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Opportunity in Infrastructure

An Examination of Infrastructure Occupations Across Third District States

COMMUNITY DEVELOPMENT & REGIONAL OUTREACH

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[1] The views expressed here are those of the author and do not reflect the views of the Federal Reserve Bank of Philadelphia or the Federal Reserve System. The author thanks Mariah Allen, Alaina Barca, Deborah Diamond, Lei Ding, Eileen Divringi, Kyle Fee, Joseph W. Kane, Adam Scavette, and Sisi Zhang for their helpful feedback.

Introduction

Building and maintaining the infrastructure that communities rely on to commute to work on time, warm their homes, and access the internet requires a workforce equipped with the knowledge and skills to operate these systems. Infrastructure workers build roads, install power lines, fix pipes, and perform other activities that support local economies and contribute to quality of life. Increased levels of infrastructure spending across all levels of government in recent years have illuminated the need for more workers to support these projects (Musick 2025, Kane et al. 2025). However, an increasing number of retirements and worker exits from infrastructure sectors may leave the United States with a shortage of workers possessing the necessary skills to fill these open positions (Kane 2022).

This anticipated availability of infrastructure job openings in coming years may provide key opportunities for workers without four-year college degrees (henceforth, *sub-baccalaureate workers*).[1] By my definition, infrastructure jobs employ over 10 million workers in the United States, and fewer than 1 million of these jobs require a four-year college degree.

Prior analyses that measure infrastructure jobs and the types of skills required to attain these occupations have largely been national in scope; however, variation in the mix of employers and industries in an area can influence the types of jobs available and the skills demanded locally (Deming and Kahn 2018, DeMaria, Fee, Wardrip 2020).

In this report, I present an overview of infrastructure occupations and the skills requested by infrastructure employers in the Third District states of Pennsylvania, New Jersey, and Delaware. There are over 600,000 infrastructure workers in the three states employed across a range of occupations. Each state also has an aging population compared with that of the United States overall,[2] which could make their infrastructure workforces more vulnerable to worker shortages due to retirements. At the same time, these shortages may provide ample opportunity for workers in the region seeking higher-paying employment. Over 80 percent of infrastructure jobs in Third District states that do not require a college degree pay above the area's median wage. Throughout the analysis, I focus on *opportunity occupations*, or occupations that pay above the area median wage but do not require a four-year college degree, because these types of occupations are prevalent among infrastructure sectors.

The analysis seeks to provide insight into the following questions:

1. **What is the landscape of infrastructure jobs in Third District states and which infrastructure occupations are most prevalent?**
2. **Who makes up the current infrastructure workforce in these states?**
3. **What skills are most frequently requested for infrastructure opportunity occupations in these states?**

Key findings from the report include:

- **Infrastructure occupations make up 5.7 percent of the workforce in Third District States, 1 percentage point lower than the national share of 6.7 percent.** Of the over 600,000 infrastructure workers, nearly 585,000 work in occupations that do not require a four-year college degree.
- **Sub-baccalaureate infrastructure occupations, or occupations that do not require a four-year college degree, tend to pay higher wages compared with all other occupations without a college degree requirement.** Opportunity occupations, occupations that do not require a four-year college degree but pay above the national median wage, make up 78.2 percent of infrastructure jobs that do not require a college degree in Pennsylvania, 87.0 percent in New Jersey, and 83.4 percent in Delaware.
- **Women are underrepresented in infrastructure employment overall, while people of color are underrepresented in some of the largest opportunity infrastructure occupations.** Women make up less than 10 percent of infrastructure employment in the three states, while people of color remain underrepresented in some of the largest opportunity occupations like electricians and plumbers. Expanding infrastructure employment among underrepresented workers could contribute to meeting the infrastructure workforce demand.
- **Infrastructure occupations across the pay scale share many of the same skills, pointing to pathways for economic mobility for lower-wage workers.** Fifteen of the 20 most frequently requested skills are the same between lower- and higher-paying sub-baccalaureate infrastructure jobs, while 10 of the 20 most frequently

[1] Sub-baccalaureate occupations refer to occupations that typically require an associate's degree, some college (no degree), a high school diploma or equivalent, or a postsecondary nondegree award. They also include occupations that require an apprenticeship or specific on-the-job training.

[2] As of 2023, Pennsylvania, New Jersey, and Delaware each have a state median age that is at least one to nearly three years older than the United States median age, according to the American Community Survey's Five-Year Estimates (2019-2023).

requested skills are the same between higher-paying infrastructure jobs and all lower-paying jobs that do not require a college degree.

The report also includes example pathways into infrastructure occupations from the Occupational Mobility Explorer developed by the Federal Reserve Banks of Philadelphia and Cleveland. This interactive tool allows users to build skills-based career pathways to visualize how the skills gained through previous work experience can transfer to higher-paying occupations. The three pathways in this report show how the skills developed in lower-paying infrastructure and noninfrastructure roles can transfer to higher-paying infrastructure occupations, highlighting opportunities for occupational advancement into and within infrastructure sectors.

Data and Methods

Most definitions of infrastructure agree that infrastructure consists of public-serving systems and facilities; however, the types of systems and facilities included across definitions vary widely. Traditional definitions of infrastructure reserve the term for physical structures built for public use, like roads, bridges, and other public works systems. More recent definitions include broadband and other telecommunications infrastructure, recognizing the capital-intensive nature of broadband assets and that most households rely on accessing the internet for work, school, or other tasks (Wong et al. 2020, Beeferman and Wain 2016, Kane and Puentes 2014, American Society of Civil Engineers 2025). Even broader definitions classify services like childcare or healthcare as infrastructure (sometimes referred to as *social infrastructure*) as these systems promote societal well-being and can affect labor force participation (Li and Laughlin 2024, Child Care is Infrastructure Act 2021, Gould-Werth et. al 2023). The definition in this report follows Kane and Puentes (2014), to include workers who contribute to the design, construction, operation, or governance of physical infrastructure systems and facilities.[3]

This report uses a combination of data from the Bureau of Labor Statistics, data from the Census Bureau, and employer job postings from Lightcast to understand the size and demographics of the infrastructure workforce and the skills often requested by employers of infrastructure workers. These data are similar to those used for the Occupational Mobility Explorer.[4] The landscape analysis uses data from the Bureau of Labor Statistics (BLS) May 2024 Occupational Employment and Wage Statistics (OEWS) for employment totals and area median wages, and the typical education and on-the-job training needed for entry from 2023 for each infrastructure occupation. I also use Occupational Employment Projections from the BLS to access the projected growth rate in employment from 2023 to 2033. For the demographic data, I use the American Community Survey's 2023 Public Use Microdata Sample (PUMS) for data on the age, gender, race, and ethnicity of infrastructure workers.[5] Finally, the skills analysis uses Lightcast's employer job postings data from 2021 to 2023 to determine the most frequently requested skills by employers of infrastructure workers. These data derive from job advertisements from more than 65,000 websites and contain information on the skills requested, the geographic area for the listing, and the associated Standard Occupation Classification (SOC) code for each occupation.[6]

To determine infrastructure occupations, I follow the methodology introduced by Kane and Puentes' 2014 report with a few modifications. I use a three-step process that consists of (1) identifying broad infrastructure sectors, (2) identifying infrastructure industries that support these sectors, and (3) classifying infrastructure occupations based on the national concentration of occupations within designated infrastructure industries. Connecting infrastructure sectors to industries, and

[3] Kane and Puentes (2014) define infrastructure as encompassing "...a broad range of systems and facilities designed, constructed, operated, and governed across the public and private sector. Foundational in nature, these physical assets are either manmade or natural, often operate as part of larger networks, support a variety of economic activities, and provide a host of other services with clear public benefit over the course of many years" (page 3).

[4] The Occupational Mobility Explorer uses data on employment and wages from the Bureau of Labor Statistics (BLS) Occupational Estimates and Wage Statistics (OEWS) May 2023 release, employment projections from 2022, and education data from Lightcast. This report uses the most recently released OEWS data from May 2024, employment projections from 2023, and educational attainment data from the BLS. Because of this, values in the tool may not exactly match those in this analysis.

[5] I use the Census-SOC crosswalk to connect SOC occupations to demographic data from the American Community Survey (2019–2023). For census occupation classifications that include multiple SOC occupations consisting of infrastructure and noninfrastructure occupations, I weight the census employment using the share of employment within that occupation that is classified as infrastructure employment in the OEWS.

