March 2023

Labor Market Analysis

Cyber Security

Prepared by the Central Valley/Mother Lode Center of Excellence

POWERED BY

California Community Colleges

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COVID-19 Statement: This report includes employment projection data by Lightcast. Lightcast's projections are modeled on recorded (historical) employment figures and incorporate several underlying assumptions, including the assumption that the economy during the projection period will be at approximately full employment or potential output. To the extent that a recession or labor shock, such as the economic effects of COVID-19, can cause long-term structural change, they may impact the projections. At this time, it is not possible to quantify the impact of COVID-19 on projections of industry and occupational employment. Other measures such as unemployment rates and monthly industry employment estimates will reflect the most recent information on employment and jobs in the state and, in combination with input from local employers, may help validate current and future employment needs as depicted here.

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Summary

The Central Valley/Mother Lode Center of Excellence developed this report for Cerro Coso College to determine whether there is demand in the local labor market that is not being met by the supply from community college programs. This report also serves a secondary purpose, which is to aid in making a data-informed decision regarding the utility of a Cyber Security Bachelor's degree program offered at Cerro Coso College. This report summarizes labor market demand, wages, skills, and postsecondary supply for *Cyber Security Occupations,* which include:

Middle-Skill:
- Computer Network Support Specialists (SOC 15-1231)
- Computer User Support Specialists (SOC 15-1232)
- Network and Computer Systems Administrators (SOC 15-1244)

Above Middle-Skill:
- Computer Systems Analysts (SOC 15-1211)
- Information Security Analysts (SOC 15-1212)
- Software Quality Assurance Analysts and Testers (SOC 15-1253)

Key findings:

- **Occupational demand —** There were 525 workers employed in jobs related to Cyber Security in 2021 in the South Central Valley/Southern Mother Lode (SCV/SML) subregion. The largest occupation is computer user support specialists with 1,908 workers, a projected growth rate of 12% over the next five years, and 200 annual openings.

- **Wages —** Information security analysts earn the highest entry-level wage, $38.92/hour in the subregion.

- **Employers and Occupational Titles —** Employers with the most job postings in the subregion are Creative Financial Staffing, Lockheed Martin, and CTG. The most common occupational title in job postings in the subregion is computer user support specialists. The most common job title is systems administrators.

- **Skills and Certifications —** The top baseline skill is mathematics, the top specialized skill is energy consumption, and the top software skill is Ruby On Rails. The most in-demand certification is CompTIA A+.

- **Education —** Some college is typically required for computer user support specialists. An associate degree is typically required for computer network support specialists. A bachelor's degree is typically required for computer systems analysts; software quality assurance analysts and testers; network and computer systems administrators; and information security analysts.

- **Supply and Demand Analysis —** Analysis of postsecondary completions shows that, on average, 150 awards were conferred in the Central Valley/Mother Lode region each year. Based on a comparison of occupational demand and supply, there is an undersupply of 639 trained workers in the region.

Recommendation:
The Center of Excellence recommends that Cerro Coso College work with the regional directors, the college's advisory board, and local industry in the expansion of programs to address the shortage of Cyber Security workers in the region.

Introduction

The Central Valley/Mother Lode Center of Excellence was asked by Cerro Coso College to provide labor market information for Cyber Security. The geographical focus for this report is the South Central Valley/Southern Mother Lode (SCV/SML) subregion, but regional demand and supply data has been included for broader applicability and use. Analysis of the program and occupational data related to Cyber Security resulted in the identification of applicable occupations. The Standard Occupational Classification (SOC) System codes and titles used in this report are:

Middle-Skill:
- Computer Network Support Specialists (SOC 15-1231)
- Computer User Support Specialists (SOC 15-1232)
- Network and Computer Systems Administrators (SOC 15-1244)

Above Middle-Skill:
- Computer Systems Analysts (SOC 15-1211)
- Information Security Analysts (SOC 15-1212)
- Software Quality Assurance Analysts and Testers (SOC 15-1253)

The occupational titles, job descriptions, sample job titles, and knowledge and skills from the Bureau of Labor Statistics and O*NET OnLine are shown below.

