



Geographic Information Systems Occupational Groups

Inland Empire/ Desert Region (Riverside-San Bernardino-Ontario Metropolitan Statistical Area) and Los Angeles County

Introduction

This report profiles occupations related to Geographic Information System (GIS) training programs in the Inland Empire/Desert Region and Los Angeles County. Each GIS occupation is separated into primary and secondary categories. The primary GIS occupational group consists of jobs that require workers to use GIS as a primary function of their daily work. The secondary GIS occupational group consists of jobs that need GIS skills, but may not necessarily apply those skills to their work on a daily basis. Occupational definitions for both the occupations included in both groups are in the appendix, along with five-year projections for each region. This report also includes a GIS skillset search of local job postings to gauge demand for GIS skills beyond the selected occupations. Together, these three separate searches provide a comprehensive outlook for GIS workers in our region.

The Student Completions section on page 16 details regional activity related to the California Community College programs, surveying (TOP 0957.30) and geographic information systems (TOP 2206.10). The surveying program prepares students in GIS occupations by providing instruction on the mapping of angles, elevations, points and contours used for construction, map-making, urban planning or other purposes, which can include Global Positioning System (GPS) and Geographic Information Systems (GIS) applications. The geographic information systems program provides training related to computer-based tools for acquiring, editing, storing, analyzing, and visualizing geographically referenced information (Taxonomy of Programs, 2012).

Demand for Primary GIS Occupations:

- Geospatial Information Scientists and Technologists (15-1199.04)
- Geographic Information Systems Technicians (15-1199.05)

The occupations listed above make up the primary GIS occupational group. Workers in these occupations use GIS as a primary function of their daily work. Since these occupations cannot be quantified using traditional LMI, a real-time job posting search was conducted to gauge regional demand.

Job Postings, Employers, Skills, and Education for Primary GIS Jobs

During the past 12-month period (March 2018 to February 2019), there were 59 job ads seeking candidates for these primary GIS occupations the Inland Empire/Desert Region, and 181 in Los Angeles County. Exhibit 1 displays the number of job ads posted during the last 12 months and the average time to fill for each occupation in the region and nationally. On average, open positions for the primary GIS occupational group take 40 days to fill in the Inland Empire/Desert Region. This one week longer than the national average, indicating that open positions are harder to fill locally.

Exhibit 1: Job ads and time to fill for primary GIS occupations in the last 12 months, Mar 2018 – Feb 2019

Region	Occupation	Job Ads	Regional Average Time to Fill (Days)	National Average Time to Fill (Days)
Inland Empire/ Desert	Geospatial Information Scientists and Technologists	44	40	33
	Geographic Information Systems Technicians	15	40	33
Los Angeles County	Geospatial Information Scientists and Technologists	124	38	33
	Geographic Information Systems Technicians	57	38	33
Total for both regions combined		240	39	33

Source: Burning Glass – Labor Insights

Exhibit 2 displays the employers posting the most job ads during the last 12 months for the Inland Empire/Desert Region and Los Angeles County.

Exhibit 2: Employers posting the most job ads for primary GIS occupations, Mar 2018 – Feb 2019

Region	Occupation	Employers Posting the Most Job Ad
Inland Empire/ Desert	Geospatial Information Scientists and Technologists (n=29)	<ul style="list-style-type: none"> • ESRI • NIIT Technologies
	Geographic Information Systems Technicians (n=12)	<ul style="list-style-type: none"> • Riverside County • San Manuel Casino
Los Angeles County	Geospatial Information Scientists and Technologists (n=90)	<ul style="list-style-type: none"> • Southern California Gas Company • Los Angeles County
	Geographic Information Systems Technicians (n=40)	<ul style="list-style-type: none"> • Los Angeles County • UDC, Digital Utility

Source: Burning Glass – Labor Insights

Exhibit 3 lists a sample of in-demand specialized, employability, and software and programming skills that employers are seeking when looking for workers to fill primary GIS positions. Specialized skills are occupation-specific skills employers are requesting for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is commonly referred to as “soft skills.” The skills reported in job postings may be utilized as a helpful guide for curriculum development.

