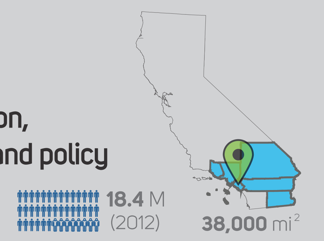
Spatial and Socioeconomic Analysis of Commuting Patterns in Southern California
Using LEHD Origin-Destination Employment Statistics (LODES), Census Transportation Planning Products (CTPP) and ACS Public Use Microdata Sample (PUMS)

What is SCAG?

Southern California Association of Governments (SCAG) is the nation's largest metropolitan planning organization, representing six counties, 191 cities and more than 18 million residents. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future.



Land Use	Acres	
Residential	1,154,378	5%
Commercial	2,758,351	12%
Industrial	204,911	1%
Transportation, Communications, and Utilities	221,087	1%
Open Space and Recreation	4,333,991	19%
Agriculture	1,266,693	6%
Vacant (Unifferentiated, Limited Improvement)	11,401,304	51%
Water	253,738	1%
Protected Land	633,970	3%

Objective:

The Southern California Association of Governments (SCAG) is in the process crafting its 2016-2040 Regional Transportation Plan/Sustainable Communities Strategy (RTP/SCS) for the Southern California region. In compliance with the Title VI of the Civil Rights Act of 1964 (Title VI), SCAG is mandated to perform environmental justice analyses on the low income and minority populations regarding benefits and burdens of proposed projects in the region. In the practice of regional transportation planning, the subject of jobs-housing imbalance and/or jobs-housing mismatch is considered a key contributor to long distance commuting and traffic congestion. In addition, the spatial mismatch between where people work and live is considered as an impediment to environmental justice and social equity, given that certain kinds of residents and workers, like low income populations, tend to be more sensitive to job accessibility due to the cost of housing and long distance commuting. Workers without a car or people with less income who cannot afford a vehicle have to either live close to their jobs where they can have access to transit or within walkable/bikable distance. On the other hand, workers with higher income who can afford to commute by car have more opportunities as their job search areas are more likely to be larger, which results in longer commute distance. To better understand the spatial and temporal dynamics of job-housing imbalance/mismatch in a geographically detailed way, this study examines the relationship between commuting pattern and socioeconomic characteristics in the Southern California region, using multiple datasets.

Methodology:

This study examines commuting distance by income level using multiple datasets including LEHD Origin-Destination Employment Statistics (LODES) Version 7.1 data, Census Transportation Planning Products (CTPP) 5-Year 2006–2010 American Community Survey (ACS) data, and 2009-2013 ACS 5-year Public Use Microdata Samples (PUMS). Due to the differences in data structure, variable and geographic units among those datasets, this study uses different methodologies to examine the relationship between commute distance and income level.

Using LODES dataset, this study examines the median commute distance, by wage group, for six counties in the region for the years 2002, 2008 and 2012. LODES dataset includes information on commute flows, residence area characteristics and workplace area characteristics at the census block level. The commute distance measured is the Euclidean distance, straight-line distance, or distance measured "as the crow flies" between the centroid of origin block and destination block. And the commute distance is weighted by block-level commuter number. The weighted block-level commute distance is compiled to estimate the median commute distance at tract level. Additionally, this study examines the job-to-worker ratio, by wage group, for the year 2012. To estimate the job-to-worker ratio, a buffer is drawn from a centroid of each tract based on county-level median commute distance and then we count total jobs and workers within the buffer for each tract. Higher job-to-worker ratio means more jobs while lower job-to-worker ratio means more workers.

Using CTPP dataset, this study examines the median commute distance, by income group, for six counties in the region. CTPP dataset includes residence-based, workplace-based and home-to-work flow tables and its geographies range from census tract to the nation. The commute distance measured is the Euclidean distance between the centroid of origin tract and destination tract and the commute distance is weighted by tract-level commuter number. We examined the median commute distance by several variables, such as household income, poverty status and vehicles available.