Computer Network Support Specialists
Job Description: Analyze, test, troubleshoot, and evaluate existing network systems, such as local area networks (LAN), wide area networks (WAN), cloud networks, servers, and other data communications networks. Perform network maintenance to ensure networks operate correctly with minimal interruption.
Knowledge: Computers and Electronics, Telecommunications, Customer and Personal Service, Engineering and Technology, English Language
Skills: Critical Thinking, Active Listening, Judgment and Decision Making, Reading Comprehension, Active Learning

Computer User Support Specialists
Job Description: Provide technical assistance to computer users. Answer questions or resolve computer problems for clients in person, via telephone, or electronically. May provide assistance concerning the use of computer hardware and software, including printing, installation, word processing, electronic mail, and operating systems.
Knowledge: Computer and Electronics, Customer and Personal Service, English Language, Telecommunications, Engineering and Technology
Skills: Active Listening, Reading Comprehension, Speaking, Complex Problem Solving, Critical Thinking

Network and Computer Systems Administrators
Job Description: Install, configure, and maintain an organization's local area network (LAN), wide area network (WAN), data communications network, operating systems, and physical and virtual servers. Perform system monitoring and verify the integrity and availability of hardware, network, and server resources and systems. Review system and application logs and verify completion of scheduled jobs, including system backups. Analyze network and server resource consumption and control user access. Install and upgrade software and maintain software licenses. May assist in network modeling, analysis, planning, and coordination between network and data communications hardware and software.
Knowledge: Computers and Electronics, English Language, Customer and Personal Service, Engineering and Technology, Mathematics
Skills: Critical Thinking, Judgment and Decision Making, Reading Comprehension, Systems Analysis, Active Listening

Computer Systems Analysts
Job Description: Analyze science, engineering, business, and other data processing problems to develop and implement solutions to complex applications problems, system administration issues, or network concerns. Perform systems management and integration functions, improve existing computer systems, and review computer system capabilities, workflow, and schedule limitations. May analyze or recommend commercially available software.
Knowledge: Computers and Electronics, English Language, Customer and Personal Service, Mathematics, Administration and Management
Skills: Active Listening, Critical Thinking, Reading Comprehension, Speaking, Systems Analysis

Information Security Analysts
Job Description: Plan, implement, upgrade, or monitor security measures for the protection of computer networks and information. Assess system vulnerabilities for security risks and propose and implement risk mitigation strategies. May ensure appropriate security controls are in place that will safeguard digital files and vital electronic infrastructure. May respond to computer security breaches and viruses.
Knowledge: Computers and Electronics, English Language, Administration and Management, Engineering and Technology, Telecommunications
Skills: Reading Comprehension, Critical Thinking, Active Listening, Complex Problem Solving, Speaking

Software Quality Assurance Analysts and Testers
Job Description: Develop and execute software tests to identify software problems and their causes. Test system modifications to prepare for implementation. Document software and application defects using a bug tracking system and report defects to software or web developers. Create and maintain databases of known defects. May participate in software design reviews to provide input on functional requirements, operational characteristics, product designs, and schedules.
Knowledge: Computers and Electronics, English Language, Engineering and Technology, Mathematics, Design
Skills: Reading Comprehension, Active Listening, Critical Thinking, Speaking, Writing

Occupational Demand

The SCV/SML subregion employed 5,229 workers in *Cyber Security Occupations* in 2021 (Exhibit 1). The occupation with the most jobs is computer user support specialists with 1,908 workers in 2021. This occupation is projected to grow by 12% over the next five years and has the greatest number of projected annual openings, 200.

Exhibit 1. Cyber Security employment and occupational projections in the SCV/SML subregion

Occupation	2021 Jobs	2026 Jobs	5-Year Change	5-Year % Change	Annual Openings
Middle-Skill Occupations					
Computer User Support Specialists	1,908	2,129	221	12%	200
Network and Computer Systems Administrators	999	1,081	83	8%	86
Computer Network Support Specialists	627	683	56	9%	61
SUBTOTAL	**3,534**	**3,893**	**359**	**10%**	**347**
Above Middle-Skill Occupation					
Computer Systems Analysts	1,130	1,272	142	13%	112
Software Quality Assurance Analysts and Testers	310	359	49	16%	34
Information Security Analysts	256	313	57	22%	32
SUBTOTAL	**1,696**	**1,944**	**248**	**15%**	**178**
TOTAL	**5,229**	**5,836**	**607**	**12%**	**525**

Wages

The average living wage for a single adult in the SCV/SML subregion is $11.91/hour.[1] Exhibit 2a shows the hourly wages of the *Cyber Security Occupations.* Information security analysts earn the highest entry-level wage, $38.92/hour in the subregion.[2] Please note 10th and 25th percentiles are considered entry-level wages while 75th and 90th are considered experienced wages, either by gained by long term employment, received extra training, etc.