Exhibit 3: In-demand skills for the primary GIS occupational, Mar 2018 – Feb 2019

Region	Occupation	Specialized Skills	Employability Skills	Software and Programming Skills
Inland Empire/ Desert	Geospatial Information Scientists and Technologists (n=41)	<ul style="list-style-type: none"> Information Systems Project Management Data Conversion 	<ul style="list-style-type: none"> Communication Skills Writing Problem Solving 	<ul style="list-style-type: none"> ArcGIS Geographic Information Systems (GIS) Python
	Geographic Information Systems Technicians (n=12)	<ul style="list-style-type: none"> Information Systems Algebra Geometry 	<ul style="list-style-type: none"> Research Editing Problem Solving 	<ul style="list-style-type: none"> Geographic Information Systems (GIS) Microsoft Office ArcGIS
Los Angeles County	Geospatial Information Scientists and Technologists (n=97)	<ul style="list-style-type: none"> Quality Assurance and Control Project Management Data Management 	<ul style="list-style-type: none"> Communication Skills Planning Research 	<ul style="list-style-type: none"> Geographic Information Systems (GIS) ArcGIS Python
	Geographic Information Systems Technicians (n=54)	<ul style="list-style-type: none"> GIS Data ESRI Software Customer Service 	<ul style="list-style-type: none"> Editing Planning Research 	<ul style="list-style-type: none"> Geographic Information Systems (GIS) ArcGIS Python

Source: Burning Glass – Labor Insights

Exhibit 4 displays the minimum advertised education requirement requested by employers in online job ads. The majority of employers in the Inland Empire/Desert Region posting job ads for geospatial information scientists and technologists (97%) are seeking workers with a bachelor's degree or higher. Employers hiring geographic information systems technicians appear to have less stringent educational requirements across both geographies.

Exhibit 4: Job ads with minimum advertised education requirements for the primary GIS occupational group, Mar 2018 – Feb 2019

Region	Occupation	Minimum Advertised Education Requirement from Job Ads			
		Number of Job Postings (n=)	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Inland Empire/ Desert	Geospatial Information Scientists and Technologists	32	3%	-	97%
	Geographic Information Systems Technicians	7	57%	-	43%
Los Angeles County	Geospatial Information Scientists and Technologists	65	8%	11%	81%
	Geographic Information Systems Technicians	31	3%	48%	49%

Source: Burning Glass – Labor Insights

* Percentage of incumbent workers with a Community College Degree/Award or Some Postsecondary Coursework

Demand for Secondary GIS Occupations:

- Cartographers and Photogrammetrists (17-1021)
- Surveying and Mapping Technicians (17-3031)
- Remote Sensing Scientists and Technologists (19-2099.01)

The occupations listed above make up the secondary GIS occupational group. These occupations require GIS skills but do not necessarily utilize these skills daily. In 2017, there were 419 jobs for cartographers and photogrammetrists, and surveying and mapping technicians combined in the Inland Empire/Desert Region (Traditional LMI is not available for remote sensing scientists and technologists at this time. Please see job postings section for demand for this occupation).

Looking forward to 2022, the labor market demand for these occupations in the Inland Empire/Desert Region is projected to increase by 11%. There will be 261 projected job openings over the next five years or 52 annual job openings due to retirements or other replacement factors. See Exhibit 5 for a more detailed employment outlook for these occupations. Job counts and job projections for the remote sensing scientist and technologist are not available due to lack of quantifiable jobs in the Inland Empire and Los Angeles County areas.

Exhibit 5: Occupational demand for secondary GIS occupations

Region	Occupation	2017 Jobs	5-Yr % Change (New Jobs)	5-Yr Openings (New + Replacement Jobs)	Annual Openings (New + Replacement Jobs)	% of workers age 55+
Inland Empire/Desert	Surveying and Mapping Technicians	337	10%	220	44	28%
	Cartographers and Photogrammetrists	83	11%	40	8	21%
	Remote Sensing Scientists and Technologists	N/A	N/A	N/A	N/A	N/A
Los Angeles County	Surveying and Mapping Technicians	788	5%	475	95	32%
	Cartographers and Photogrammetrists	380	8%	170	34	22%
	Remote Sensing Scientists and Technologists	N/A	N/A	N/A	N/A	N/A
Total for both regions combined		1,588	8%	905	181	27%

Source: EMSI 2018.4

Earnings

The entry-level wage for each of the occupations in the secondary GIS occupational group is above the MIT Living Wage estimate of \$12.39 per hour for a single adult living in the Inland Empire/Desert Region (\$14.36 for Los Angeles County) (Glasmeier, 2019). These wages are also sufficient for two adults and one child (\$14.75 per hour, per adult or \$30,680 annually for each adult). Exhibit 6 displays wage information for this occupational group in the Inland Empire/Desert Region as well as Los Angeles County. Wage data for remote sensing scientists and technologists is not available at this time.