Using PUMS dataset, this study examines the median wages for inter-county and intra-county commuters to compare the median wages between workers residing in their destination-work-counties and outside their destination-work-counties. The most detailed unit of geography contained in the PUMS dataset is the Public Use Microdata Area (PUMA) and the weighting variable (PWGTP) is used to generate accurate estimates.

Conclusion:

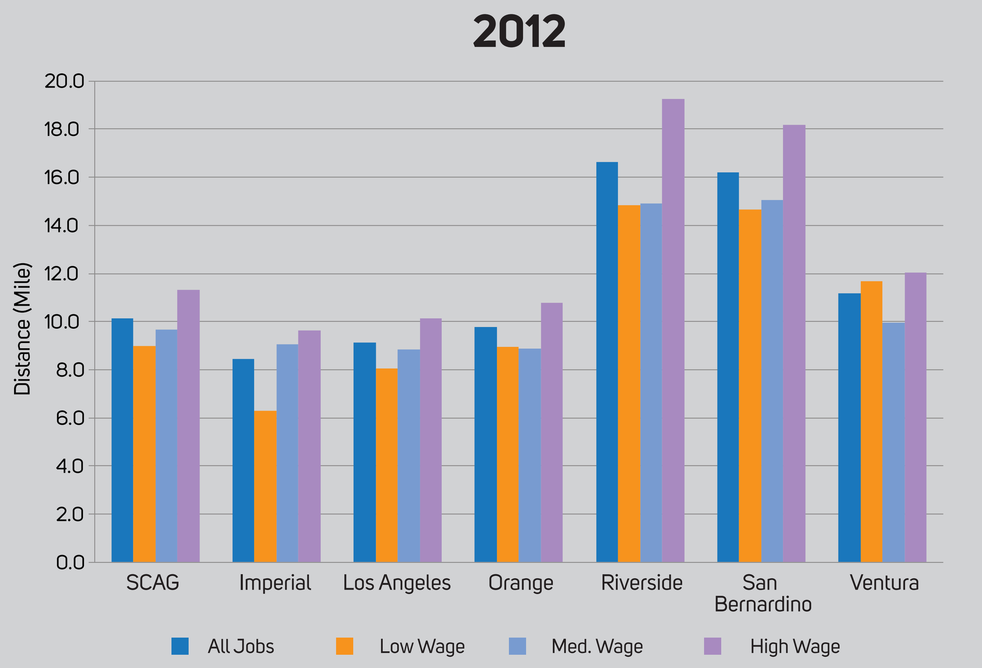
Findings from this study include:

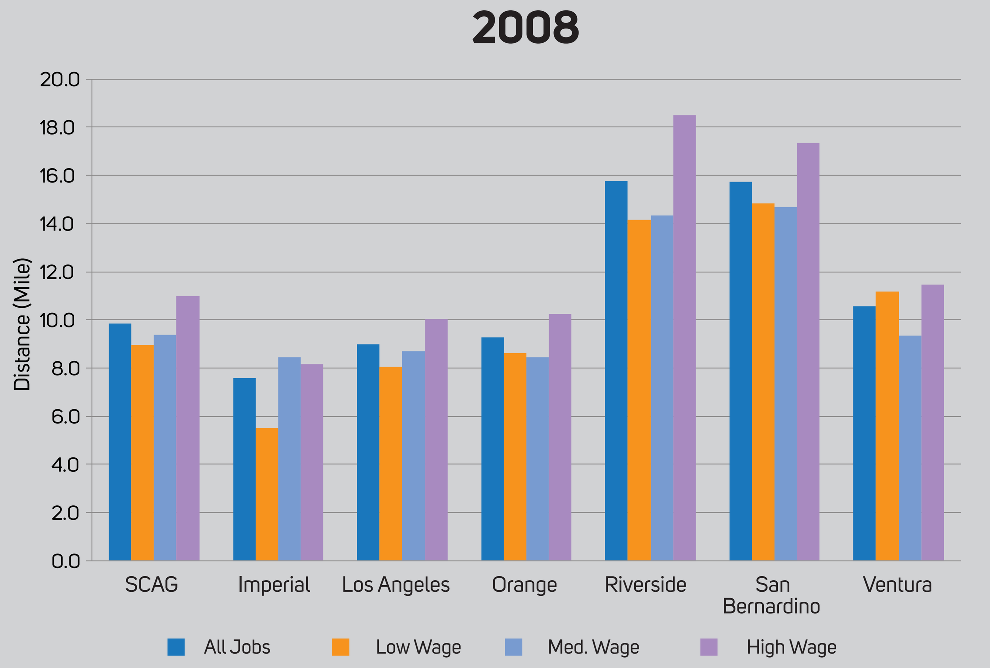
- Higher wage workers tend to commute longer distance than lower wage workers;
- The commute distance is growing in all 6 counties between 2002 and 2012;
- The commute distance of workers in inland counties (Riverside and San Bernardino Counties) is longer and grows more rapidly than in coastal counties (Los Angeles and Orange Counties);
- Inland counties show lower job-to-worker ratio than coastal counties, which would generate more long distance commuters in inland counties;
- More balanced distribution of population and employment may result in the reduction of transportation congestion and the related air quality problems.

