Construction
in the Los Angeles Basin

An industry with growing "middle-skill" workforce shortages

JUNE 2020

CENTER FOR A COMPETITIVE WORKFORCE

LAEDC

Table of Contents

About CCW
Center for a Competitive Workforce

CCW

The Center for a Competitive Workforce (CCW) was established in 2017 as a Strong Workforce Program regional project of the 19 community colleges in the Los Angeles region, in collaboration with the L.A./O.C. Center of Excellence for Labor Market Research (COE), hosted at Mt. San Antonio College, the Los Angeles County Economic Development Corporation (LAEDC) and its Institute for Applied Economics.

CCW is focused on institutionalizing the regular engagement of and partnerships between our 19 community colleges in the L.A. region and employers from high-growth industry sectors (i.e. those with productive advantages, deep labor concentrations and projected growth of middle skill jobs). It is through the development, institutionalization and activation of these productive partnerships and real-time feedback loops that colleges can adaptively attune their programs, courses and curricula to the workforce needs in a way that this truly responsive, demand-driven and future-forward, while also providing students with the very important real-world experiences that come from work-based learning opportunities such as internships.

CCW has published 15 regional labor market and occupational reports for L.A. and Orange County. These reports analyze labor supply and demand data for middle-skill occupations in high-growth industries to inform and influence the expansion of new or modified career education, and workforce development programs and curricula. CCW supports quarterly convenings with education, workforce, nonprofit, government and industry leaders in three of the L.A. region's most highly concentrated and fastest growing industry sectors—advanced transportation, bioscience and digital media/entertainment—with the co-equal goals to strengthen industry engagement with faculty, and connect students to meaningful work-based learning opportunities.

This is one of the best ways to, constructively, prepare them for the 21st century jobs and careers, in the fast-emerging and rapidly-changing knowledge-intensive industries that drive our regional economy.

In partnership with the regional directors for employer engagement, CCW has hosted seven regional program advisory committee meetings to further strengthen regional alignment of, and ongoing connections between, faculty and industry. CCW has developed two online platforms: a Biosciences Industry Portal, and a regional Workforce and Education Partner Portal to increase the speed and richness of industry-college connections. The goal is to seamlessly access and deploy the economic intelligence gleaned through industry engagement, and to rapidly expand and scale the number of work-based learning and employment opportunities for career education students and graduates.

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Executive Summary

In this report, the center:

- Analyzes the major shifts occurring in the construction industry
- Forecasts the industry's regional employment
- Identifies jobs with the brightest future for community college students in the region

WHY FOCUS ON CONSTRUCTION?

Communities across the LA Basin are looking to address the deepening housing crisis and also meet ambitious environmental goals. The construction industry is an integral component of both. With each of the construction subsectors (described below) forecasted to experience steady growth during the next three to five years, the industry will be a key player in meeting regional housing demands. Additional housing cannot be built without the necessary workforce of builders, cost estimators, carpenters, and other construction workers. Environmental goals also cannot be met without ensuring that the workers responsible for installing solar, electric and other emerging renewable technologies are appropriately trained. The construction industry will continue to see its growth shaped by the region's priorities of housing and the environment. The developments within these sectors will drive labor demand for middle-skill workers who are ready to help meet regional goals.

The competitive and rapidly changing economic landscape of the Los Angeles (LA) Basin has given rise to a job market in which highly specialized knowledge and skills often mean the difference between success and failure. To help meet this challenge, the Center for a Competitive Workforce ("CCW" or "the Center") set out to study the major industries driving growth and to pinpoint how education and industry stakeholders can work together to deliver the labor force that will be needed today and tomorrow, i.e. one that industry demands and that is necessary to fuel a vibrant economy.

This report is the latest in a series of reports produced by CCW, the Center of Excellence (COE) at Mt. San Antonio College, and the Los Angeles County Economic Development Corporation (LAEDC); it focuses on the construction industry in the Los Angeles Basin (Los Angeles and Orange counties).

Construction

SUPPLY VS. DEMAND

In this report, the Center also assesses whether community colleges are meeting workforce demands. Based on data from regional community college completions, there is an acute shortage in labor across many of the middle-skill occupations that are covered in this report. Within the seven occupations that fall under the construction and extraction occupational group designation, there were only 838 awards conferred in relevant college programs during the 2018-19 academic year, compared to nearly 11,000 annual job openings. Similarly, the installation, maintenance and repair and the production occupational groups face an undersupply of qualified workers. Only one occupation —architectural and civil drafters— had a mild oversupply of workers, with 550 annual openings and 578 awards conferred. Based on these statistics, the community college supply is not adequately meeting workforce demand in most middle-skill occupations.

WHERE WILL THE JOBS BE?

The highest number of new jobs from 2017 to 2022 will be in three main component industries: Building Equipment Contractors (3,810 jobs); Building Finishing Contractors (2,200 jobs); and Building Foundation Contractors (1,790 jobs).

Analysis of the skills classifications for total job openings over the next five years reveals that over half of projected openings will be for middle-skill occupations, which reinforces the selection of this industry as a valid target for community college programs.

OCCUPATIONAL PROFILES

This report identifies ten promising target occupations for middle-skill workers, who are characterized as those with an associate degree or other post secondary education that is less than a bachelor's degree, across ten component industries that make up the construction industry sector. In-demand middle-skill occupations to note include carpenters, electricians, and plumbers, pipefitters and steamfitters.

RISE OF TECHNOLOGY

This report also examines the growing influence and impact of technology in the construction industry and its potential effects on the industry's future workforce. Occupations at all stages of the construction pipeline will benefit from developing new skillsets and harnessing technology to improve their productivity; for example, project managers are using building information modeling (BIM) to digitally model the progression of projects, and construction workers are performing dangerous tasks with drones instead of in-person. Technology has the potential to disrupt the number of jobs within the different occupational categories across the industry, as well as the job activities associated with a particular occupation and the number of future jobs. However, there are still opportunities available in the essential construction professions that are not as easy to automate, such as plumbers, pipe layers and bricklayers.

ADDITIONAL TRENDS

Two trends to watch are the utilization of data analytics and the Internet of Things (IoT) in construction. These are helping managers make their worksites more efficient by analyzing how best to improve performance and quality while maintaining worker safety. As the technology improves, particularly for monitors that can be worn by individual workers, analytical and planning roles will become more in-demand.

Another trend to monitor is how the current shortage of workers available to fill important construction jobs might impact the industry. Firms are realizing the need to create better training and recruitment programs in schools in order to prepare more students for these future in-demand roles, and in many cases, to spread awareness amongst younger people that they can still build meaningful careers in these construction-related occupations.

Finally, perhaps an underrated and unexpected trend in construction is the need for workers to develop better soft skills, especially in communication and customer relations. In the digital era, contract work has become more competitive as customers have a wider array of options and the means to quickly engage with, vet and compare many firms. In order to retain and expand business, and improve the yields on their marketing and business development activities, construction businesses are pushing to personalize their services for each specific customer and working to fulfill a wider range of needs instead of performing one single function. As such, divisions that interact with customers are facing pressure to create stronger client relationships and offer a greater amount of services than before.

Construction
An industry with growing workforce shortages.

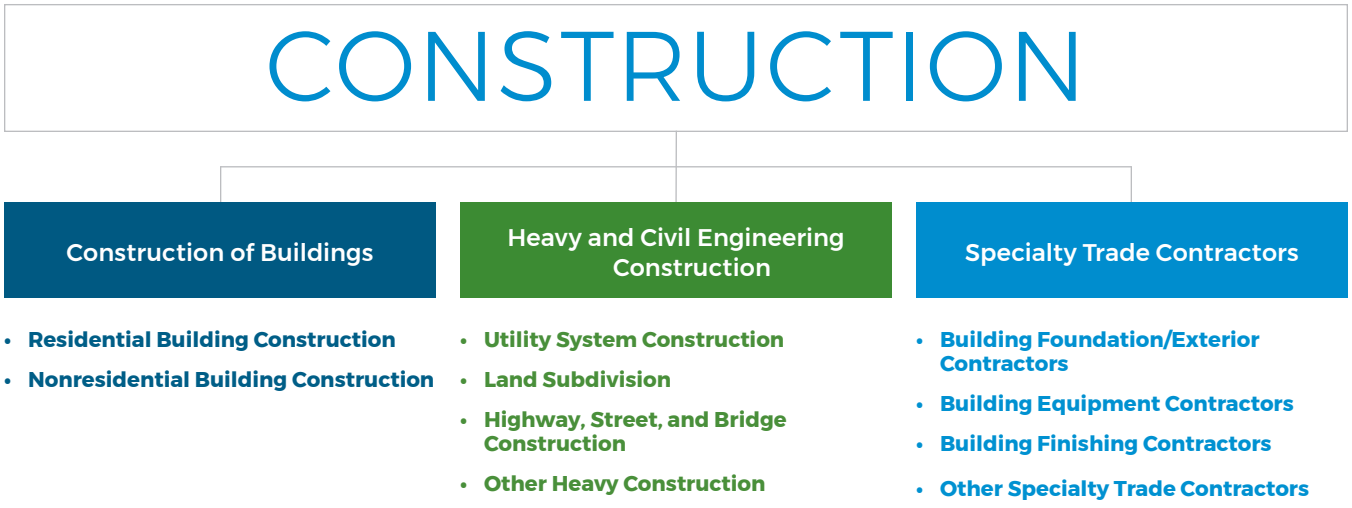
Building on the success of its 2017 baseline report, "L.A. & Orange County Community Colleges: Powering Economic Opportunity," the Center for a Competitive Workforce once again joined forces with the LAEDC's Institute for Applied Economics to identify significant opportunities within the L.A. Basin for community college students. This report focuses exclusively on the construction industry, its subsectors, and high-growth occupations. This and forthcoming reports are intended to encourage the Center and the region's community colleges to develop partnerships with industry in order to amplify understanding about the region's labor markets and workforce gaps, as gauged by the difference between industry needs and community college completions.

The construction industry has a very significant presence in the region, and is forecasted to grow steadily to keep up with the region's demands for more housing and renewable energy infrastructure for electric vehicle, smart grid integration and solar. In the construction industry, technical skills, craftsmanship and critical thinking skills are of paramount importance. Creative problem solving and excellent communication skills are also essential to many construction component industries and their occupations, especially for Specialty Trade Contractors. For all the target occupations selected for this report, employment opportunities are strong, especially for middle-skill workers. For this reason, the industry offers significant opportunities for students attending community colleges in the region.

The Construction Industry Defined

Three industry subsectors and their ten component industries make up the construction industry sector; the Construction of Buildings subsector (comprised of the industries of Residential and Nonresidential Building Construction); the Heavy and Civil Engineering Construction subsector (comprised of the industries of Utility System Construction; Land Subdivision; Highway, Street and Bridge Construction; and Other Heavy Construction); and the Specialty Trade Contractors subsector (comprised of the industries of contractors in Building Foundation/Exterior; Building Equipment; Building Finishing; and Other Specialty Trade). This report provides forecasts of the three construction industry subsectors as well as industry snapshots of their ten component industries.

The Los Angeles Basin's construction businesses employ a wide range of workers by occupation, skill level, educational attainment and experience. There are distinct differences across the component industries that comprise the construction industry, including the size of operations and staffing patterns. Labor shortages and skills gaps vary among these industries and across occupations.



The Construction Workforce

Due to the strength of the California construction industry, and a shortage of essential workers, there are many pathways to join the workforce. This is especially true for students, job seekers and incumbent workers who are willing to learn how to use a variety of new worksite technologies and participate in training and retraining programs. To address the growing usage of data analytics in the construction industry, the current workforce must be augmented by employees with new and more technical skillsets. However, there will also be many positions available in traditional occupations such as bricklayers, sheet metal workers, pipe layers and more.

The construction industry employs many workers in the Los Angeles Basin across three major areas: construction of buildings; heavy and civil engineering construction; and specialty trade contractors. Within these three sectors, there are numerous middle-skill occupations available for workers with an associate degree, postsecondary nondegree award, or certification, which can provide entry into the industry. These workers may then become more specialized and move up the ranks as they gain greater experience and on-the-job training. Employers are particularly interested in workers with previous industry experience in the form of an apprenticeship, college training program, or other comparable certification.

The most influential recent development for the construction workforce has been the growing prevalence of technology across all aspects of the industry. Technology's influence begins even before the work starts at a construction site. Modeling programs allow firms to simulate project lifecycles before setting foot on location, and other programs handle scheduling and project management in the cloud. Similarly, new and compressed material preconstruction technologies and processes allow for prefabricated building modules to be built offsite and completely outfitted with furnishings, making onsite installation quick and simple. These abilities give construction companies an advantage by increasing coordination and efficiency while reducing waste.

At the worksite itself, a range of technological advantages are paying major productivity and efficiency dividends. Self-operating equipment and artificial intelligence are at the forefront of allowing employers to conduct tasks safely and more productively. Furthermore, three-dimensional printing is becoming extremely useful to produce parts onsite and on-demand. Augmenting the traditional workforce with technological upgrades is helping workers do their jobs better and with fewer concerns.

Construction

An industry with growing workforce shortages.

The far-ranging abilities of technology are also changing the types of products being created in the construction industry. For example, breakthroughs in the design and energy output of solar technology have allowed firms to become more flexible with the usage of such installations. Many firms are also upgrading buildings with modern devices and smart technology that responds to user inputs or the surrounding environment. Often these devices are energy-efficient and save consumers money; as such, the growing popularity of these products will increase construction industry demand.

Perhaps the most transformative technology has been the introduction of IoT into the construction site. Data analytics can help employers analyze worker performance and production quality, monitor the safety of the jobsite, harness predictive maintenance, anticipate failures, and more. As cameras and sensors grow smaller, they have become easier to install around worksites and even on workers themselves, giving project managers an unprecedented level of access and control over their surroundings.

Accordingly, the composition of the construction workforce must change to adapt to these changes. Workers that are already skilled with technology or able to quickly learn on the job will be extremely important. Additionally, managers must learn to structure their worksites and project lifecycles around technological aids like building information technology and cloud solutions to make construction projects more efficient, safe and productive. Meanwhile, those with backgrounds in data analytics or similar fields may find employment opportunities in construction as firms look to expand their capabilities.

EXHIBIT 1:
AVERAGE MONTHLY EARNINGS 2017
BY EDUCATIONAL ATTAINMENT, AGES 25+ YEARS

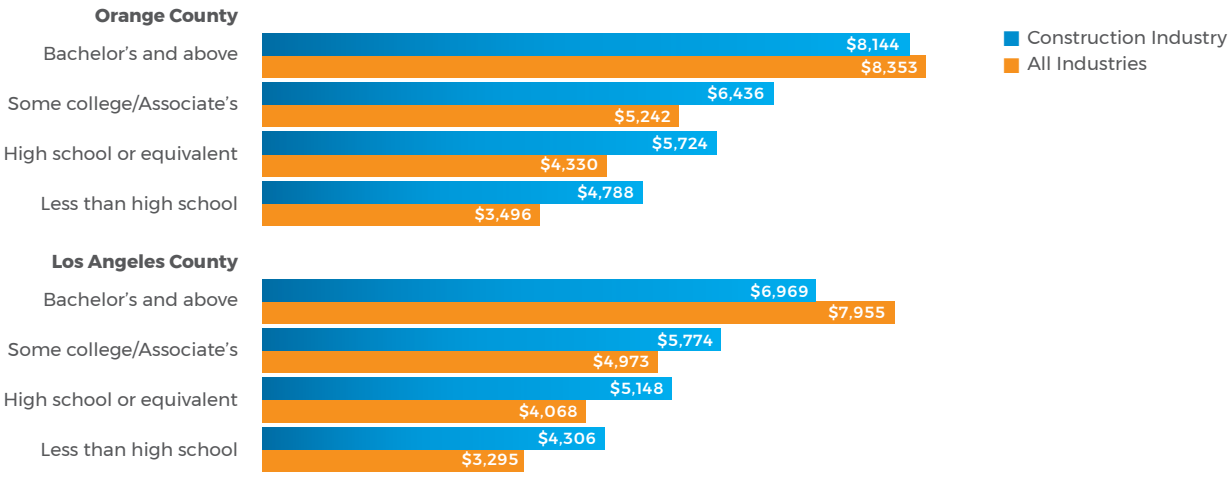
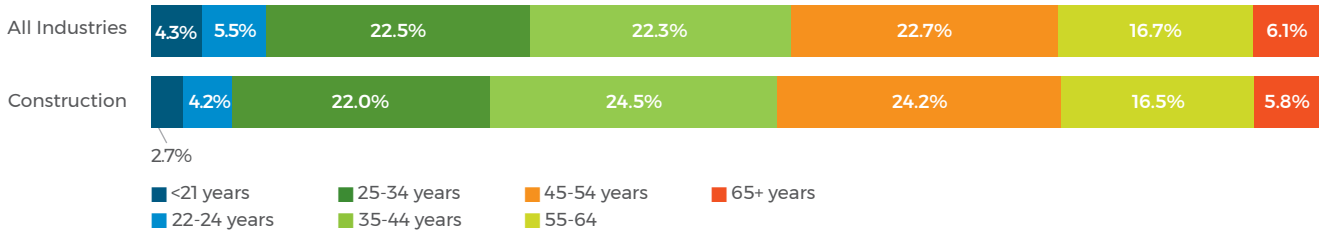


EXHIBIT 2:
AGE DISTRIBUTION OF WORKFORCE



While these technologically-integrated occupations are becoming more prevalent in the industry, many construction firms are facing hiring shortages for some of the more traditional and most integral jobs in the industry. Occupations such as bricklayers, drywall installers, pipe layers and plumbers, sheet metal workers, carpenters, and others are becoming much harder to fill. This may be the result of the devaluing and subsequent defunding of trade education in schools that has happened as students have sought careers in higher-skilled jobs. As a result of these workforce shortages, firms are looking to establish reliable training pipelines that can provide new workers capable of performing these essential roles.

The age distribution of the workforce in the construction industry is presented in Exhibit 2. It indicates that upskilling or additional training opportunities are a feasible option for workers already employed in the industry. With nearly 30 percent of the workforce under 34 years of age, construction employees have time to adapt to industry changes, which may improve the value of their skill sets in other occupations with higher wages and/or growth projections. The construction industry has a smaller share of workers under the age of 24 years compared to the average across all industries. However, as community colleges and other institutions educate young workers on the employment opportunities available in the industry, occupations with high-growth projections, and relatively higher wages for those with less than a bachelor's degree (Exhibit 1), more young workers may be attracted to join the construction workforce.

In light of these technological, demographic, and labor market trends, there are several ways workers looking to enter the construction industry can make themselves stand out to employers. Experience with relevant technology will be in high demand, but an understanding of the more basic trades in construction will also be helpful. It is recommended that those wishing to build a career in the construction industry remain adaptable to increasing responsibilities and willing to learn new skills on the job so they can be an asset and fulfill a number of needs across different projects. The region's construction industry is expected to remain strong, so those willing to learn the necessary tools of the trade will be able to build solid careers.