Exhibit 6: Earnings for secondary GIS occupations

Region	Occupation	Entry to Experienced Hourly Earnings Range*	Median Wage*	Avg. Annual Earnings
Inland Empire/ Desert Living Wage \$12.39/hr	Cartographers and Photogrammetrists	\$32.54 to \$46.89	\$39.60	\$82,900
	Surveying and Mapping Technicians	\$24.02 to \$37.37	\$28.73	\$64,400
	Remote Sensing Scientists and Technologists	N/A	N/A	N/A
Los Angeles County Living Wage \$14.36/hr	Cartographers and Photogrammetrists	\$34.24 to \$47.27	\$40.61	\$83,800
	Surveying and Mapping Technicians	\$24.13 to \$37.51	\$28.91	\$63,100
	Remote Sensing Scientists and Technologists	N/A	N/A	N/A

Source: EMSI 2018.4

*Entry Hourly is 25th percentile wage, the median is 50th percentile wage, experienced is 75th percentile wage.

Job Postings, Employers, Skills, and Education for Secondary GIS Jobs

During the past 12-month period (March 2018 to February 2019), there were 89 job ads seeking candidates for these secondary GIS occupations in the Inland Empire/Desert Region. Exhibit 7 displays the number of job ads posted during the last 12 months and the average time to fill for each occupation in the region and nationally. On average, open positions for the secondary GIS occupational group take 40 days to fill in the Inland Empire/Desert Region. This is four days longer than the national average, indicating that open positions are slightly harder to fill locally. Time to fill is not currently available for remote sensing scientists and technologists.

Exhibit 7: Job ads and time to fill for secondary GIS occupations in the last 12 months, Mar 2018 – Feb 2019

Region	Occupation	Job Ads	Regional Average Time to Fill (Days)	National Average Time to Fill (Days)
Inland Empire/ Desert	Surveying and Mapping Technicians	83	41	38
	Cartographers and Photogrammetrists	5	40	33
	Remote Sensing Scientists and Technologists	1	N/A	N/A
Los Angeles County	Surveying and Mapping Technicians	101	47	38
	Cartographers and Photogrammetrists	4	38	33
	Remote Sensing Scientists and Technologists	15	N/A	N/A
Total for both regions combined		209	44	37

Source: Burning Glass – Labor Insights

Exhibit 8 displays the employers posting the most job ads during the last 12 months for the Inland Empire/Desert Region and Los Angeles County.

Exhibit 8: Employers posting the most job ads for secondary GIS occupations, Mar 2018 – Feb 2019

Region	Occupation	Employers
Inland Empire/ Desert	Surveying and Mapping Technicians (n=66)	<ul style="list-style-type: none"> • ESRI • NIIT Technologies
	Cartographers and Photogrammetrists (n=5)	<ul style="list-style-type: none"> • Riverside County • San Manuel Casino
	Remote Sensing Scientists and Technologists	<ul style="list-style-type: none"> • N/A
Los Angeles County	Surveying and Mapping Technicians (n=75)	<ul style="list-style-type: none"> • Los Angeles County • Michael Baker International
	Cartographers and Photogrammetrists (n=4)	<ul style="list-style-type: none"> • UCLA • Radman Aerial Surveys
	Remote Sensing Scientists and Technologists (n=11)	<ul style="list-style-type: none"> • The Aerospace Corporation • Electronic Arts Inc.

Source: Burning Glass – Labor Insights

Exhibit 9 lists a sample of in-demand specialized, employability, and software and programming skills that employers are seeking when looking for workers to fill primary GIS positions. Specialized skills are occupation-specific skills employers are requesting for industry or job competency. Employability skills are foundational skills that transcend industries and occupations; this category is commonly referred to as “soft skills.” The skills reported in job postings may be utilized as a helpful guide for curriculum development.