[6] For more information on Lightcast's data and methodology, visit its https://lightcast.io/.

TABLE 1

Examples of Infrastructure Industries and Share of Infrastructure Employment Captured by These Industries

Infrastructure Sectors	Sample NAICS industries	Employment in Infrastructure Industries (%)
Transportation	Deep sea, coastal, and great lakes water transportation; urban transit systems; highway street and bridge construction	12.8%
Trade and logistics	Truck transportation, warehousing and storage, local messengers and local delivery	14.6%
Telecommunications	Telecommunications	2.2%
Water	Water, sewage, and other systems	0.3%
Energy	Utility system construction; natural gas distribution; electric power generation, transmission, and distribution	7.1%
Public works	Land subdivision, waste treatment and disposal, other heavy and civil engineering construction	17.5%
Building construction	Building equipment contractors; nonresidential building construction; foundation, structure, and building exterior contractors	45.5%

Source
Author's calculations using data from BLS National Employment Matrix (2023).

finally, to occupations helps to ensure that most infrastructure occupations directly support activities related to building, maintaining, and operating infrastructure.

Infrastructure sectors identified in the first step are: (1) transportation, (2) trade and logistics, (3) telecommunications, (4) water, (5) energy, (6) public works, and (7) building construction.[7] These sectors largely account for the physical structures and systems that service an area. I then identify 46 four-digit NAICS infrastructure industries associated with the seven infrastructure sectors. Given that federal, state, and local governments employ a substantial share of infrastructure workers, I also include these industries in my analysis.

After identifying infrastructure sectors and related industries, I use the BLS's 2023 National Employment Matrix, which captures national industry employment by occupation, to calculate the share of employment in each occupation that supports infrastructure industries. An *infrastructure occupation* is one where at least 50 percent of national employment is concentrated within infrastructure industries. For example, 77.3 percent of all U.S. electricians are employed within the 46 designated infrastructure industries, making it an infrastructure occupation.[8] Based on this framework, I classify 97 occupations as infrastructure occupations.[9]

Infrastructure Occupations in Third District States

As of 2024, infrastructure occupations employ about 609,000 workers in Third District states. These jobs account for 5.7 percent of total employment in Delaware, 5.2 percent in New Jersey, and 6.0 percent in Pennsylvania, slightly lower than the national share of 6.7 percent. Of the 609,000 infrastructure jobs, about 585,000 do not require a four-year college degree, and 81.6 percent of these sub-baccalaureate jobs pay above the area median wage. Infrastructure occupations that employ the most workers across the three states include truck drivers, construction laborers, construction supervisors, electricians, and HVAC mechanics and installers. These five infrastructure occupations make up over half of infrastructure employment in the three states combined.

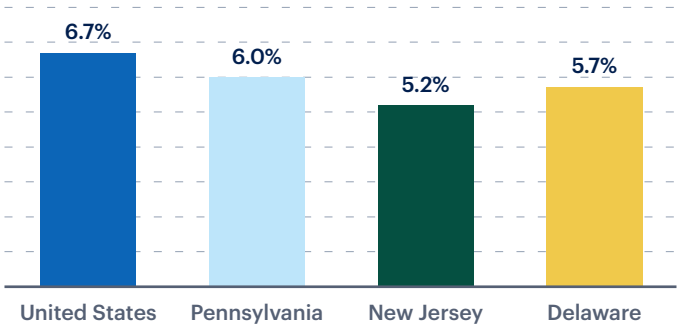
[7] These sectors largely align with Kane and Puentes' classifications, aside from the inclusion of building construction. I choose to classify building construction as infrastructure because, like core infrastructure sectors (e.g., public works, transportation, water), buildings are similarly capital intensive and share many of the same occupations, like plumbers and electricians, for example. The residential building construction NAICS industry is excluded from this analysis.

[8] I remove occupations that clearly do not support one of the seven above sectors given the inclusion of federal, state, and local government industries (e.g., bailiffs, legislators, etc.).

[9] See Tables A2 and A3 in the Appendix for a full list of infrastructure industries and occupations.

FIGURE 1

Infrastructure Employment in the Third District States and United States, 2024



Sources
Author's calculations using data from BLS Occupational Employment and Wage Statistics (May 2024).

TABLE 2 lists the 10 largest infrastructure occupations in each of the three states, in addition to the typical entry-level education and training for these roles. Most of these occupations pay at or above the state's median wage (with the exception of construction laborers in Delaware and Pennsylvania and highway maintenance workers in New Jersey and Pennsylvania). Cost estimator is the only role among the largest infrastructure occupations that typically requires a bachelor's degree. While the other occupations listed may not request a college degree, some level of on-the-job training or an apprenticeship is often required to develop the competencies necessary for these occupations. These types of occupations include HVAC mechanics and installers, electricians, and plumbers.

National forward-looking projections suggest that employment in infrastructure occupations will likely grow from 2023 to 2033. The projected growth rate in infrastructure occupations is 5.1 percent nationally, higher than the national projected growth rate of 4.0 percent across all occupations. All 5 of the largest infrastructure occupations in Third District States are projected to experience even higher growth over this period — construction laborers (8.2 percent), construction supervisors (5.9 percent), electricians (10.8 percent), plumbers (5.6 percent), and HVAC mechanics and installers (9.1 percent). Other occupations with high projected growth in employment include solar photovoltaic installers (48.0 percent), flight attendants (9.9 percent), cargo and freight agents (9.7 percent), and electrical power-line installers and repairers (7.6 percent). These employment projections do not include the expected increases in the number of infrastructure vacancies due to retirements or separations for other reasons.

TABLE 2

Largest Infrastructure Occupations in Third District States, 2024

Occupation Title	Employment	Median Hourly Wage	Typical Education	Typical On-the-Job Training Required
DELAWARE				
Heavy and tractor-trailer truck drivers	5,950	$28.13	Postsecondary nondegree award	Short-term training
Construction laborers	2,760	$21.92	No formal educational credential	Short-term training
First-line supervisors of construction trades and extraction workers	2,350	$39.02	High school diploma or equivalent	None (five-plus years experience)
Electricians	2,220	$30.27	High school diploma or equivalent	Apprenticeship
Heating, air conditioning, and refrigeration mechanics and installers	1,790	$28.82	Postsecondary nondegree award	Long-term training
Plumbers, pipefitters, and steamfitters	1,570	$30.91	High school diploma or equivalent	Apprenticeship
Operating engineers and other construction equipment operators	1,190	$27.23	High school diploma or equivalent	Moderate-term training
Cost estimators	1,000	$36.25	Bachelor's degree	Moderate-term training
Construction and building inspectors	650	$31.25	High school diploma or equivalent	Moderate-term training
Painters, construction and maintenance	530	$26.81	No formal educational credential	Moderate-term training

TABLE CONTINUES ON PAGE 6 >

Occupation Title	Employment	Median Hourly Wage	Typical Education	Typical On-the-Job Training Required
NEW JERSEY				
Heavy and tractor-trailer truck drivers	49,450	$31.12	Postsecondary nondegree award	Short-term training
Construction laborers	20,720	$30.38	No formal educational credential	Short-term training
First-line supervisors of construction trades and extraction workers	15,670	$49.93	High school diploma or equivalent	None (five-plus years experience)
Electricians	15,230	$35.14	High school diploma or equivalent	Apprenticeship
Heating, air conditioning, and refrigeration mechanics and installers	10,680	$33.56	Postsecondary nondegree award	Long-term training
Plumbers, pipefitters, and steamfitters	9,840	$37.10	High school diploma or equivalent	Apprenticeship
Construction and building inspectors	7,040	$39.52	High school diploma or equivalent	Moderate-term training
Operating engineers and other construction equipment operators	6,450	$40.47	High school diploma or equivalent	Moderate-term training
Bus drivers, transit and intercity	5,850	$29.90	High school diploma or equivalent	Moderate-term training
Highway maintenance workers	5,780	$24.38	High school diploma or equivalent	Moderate-term training
PENNSYLVANIA				
Heavy and tractor-trailer truck drivers	90,160	$28.14	Postsecondary nondegree award	Short-term training
Construction laborers	38,350	$23.31	No formal educational credential	Short-term training
First-line supervisors of construction trades and extraction workers	26,590	$38.60	High school diploma or equivalent	None (five-plus years experience)
Electricians	21,860	$31.44	High school diploma or equivalent	Apprenticeship
Operating engineers and other construction equipment operators	20,680	$28.16	High school diploma or equivalent	Moderate-term training
Heating, air conditioning, and refrigeration mechanics and installers	16,930	$29.38	Postsecondary nondegree award	Long-term training
Plumbers, pipefitters, and steamfitters	13,990	$32.04	High school diploma or equivalent	Apprenticeship
Highway maintenance workers	11,210	$22.92	High school diploma or equivalent	Moderate-term training
Cost estimators	9,370	$35.86	Bachelor's degree	Moderate-term training
Painters, construction and maintenance	6,110	$24.15	No formal educational credential	Moderate-term training

Notes
Typical on-the-job training indicates the length of training often needed for a worker to obtain the necessary skill set for an occupation. Short-term training means the occupation requires one month or less of on-the-job experience and informal training, moderate-term training means it requires more than one month and up to one year of on-the-job experience and informal training, and long-term training means it requires more than one year of on-the-job training or a combination of work experience and formal instruction. None means that there is no occupation-specific training, but as noted, these roles may require certain skills gained from experience in a related occupation. For more information, see https://www.bls.gov/emp/documentation/definitions.htm.

