0.05	1.31	1.33	1.36	1.25	1.42
San Diego County	627	1.2	0.28	1.06	1.25	1.36	0.08	1.98
Comparison neighborhoods	15	1.25	0.12	1.19	1.26	1.3	1.01	1.53

Table 30 Relative job accessibility by car during off-peak hours

1) competitors using walk+transit+walk

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.32	0.05	1.28	1.32	1.35	1.24	1.39
San Diego County	627	1.21	0.27	1.08	1.24	1.35	0.12	1.91
Comparison neighborhoods	15	1.25	0.11	1.18	1.25	1.30	1.12	1.56

2) competitors using bike+transit+bike

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.32	0.05	1.28	1.31	1.34	1.24	1.39
San Diego County	627	1.21	0.27	1.08	1.24	1.35	0.12	1.90
Comparison neighborhoods	15	1.25	0.11	1.18	1.25	1.30	1.12	1.56

3) competitors using car+transit+walk

	N	mean	sd	p25	p50	p75	min	max
City Heights	15	1.32	0.05	1.28	1.32	1.34	1.24	1.39
San Diego County	627	1.21	0.27	1.08	1.24	1.35	0.12	1.90
Comparison neighborhoods	15	1.25	0.11	1.18	1.25	1.30	1.12	1.56