Exhibit 9: In-demand skills for the secondary GIS occupational group, Mar 2018 – Feb 2019

Region	Occupation	Specialized skills	Employability skills	Software and Programming Skills
Inland Empire/Desert	Surveying and Mapping Technicians (n=66)	<ul style="list-style-type: none"> Thought Leadership Business Development Budgeting 	<ul style="list-style-type: none"> Research Teamwork/ Collaboration Problem Solving 	<ul style="list-style-type: none"> Geographic Information Systems (GIS) ESRI Software ArcGIS
	Cartographers and Photogrammetrists (n=5)	<ul style="list-style-type: none"> Web Application Development Transit Systems Mapping 	<ul style="list-style-type: none"> Communication Skills Teamwork/ Collaboration Energetic 	<ul style="list-style-type: none"> ArcGIS HTML5 JavaScript
	Remote Sensing Scientists and Technologists	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A 	<ul style="list-style-type: none"> N/A
Los Angeles County	Surveying and Mapping Technicians (n=81)	<ul style="list-style-type: none"> Calculation Project Management Information Systems 	<ul style="list-style-type: none"> Communication Skills Planning Teamwork/ Collaboration 	<ul style="list-style-type: none"> Geographic Information Systems (GIS) ArcGIS Microsoft Office
	Cartographers and Photogrammetrists (n=3)	<ul style="list-style-type: none"> Urban Design Mapping Software Data Visualization 	<ul style="list-style-type: none"> Creativity Teamwork/ Collaboration Time Management 	<ul style="list-style-type: none"> Adobe Creative Suite Microsoft Office AutoCAD
	Remote Sensing Scientists and Technologists (n=13)	<ul style="list-style-type: none"> Calibration Data Analysis Algorithm Development 	<ul style="list-style-type: none"> Research Building Effective Relationships Creativity 	<ul style="list-style-type: none"> Python MATLAB Java

Exhibit 10 displays the entry-level education typically required to enter these occupations according to the Bureau of Labor Statistics (BLS). This chart also displays educational attainment for incumbent workers with “some college, no degree” and an “associate degree” according to the U.S. Census (2016-17) and the minimum advertised education requirement requested by employers in online job ads.

Exhibit 10: Educational attainment and online job ads with minimum advertised education requirements for the secondary GIS occupational group, Mar 2018 – Feb 2019

Region	Occupation	Typical Entry-Level Education Requirement	Two-year Postsecondary Level of Educational Attainment*	Minimum Advertised Education Requirement from Job Ads			
				Number of Job Postings (n=)	High school diploma or vocational training	Associate degree	Bachelor's degree or higher
Inland Empire/ Desert Region	Surveying and Mapping Technicians	High school diploma or equivalent	57%	44	7%	9%	84%
	Cartographers and Photogrammetrists	Bachelor's degree	12%	4	-	-	100%
	Remote Sensing Scientists and Technologists	N/A	N/A	-	-	-	-
Los Angeles County	Surveying and Mapping Technicians	High school diploma or equivalent	57%	52	29%	12%	59%
	Cartographers and Photogrammetrists	Bachelor's degree	12%	2	-	-	100%
	Remote Sensing Scientists and Technologists	N/A	N/A	7	-	-	100%

Source: EMSI 2018.4, Burning Glass – Labor Insights

* Percentage of incumbent workers with a Community College Degree/Award or Some Postsecondary Coursework

Demand for GIS Skillset

A regional GIS skill-based search was utilized to identify job postings that require a GIS skillset for the Inland Empire/Desert Region and Los Angeles County combined. Due to the overlapping nature of this search with the two previous job posting searches, there is some redundancy in the postings. During the past 12-month period, there were 783 job postings seeking candidates with GIS skills. Exhibit 11 displays the top occupations from job ads looking for GIS skills. Postings for other occupations have been aggregated in one line item above the total row.

Exhibit 11: Number of postings by occupation, Mar 2018 – Feb 2019

Top Occupations	Job Postings
Geospatial Information Scientists and Technologists	133
Mapping Technicians	100
Geographic Information Systems Technicians	58
Software Developers, Applications	29
Civil Engineers	26
Computer Systems Analysts	26
Information Security Analysts	21
Database Administrators	17
<i>Other Occupations</i>	373
Total	783

Source: Burning Glass – Labor Insights

Exhibit 12 shows the top job titles from the job ads. The most common job title was a geographic information systems (GIS) analyst. Again, postings for other job titles not reported here are aggregated in one line item above the total row.

Exhibit 12: Number of postings by job title, Mar 2018 – Feb 2019

Top Job Titles	Job Postings
Geographic Information Systems (GIS) Analyst	78
GIS Technician	31
GIS Specialist	28
GIS Manager	23
GIS Business Systems Analyst	15
Geographer	13
GIS Developer	12
GIS Programmer/Analyst	11
Senior GIS Developer	10
<i>Other Job Titles</i>	<i>571</i>
Total	783

Source: Burning Glass – Labor Insights

Exhibit 13 shows the minimum advertised education from the GIS job ads. Most employers posting job ads were seeking candidates with a bachelor’s degree or higher (88%).