EXHIBIT 3:
CURRENT DEGREE OF AUTOMATION

Highly Automated	Moderately Automated	Slightly Automated	Very Little Automated
• None	• Segmental Pavers • Paving, Surfacing, and Tamping Equipment Operators • Helpers — Roofers	• Electricians • Cement Masons and Concrete Finishers • Floor Sanders and Finishers • Elevator Installers and Repairers	• Solar Photovoltaic Installers • Pile-Driver Operators • Tile and Marble Setters

Utility system construction experienced a 25 percent leap in payroll employment over the last decade.

Sizing Things Up
The industry defined.

Analysis of construction trends provides insights into the challenges and opportunities facing the industry's workers and employers. Understanding where the jobs are now and where they will be in the future is critical to the development of training and career educational programs. It is also essential to constructing regional policies to fill the jobs of the future with a workforce that is competitive in a fast-changing global economy.

In this section, job counts, changes in payroll employment, and wages are discussed for the L.A. Basin counties of Los Angeles and Orange.

Industry Employment

The construction industry employed 238,530 public and private payroll workers in the LA Basin in 2017 (Exhibit 4), accounting for 4.5 percent of total regional employment. Construction workers in the region account for just under 30 percent of all construction employment in California, and 3.4 percent of construction employment nationwide. Building equipment contractors accounted for nearly a third of total industry employment. Building finishing contractors comprised the next largest share with over 16 percent of all industry employment (40,100 jobs), and building foundation contractors and residential building construction workers each make up another 13 percent.

construction

EXHIBIT 4:
EMPLOYMENT DISTRIBUTION ACROSS THE CONSTRUCTION INDUSTRY IN THE L.A. BASIN

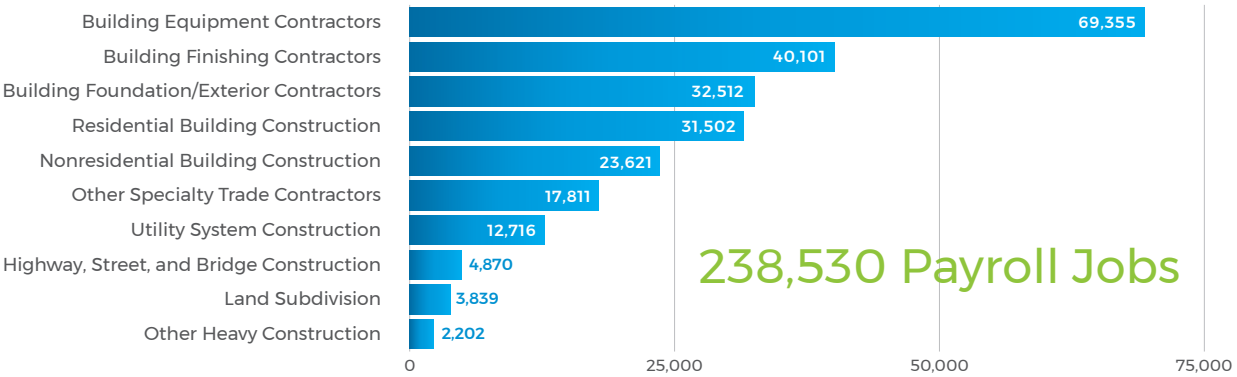
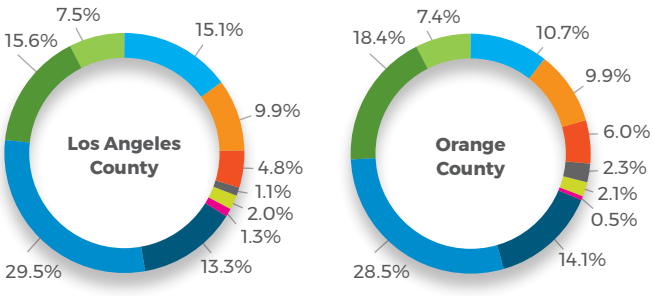


EXHIBIT 5:
CONSTRUCTION EMPLOYMENT DISTRIBUTION IN L.A. AND ORANGE COUNTIES IN 2017



The composition of the construction industry employment varies little between L.A. and Orange counties (Exhibit 5). In both counties, the Building Equipment Contractor industry accounts for the largest share of employment, employing 40,490 workers in L.A. County (29.5 percent) and 28,870 workers in Orange County (28.5 percent).

However, the size of the industry differs significantly between the two counites; there are 137,400 payroll employees in the construction industry in Los Angeles County, versus 101,130 in Orange County. Consequently, there will be differences in the number of middle-skill employment opportunities in each.

Overall, employment in the industry has fallen in the last ten years, with an average annual decrease of 1.7 percent per year. From 2007 to 2017, construction employment in the region declined by 8.6 percent (-22,530 jobs) compared to 5.6 percent total payroll employment growth across all industries (Exhibit 6).

Much of the job loss in this industry over the past decade has been concentrated in four construction component industries: Land Subdivision, Building Finishing Contractors, Other Heavy Construction, and Residential Building Construction. Overall, each of these four industries lost more than 20 percent of payroll employment from 2007 to 2017, a loss of 23,770 jobs in total.

However, job growth performance across the component industries was mixed. For example, Utility System Construction experienced a 25 percent leap in payroll employment, increasing from just over 10,000 jobs in 2017 to 12,710 jobs in 2017, while the Building Equipment Contractor industry added 5,860 jobs (a 9.2 percent increase) over the same period.

Over the last decade, wage growth in other heavy construction grew by 21.6 percent, far outpacing real wage growth in other component industries.

Industry Wages

Employees in the construction industry typically earn higher-than-average wages compared to the regional economy (Exhibit 7). Employees in this industry earn, on average, $77,060, an annual wage premium of close to $16,000; the regional average across all industries is $61,510. Still, this is only an average across all construction industries. Some component industries pay significantly higher wages while others pay significantly lower wages. For example, despite a decline since the highpoint of 2007, employees in the Land Subdivision component industry are among the highest paid in this industry, earning an average wage of $103,570 in 2017, followed by the Other Heavy Construction component industry with an average wage $100,470.

From 2007 to 2017, real wages in the construction industry grew by 4.3 percent overall. This is slightly less than real wage growth across all industries in the Los Angeles Basin, where inflation-adjusted (real) wages increased by just under five percent (Exhibit 7). Over the last decade, wage growth in Other Heavy Construction grew by 21.6 percent, far outpacing real wage growth in other component industries. Real wages in the Utility System Construction industry and Building Finishing Contractors industries grew by 11.3 percent and 10.3 percent, respectively. Two of the ten construction component industries have experienced a decline in real wages: Land Subdivision (10.2 percent decrease) and Residential Building Construction (2.1 percent decrease).

EXHIBIT 6:
CHANGE IN PAYROLL EMPLOYMENT FROM 2007 TO 2017

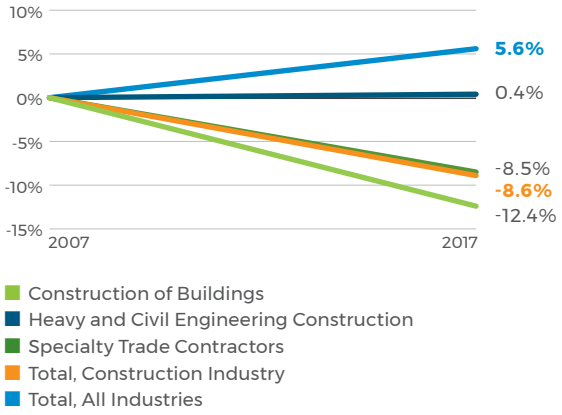
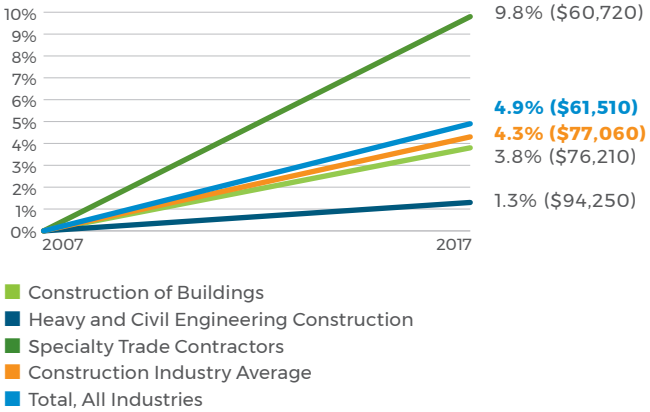


EXHIBIT 7:
CHANGE IN REAL WAGES FROM 2007 TO 2017



Demand-side Analysis
Industry outlook and future workforce needs.

To determine where the construction industry is headed, the growth of its component industries was forecasted over the next five years and used to extrapolate future workforce needs.

Construction Industry Outlook

The Specialty Trade Contractor subsector employs the most workers in the L.A. Basin's construction industry. In 2017, nearly 160,000 workers were employed in this industry subsector, and growth is expected to continue with a projection of an additional 8,770 net jobs by 2022 (5.5 percent). The largest share of the specialty trade contractor workforce —43 percent— is employed in the Building Equipment Contractors Component industry (69,360 jobs); this industry is forecasted to experience the most growth between 2017 and 2022. Construction of Buildings, which is comprised of the Residential and Nonresidential Building Construction industries, will also continue to be a significant employer in the region, adding 2,980 jobs by 2022 (5.4 percent). While comprising a smaller share of total employment, Heavy and Civil Engineering Construction will add 1,180 jobs between 2017 and 2022 and continue to be an essential component of the region's construction industry (Exhibit 8).

EXHIBIT 8:
CONSTRUCTION OUTLOOK

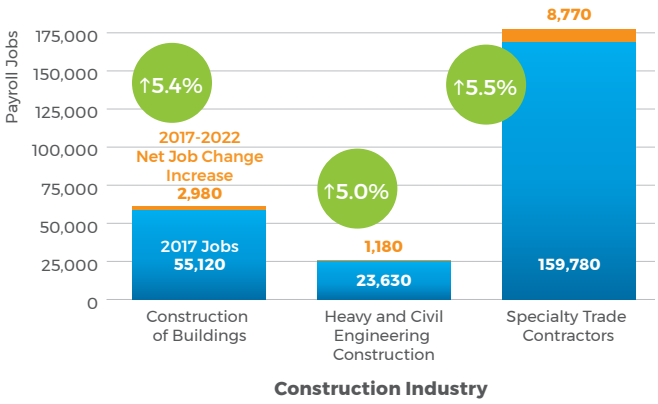


EXHIBIT 9:
251,460 JOBS IN 2022
(169,100 NEW OPENINGS)

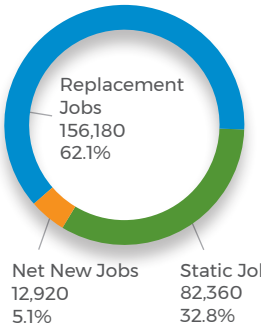
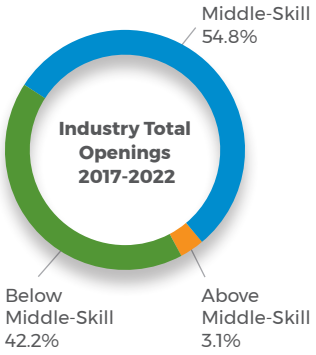


EXHIBIT 10:
SKILLS CLASSIFICATION
FOR THE REGION'S
CONSTRUCTION INDUSTRY



The number of projected new jobs can be combined with job openings from replacements and retirements to provide an overall estimate of employer hiring needs. Overall, employment in the construction industry is forecasted to reach 251,460 jobs in 2022, of which 156,180 will be replacement workers (Exhibit 9). Between 2017 and 2022, there will be over 169,000 new openings.

Of all the construction industry openings over the five-year period, just under 55 percent will be in middle-skill occupations requiring some college education such as an associate degree or a nondegree award or certificate; this reinforces the selection of this industry as a valid target for community college programs (Exhibit 10). Only three percent (3%) of the projected openings will be for workers with a bachelor's degree or higher, representing jobs that are above middle-skill. A significant share of total openings, just over 42 percent, are expected to be in occupations classified as below middle-skill, requiring a high school diploma or less.

Characteristics of Workers Hired

Observing the characteristics of workers hired in the industry can reveal who is filling vacant positions. The composition of all hires (the sum of new hires and recalls) in the construction industry in the Los Angeles Basin varies according to educational attainment, age, and race, and ethnicity.

The construction industry provides a wide range of jobs to individuals with different levels of education (Exhibit 11). Nearly a quarter (24.3 percent) of all hires, which include the estimated number of workers who started a new job in 2017 (new hires and recall employees), were middle-skill workers. Above middle-skill workers, those with a bachelor's degree or higher represent just under 14 percent of all hires, while those with a high school diploma or less (below middle-skill) account for nearly half (48 percent) of all new hires in 2017.

The construction industry hires a significant share of young workers. Of all new hires in 2017, just under 40 percent (39.8 percent) were under the age of 34. Close to a quarter (23.6 percent) were between 35 and 44 years old. New hires between the ages of 45 and 54 years accounted for just over 20 percent (20.1 percent). The share of new hires beyond 55 years of age was 16.6 percent in 2017 (Exhibit 12).

Regionally, the construction industry workforce is both racially and ethnically diverse (Exhibit 13). Over half (53.8 percent) of all new hires in 2017 were Hispanic or Latino (all races). White workers represented a third (33.3 percent) of hires, while Asians and black/African American workers account for 4.8 percent and 5.8 percent of the hired workforce, respectively.

EXHIBIT 11:
NEW HIRES IN 2017, EDUCATIONAL ATTAINMENT

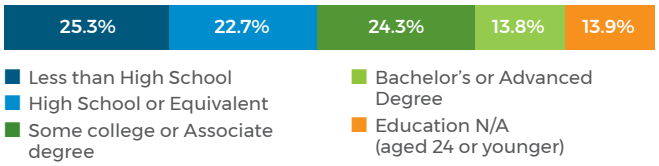


EXHIBIT 12:
NEW HIRES IN 2017, BY AGE GROUP

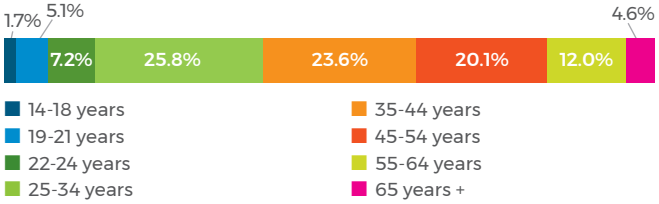
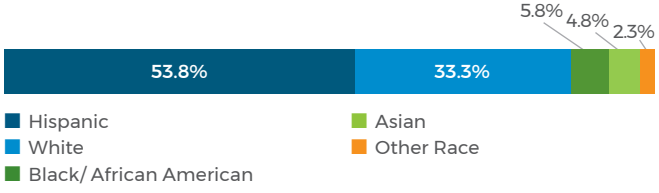


EXHIBIT 13:
NEW HIRES IN 2017, RACE AND ETHNICITY



Occupational Movement in the Industry

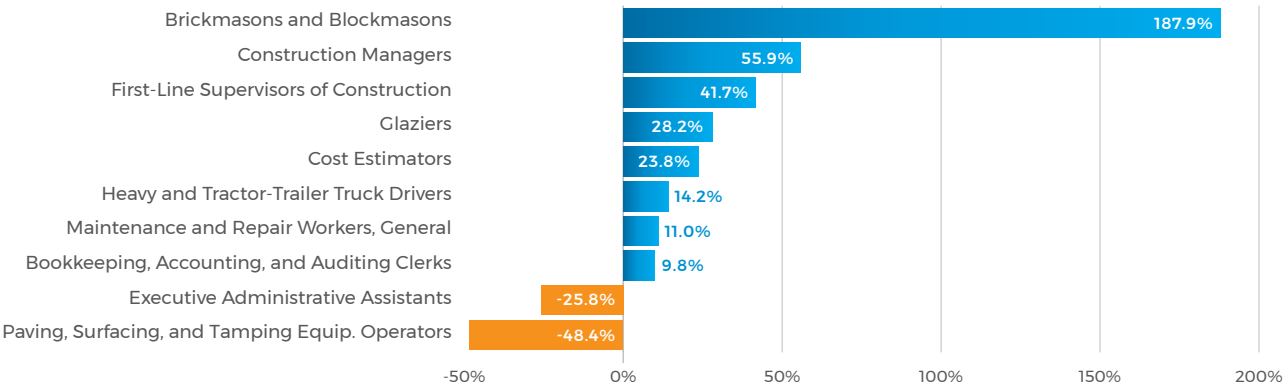
The construction industry has undergone significant changes over the last decade that have impacted the industry's workforce. In particular, technology-driven changes have had both positive and negative affects on component industries.

Identifying construction occupations that have experienced employment change, both positive and negative, can help us to identify trends that may be transforming the industry's workforce. For this reason, this report looks at the employment change in occupations from 2012 to 2017, along with their forecast employment, to identify those exhibiting robust growth and those that may be on the verge of becoming obsolete. These changes are depicted in Exhibit 14. Secondarily, based upon the jobs identified, we attempt to identify the underlying cause of these rates of change.

Significant job gains in occupations can mean positive growth for other supporting occupations. For example, growth in the Construction of Buildings industry requires increased demand for occupations such as *brickmasons, blockmasons,* and *glaziers.* These workers are needed both during the initial phases of a development project and after construction is complete to maintain and repair existing structures. New projects and building regulations are also driving demand for supporting occupations such as *cost estimators* and *construction managers.* As projects require workers with both hands-on experience and technical skill sets to adhere to increasingly complex state and local codes, the need for personnel that can oversee many moving parts of a project has become an increasingly essential component to success.

growth

EXHIBIT 14:
OCCUPATIONAL MOVEMENT
JOB GROWTH 2012 TO 2017

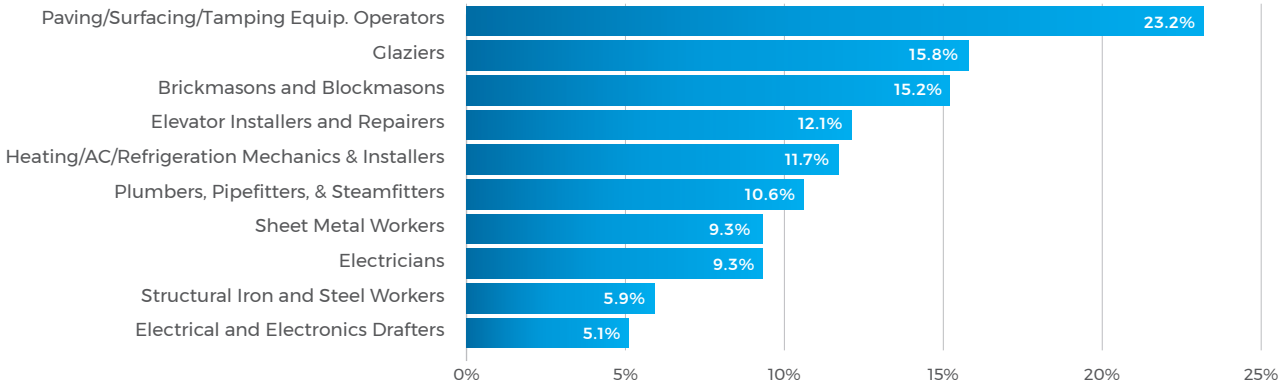


Some occupations in the construction industry are particularly susceptible to displacement by automation. *Administrative assistants* and *equipment operators* have seen significant employment declines since 2012 (Exhibit 14). Unlike *managers* and *supervisors* who are required to have critical thinking and leadership skills, or *glaziers* and *repair workers* who possess detailed knowledge of their craft, the occupations experiencing declines are reliant on repetitive and routine tasks that can be replicated by robots or technological systems. Workers in the construction industry should focus on attaining a high-level of expertise for their craft as well as excellent social, relationship, and communication skills to advance up the "career ladder" and avoid losing job opportunities to automation.

