

Lightweight Technology Workforce

Supply-Demand Annual Update



ABOUT THIS REPORT

Lightweight Innovations for Tomorrow (LIFT) is a public-private partnership that develops and deploys advanced lightweight materials manufacturing technologies and implements education and training programs to prepare the workforce. An educated and skilled workforce is critical to the future of manufacturing. Under the direction of Emily Stover DeRocco, LIFT's Education & Workforce Director, LIFT's State Teams, engaging manufacturers, educators, workforce and economic developers, and state and local officials, are designing and implementing a cohesive strategy to deliver the talent necessary to the long-term health of the U.S. defense and commercial industrial bases.

Lightweight materials are increasingly important to the competitiveness of transportation manufacturing sectors, including suppliers in the automotive, aircraft, heavy truck, ship, rail, and defense manufacturing industries. Lighter vehicles for the military, industry, and consumer alike, are more fuel-efficient and demonstrate better performance.

From welding to skilled metalwork, to logistics and mechanical and chemical engineering, to industrial design and manufacturing management, lightweighting-related jobs are found in nearly every manufacturing sector. This report provides an overview and examines the changing demand for workers in jobs related to lightweighting in Tennessee. This analysis is meant to further enhance the future development of lightweighting workforce education and training in the region.

Of particular note, throughout this analysis and report, we rely not only on national databases related to traditional occupations and job families. The pace of change in the manufacturing industry, largely resulting from technology infusion and forces of globalization, is reflected in rapid-fire change in the knowledge, skills, and abilities the manufacturing workforce requires. To provide the best available analyses, this report integrates intelligence gathered from the real-time, transactional labor market reflecting the realities of demand and supply, the changing nature of manufacturing employment, and the competencies that are needed in the 21st century manufacturing workforce.

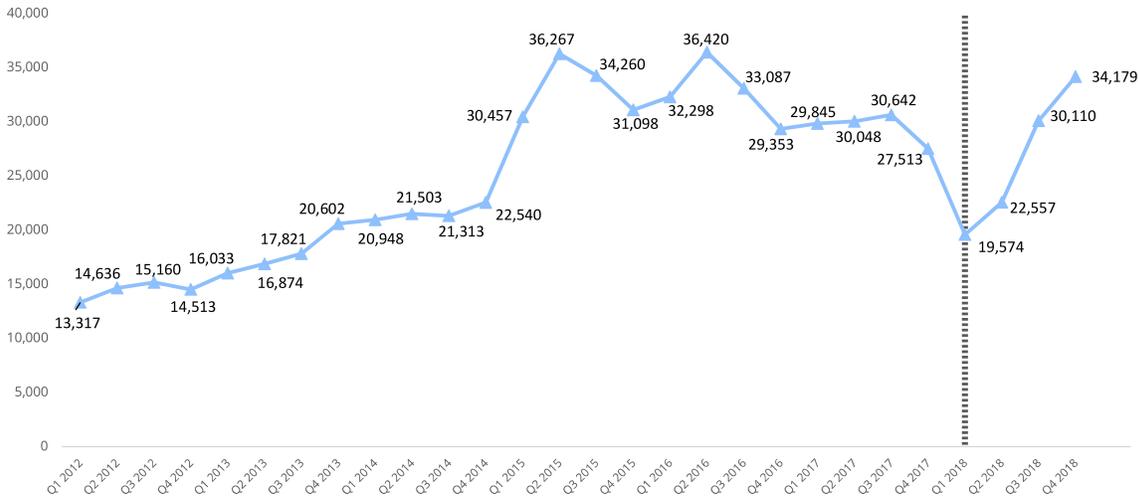


OVERVIEW

EMPLOYER DEMAND AND EMPLOYMENT TRENDS

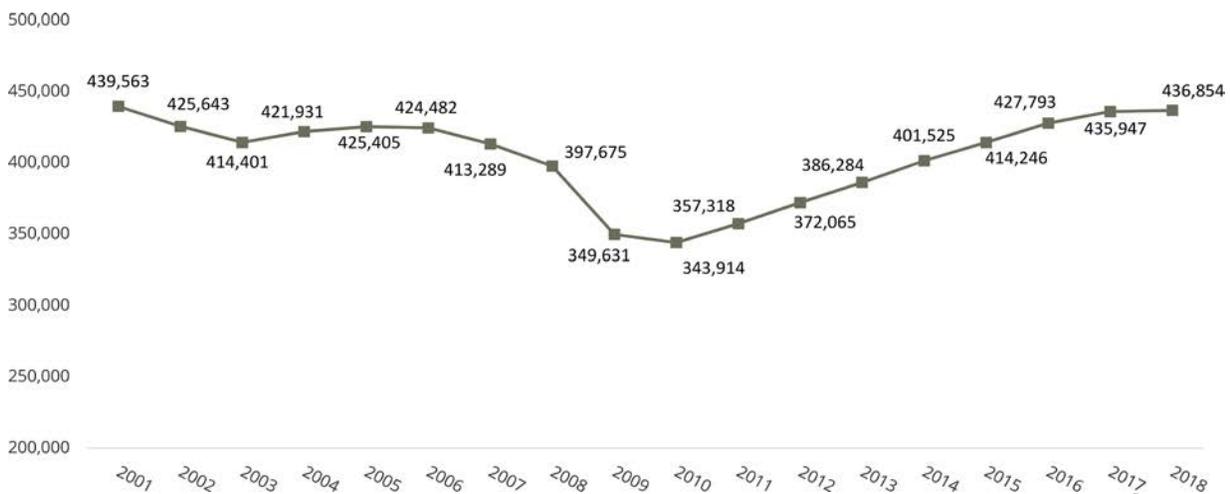
Job postings for occupations related to lightweight advanced manufacturing in Tennessee grew throughout 2018, increasing 13.5 percent from Q3 2018 to 34,179 postings in Q4 2018. This also represents 24.2 percent growth since Q4 2017. Employment also continues to grow steadily after hitting a low of 343,914 workers in 2010. There were 436,854 Tennessee workers employed in advanced manufacturing jobs related to lightweighting in 2018, marking the eighth consecutive year of employment growth.