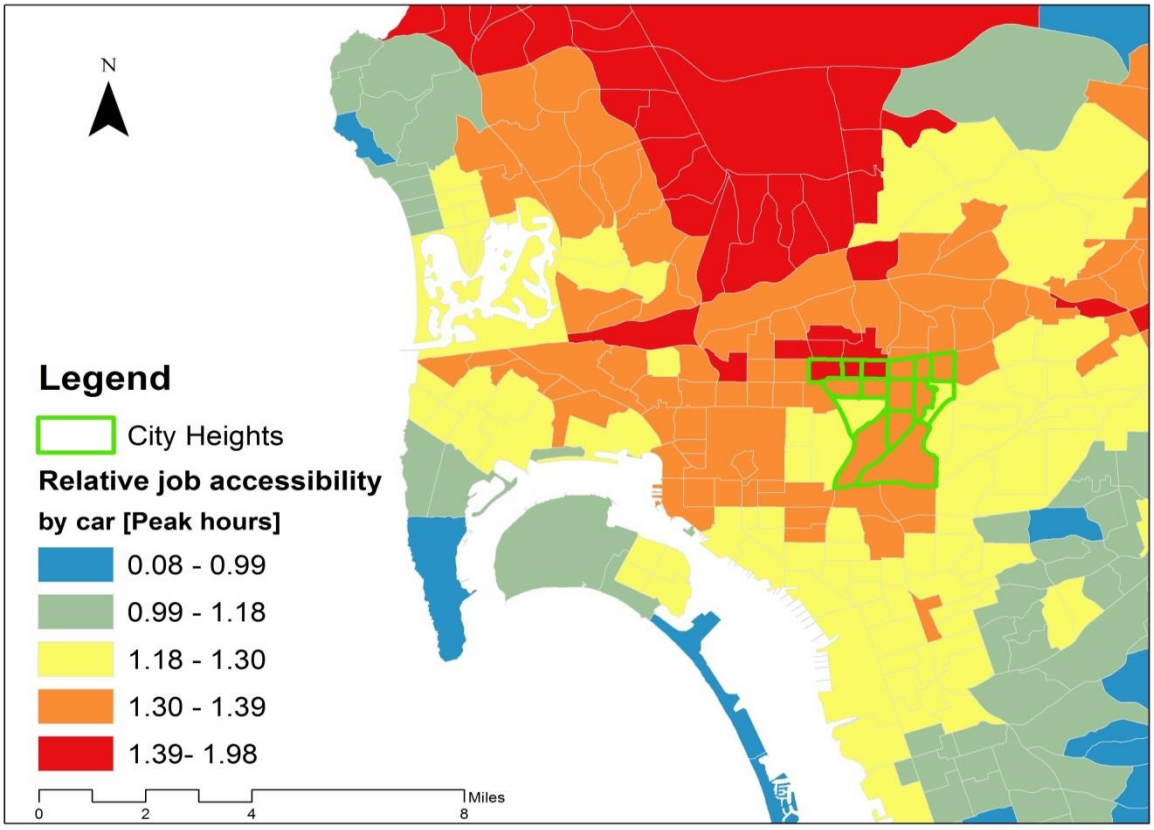

Figure 26 Relative low-wage job accessibility by car during peak hours

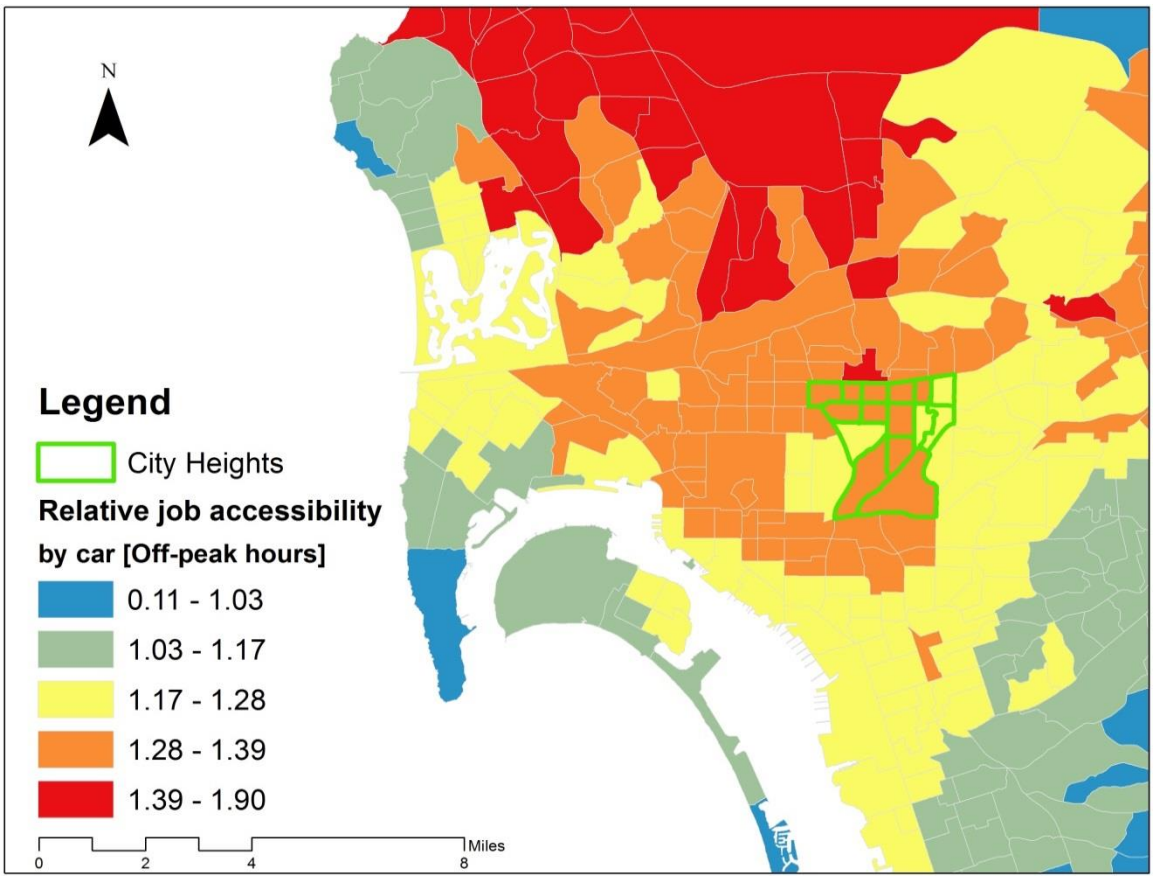

Figure 27 Relative low-wage job accessibility by car during off-peak hours

Transit network

Tables 31-32 show the summary statistics of relative job accessibility by transit for peak and off-peak hours. The first point to note is the difference in average values; car access is on the order of 1.2 for all tracts, while transit access is on the order of 0.06. Again, the disadvantage of transit is illustrated. The second point is that all areas are comparatively disadvantaged; nowhere in the County is there an area of high transit relative job accessibility. Compared with the entire county, potential workers in City Heights and comparison neighborhoods seem to be neither better nor worse off in terms of transit job access. Figures 27 and 28 also show that there is large variation in relative job accessibility within City Heights; the northern part of City Heights is on average better off in terms of relative job access. The two tracts with the longest transit travel time also have the worst job accessibility.

We also find that the gap between car and transit access does not change much when the relative job accessibility measure is used. For example, during peak hours, the relative job accessibility index for City Heights by car is about 35 times the accessibility index by walk and transit, 19 times the accessibility index by bike and transit, and 24 times the accessibility index by