The construction industry has several middle-skill occupations that have significant employment churn and relatively higher numbers of replacement jobs annually. This is important to note, as occupations with a lot of movement can have a negative net change in new jobs while still holding a high number of total openings. For example, retirements represent additional job opportunities not related to growth. In the event that the predicted net change in jobs in a particular occupation slowed and dipped negative, the large number of openings from individuals changing jobs and retiring would still provide opportunities for job seekers.

One explanation for particularly high employment churn is the use of contingent workers (short-term workers that typically work on a per-project basis, such as consultants and independent contractors). Examples of occupations in the construction industry with high replacement rates include *equipment operators, glaziers,* and *brickmasons* and *blackmasons* (Exhibit 15).

EXHIBIT 15:
MIDDLE-SKILL OCCUPATIONS WITH HIGH EMPLOYMENT CHURN



Workforce and Technology Trends

CONSTRUCTION OF BUILDINGS & HEAVY AND CIVIL ENGINEERING CONSTRUCTION

Construction industries are embracing the role of technology in the workplace, and many firms are using apprenticeships and retraining programs to prepare their workers for this transition. At the forefront of this evolution is building information modeling (BIM) technology, used to design and simulate an entire construction project's lifecycle. This is beneficial for project management and coordination, and is also critical for cutting costs. Meanwhile, a greater reliance on and integration of drones, three-dimensional printing, and self-operating vehicles are other technologies that are being incorporated into the construction project lifecycle. Software and mobile solutions are becoming more important for expediting preconstruction, scheduling, and facilitating project management. Linking these solutions to the cloud allows for real-time updates and collaboration, as well as easier data collection and transmission.

Another place where technology has been useful is modular and prefabricated offsite construction; rooms are built in a controlled environment where they are outfitted appropriately with fixtures and finishes, and then fitted together onsite.

With regards to analytics, firms are using artificial intelligence to turn the vast amounts of data they have gathered into productive solutions. They can analyze how workers perform their tasks, assess the quality of production, identify errors, and more. Wearables are also being integrated into this workflow to monitor workers and make the jobsite safer. Other innovations include virtual safety and equipment operator training to help workers become familiar with dangerous tasks in a controlled environment.

Overall, there are a wide range of uses for technology in construction industries, with an emphasis on increasing productivity, efficiency, and safety.

SPECIALTY TRADE CONTRACTORS

Specialty trade contractors are using technology in one extremely important way: communication. This is critical in the process of subcontracting, as digital technologies can expedite the bidding process and work authorization, evaluate the performance of subcontractors efficiently, easily manage payments, and much more. By using apps, cameras, sensors, and other wearables, contractors are connecting to the Internet of Things to gather this data more efficiently. While in the field, these firms are hoping to harness artificial intelligence to allow for predictive maintenance and diagnostics, helping them dispatch technicians when products and components are close to expiration or failure. Firms have also adopted and deployed three-dimensional printing at job sites to manufacture new parts as needed, and even use augmented reality glasses to aid the repair and service processes.

ENERGY-EFFICIENT INSTALLATIONS

Technology has made the modern home more energy-efficient and self-sufficient in many ways. Electronic devices and appliances can now be linked to the internet, providing real-time data to help users understand and lower their energy usage. Many of these processes are already automated, such as control systems for heating and cooling units, or systems that use data such as room temperature, humidity, light level, and occupancy to control settings. Dishwashers, refrigerators, and washing machines are some of the appliances that have greatly benefitted from improvements in smart technology. However, these applications are expanding to encompass almost every aspect of the home environment and experience. Advanced window controls are one example, as highly insulated windows use sensors and microprocessors to adjust shading based on the amount of available light. Energy efficiency improvements have also been achieved through advances in "green" technology, such as improved LED lighting, solar panels, energy storage and related controls. As technology improves, installations will become even more energy-efficient, cost-effective, and relevant for homeowners.

ELECTRIC VEHICLE CHARGING STATIONS (EVSE)

With programs and incentives to achieve its goal of having five million electric vehicles (EV) on the road by 2030, California has catalyzed growth in the electric vehicle market. The issue for many is whether the state can build the necessary infrastructure to provide millions of vehicles with charging capabilities. In response, the California Energy Commission and innovative start-ups throughout the state are accelerating EV adoption by deploying chargers and creating incentive programs for homes and businesses to make the shift to electric vehicles. Legislation in the state is now calling for EV charging infrastructure to be available for ten percent of all parking spaces in multi-unit housing. Charging goals put forth by the City of L.A.'s Green New Deal estimate that charging will support an additional 1,500 jobs for Angelinos.

The construction industry stands to gain from local and state-wide EV goals, as the industry's workforce will be tasked with the planning, installing and maintenance of chargers. Contractors and workers familiar with EV technology will be especially valuable in the coming years as developers strive to achieve zero emissions climate goals.

SOLAR IN THE GOLDEN STATE

REGULATIONS DRIVING GROWTH

As of January 1, 2020, new homes built in California will be required to feature a solar electricity system. Solar power can either come from the new installation of solar panels by homeowners and builders or from tapping into a local solar site. The new building code is intended to help California reach carbon-neutral energy status by 2045 and improve environmental conditions in the state. While the mandate is expected to increase upfront costs to homeowners and add extra delays for developers, the push for solar and related energy storage is fueling growth in the construction industry. Increased solar projects in the state are creating new job opportunities within construction, from installing new panels, energy storage and related controls on existing buildings and incorporating solar into new construction projects, to repairing and maintaining previously installed panels and related systems.

Target Occupations

Despite the rise of new technology in the construction industry, many of the target occupations identified in this report are more traditional and rely less on automation. There are many critical construction occupations with a high number of total openings for new workers, most of which benefit from prior experience, training, or trade and technical knowledge. In this section, promising middle-skill occupations in the construction industry are identified.

The highlighted occupation with the highest level of employment in 2017 (25,450 jobs) is *carpentry*. Annual openings for *carpenters* across all industries are projected at 4,250 jobs (Exhibit 16). *Carpenters* are responsible for constructing and repairing wood structures and fixtures, as well as building frameworks and floors. They have several important functions in the construction industry and are critical on all major projects. Over 90 percent of *carpenters* in the L.A. Basin have less than a bachelor's degree, indicating that middle-skilled workers are ideal for this occupation. *Carpenters* generally build expertise over time; indeed, the majority of the workforce is over 40 years old.

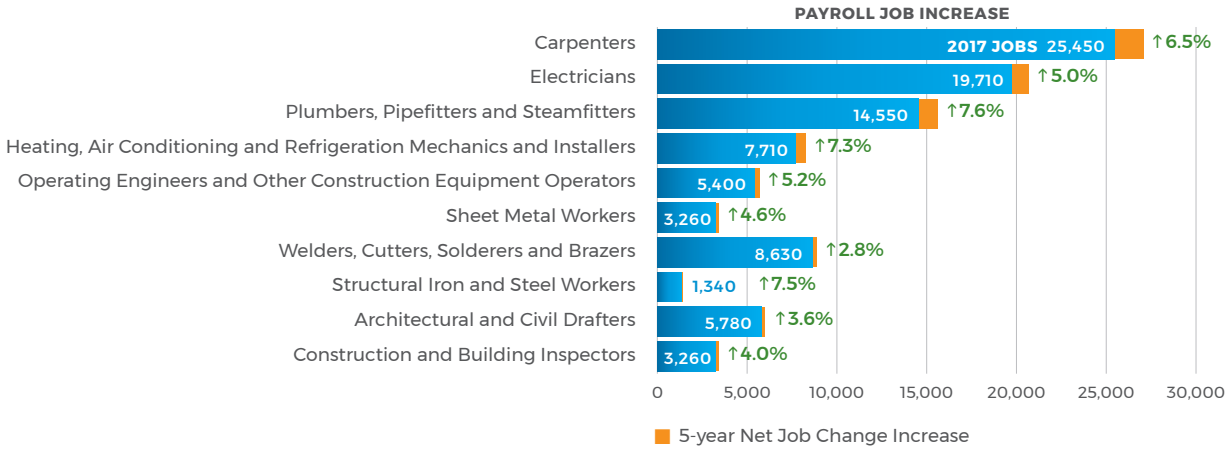
Electricians are another occupation that has a positive outlook, with forecasted growth of 7.6 percent between 2017 and 2022 and close to 20,000 total jobs in the L.A. Basin. Nearly three-quarters of *electricians* fall into the specialty trade contractors subsector, as they are generally called in for the installation and maintenance of electrical wiring, equipment, and fixtures rather than heavy construction or construction of buildings. *Electricians* are in demand across a wide range of industries in California, and with a median annual wage above $60,000, they represent an attractive middle-skill opportunity.

Additional specialty service occupations that this report covers are *plumbers, pipefitters* and *steamfitters*, and *heating, air conditioning and refrigeration (HVAC/R) mechanics and installers*. These occupations perform essential auxiliary services that complement large construction projects, including the assembly of water and heating pipelines and the installation of air conditioning and refrigeration units. Payroll jobs in these two occupations are expected to grow 7.6 percent and 7.3 percent, respectively, across all industries (Exhibit 17).

EXHIBIT 16:
TARGET MIDDLE-SKILL OCCUPATIONS
BY TOTAL OPENINGS 2017-2022

		CONSTRUCTION INDUSTRY		ACROSS ALL INDUSTRIES		
SOC	Occupation	2017 Employment	Annual Openings	2017 Employment	Annual Openings	Median Hourly Wage
47-2031	Carpenters	21,320	3,550	25,450	4,250	$25.17
47-2111	Electricians	14,210	1,980	19,710	2,740	$30.35
47-2152	Plumbers, Pipefitters and Steamfitters	12,080	1,680	14,550	2,030	$24.98
49-9021	Heating, Air Conditioning and Refrigeration Mechanics and Installers	5,850	900	7,710	1,190	$28.31
47-2073	Operating Engineers and Other Construction Equipment Operators	3,480	450	5,400	700	$38.63
47-2211	Sheet Metal Workers	2,300	320	3,260	460	$23.85
51-4121	Welders, Cutters, Solderers and Brazers	1,570	210	8,630	1,160	$18.21
47-2221	Structural Iron and Steel Workers	970	90	1,340	130	$27.08
17-3011	Architectural and Civil Drafters	550	50	5,780	550	$28.71
47-4011	Construction and Building Inspectors	180	30	3,260	430	$42.56
Total Employment		**62,420**	**9,260**	**95,090**	**13,640**	

EXHIBIT 17:
TARGET OCCUPATIONS EMPLOYMENT OUTLOOK, ACROSS ALL INDUSTRIES



There are also structural occupations that, while they have less overall employment and annual job openings, represent essential construction roles that firms will always be looking to fill. These include *sheet metal workers, structural iron and steel workers, operating engineers,* and *welders and cutters.* Though wages in these roles are generally lower, workers can rise to high levels of specialization with training and experience, and perform more essential functions within their company bolstered by these base skillsets. As the vast majority of workers have at most an associate degree, these are important middle-skill positions available to a variety of trade workers.

Finally, this report examines two softer-skill roles: *architectural and civil drafters,* and *construction and building inspectors. Drafters* are hired for detailed drawings of architectural and structural features of buildings or topographical relief maps used in civil engineering projects, such as highways, bridges, and public works; they are required to have knowledge of mathematics and engineering principles. Meanwhile, *inspectors* use similar engineering skills to determine structural soundness and compliance with specifications, building codes, and other regulations. These occupations are indicative of the wide range of roles available in construction, though they generally require a higher level of education for consideration. The occupation of *construction and building inspector* has a median annual salary of nearly $90,000 for qualified employees.

Although there are particular skills required of each individual occupation, general competencies that will be necessary include flexibility and the ability to learn and utilize new technologies in everyday activities. The construction worksite is changing, and workers that can adapt to these changes and perform high-quality work will be in a good position to succeed.

The occupations predicted to have significant job growth over the next five years —and those which stand to benefit from investment into apprenticeship and training programs— include *carpenters, plumbers,* and *structural iron and steel workers.* Across the ten highlighted occupations, the region is forecasted to add 5,420 net new jobs by 2022 (Exhibit 17).

The ten target middle-skill occupations in the Los Angeles Basin over the next five years are shown in Exhibits 16 and 17.

Supply-Side Analysis
The region's community college talent pool.

This section details community college program offerings and student completions related to middle-skill occupations in the L.A. Basin's construction industry. For a complete list of colleges with related program offerings, see Appendix A. Classified by major occupational group, the ten middle-skill target occupations in construction offering promising career prospects for community college students were examined. These occupations have positive employment outlooks and pay above the living wage in the region. In total, 14 community college programs in the region prepare students to enter these occupations in construction. During the 2018-19 academic year, these 14 programs conferred 1,773 certificates and associate degrees.

Over the next five years, the L.A. Basin can expect a combined 9,260 job openings annually across the ten identified target middle-skill occupations in construction, and 13,640 job openings in these occupations across all industries. While the region may be facing a workforce shortage in coming years, there is projected to be an undersupply of nearly 7,500 workers to fill construction-related job openings within construction industries. The selected construction occupations have strong median hourly wages between $18.21 and $42.56. In fact, wages for one occupation, *construction and building inspectors*, are nearly three times the living wage for the Los Angeles Basin.

Supply data in this report includes only community college completions (certificates and associate degrees). Awards for the 2018-19 academic year are used throughout this report to gauge the amount of qualified construction workers entering the industry. Due to a lack of centralized information on apprenticeship completions, these completions are not included in the report.

The following section will explore in depth which occupational clusters are meeting workforce demand and which are falling short. Because construction occupations exist across many different industries, occupations were categorized into the following four major occupational groups.

MAJOR OCCUPATIONAL GROUPS:

1. **Architecture and Engineering**
2. **Construction and Extraction**
3. **Installation, Maintenance and Repair**
4. **Production**

Construction and extraction occupations is the largest group within construction in terms of employment and projected growth, accounting for more than 87 percent of construction job annual openings. This major group also has the highest median hourly wage, with an occupational group average of $30.37.

According to LaunchBoard data from the 2016-17 academic year (most recent available), there were 23,008 unique students enrolled in one or more energy, construction and utilities (ECU) courses in the L.A. Basin. Male students account for 85 percent of enrollments and predominantly fill ECU courses. More than half of the students in advanced manufacturing programs are Hispanic and nearly a quarter are white. The majority (65 percent) of ECU students are 29 or younger, with 44 percent of students being under 25 years old.

Architecture and Engineering

Within the construction industry, 50 annual job openings are projected for the one occupation related to architecture and engineering: *architectural and civil drafting*. Approximately ten percent of *architectural and civil drafters* are employed within construction industries, and the vast majority (90 percent) are employed outside of the construction industry. Across all industries, there are 550 annual openings for this architecture and engineering occupation (Exhibit 1). *Architectural and civil drafters* have high median wages at $28.71 per hour.

There seems to be an oversupply of qualified middle-skill workers from community colleges to fill open *drafter* positions, as there were 578 awards conferred in the 2018-19 academic year and only 50 annual openings within construction industries. The architecture and architectural technology program had the most completions out of the four related training programs, with 308 for-credit awards conferred in the 2018-19 academic year. Of the four programs that have historically trained for the occupation, the civil drafting program conferred the fewest. This signals an oversupply of workers for the one architecture and engineering occupation, given the 578 for-credit awards conferred annually and the 550 annual job openings across all industries. In addition to the for-credit awards listed in Exhibit 2 (below), the regional architecture and architectural technology programs issued 30 other-credit awards during the 2018-2019 academic year.

supply

EXHIBIT 1:
EMPLOYMENT, ANNUAL OPENINGS, AND WAGES FOR ARCHITECTURE AND ENGINEERING OCCUPATIONS IN CONSTRUCTION AND IN ALL INDUSTRIES

		CONSTRUCTION INDUSTRY		ACROSS ALL INDUSTRIES		
SOC	Occupation	2017 Employment	Annual Openings	2017 Employment	Annual Openings	Median Hourly Wage
17-3011	Architectural and Civil Drafters	550	50	5,780	550	$28.71
		550	**50**	**5,780**	**550**	**$28.71**

EXHIBIT 2:
COMMUNITY COLLEGE AWARDS RELATED TO ONE ARCHITECTURE AND ENGINEERING OCCUPATION

Program	2014-2015 Awards	2015-16 Awards	2016-17 Awards	2017-18 Awards	2018-19 Awards
Architecture and Architectural Technology	199	221	245	341	308
Drafting Technology	217	204	203	321	255
Architectural Drafting	17	5	16	15	13
Civil Drafting	4	7	8	3	2
Total	**437**	**437**	**472**	**680**	**578**

Construction and Extraction Occupations

Projections through 2022 show that there will be 8,100 annual openings for the seven target middle-skill occupations included in the major occupational group of construction and extraction occupations. Approximately 75 percent of projected annual openings will occur within the construction industry – 8,100 annual openings within construction compared to 10,740 annual openings across all industries. With a median hourly wage between $23.85 and $42.56, these occupations present an attractive opportunity for community college graduates.

Currently, eight community college programs train students for the seven target occupations included in the construction and extraction occupations group. Collectively, the eight programs listed in Exhibit 4 conferred 838 awards in 2018-19, with environmental control technology programs conferring the most awards (58 percent of all awards). On a larger scale, there appears to be an undersupply of workers for the seven construction and extraction occupations studied in this section, given the 838 awards conferred in 2018-19 and the 10,740 annual job openings across all industries. It is also worth noting that regional community colleges issued 41 non-credit awards in the 2018-2019 academic year, in addition to the 838 for-credit awards.