JOB POSTINGS OVER TIME TENNESSEE Q1 2012 - Q4 2018



A change in data de-duplication methodology of job posting estimates occurred at the time of the dotted line on the graph. Though data from before 2018 may have included duplicate postings and therefore report slightly inflated numbers, the trends shown remain consistent.

EMPLOYMENT OVER TIME TENNESSEE 2001 - 2018



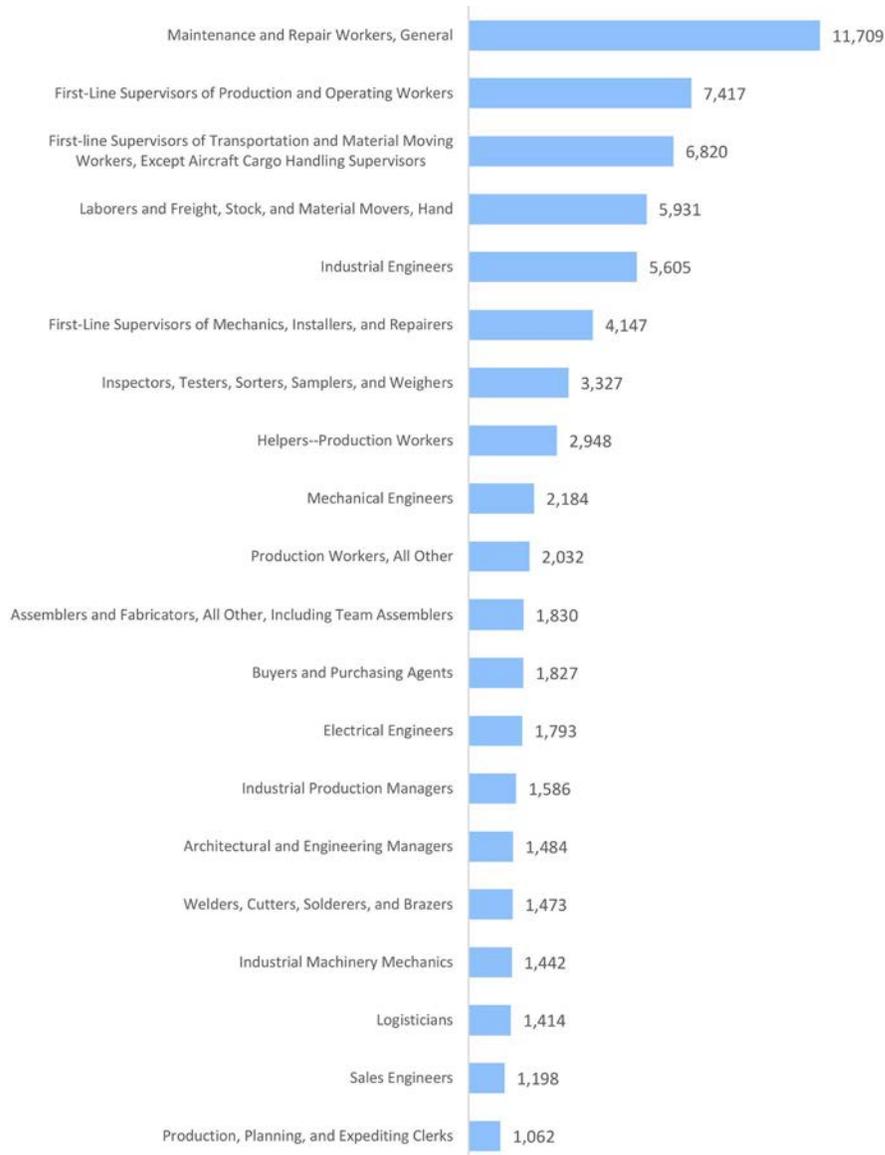
Data: Emsi
Analysis: Workforce Intelligence Network

OVERVIEW

TOP JOBS

Maintenance and Repair Workers, General were the most in-demand lightweighting-related occupation in Tennessee with almost 12,000 online job ads during 2018. First-Line Supervisors of Production and Operating Workers were the second-most in-demand occupation in 2018 with around 7,400 postings. Other engineering and supervisory occupations were also in high demand in Tennessee during 2018, including Industrial Engineers and First Line Supervisors of Transportation and Material Moving Workers.

★ TOP POSTING JOBS TENNESSEE 2018



156.7%

increase in demand for advanced manufacturing workers since 2012

34,179

Total online job ads in Q4 2018

Maintenance and repair workers: top in-demand job



INTRODUCTION TO SKILLED TRADES

Skilled Trades workers are the builders and makers of America. They work directly with advanced materials, assemble complicated products, and are experts in welding and machinery. They ensure that designs and plans are carried out to every detail and specification. These workers do everything from welding, to setting and managing computer-numerically-controlled machines, to overseeing manufacturing floors. These skilled workers are essential to manufacturing of lightweight materials.

The 71 individual occupations within this cluster can be split into three distinct occupation sub-groups; Machinists, Assembly & Operations workers, and Skilled Materials Workers.

Machinists

Machinists set up and operate a variety of machine tools to produce parts and instruments. Some work on traditional industrial machinery while others operate or develop programs for computer-controlled machinery.