car and transit. For other neighborhoods, the ratios of relative accessibility index between car access and three scenarios of transit access is very similar to that of City Heights. This result again suggests that workers relying on transit have less job access than those who have cars available.

Table 31 Relative job accessibility by transit during peak hours

	1) walk+transit+walk							
	N	mean	sd	min	p25	p50	p75	max
City Heights	15	0.04	0.03	1.9E-03	0.02	0.03	0.06	0.10
San Diego County	466	0.04	0.04	1.9E-04	0.01	0.02	0.04	0.23
Comparison neighborhoods	14	0.04	0.03	1.2E-03	0.02	0.03	0.05	0.13
	2) bike+transit+bike							
	N	mean	sd	min	p25	p50	p75	max
City Heights	15	0.07	0.05	2.8E-03	0.05	0.06	0.09	0.16
San Diego County	517	0.07	0.06	4.0E-04	0.03	0.05	0.10	0.33
Comparison neighborhoods	14	0.08	0.04	6.4E-03	0.06	0.07	0.09	0.19
	3) car+transit+walk							
	n	mean	sd	min	p25	p50	p75	max
City Heights	15	0.06	0.04	2.8E-03	0.03	0.05	0.07	0.15
San Diego County	513	0.05	0.05	5.4E-04	0.02	0.04	0.07	0.27
Comparison neighborhoods	14	0.06	0.03	6.5E-03	0.04	0.06	0.07	0.15

Table 32 Relative job accessibility by transit during off-peak hours

	1) walk+transit+walk							
	N	mean	sd	min	p25	p50	p75	max
City Heights	15	0.04	0.03	1.9E-03	0.019	0.03	0.05	0.14
San Diego County	442	0.04	0.04	1.8E-04	0.010	0.02	0.04	0.21
Comparison neighborhoods	14	0.03	0.02	1.2E-03	0.019	0.03	0.05	0.07
	2) bike+transit+bike							
	N	mean	sd	min	p25	p50	p75	max
City Heights	15	0.07	0.04	2.8E-03	0.05	0.06	0.12	0.16
San Diego County	497	0.06	0.05	5.3E-04	0.02	0.05	0.09	0.31
Comparison neighborhoods	14	0.06	0.04	0.01	0.04	0.06	0.08	0.15

3) car+transit+walk

	N	mean	sd	min	p25	p50	p75	max
City Heights	15	0.05	0.04	2.8E-03	0.03	0.05	0.06	0.15
San Diego County	494	0.05	0.04	5.3E-04	0.02	0.04	0.06	0.25
Comparison neighborhoods	14	0.05	0.03	0.01	0.03	0.05	0.06	0.10