EXHIBIT 3:
EMPLOYMENT, ANNUAL OPENINGS, AND WAGES FOR CONSTRUCTION AND EXTRACTION OCCUPATIONS IN CONSTRUCTION AND ACROSS ALL INDUSTRIES

		CONSTRUCTION INDUSTRY		ACROSS ALL INDUSTRIES		
SOC	Occupation	2017 Employment	Annual Openings	2017 Employment	Annual Openings	Median Hourly Wage
47-2031	Carpenters	21,230	3,550	25,450	4,250	$25.17
47-2073	Operating Engineers and Other Construction Equipment Operators	3,480	450	5,400	700	$38.63
47-2111	Electricians	14,210	1,980	19,710	2,740	$30.35
47-2152	Plumbers, Pipefitters, and Steamfitters	12,080	1,680	14,550	2,030	$24.98
47-2211	Sheet Metal Workers	2,300	320	3,260	460	$23.85
47-2221	Structural Iron and Steel Workers	970	90	1,340	130	$27.08
47-4011	Construction and Building Inspectors	180	30	3,260	430	$42.56
Total Employment		**54,450**	**8,100**	**72,970**	**10,740**	**$30.37**

EXHIBIT 4:
COMMUNITY COLLEGE AWARDS RELATED TO SEVEN CONSTRUCTION AND EXTRACTION OCCUPATIONS

Program	2014-2015 Awards	2015-16 Awards	2016-17 Awards	2017-18 Awards	2018-19 Awards
Environmental Control Technology	401	371	417	429	482
Heavy Equipment Operation	45	18	0	4	44
Carpentry	34	43	31	38	25
Electrical	180	178	140	177	202
Plumbing, Pipefitting and Steamfitting	35	23	35	35	10
Mill and Cabinet Work	37	33	12	32	17
Sheet Metal and Structural Metal	6	9	2	1	15
Construction Inspection	48	38	31	32	43
Total	**786**	**713**	**668**	**748**	**838**

Installation, Maintenance, and Repair Occupations

Within the construction industry, 900 job openings are projected annually through 2022 for one installation, maintenance, and repair occupation studied in this section. Approximately 76 percent of all job openings for *heating, air conditioning and refrigeration mechanics and installers* exist within the construction industry. The median wage for this occupation is $28.31, which is above the living wage in both Los Angeles and Orange counties.

During the 2018-19 academic year, community colleges in the region conferred 515 awards in two related programs. Environmental control technology programs conferred the majority of completions (94 percent), while six percent (6%) of awards came from energy systems technology programs. There appears to be an undersupply of *heating, air conditioning, and refrigeration mechanics and installers*, given the 515 awards conferred in 2018-19 and the approximately 1,190 annual job openings across all industries. In addition to these for-credit awards listed in Exhibit 6, eleven awards were issued as non-credit awards in the 2018-2019 academic year.

EXHIBIT 5:
EMPLOYMENT, ANNUAL OPENINGS, AND WAGES FOR ONE INSTALLATION, MAINTENANCE, AND REPAIR OCCUPATION IN CONSTRUCTION AND IN ALL INDUSTRIES

		CONSTRUCTION INDUSTRY		ACROSS ALL INDUSTRIES		
SOC	Occupation	2017 Employment	Annual Openings	2017 Employment	Annual Openings	Median Hourly Wage
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	5,850	900	7,710	1,190	$28.31
		5,850	**900**	**7,710**	**1,190**	**$28.31**

EXHIBIT 6:
COMMUNITY COLLEGE AWARDS RELATED TO ONE INSTALLATION, MAINTENANCE, AND REPAIR OCCUPATION

Program	2014-2015 Awards	2015-16 Awards	2016-17 Awards	2017-18 Awards	2018-19 Awards
Environmental Control Technology	401	371	417	429	482
Energy Systems Technology	51	47	64	59	33
Total	**452**	**418**	**481**	**488**	**515**

Production Occupations

Within the construction industry, 210 job openings are projected annually through 2022 for *welders, cutters, solderers, and brazers.* Approximately 18 percent of all job openings for this occupation exist within the construction industry. The median wage for *welders, cutters, solderers, and brazers* is $18.21 (Exhibit 5).

During the 2018-19 academic year, community colleges in the region conferred 324 awards in one related program. Welding technology programs in the L.A. Basin averaged 232 awards conferred annually between 2014 and 2019. There appears to be an undersupply of workers for the one production occupation, given the 324 awards conferred in 2018-19 and the approximately 1,160 annual job openings across all industries.

EXHIBIT 7:
EMPLOYMENT, ANNUAL OPENINGS, AND WAGES FOR PRODUCTION OCCUPATIONS IN CONSTRUCTION AND IN ALL INDUSTRIES

		CONSTRUCTION INDUSTRY		ACROSS ALL INDUSTRIES		
SOC	Occupation	2017 Employment	Annual Openings	2017 Employment	Annual Openings	Median Hourly Wage
51-4121	Welders, Cutters, Solderers, and Brazers	1,570	210	8,630	1,160	$18.21
		1,570	**210**	**8,630**	**1,160**	**$18.21**

EXHIBIT 8:
COMMUNITY COLLEGE AWARDS RELATED TO ONE PRODUCTION OCCUPATION

Program	2014-2015 Awards	2015-16 Awards	2016-17 Awards	2017-18 Awards	2018-19 Awards
Welding Technology	184	208	228	218	324
Total	**184**	**208**	**228**	**218**	**324**

Industry Forecast

WHERE THE JOBS WILL BE

To better understand where the construction industry is headed, its component industries are quantified, and their growth is forecasted over the next five years. These projections are used to extrapolate future workforce needs, i.e., the demand for workers.

236 Construction of Buildings

SIZING THINGS UP

In 2017, the Construction of Buildings industry employed over 55,100 payroll workers in the L.A. Basin, accounting for 23 percent of the overall construction industry. Projections indicate that middle-skill jobs will comprise 61.2 percent of all openings between 2017 and 2022.

The Construction of Buildings industry is expected to increase 5.4 percent by 2022, adding an estimated 2,980 jobs.

The Construction of Buildings industry subsector is comprised of two component industries: Residential Building Construction and Nonresidential Building Construction.

Residential Building Construction (NAICS 2361)

This industry is comprised of the following:

- New single-family housing construction
- New multifamily housing construction
- New housing for-sale builders
- Residential remodelers

In 2017, residential building construction employed 31,500 payroll workers in the L.A. Basin, over 13 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 1,700 jobs in the region (Exhibit 18).

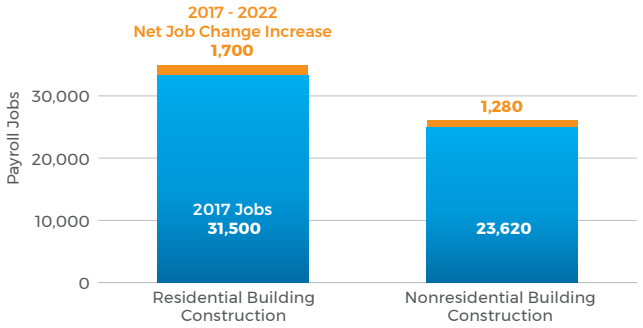
Nonresidential Building Construction (NAICS 2362)

This industry is comprised of the following:

- Industrial building construction
- Commercial and institutional building construction

In 2017, Nonresidential Building Construction employed 23,620 payroll workers in the L.A. Basin, approximately ten percent of the overall construction industry. By 2022, this industry is forecasted to add 1,280 jobs in the region (Exhibit 18).

EXHIBIT 18: CONSTRUCTION OF BUILDINGS OUTLOOK



CHARACTERISTICS OF WORKERS HIRED

The composition of all hires in the Construction of Buildings industry in the L.A. Basin varies according to educational attainment, age, and race and ethnicity. Nearly a quarter of workers hired in 2017 had some college or an associate degree, signaling that this industry targets middle-skill workers (Exhibit 20). One quarter of workers in this industry were between the ages of 25 and 34 years old in 2017. Nearly 15 percent of workers were 24 years old or younger. 22 percent and 19.9 percent of workers were between the ages of 35 and 44 and 45 and 54, respectively (Exhibit22).

Workers in Orange County benefit from higher wages across all education levels when compared to average monthly earnings in Los Angeles County. Middle-skill workers with an associate degree or some college had average monthly earnings of $7,540 and $6,110 in 2017 in Orange and L.A. counties, respectively (Exhibit 19). The greatest share of workers in this industry in 2017 by race and ethnicity were Hispanic (all races) (47.9 percent), while over one third were white (36.2 percent). Black workers accounted for 7.4 percent of workers in 2017, and 6.4 percent identified as Asian (Exhibit 21).

EXHIBIT 19:
AVERAGE MONTHLY EARNINGS 2017
BY EDUCATIONAL ATTAINMENT, AGES 25+ YEARS

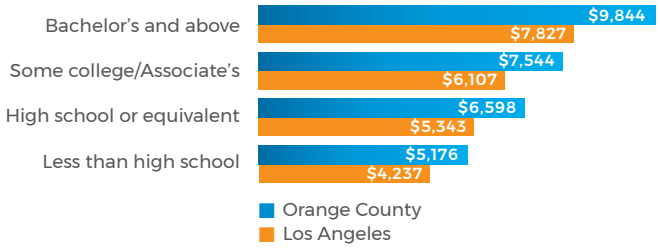


EXHIBIT 20: EDUCATIONAL ATTAINMENT, 2017

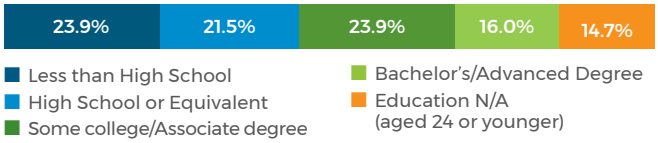


EXHIBIT 21: RACE AND ETHNICITY, 2017

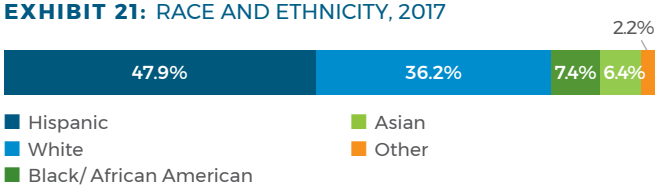
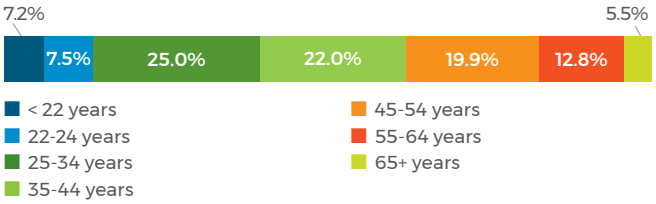


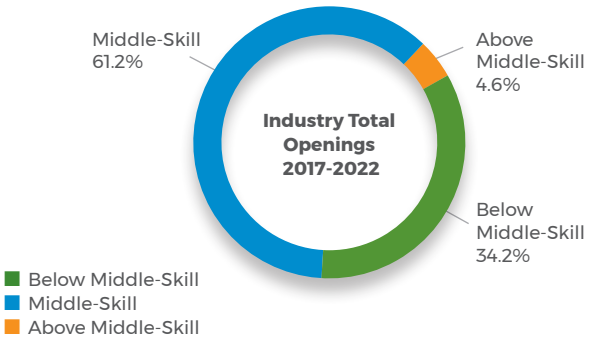
EXHIBIT 22: AGE DISTRIBUTION OF WORKFORCE



FUTURE WORKFORCE NEEDS

Overall, the Construction of Buildings industry is projected to have 39,480 new and replacement openings in the L.A. Basin by 2022, of which an estimated 3,070 will be net new jobs and 36,410 will be replacement jobs. Analysis of the skills classifications for total job openings by 2022 reveals that approximately 24,160 of openings will be for middle-skill workers (61.2 percent) (Exhibit 23).

EXHIBIT 23:
SKILLS CLASSIFICATION FOR THE REGION'S CONSTRUCTION OF BUILDINGS INDUSTRY



MIDDLE-SKILL OCCUPATIONS (NAICS 236):

Significant Job Prospects
(2017-2022 5-year industry openings)

Occupational Group	Openings
• First-Line Supervisors of Construction Workers	3,150
• Carpenters	8,880
• Construction Managers	3,470
• Bookkeeping, Accounting and Auditing Clerks	810

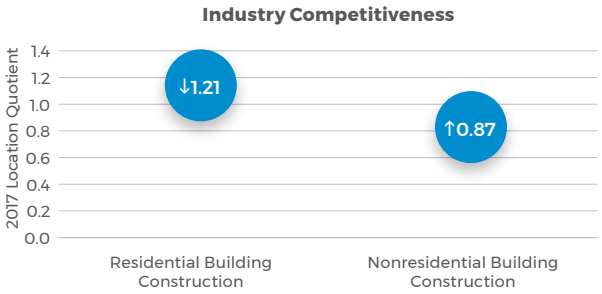
SIGNIFICANT JOB PROSPECTS:

Middle-skill occupations will be the main driver of labor demand in this industry, especially *supervisors of construction workers, carpenters, managers, and bookkeepers.* Related occupations, such as *repair workers, welders, sheet metal workers,* and *architectural and civil drafters* will also experience openings in the job prospects listed above.

INDUSTRY LOCATION QUOTIENTS

The component industries of the Construction of Buildings vary in their regional competitiveness. Changes in competitiveness over time show whether an industry in a region is gaining or losing competitive strength. Exhibit 24 shows the location quotients in 2017 of the industry sectors and their change from 2007 to 2017. With a regional location quotient of 1.21 in 2017, the Residential Building Construction industry is more competitive in the Los Angeles Basin compared to the rest of the nation. As the second most populated metro area in the nation, construction is an essential component of the L.A. Basin economy. The nonresidential building construction industry is less competitive in the L.A. Basin than the rest of the nation, with a location quotient of 0.87 in 2017. However, this is an 8.6 percent increase since 2007, representative of the industry's overall growth.

EXHIBIT 24:
INDUSTRY COMPETITIVENESS, AS MEASURED BY LOCATION QUOTIENTS, WITH CHANGE SINCE 2007



237 Heavy and Civil Engineering Construction

SIZING THINGS UP

In 2017, the Heavy and Civil Engineering industry employed over 23,600 payroll workers in the L.A. Basin, or 9.9 percent of the overall construction industry. Projections indicate that middle-skill jobs will comprise 50.6 percent of all jobs in the Heavy and Civil Engineering construction industry by 2022 (Exhibit 25).

The Heavy and Civil Engineering construction industry is expected to grow 5.0 percent, adding 1,180 additional jobs by 2022.

The Heavy and Civil Engineering Construction industry subsector is comprised of four component industries: Utility System Construction, Land Subdivision, Highway, Street and Bridge Construction, and Other Heavy Construction.

Utility System Construction (NAICS 2371)

This industry is comprised of the following:

- Water and sewer line and related structures
- Oil and gas pipeline and related structures
- Power and communication line and related structures

In 2017, Utility System Construction employed 12,720 payroll workers in the Los Angeles Basin, or 5.3 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 630 jobs in the region (Exhibit 25).

Land Subdivision (NAICS 2372)

In 2017, Land Subdivision employed 3,840 payroll workers in the L.A. Basin, or 1.6 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 190 jobs in the region (Exhibit 25).

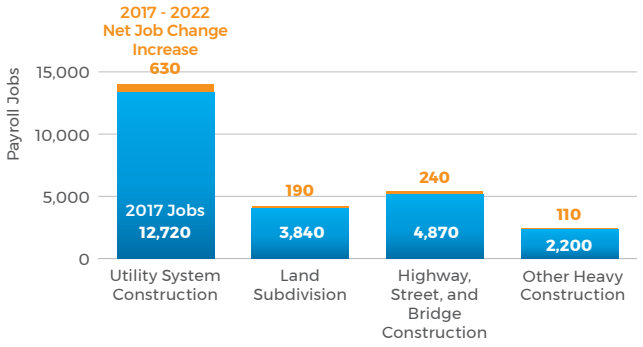
Highway, Street and Bridge Construction (NAICS 2373)

In 2017, Highway, Street and Bridge Construction employed 4,870 payroll workers in the L.A. Basin, representing two percent (2%) of the overall construction industry. Between 2017 and 2022, this industry is expected to add 250 jobs in the region (Exhibit 25).

Other Heavy Construction (NAICS 2379)

In 2017, the Other Heavy Construction industry employed 2,200 payroll workers in the Los Angeles Basin, less than one percent (1%) of the overall construction industry. Between 2017 and 2022, this industry is expected to add 110 jobs in the region (Exhibit 25).

EXHIBIT 25:
HEAVY AND CIVIL ENGINEERING CONSTRUCTION OUTLOOK



CHARACTERISTICS OF WORKERS HIRED

The composition of all hires in the Heavy and Civil Engineering Construction industry in the LA Basin in 2017 varies according to educational attainment, age, and race and ethnicity. The largest share of workers in this industry have some college or an associate degree (26.2 percent), signaling that this industry represents strong employability for community college students (Exhibit 27). Nearly a quarter of new hires in 2017 had a high school diploma, and another 23.2 percent had less than a high school diploma.

The largest age group of workers is 25 to 34 years old, comprising 26.2 percent of those employed in the industry in 2017. One third of workers are between ages 45 and 64, while an additional quarter are between 35 and 44 years old (24.6 percent) (Exhibit 29). Nearly half of workers in 2017 were Hispanic (all races) (48.8 percent), while those who identify as white made up 35.5 percent of the workforce. Black and Asian workers accounted for 8.4 and 4.0 percent of the workforce, respectively (Exhibit 28).

Middle-skill workers holding an associate degree in the heavy and civil engineering construction industry earn an average monthly income of nearly $7,790 to $8,020 across the region, while those with a high school diploma earn $6,900 to $7,320. Those holding a bachelor's degree or higher earn over $10,100 in monthly wages (Exhibit 26).

EXHIBIT 26:
AVERAGE MONTHLY EARNINGS 2017
BY EDUCATIONAL ATTAINMENT, AGES 25+ YEARS

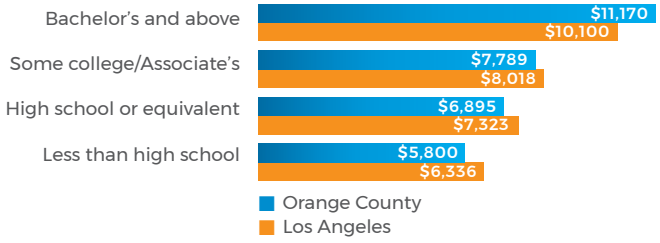


EXHIBIT 27: EDUCATIONAL ATTAINMENT, 2017

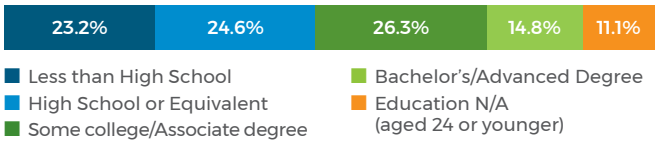


EXHIBIT 28: RACE AND ETHNICITY, 2017

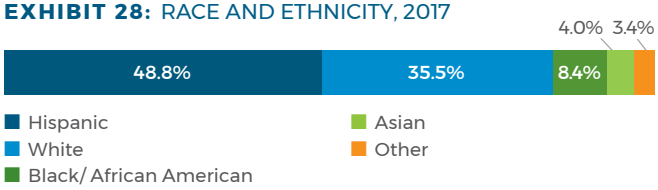
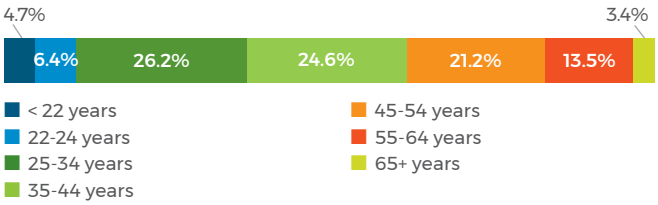


EXHIBIT 29: AGE DISTRIBUTION OF WORKFORCE



FUTURE WORKFORCE NEEDS

Overall, the Heavy and Civil Engineering Construction industry is projected to have 16,080 new and replacement openings in the L.A. Basin by 2022, of which an estimated 1,210 will be net new jobs and 14,880 will be replacement jobs. Analysis of the skills classifications for total job openings by 2022 reveals that approximately 8,140 of openings will be for middle-skill workers (50.6 percent) (Exhibit 30). These openings will be distributed amongst the industry's four component industries: Utility System Construction, Land Subdivision, Highway, Street, and Bridge Construction, and Other Heavy Construction.