**Exhibit 2a. Cyber Security hourly wages in the SCV/SML subregion**

Occupation	Pct. 25 Hourly Earnings	Median Hourly Earnings	Pct. 75 Hourly Earnings
Middle-Skill Occupations			
Network and Computer Systems Administrators	$31.66	$40.93	$47.89
Computer Network Support Specialists	$24.70	$29.72	$36.91
Computer User Support Specialists	$20.45	$27.03	$34.45
Above Middle-Skill Occupations			
Information Security Analysts	$38.92	$51.50	$66.53
Computer Systems Analysts	$33.24	$42.10	$54.32
Software Quality Assurance Analysts and Testers	$32.65	$40.74	$55.30

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[1] The term "living wage" in Center of Excellence reports is calculated by averaging the self-sufficiency wages from the Insight Center's California Family Needs Calculator for each county in the subregion: https://insightcced.org/tools-metrics/self-sufficiency-standard-tool-for-california/.

[2] Entry-level wages are derived from the 25th percentile.

Exhibit 2b shows the average hourly wages for *Cyber Security Occupations*, the average entry-level wage exceeds the average living wage for the SCV/SML subregion.

Exhibit 2b. Cyber Security average hourly wages in the SCV/SML subregion
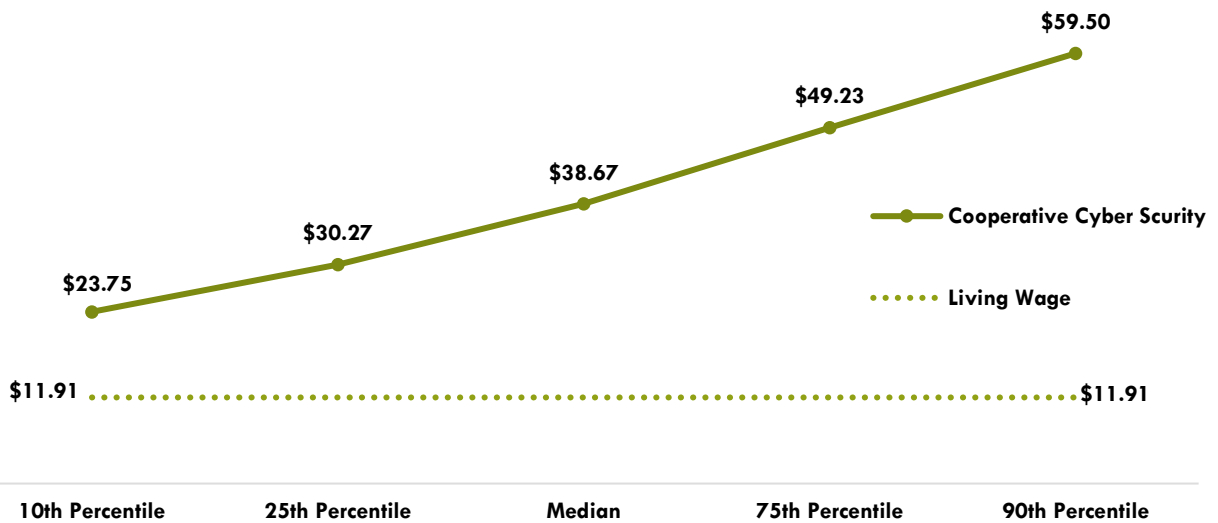
Job Postings

There were 1,612 job postings for the occupations of interest in the SCV/SML subregion from September 2022 to February 2023.[3] The employers with the most job postings are listed in Exhibit 3.

Exhibit 3. Top employers of *Cyber Security Occupations* by number of job postings

Employer
Creative Financial Staffing
Lockheed Martin
CTG
Northrop Grumman
Naval Air Systems Command
Internal Revenue Service
Deloitte
Robert Half
Best Buy
Kern Community College District

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[3] Other than occupation titles and job titles, the categories below can be counted one or multiple times per job posting, and across several areas in a single posting. For example, a skill can be counted in two different skill types, and an employer can indicate more than one education level.

Salaries

Exhibit 4 shows the "Market Salaries" for Cyber Security occupations. These are calculated by Burning Glass using a machine learning model built off of millions of job postings every year. This accounts for adjustments based on locations, industry, skills, experience, education requirements, among other variables.

