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Jobs for the Future

Blueprint for the Future: Strengthening Inclusive Talent Pathways in the Built Environment

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About Jobs for the Future

Jobs for the Future (JFF) drives transformation of the U.S. education and workforce systems to achieve equitable economic advancement for all. www.jff.org.

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Executive Summary

Research Background and Context

The built environment workforce is large, growing, and under significant strain. Nearly 10 million workers are employed across architecture, design, engineering, and construction (ADEC), yet persistent labor shortages, high turnover rates, and an aging managerial workforce threaten the sector's ability to meet future demand. Construction alone needs to attract hundreds of thousands of new workers annually, and engineering fields face some of the sharpest supply-demand imbalances with job postings far outpacing the supply of new graduates in the field.

Most existing research focuses on narrow segments of the broader built environment talent ecosystem, specific occupations, sectors, or program types. While valuable, this siloed approach doesn't account for the interrelatedness of these fields, nor does it capture the full range of opportunities and barriers that learners and workers face when exploring careers in the built environment. In seeking to inform future direction of the built environment talent ecosystem, we take a different, more holistic approach that accounts for the fact that learners often consider multiple career paths, and that movement between fields like architecture, construction, and engineering (ACE) is more fluid than traditional research suggests. Our ecosystem approach prioritized multiple inputs (i.e., qualitative interviews, labor market data analysis, student surveys, focus groups, regional convenings) to ensure we captured the full diversity and complexity of this ecosystem.

Key Findings

The workforce is bifurcated by education, earnings, and demographics in ways that limit both access and diversity. Most higher-paying roles in architecture, engineering, and design require bachelor's degrees, while roles in the trades are typically more accessible. However, there is wide variation in job quality and earnings across the built environment fields generally and within the construction sector, in particular. Efforts to diversify the workforce must further equalize access to bachelor's degrees, work-based learning, social capital building, and on-the-job advancement pathways for tradespeople. Historically underrepresented groups such as women of all racial backgrounds and workers of color remain significantly underrepresented across nearly all top occupations, with only interior and graphic design, the lowest-wage, slowest-growth fields, maintaining majority-female workforces.



Recommended action: Model a national movement among employers to offer professional advancement opportunities, particularly to workers without a college degree. Draw on examples from other sectors, such as the Chicago Healthcare Workforce Alliance, which brings together employers in a sector to reduce barriers and foster mobility.

Career awareness is arriving too late and through too few channels. Young people most commonly learn about built environment careers through social media and word of mouth rather than structured guidance. Early exposure is limited, informal, and inequitably distributed, meaning students from lower-income backgrounds, and those without family connections to the field, are far less likely to consider these careers. Reaching students as early as elementary school through hands-on, industry-connected learning is among the most impactful interventions available.



Recommended action: Support dual-enrollment programs and high school-based career and technical education (CTE) curricula to set learners on the path to career success in the built environment.

Education and training programs are not fully preparing learners for the realities of built environment careers. Postsecondary students consistently report wanting more applied, hands-on learning rather than theory-heavy coursework, and fewer than one in five surveyed report internship or co-op requirements in their programs, which may limit engagement for low-income learners in particular. Math skills and access to advanced coursework remain significant barriers at every level, from high school trades programs through engineering degrees. Meanwhile, growing industry integration across the built environment is outpacing curricular innovation at most institutions.



Recommended action: Support scholarships and funding for innovative practices to ensure students from low-income backgrounds can benefit from critical work-based learning opportunities like internships and co-ops.

Financial pressures and insufficient wraparound supports drive significant talent leakage. Cost of attendance, required equipment expenses, and the economic necessity of paid work over unpaid internships push postsecondary learners, particularly Black, Latine, and lower-income learners, away from career-relevant experiences and toward fields that offer quicker financial returns. Adult learners face compounding barriers including child care, transportation, academic gaps, and limited access to emergency support, all of which require coordinated wraparound services to overcome.



Recommended action: Invest in training stipends and wraparound supports for learners progressing through trades training programs.

Transitions from education into employment are poorly supported and inequitably structured. Half of surveyed alumni interested in built environment careers were working outside the field after graduation. Students lack consistent access to career coaching, mentoring, and networking opportunities, while the job market increasingly rewards social capital and personal connections that not all students have. The pipeline's reliance on informal networks to secure first jobs is both inequitable and unsustainable. Therefore, more intentional, structured, career transition support is needed across all built environment education programs to support employment and improve retention.