SIGNIFICANT JOB PROSPECTS:

Middle-skill occupations will be driving demand in the industry through 2022. Opportunities in managerial and supervisory roles will continue to grow, as will opportunities for *equipment operators*. Occupations that are considered below middle-skill, such as *laborers* and *pipefitters*, will also be high in demand over the next few years. Advancements in machinery suggest that occupations such as equipment operators are susceptible to disemployment by automation in the future.

MIDDLE-SKILL OCCUPATIONS

Significant Job Prospects (2017–2022 5-year industry openings)

Occupational Group	Openings
• First-Line Supervisors of Construction Workers	1,060
• Operating Engineers and Other Construction Equipment Operators	1,040
• Construction Managers	740
• Carpenters	500
• Paving, Surfacing, and Tamping Equipment Operators	580

INDUSTRY LOCATION QUOTIENTS

The component industries of Heavy and Civil Engineering Construction vary in their regional competitiveness. Changes in competitiveness over time show whether an industry is gaining or losing competitive strength in a region. Exhibit 31 shows the location quotients in 2017 of the industries, and their change from 2007 to 2017. With a regional location quotient of 0.73, the Utility System Construction industry is less concentrated in the region than in the rest of the nation. With a regional location quotient of 2.78, Land Subdivision is the most concentrated of the construction industries in the region and is much more competitive than the rest of the nation. This is largely due to the region's reliance on small lot subdivisions to meet housing needs, which has increased significantly since 2007. Highway, Street, and Bridge Construction is the least concentrated of the region's construction industries, with a 0.44 location quotient that reflects the lack of infrastructure projects in the region. With a regional location quotient of 0.57, Other Heavy Construction is not competitive compared to the rest of the nation, and has been substantially declining in regional competitiveness since 2007.

EXHIBIT 30:
SKILLS CLASSIFICATION FOR THE REGION'S HEAVY AND CIVIL ENGINEERING CONSTRUCTION INDUSTRY

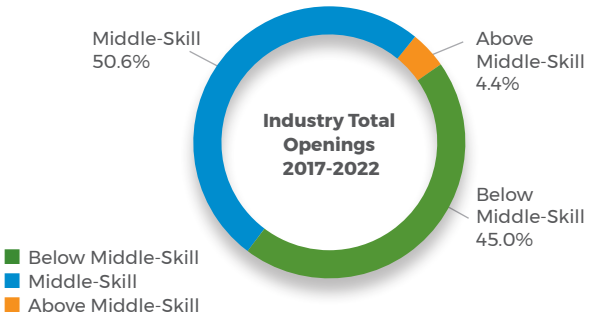
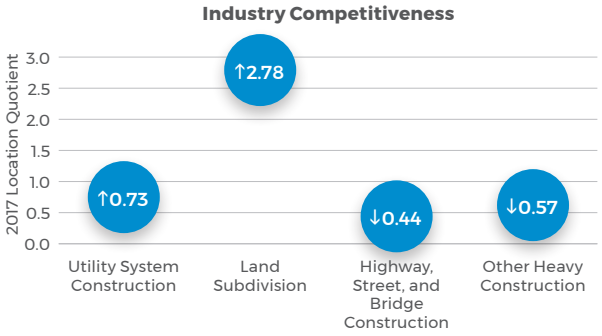


EXHIBIT 31:
INDUSTRY COMPETITIVENESS, AS MEASURED BY LOCATION QUOTIENTS, WITH CHANGE SINCE 2007



238 Specialty Trade Contractors

SIZING THINGS UP

In 2017, the Specialty Trade Contractor industry employed nearly 160,000 payroll workers in the L.A. Basin, or 67 percent of the overall construction industry. Projections indicate that middle-skill jobs will comprise 53.2 percent of all job openings in this industry by 2022 (Exhibit 32).

The Specialty Trade Contractor industry is expected to grow 5.5 percent by 2022, adding 8,770 additional jobs in the region.

The Specialty Trade Contractor industry subsector is comprised of four component industries: Building Foundation and Exterior Contractors, Building Equipment Contractors, Building Finishing Contractors, and Other Specialty Trade Contractors.

Building Exterior Contractors (NAICS 2381)

This industry is comprised of the following:

- Foundation, structure and building contractors
- Poured concrete foundation and structure contractors
- Structural steel and precast concrete contractors
- Framing contractors
- Masonry contractors
- Glass and glazing contractors
- Roofing contractors
- Siding contractors

In 2017, Building and Exterior Contractors employed 32,510 payroll workers in the L.A. Basin, or over 13 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 1,790 jobs in the region (Exhibit 32).

Building Exterior Contractors (NAICS 2382)

This industry is comprised of the following:

- Electrical contractors and other wiring installation contractors
- Plumbing, heating, and air-conditioning contractors
- Other building equipment contractors

In 2017, Building Equipment Contractors employed 69,360 payroll workers in the L.A. Basin, representing the largest share of the overall construction industry (29.1 percent). Between 2017 and 2022, this industry is expected to add 3,800 jobs in the region (Exhibit 32).

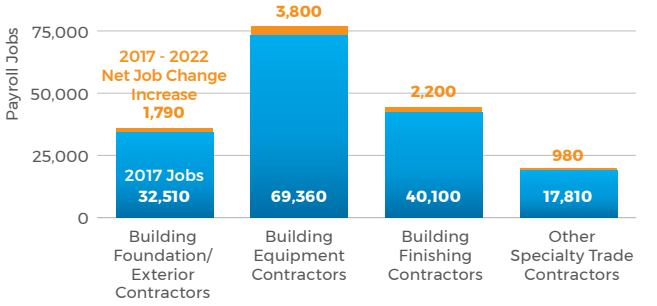
Building Finishing Contractors (NAICS 2383)

This industry is comprised of the following:

- Drywall and installation contractors
- Painting and wall covering contractors
- Flooring contractors
- Tile and terrazzo contractors
- Finish carpentry contractors

In 2017, Building Finishing Contractors employed 40,100 payroll workers in the L.A. Basin, or 16.8 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 2,200 jobs in the region (Exhibit 32).

EXHIBIT 32:
SPECIALTY TRADE CONTRACTORS CONSTRUCTION OUTLOOK



Other Specialty Trade Contractors (NAICS 2389)

This industry is comprised of the following:

- Site Preparation contractors
- All other specialty trade contractors

In 2017, Other Specialty Trade Contractors employed 17,810 workers in the L.A. Basin, or 7.5 percent of the overall construction industry. Between 2017 and 2022, this industry is expected to add 980 jobs in the region (Exhibit 32).

CHARACTERISTICS OF WORKERS HIRED

The composition of all hires in the Specialty Trade Contractors industry in the L.A. Basin varies according to educational attainment, age, and race and ethnicity. In 2017, workers with some college or an associate degree accounted for 24.2 percent of all new hires (Exhibit 34). This industry employs many workers below middle-skill —25.9 percent with less than a high school diploma and 22.8 with a diploma— but the growth of middle-skill workers makes this industry particularly attractive for community college students.

Nearly half of new hires are between ages 25 and 34 and 35 and 44 (26.0 and 24.0 percent, respectively). Nearly 15 percent of all hires were 24 years old or younger (Exhibit 36). The majority of workers in this industry reported their ethnicity as Hispanic or Latino (all races) (56.2 percent). Workers reporting their race as white accounted for 32.2 of all hires in the industry. Black and Asian workers accounted for 5.1 and 4.4 percent of new hires, respectively (Exhibit 35).

EXHIBIT 33:
AVERAGE MONTHLY EARNINGS 2017
BY EDUCATIONAL ATTAINMENT, AGES 25+ YEARS

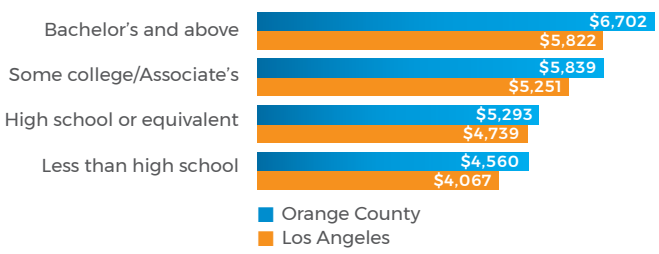


EXHIBIT 34: EDUCATIONAL ATTAINMENT, 2017

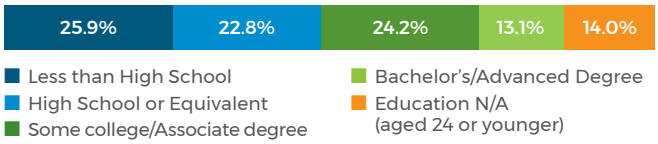


EXHIBIT 35: RACE AND ETHNICITY, 2017

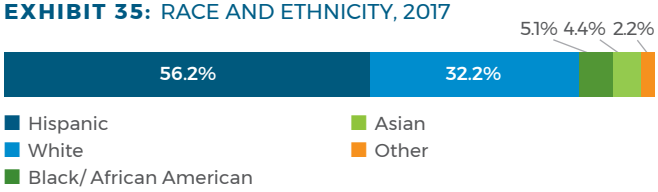
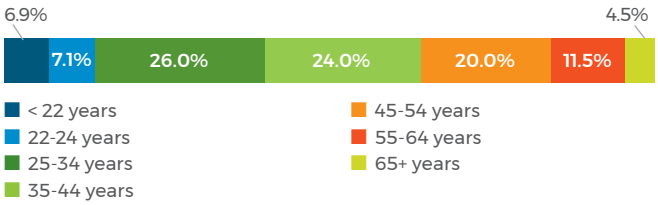


EXHIBIT 36: AGE DISTRIBUTION OF WORKFORCE



The industry provides a wide range of decent-paying jobs to individuals with different levels of education. Average monthly earnings for middle-skill workers with an associate degree or some college are $5,840 and $5,250 in Orange and L.A. counties, respectively. Those with a bachelor's or advanced degree earn an average of $5,820 to $6,700 per month (Exhibit 33).

FUTURE WORKFORCE NEEDS

Overall, the Specialty Trade Contractors industry is projected to have 113,530 new and replacement openings in the L.A. Basin by 2022, of which an estimated 8,640 will be net new jobs and 104,890 will be replacement jobs. Analysis of the skills classifications for total job openings by 2022 reveals that approximately 60,400 of openings will be for middle-skill workers (53.2 percent). These openings will be distributed amongst the industry's four subsectors.

MIDDLE-SKILL OCCUPATIONS

Significant Job Prospects (2017–2022 5-year industry openings)

Occupational Group	Openings
• Electricians	9,170
• Carpenters	8,360
• Plumbers, Pipefitters, and Steamfitters	7,700
• Heating, Air Conditioning, and Refrigeration Mechanics and Installers	4,520
• Sales Representatives	1,800

SIGNIFICANT JOB PROSPECTS:

The nature of this industry is dependent on skilled trade workers. Craftsmanship, attention to detail, and creative problem solving mean that occupations such as *electricians*, *carpenters*, and *plumbers* are still relatively safe from automation and remain in high demand.

LOCATION QUOTIENT:

The component industries of specialty trade contractors vary in their regional competitiveness. Changes in competitiveness over time show whether an industry in a region is gaining or losing competitive strength. Exhibit 38 shows the location quotients in 2017 of the component industries and their change from 2007 to 2017. With a regional location quotient of 1.08, the Building Foundation and Exterior Contractor industry is slightly more competitive compared to the rest of the nation, while the Building Equipment Contractor industry is closer to the national average (1.0) with a regional location quotient of 0.97. With a regional location quotient of 1.47, the Building Finishing Contractor industry is the second most concentrated of the ten construction industries in the region, and is more competitive than the national average. This industry is driven by the domestic construction sector including residents maintaining, repairing or creating additions to their properties. The Other Specialty Trade Contractors sector is less competitive in the L.A. Basin than the rest of the nation, and has been declining since 2007.

EXHIBIT 37:
SKILLS CLASSIFICATION FOR THE REGION'S SPECIALTY TRADE CONTRACTORS INDUSTRY

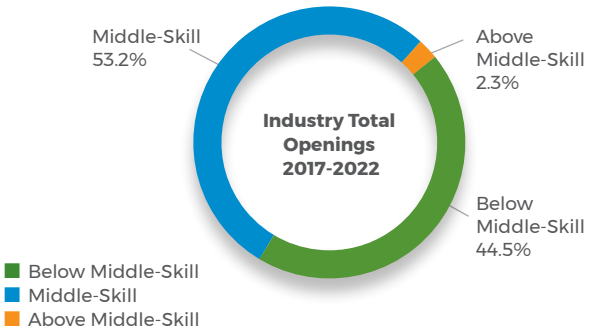
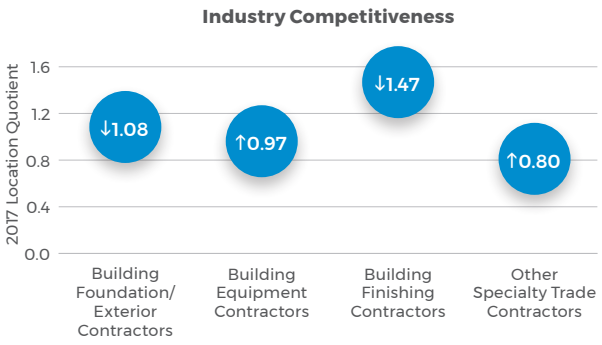


EXHIBIT 38:
INDUSTRY COMPETITIVENESS, AS MEASURED BY LOCATION QUOTIENTS, WITH CHANGE SINCE 2007



The construction industry is a major economic driver in the regional economy. Over the next five years, 169,100 construction-related job openings will be created in the L.A. Basin, with employers seeking to fill the majority of those openings with middle-skill workers.

Conclusions & Recommendations

The high percentage of middle-skill jobs that comprise the construction industry combined with the strong projections for growth in middle-skill opportunities over the next few years makes prioritizing this industry for the development of training and educational programs particularly compelling for community colleges in the L.A. Basin.

Specifically, one of this report's key findings is that over 50 percent of projected openings in this industry will be for middle-skill occupations over the next five years in the region. Moreover, the construction industry is largely composed of a young workforce, with 47 percent of workers between the ages of 25 and 44 years; less than a quarter are 55 years or older. And construction employees typically earn higher-than-average wages compared to the regional economy for workers with less than a bachelor's degree. Workers in the construction industry earn an average of $77,060, which is more than the regional average of $61,510 across all industries. The Heavy and Civil Engineering industry pays particularly well, with an average salary of $94,250.

Workforce Shortages

When workforce demand is considered, there is a serious justification for the creation and expansion of college programs, apprenticeships and similar training opportunities for construction industry occupations. Based on community college program completions, there is a looming workforce shortage on the horizon. An undersupply of over 10,000 workers is possible without intervention, as there are 13,640 projected annual openings for the ten middle-skill occupations profiled in this report, yet only 2,250 awards were conferred in 2018-19.

As most of this undersupply comes from occupations in the construction and extraction major occupational group, it appears that many students may no longer be interested in trades such as *carpentry, structural steel, iron working, plumbing,* and *pipefitting.* The lone oversupply out of the ten industries is in *architectural and civil drafting,* hinting that graduates may be seeking softer-skilled professions instead of those in heavy engineering and construction. However, these occupations represent integral parts of the construction industry, and as such it is imperative that companies and community colleges work to develop stronger programs that promote these well-paying occupations and address these workforce needs.

The Future Workforce

Construction industry occupations exhibiting the most robust growth have the shared characteristic of being driven by an expertise in manual skills that are difficult to replace through automation. *Plumbers, pipefitters, HVAC maintenance and repair workers,* and *structural iron and steel workers* are forecasted to experience the greatest growth by 2022. Regardless of the use of more advanced products and expanded use of technology, the foundation of the construction industry continues to be traditional trade work.

While traditional jobs are the backbone of the industry, workers must remain open and adaptable to new technologies. Changes in regulations and advancements in "green" technology mean that workers need to remain knowledgeable of evolving products, rules, and practices. Workers with skills in growing fields, such as solar panel installation and electric vehicle infrastructure, will be seen as key assets on new development projects in the region.

Attention should also be directed toward component industries in the construction industry where the greatest amount of growth is expected to occur. Projections show that 6,005 new jobs will be added for *building equipment contractors* and *building finishing contractors* in the region by 2022. Another high-growth component industry is Residential Building Construction, which is anticipated to add 1,700 new jobs.

Community colleges may want to closely partner with industry stakeholders in these areas to update and/or expand programs preparing students to enter related occupations. Increased attention paid to regional and state regulatory policies (safety, environmental, land use) and integration of those policies into coursework will also help community colleges prepare students to meet the industry's growing needs. While these jobs are mainly focused on expertise in a particular skill set, critical thinking and exceptional communication skills will allow workers to advance within teams and with clients, thereby avoiding displacement by automation.

As programs are developed and modernized, technical training should be a top consideration. Internships and job readiness skills are among the most desirable qualifications for new hires.

Opportunities and Challenges

This report dove into where the greatest job growth will be in the future, and also asked the important question: Where won't the jobs be? As community colleges in the region look toward developing new programs and updating or revising existing programs related to construction, they should consider whether the occupations they are training for are vulnerable to automation.

While none of the construction industry subsectors or their component industries are expected to experience losses by 2022, historical data provides us with insights into which industries will be stronger than others. It is imperative to take stock of current community college program enrollments to ensure students will be able to obtain employment upon graduation. As in many other industries, rapid technological change is transforming the construction industry. Digitization and other forms of automation are disruptive forces, causing some occupations (and/or job activities) to become obsolete, while providing increased career opportunities in others. Occupations that have traditionally relied on repetitive labor are especially vulnerable to these changes. For example, equipment operators throughout the construction industry have already experienced major declines due to automation.