Exhibit 4. Salaries for *Cyber Security Occupations*

Market Salary	Job postings
$90,000-$210,000	147
$54,000-$59,999	121
$48,000-$53,999	65
$42,000-$47,999	56
$36,000-$41,999	50

Education

Of the 1,612 job postings, 1,290 listed an education level preferred for the positions being filled. Among those, 39% requested a bachelor's degree, 18% requested a High School or GED, and 14% requested associate degree (Exhibit 5).

Exhibit 5. Education levels requested in job postings for *Cyber Security Occupations*

Education Level	Job Postings	% of Job Postings
Bachelor's degree	627	39%
High school or GED	289	18%
Associate degree	230	14%
Master's degree	110	7%
Ph.D. or professional degree	34	2%

Baseline, Specialized, and Software Skills

Exhibit 6 depicts the top baseline, specialized, and software skills in job postings. The three most important baseline skills are troubleshooting (problem solving), management, and problem solving. The top three specialized skills are computer science, help desk support, and technical support. The top software is Ruby on Rails.

Exhibit 6. *Cyber Security Occupations* **baseline, specialized, and software skills**

Baseline Skills	Specialized Skills	Software Skills
Troubleshooting (Problem Solving)	Computer Science	Ruby On Rails
Management	Help Desk Support	Geographic Information Systems
Problem Solving	Technical Support	Anaconda (Software)
Operations	Operating Systems	AutoCAD
Information Technology	Information Systems	ArcGIS (GIS Software)

Certifications

Of the 1,612 job postings, 1,268 contained certification data. Among those, 8% indicated a need for a CompTIA A+. The next top certification is CompTIA Security+ and Cisco Certified Network Associate (Exhibit 7).

Exhibit 7. Top *Cyber Security Occupations* **certifications requested in job postings**

Certifications	% of Job Postings
CompTIA A+	8%
CompTIA Security+	8%
Cisco Certified Network Associate	5%
CompTIA Network+	4%

Education, Work Experience & Training

Some college is typically required for computer user support specialists. An associate degree is typically required for computer network support specialists. A bachelor's degree is typically required for computer systems analysts, software quality assurance analysts and testers, network and computer systems administrators, and information security analysts. (Exhibit 8).

Exhibit 8. Education, work experience, training, and Current Population Survey results for *Cyber Security Occupations*[4]

Occupation	Typical Entry-level Education	Work Experience Required	Typical On-The-Job Training	CPS: Some College	CPS: Bachelor's Plus
Computer Network Support Specialists	Associate degree	None	None	39.2%	37.2%
Computer Systems Analysts	Bachelor's degree	None	None	20.8%	48.4%
Network and Computer Systems Administrators	Bachelor's degree	None	None	37.4%	40.8%
Software Quality Assurance Analysts and Testers	Bachelor's degree	None	None	11.7%	50.5%
Information Security Analysts	Bachelor's degree	Less than 5 years	None	25.7%	43.3%
Computer User Support Specialists	Some college, no degree	None	None	39.2%	37.2%

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[4] "Labor Force Statistics from the Current Population Survey," Bureau of Labor Statistics, https://www.bls.gov/cps/.

Supply

An analysis of program data from the Integrated Postsecondary Education Data System (IPEDS) for the last three program years shows that, on average, 150 awards were conferred in the region (Exhibit 9 and 10).

Exhibit 9. TOP and CIP codes for *Cyber Security Occupations*

TOP Titles	CIP Titles
0708.10 - Computer Networking	11.0901 - Computer Systems Networking and Telecommunications 11.1001 - Network and System Administration/Administrator 11.1003 - Computer and Information Systems Security/Information Assurance

Exhibit 10. Postsecondary supply for *Cyber Security Occupations*

TOP/ CIP Code- Title	College	Associate Degree	Award 1 < 2 Academic Years	Certificate 12 < 18 Semester Units	Certificate 16 < 30 Semester Units	Certificate 18 < 30 Semester Units	Certificate 30 < 60 Semester Units	Certificate 6 < 18 Semester Units	Certificate 8 < 16 Semester Units	Subtotal
070810 - Computer Networking	Cerro Coso	9					10			**19**
	Clovis	2				1				**3**
	Fresno City	22					22			**44**
	Modesto			7					1	**8**
	Reedley College	4			9	7				**20**
	San Joaquin Delta	15				18	3			**36**
	Sequoias	1						5		**6**
	West Hills Lemoore					1				**1**
11.0901 - Computer Systems Networking and Telecommunications	Institute of Technology		13							**13**
CVML TOTAL		**53**	**13**	**7**	**9**	**27**	**35**	**5**	**1**	**150**

There is total undersupply of 639 Cyber Security workers in the region (Exhibit 11).