Recommended action: Support organizations and initiatives that help workers build professional social capital.

Workplace culture and employer practices are decisive factors in who stays and who leaves. Construction job sites continue to present documented challenges around harassment, racism, and unsafe conditions, particularly for historically underrepresented groups such as women of all racial backgrounds and workers of color. Architecture and design firms face their own pressures around long hours and midcareer attrition. Leading employers are responding with flexible scheduling, mentorship programs, clear advancement pathways, and anti-harassment initiatives, but these practices remain far from universal, and employer accountability structures are still underdeveloped across much of the sector.



Recommended action: Model a national movement among employers that highlights the business impact of efforts to promote belonging and safety on job sites and offer professional advancement opportunities to workers without a college degree.

Technological, environmental, and policy forces are reshaping the workforce at an accelerating pace. Artificial intelligence (AI) and robotic automation are beginning to transform both white-collar and trades roles, with the potential to bifurcate the workforce between high-skill, tech-enabled positions and lower-wage, on-site labor. Climate change is simultaneously generating new green construction roles while requiring broad reskilling of the existing workforce. Immigration enforcement is already reducing frontline construction capacity. Taken together, these forces risk producing a more unequal labor market without intentional investment in workforce preparation and transition supports.



Recommended action: Fund innovative training models that focus on the integration of emerging technologies into built environment fields.

The funding landscape is fragmented, heavily weighted toward entry-level pipeline activity, and missing key opportunities. Corporate funders, particularly large home improvement and tool retailers, are direct supporters of skilled trades pathways. Public funding through the workforce system, CTE, and regional public-private partnerships helps to provide scale. However, midcareer upskilling, adult transitions to career training, and retention and advancement supports remain chronically underfunded. No single philanthropic investment currently unites these threads into a coherent built environment workforce strategy. However, an increased focus on skilled trades driven by AI data centers and infrastructure demands is building momentum for both collaboration and investment from both endemic and new funders.



Recommended action: Fund collaborative efforts through national and regional intermediaries that bring together key stakeholders across the built environment ecosystem.

Philanthropy & Investment Opportunities

Strategic philanthropic investment must connect and strengthen a fragmented ecosystem. The most impactful opportunities lie not in replicating existing youth exposure programs, but in bridging the gaps between employer demand, public systems, and career mobility, such as retention efforts for apprenticeship pathways or upskilling initiatives for incumbent workers. Future investments should be regionally grounded, require employer co-investment or meaningful engagement, embed diversity by design, and prioritize stackable credentials and wraparound supports. Coordinating across the ecosystem through intermediaries, regional convenings, and shared research infrastructure will be essential to moving from isolated, promising practices to durable, scalable workforce systems. Where possible, complement ongoing federal funding for education and training, and increase awareness of the build-and-bust funding cycle that many training providers must navigate to ensure more sustainable programs can continue to operate.

Introduction

The built environment, specifically the ADEC sectors, plays a central role in shaping economic opportunity, infrastructure, and community resilience in the United States. As demand for talent across these sectors continues to grow, so too does the urgency to ensure that pathways into and through these careers are accessible and aligned with the evolving needs of the workforce and economy.

Yet despite this demand, built environment sectors face persistent talent challenges. Participation is not keeping pace with need, and retention remains uneven, particularly for historically underrepresented groups such as women of all racial backgrounds and people of color. These challenges are not the result of a single broken pipeline but rather a set of interconnected barriers spanning awareness, education, training, hiring, and advancement. Addressing them requires a comprehensive, systems-level understanding of how talent flows into and through the built environment ecosystem and where those pathways break down.

Background and Context

Jobs for the Future (JFF) partnered with the Brendan & Helen Bechtel Foundation to conduct an exploratory research effort to understand and strengthen the systems that support talent development across built environment sectors. While these disciplines are often treated as distinct, this work is grounded in the recognition that they operate as an interconnected ecosystem with shared challenges, overlapping pathways, and significant opportunities for greater alignment.

This research seeks to answer a core set of questions: Why do so few workers pursue these careers despite growing demand? Why do many who enter these fields, especially women of all racial backgrounds and people of color, leave at disproportionate rates? And what would it take to build a more resilient and future-ready talent system?