Exhibit 13: Minimum advertised education requirements for GIS job ads, Mar 2018 – Feb 2019

Education level	Percent of job ads
High school or vocational training	5%
Associate degree	7%
Bachelor’s degree or higher	88%

Source: Burning Glass – Labor Insights



Exhibit 14 lists the top skills that employers are seeking when looking to hire GIS technicians. The top skill requested by employers looking for GIS technicians beside Geographic Information Systems (GIS), was information systems, followed closely by ArcGIS, another GIS application.

Exhibit 14: Top skills in job ads, Mar 2018 – Feb 2019

Top Skills	Job Postings
Geographic Information Systems (GIS)	783
Information Systems	371
ArcGIS	288
Project Management	173
ESRI Software	162
Python	161
SQL	155
Budgeting	144
Software Development	129

Source: Burning Glass – Labor Insights

The employer posting the most jobs ads in the region for GIS positions was ESRI; an international supplier of geographic information system software, web GIS, and geodatabase management applications headquartered in Redlands. Exhibit 15 lists the top employers posting job ads across the regions.

Exhibit 15: Employers posting the most job ads, Mar 2018 – Feb 2019

Employers	Job Postings
ESRI	130
San Bernardino County	29
Los Angeles County	27
Riverside County	15
Activision	11
City of Long Beach	10
Riverside University Health System	7
SoCal Gas	7

Source: Burning Glass – Labor Insights

Student Completions

Exhibits 16 and 17 display the annual average regional California Community College (CCC) credentials (associate degrees and certificates) conferred during the three academic years between 2014 and 2017, from the California Community Colleges Chancellor’s Office Management Information Systems (MIS) Data Mart, along with the headcount from the most recent year available on LaunchBoard. Credentials are the combined total of degrees and certificates issued during the timeframe, divided by three in this case in order to calculate an annual average. This is done to minimize the effect of atypical variation that might be present in a single year. Headcount is the unduplicated number of students who enrolled in one or more courses. The relevant TOP code is from the Taxonomy of Programs manual, and the corresponding program title used at each college (in *italics*) is sourced from the Chancellor’s Office Curriculum Inventory (COCI). Please note, a credential is not always equivalent to a single person in search of a job opening since a student may earn more than one credential, such as an associate degree in addition to a certificate.

Exhibit 16: Annual average community college credentials for surveying programs in the Inland Empire/Desert Region

0957.30 – Surveying	CCC Headcount, Academic Year 2016-17	CCC Annual Average Credentials, Academic Years 2014-17
Mt. San Jacinto	22	-
Total CCC Headcount, Academic Year 2016-17	22	
Total Annual Average CCC Credentials, Academic Years 2014-17		-

Source: LaunchBoard, MIS Data Mart, COCI

Exhibit 16: Annual average community college credentials for geographic information systems programs in the Inland Empire/Desert Region

2206.10 – Geographic Information Systems	CCC Headcount, Academic Year 2016-17	CCC Annual Average Credentials, Academic Years 2014-17
Mt. San Jacinto - Geographic Information Systems	Insf. Data	
Associate Degree		1
Certificate 30 to < 60 semester units		1
San Bernardino - Geographic Information Systems	36	
Certificate 6 to < 18 semester units		3
Total CCC Headcount, Academic Year 2016-17	43	
Total Annual Average CCC Credentials, Academic Years 2014-17		5

Source: LaunchBoard, MIS Data Mart, COCI



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Appendix: Occupational definitions, sample job titles, and five-year projections for the GIS occupational group

Occupation Definitions (O*NET code), Education and Training Requirement, Community College Education Attainment

Geospatial Information Scientists and Technologists (15-1199.04)*

Research or develop geospatial technologies. May produce databases, perform applications programming, or coordinate projects. May specialize in areas such as agriculture, mining, health care, retail trade, urban planning, or military intelligence.

Sample of reported job titles: Geographic Information System Analyst (GIS Analyst), Geographic Information Systems Administrator (GIS Administrator), Geographic Information Systems Analyst (GIS Analyst), Geographic Information Systems Coordinator (GIS Coordinator), Geographic Information Systems Director (GIS Director), Geographic Information Systems Manager (GIS Manager), Geographic Information Systems Specialist (GIS Specialist), Geospatial Intelligence Subject Matter Expert, Geospatial Program Management Officer, Resource Analyst

Geographic Information Systems Technicians (15-1199.05)*

Assist scientists, technologists, or related professionals in building, maintaining, modifying, or using geographic information systems (GIS) databases. May also perform some custom application development or provide user support.