Exhibit 11. Cyber Security workforce demand (annual job openings), postsecondary supply of students (awards), and additional students needed to fill gap in the region

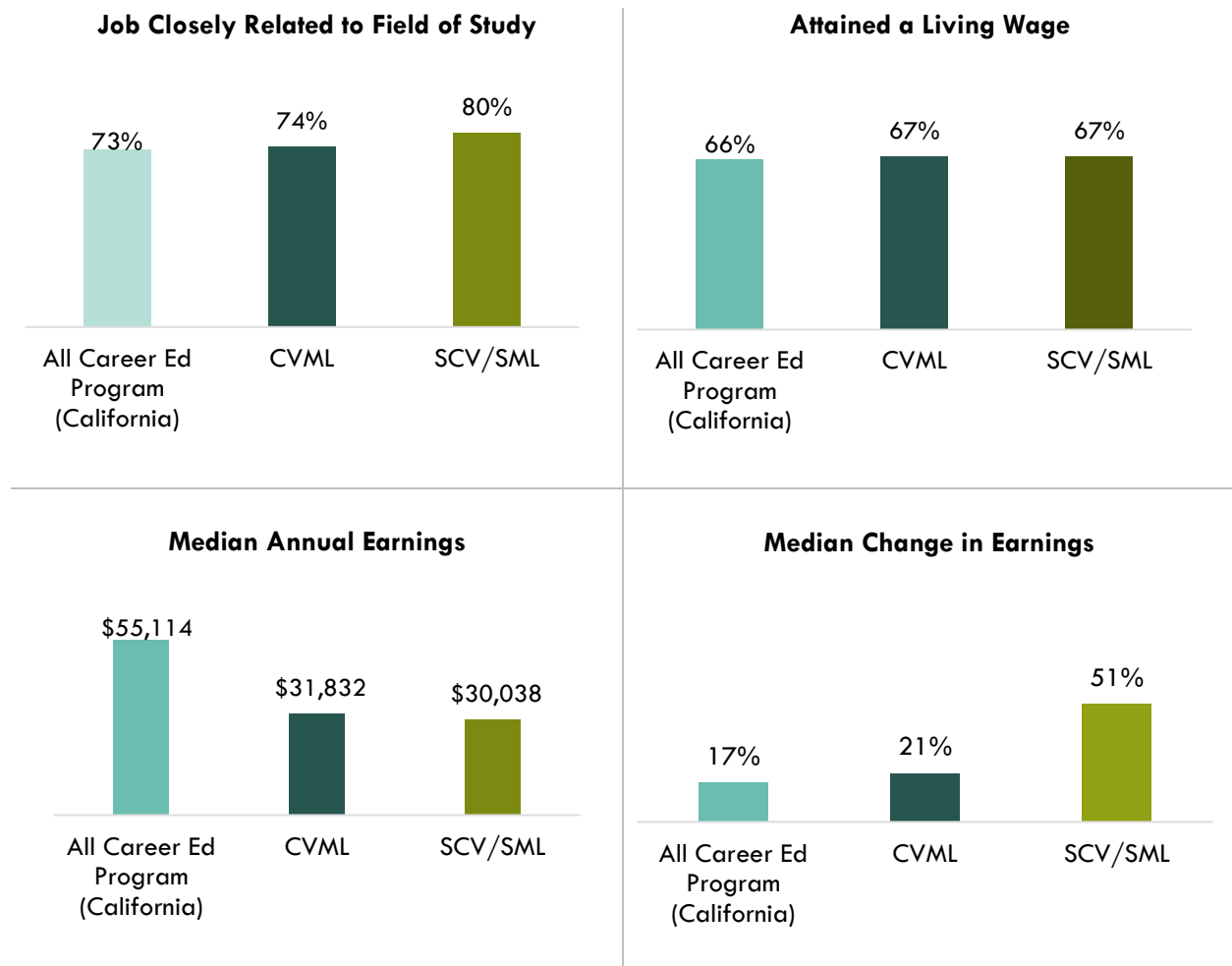| Region	Demand (Annual Openings)	Supply (Total Annual Average Supply)	Supply Gap or Oversupply
Middle-Skill Occupations			
CVML	513	150	363
Above Middle-Skill Occupations			
CVML	276	-	276
Middle-Skill and Above Middle-Skill Occupations			
CVML	789	150	639

Student Outcomes

Exhibits 12a-12b summarize outcomes from California Community College Chancellor's Cal-PASS Plus LaunchBoard for TOP codes related to Cyber Security occupations. Notably, 52 students obtained a job closely related to their field of study in the subregion and 16 attained a living wage.