Sources
Author's calculation using data from BLS Occupational Employment and Wage Statistics (May 2024), BLS Occupational Projections (2023–2033), and BLS Worker Characteristics (2023).

Opportunity Employment in Infrastructure Occupations

Because infrastructure occupations are an important source of employment for workers without a college degree, this potential growth in infrastructure employment could particularly benefit workers without a college degree. In 2024, infrastructure jobs made up 9.0 percent of sub-baccalaureate employment nationally and 7.8 percent in Third District states. These occupations range from various helpers in the construction trades to electricians to subway and streetcar operators. While most of these occupations only require a high school diploma, many infrastructure jobs, especially those in the skilled trades, require additional training or related on-the job experience before practicing. Over 40 percent of infrastructure jobs in Third District states are in occupations that typically require an associate's degree, postsecondary nondegree credential or at least five years of experience, and 50 percent typically require moderate- or long-term training or an apprenticeship. Even so, the nature of classroom instruction and training for many infrastructure jobs accommodates prospective workers who may want to work while in school or even provides the opportunity for those training to "earn while they learn" (U.S. Department of Labor, 2020).

Infrastructure occupations also offer higher-earning opportunities for workers without a four-year college degree in relation to all other occupations. **TABLE 3** shows that sub-baccalaureate workers in infrastructure occupations earn higher wages up to the 90th percentile in all three states, compared to sub-baccalaureate workers across all other occupations. At the 10th and 25th wage percentiles, infrastructure occupations pay from $4.80 to $8.50 more per hour than all other occupations without a college degree requirement. Most roles at the 10th and 25th wage percentiles,

CAREER PATH EXAMPLE 1:

Ticket Agent to Airfield Operations Specialist

Reservation and transportation ticket agents and travel clerks are one of the lowest-paid infrastructure occupations in the Philadelphia region. However, this occupation teaches workers valuable communication, customer service, and computer literacy skills that workers can use in higher-paying infrastructure jobs. The career path below shows how a worker could advance from a ticket agent to a cargo and freight agent to an airfield operations specialist by leveraging skills gained through previous experience. Shared skills between the three occupations include communication, customer service, operations, and management. Although common skills for cargo and freight agents like warehousing, invoicing, and freight forwarding are not often requested by ticket agents, workers could potentially learn these skills on the job. On top of the skills listed in the tool, like coaching, time management, and administrative functions, most employers of airfield operations specialists also request some type of training or certification in airfield operations (O-Net, n.d.).

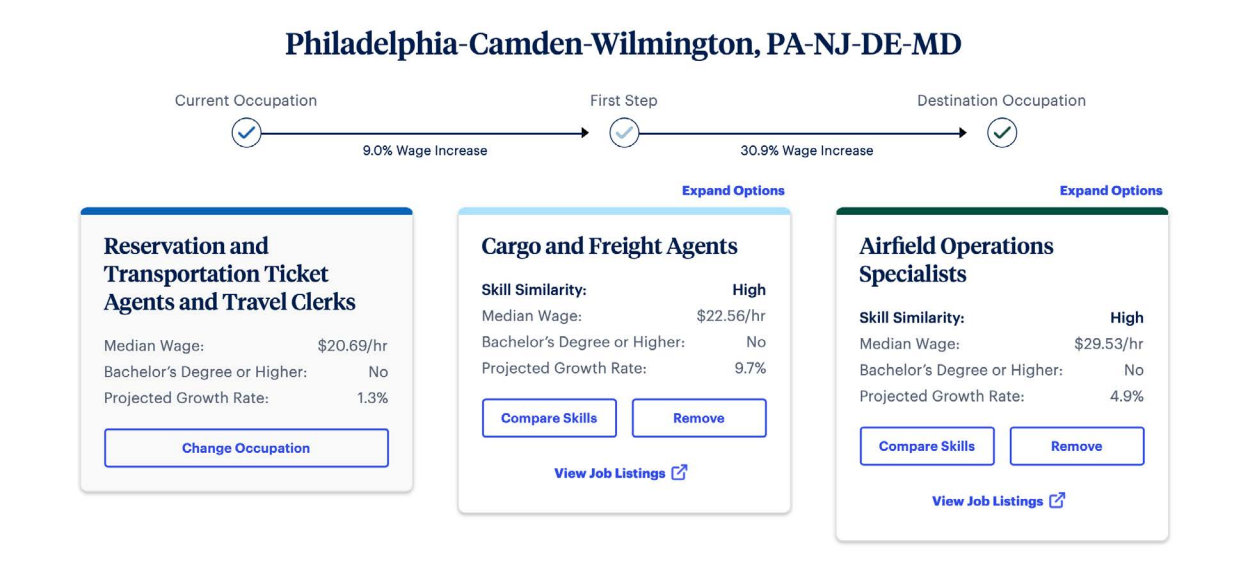


TABLE 3

Wage Percentiles for Sub-Baccalaureate Infrastructure Occupation vs. All Other Sub-Baccalaureate Occupations, 2024

Wage Percentile	Pennsylvania		New Jersey		Delaware	
	Sub-Baccalaureate Infrastructure Occupations	All Other Sub-Baccalaureate Occupations	Sub-Baccalaureate Infrastructure Occupations	All Other Sub-Baccalaureate Occupations	Sub-Baccalaureate Infrastructure Occupations	All Other Sub-Baccalaureate Occupations
10%	$20.54	$15.74	$22.44	$17.27	$20.13	$15.12
25%	$24.30	$18.54	$27.87	$19.38	$23.08	$17.77
50%	$28.60	$22.38	$33.15	$24.00	$28.06	$22.56
75%	$35.50	$27.71	$40.50	$30.59	$33.16	$29.06
90%	$41.93	$32.01	$52.28	$39.34	$40.38	$35.96

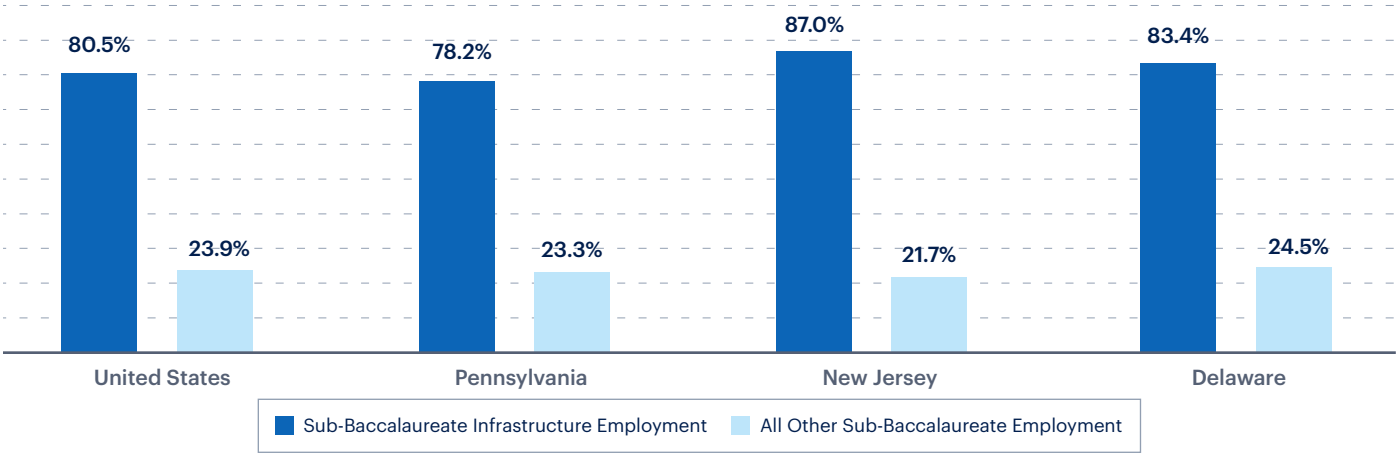
Sources
Author's calculations using data from BLS Occupational Employment and Wage Statistics (May 2024) and BLS Worker Characteristics (2023).

like passenger attendants, various helpers in the skilled trades, and ticket agents, do not have formal education or training requirements past a high school degree, making them potential entry points into infrastructure sectors.