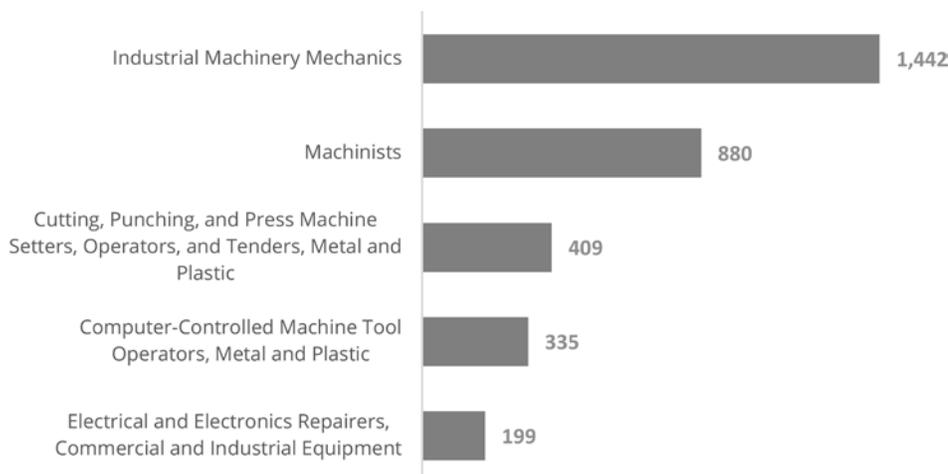
Assembly & Operations

Assembly & Operations workers assist other Skilled Trades workers during production. Some perform quality assurance inspections, assist with assembly, or perform supervisory duties on the factory floor.

Skilled Materials

Skilled Materials workers perform numerous roles from general maintenance to welding. All Skilled Materials workers must have intimate knowledge of lightweight metals and techniques in order to conduct proper repairs and/or assembly.

★ TOP POSTING JOBS TENNESSEE 2018



Machinists

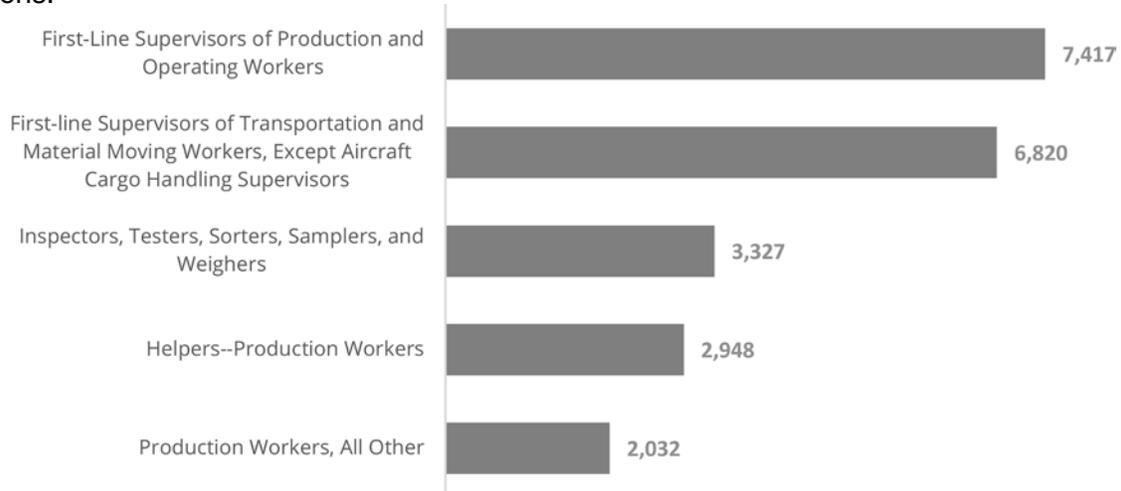
Industrial Machinery Mechanics were the most in-demand occupation in the Machinists sub-group during 2018 with 1,442 job postings, followed by General Machinists with 880 job postings. Other top jobs included Cutting, Punching and Press Machine Setters, Operators, and Tenders, Metal and Plastic (409 postings) and Computer-Controlled Machine Tool Operators, Metal and Plastic (335 postings).

SKILLED TRADES

★ TOP POSTING JOBS TENNESSEE 2018

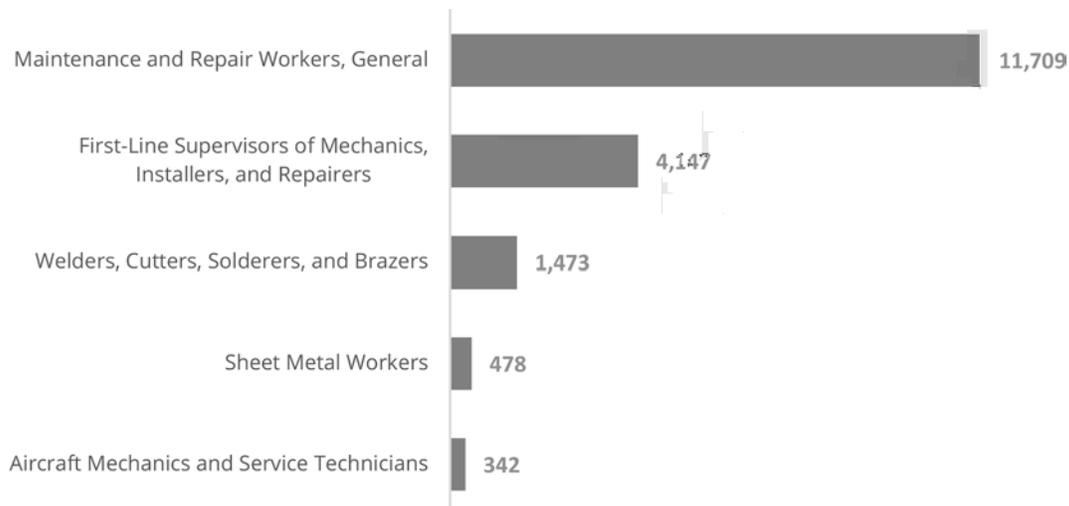
Assembly & Operations

Supervisory roles predominated among Assembly and Operations occupations in 2018. First-Line Supervisors of Production and Operating Workers were the most in-demand occupation, with 7,417 postings. Following closely behind, First-line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors (6,820 postings) and Inspectors, Testers, Samplers, Sorters and Weighers (3,327 postings) were also popular occupations.



