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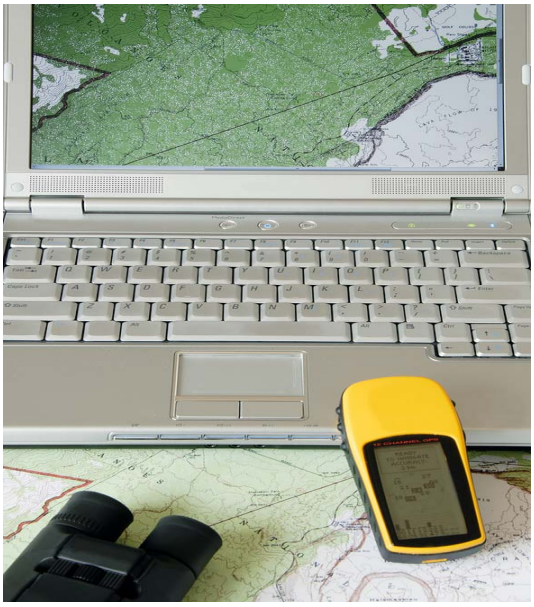
GIS CAREERS

REPORT FOR NOCCCD

DECEMBER 2008



CENTER OF EXCELLENCE,
ORANGE COUNTY

Rancho Santiago Community College District
2323 N. Broadway, Suite 328,
Santa Ana, CA 92706
(714) 564-5529
madrigal_osiel@rsccd.edu
www.rsccd.edu

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Initiative of ECONOMIC & WORKFORCE DEVELOPMENT through the CALIFORNIA COMMUNITY COLLEGES

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Introduction

This report explores three Geographic Information Systems (GIS) career-related occupations in Orange County and Los Angeles County, California, and compares it to the state and national level. The GIS occupations are (1) cartographers and photogrammetrists, (2) mapping technicians, and (3) surveyors. It includes analysis of major industries within the occupation, their size by employment, geographical concentration and growth potential. The reports is aimed at assisting North Orange County Community College District administration in decision-making regarding future educational and training programs that would be appropriate and timely considering industry composition and employment projections.

This report contains information that was compiled from the InfoUSA employer listings and analyzed with the help of Environmental System Research Institute's (ESRI) GIS software application. Occupational projections data was provided by Economic Modeling Specialists Inc. (EMSI), Career One Stop, O*Net Online and the Bureau of Labor Statistics.

All data comes from secondary sources. No primary research (interviews or surveys) was conducted nor was any industry validation performed to compile the data herein.

About the Centers of Excellence

The Centers of Excellence (COE) are part of the Business and Workforce Performance Improvement (BWPI) initiative within the California Community College's Economic and Workforce Development Network. The regional COEs are focused on building the capacity of the community colleges in the area of economic and workforce development to enhance their ability to deliver education and training services to businesses and workers in high growth industries, new technologies, and other clusters of opportunities. Centers provide market intelligence regarding workforce trends, increasing awareness and visibility about the colleges economic and workforce development programs and services, and strategically develop partnerships with business and industry. More information about the Centers is available online at www.coeccc.net.

Important Disclaimer

All representations included in this report have been produced from a secondary review of publicly and/or privately available data and/or research reports. Efforts have been made to qualify and validate the accuracy of the data and the reported findings. However, neither the Business and Workforce Performance Improvement, Centers of Excellence, COE host District or California Community Colleges Chancellor's Office are responsible for applications or decisions made by recipient community colleges or their representatives based upon this study including components or recommendations.

Report Scope

This Occupational Profile Report provides basic occupational information, projections, wages, and skills needed for cartographers and photogrammetrists, mapping technicians, and surveyors.

This report includes data for North Orange County Community College District's service area, which covers Orange County, CA. Occupation projections (in particular, 2007 wages and percentage change of employment between 2007 and 2014) were also extracted for Los Angeles County, the State of California, and the U.S.

Job Description and Primary Tasks[1]

This section reviews the job descriptions and primary tasks for cartographers and photogrammetrists, mapping technicians, and surveyors.

Cartographers and Photogrammetrists

The standard job description for cartographers and photogrammetrists (SOC 17-1021) is to:

> 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 GIS. May design and evaluate algorithms, data structures, and user interfaces for GIS and mapping systems.

Sample of reported job titles:

> Photogrammetrist, Cartographer, Production Manager, Photogrammetric Technician, Stereo Compiler, GIS Technician, Compiler, GIS Analyst, Digital Cartographer, and GIS Manager.

Primary tasks for cartographers and photogrammetrists include:

- Identify, scale, and orient geodetic points, elevations, and other planimetric or topographic features, applying standard mathematical formulas.
- Collect information about specific features of the Earth using aerial photography and other digital remote sensing techniques.
- Revise existing maps and charts, making all necessary corrections and adjustments.
- Compile data required for map preparation, including aerial photographs, survey notes, records, reports, and original maps.
- Inspect final compositions to ensure completeness and accuracy.
- Determine map content and layout, as well as production specifications such as scale, size, projection, and colors, and direct production to ensure that specifications are followed.
- Examine and analyze data from ground surveys, reports, aerial photographs, and satellite images to prepare topographic maps, aerial-photograph mosaics, and related charts.
- Select aerial photographic and remote sensing techniques and plotting equipment needed to meet required standards of accuracy.
- Delineate aerial photographic detail such as control points, hydrography, topography, and cultural features using precision stereoplotting apparatus or drafting instruments.

[1] Source for entire section: O*Net Online (http://online.onetcenter.org)

- Build and update digital databases.

Mapping Technicians

The standard job description for mapping technicians (SOC 17-3031) is to:

> Calculate mapmaking information from field notes, and draw and verify accuracy of topographical maps.

Sample of reported job titles:

> GIS Specialist, GIS Analyst, Mapping Technician, Stereoplotter Operator, GIS Technician, Photogrammetric Compilation Specialist, Photogrammetric Technician, Computer Aided Design Technician (CAD Technician), Draftsman, and Hydrographic Surveyor.

Primary tasks for mapping technicians include:

- Check all layers of maps to ensure accuracy, identifying and marking errors and making corrections.
- Determine scales, line sizes, and colors to be used for hard copies of computerized maps, using plotters.
- Monitor mapping work and the updating of maps to ensure accuracy, the inclusion of new or changed information, and compliance with rules and regulations.
- Identify and compile database information to create maps in response to requests.
- Produce and update overlay maps to show information boundaries, water locations, and topographic features on various base maps and at different scales.
- Trace contours and topographic details to generate maps that denote specific land and property locations and geographic attributes.
- Lay out and match aerial photographs in sequences in which they were taken, and identify any areas missing from photographs.
- Compare topographical features and contour lines with images from aerial photographs, old maps, and other reference materials to verify the accuracy of their identification.
- Compute and measure scaled distances between reference points to establish relative positions of adjoining prints and enable the creation of photographic mosaics.
- Research resources such as survey maps and legal descriptions to verify property lines and to obtain information needed for mapping.

Surveyors

The standard job description for surveyors (SOC 17-1022) is to:

> Make exact measurements and determine property boundaries. Provide data relevant to the shape, contour, gravitation, location, elevation, or dimension of land or land features on or near the earth's surface for engineering, mapmaking, mining, land evaluation, construction, and other purposes.

Sample of reported job titles:

> County Surveyor, Surveyor, Land Surveyor, Survey Party Chief, Engineer, Engineering Technician, Geodesist, Licensed Land Surveyor, Mine Surveyor, and Professional Land Surveyor.