At the same time, more infrastructure jobs in Third District states are opportunity occupations compared with total employment. Opportunity occupations make up 78.2 percent of sub-baccalaureate infrastructure jobs in Pennsylvania, 87.0 percent in New Jersey, and 83.4 percent in Delaware. Conversely, less than one-quarter of all other employment in each state is in occupations that do not require a college degree but pay above the state median wage. This means that workers without a bachelor's degree are fairly limited when it comes to opportunities to move up the wage scale into higher-paying occupations, particularly outside of infrastructure employment.

FIGURE 2

Share of Opportunity Employment in Sub-Baccalaureate Infrastructure Employment vs. All Other Sub-Baccalaureate Employment, 2024



Sources
Author's calculations using data from BLS Occupational Employment and Wage Statistics (May 2024) and BLS Worker Characteristics (2023).

Access to Opportunity Infrastructure Occupations by Worker Demographics

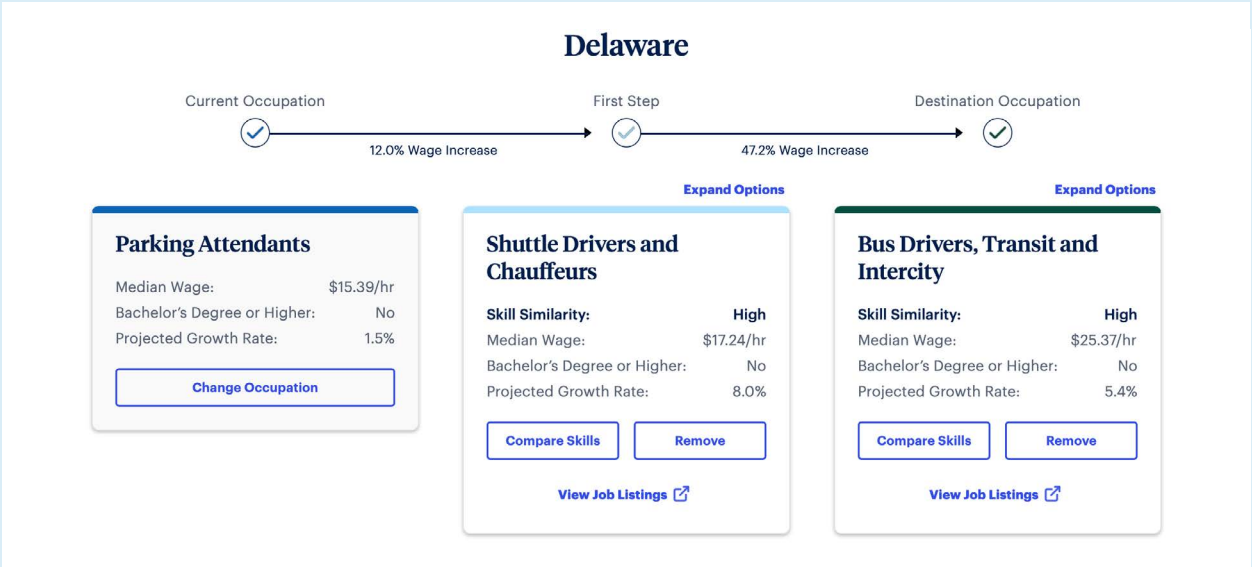
Many infrastructure occupations face ongoing worker shortages that could worsen as more workers retire from or leave the infrastructure workforce altogether. About 31 percent of infrastructure workers in Pennsylvania, New Jersey, and Delaware are 55 or older versus 29.5 percent across all occupations.[10] Water and wastewater treatment plant operators in Delaware, bus drivers in Pennsylvania, and construction and building inspectors in New Jersey are examples of opportunity occupations where over 50 percent of workers are at least 55. Furthermore, there are not enough young workers entering the infrastructure workforce at the same rate needed to replace some of these in-demand, higher-paying occupations (Kane 2022, Greenberg et al. 2024). Only 11.1 percent of infrastructure workers are 25 and under, compared with 15.6 of all occupations in the three states. To address this shortage, employers of infrastructure jobs may consider expanding hiring efforts to reach new workers who are currently underrepresented in many infrastructure occupations to meet their staffing needs.

In Pennsylvania, New Jersey, and Delaware, infrastructure occupations remain over 90 percent male, even though women compose almost 50 percent of the total three-state workforce.

CAREER PATH EXAMPLE 2:

Parking Attendant to Bus Driver

While parking attendants are not an infrastructure occupation by my definition, they require skills that are often requested by employers of infrastructure workers, like customer service, communication, a good driving record, and lifting ability. Parking attendants in Delaware have high skill similarity to shuttle drivers and chauffeurs — they both demand customer service, loading and unloading, management, and vehicle inspection skills. In addition to these "soft" skills, employers hiring shuttle drivers often also request experience with vehicle maintenance, replacing oil and gas, and commercial driving. Both the "soft" skills developed as a parking attendant and the technical skills learned through shuttle driving could transfer to a job as a bus driver in Delaware. Overlapping skills, such as a good driving record, customer service, and communication, are some of the most requested skills for bus drivers. Other requested skills for bus drivers include bus driving, air brakes, and occupational safety and health. In Delaware, moving along this career path from a parking attendant to a transit bus driver could result in a wage increase of almost 65 percent, based on the state's median wage for these positions.



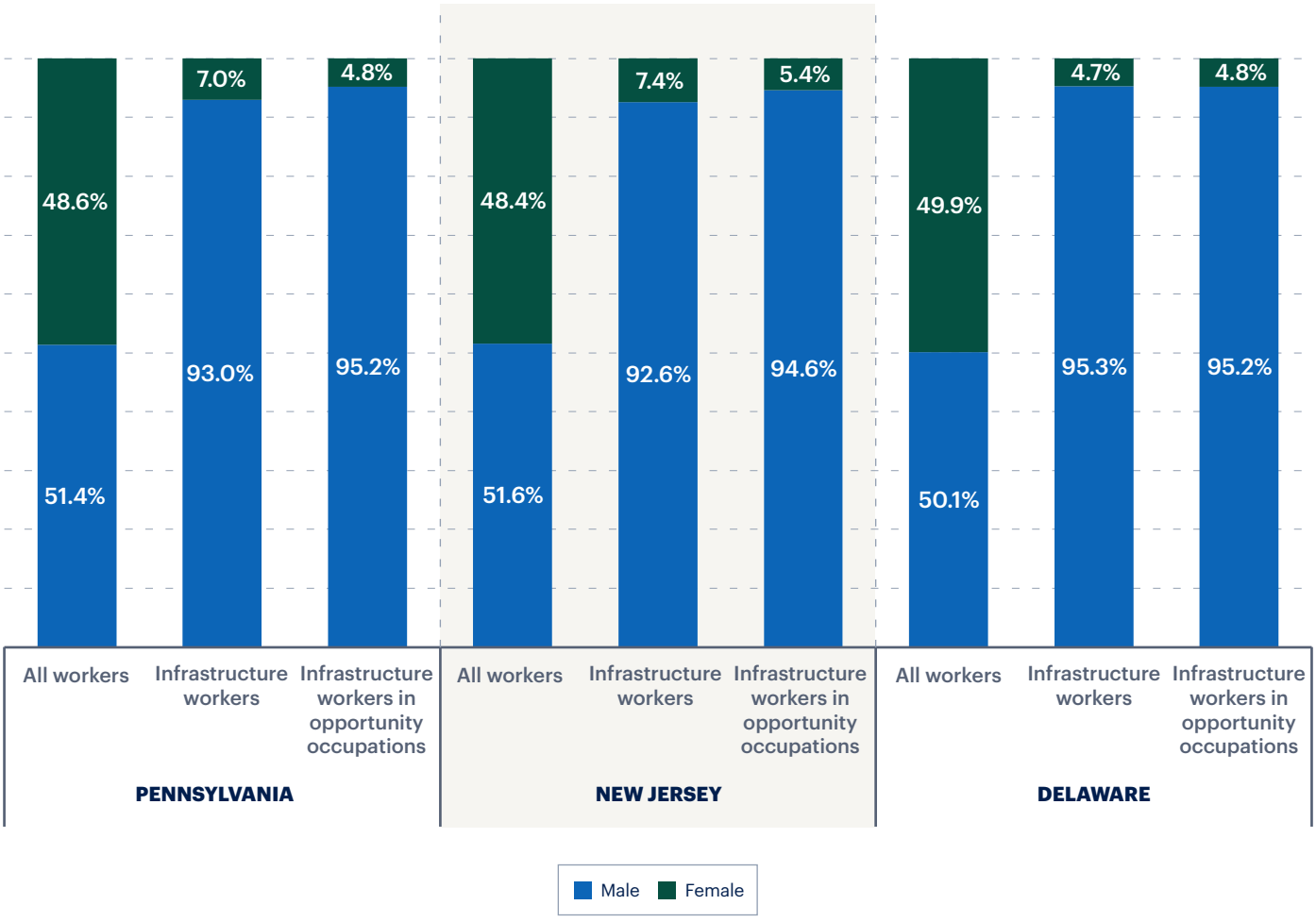
[10] Percentage comparisons noted throughout are not necessarily statistically significant.