To address these questions, JFF employed a mixed-methods approach, combining quantitative labor market and workforce data analysis with qualitative insights from stakeholders across education, workforce development, industry, and philanthropy. The work also engaged a broad cross section of the ecosystem to identify persistent barriers, promising solutions, and emerging innovations across regions and various career stages.

For this research, we use the term "built environment" to refer to four key sectors related to the planning and building of housing and infrastructure: construction, architecture, design, and engineering.

Research Objectives

JFF's research into the built environment focused on:

- Defining the current state of fields in the built environment, including employer demand for key occupations, supply of talent from aligned pathways, and emerging innovations.
- Identifying successes and barriers to success in training, education, and employment across built environment sectors for women of all racial backgrounds, people of color, the justice-involved, and immigrants.
- Exploring root causes of workforce issues in the built environment, including variations across fields, regions, and occupation types.
- Highlighting the future forces and trends most likely to reshape the built environment workforce.
- Mapping the landscape of key funders in the built environment workforce ecosystem.
- Recommending philanthropic investments or interventions that could better enable a diverse and resilient workforce in the built environment.

Research Approach

The JFF research team employed a mixed methods approach to exploring the built environment workforce ecosystem, including the following activities:

- *Desk research:* JFF reviewed recent literature to understand workforce trends, gaps, and challenges in architecture, design, engineering, and construction sectors. This effort informed the development of interview protocols and provided context for interpreting labor market data and other analyses.
- *Analysis of labor market information:* JFF defined "built environment jobs" using specific sectors, including construction, architecture, design, and engineering. This allowed us to identify a universe of built environment-relevant roles. Our analysis focused on a subset of representative occupations to highlight employment trends and demographics across these sectors.
- *Stakeholder interviews:* The team conducted over 50 semi-structured interviews with stakeholders across the built environment ecosystem, including employers, workers, training providers, and other educators, as well as industry experts from professional associations. These conversations were analyzed to explore themes around trends, barriers to career pathway entry and advancement, and supports to learner and worker success. (See Appendix B for more on our analysis process.) In addition, interviews analyzed contextual factors shaping the current and future context of built environment careers and identified opportunities for philanthropic and other investments.
- *College student survey:* To complement interviews, JFF collaborated with College Pulse to survey 1,000 college students at two-year and four-year institutions and recent alumni from academic programs related to the built environment. The survey explored career exposure and entry into fields of study, experience in college programs, transitions to employment, and early-career satisfaction.[1] The JFF team conducted follow-up focus groups and interviews with seven alumni to provide deeper insights into career trajectories and early-career barriers and supports.
- *Forces and trends analysis:* JFF compiled guidance from interviews, secondary research, and labor market data on the key forces and trends likely to reshape the built environment workforce over the next decade. While predicting even the near future is inherently uncertain, our approach aimed to identify the most likely and most transformational forces across technology, policy, and the environment. We also map out potential scenarios and their implications for the future workforce.
- *Advisory board:* JFF convened a 13-member advisory board composed of leaders from industry associations, employers, workforce organizations, education and training providers, as well as nonprofit organizations across the built environment ecosystem. Serving as thought partners throughout the project, advisory board members shared insights drawn from their organizations, regions, and areas of expertise, challenged

assumptions, validated emerging findings, and helped ensure the research and recommendations reflected diverse perspectives from across the field.
- *Regional convenings:* JFF also conducted two regional convenings in Columbus, Ohio, and Phoenix, Arizona, to gain regionally contextualized insights on how to strengthen the ADEC talent pipelines at the community level. These convenings allowed us to obtain the perspective of an additional 55 stakeholders, including on-the-ground perspectives from community-based organizations (CBOs) and employers.

In conducting our research, we aimed to take an assets-based approach, integrating an appreciative inquiry lens to identify what is working well in the current ecosystem and capitalize on the collective insights and imagination of multiple stakeholders to make recommendations for a stronger future for the nation's built environment systems and pathways.[2] This approach allowed us to surface innovative career pathway development and retention solutions, identifying opportunities to shift the broader messaging around built environment careers and prioritizing worker and learner voice in articulating how to create systems that meet their needs throughout their training and careers. (For more on our process, see Appendix B.)