Sample of reported job titles: Cartographer, Geographic Information Systems Analyst (GIS Analyst), Geographic Information Systems Coordinator (GIS Coordinator), Geographic Information Systems Specialist (GIS Specialist), Geographic Information Systems Technician (GIS Technician), Technical Support Specialist

Remote Sensing Scientists and Technologists (19-2099.01)*

Apply remote sensing principles and methods to analyze data and solve problems in areas such as natural resource management, urban planning, or homeland security. May develop new sensor systems, analytical techniques, or new applications for existing systems.

Sample of reported job titles: Data Analytics Chief Scientist, Geospatial Intelligence Analyst, Professor, Remote Sensing Analyst, Remote Sensing Program Manager, Remote Sensing Scientist, Research and Development Director (R&D Director), Research Scientist, Scientist, Sensor Specialist

*Traditional labor market data is not available for these emerging occupations at this time.



Occupation Definitions (SOC code), Education and Training Requirement, Community College Education Attainment

Cartographers and Photogrammetrists (17-1021)

Collect, analyze, and interpret geographic information provided by geodetic surveys, aerial photographs, and satellite data. Research, study, and prepare maps and other spatial data in digital or graphic form for legal, social, political, educational, and design purposes. May work with Geographic Information Systems (GIS). May design and evaluate algorithms, data structures, and user interfaces for GIS and mapping systems.

Sample of reported job titles: Aerial Photogrammetrist, Cartographer, Cartographic Designer, Compiler, Digital Cartographer, Mapper, Photogrammetric Technician, Photogrammetrist, Stereo Compiler, Stereoplotter Operator

Entry-Level Education Requirement: Bachelor's degree

Training Requirement: None

Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 12%

Surveying and Mapping Technicians (17-3031)

Perform surveying and mapping duties, usually under the direction of an engineer, surveyor, cartographer, or photogrammetrist to obtain data used for construction, mapmaking, boundary location, mining, or other purposes. May calculate mapmaking information and create maps from source data, such as surveying notes, aerial photography, satellite data, or other maps to show topographical features, political boundaries, and other features. May verify accuracy and completeness of maps.

Sample of reported job titles: Aerotriangulation Specialist, CAD Technician (Computer Aided Design Technician), Geospatial Analyst, Mapping Editor, Mapping Technician, Photogrammetric Compilation Specialist, Photogrammetric Stereo Compiler, Photogrammetric Technician, Stereoplotter Operator, Tax Map Technician

Entry-Level Education Requirement: High school diploma or equivalent

Training Requirement: One to twelve months on-the-job training

Percentage of incumbent workers with a Community College Award or Some Postsecondary Coursework: 57%



Table 1. 2017 to 2022 job growth, wages, education, training, and work experience required for the geographic information systems occupational group, Inland Empire/Desert Region

Occupation (SOC)	2017 Jobs	5-Yr Change	5-Yr % Change	Annual Openings (New + Replacement Jobs)	Entry-Experienced Hourly Wage*	Median Hourly Wage	Average Annual Earnings	Typical Entry-Level Education & On-The-Job Training Required	Work Experience Required
Surveying and Mapping Technicians (17-3031)	337	34	10%	44	\$24.02 to \$37.37	\$28.73	\$64,400	High school diploma or equivalent & 1-12 months	None
Cartographers and Photogrammetrists (17-1021)	83	9	11%	8	\$32.54 to \$46.89	\$39.60	\$82,900	Bachelor's degree & none	None
Total	419	44	11%	52	-	-	-	-	-

Source: EMSI 2018.4

Table 2. 2017 to 2022 job growth, wages, education, training, and work experience required for the geographic information systems occupational group, Los Angeles County

Occupation (SOC)	2017 Jobs	5-Yr Change	5-Yr % Change	Annual Openings (New + Replacement Jobs)	Entry-Experienced Hourly Wage*	Median Hourly Wage	Average Annual Earnings	Typical Entry-Level Education & On-The-Job Training Required	Work Experience Required
Surveying and Mapping Technicians (17-3031)	788	43	5%	95	\$24.13 to \$37.51	\$28.91	\$63,100	High school diploma or equivalent & 1-12 months	None
Cartographers and Photogrammetrists (17-1021)	380	32	8%	34	\$34.24 to \$47.27	\$40.61	\$83,800	Bachelor's degree & none	None
Total	1,168	75	6%	129	-	-	-	-	-

Source: EMSI 2018.4