Skilled Materials

Maintenance and Repair Workers, General (11,709 postings) had nearly three times the number of postings as the next most in-demand job in the Skilled Materials sub-group during 2018. First-Line Supervisors of Mechanics, Installers, and Repairers (4,147 postings) were also sought after, indicating the potential for career growth in this in-demand field. Welders, Cutters, Solderers, and Brazers garnered 1,473 postings in 2018.



SKILLED TRADES

IN-DEMAND TECHNICAL SKILLS

The Skilled Trades group requires a wide array of high-level technical skills. While traditional skills like HVAC, plumbing, and hydraulics remain necessary, skills requiring post-secondary education and training have become more prevalent in Skilled Trades job postings. Quality assurance, preventive maintenance, and similar skills indicate a preference for detail-oriented candidates.

- Warehousing
 - HVAC
 - Packaging And Labeling
 - Plumbing
 - Continuous Improvement Process
 - Preventive Maintenance
 - Carpentry
 - Mechanics
- Painting
 - Welding
 - Corrective And Preventive Actions
 - Quality Management
 - Personal Protective Equipment
 - Blueprinting
 - Product Quality Assurance
 - Hydraulics

IN-DEMAND EMPLOYABILITY SKILLS

While Skilled Trades workers need mastery of advanced technical skills, they also need the foundational skills critical to succeeding in any workplace. Employers hiring Skilled Trades workers often post employability skills like communication, problem solving, the ability to perform physical labor, and planning and organizational abilities. The increased frequency of requests for supervisory and leadership skills reflects the growing demand for managers within the Skilled Trades.

- Management
 - Operations
 - Communications
 - Troubleshooting (Problem Solving)
 - Leadership
 - Customer Service
 - Problem Solving
 - Sales
- Computer Literacy
 - Written Communication
 - Innovation
 - Interpersonal Skills
 - Construction
 - Research
 - Microsoft Excel
 - Coordinating

SKILLED TRADES

✓ IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

Online job postings for Skilled Trades workers in Tennessee primarily advertise openings requiring five or fewer years of experience. Of those that specified a desired experience range, 57.5 percent were open to candidates with two years of experience or less (11,287 postings) while another 7,398 require three to five years. A growing portion of advertised Skilled Trades occupations suggest a bachelor's degree for entry (24.4 percent in 2018), though the majority of postings prefer a high school diploma paired with vocational training or short-term credentials. If potential candidates can learn valuable in-demand technical skills like welding, programming, or mathematics, they can fill the entry-level openings that have such high demand among Tennessee employers. Job postings requiring five or more years of experience most likely represent supervisory or management roles.

IN-DEMAND EXPERIENCE

TENNESSEE 2018



IN-DEMAND EDUCATION

TENNESSEE 2018



\$ WAGES

The wage table below, containing data from the Bureau of Labor Statistics (BLS) indicates the hourly wage distribution for the top five posted Skilled Trades occupations. Maintenance and Repair Workers, General, the top occupation in this subgroup and one of the highest-demand overall, earn about \$17.46 at the median, or around \$36,000 annually. High demand supervisory roles in the Skilled Trades groups offer greater earning potential, with median wages for two of the top five jobs above \$24 hourly.

TOP JOBS WAGE SCALE

TENNESSEE 2018

Occupation Code	Occupation Name	10th Percentile Wages	25th Percentile Wages	Median Wages	75th Percentile Wages	90th Percentile Wages
49-9071	Maintenance and Repair Workers, General	\$10.99	\$13.84	\$17.46	\$22.36	\$27.78
51-1011	First-Line Supervisors of Production and Operating Workers	\$15.23	\$19.17	\$25.91	\$34.30	\$44.14
53-1048	First-line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors	\$14.66	\$17.94	\$23.75	\$31.01	\$38.61
49-1011	First-Line Supervisors of Mechanics, Installers, and Repairers	\$17.45	\$22.97	\$29.71	\$38.33	\$46.95
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	\$9.84	\$12.49	\$16.44	\$21.63	\$27.99

0-5 years

Experience most in-demand by Tennessee employers

\$36,000

top occupation median salary

7,117

postings requiring a bachelor's degree

Data: Emsi
Analysis: Workforce Intelligence Network





INTRODUCTION TO ADMINISTRATION

Purchasing materials, ensuring worker safety around machines and with materials, and coordinating and analyzing material and goods movement are essential administration jobs related to lightweighting. Without workers focused on worker safety, production would slow down, and more workers would be injured. Procurement professionals require an extensive understanding of the materials that they purchase. Logistics workers range from materials movers to logistics analysts. While these jobs are focused on administration, all of the workers in this occupation category must have detailed knowledge of materials, goods movement, and worker safety to help ensure smooth and seamless production.

There are 17 individual occupations within this cluster, which can be split into three distinct occupation sub-groups: Procurement & Purchasing, Human Safety, and Logistics Workers.

Logistics

Logistics workers ensure transportation optimization of materials within organizations, from designing efficient supply chain processes to engaging in the actual transport of material and freight.