Still, opportunities also arise from these changes. Growth within the Specialty Trade Contractors industry is largely due to increased efficiencies. Mobile applications have made it easier for contractors to process payments, review orders, and meet client demand without the need to rely on outside vendors. The streamlining of their work is a contributing factor to these contractors seeing the largest increase in real wages over the past ten years. Similarly, as jobs become more complicated through new environmental regulations and/or because equipment used on-the-job is more advanced, contract workers are expected to be more knowledgeable in a variety of subjects.

The loss of jobs seen between 2007 and 2017 does not paint a flattering picture for the region's construction industry. While recovery from the recession was slow, it has picked up since, and this report projects growth in the component industries exceeding five percent (5%) between 2017 and 2022. Residential Construction of Buildings is particularly poised for success if legislation continues offering solutions to address the housing shortage in the region. Employees in the construction industry are an integral factor in meeting regional demands and will be needed increasingly over the next few years to ensure that the L.A. Basin is meeting its housing, transportation and environmental goals. Community colleges in the L.A. Basin should position themselves to help the region meet those goals with industry-recognized and/or -certified programs that deliver an adequately trained construction industry workforce.

Occupational Profiles

TARGET MIDDLE-SKILL OCCUPATIONS

1. Carpenters
2. Electricians
3. Plumbers, Pipefitters and Steamfitters
4. Heating, Air Conditioning and Refrigeration Mechanics and Installers
5. Operating Engineers and Other Construction Equipment Operators
6. Sheet Metal Workers
7. Welders, Cutters, Solderers and Brazers
8. Structural Iron and Steel Workers
9. Architectural and Civil Drafters
10. Construction and Building Inspectors

Employment Numbers and Worker Characteristics

Detailed information has been compiled for the top ten middle-skill occupations in the construction industries. Data from 2017, the most recent available, was used to determine wages and worker characteristics for the charts included within each profile.

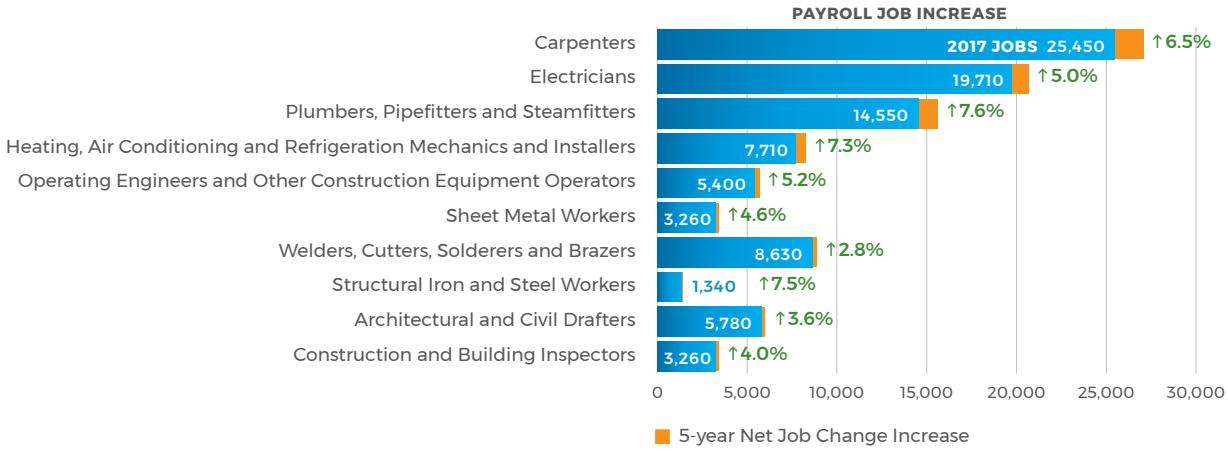
Information regarding top industries employing these occupations, current and projected employment, wages and demographics can be used by community colleges to tailor existing programs and to guide outreach to potential students. The occupational analyses that follow may even inspire new program development or new approaches in attracting students to promising career paths.

EACH OCCUPATIONAL PROFILE CONTAINS:

- Hourly wages paid in 2017 for workers in Los Angeles and Orange counties compared to the living wage.
- The distribution of workers across industry sectors in the Los Angeles Basin
- Metrics for the occupation including the number of current jobs and projected openings
- Worker characteristics, such as educational attainment, age distribution, race and ethnicity, and gender

employment

EXHIBIT 39:
TARGET OCCUPATIONS EMPLOYMENT OUTLOOK, ACROSS ALL INDUSTRIES



Carpenters
(SOC 47-2031)

Construct, erect, install, or repair structures and fixtures made of wood, such as concrete forms; building frameworks, including partitions, joists, studding, and rafters; and wood stairways, window and door frames, and hardwood floors. May also install cabinets, siding, drywall and batt or roll insulation. Includes brattice builders who build doors or brattices (ventilation walls or partitions) in underground passageways.

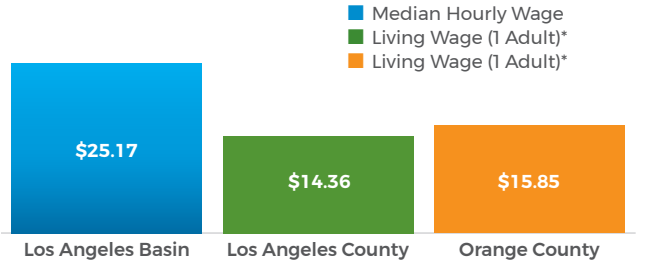
TOTAL PROJECTED OPENINGS 2022

- **21,270** Total Openings (5-yr)
- **17,740** Construction Openings (5-Yr)
- **0.9** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

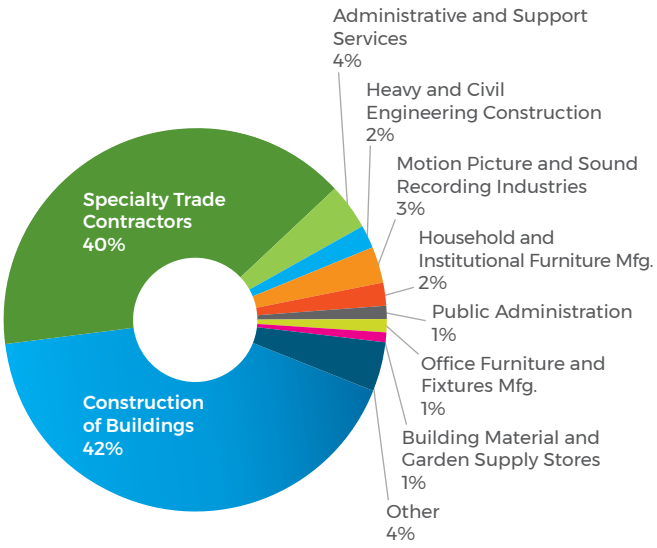
25,450

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2031



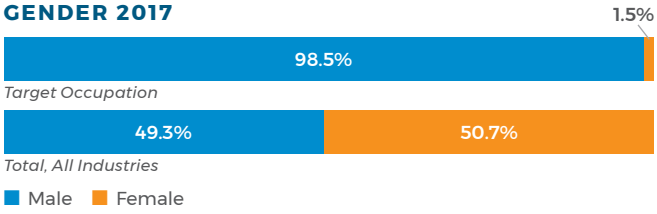
21,230
Carpenter jobs employed in construction industry.

83.4%
Percentage of employment in this occupation across all industries.

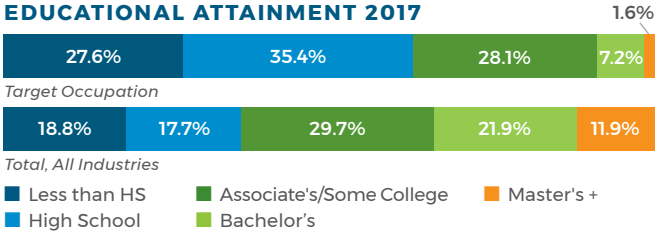
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

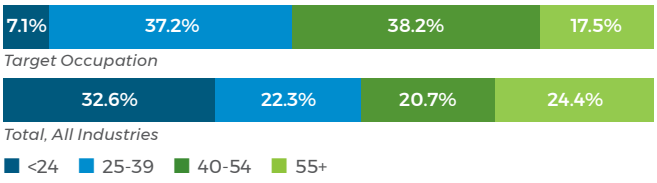
GENDER 2017



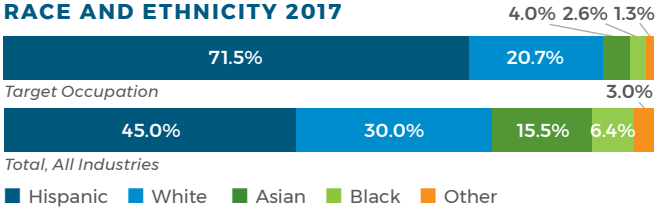
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Electricians
(SOC 47-2111)

Install, maintain, and repair electrical wiring, equipment, and fixtures. Ensure that work is in accordance with relevant codes. May install or service street lights, intercom systems, or electrical control systems. Excludes "Security and Fire Alarm Systems Installers" (49-2098).

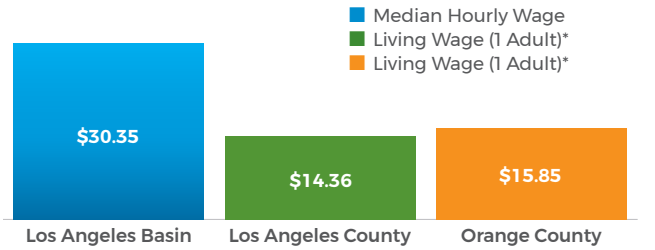
TOTAL PROJECTED OPENINGS 2022

- **13,720** Total Openings (5-yr)
- **9,890** Construction Openings (5-Yr)
- **0.81** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

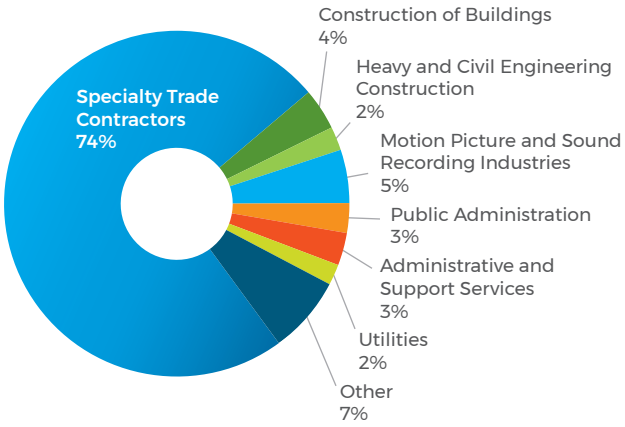
19,710

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2111



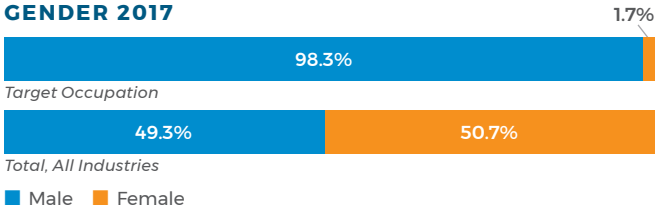
14,200
Electrician jobs employed in construction industry.

72.1%
Percentage of employment in this occupation across all industries.

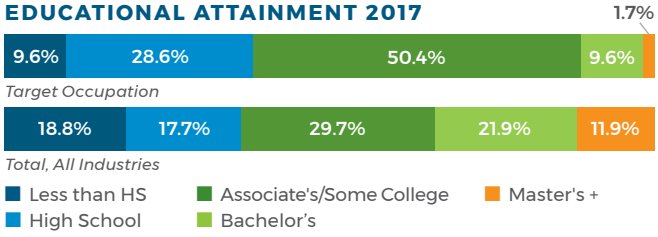
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

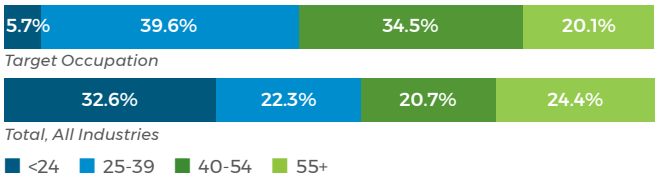
GENDER 2017



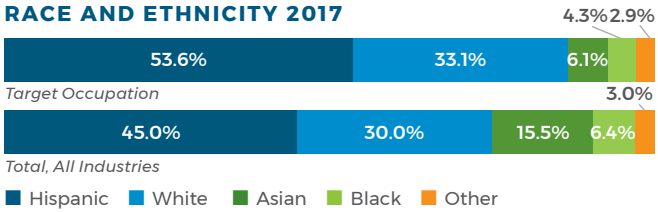
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Plumbers, Pipefitters and Steamfitters

(SOC 47-2152)

Assemble, install, alter, and repair pipelines or pipe systems that carry water, steam, air, or other liquids or gases. May install heating and cooling equipment and mechanical control systems. Includes sprinkler fitters.

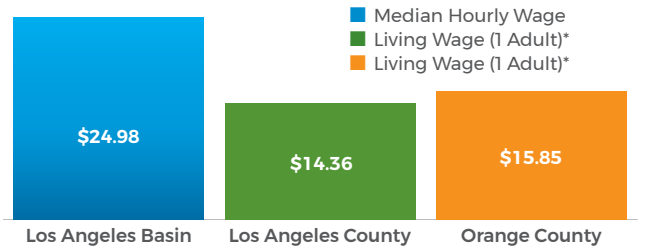
TOTAL PROJECTED OPENINGS 2022

- **10,140** Total Openings (5-yr)
- **8,420** Construction Openings (5-Yr)
- **0.85** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

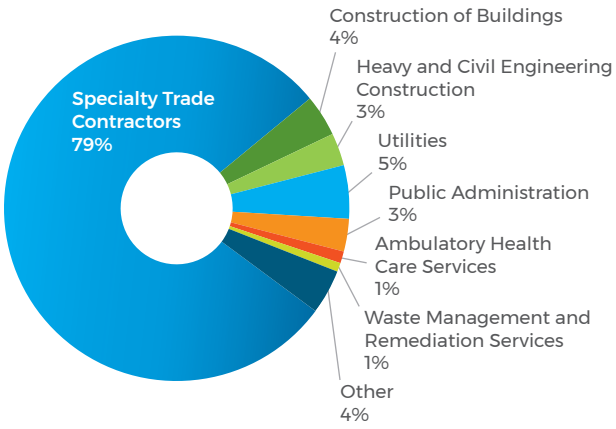
14,550

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2152



12,080

Plumber, pipefitter and steamfitter jobs in construction industry.

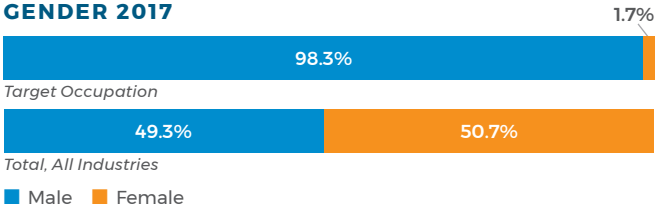
83.0%

Percentage of employment in this occupation across all industries.

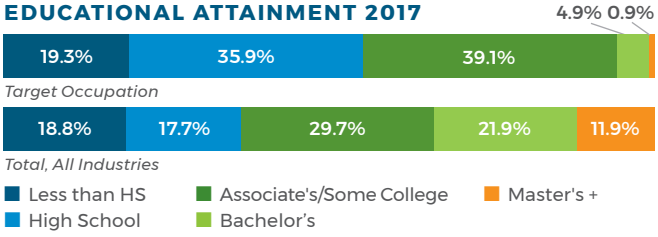
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

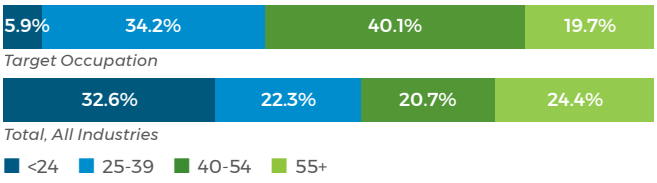
GENDER 2017



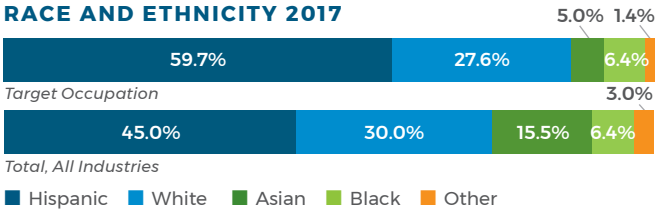
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Heating, Air Conditioning and Refrigeration Mechanics and Installers

(SOC 49-9021)

Install or repair heating, central air conditioning, or refrigeration systems, including oil burners, hot-air furnaces, and heating stoves.

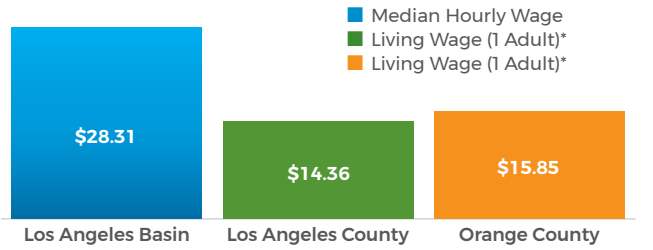
TOTAL PROJECTED OPENINGS 2022

- **5,960** Total Openings (5-yr)
- **4,520** Construction Openings (5-Yr)
- **0.59** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

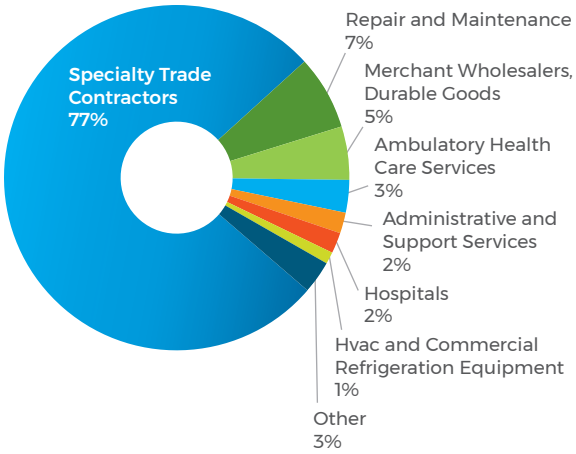
7,710

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 49-9021



5,850

Heating & A/C mechanics and installers employed in construction industry.

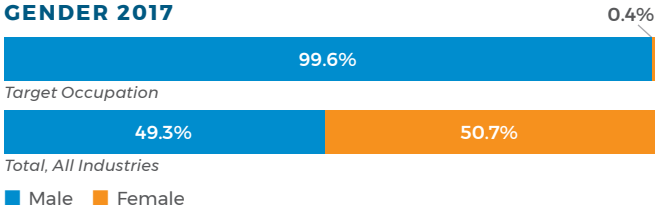
75.9%

Percentage of employment in this occupation across all industries.