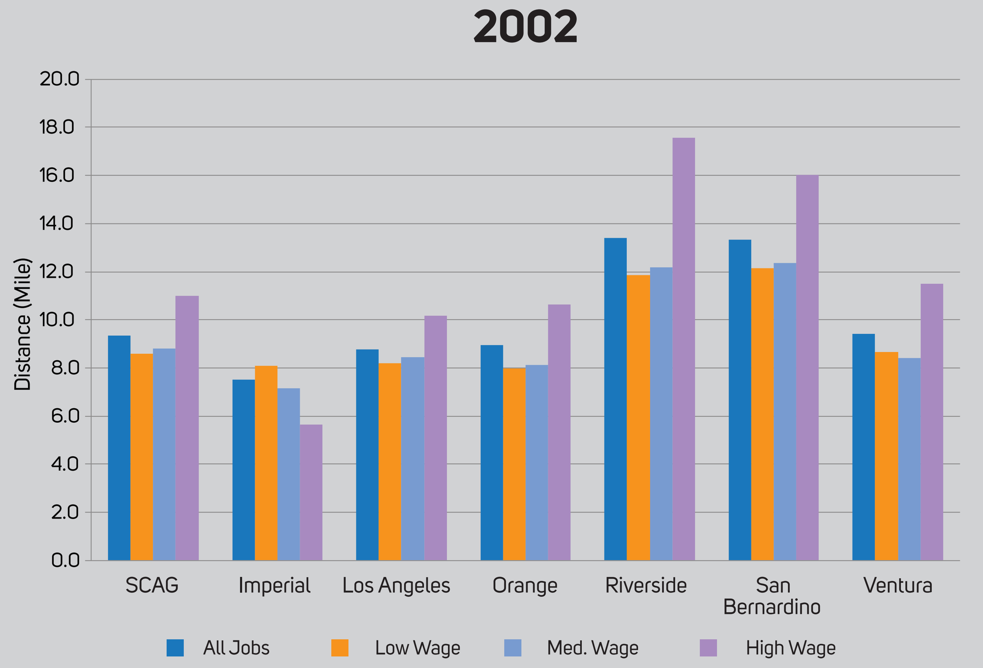
In general, the commuting pattern from LODES, CTPP and PUMS datasets are strongly correlated. However, it is observed that the median commute distance from LODES dataset is longer than those from CTPP dataset. It may result from differences between two datasets in data input source, data coverage, geographic tabulation level, time period and characteristics level. Two datasets are complementary given that each dataset has its unique characteristics that the other does not provide. LODES commute flow characteristics (age, wage level and industry) are released at the census block level which would enable users to conduct geographically detailed analysis. Though the smallest geographic unit of CTPP dataset is the census tract, its work-to-home flow table provides more characteristics than LODES dataset such as commute mode, departure time from home, arrival time to work, travel time (minutes), sex, age, race, ethnicity, earnings, poverty status, industry and number of vehicles available. Compared to LODES and CTPP's work-to-home flow datasets, PUMS dataset has limitations in sample size and geographic detail. The smallest geographic unit of PUMS is Public Use Microdata Area (PUMS), which has a population threshold of 100,000 or more; as a result, users cannot pinpoint the individual down to the census tract or townships.