Procurement & Purchasing

Procurement & Purchasing workers ensure that all of the machinery, equipment, tools, and supplies necessary for manufacturers are ready and available for production.

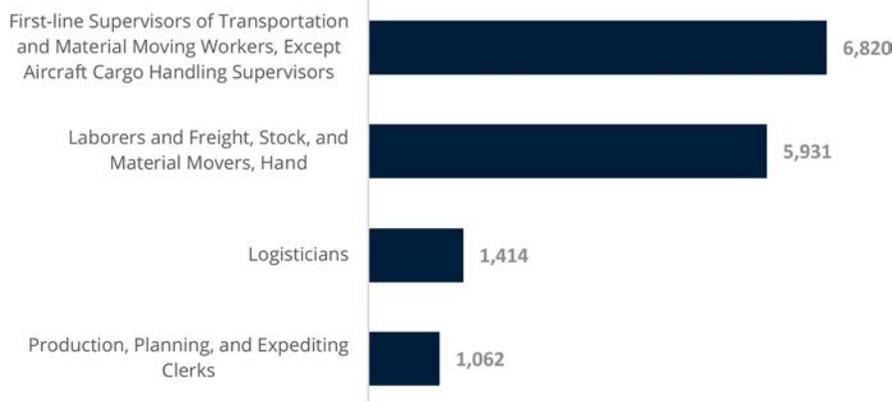
Human Safety

Human Safety workers plan, implement, coordinate, review, and inspect safety programs and protocols to ensure a safe workforce environment.

★ TOP POSTING JOBS TENNESSEE 2018

Logistics

First-line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors, topped demand in this sub-group. Tennessee employers posted 6,820 online job ads for these workers during 2018, making it one of the state's most in-demand lightweighting occupations overall. The next most in-demand occupation, Laborers and Freight, Stock, and Material Movers, Hand, garnered 5,931 online job postings in 2018.