Conceptual Framework

To orient our research, the team used an ecosystem framework (see upcoming graphic) encompassing pathway elements, system actors, individual experiences, and contextual factors, including the following:

- *Career exploration/navigation:* Messaging and perceptions of built environment careers as well as career navigation practices and possibilities.
- *Access:* Built environment pathway entrants; barriers to entry, including for particular groups; ideas for expanding access; and K-12 to postsecondary alignment.
- *Education and training:* Supports and models to promote learner wellness and success; portability and stackability of credentials; apprentice and work-based learning expansion opportunities; and career guidance and career mobility.
- *Employer practices and work environments:* Fair hiring practices in built environment fields; transparency of career ladders and lattices; approaches to job quality improvement; and efforts to promote retention and advancement of women of all racial backgrounds and people of color.
- *Mentorship and belonging:* Efforts to embed mentorship and foster belonging for learners and workers in built environment fields.
- *Technology and innovation:* Integration of emerging technologies such as AI, digital twins, and the industrial metaverse, as well as Internet of Things (IoT) and consequences for built environment skills, training, and jobs.
- *Dynamic contextual factors:* Infrastructure demands, climate resilience, market trends, and elevation of community priorities.

These elements were applied to the development of interview protocols, as well as the analysis of qualitative data.

The Built Environment Workforce Pipeline Ecosystem



Organization of the Report

The report begins with a brief grounding in current workforce trends, followed by presentation of insights gained through stakeholder interviews and focus groups, as well as the College Pulse survey of students. We augment these insights with regional perspectives from Ohio and Arizona and offer potential opportunities for enhancing the built environment workforce ecosystem. We next explore forces and trends acting on the built environment ecosystem. We offer a view of the current funding landscape and offer suggestions for future investments and activities.

The Current State of the Built Environment Workforce

The built environment workforce represents a substantial share of the U.S. economy with 9 .9 million employed as of 2025. The construction industry alone employs more than 8 million workers today, and the built environment overlaps with other critical growth areas for the U.S. economy, including semiconductor manufacturing, data center construction, and infrastructure investment in transportation and electrification.[3]

TABLE 1. TOTAL EMPLOYMENT FOR BUILT ENVIRONMENT SECTORS

Architecture	Design	Engineering	Construction
202,597	85,442	1,197,332	8,402,341

Source: Lightcast 2026.1

Despite strong prospects for future growth, the industry faces critical workforce challenges that could impede its ability to meet future demand. Associated Builders and Contractors estimated that to meet demand the construction industry needed to attract 439,000 new workers in 2025 and nearly half a million new workers by 2026.[4] Current pipelines are likely insufficient to meet that demand for workers, and high turnover continues to impact firms in the built environment.

Our JFF team's workforce analysis involved identifying occupations within the built environment sectors that represent either a high share of existing jobs (at least 1,000 people in built environment sectors employed in this occupation) or critical functions as identified through qualitative research (e.g., commercial or industrial designers). A full description of our methodology and list of occupations and North American Industry Classification System (NAICS) codes is included in Appendix A.

Overview of Major Built Environment Fields

- **The built environment workforce is bifurcated, with high-earning jobs typically requiring a bachelor's degree and more accessible jobs offering less earning potential and work stability.** The tables in this section highlight the top built environment occupations by size, earnings, and growth; only three of the 15 do not require a bachelor's degree. In particular roles in architecture, engineering, and design are less accessible to those without a bachelor's degree. Some quality jobs exist in construction that do not require a college degree, but workers in those fields often still lack pathways to the highest earning occupations.
- **Construction is the workforce engine of the built environment but faces challenges meeting employer demand.** As labor market data show, more people are employed in construction than architecture, engineering, and design combined. Strong and growing demand exists for construction managers who have specialized skills and predominantly work in the construction industry. Construction firms also seek large numbers of general and operations managers but must compete with numerous other industries, as indicated by the lower proportion of these workers employed in built environment fields.
- **Design occupations display the most potential exposure to disruption with low wages, low growth, and low sector-specific employment compared to other top built environment occupations.** Design fields show a concerning combination of low projected growth (3-4%), relatively low wages compared to other fields ($29-$38/hour), and low in-sector employment. This low sector specificity suggests these workers are fungible across many industries, making retention within the built environment difficult when other sectors compete for the same talent.
- **Construction managers and electrical power-line installers experience the highest annual turnover, though different reasons may drive dissatisfaction.** Interview contacts report an undersupply of experienced construction managers, which often leads to poaching by competitor firms, thus amplifying turnover. Interior designers may leave the occupation in the future when slow growth and low wages impede opportunities to advance. Meanwhile, physical demands and safety concerns may drive workers out of electrical power-line installation jobs.[5]