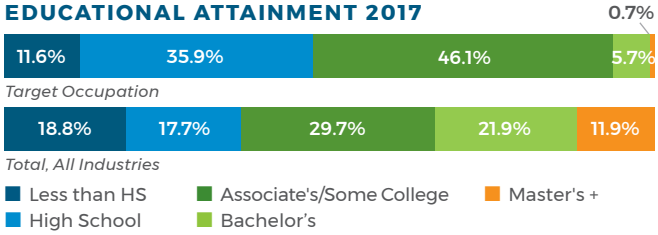
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

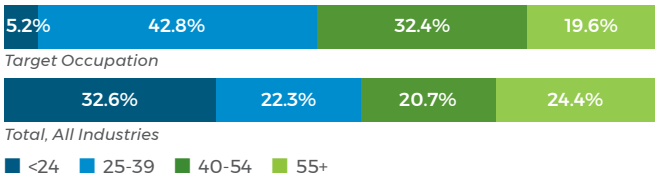
GENDER 2017



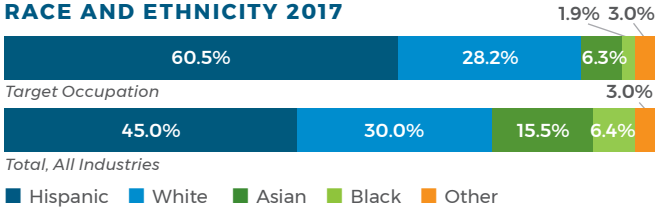
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Operating Engineers and Other Construction Equipment Operators
(SOC 47-2073)

Operate one or several types of power construction equipment, such as motor graders, bulldozers, scrapers, compressors, pumps, derricks, shovels, tractors, or front-end loaders to excavate, move, and grade earth, erect structures, or pour concrete or other hard surface pavement. May repair and maintain equipment in addition to other duties. Excludes "Crane and Tower Operators" (53-7021) and "Extraction Workers" (47-5000).

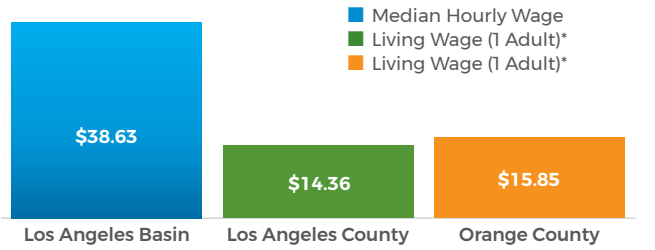
TOTAL PROJECTED OPENINGS 2022

- **3,520** Total Openings (5-yr)
- **2,270** Construction Openings (5-Yr)
- **0.37** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

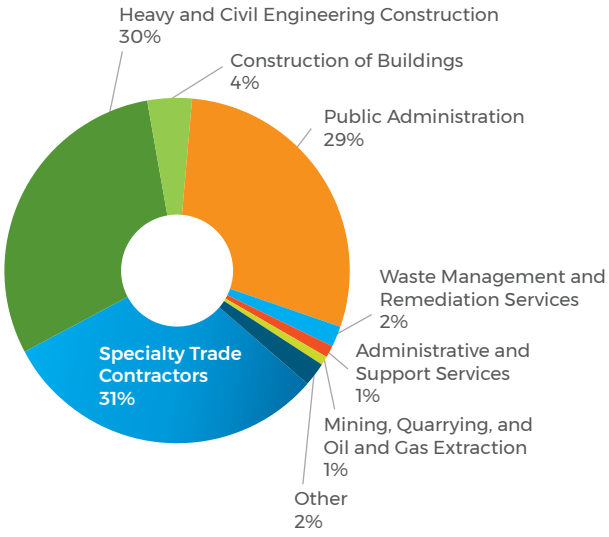
5,400

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2073



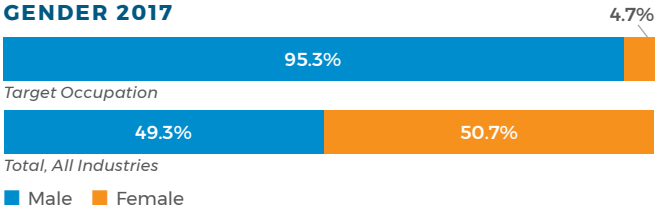
3,480
Operating engineer jobs employed in construction industry.

64.4%
Percentage of employment in this occupation across all industries.

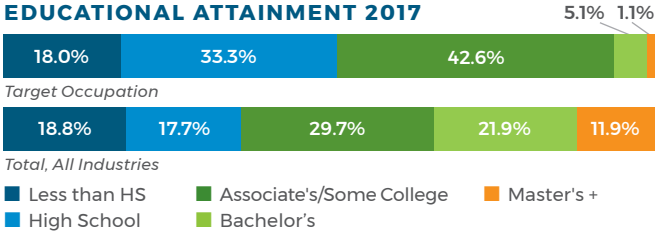
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

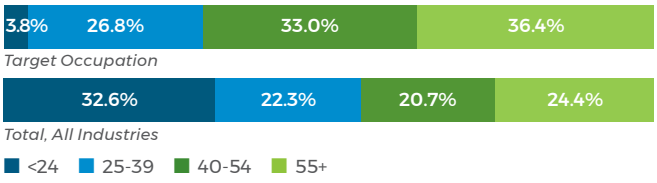
GENDER 2017



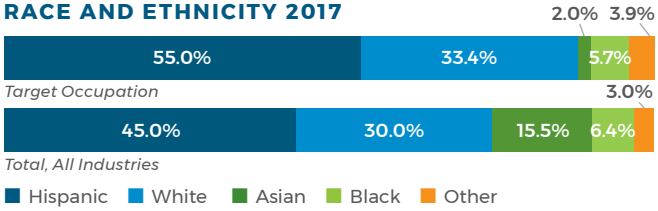
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Sheet Metal Workers
(SOC 47-2211)

Fabricate, assemble, install, and repair sheet metal products and equipment, such as ducts, control boxes, drainpipes, and furnace casings. Work may involve any of the following: setting up and operating fabricating machines to cut, bend, and straighten sheet metal; shaping metal over anvils, blocks, or forms using hammer; operating soldering and welding equipment to join sheet metal parts; or inspecting, assembling, and smoothing seams and joints of burred surfaces. Includes sheet metal duct installers who install prefabricated sheet metal ducts used for heating, air conditioning, or other purposes.

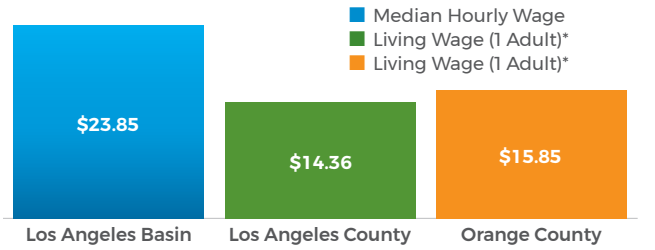
TOTAL PROJECTED OPENINGS 2022

- **2,290** Total Openings (5-yr)
- **1,610** Construction Openings (5-Yr)
- **0.71** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

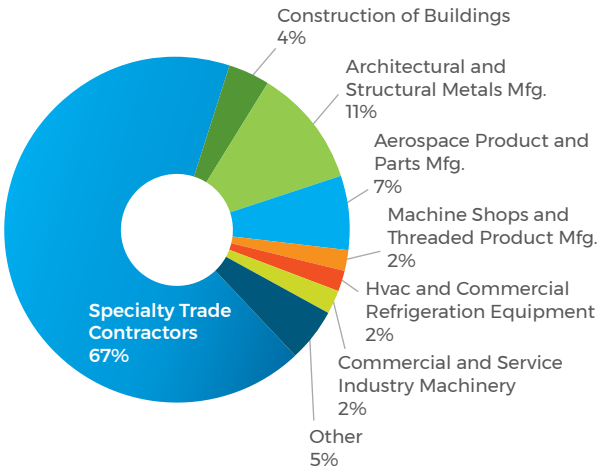
3,260

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2211



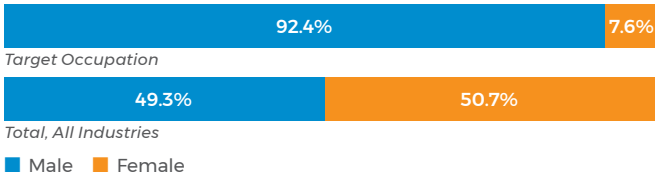
2,300
Sheet metal worker jobs employed in construction industry.

70.6%
Percentage of employment in this occupation across all industries.

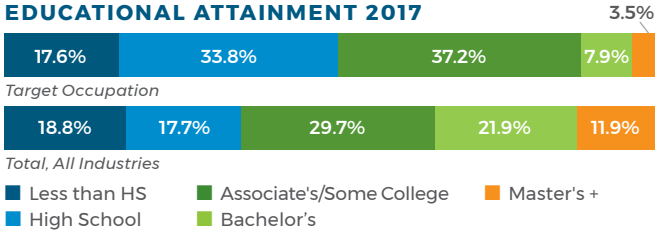
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

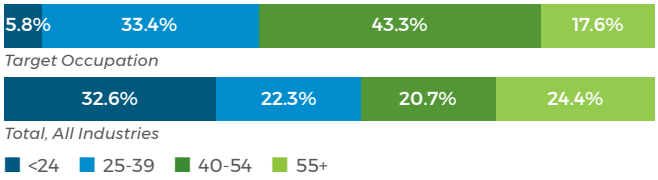
GENDER 2017



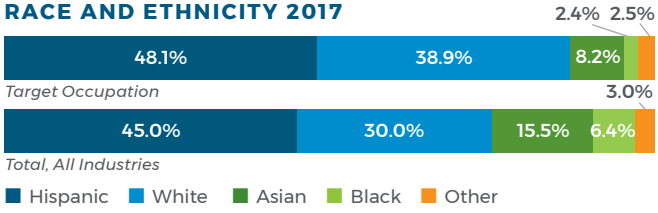
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Welders, Cutters, Solderers and Brazers
(SOC 51-4121)

Use hand-welding, flame-cutting, hand soldering, or brazing equipment to weld or join metal components or to fill holes, indentations, or seams of fabricated metal products.

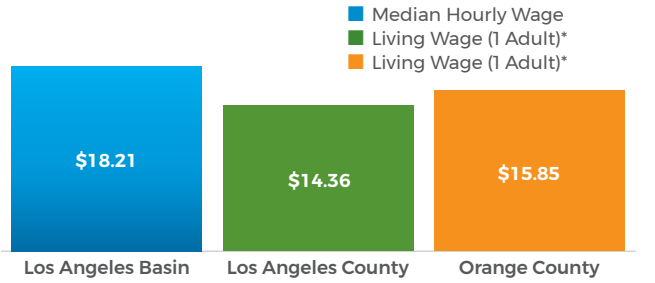
TOTAL PROJECTED OPENINGS 2022

- **5,780** Total Openings (5-yr)
- **1,050** Construction Openings (5-Yr)
- **0.56** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

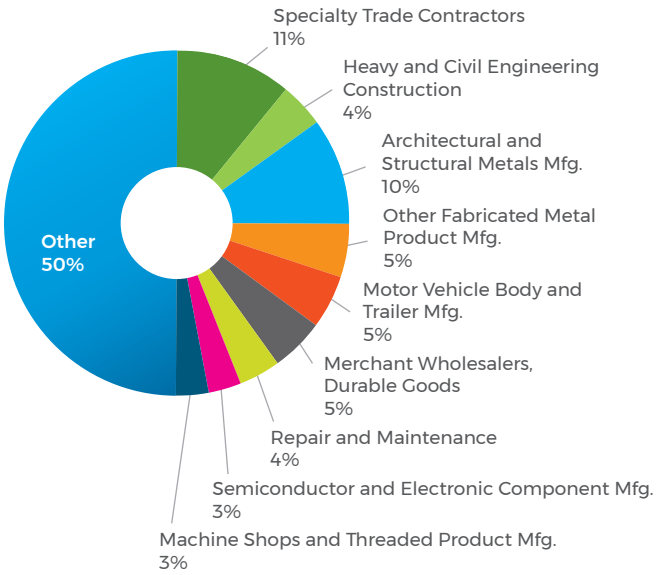
8,630

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 51-4121



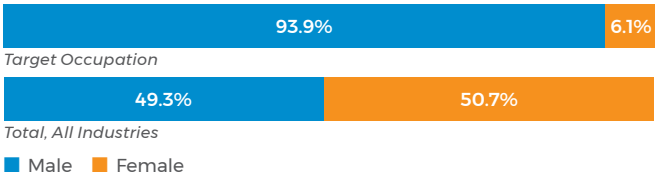
1,570
Welders, cutters, solderers and brazers jobs employed in construction industry.

18.2%
Percentage of employment in this occupation across all industries.

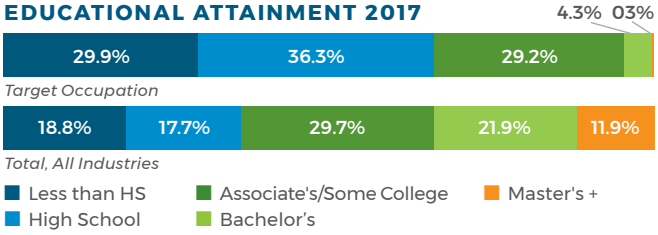
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

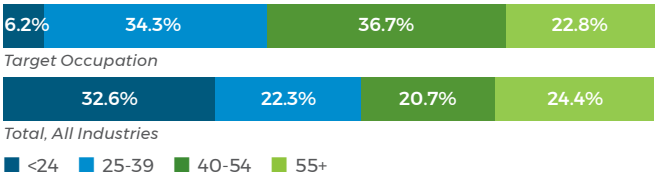
GENDER 2017



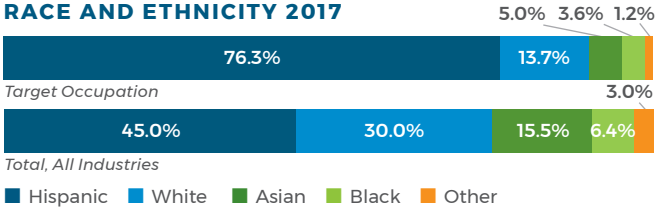
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Structural Iron and Steel Workers

(SOC 47-2221)

Raise, place, and unite iron or steel girders, columns, and other structural members to form completed structures or structural frameworks. May erect metal storage tanks and assemble prefabricated metal buildings. Excludes "Reinforcing Iron and Rebar Workers" (47-2171).

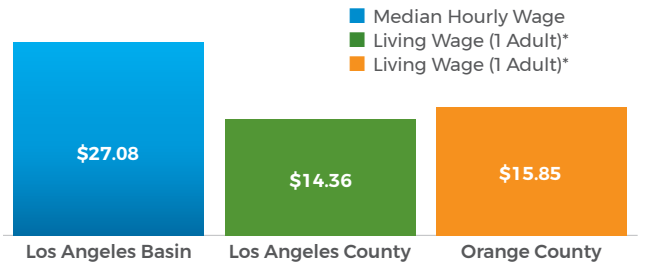
TOTAL PROJECTED OPENINGS 2022

- **640** Total Openings (5-yr)
- **460** Construction Openings (5-Yr)
- **0.58** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

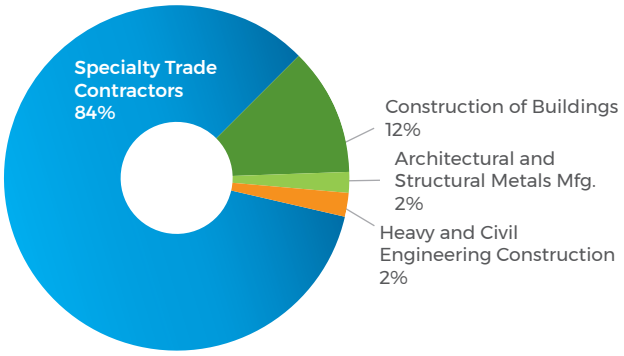
1,340

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-2221



970

Structural iron and steel worker jobs employed in construction industry.

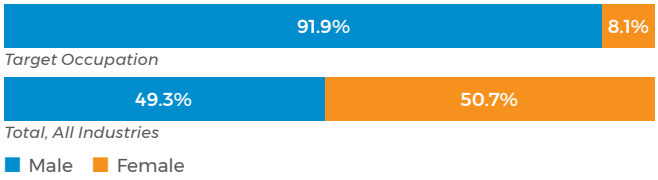
72.4%

Percentage of employment in this occupation across all industries.

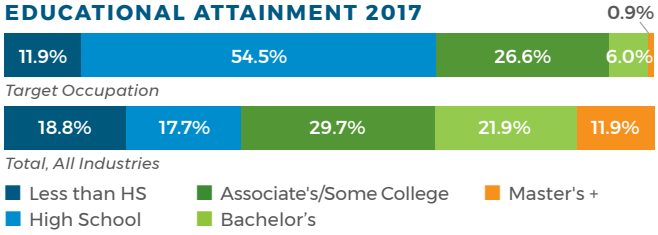
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

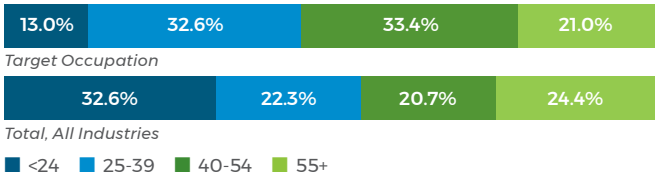
GENDER 2017



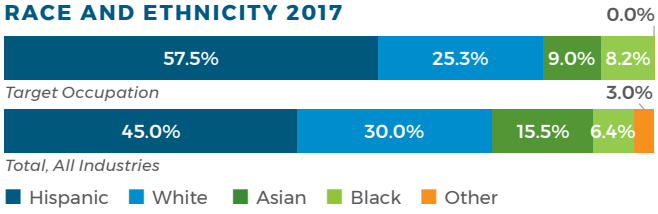
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Architectural and Civil Drafters
(SOC 17-3011)

Prepare detailed drawings of architectural and structural features of buildings or drawings and topographical relief maps used in civil engineering projects, such as highways, bridges, and public works. Use knowledge of building materials, engineering practices, and mathematics to complete drawings.