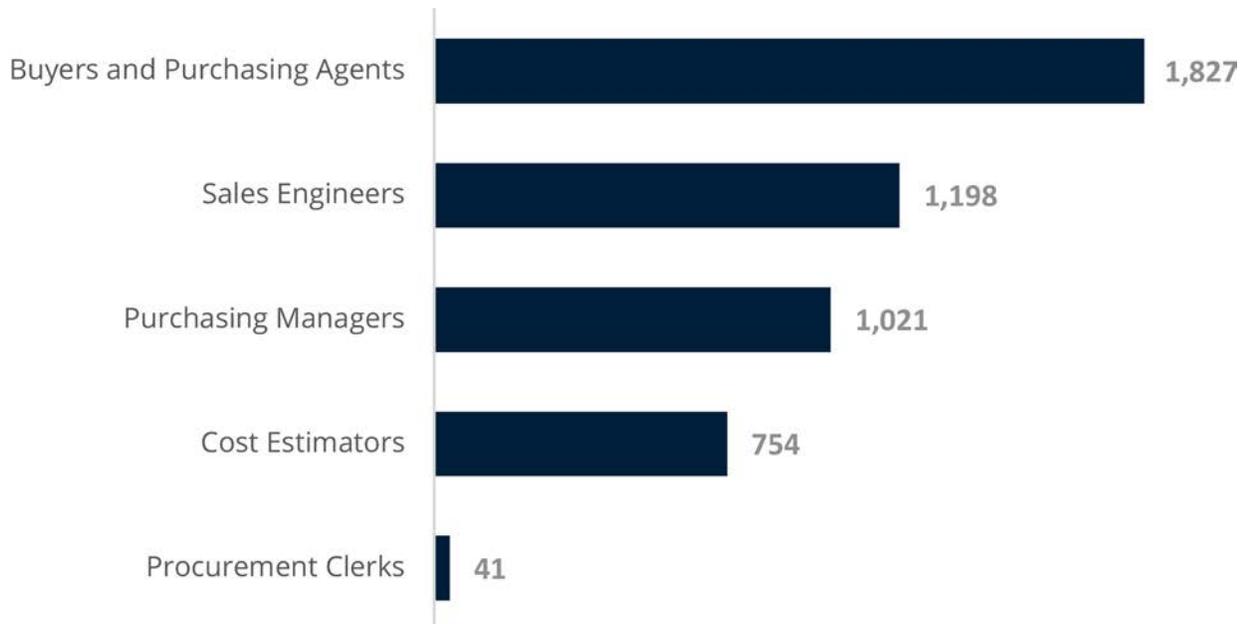


ADMINISTRATION

★ TOP POSTING JOBS TENNESSEE 2018

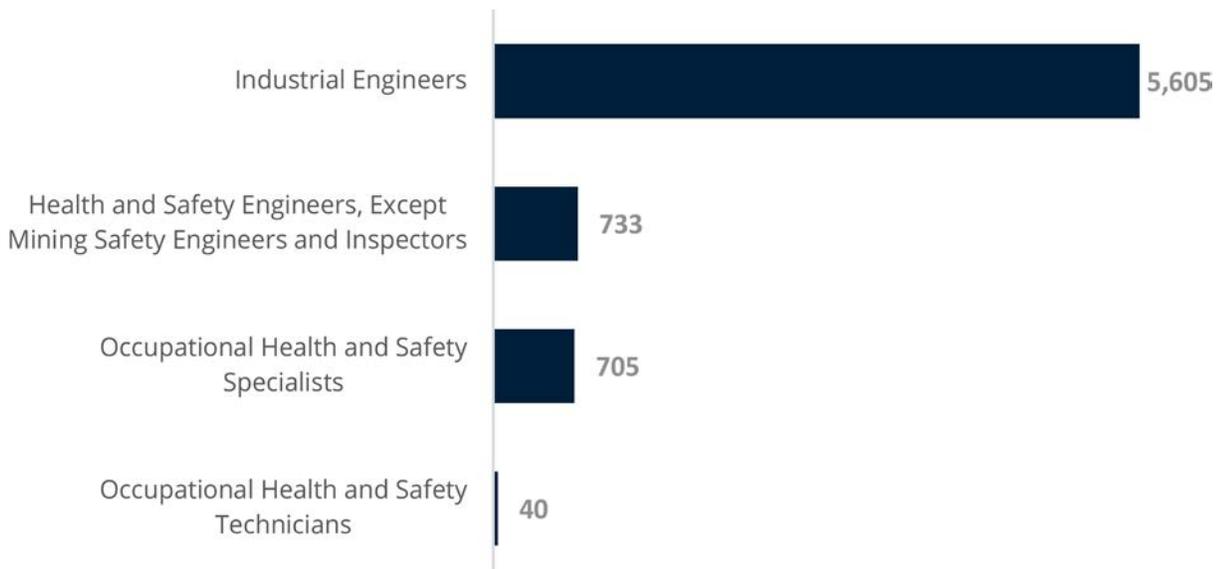
Procurement & Purchasing

Buyers and Purchasing Agents led the Procurement and Purchasing sub-group with 1,827 online ads during 2018. Sales Engineers were second most in-demand with 1,198 postings. Purchasing Managers and Cost Estimators had over 500 postings each, while Procurement Clerks represented a much smaller portion of the advertised openings.



Human Safety

Industrial Engineers were by far the most in-demand occupation in the Human Safety subgroup, as well as a top lightweighting-related occupation in Tennessee overall. Health and Safety Engineers, Except Mining Safety Engineers and Inspectors (733 postings) and Occupational Health and Safety Specialists (705 postings) were also in demand.



ADMINISTRATION

IN-DEMAND TECHNICAL SKILLS

Occupations within the Administration group require a wide array of high-level technical and managerial skills. Traditional skills like forklift operation and inspection are present in many postings. The job postings for Administration workers reflect the greater employer focus on engineering and management roles. Frequent requirements for project management experience communicate employer demand for talent in high-wage management occupations.

- | | |
|--|---|
| <ul style="list-style-type: none">• Warehousing• Purchasing• Continuous Improvement Process• Forklift Truck• Procurement• Packaging and Labeling• Corrective and Preventive Actions• Auditing | <ul style="list-style-type: none">• Palletizing• Merchandising• Manufacturing Processes• Product Quality Assurance• Supply Chain Management• Lean Manufacturing• Automation• Material Handling |
|--|---|

IN-DEMAND EMPLOYABILITY SKILLS

Like the Skilled Trades group, Tennessee employers seek Administration workers with traditional employability skills such as the ability to communicate, organize, and solve problems. The inclusion of mathematics as a common baseline skill in postings reflects the technical nature of Administration occupations and the higher levels of education required for most openings. Due to the numerous business-oriented duties Administration workers have, strong computer and writing skills are necessary for success.

- | | |
|--|---|
| <ul style="list-style-type: none">• Management• Operations• Communications• Leadership• Problem Solving• Sales• Unloading• Customer Service | <ul style="list-style-type: none">• Innovation• Written Communication• Microsoft Excel• Interpersonal Skills• Presentations• Computer Literacy• Microsoft Office• Coordinating |
|--|---|

ADMINISTRATION

✓ IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

Among job advertisements posting experience requirements, 48.6 percent required two years of experience or less (5,978 postings). Similarly, 42.8 percent of postings required between three and five years of experience (5,270 postings), indicating that employers would like workers with enough prior experience for management positions. The increase in this intermediate experience category is a good indicator of the growing demand for managers in Administration occupations overall. Among those stating education requirements, 30 percent required at least an associate's degree, and 54 percent of Administration postings required a bachelor's degree.

IN-DEMAND EXPERIENCE

TENNESSEE 2018



IN-DEMAND EDUCATION

TENNESSEE 2018



\$ WAGES

TOP JOBS WAGE SCALE

TENNESSEE 2018

The wage table below, containing data from the Bureau of Labor Statistics (BLS) indicates the hourly wage distribution for the top five posted Skilled Trades occupations. Engineering positions can lead to high wages within this group; Industrial Engineers earn nearly \$40 hourly at the median. Other occupations' wages vary with education and experience.

Occupation Code	Occupation Name	10th Percentile Wages	25th Percentile Wages	Median Wages	75th Percentile Wages	90th Percentile Wages
53-1048	First-line Supervisors of Transportation and Material Moving Workers, Except Aircraft Cargo Handling Supervisors	\$14.66	\$17.94	\$23.75	\$31.01	\$38.61
53-7062	Laborers and Freight, Stock, and Material Movers, Hand	\$9.23	\$10.73	\$13.07	\$16.52	\$19.26
17-2112	Industrial Engineers	\$26.06	\$32.50	\$39.26	\$47.72	\$57.49
13-1028	Buyers and Purchasing Agents	\$16.44	\$21.72	\$27.80	\$37.58	\$49.86
13-1081	Logisticians	\$15.34	\$21.83	\$28.35	\$36.40	\$48.14

0-5 years
Experience most in-demand by Tennessee employers

\$49,400
top occupation median salary

9,135
job postings requiring a bachelor's degree



INTRODUCTION TO ENGINEERING & DESIGN

Engineers and industrial designers create the blueprints for all things manufacturing. These workers not only envision the products of the future but they also ensure that the products are functional, safe, reliable, and durable.

There are 52 individual occupations within this group which can be split into four distinct occupation sub-groups; Electrical & Mechanical Engineering, Chemical Engineering & Metallurgy, Industrial Designers & Drafters, and Process Engineering & Testing.