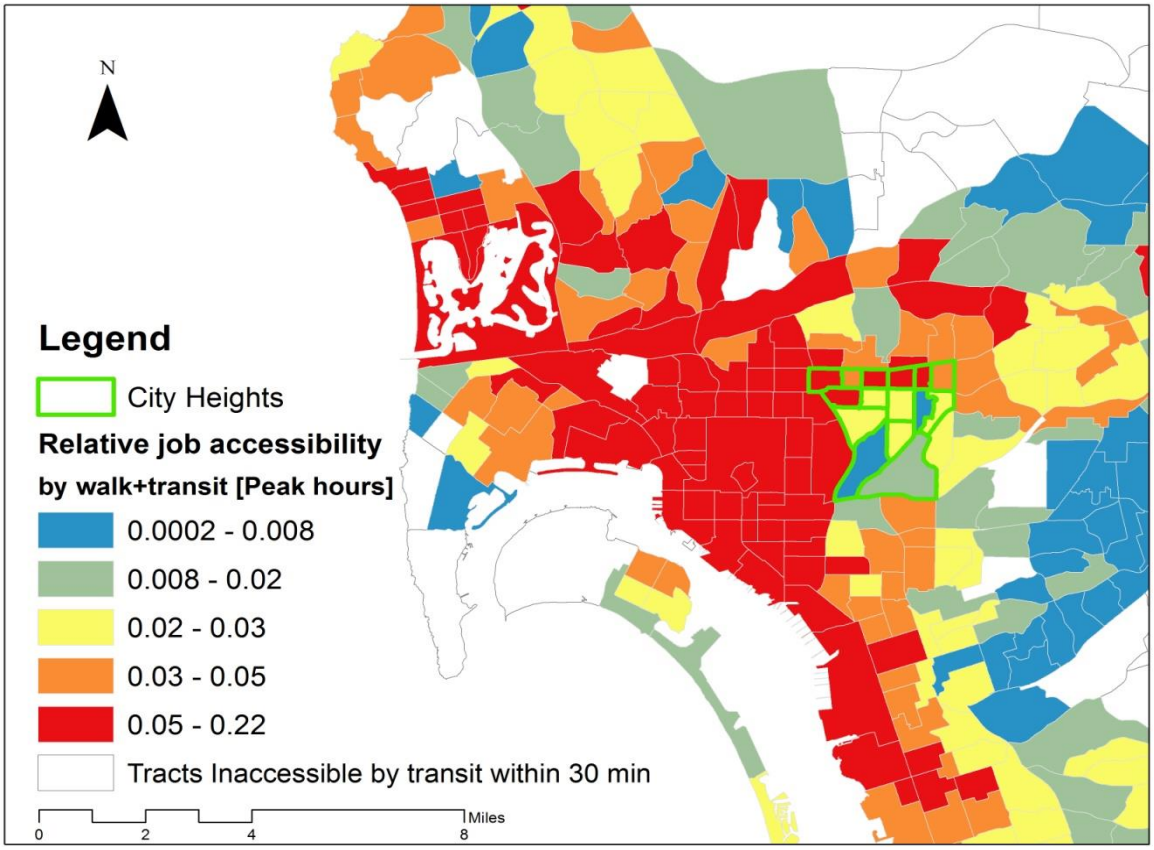

Figure 28 Relative accessibility of low-wage jobs within 30 min by transit + walk (Peak hours)