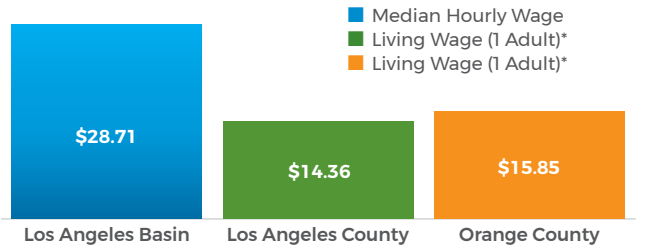
TOTAL PROJECTED OPENINGS 2022

- **2,730** Total Openings (5-yr)
- **260** Construction Openings (5-Yr)
- **1.43** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

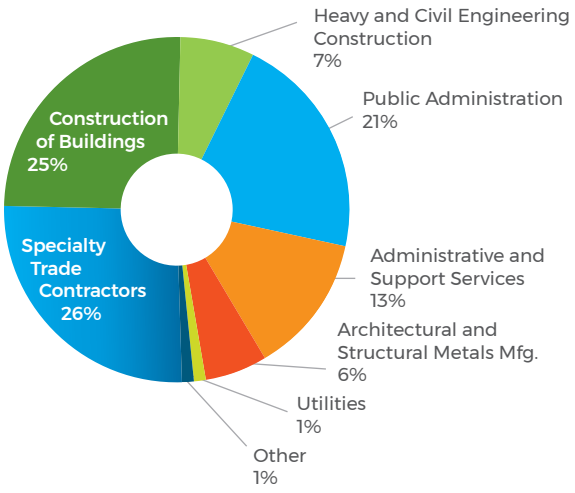
5,780

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 17-3011



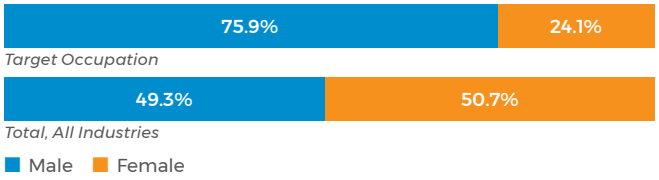
550
Architectural and civil drafter jobs employed in construction industry.

9.5%
Percentage of employment in this occupation across all industries.

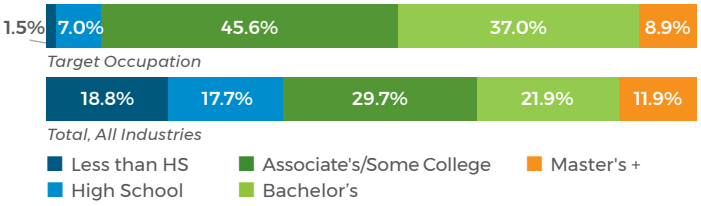
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

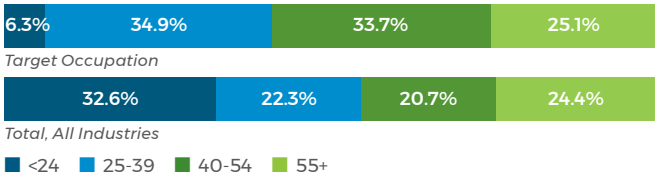
GENDER 2017



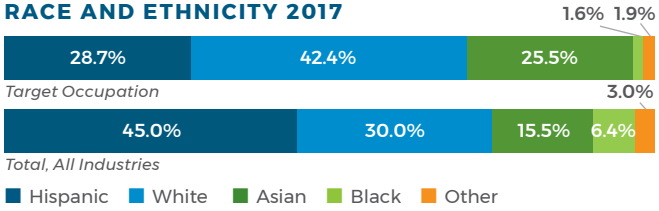
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Construction and Building Inspectors

(SOC 47-4011)

Inspect structures using engineering skills to determine structural soundness and compliance with specifications, building codes, and other regulations. Inspections may be general in nature or may be limited to a specific area, such as electrical systems or plumbing.

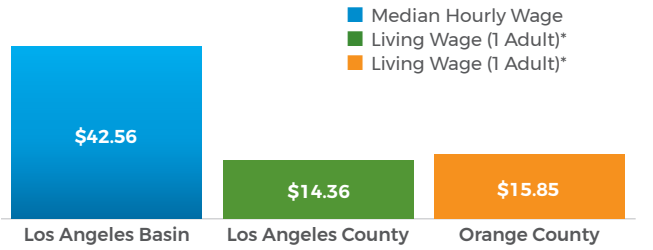
TOTAL PROJECTED OPENINGS 2022

- **2,170** Total Openings (5-yr)
- **130** Construction Openings (5-Yr)
- **0.78** Location Quotient

TOTAL JOBS IN 2017, IN LA/OC

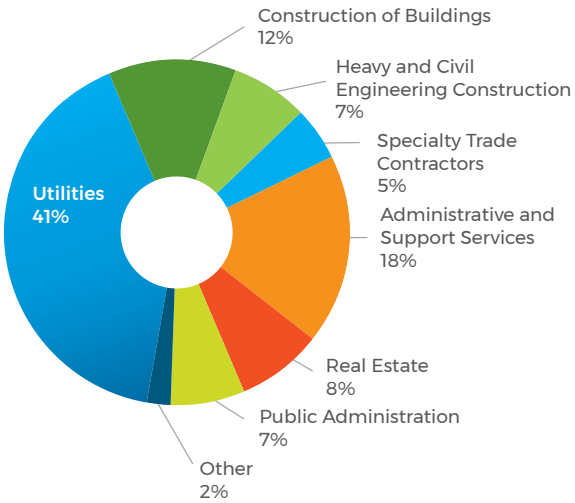
3,260

2017 HOURLY WAGES IN L.A. BASIN



*MIT Living Wage Calculator

INDUSTRY DISTRIBUTION OF 47-4011



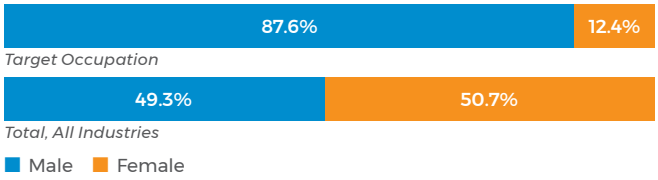
180
Construction and building inspector jobs employed in construction industry.

5.5%
Percentage of employment in this occupation across all industries.

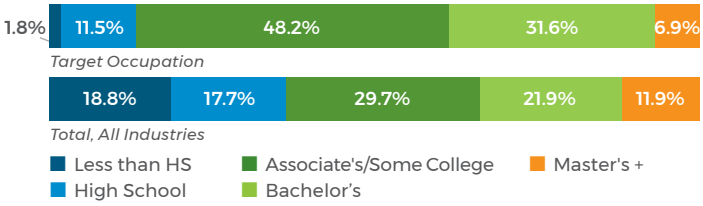
Worker Characteristics

The demographics of the workforce provide an additional layer of information to further highlight who is employed in this occupation in the L.A. Basin:

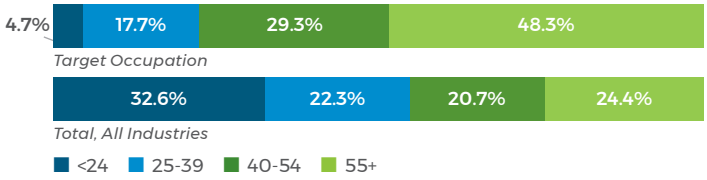
GENDER 2017



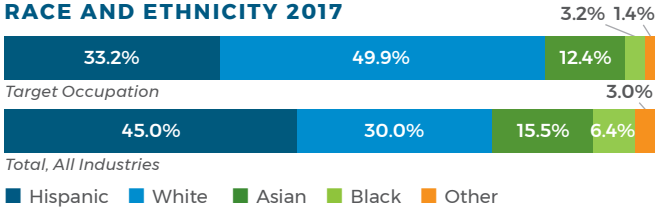
EDUCATIONAL ATTAINMENT 2017



AGE DISTRIBUTION 2017



RACE AND ETHNICITY 2017



Appendix A
Regional Community College Completions (certificates and associate degrees) by Program
(2018-19)

Architecture and Architectural Technology-0201.00
Program has historically trained for architectural and civil drafters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Cerritos	17	7	24
Citrus	3	-	3
Compton	1	1	2
East LA	3	24	27
El Camino	8	5	13
Fullerton	5		5
Glendale	1	5	6
LA Harbor	2	3	5
LA Pierce	2	7	9
LA Trade	5	6	11
LA Valley	-	1	1
Long Beach	13	1	14
Mt San Antonio	12	85	97
Orange Coast	20	20	40
Pasadena	16	-	16
Rio Hondo	14	6	20
Saddleback	7	8	15
Total	**129**	**179**	**308**

Environmental Control Technology-0946.00

Program has historically trained for sheet metal workers; and heating, air conditioning, and refrigeration mechanics and installers.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Compton	2	48	50
Cypress	2	95	97
El Camino	12	141	153
LA Trade	17	69	86
Mt San Antonio	8	39	47
Orange Coast	5	44	49
Total	**46**	**436**	**482**

Energy System Technology-0946.10

Program has historically trained for heating, air conditioning, and refrigeration mechanics and installers.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Golden West	1	-	1
LA Trade	-	11	11
Mt San Antonio	2	2	4
Pasadena	-	3	3
Rio Hondo	2	2	4
Santa Monica	2	8	10
Total	**7**	**26**	**33**

Heavy Equipment Operation-0947.30

Program has historically trained for operating engineers and other construction equipment operators.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Santiago Canyon	-	44	44
Total	**-**	**44**	**44**

Carpentry-0952.10

Program has historically trained for carpenters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Fullerton	3	--	3
LA Trade	7	14	21
Santiago Canyon	-	1	1
Total	**10**	**15**	**25**

Electrical-0952.20

Program has historically trained for electricians.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Irvine	-	15	15
LA Trade	29	103	132
Orange Coast	-	4	4
Santiago Canyon	-	51	51
Total	**29**	**173**	**202**

Plumbing, Pipefitting and Steamfitting-0952.30

Program has historically trained for plumbers, pipefitters, and steamfitters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
LA Trade	2	8	10
Total	**2**	**8**	**10**

Mill and Cabinet Work-0952.50

Program has historically trained for carpenters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Cerritos	4	13	17
Total	**4**	**13**	**17**

Drafting Technology-0953.00

Program has historically trained for architectural and civil drafters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Cerritos	12	23	35
Citrus	5	8	13
East LA	3	33	36
El Camino	8	13	21
Fullerton	2	3	5
Golden West	13	44	57
Irvine	1	1	2
LA Harbor	2	1	3
LA Pierce	1	4	5
LA Valley	-	1	1
Mt San Antonio	7	35	42
Pasadena	1	4	5
Rio Hondo	9	5	14
Saddleback	-	1	1
Santa Ana	2	13	15
Total	**66**	**189**	**255**

Architectural Drafting-0953.10

Program has historically trained for architectural and civil drafters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Fullerton	-	3	3
Long Beach	5	2	7
Santa Ana	2	1	3
Total	**7**	**6**	**13**

Civil Drafting-0953.20

Program has historically trained for architectural and civil drafters.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Irvine	-	1	1
Rio Hondo	-	1	1
Total	**0**	**2**	**2**

Sheet Metal and Structural Metal-0956.40

Program has historically trained for sheet metal workers; and structural iron and steel workers.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Long Beach	7	8	15
Total	**7**	**8**	**15**

Welding Technology-0956.50

Program has historically trained for welders, cutters, solderers, and brazers.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Cerritos	26	95	121
Compton	1	-	1
El Camino	12	21	33
Fullerton	-	9	9
Glendale	-	2	2
LA Trade	3	13	16
Long Beach	-	11	11
Mt San Antonio	11	17	28
Orange Coast	8	12	20
Pasadena	1	10	11
Rio Hondo	-	2	2
Santa Ana	6	54	60
Total	**68**	**256**	**324**

Construction Inspection-0957.20

Program has historically trained for construction and building inspectors.

College	# of Associate Degrees, 2018-19	# of Certificates, 2018-19	Total Awards
Coastline	7	8	15
Fullerton	6	5	11
Pasadena	1	6	7
Saddleback	2	8	10
Total	**16**	**27**	**43**

Appendix B

Methodology

INDUSTRY FORECAST

An economic forecast is created to project employment by industry over the next five years using statistical analysis of historical data paired with the most recent qualitative information impacting a set of 151 industries in the Los Angeles Basin. The industries configured for this forecast are defined through the North American Industry Classification System (NAICS) and comprise industries denoted with 2-digit, 3-digit and 4-digit codes through the NAICS hierarchical classification system. A key input for the regional forecast is projected population growth in Los Angeles and Orange counties, provided by the California Department of Finance. State and national trends concerning production methods, consumer behavior, construction and property values that correspond to each industry are a few of the inputs used for the economic forecast model.

OCCUPATIONS AND PROJECTIONS

Occupations are commonly classified using the Standard Occupational Classification (SOC) System, developed by the Bureau of Labor Statistics. This system classifies workers into 840 detailed occupations that share similar job duties, skills, education and training. These occupations are not industry-specific but are common to many industries. For example, retail salespersons are employed in a full spectrum of industries, from department and discount stores to computer systems design.

The economic forecast for employment by industry is used to guide a projection of net new jobs for each occupation, calculated by applying the industry occupational composition to the detailed industry employment forecast; occupational forecasts are aggre-gated across industries.

The United States Census Bureau estimates replacement needs by industry and occupation through detailed surveys of employers and households. These take into account industry changes, the age of the current workforce within each industry and occupation, and the nature of the career path. These estimates are an important component of occupational job openings and workforce develop¬ment needs, since the retirement and promotion of individuals leave openings for new entrants and those moving up the career ladder.

Total openings are the sum of projected five-year replacement needs and positive net new jobs forecast over the period.

TARGET INDUSTRIES AND OCCUPATIONS

Target occupations are selected in a two-step process. First, all occupations identified as middle-skill (jobs that require education and training beyond a high school diploma but less than a bachelor's degree) are isolated from each target industry. Then, a variety of metrics are used to select target occupations: 2017 employment; projected net job change; replace¬ment rate; number of projected replacement jobs from 2017 to 2022; number of projected total job openings from 2017 to 2022; and annual median wages.

LOCATION QUOTIENT

A common metric to assess a region's competitiveness is employ-ment concentration or location quotients. A location quotient for an industry in a specific region compares the percent of total employment in the industry to the average percent nationwide. For example, if four percent of employment in a region is in the aerospace industry compared to two percent across the nation, the location quotient for the region's aerospace industry is two, indicating the region is more specialized in aerospace than the nation.

A location quotient equal to 1.0 indicates the employment concentration in the region is equal to the nation, meaning the region is not highly specialized in that industry. Higher location quotients imply a competitive advantage. While there can be some variation in this metric, the location quotient threshold of 1.2 usually demonstrates regional specialization and competitiveness.

SUPPLY

Community colleges and other two-year educational institutions provide education and training relevant to middle-skill occupations. Comparing occupations with related training programs provides information for supply-and-demand analysis. The number of awards conferred by community colleges reflects the most recent data available from the **2018-19 academic year.** Award data for other two-year education institutions is from the **2018-19 academic year.** Due to data and timing limitations, training gap forecasts approximate unmet labor demand and do not represent an absolute oversupply or undersupply of available talent. In addition, a one-to-one relationship between program completions and occupational demand does not exist because some programs train for multiple occupations. Consequently, awards for some education and training programs overlap with multiple occupations.

DATA SOURCES

All data was obtained from the Bureau of Labor Statistics and the Census Bureau. Annual employment and payroll data are from the Quarterly Census of Employment and Wages series. Estimates for non-disclosed employment and payroll data were produced using proportional shares of the prior year's data or using midpoint estimates from the Census Bureau's County Business Patterns dataset. Occupational data are from the Occupational Employment Statistics program. Unless noted otherwise, all data is for the 2017 calendar year.

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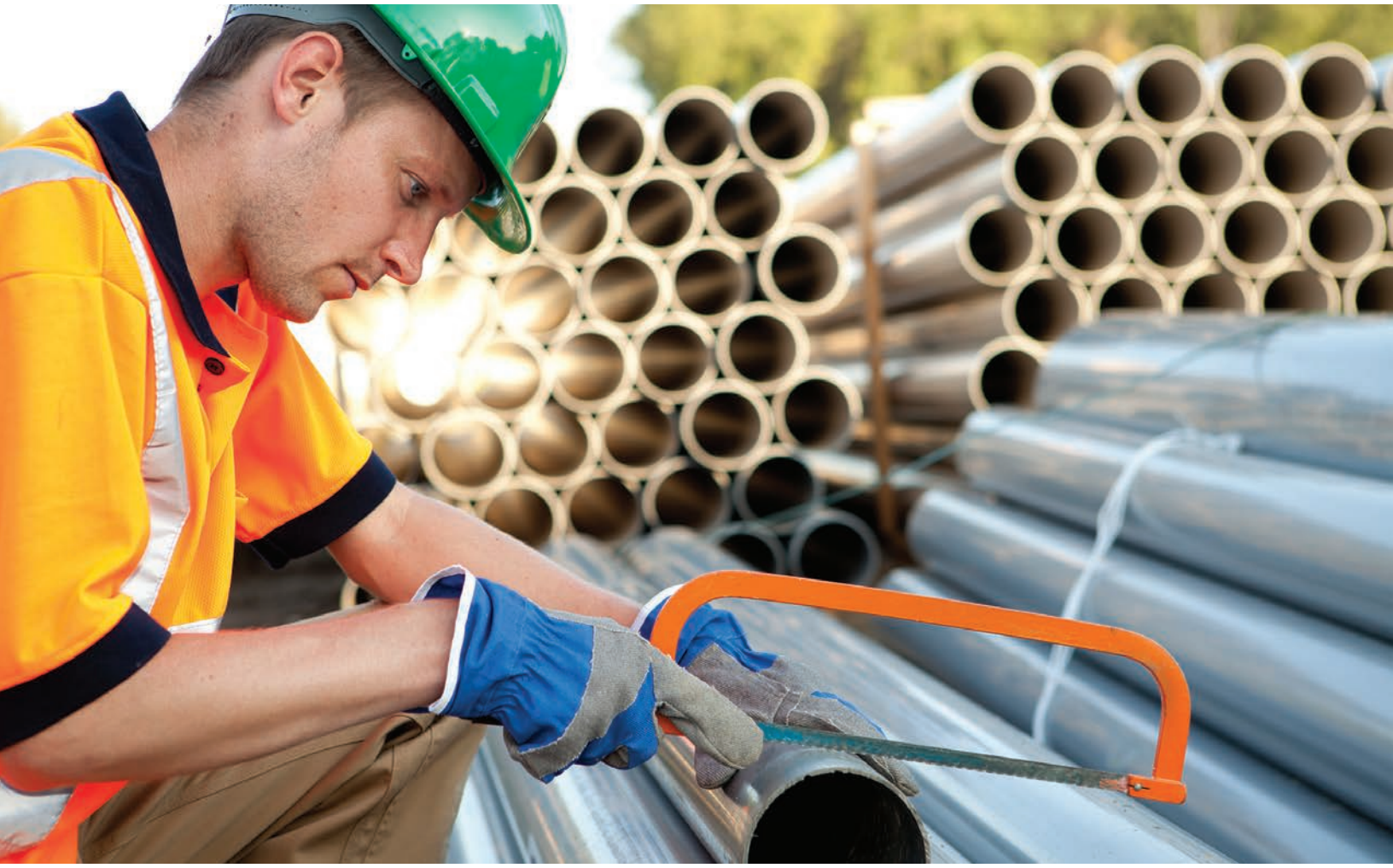

FOR MORE INFORMATION

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