Electrical & Mechanical Engineers

Electrical & Mechanical Engineers perform duties related to the research, design, development, and testing of mechanical functioning, electrical, and manufacturing equipment, components, or systems for commercial, industrial, military, or scientific use.

Chemical Engineers & Metallurgy

Chemical Engineers & Metallurgy workers perform duties related to the research, design, development, and testing of chemicals and metal materials. These workers often lead the charge in finding cutting-edge uses of lightweight metal materials.

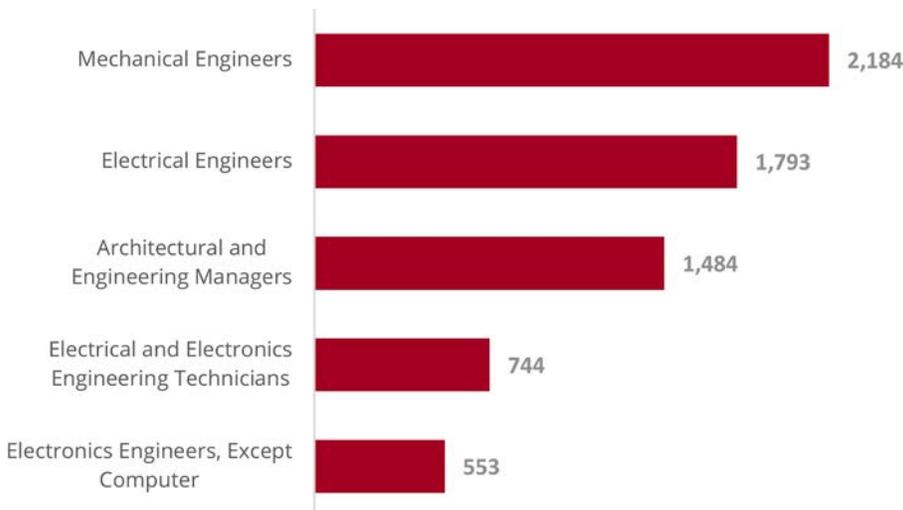
Designers & Drafters

Designers & Drafters collaborate with other workers within the Engineer group to prepare detailed diagrams and designs of machinery, devices, and manufactured products. They combine their artistic talents and knowledge of lightweight metal capabilities to create both functional and appealing product designs.

Process Engineers & Testing

Process Engineering & Testing workers design processes and test manufacturing machinery to ensure that production of lightweight metal materials meet both internal and external safety and quality requirements.