Primary tasks for surveyors include:

- Verify the accuracy of survey data including measurements and calculations conducted at survey sites.
- Search legal records, survey records, and land titles to obtain information about property boundaries in areas to be surveyed.
- Calculate heights, depths, relative positions, property lines, and other characteristics of terrain.
- Prepare and maintain sketches, maps, reports, and legal descriptions of surveys to describe, certify, and assume liability for work performed.
- Direct or conduct surveys to establish legal boundaries for properties, based on legal deeds and titles.
- Prepare or supervise preparation of all data, charts, plots, maps, records, and documents related to surveys.
- Write descriptions of property boundary surveys for use in deeds, leases, or other legal documents.
- Compute geodetic measurements and interpret survey data to determine positions, shapes, and elevations of geomorphic and topographic features.
- Determine longitudes and latitudes of important features and boundaries in survey areas using theodolites, transits, levels, and satellite-based global positioning systems (GPS).
- Record the results of surveys including the shape, contour, location, elevation, and dimensions of land or land features.

Required Knowledge Skills and Abilities[2]

This section reviews the required knowledge and skills for cartographers and photogrammetrists, mapping technicians, and surveyors.

Cartographers and Photogrammetrists

The required knowledge to become a successful cartographer and photogrammetrist includes:

- **Geography** — Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.
- **Computers and Electronics** — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- **Engineering and Technology** — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- **Mathematics** — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Design** — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- **Production and Processing** — Knowledge of raw materials, production processes, quality control, costs, and other techniques for maximizing the effective manufacture and distribution of goods.
- **Customer and Personal Service** — Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

The required skill sets include:

- **Active Learning** — Understanding the implications of new information for both current and future problem-solving and decision-making.
- **Reading Comprehension** — Understanding written sentences and paragraphs in work related documents.
- **Writing** — Communicating effectively in writing as appropriate for the needs of the audience.
- **Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- **Mathematics** — Using mathematics to solve problems.
- **Troubleshooting** — Determining causes of operating errors and deciding what to do about it.

[2] Source for entire section: O*Net Online (http://online.onetcenter.org)

- **Active Listening** — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Technology Design** — Generating or adapting equipment and technology to serve user needs.
- **Complex Problem Solving** — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Learning Strategies** — Selecting and using training/instructional methods and procedures appropriate for the situation when learning or teaching new things.

The most important abilities are:

- **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- **Inductive Reasoning** — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- **Mathematical Reasoning** — The ability to choose the right mathematical methods or formulas to solve a problem.
- **Written Comprehension** — The ability to read and understand information and ideas presented in writing.
- **Deductive Reasoning** — The ability to apply general rules to specific problems to produce answers that make sense.
- **Category Flexibility** — The ability to generate or use different sets of rules for combining or grouping things in different ways.
- **Flexibility of Closure** — The ability to identify or detect a known pattern (a figure, object, word, or sound) that is hidden in other distracting material.
- **Number Facility** — The ability to add, subtract, multiply, or divide quickly and correctly.

Mapping Technicians

The required knowledge to become a successful mapping technician includes:

- **Computers and Electronics** — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.
- **Geography** — Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.

- **English Language** — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- **Mathematics** — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Design** — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- **Administration and Management** — Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- **Customer and Personal Service** — Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.
- **Engineering and Technology** — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.

The required skill sets include:

- **Active Learning** — Understanding the implications of new information for both current and future problem-solving and decision-making.
- **Reading Comprehension** — Understanding written sentences and paragraphs in work related documents.
- **Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- **Active Listening** — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Time Management** — Managing one's own time and the time of others.
- **Complex Problem Solving** — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.
- **Troubleshooting** — Determining causes of operating errors and deciding what to do about it.
- **Judgment and Decision Making** — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- **Quality Control Analysis** — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.
- **Coordination** — Adjusting actions in relation to others' actions.

The most important abilities are:

- **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).

- **Written Comprehension** — The ability to read and understand information and ideas presented in writing.
- **Deductive Reasoning** — The ability to apply general rules to specific problems to produce answers that make sense.
- **Mathematical Reasoning** — The ability to choose the right mathematical methods or formulas to solve a problem.
- **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- **Flexibility of Closure** — The ability to identify or detect a known pattern (a figure, object, word, or sound) that is hidden in other distracting material.
- **Finger Dexterity** — The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
- **Inductive Reasoning** — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).
- **Perceptual Speed** — The ability to quickly and accurately compare similarities and differences among sets of letters, numbers, objects, pictures, or patterns. The things to be compared may be presented at the same time or one after the other. This ability also includes comparing a presented object with a remembered object.

Surveyors

The required knowledge to become a successful surveyor includes:

- **Mathematics** — Knowledge of arithmetic, algebra, geometry, calculus, statistics, and their applications.
- **Law and Government** — Knowledge of laws, legal codes, court procedures, precedents, government regulations, executive orders, agency rules, and the democratic political process.
- **Engineering and Technology** — Knowledge of the practical application of engineering science and technology. This includes applying principles, techniques, procedures, and equipment to the design and production of various goods and services.
- **Administration and Management** — Knowledge of business and management principles involved in strategic planning, resource allocation, human resources modeling, leadership technique, production methods, and coordination of people and resources.
- **Design** — Knowledge of design techniques, tools, and principles involved in production of precision technical plans, blueprints, drawings, and models.
- **Geography** — Knowledge of principles and methods for describing the features of land, sea, and air masses, including their physical characteristics, locations, interrelationships, and distribution of plant, animal, and human life.
- **Computers and Electronics** — Knowledge of circuit boards, processors, chips, electronic equipment, and computer hardware and software, including applications and programming.

- **English Language** — Knowledge of the structure and content of the English language including the meaning and spelling of words, rules of composition, and grammar.
- **Building and Construction** — Knowledge of materials, methods, and the tools involved in the construction or repair of houses, buildings, or other structures such as highways and roads.
- **Customer and Personal Service** — Knowledge of principles and processes for providing customer and personal services. This includes customer needs assessment, meeting quality standards for services, and evaluation of customer satisfaction.

The required skill sets include:

- **Writing** — Communicating effectively in writing as appropriate for the needs of the audience.
- **Reading Comprehension** — Understanding written sentences and paragraphs in work related documents.
- **Active Listening** — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions or approaches to problems.
- **Speaking** — Talking to others to convey information effectively.
- **Time Management** — Managing one's own time and the time of others.
- **Coordination** — Adjusting actions in relation to others' actions.
- **Judgment and Decision Making** — Considering the relative costs and benefits of potential actions to choose the most appropriate one.
- **Monitoring** — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- **Complex Problem Solving** — Identifying complex problems and reviewing related information to develop and evaluate options and implement solutions.

The most important abilities:

- **Oral Comprehension** — The ability to listen to and understand information and ideas presented through spoken words and sentences.
- **Written Comprehension** — The ability to read and understand information and ideas presented in writing.
- **Oral Expression** — The ability to communicate information and ideas in speaking so others will understand.
- **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing there is a problem.
- **Written Expression** — The ability to communicate information and ideas in writing so others will understand.
- **Deductive Reasoning** — The ability to apply general rules to specific problems to produce answers that make sense.

- **Information Ordering** — The ability to arrange things or actions in a certain order or pattern according to a specific rule or set of rules (e.g., patterns of numbers, letters, words, pictures, mathematical operations).
- **Near Vision** — The ability to see details at close range (within a few feet of the observer).
- **Far Vision** — The ability to see details at a distance.
- **Inductive Reasoning** — The ability to combine pieces of information to form general rules or conclusions (includes finding a relationship among seemingly unrelated events).

Occupational Earnings

This section reviews the hourly and annual wages[3] for cartographers and photogrammetrists, mapping technicians, and surveyors.