LEHD Origin-Destination Employment Statistics (LODES), Version 7.1

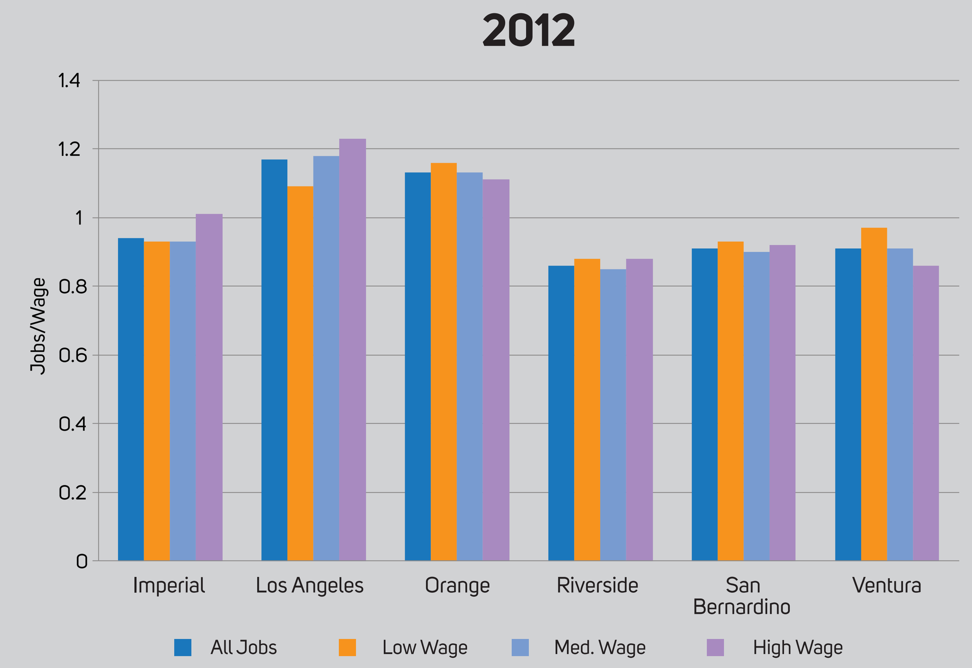
Median Commute Distance by wage in the SCAG Region