Women make up the largest share of infrastructure employment in New Jersey at 7.4 percent, followed by Pennsylvania at 7.0 percent, and finally Delaware at 4.7 percent. Even smaller shares of women work in infrastructure opportunity occupations. For example, women represent less than 2 percent of plumbers, HVAC mechanics and installers, and electricians in these states. Infrastructure occupations that are most common among women include service-oriented jobs like passenger attendants (75.0 percent women), flight attendants (74.0 percent women), and reservation and transportation ticket agents and travel clerks (51.6 percent women), which tend to pay less than infrastructure jobs in the skilled trades or construction.

In contrast with the large gender disparities observed in infrastructure employment rates, infrastructure occupation employment by race tends to be more consistent with the racial composition of the overall workforce. In Pennsylvania, White workers are overrepresented in infrastructure employment, while workers of another race or multiple races are underrepresented. White workers and workers of another race are underrepresented in infrastructure jobs in New Jersey compared with their share of the state's total employment. Hispanic workers are overrepresented in infrastructure employment in New Jersey and Delaware, while the share of Hispanic workers in infrastructure jobs in Pennsylvania is roughly similar to that of the workforce overall. As for opportunity infrastructure employment shares, the racial and

FIGURE 3

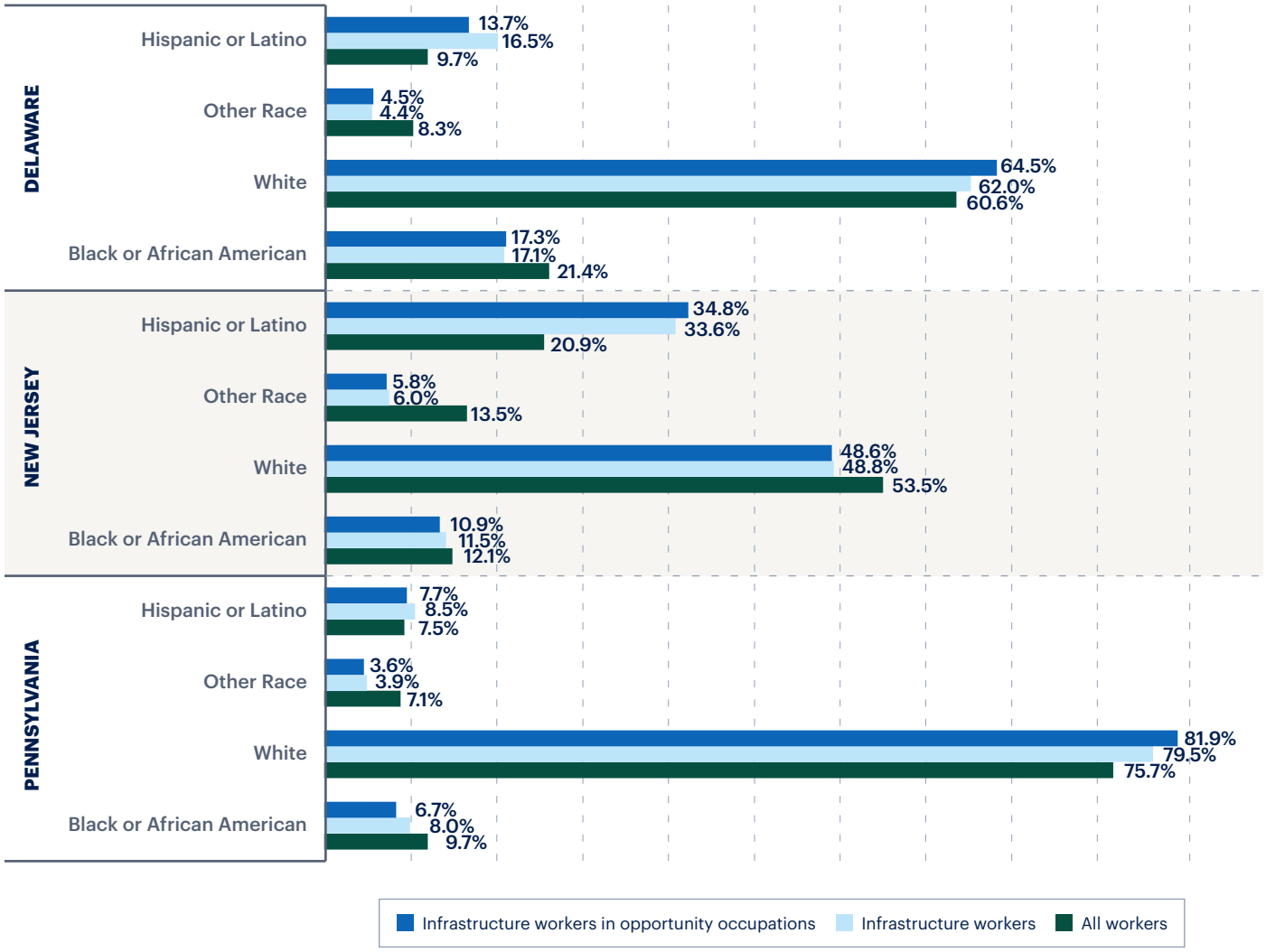
Share of Infrastructure Workers vs. Share of Infrastructure Workers in Opportunity Occupations Across Third District States by Gender, 2019–2023



Sources
Author's calculations using data from the American Community Survey Five-Year Public Use Microdata Sample (2019–2023).

FIGURE 4

Share of Infrastructure Workers vs. Share of Infrastructure Workers in Opportunity Occupations Across Third District States by Race and Ethnicity, 2019–2023



Sources

Author's calculations using data from the American Community Survey Five-Year Public Use Microdata Sample (2019-2023). Note: The Hispanic or Latino ethnicity classification is mutually exclusive, (i.e. workers classified as Hispanic or Latino can be of any race whereas workers classified as White, Black or African American, or Other Race are not Hispanic). The category 'Other race' includes workers who identify as another race than those shown or two or more races.

ethnic composition of all infrastructure workers and infrastructure workers in opportunity employment remains similar to that of total infrastructure employment, often within 2 percentage points. Nevertheless, larger disparities by race and ethnicity begin to emerge when examining the breakdown of specific occupations.