Cartographers and Photogrammetrists

Wages in Los Angeles County for cartographers and photogrammetrists at the 75% and 90% stages exceed those at the state level. In addition, there is a greater wage in Orange County at the highest (90%) stage than at the state level. The following is a comparison of Orange County, Los Angeles County, state, and national wages:

U.S., California, and Orange County Cartographer & Photogrammetrist Wages

Location	Pay Period	2007				
		10%	25%	Median	75%	90%
United States[4]	Hourly	$15.57	$18.83	$24.02	$32.04	$39.92
	Yearly	$32,400	$39,100	$50,000	$66,600	$83,000
California	Hourly	$18.90	$23.88	$28.63	$35.21	$42.02
	Yearly	$39,300	$49,700	$59,600	$73,200	$87,400
Orange County	Hourly	$15.09	$18.84	$24.99	$33.64	$44.74
	Yearly	$31,387	$39,187	$51,979	$69,971	$93,059
Los Angeles County	Hourly	$15.52	$20.17	$27.13	$36.03	$49.15
	Yearly	$32,282	$41,954	$56,430	$74,942	$102,232

Mapping Technicians

Across the board, wages in Los Angeles County for mapping technicians exceed those at the national and state level, as well as Orange County. Moreover, there are greater wages in Orange County at the two highest (75% and 90%) stages than at the state level. The following is a comparison of Orange County, Los Angeles County, state, and national wages:

[3] Since EMSI (www.economicmodeling.com) did not provide annual wages, annual pay for Cartographers and Phtogrammetrists, Mapping Technicians, and Surveyors in Orange and Los Angeles County was calculated using the following logic: hourly pay * 260 paid days a year * 8 hours a day.

[4] Source for United States and California hourly and yearly wages was Career One Stop (www.careeronestop.org).

U.S., California, and Orange County Wages for Mapping Technicians

Location	Pay Period	2007				
		10%	25%	Median	75%	90%
United States[5]	Hourly	$9.94	$12.58	$16.17	$21.13	$26.65
	Yearly	$20,700	$26,200	$33,600	$44,000	$55,400
California	Hourly	$15.36	$19.26	$25.69	$31.60	$37.63
	Yearly	$32,000	$40,100	$53,400	$65,700	$78,300
Orange County	Hourly	$15.35	$17.98	$22.82	$31.73	$42.06
	Yearly	$31,928	$37,398	$47,466	$65,998	$87,485
Los Angeles County	Hourly	$16.79	$22.68	$27.80	$34.80	$43.83
	Yearly	$34,923	$47,174	$57,824	$72,384	$91,166

Surveyors

Except for the 25% stage, where wages in Orange County for surveyors are slightly higher, Los Angeles County wages exceed those in Orange County and at every stage nationally and statewide. Furthermore, except at the 75% stage, there are greater wages in Orange County than at the state level. The following is a comparison of Orange County, Los Angeles County, state, and national wages:

U.S., California, and Orange County Wages for Surveyors

Location	Pay Period	2007				
		10%	25%	Median	75%	90%
United States[6]	Hourly	$13.75	$18.24	$24.82	$32.85	$40.15
	Yearly	$28,600	$37,900	$51,600	$68,300	$83,500
California	Hourly	$21.29	$28.32	$34.61	$39.54	$46.33
	Yearly	$44,300	$58,900	$72,000	$82,200	$96,400
Orange County	Hourly	$21.85	$30.23	$34.62	$39.31	$46.93
	Yearly	$45,448	$62,878	$72,010	$81,764	$97,614
Los Angeles County	Hourly	$23.56	$30.01	$34.90	$40.86	$53.91
	Yearly	$49,005	$62,421	$72,592	$84,989	$112,133

Occupational Information[7]

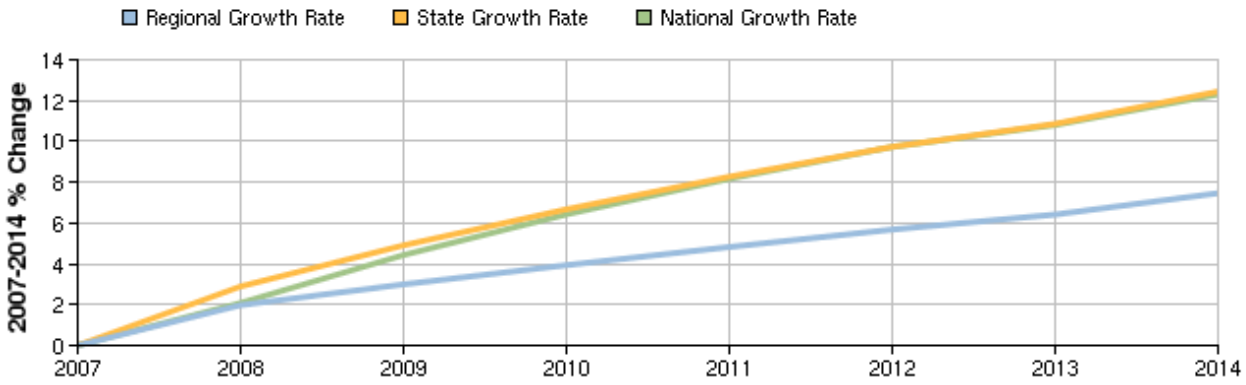
This section reviews the occupational growth of cartographers and photogrammetrists, mapping technicians, and surveyors.

Cartographers and Photogrammetrists

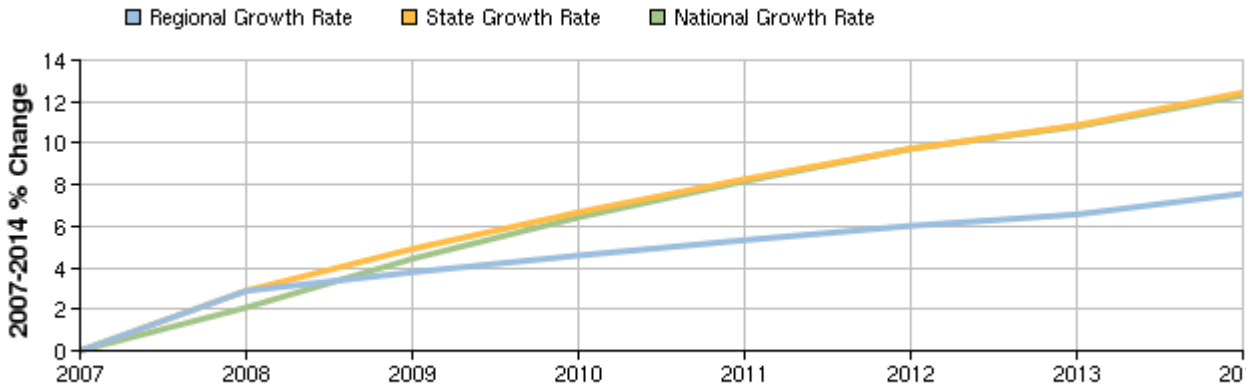
Between 2007-2014, the Orange County area can expect a 7% increase and Los Angeles County an 8% increase in jobs for cartographers and photogrammetrists, which is below the average growth rate for this occupation in the state (12%) and nationally (12%). Combined, the growth in these two regions equates to 36 new jobs over the 7-year period.