Exhibit 12a. Regional metrics for TOP 0708.10 - Computer Networking

Metric	
Students Who Got a Degree or Certificate or Attained Apprenticeship Journey Status	52
Number of Students Who Transferred	16

Exhibit 12b. Metrics for TOP 0708.10 - Computer Networking

Job Closely Related to Field of Study

- All Career Ed Program (California): 73%
- CVML: 74%
- SCV/SML: 80%

Attained a Living Wage

- All Career Ed Program (California): 66%
- CVML: 67%
- SCV/SML: 67%

Median Annual Earnings

- All Career Ed Program (California): $55,114
- CVML: $31,832
- SCV/SML: $30,038

Median Change in Earnings

- All Career Ed Program (California): 17%
- CVML: 21%
- SCV/SML: 51%

Recommendation

This report suggests there is a shortage of 639 workers in the region for *Cyber Security Occupations*. Based on these findings, it is recommended that Cerro Coso College work with the regional directors, the college's advisory board, and local industry in the expansion of programs to address the shortage of Cyber Security workers in the region.

Appendix A: Methodology & Data Sources

Data Sources

Labor market and educational supply data compiled in this report derive from a variety of sources. Data were drawn from external sources, including the Economic Modeling Specialists, Inc., the California Community Colleges Chancellor's Office Management Information Systems Data Mart and the National Center for Educational Statistics (NCES) Integrated Postsecondary Education Data System (IPEDS). Below is the summary of the data sources found in this study.

Data Type	Source
Labor Market Information/Population Estimates and Projections/Educational Attainment	Economic Modeling Specialists, Intl. (Lightcast). Lightcast occupational employment data are based on final LIGHTCAST industry data and final Lightcast staffing patterns. Wage estimates are based on Occupational Employment Statistics (QCEW and Non-QCEW Employees classes of worker) and the American Community Survey (Self-Employed and Extended Proprietors). Occupational wage estimates also affected by county-level Lightcast earnings by industry: economicmodeling.com.
Typical Education Level and On-the-job Training	Bureau of Labor Statistics (BLS) uses a system to assign categories for entry-level education and typical on-the-job training to each occupation for which BLS publishes projections data: https://www.bls.gov/emp/tables/educational-attainment.htm.
Labor Force, Employment and Unemployment Estimates	California Employment Development Department, Labor Market Information Division: labormarketinfo.edd.ca.gov.
Job Posting and Skills Data	Burning Glass: burning-glass.com/.
Additional Education Requirements/ Employer Preferences	The O*NET Job Zone database includes over 900 occupations as well as information on skills, abilities, knowledge, work activities and interests associated with specific occupations: onetonline.org.

Key Terms and Concepts

Annual Job Openings: Annual openings are calculated by dividing the number of years in the projection period by total job openings.

Education Attainment Level: The highest education attainment level of workers age 25 years or older.

Employment Estimate: The total number of workers currently employed.

Employment Projections: Projections of employment are calculated by a proprietary Economic Modeling Specialists, Intl. (Lightcast) formula that includes historical employment and economic indicators along with national, state and local trends.

Living Wage: The cost of living in a specific community or region for one adult and no children. The cost increases with the addition of children.

Occupation: An occupation is a grouping of job titles that have a similar set of activities or tasks that employees perform.

Percent Change: Rate of growth or decline in the occupation for the projected period; this does not factor in replacement openings.

Replacements: Estimate of job openings resulting from workers retiring or otherwise permanently leaving an occupation. Workers entering an occupation often need training. These replacement needs, added to job openings due to growth, may be used to assess the minimum number of workers who will need to be trained for an occupation.

Total Job Openings (New + Replacements): Sum of projected growth (new jobs) and replacement needs. When an occupation is expected to lose jobs, or retain the current employment level, number of openings will equal replacements.

Typical Education Requirement: represents the typical education level most workers need to enter an occupation.

Typical On-The-Job Training: indicates the typical on-the-job training needed to attain competency in the skills needed in the occupation.