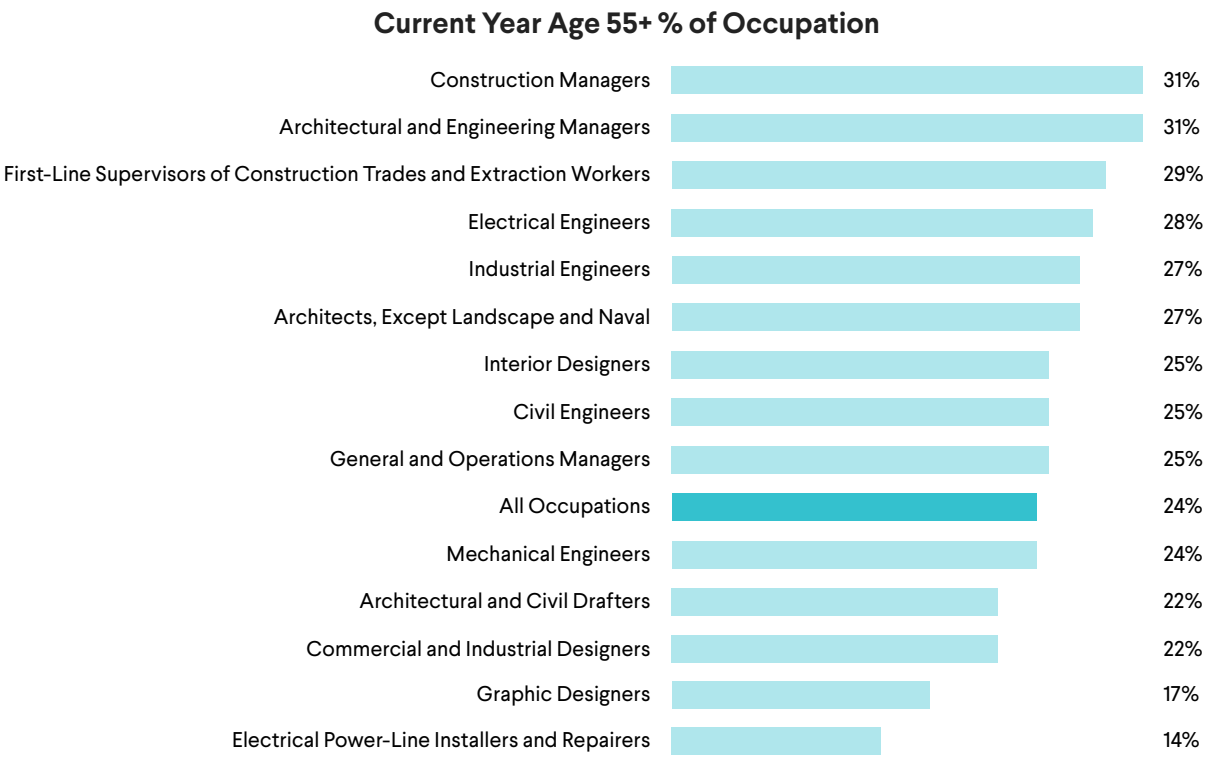
TABLE 2. PROJECTED GROWTH WITHIN BUILT ENVIRONMENT

Occupation	Turnover Rate (2025)	Projected Growth Within Built Environment (2025-2030)
Construction Managers	49%	24,310
Interior Designers	48%	2,193
Electrical Power-Line Installers and Repairers	45%	3,668
Commercial and Industrial Designers	45%	286
First-Line Supervisors of Construction Trades and Extraction Workers	44%	41,513
General and Operations Managers	43%	18,535
Graphic Designers	43%	1,637
Architectural and Civil Drafters	39%	4,559
Civil Engineers	38%	15,090
Industrial Engineers	34%	1,599
Mechanical Engineers	31%	3,849
Electrical Engineers	30%	3,598
Architects, Except Landscape and Naval	29%	2,789
Architectural and Engineering Managers	23%	3,124

Source: Lightcast 2025.4

- **The built environment faces a looming demographic cliff as high proportions of workers in management roles approach retirement age.** Labor market data show that construction managers, architectural and engineering managers, and first-line supervisors of construction and trades have the highest proportion of workers who are 55 or over. Employers in the industry will likely see increased competition for experienced managers as workers approach retirement age or actively transition into less-demanding roles. For context, 24% of the U.S. workforce is 55 or older.[6]