[5] Source for United States and California hourly and yearly wages was Career One Stop (www.careeronestop.org).
[6] Source for United States and California hourly and yearly wages was Career One Stop (www.careeronestop.org).
[7] Source for entire section: EMSI (www.economicmodeling.com)

Orange County (Regional) Occupational Change Summary



Los Angeles County (Regional) Occupational Change Summary

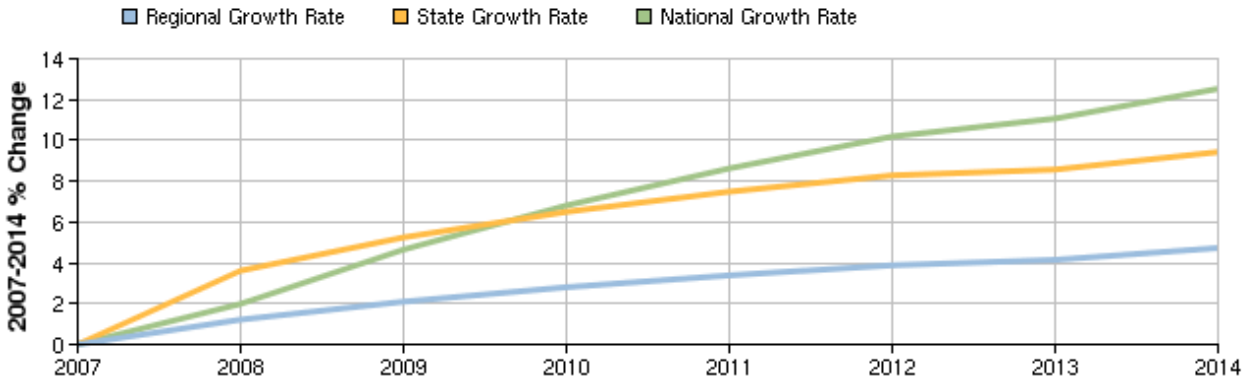


Region	2007 Jobs	2014 Jobs	Change	% Change
Orange County Total	151	162	11	7%
Los Angeles County Total	329	354	25	8%
State Total	1,878	2,112	234	12%
National Total	17,344	19,478	2,134	12%

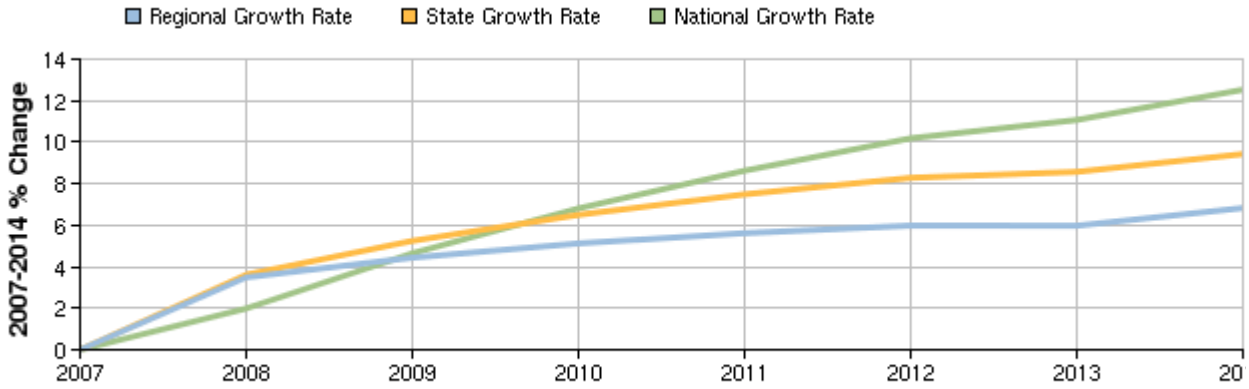
Mapping Technicians

Between 2007-2014, the Orange County area can expect a 5% increase and Los Angeles County a 7% increase in jobs for mapping technicians, which is below the average growth rate for this occupation in the state (9%) and nationally (13%). Combined, the growth in these two regions equates to 105 new jobs over the 7-year period.

Orange County (Regional) Occupational Change Summary



Los Angeles County (Regional) Occupational Change Summary

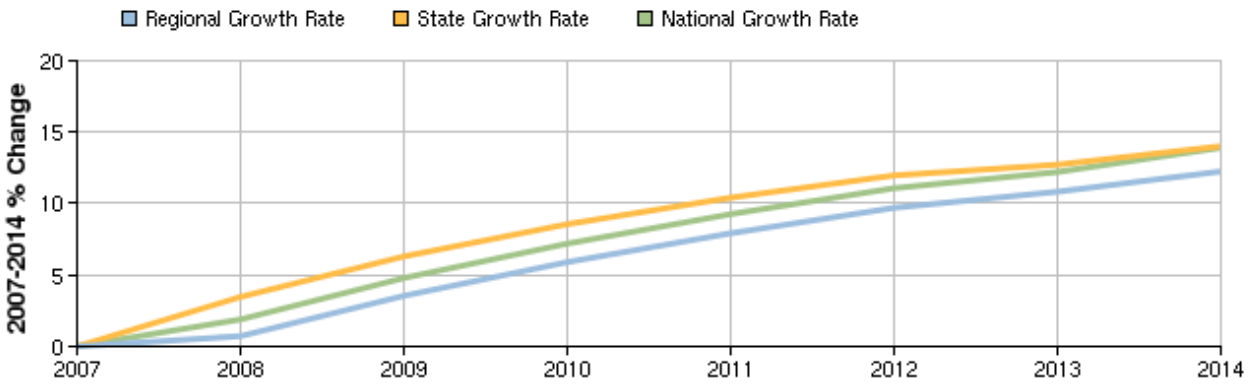


Region	2007 Jobs	2014 Jobs	Change	% Change
Orange County Total	565	592	27	5%
Los Angeles County Total	1,153	1,231	78	7%
State Total	6,021	6,589	568	9%
National Total	85,926	96,691	10,765	13%

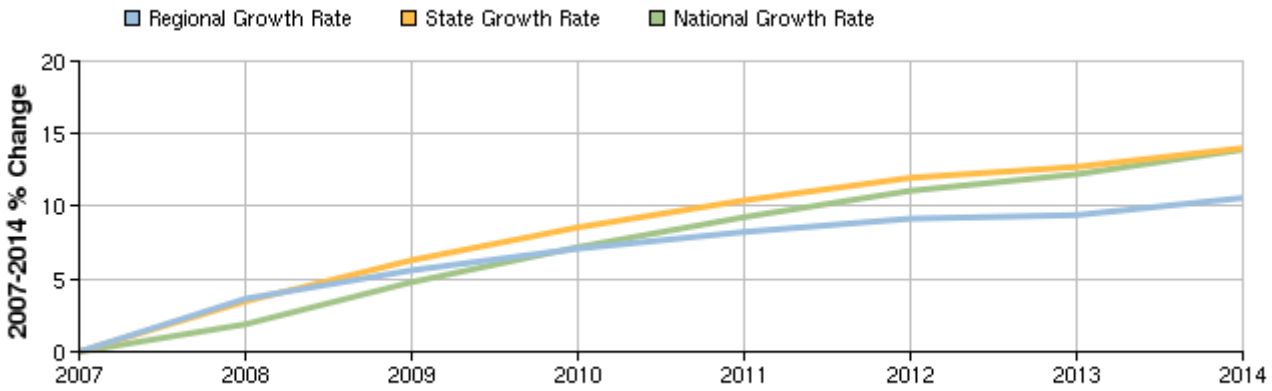
Surveyors

Between 2007-2014, the Orange County area can expect a 12% increase and Los Angeles County an 11% increase in jobs for surveyors, which is below the average growth rate for this occupation in the state (14%) and nationally (14%). Combined, the growth in these two regions equates to 226 new jobs over the 7-year period.

Orange County (Regional) Occupational Change Summary



Los Angeles County (Regional) Occupational Change Summary



Region	2007 Jobs	2014 Jobs	Change	% Change
Orange County Total	834	936	102	12%
Los Angeles County Total	1,165	1,289	124	11%
State Total	6,920	7,890	970	14%
National Total	62,231	70,890	8,659	14%

Top Industries[8]

This section reviews the top employment industries for cartographers and photogrammetrists, mapping technicians, and surveyors.