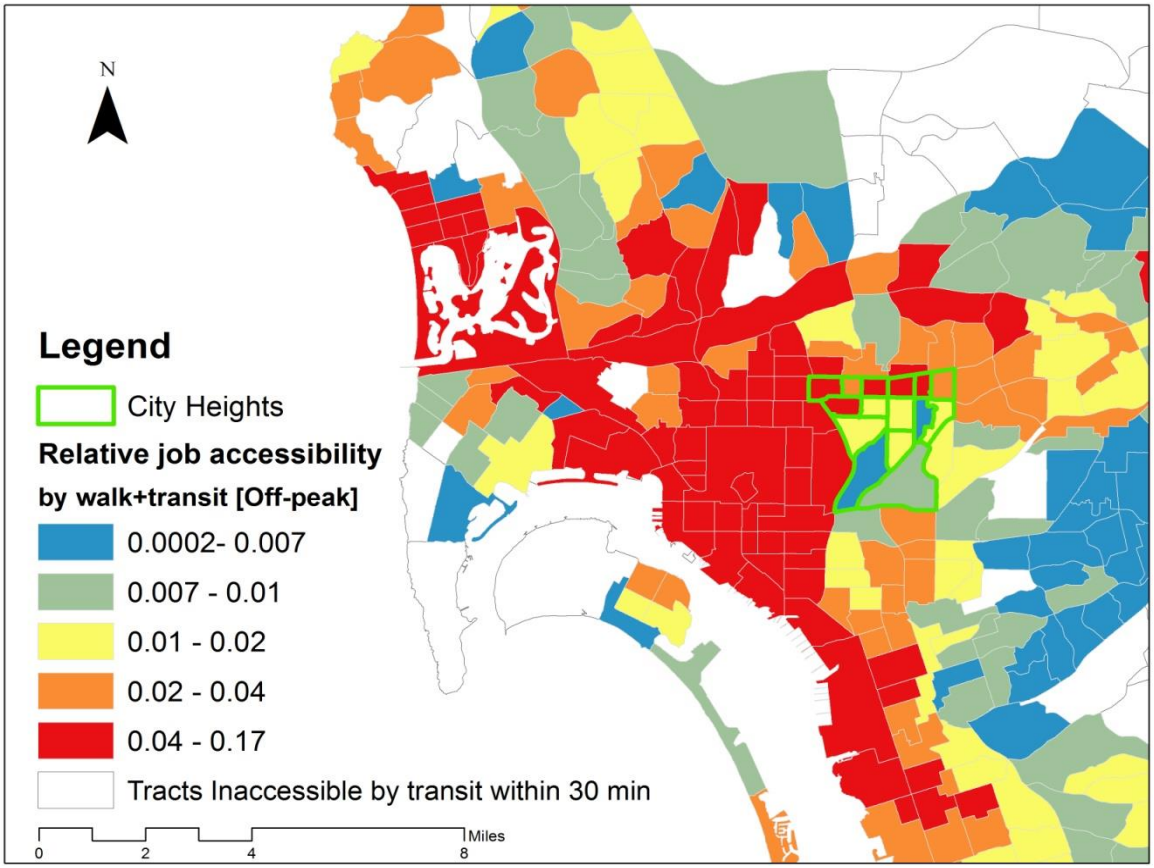

Figure 29 Relative accessibility of low-wage jobs within 30 min by transit + walk (Off-Peak hours)

5. Summary and Policy Implications

5.1 Summary of major findings

We constructed three measures of accessibility to compare access to employment opportunities from City Heights: 1) Average census tract-to-census tract travel time, in minutes; 2) Cumulative opportunities: the number of jobs that can be reached from City Heights in 30-minute and 60-minute travel times; 3) Relative job accessibility: the number of jobs adjusted for the number of potential competing workers within 30 minutes travel time. The main findings of our study are summarized in Table 33 and the following discussion.