CHART 1. PERCENTAGE OF WORKERS 55 AND OVER

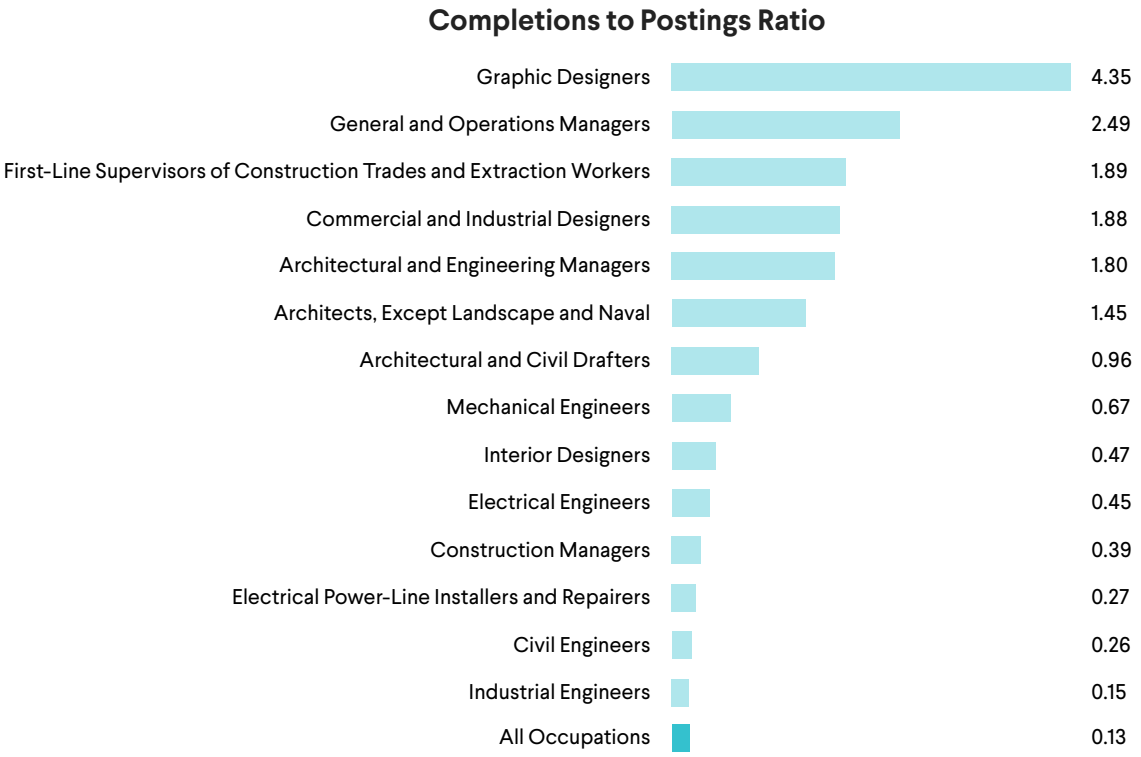


Source: Lightcast 2026.1

- **Engineering roles face the largest undersupply of talent relative to employer demand.** The table below displays the ratio of program completions to job postings for each occupation. Low ratios for roles like industrial engineers and civil engineers indicate a shortage of new engineering graduates for available jobs. For example, there are roughly seven job postings for every new industrial engineering graduate. This supply-demand dynamic likely drives up wages for people entering the workforce as firms compete for scarce talent. This undersupply, however, likely impedes firm and industry growth as engineers become chokepoints in the capacity to take on and deliver new projects.

CHART 2. RATIO OF COMPLETIONS TO POSTINGS

Graphic design reported the lowest ratio at 4.4, which means for every four people or more who graduate in graphic design, there is only one job posting.



Source: Lightcast 2026.1

The following tables provide an overview of workforce indicators in the four built environment areas of architecture, design, engineering, and construction.