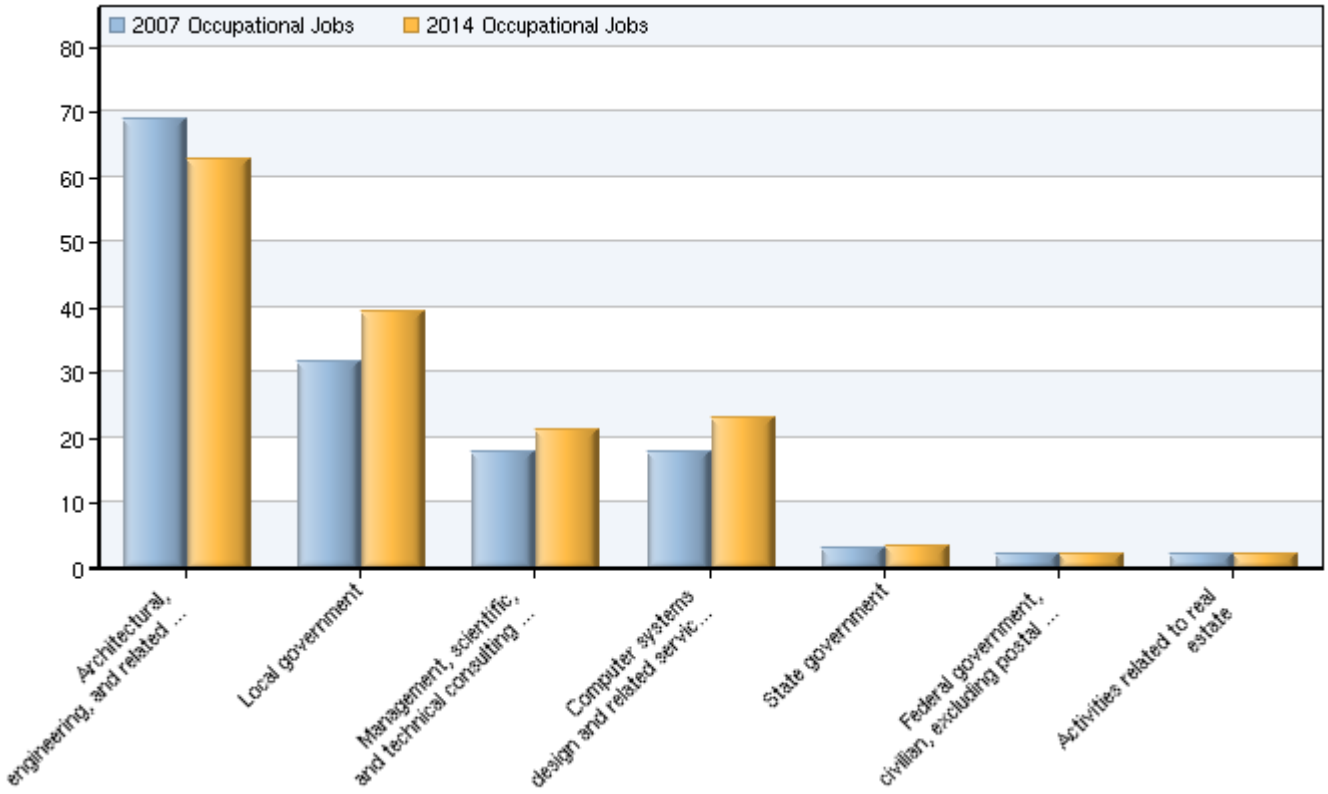
Cartographers and Photogrammetrists

As classified by the North American Industry Classification System (NAICS) codes, the following illustrate the top seven industries that employ cartographers and photogrammetrists within the Orange County and Los Angeles County area. Architectural, engineering, and related services (NAICS 5431XX) and local government (NAICS 930000) employ the most.

[8] Source for entire section: EMSI (www.economicmodeling.com)

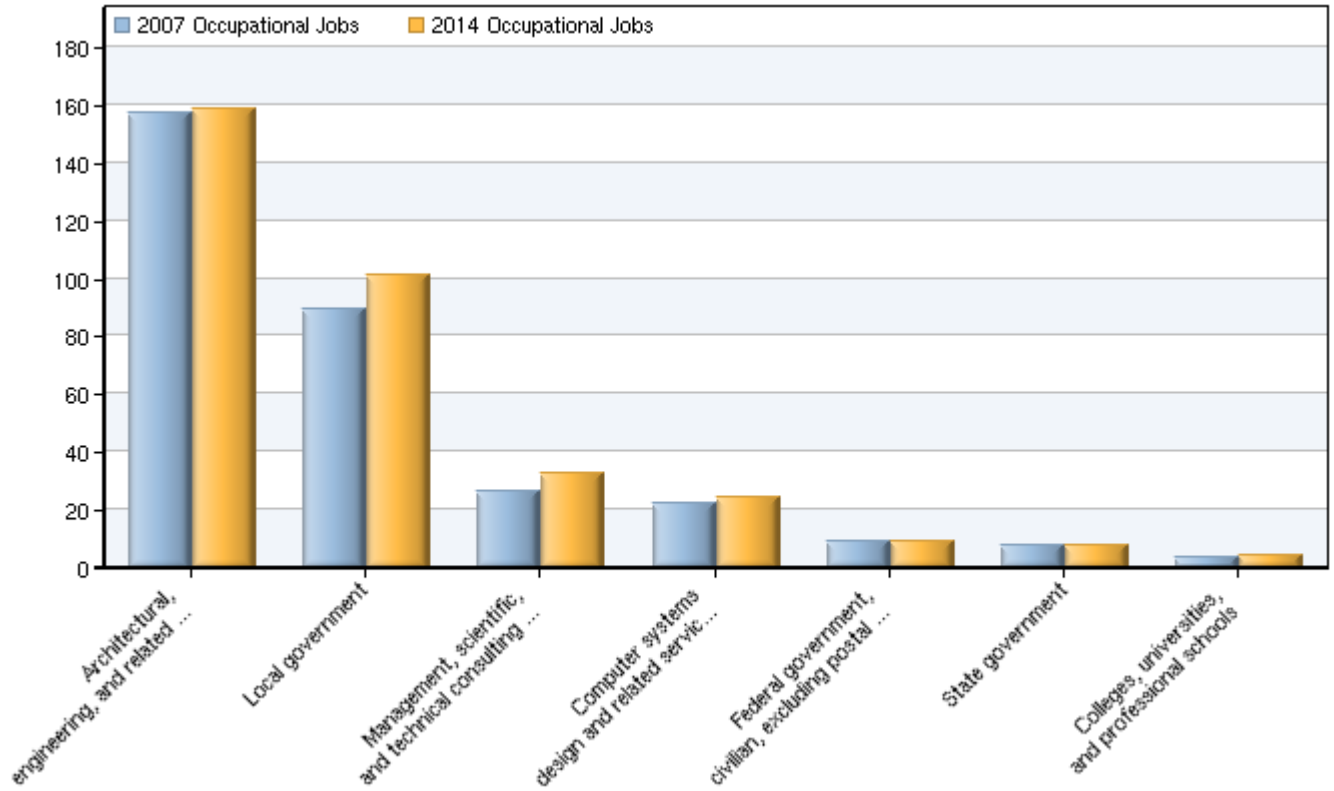
Nevertheless, there will be a 6% decline in Orange County and only a 1% increase in Los Angeles County, from 2007-2014, of cartographers and photogrammetrists in the Architectural, engineering, and related services industry.