TABLE 4 shows the share of workers by race and ethnicity in five infrastructure occupations among the 10 largest opportunity occupations in Third District states compared with their share in the state's workforce overall. In each state, White workers are overrepresented in all of the five opportunity occupations, while conversely, Black workers and workers of another race are underrepresented in nearly all these occupations. The shares of Hispanic workers in three skilled trades occupations in Pennsylvania (electricians, HVAC installers, and plumbers) are disproportionately smaller than the share of Hispanic workers in Pennsylvania's workforce (**TABLE 4**). Hispanic workers are also underrepresented as construction and building inspectors and

TABLE 4

Share of Workers in Five Opportunity Infrastructure Occupations Compared with All Occupations in Third District States by Race and Ethnicity, 2019–2023

Race/Ethnicity	All Occupations	Construction and Building Inspectors	Construction Supervisors	Electricians	HVAC Installers	Plumbers, Pipefitters, Steamfitters
DELAWARE						
Black or African American	21.4%	15.1%	4.6%	14.1%	1.3%	3.6%
Other race	8.3%	4.4%	4.6%	6.9%	6.6%	4.9%
White	60.6%	80.5%	83.6%	71.9%	77.6%	85.7%
Hispanic or Latino	9.7%	—	7.1%	7.1%	14.5%	5.8%
NEW JERSEY						
Black or African American	12.1%	4.5%	4.6%	8.0%	9.4%	8.2%
Other race	13.5%	12.7%	6.5%	4.9%	7.8%	5.3%
White	53.5%	72.6%	66.2%	69.8%	59.3%	63.4%
Hispanic or Latino	20.9%	10.1%	22.7%	17.3%	23.6%	23.0%
PENNSYLVANIA						
Black or African American	9.7%	1.8%	1.6%	5.7%	5.2%	7.0%
Other race	7.1%	4.1%	4.2%	3.0%	2.9%	1.6%
White	75.7%	87.1%	85.9%	86.0%	86.8%	86.3%
Hispanic or Latino	7.5%	7.0%	8.3%	5.4%	5.1%	5.1%

Sources

Author's calculations using data from the American Community Survey Five-Year Public Use Microdata Sample (2019-2023). Note: The Hispanic or Latino ethnicity classification is mutually exclusive, (i.e. workers classified as Hispanic or Latino can be of any race whereas workers classified as White, Black or African American, or Other Race are not Hispanic). The category 'Other race' includes workers who identify as another race than those shown or two or more races.

electricians in New Jersey and as plumbers, electricians, and construction supervisors in Delaware.

Strategies to recruit and retain new infrastructure workers with different backgrounds are important to addressing the infrastructure workforce shortage and promoting economic mobility. Barriers like insufficient exposure to certain infrastructure jobs, hiring biases, discrimination or harassment on the job, a lack of information on infrastructure career pathways, or caregiving responsibilities can obstruct women and people of color from pursuing these types of roles (Bridges et al. 2020, Isingizwe et al. 2023, Fielden et al. 2000, Kelly et al. 2015). Without equal access to higher-paying infrastructure employment, the pool of higher-paying sub-baccalaureate jobs available to nontraditional workers becomes even smaller, limiting opportunities for underrepresented workers to move up the economic ladder. Expanding access to apprenticeship and preapprenticeship programs, forming local industry partnerships between businesses, training providers, and other workforce actors, and offering workers wraparound supports are just some of the ways workforce actors can address barriers and support nontraditional workers in infrastructure roles (Bilginsoy 2022, Guerrero et al. 2024, Moir et al. 2011, Spiker 2019).

Bridging the Skills Gap into Infrastructure Occupations

Over 80 percent of infrastructure employment in the Third District states is opportunity employment. **TABLE 5** lists the 10 largest opportunity occupations in each Third District state. Shared occupations in all three states include certain construction occupations, like construction supervisors and construction and building inspectors, occupations in the skilled trades like electricians, HVAC mechanics and installers, and plumbers, plus heavy and tractor-trailer truck drivers.

Most of these occupations require some form of certification or specialization. Workers in the skilled trades, like electricians, HVAC mechanics and installers, and plumbers, all require licensing in order to practice. Bus and heavy and tractor-trailer truck drivers must obtain their commercial driver's license (CDL) before formally getting behind the wheel. Employers hiring construction and building inspectors and construction supervisors typically seek candidates that have at least five years of experience. Vocational schools, community colleges, local workforce organizations, and employers often provide this training or connect prospective workers to pathways into infrastructure careers. Unions also play a pivotal role in training and skill development, mentoring, and job placement, especially in construction and the skilled trades (AFL-CIO, n.d., Takahashi and Melendez, 2004). Despite the specialized nature of higher-paying infrastructure occupations, these occupations also frequently request skills that can be obtained through previous work experience in both related and unrelated roles.

TABLE 6 compares the 20 most requested skills for opportunity infrastructure occupations, lower-wage, sub-baccalaureate infrastructure occupations, and all lower-wage sub-baccalaureate occupations. Communication, customer service, and lifting ability make up the top three skills requested for both opportunity and lower-wage infrastructure occupations. In fact, 15 of the skills listed for opportunity infrastructure occupations are the same as those for lower-wage infrastructure occupations. These include skills clearly connected to infrastructure roles, like construction, having a good driving record, and power tool operation, and others that are less so, like sales and leadership. Truck driving, painting, HVAC, and telecommunications are technical skills that do not fall within the most frequently requested skills for lower-wage infrastructure occupations.

TABLE 5

Largest Opportunity Occupations in Third District States, 2024

Occupation Title	Employment	Median Hourly Wage
DELAWARE		
Heavy and tractor-trailer truck drivers	5,950	$28.13
First-line supervisors of construction trades and extraction workers	2,350	$39.02
Electricians	2,220	$30.27
Heating, air conditioning, and refrigeration mechanics and installers	1,790	$28.82
Plumbers, pipefitters, and steamfitters	1,570	$30.91
Operating engineers and other construction equipment operators	1,190	$27.23
Construction and building inspectors	650	$31.25
Painters, construction and maintenance	530	$26.81
Telecommunications line installers and repairers	530	$39.50
Cement masons and concrete finishers	470	$25.22

TABLE CONTINUES ON PAGE 6 >

Occupation Title	Employment	Median Hourly Wage
NEW JERSEY		
Heavy and tractor-trailer truck drivers	49,450	$31.12
Construction laborers	20,720	$30.38
First-line supervisors of construction trades and extraction workers	15,670	$49.93
Electricians	15,230	$35.14
Heating, air conditioning, and refrigeration mechanics and installers	10,680	$33.56
Plumbers, pipefitters, and steamfitters	9,840	$37.10
Construction and building inspectors	7,040	$39.52
Operating engineers and other construction equipment operators	6,450	$40.47
Bus drivers, transit and intercity	5,850	$29.90
Painters, construction and maintenance	4,230	$28.99
PENNSYLVANIA		
Heavy and tractor-trailer truck drivers	90,160	$28.14
First-line supervisors of construction trades and extraction workers	26,590	$38.60
Electricians	21,860	$31.44
Operating engineers and other construction equipment operators	20,680	$28.16
Heating, air conditioning, and refrigeration mechanics and installers	16,930	$29.38
Plumbers, pipefitters, and steamfitters	13,990	$32.04
Painters, construction and maintenance	6,110	$24.15
Construction and building inspectors	5,570	$30.38
Water and wastewater treatment plant and system operators	5,190	$28.45
Telecommunications equipment installers and repairers	4,990	$32.32

Sources
Author's calculations using data from BLS Occupational Employment and Wage Statistics (May 2024) and BLS Worker Characteristics (2023).

Interestingly, 10 of the 20 most requested skills for all other lower-wage, sub-baccalaureate occupations are also frequently requested by opportunity infrastructure occupations, suggesting that workers in lower-paying occupations outside of infrastructure sectors may develop critical skills often requested for these positions. These include customer service, communication, management, sales, operations, detail oriented-ness, lifting ability, leadership, problem solving, and English language. The 20 most requested skills for all other lower-wage occupations also contain administrative skills, such as computer literacy, writing, and scheduling. The considerable overlap in skills between these three occupation types demonstrates how skills can transfer from lower-wage noninfrastructure roles to higher-paying infrastructure jobs.

This is not to say that attaining the listed skills in Table 6 automatically qualifies workers for any infrastructure occupation. As previously mentioned, many of these occupations require specialized training, certification, and varying levels of experience. Rather, these skills can serve as a bridge for workers interested in pursuing careers in infrastructure occupations. On-the-job training, apprenticeships, and/or further education can help workers attain the additional skills necessary to pursue infrastructure career paths.

Conclusion

Infrastructure workers support the critical systems and facilities that allow us to perform our everyday activities. The expected growth of infrastructure employment in the coming years will require an expanded workforce equipped with the knowledge and skills to deploy, operate, and maintain these systems (Kane 2022). At the same time, many infrastructure occupations across Third District states face aging workforces, which may lead employers to consider reaching out to historically underrepresented groups to fill these roles.