★ TOP POSTING JOBS TENNESSEE 2018

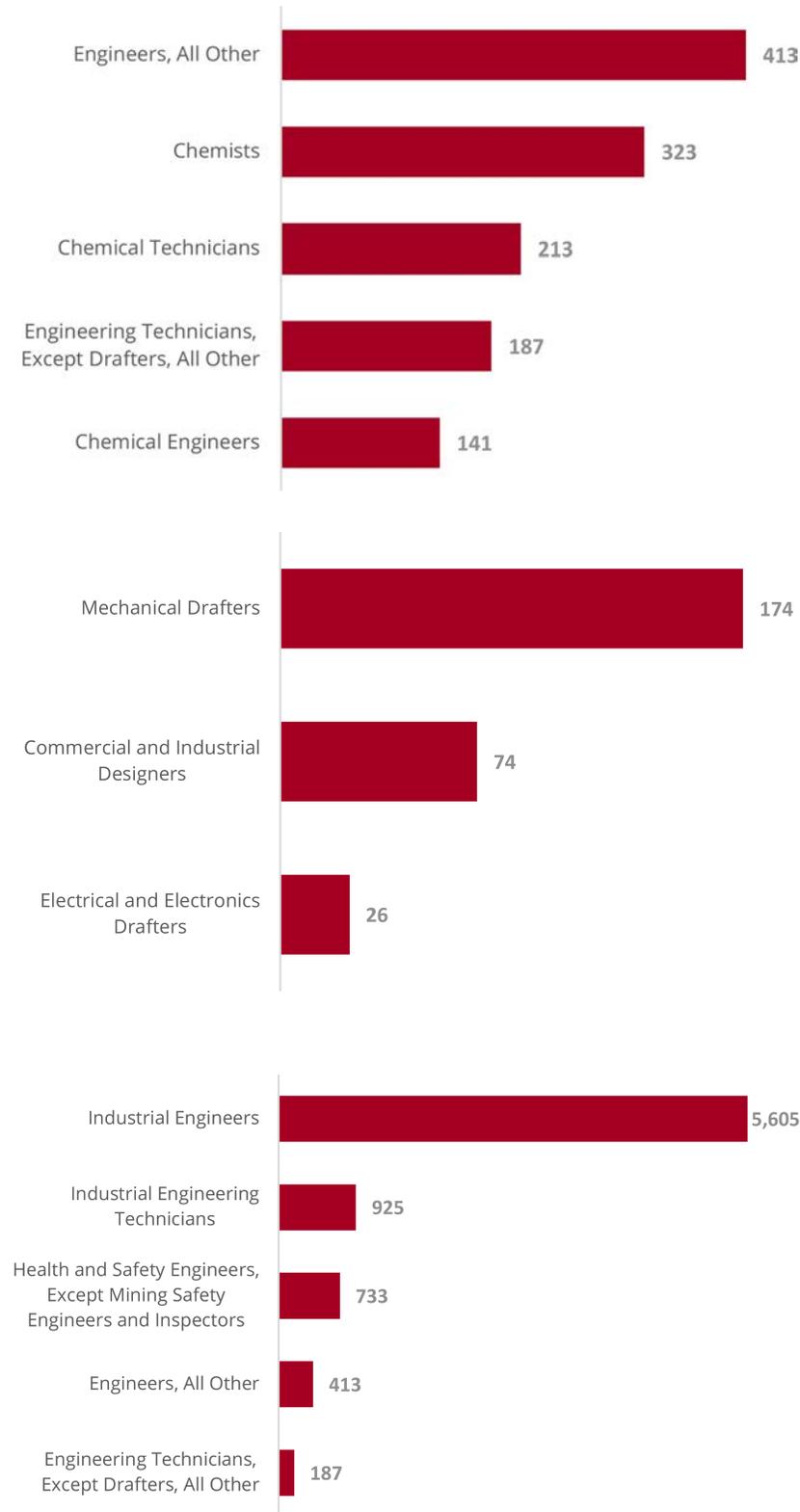


Electrical & Mechanical

This sub-group represents the largest in the Engineering and Design group in terms of employer demand. High demand for Mechanical (2,184 postings) and Electrical Engineers (1,793 postings) continually pushes these occupations to the top of the in-demand list for their sub-group.

ENGINEERING & DESIGN

★ TOP POSTING JOBS TENNESSEE 2018



Chemical & Metallurgy

Engineers, All Other led this sub-group during 2018 with 413 online ads. Demand for Chemists (323 postings) and Chemical Technicians (213 postings) was also high. Engineering Technicians, Except Drafters, All Other and Chemical Engineers followed closely, with over 100 postings each.

Designers & Drafters

Mechanical Drafters took the top position in the Designers and Drafters sub-group during 2018 with 174 postings. Commercial and Industrial Designers (74 postings) and Electrical and Electronics Drafters (26 postings) held the second and third spots for the sub-group in 2018.

Process & Testing

In addition to topping the Human Safety subgroup, Industrial Engineers were the top in-demand occupation for the Process Engineering and Testing sub-group with 5,605 postings in 2018. Though apparently dwarfed by demand for Industrial Engineers, other occupations in this subgroup were in high demand as well; Industrial Engineering Technicians garnered 925 online job ads, while Health and Safety Engineers, Except Mining Safety Engineers and Inspectors and Engineers, All Other were also in demand.

ENGINEERING & DESIGN

IN-DEMAND TECHNICAL SKILLS

In addition to skills such as electrical engineering, AutoCAD, and automation, business and management-related skills dominate the technical proficiency list for the Engineers group. Skills related to product design, auditing, and manufacturing processes were prevalent throughout 2018 in job postings made for Tennessee Engineers.

- Continuous Improvement Process
 - Mechanical Engineering
 - Automation
 - Manufacturing Processes
 - Corrective and Preventive Actions
 - Product Quality Assurance
 - Electrical Engineering
 - Lean Manufacturing
- Process Engineering
 - Control Systems
 - Computer-Aided Design
 - Auditing
 - Computer Control Systems
 - Quality Management
 - Six Sigma Methodology
 - New Product Development

IN-DEMAND EMPLOYABILITY SKILLS

While Engineers and Designers require critical technical skills learned through advanced education, employers also require these workers to have foundational skills necessary to function efficiently on a team such as communication, planning, and teamwork. They must also have important project-oriented skills like writing, researching, and presenting. Overall, the top employability and technical skills reflect that Tennessee employers seek well-rounded candidates for Engineering and Design job openings.

- Management
 - Operations
 - Communications
 - Leadership
 - Problem Solving
 - Innovation
 - Troubleshooting (Problem Solving)
 - Written Communication
- Microsoft Excel
 - Research
 - Microsoft Office
 - Coordinating
 - Sales
 - Project Management
 - Presentations
 - Interpersonal Skills

ENGINEERING & DESIGN

✓ IN-DEMAND EXPERIENCE & EDUCATIONAL ATTAINMENT

Among online job postings advertising a preferred level of experience in 2018, most (50 percent) preferred candidates with three to five years of experience. Entry level positions, requiring zero to two years, also had a high share of postings (36 percent). Employers may prefer Engineering and Design workers with previous experience, but opportunities do exist at the entry-level. The majority of postings for Engineers and Designers in Tennessee during 2018 advertised an education requirement, and 64.6 percent required a bachelor's degree. Some engineering technician positions in the group are open to candidates with some post-secondary training or a related associate's degree, and 13.2 percent require more than a bachelor's degree.

IN-DEMAND EXPERIENCE

TENNESSEE 2018



IN-DEMAND EDUCATION

TENNESSEE 2018



\$ WAGES

TOP JOBS WAGE SCALE

TENNESSEE 2018

The wage table below, containing data from the Bureau of Labor Statistics (BLS) indicates the hourly wage distribution for the top five posted Skilled Trades occupations. The high education and experience requirements for Engineering occupations translates to high wages; four of the top five jobs report median wages around \$40 per hour, with exceptionally high wages for those with management experience.

Occupation Code	Occupation Name	10th Percentile Wages	25th Percentile Wages	Median Wages	75th Percentile Wages	90th Percentile Wages
17-2112	Industrial Engineers	\$26.06	\$32.50	\$39.26	\$47.72	\$57.49
17-2141	Mechanical Engineers	\$23.97	\$30.27	\$39.76	\$49.82	\$61.51
17-2071	Electrical Engineers	\$27.50	\$33.55	\$42.59	\$52.95	\$60.95
11-9041	Architectural and Engineering Managers	\$34.09	\$42.61	\$55.51	\$71.91	\$91.51
17-3026	Industrial Engineering Technicians	\$13.82	\$16.86	\$21.55	\$26.88	\$33.50

9,052
job postings
requiring a
bachelor's degree

\$81,660
top occupation
median salary

0-5 years
Experience most in-
demand by Tennessee
employers



For more information about LIFT and additional workforce data visit www.lift.technology