Top Industries in Orange County for Cartographers & Photogrammetrists



NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	69	63	-6	-9%
930000	Local government	32	39	7	22%
541600	Management, scientific, and technical consulting services	18	21	3	17%
541500	Computer systems design and related services	18	23	5	28%
920000	State government.	3	4	1	31%
911000	Federal government, civilian, excluding postal srvc.	2	2	0	0%
531300	Activities related to real estate	2	2	0	0%

Top Industries in Los Angeles County for Cartographers & Photogrammetrists

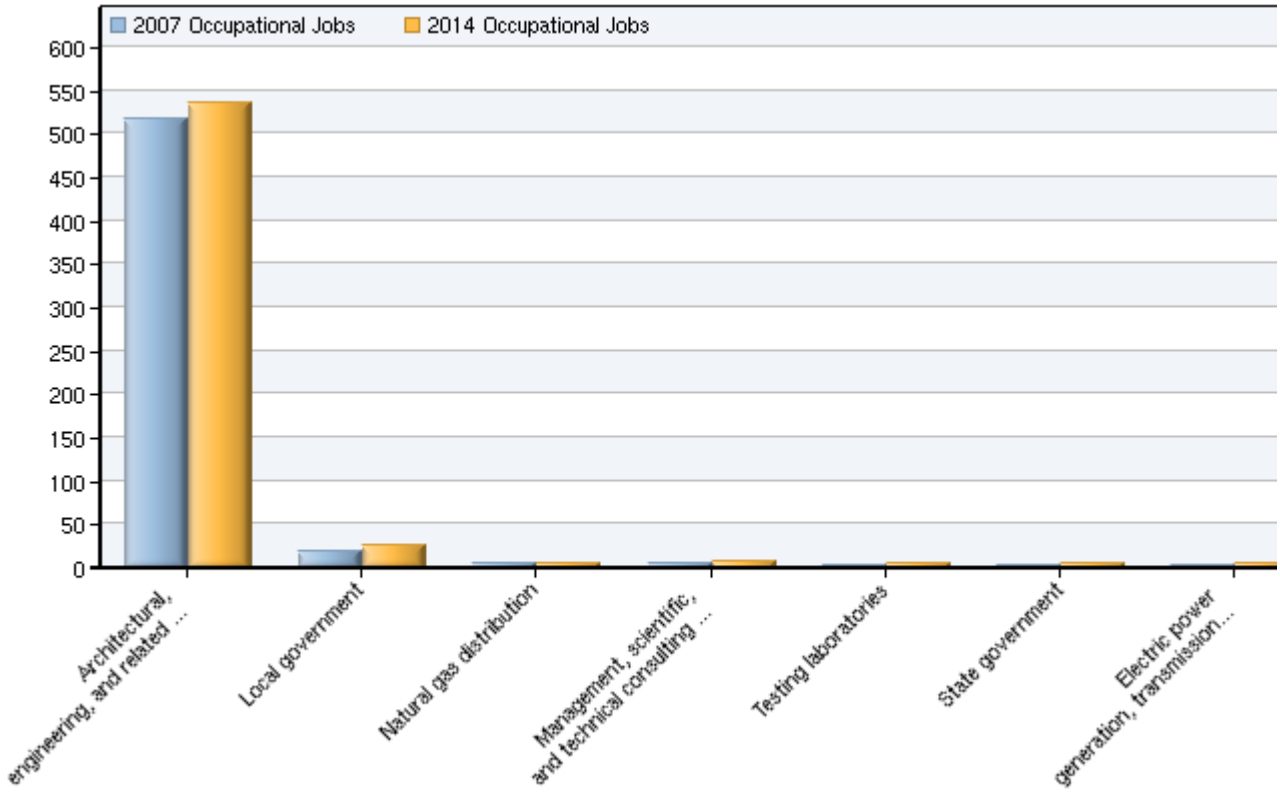


NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	157	159	2	1%
930000	Local government	89	101	12	13%
541600	Management, scientific, and technical consulting services	26	33	7	27%
541500	Computer systems design and related services	22	24	2	9%
911000	Federal government, civilian, excluding postal srvc.	9	9	0	0%
920000	State government.	8	8	0	0%
611300	Colleges, universities, and professional schools	4	4	0	0%

Mapping Technicians

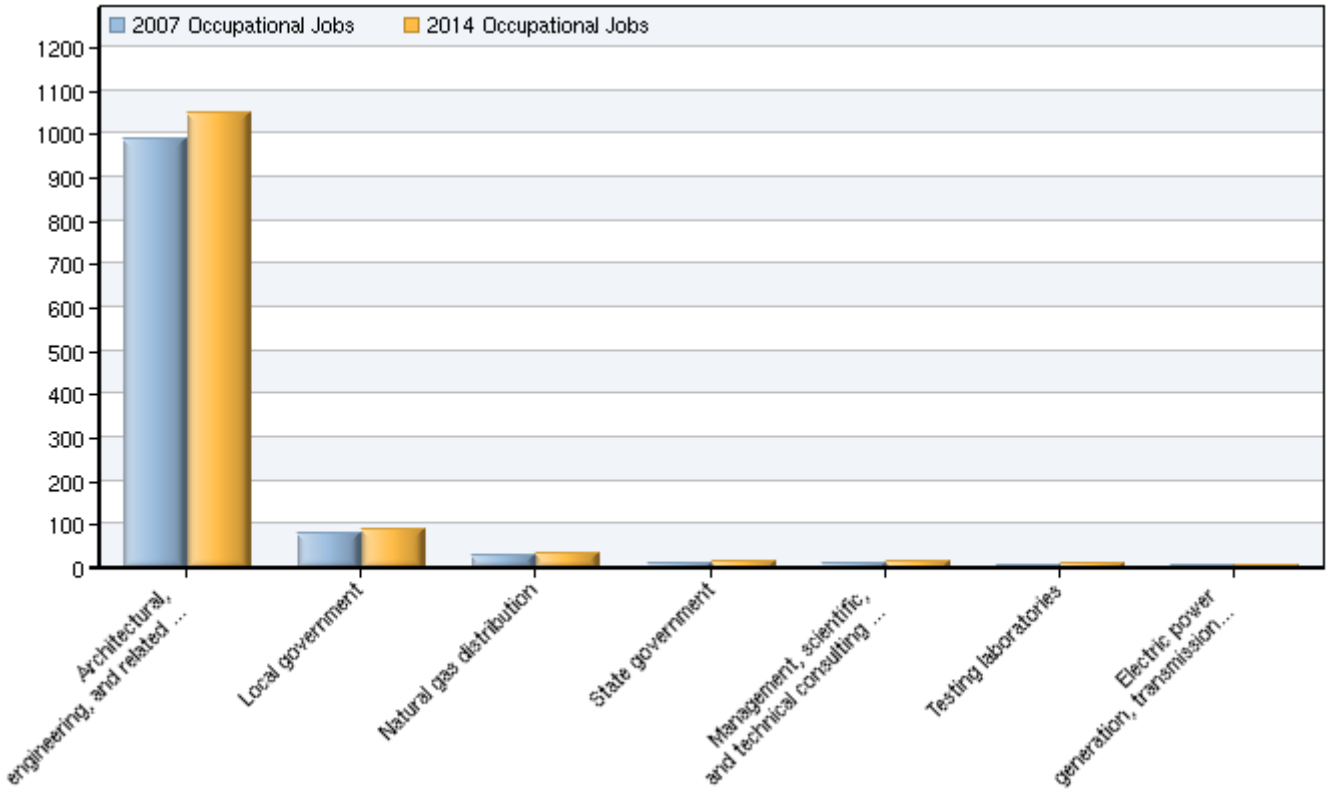
As classified by the NAICS codes, the following illustrate the top seven industries that employ mapping Technicians within the Orange County and Los Angeles County areas. Architectural, engineering, and related services (NAICS 5431XX) and local government (NAICS 930000) employ the most.