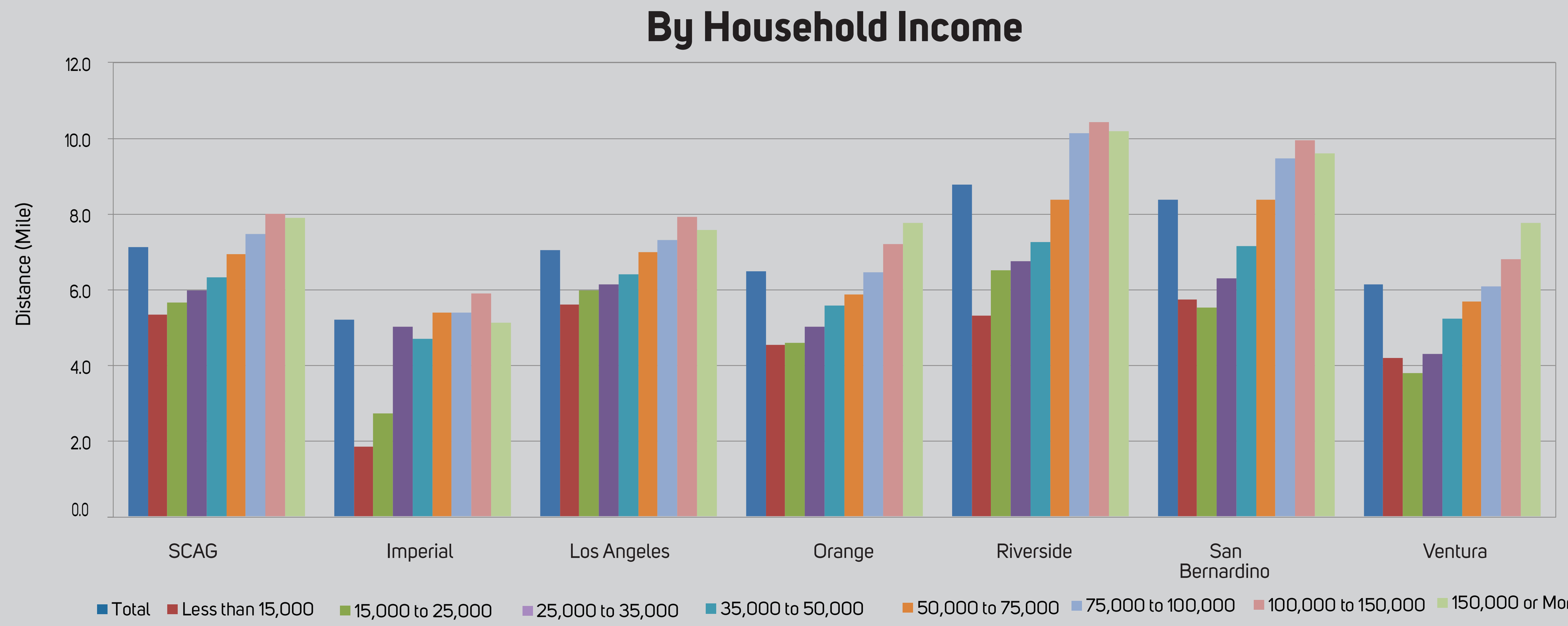
Job-to-Worker Ratio by wage in the SCAG Region