CAREER PATH EXAMPLE 3:

Maintenance and Repair Worker to Telecommunications Line Installer and Repairer

is one of the highest-paid infrastructure occupations in New Jersey. This example outlines a career path that could help a worker develop the skills most frequently requested for a telecommunications line installer, starting as a general maintenance worker. Maintenance and repair workers tend to perform general maintenance on machines, mechanical equipment, and buildings, but they also develop skills that can transfer to more specialized occupations including troubleshooting, plumbing, preventive maintenance, and management. These types of skills are also commonly requested by electrical and electronics repairers of commercial and industrial equipment. To advance from a general maintenance worker to an electrical repairer, a worker would likely require training in electrical wiring, electronics, and control systems, according to the OME. The electrical skills, plus experience with power tools, hand tools, and testing equipment learned as an electronic repairer are skills that are often also requested by telecommunications line installers and repairers. Following this career path from a maintenance worker to a telecommunications installer could result in a worker doubling their wages based on the area median wages for these occupations.

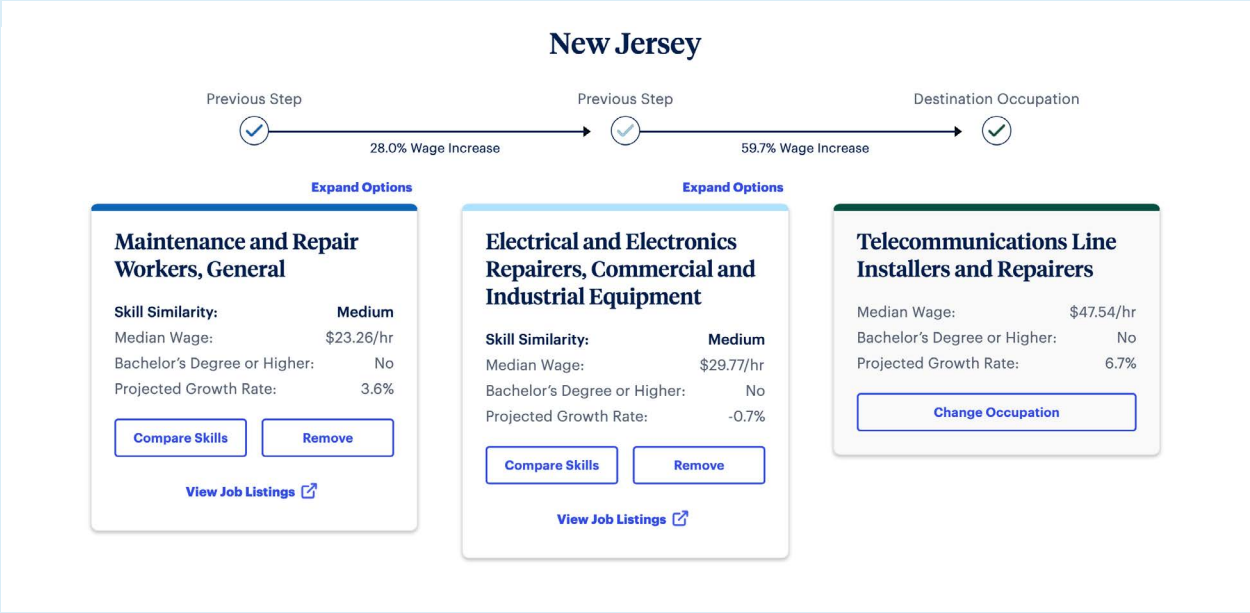


TABLE 6

Most Frequently Requested Skills Among Opportunity Infrastructure, Lower-Wage Infrastructure, and All Other Lower-Wage Occupations in Third District States, 2021–2023

Opportunity Infrastructure Occupations		Lower-Wage, Sub-Baccalaureate Infrastructure Occupations		All Other Lower-Wage, Sub-Baccalaureate Occupations	
Skill Name	% of Ads	Skill Name	% of Ads	Skill Name	% of Ads
Communication	22.4%	Communication	25.6%	Customer service	37.1%
Customer service	16.5%	Lifting ability	21.8%	Communication	31.6%
Lifting ability	13.8%	Customer service	20.1%	Management	18.4%
Operations	13.4%	Traffic control	14.6%	Sales	18.4%
Good driving record	12.7%	Construction	13.1%	Detail oriented	13.7%
Troubleshooting (problem-solving)	11.1%	Operations	11.9%	Operations	13.4%
Management	10.3%	Reservations	9.3%	Lifting ability	12.5%
Truck driving	9.2%	Management	9.0%	Merchandising	11.3%
Construction	8.8%	Hand tools	8.9%	Multitasking	9.1%
Painting	8.0%	Detail oriented	8.3%	Leadership	8.6%
Hand tools	7.9%	Loading and unloading	8.0%	Computer literacy	8.4%
Loading and unloading	7.9%	Sales	7.7%	Cleanliness	8.1%
Detail oriented	7.3%	Good driving record	7.3%	English language	7.7%
English language	6.6%	English language	6.9%	Problem solving	7.6%
Hvac	5.7%	Traffic flow	6.7%	Warehousing	7.5%
Sales	5.1%	Power tool operation	6.5%	Professionalism	7.1%
Power tool operation	5.1%	Plumbing	6.2%	Interpersonal communications	7.0%
Problem solving	5.1%	Leadership	5.0%	Writing	6.8%
Leadership	5.0%	Multitasking	4.7%	Organizational skills	6.7%
Telecommunications	4.9%	Troubleshooting (problem solving)	4.4%	Scheduling	6.4%

Sources
Author's calculations using data from Lightcast (2021–2023).
Notes
Dark green indicates skill spans all three lists. Light green indicates that skill is in the top 20 skills requested between either of the lower-wage occupation categories (infrastructure versus all other) and opportunity infrastructure occupations.

The anticipated need for infrastructure workers may particularly benefit prospective workers without a college degree. In the Third District states, sub-baccalaureate infrastructure occupations tend to offer higher wages at nearly every point along the wage spectrum compared with all other sub-baccalaureate occupations. Given that over 80 percent of infrastructure employment in the Third District states is opportunity employment, it is especially important that underrepresented groups in higher-paying infrastructure occupations, like women and people of color, can access pathways into these jobs to increase their opportunities for economic mobility. Prior research suggests increasing exposure to infrastructure occupations in construction and the skilled trades in high school and offering wraparound support services can help employers recruit and retain underrepresented workers (Fielden et al. 2000, Guerrero et al. 2024).

Improving access to required training or certifications can facilitate entry into infrastructure occupations. While many infrastructure occupations require highly specialized skill sets obtained through on-the-job training or certifications, there are also skills workers learn in and outside of infrastructure employment that can open the door to higher-paying infrastructure roles. For example, foundational skills like communication, customer service, leadership, and problem-solving, otherwise known as "soft" skills, are frequently requested by employers of both infrastructure and noninfrastructure workers in Third District states. Skills like having a good driving record, hand tools, and construction commonly appear in postings for lower- and higher-paying infrastructure jobs. Workers can leverage these shared skills to help bridge the skills gap, reducing barriers between lower-paying jobs and higher-paying infrastructure jobs that may require additional training.

The Occupational Mobility Explorer allows users to explore these skills-based connections further by showing how the skills requested for lower-paying occupations can transfer to higher-paying ones, including infrastructure occupations. This report highlights three examples of skills-based career pathways into infrastructure occupations throughout, but the tool includes many more. **For more information on the Occupational Mobility Explorer, please visit www.philadelphiafed.org/ome.**

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Appendix

TABLE A1

Infrastructure Employment and Wages Across Metro Regions in Third District States, 2024

Region	Infrastructure Employment	Infrastructure Employment Share	Share of Opportunity Employment in Infrastructure Occupations	Median Hourly Wage of Sub-Baccalaureate Infrastructure Occupations	Median Hourly Wage of All Sub-Baccalaureate Occupations
Allentown-Bethlehem-Easton, PA-NJ	19,650	5.3%	90.5%	$28.94	$22.84
Altoona, PA	3,210	5.5%	93.1%	$25.97	$19.94
Atlantic City-Hammonton, NJ	8,690	5.2%	83.7%	$29.06	$23.29
Chambersburg, PA	3,510	6.1%	83.2%	$26.88	$22.24
Dover, DE	3,410	5.0%	80.4%	$27.71	$21.50
Gettysburg, PA	1,690	5.3%	95.9%	$28.31	$20.92
Harrisburg-Carlisle, PA	16,370	4.9%	83.8%	$29.33	$22.51
Johnstown, PA	2,430	5.0%	95.9%	$24.86	$19.11
Lancaster, PA	17,650	7.1%	93.4%	$28.21	$22.32
Lebanon, PA	2,720	5.1%	97.1%	$28.44	$21.63
Philadelphia-Camden-Wilmington, PA-NJ-DE-MD	143,750	5.0%	83.2%	$29.71	$24.10
Reading, PA	9,200	5.4%	82.9%	$29.00	$23.12
Scranton–Wilkes-Barre, PA	14,340	5.6%	93.7%	$27.15	$21.65
State College, PA	3,250	4.7%	92.0%	$26.90	$21.48
Vineland, NJ	3,340	5.5%	95.2%	$35.23	$23.01
Williamsport, PA	2,390	4.8%	95.4%	$26.58	$21.62
York-Hanover, PA	11,880	6.5%	94.2%	$28.55	$22.08
MSA Regions Outside of Third District	572,930	5.3%	85.5%	$31.30	$23.95
Non-MSA Regions	47,470	6.8%	86.8%	$26.07	$21.24

Sources
Author's calculations using data from BLS Occupational Employment and Wage Statistics (May 2024) and BLS Worker Characteristics (2023).