Top Industries in Orange County for Mapping Technicians



NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	516	535	19	4%
930000	Local government	20	24	4	21%
221200	Natural gas distribution	5	5	0	0%
541600	Management, scientific, and technical consulting services	5	6	1	20%
541380	Testing laboratories	3	4	1	30%
920000	State government	3	4	1	30%
221100	Electric power generation, transmission and distribution	3	4	1	33%

Top Industries in Los Angeles County for Mapping Technicians

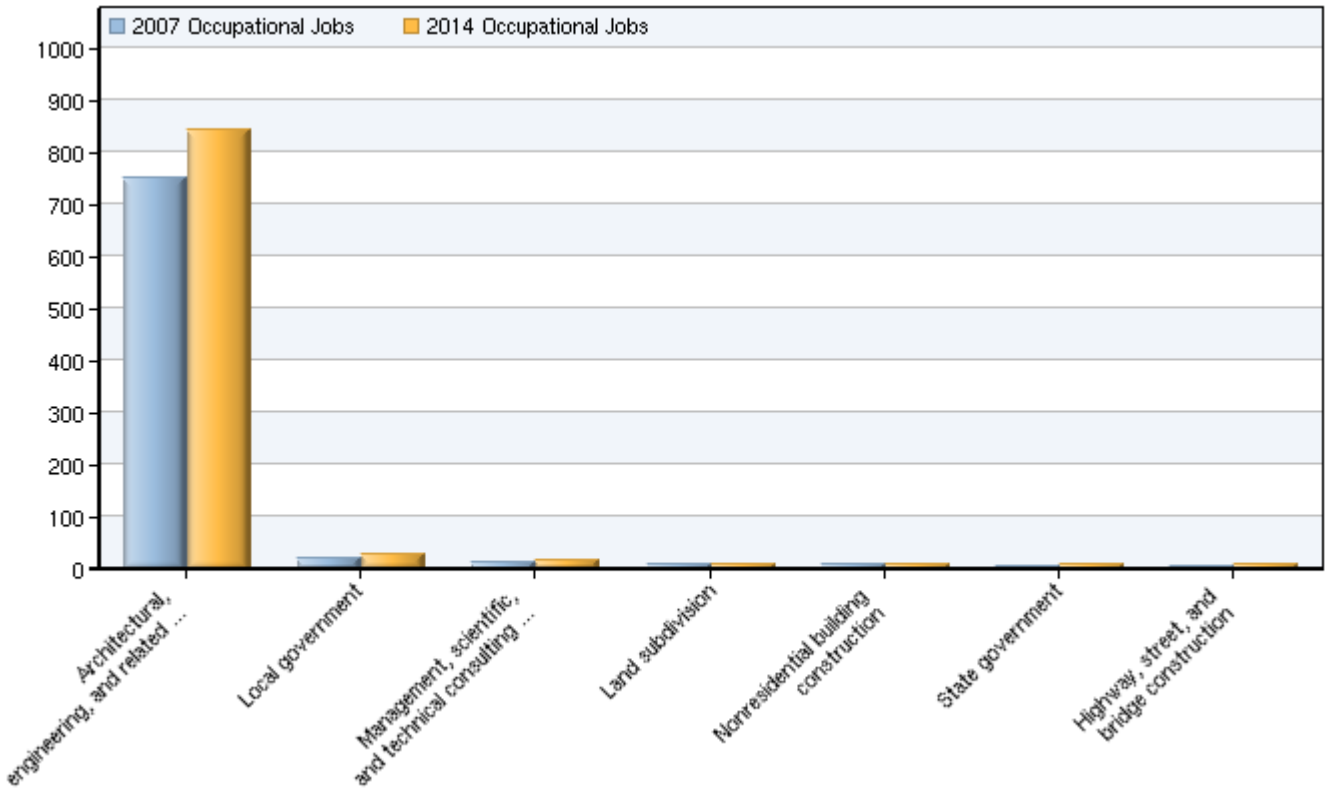


NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	987	1,046	59	6%
930000	Local government	79	89	10	13%
221200	Natural gas distribution	29	32	3	10%
920000	State government	11	12	1	9%
541600	Management, scientific, and technical consulting services	10	13	3	29%
541380	Testing laboratories	7	8	1	15%
221100	Electric power generation, transmission and distribution	5	5	0	0%

Surveyors

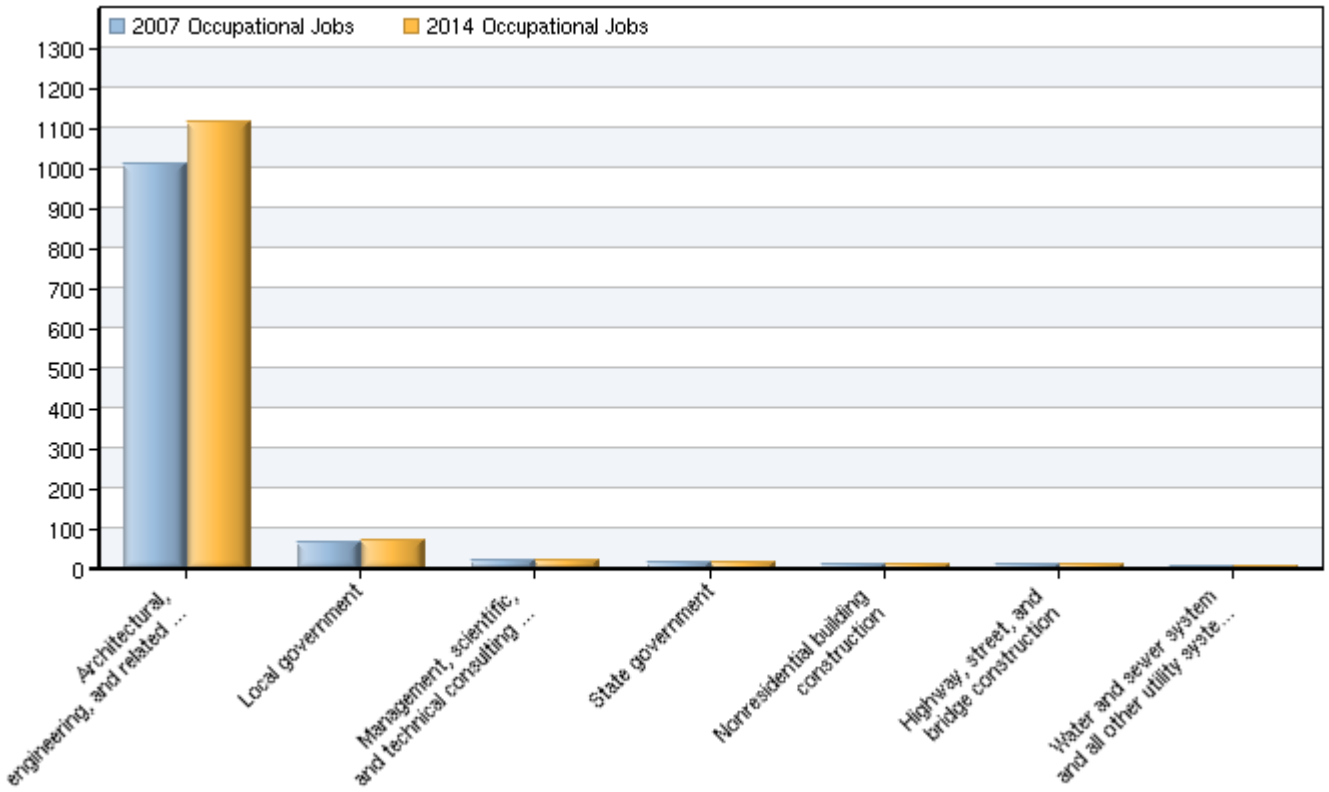
As classified by the NAICS codes, the following illustrate the top seven industries that employ surveyors within the Orange County and Los Angeles County areas. Architectural, engineering, and related services (NAICS 5431XX) and local government (NAICS 930000) employ the most.