Table 33 Three measures of accessibility in different areas

Area	Travel Mode	Average tract-to-tract travel time (min)		Sum of low wage jobs accessible (30 min catchment area)		Sum of low wage jobs accessible (60 min catchment area)		Relative low-wage job accessibility (30 min catchment area) [9]	
		Peak	Off-peak	Peak	Off-peak	Peak	Off-peak	Peak	Off-peak
City Heights	By Car	22.65	21.71	469,142	479,213	634,783	637,347	1.34	1.32
	By Transit (+walk)	64	64.39	14,527	15,335	155,957	136,983	0.04	0.04
	By Transit (+bike)	60.01	60.95	27,346	27,170	189,888	159,760	0.07	0.07
	By Transit (+car+walk)	61.54	62.31	22,549	21,498	173,782	150,077	0.06	0.05
San Diego County	By Car	29.13	28.13	361,831	380,253	616,643	621,221	1.20	1.21
	By Transit (+walk)	71.72	71.31	12,820	12,505	83,396	77,885	0.04	0.04
	By Transit (+bike)	68.62	68.31	22,168	21,485	108,782	100,483	0.07	0.06
	By Transit (+car+walk)	69.64	69.27	17,704	17,127	98,447	91,749	0.05	0.05
Comparison	By Car	24.89	23.92	416,591	435,218	628,287	632,540	1.25	1.25

[9] Although we have calculated the relative job accessibility by car with the competitor labor force using transit calculated under all the three scenarios, we only report the "walk and transit" scenario because the numbers are very close across all the three scenarios.

Neighborhoods	By Transit (+walk)	65.02	65.51	14,561	12,674	123,174	114,107	0.04	0.03
	By Transit (+bike)	61.47	62.05	27,192	23,418	161,382	141,544	0.08	0.06
	By Transit (+car+walk)	62.82	63.42	21,631	19,081	142,862	128,763	0.06	0.05

The automobile provides accessibility that is far superior to transit.

Our results show that there is a striking difference between job access by car and by transit, consistent with previous studies. However, the difference is even greater in San Diego than in metropolitan areas with higher densities and more developed public transit systems (e.g Boston, Los Angeles).

In terms of network accessibility, automobile commuters can reach most of the San Diego metropolitan area within 30 minutes, while a 30 minute transit commute will not reach as far as La Jolla or downtown. When we extend the time limit to 60 minutes, the area accessible by transit commuters in City Heights is still limited and far from covering the whole county. One possible reason is that the transfer wait time in San Diego County is unusually long, taking more than 35% of total transit travel time. Thus, even if we assume that commuters access transit by bike or car, the 30-minute transit travel time catchment area becomes a bit larger and the average tract-to-tract travel time is shortened, but the basic pattern of transit access does not change.

Averaging across the census tracts within City Heights, there are 469,142 low-wage jobs accessible within a 30-minute peak-hour car commute, compared to only 14,527 low-wage jobs accessible within a 30-minute transit commute with walk access/egress. Using the 60-minute catchment area, the number of jobs accessible from City Heights by car in peak-hour is 634,783, almost equivalent to the total number of low-wage jobs in the whole county and more than 4 times of the number of jobs accessible by transit. This implies that the gap between car and transit access would be narrowed greatly if we allow for longer commuting time. However, we caution that the improved competitiveness of transit job access for 60-minute travel times (compare to car access also for 60-minute travel times) does not indicate that transit travel compares favorably to car travel. A 60-minute travel time is a long one-way commute. In San Diego County, only 6 percent of all residents commute 60-minutes or more to work, according to the 2007-2011 ACS (see Table 34).

Table 34 Cumulative percentage of people traveling within different commuting times

	Less than 15 min	Less than 30 min	Less than 45 min	Less than 60 min
All modes	41.90	66.93	87.93	93.98
Car	41.50	67.76	89.20	95.13
Transit	12.87	22.37	47.37	61.21

When the walk transit access is replaced by bike or combined car and walk transit access, the gap between access by car and by transit is narrowed somewhat. For example, the number of jobs accessible by car within 30 minutes peak-hour travel time is about 17 times as large as the number of jobs accessible by "bike+transit+bike" and 20 times as large as the number of jobs accessible by "car+transit+walk". The result indicates that transit access to jobs could be improved if access to and egress from transit stops is improved by other modes, but it does not fundamentally change the large gap between car access and transit access.