Appendix

TABLE A2

List of Infrastructure Occupations Included in Analysis

SOC Code	Occupation Title
53-2021	Air traffic controllers
53-1041	Aircraft cargo handling supervisors
49-3011	Aircraft mechanics and service technicians
53-6032	Aircraft service attendants
53-2022	Airfield operations specialists
53-2011	Airline pilots, copilots, and flight engineers
47-2011	Boilermakers
47-2021	Brickmasons and blockmasons
53-6011	Bridge and lock tenders
53-3052	Bus drivers, transit and intercity
53-5021	Captains, mates, and pilots of water vessels
43-5011	Cargo and freight agents
47-2051	Cement masons and concrete finishers
19-1031	Conservation scientists
47-4011	Construction and building inspectors
47-2061	Construction laborers
49-9012	Control and valve installers and repairers, except mechanical door
13-1051	Cost estimators
53-7021	Crane and tower operators
47-2081	Drywall and ceiling tile installers
47-5023	Earth drillers, except oil and gas
49-2093	Electrical and electronics installers and repairers, transportation equipment
49-2095	Electrical and electronics repairers, powerhouse, substation, and relay
49-9051	Electrical power-line installers and repairers
47-2111	Electricians
47-4021	Elevator and escalator installers and repairers
47-4031	Fence erectors
47-1011	First-line supervisors of construction trades and extraction workers
53-2031	Flight attendants
47-2042	Floor layers, except carpet, wood, and hard tiles
47-2043	Floor sanders and finishers

TABLE CONTINUES ON PAGE 6 >

Appendix

SOC Code	Occupation Title
19-4071	Forest and conservation technicians
51-8092	Gas plant operators
47-2121	Glaziers
47-4041	Hazardous materials removal workers
49-9021	Heating, air conditioning, and refrigeration mechanics and installers
53-3032	Heavy and tractor-trailer truck drivers
47-3019	Helpers, construction trades, all other
47-3011	Helpers–brickmasons, blockmasons, stonemasons, and tile and marble setters
47-3013	Helpers–electricians
47-3014	Helpers–painters, paperhangers, plasterers, and stucco masons
47-3015	Helpers–pipelayers, plumbers, pipefitters, and steamfitters
47-3016	Helpers–roofers
47-4051	Highway maintenance workers
19-4044	Hydrologic technicians
19-2043	Hydrologists
47-2131	Insulation workers, floor, ceiling, and wall
47-2132	Insulation workers, mechanical
53-4011	Locomotive engineers
49-9011	Mechanical door repairers
43-5041	Meter readers, utilities
47-4090	Miscellaneous construction and related workers
17-2161	Nuclear engineers
51-8011	Nuclear power reactor operators
19-4051	Nuclear technicians
47-2073	Operating engineers and other construction equipment operators
47-2141	Painters, construction and maintenance
53-6061	Passenger attendants
47-2071	Paving, surfacing, and tamping equipment operators
47-2072	Pile driver operators
47-2151	Pipelayers
47-2161	Plasterers and stucco masons
47-2152	Plumbers, pipefitters, and steamfitters
51-8012	Power distributors and dispatchers

TABLE CONTINUES ON PAGE 6 >

Appendix

SOC Code	Occupation Title
51-8013	Power plant operators
49-2021	Radio, cellular, and tower equipment installers and repairers
49-3043	Rail car repairers
53-4099	Rail transportation workers, all other
53-4013	Rail yard engineers, dinkey operators, and hostlers
53-4022	Railroad brake, signal, and switch operators and locomotive firers
53-4031	Railroad conductors and yardmasters
47-4061	Rail-track laying and maintenance equipment operators
53-7081	Refuse and recyclable material collectors
47-2171	Reinforcing iron and rebar workers
43-4181	Reservation and transportation ticket agents and travel clerks
47-2181	Roofers
53-5011	Sailors and marine oilers
47-4071	Septic tank servicers and sewer pipe cleaners
47-2211	Sheet metal workers
53-5031	Ship engineers
49-9097	Signal and track switch repairers
47-2231	Solar photovoltaic installers
47-2022	Stonemasons
47-2221	Structural iron and steel workers
53-4041	Subway and streetcar operators
53-7121	Tank car, truck, and ship loaders
47-2082	Tapers
49-2022	Telecommunications equipment installers and repairers, except line installers
49-9052	Telecommunications line installers and repairers
47-2053	Terrazzo workers and finishers
47-2044	Tile and stone setters
53-6041	Traffic technicians
33-3052	Transit and railroad police
53-6051	Transportation inspectors
33-9093	Transportation security screeners
19-3051	Urban and regional planners
51-8031	Water and wastewater treatment plant and system operators

Source
Occupation codes and titles derive from the 2018 Standard Occupation Classification system. For more information, see www.bls.gov/soc/.

Appendix

TABLE A3

List of Infrastructure Industries Included in Analysis

NAICS code	NAICS Title	Related Sector
2382	Building equipment contractors	Building construction
2383	Building finishing contractors	Building construction
4855	Charter bus industry	Transport
4921	Couriers and express delivery services	Trade and logistics
4831	Deep sea, coastal, and great lakes water transportation	Transport
2211	Electric power generation, transmission and distribution	Energy
9991	Federal government, excluding postal service	Cross-sector
2381	Foundation, structure, and building exterior contractors	Building construction
4885	Freight transportation arrangement	Trade and logistics
2373	Highway, street, and bridge construction	Transport
4832	Inland water transportation	Transport
4852	Interurban and rural bus transportation	Transport
2372	Land subdivision	Public works
9993	Local government, excluding education and hospitals	Cross-sector
4922	Local messengers and local delivery	Trade and logistics
2212	Natural gas distribution	Energy
2362	Nonresidential building construction	Building construction
4812	Nonscheduled air transportation	Transport
2379	Other heavy and civil engineering construction	Public works
4869	Other pipeline transportation	Energy
2389	Other specialty trade contractors	Building construction
4889	Other support activities for transportation	Transport
4859	Other transit and ground passenger transportation	Transport
4861	Pipeline transportation of crude oil	Energy
4862	Pipeline transportation of natural gas	Energy
482	Rail transportation	Transport
5629	Remediation and other waste management services	Public works
4871	Scenic and sightseeing transportation, land	Transport
4879	Scenic and sightseeing transportation, other	Transport
4872	Scenic and sightseeing transportation, water	Transport

TABLE CONTINUES ON PAGE 6 >

Appendix

NAICS code	NAICS Title	Related Sector
4811	Scheduled air transportation	Transport
4854	School and employee bus transportation	Transport
9992	State government, excluding education and hospitals	Cross-sector
4881	Support activities for air transportation	Transport
4882	Support activities for rail transportation	Transport
4884	Support activities for road transportation	Transport
4883	Support activities for water transportation	Transport
4853	Taxi and limousine service	Transport
517	Telecommunications	Telecommunications
484	Truck transportation	Trade and logistics
4851	Urban transit systems	Transport
2371	Utility system construction	Energy
4930	Warehousing and storage	Trade and logistics
5621	Waste collection	Public works
5622	Waste treatment and disposal	Public works
2213	Water, sewage, and other systems	Water

Source
Industry codes and titles derive from the 2022 North American Industry Classification System (NAICS). For more information, see https://www.census.gov/naics/?99967

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