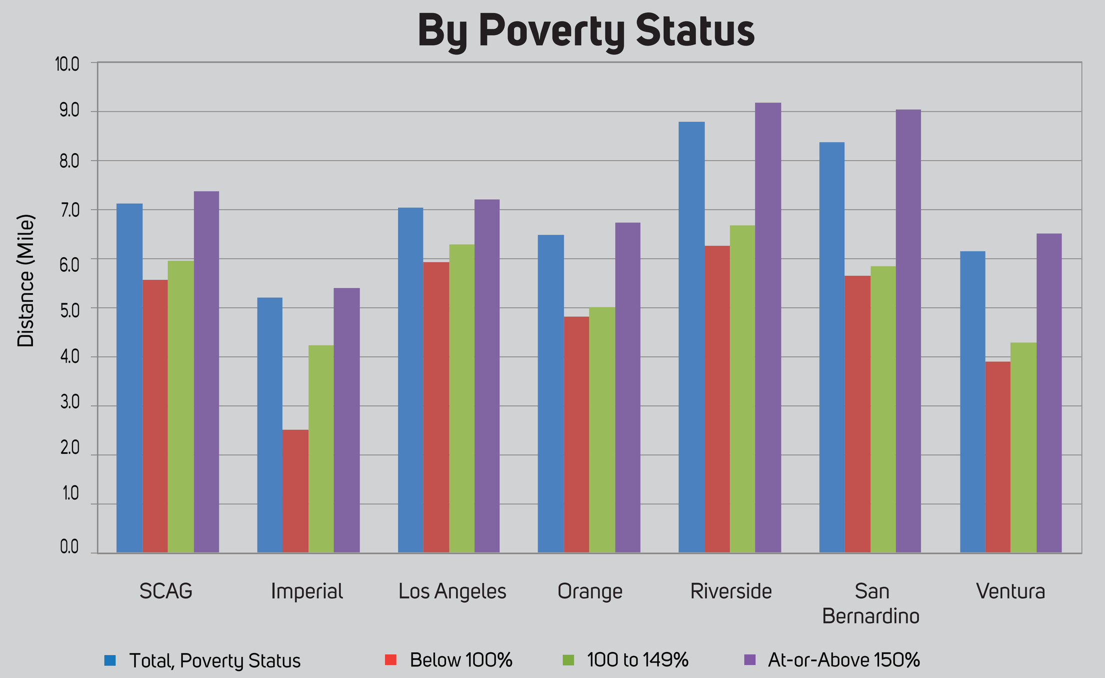


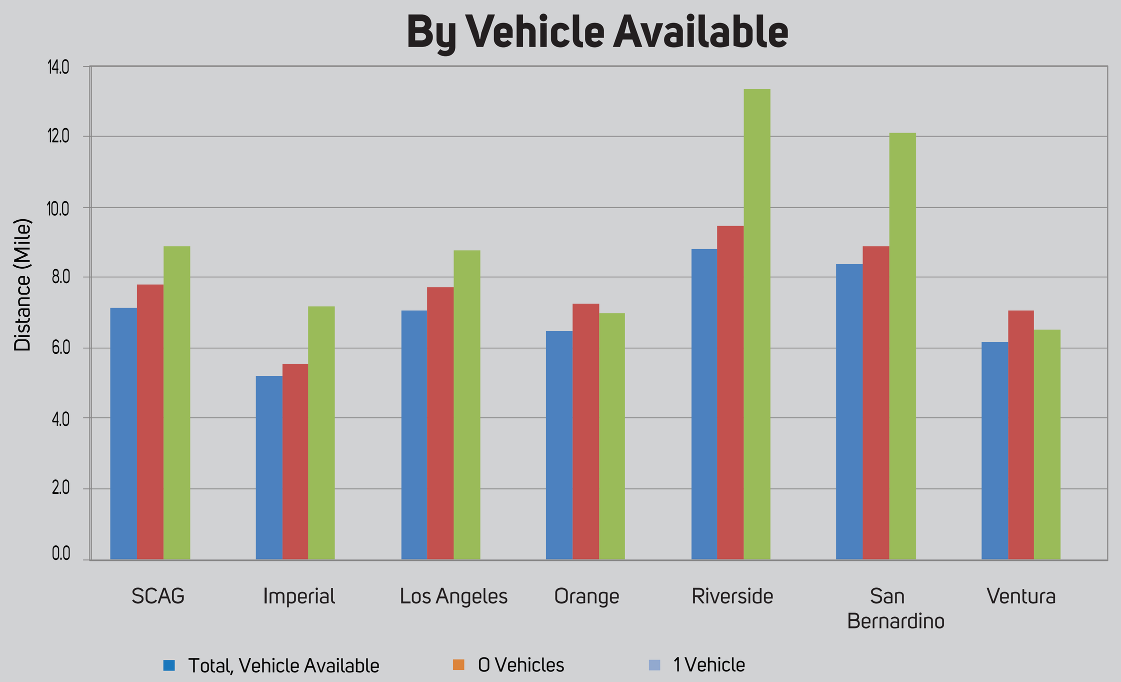
(Note: 'Low Wage' = Jobs with earnings $1250/month or less ; 'Med. Wage' = Jobs with earnings $1251/month to $3333/month; 'High Wage' = Jobs with earnings greater than $3333/month)
Source: U.S. Census Bureau. 2015. LODES Data. Longitudinal-Employer Household Dynamics Program. http://lehd.ces.census.gov/data/lodes

Census Transportation Planning Products (CTPP) 5-Year Data Set (2006-2010)

Median Commute Distance







Source: U.S. Census Bureau. 2006-2010. American Community Survey (ACS) Data. American Association of State Highway and Transportation Officials. http://ctpp.transportation.org/Pages/5-Year-Data.aspx

Public Use Microdata Sample (PUMS)

Median Wage for Workers by Place of Residence and Work (1990-2013)