Similar to the results of absolute job accessibility, we also find the gap between the transit and car access does not change that much when the relative job accessibility measure is used. The relative job accessibility index for the 30 minutes car travel catchment area from City Heights is 1.34 (peak hour), which is about 35 times the relative job access for a 30-minute commute by "walk+transit+walk", 19 times the relative job access by "bike+transit+bike", and 24 times the relative job access by "car+transit+walk". The result again suggests that workers depends on transit have less job opportunities than those commute by cars.

Because car commuting gives far superior access for City Heights, we report census data on vehicle ownership in City Heights compared to San Diego County and comparison neighborhoods in Table 35 . Over 17 percent of City Heights residents own no vehicle, a rate almost three times the county's rate of zero-vehicle households.

Table 35 Vehicle ownership

Percentage	no vehicle	one vehicle	two vehicle	three vehicle	four vehicle	more than five vehicle
City Heights	17.27	42.56	28.04	8.09	2.68	1.36
San Diego	6.34	31.24	38.58	15.59	5.34	2.27
Comparison neighborhoods	15.68	40.14	27.96	10.77	3.59	1.87

City Heights' access is not noticeably worse than access from comparison neighborhoods or the county average.

Are worker residents of City Heights disadvantaged, compared with other potential workers living in the rest of the county? According to the results of our accessibility analysis, our answer is no. As we have discussed, the access measures in San Diego are similar to county and comparison area averages. The difficulty in City Heights is not that it is particularly disadvantaged in terms of job access, but that City Heights residents are more dependent on transit and transit provides particularly poor job access in most locations in San Diego County.

The internal variations in job access within City Heights are large and possibly important.

Our results show that car access does not vary much across City Heights, but transit access degrades rapidly as one moves away from the University Avenue corridor. There are express bus stops in the northern part of City Heights which contribute to that area's better transit accessibility. We also found that those tracts in the northern part with the highest transit access also have a larger share of transit commuters and lower share of car commuters, compared with other tracts within City Heights.

5.2 Policy Implications

The goal of this research was to describe access, but we suggest some possible policy directions which are, at this stage, still preliminary.

Car Access

Car access is far superior to transit access in City Heights and in most locations in San Diego. It would be difficult and costly to invest in the transit system in ways that would substantially close the car-transit access gap. Given that, one policy direction would be to examine ways to increase private car ownership or car availability among residents of City Heights. We list a few options below.

1) Car-sharing: Private car-sharing services, such as ZIPCAR, are becoming popular but are still rare in lower income neighborhoods. Perhaps ironically, low-income residents might particularly benefit from the ability to "rent" rather than own a car. It would be useful to explore the possibility of bringing car-sharing services into City Heights.

2) Ride sharing: City Heights residents likely already share cars or rides in an informal way. Methods to increase or formalize car-sharing, including social media applications, might be explored.

3) Car subsidies: Various programs, including some provisions in the 1996 welfare reform act, have provided subsidies for low income car ownership. Difficulties include interactions within government regulations and the cost of owning and maintaining a vehicle. Having said that, car ownership provides the best access for residents and might be preferred by some City Heights residents.

Transit Improvements

Most transit improvements would need to be system-wide to have an impact on City Heights. There may be localized transit solutions, in the form of express bus service or improvements in service frequency, which may increase access particularly in more access-poor locations within City Heights. Programs to improve access to transit, such as the provision of zipcars to the transit stops and encouraging the combined mode of bike and transit, may also increase transit accessibility by reducing transit travel time, and hence reduce the gap between car and transit access.

Developing the Employment Base in City Heights

The previous two policy solutions focus on linking City Heights residents to jobs. Bringing jobs into City Heights is an alternative or complementary strategy. The Price Charities have long

worked to increase the job base in City Heights, and a strategy of bringing jobs into the neighborhood ought not be overlooked.

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