Top Industries in Orange County for Surveyors



NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	750	842	92	12%
930000	Local government	21	26	5	24%
546100	Management, scientific, and technical consulting services	12	14	2	17%
237200	Land subdivision	8	8	0	0%
236200	Nonresidential building construction	8	9	1	12%
920000	State government	5	6	1	19%
237300	Highway, street, and bridge construction	5	6	1	19%

Top Industries in Los Angeles County for Surveyors



NAICS Code	Name	2007 Jobs	2014 Jobs	Change	% Change
5413XX	Architectural, engineering, and related services	1,008	1,116	108	11%
930000	Local government	63	71	8	13%
546100	Management, scientific, and technical consulting services	18	22	4	22%
920000	State Government	13	14	1	7%
236200	Nonresidential building construction	10	10	0	0%
237300	Highway, street, and bridge construction	8	11	3	36%
2371XX	Water and sewer system and all other utility system construction	6	7	1	17%

National Job Outlook[9]

Nationally, employment of cartographers and photogrammetrists, mapping technicians, and surveyors is expected to increase by 21 percent from 2006 to 2016, which is much faster than the average for all occupations. Increasing demand for fast, accurate, and complete geographic information will be the main source of growth for these occupations.

An increasing number of firms are interested in geographic information and its applications. For example, GIS can be used to create maps and information used in emergency planning, security, marketing, urban planning, natural resource exploration, construction, and other

[9] Source for entire section: Bureau of Labor Statistics (http://www.bls.gov)

applications. Also, the increased popularity of online mapping systems has created a higher demand for and awareness of geographic information among consumers.

In addition to openings from growth, job openings will continue to arise from the need to replace workers who transfer to other occupations or who leave the labor force altogether. Many of the workers in these occupations are approaching retirement age.

Opportunities for surveyors, cartographers and photogrammetrists should remain concentrated in engineering, surveying, mapping, building inspection, and drafting services firms. However, employment may fluctuate from year to year with construction activity or with mapping needs for land and resource management.

Opportunities should be stronger for professional surveyors than for mapping technicians. Advancements in technology, such as total stations and GPS, have made surveying parties smaller than they once were. Additionally, cartographers and photogrammetrists, and mapping technicians who produce more basic GIS data may face competition for jobs from offshore firms and contractors.

As technologies become more complex, opportunities will be best for surveyors, cartographers and photogrammetrists who have a bachelor's degree and strong technical skills. Increasing demand for geographic data, as opposed to traditional surveying services, will mean better opportunities for cartographers and photogrammetrists who are involved in the development and use of geographic and land information systems.

Education and Training[10]

This section reviews the education and training requirements for cartographers and photogrammetrists, mapping technicians, and surveyors.

Cartographers and Photogrammetrists

Cartographer and photogrammetrist occupations at a minimum require training in vocational schools, related on-the-job experience, or an associate's degree. Cartographers and photogrammetrists usually have a bachelor's degree in cartography, geography, surveying, engineering, forestry, computer science, or a physical science, although a few enter these positions after working as technicians. With the development of GIS, Cartographers and photogrammetrists need more education and stronger technical skills—including more experience with computers—than in the past.

The American Society for Photogrammetry and Remote Sensing has voluntary certification programs for technicians and professionals in photogrammetry, remote sensing, and GIS. To qualify for these professional distinctions, individuals must meet work experience and training standards and pass a written examination. The professional recognition these certifications can help workers gain promotions.

[10] Sources for entire section: O*Net Online (http://online.onetcenter.org) and Bureau of Labor Statistics (http://www.bls.gov)

High school students interested in cartography should take courses in algebra, geometry, trigonometry, drafting, mechanical drawing, and computer science.

Mapping Technicians

Most mapping technician occupations usually require training in vocational schools, related on-the-job experience, or an associate's degree. Some may require a bachelor's degree.

Surveyors

Most surveyor occupations require a four - year bachelor's degree. In the past, many people with little formal training started as members of survey crews and worked their way up to become licensed surveyors, but this has become increasingly difficult to do. Now, most surveyors need a bachelor's degree. A number of universities offer bachelor's degree programs in surveying, and many community colleges, technical institutes, and vocational schools offer 1-, 2-, and 3-year programs in surveying or surveying technology.

High school students interested in surveying should take courses in algebra, geometry, trigonometry, drafting, mechanical drawing, and computer science. High school graduates with no formal training in surveying usually start as apprentices. Beginners with postsecondary school training in surveying usually can start as surveying or mapping technicians. With on-the-job experience and formal training in surveying—either in an institutional program or from a correspondence school—workers may advance to senior survey technician, then to party chief. Depending on state licensing requirements, in some cases they may advance to licensed surveyor.

Regional Employers

To reiterate, an increasing number of firms are interested in geographic information and its applications. As a result, various other industries than those who only hire cartographers and photogrammetrists, mapping technicians, and surveyors are hiring GIS-related occupations. See the report in the following page for the complete list of these industries in Orange and Los Angeles County.

Appendix A displays the number of companies in Orange County and Los Angeles County that employ GIS-related occupations.

OVERVIEW REPORT: COMPANIES AND INSTITUTIONS EMPLOYING GIS-RELATED PROFESSIONALS

Prepared by Center of Excellence in Orange County.
December 2008

TABLE 1: COMPANIES IN LOS ANGELES AND ORANGE COUNTIES EMPLOYING GIS-RELATED OCCUPATIONS
(sorted by NAICS code)

		# of Establishments		
NAICS6	Description	Los Angeles	Orange	Both Counties
115310	Support Activities for Forestry	19	5	24
211111	Crude Petroleum and Natural Gas Extraction	94	26	120
212311	Dimension Stone Mining and Quarrying	54	22	76
212319	Other Crushed and Broken Stone Mining and Quarrying	7	1	8
212322	Industrial Sand Mining	0	1	1
212393	Other Chemical and Fertilizer Mineral Mining	1	1	2
212399	All Other Nonmetallic Mineral Mining	16	7	23
213111	Drilling Oil and Gas Wells	16	16	32
213112	Support Activities for Oil and Gas Operations	25	13	38
221119	Other Electric Power Generation	15	5	20
221122	Electric Power Distribution	48	24	72
221210	Natural Gas Distribution	28	8	36
221310	Water Supply and Irrigation Systems	165	50	215
221320	Sewage Treatment Facilities	6	2	8
221330	Steam and Air-Conditioning Supply	3	3	6
541320	Landscape Architectural Services	334	216	550
541360	Geophysical Surveying and Mapping Services	3	1	4
541370	Surveying and Mapping (except Geophysical) Services	132	67	199
541620	Environmental Consulting Services	8	4	12
712190	Nature Parks and Other Similar Institutions	435	81	516
813312	Environment, Conservation and Wildlife Organizations	34	5	39
921110	Executive Offices	180	61	241
921190	Other General Government Support	147	98	245
922120	Police Protection	295	127	422
922150	Parole Offices and Probation Offices	39	9	48
922160	Fire Protection	189	28	217
922190	Other Justice, Public Order, and Safety Activities	13	4	17
924110	Administration of Air & Water Resource & Solid Waste Mnt Programs	27	10	37
924120	Administration of Conservation Programs	14	5	19
925120	Administration of Urban Planning & Community & Rural Development	63	23	86
	TOTAL	2410	923	3333

Source: Centers of Excellence, California Community Colleges Chancellor's Office. Data provided by ESRI, Inc.

Companies Employing GIS-related Professionals in Orange and Los Angeles Counties, 2008