2013

Place of Residence	2013 Place of Work: Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	$26,154	$2,637	$43,744	$18,983	$4,218	$108,547	$43,455
Los Angeles	$40,995	$27,990	$36,896	$35,264	$30,747	$37,991	$30,226
Orange	$163,982	$55,344	$31,973	$48,121	$45,340	$40,302	$53,188
Riverside	$40,909	$48,444	$46,120	$24,597	$38,946	$25,189	$47,458
San Bernardino	$32,904	$43,419	$43,419	$33,048	$25,837	$32,296	$37,966
Ventura	-	$60,453	$58,438	$4,091	$52,731	$27,420	$65,669
San Diego	$77,511	$54,273	$60,113	$53,188	$42,185	$70,528	$32,564

(Source: 2009-2013 ACS 5-years PUMS (CPI adjusted to $ in 2013)

2008

Place of Residence	2008 Place of Work: Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	$20,804	$27,581	$28,369	$25,217	$23,641	$30,576	$27,581
Los Angeles	$40,978	$23,641	$26,005	-	$37,826	$40,978	$35,462
Orange	$39,402	$33,097	$19,701	$37,826	$28,369	$47,282	$31,521
Riverside	$22,065	$26,793	$23,641	$16,549	$33,097	-	$27,581
San Bernardino	$31,521	$31,521	$23,641	$86,684	$19,701	$45,706	$23,641
Ventura	$44,918	$56,738	$10,560	-	$60,679	$23,641	$20,489
San Diego	$43,342	$39,402	$37,826	$55,162	$63,043	$17,337	$25,217

Source: 2008 ACS PUMS (CPI adjusted to $ in 1999

2000

Place of Residence	2000 Place of Work: Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	$19,000	$16,000	$6,300	$10,400	$81,000	-	$25,200
Los Angeles	$20,000	$21,000	$27,900	$26,800	$22,400	$28,000	$21,000
Orange	$10,500	$41,000	$24,600	$30,000	$40,000	$35,000	$39,000
Riverside	$44,400	$40,000	$36,500	$18,000	$30,000	$40,000	$36,800
San Bernardino	$27,800	$35,000	$35,000	$27,000	$19,500	$42,000	$26,000
Ventura	-	$43,000	$45,000	$50,000	$40,000	$22,000	$45,000
San Diego	$30,000	$36,000	$40,000	$30,000	$19,000	$35,000	$23,600

Source: 2000 PUMS 5% (CPI adjusted to $ in 1999

1990

Place of Residence	1990 Place of Work: Imperial	Los Angeles	Orange	Riverside	San Bernardino	Ventura	San Diego
Imperial	$16,830	$6,991	$32,365	$16,364	$41,427	$7,664	$23,303
Los Angeles	$23,303	$22,008	$27,758	$25,892	$22,008	$29,776	$15,535
Orange	$23,303	$42,722	$23,303	$32,365	$33,660	$38,838	$38,838
Riverside	$12,946	$41,427	$37,543	$17,865	$31,070	$36,249	$31,718
San Bernardino	$51,784	$36,016	$36,249	$27,187	$19,419	$46,606	$32,365
Ventura	-	$44,016	$49,345	$38,191	$25,892	$20,714	$28,481
San Diego	$29,776	$37,543	$36,249	$27,187	$29,776	$33,660	$20,714

Source: 1990 PUMS 5% (CPI adjusted to $ in 1999

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Washington, D.C., USA

Tom Vo, Jung H. Seo, JiSu Lee, Dr. Frank Wen, and Dr. Simon Choi

ABOUT SOUTHERN CALIFORNIA ASSOCIATION OF GOVERNMENTS

SCAG is the nation's largest metropolitan planning organization, representing six counties, 191 cities and more than 18 million residents. SCAG undertakes a variety of planning and policy initiatives to encourage a more sustainable Southern California now and in the future.

GEOGRAPHIC INFORMATION SYSTEMS (GIS)

The SCAG GIS and Data Service Program was designed as the preferred source for customized demographic and economic studies, data and analysis, Geographic Information Systems (GIS) analysis and mapping for the Southern California region. We maintain data/information and GIS files for the counties of Imperial, Los Angeles, Orange, Riverside, San Bernardino and Ventura.

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