The architecture sector contains three key occupations spanning management, design, and technical roles. Architectural and engineering managers command the highest median hourly wage at $80 .64 and represent the largest share of total employment at nearly 215,000 workers, though only 26% work within the sector itself. Architects have the strongest in-sector concentration at 62%, with modest projected growth of 5% through 2030 and a median hourly wage of $46.49. Architectural and civil drafters, the most sector-concentrated role at 72%, have the lowest wage ($30.90 per hour) and slowest growth (3%), but require only an associate's degree. Across all three occupations, growth projections are relatively modest, ranging from 3% to 5% through 2030.

TABLE 3. KEY OCCUPATIONS IN ARCHITECTURE

Occupation	Job Postings	In-Sector Employment	Total Employment	Projected Growth (through 2030)	Median Hourly Wages	Typical Ed Level Required
Architectural and Engineering Managers	70,761	26%	214,869	4%	$80.64	Bachelor's degree
Architects, Except Landscape and Naval	5,732	62%	113,406	5%	$46.49	Bachelor's degree
Architectural and Civil Drafters	21,325	72%	109,883	3%	$30.90	Associate's degree

Source: Lightcast 2025.4

The design sector contains three key occupations in interior, graphic, and commercial/industrial design, all typically requiring a bachelor's degree. Commercial and industrial designers stand out with the highest median wage at $38.20 per hour despite having the smallest total workforce of just under 30,000—suggesting a specialized, higher-value field. Graphic designers make up the largest workforce by far at over 217,000, yet only 8% work within the design sector itself, reflecting how broadly graphic design skills are applied across industries. Interior designers have the strongest in-sector concentration at 43%, with a median wage of $30.52 per hour and modest 3% projected growth through 2030. Overall, growth across all three design occupations is slow, ranging from just 3% to 4%, indicating a relatively stable but not rapidly expanding field.

TABLE 4. KEY OCCUPATIONS IN DESIGN

Occupation	Job Postings	In-Sector Employment	Total Employment	Projected Growth (through 2030)	Median Hourly Wages	Typical Ed Level Required
Interior Designers	7,611	43%	70,845	3%	$30.52	Bachelor's degree
Graphic Designers	12,863	8%	217,222	4%	$29.47	Bachelor's degree
Commercial and Industrial Designers	15,870	14%	29,795	3%	$38.20	Bachelor's degree

Source: Lightcast 2025.4

The engineering sector contains five key occupations, all requiring a bachelor's degree, with notably stronger growth projections than architecture or design. Industrial engineers lead in both job postings (88,760) and projected growth (8% through 2030), yet only 6% work within the engineering sector, reflecting their broad applicability across many industries. Civil engineers have the strongest in-sector concentration at 65% and the largest total workforce at nearly 377,000, with a competitive median wage of $47.88 per hour. Architectural and engineering managers earn by far the highest hourly wages at $80.64, nearly double that of other occupations in the table, underscoring the premium placed on senior leadership roles. Overall, engineering occupations show healthier growth trajectories than design or architecture with projected rates ranging from 4% to 8% through 2030.

TABLE 5. KEY OCCUPATIONS IN ENGINEERING

Occupation	Job Postings	In-Sector Employment	Total Employment	Projected Growth (through 2030)	Median Hourly Wages	Typical Ed Level Required
Architectural and Engineering Managers	70,761	26%	214,869	4%	$80.64	Bachelor's degree
Civil Engineers	73,890	65%	376,941	5%	$47.88	Bachelor's degree
Electrical Engineers	63,423	26%	194,035	6%	$53.80	Bachelor's degree
Industrial Engineers	88,760	6%	358,084	8%	$48.63	Bachelor's degree
Mechanical Engineers	54,641	21%	294,842	7%	$49.19	Bachelor's degree

Source: Lightcast 2025.4

The construction sector contains four key occupations ranging from management to skilled trades, with educational requirements spanning high school diplomas to bachelor's degrees. Construction managers dominate the sector with the highest in-sector concentration at 83% and strong projected growth of 7% through 2030, earning a median hourly wage of $51.43. General and operations managers have by far the largest total workforce at nearly 3 .8 million, though only 9% are employed within construction, reflecting how highly demanded this role remains across numerous industries. First-line supervisors of construction trades represent a large skilled workforce of over 842,000 and maintain a strong 79% in-sector concentration, requiring only a high school diploma at a median wage of $37.83 per hour. Overall, growth projections across construction occupations are moderate to high, ranging from 5% to 7%, with the sector offering competitive wages, particularly for management-level roles.

TABLE 6. KEY OCCUPATIONS IN CONSTRUCTION

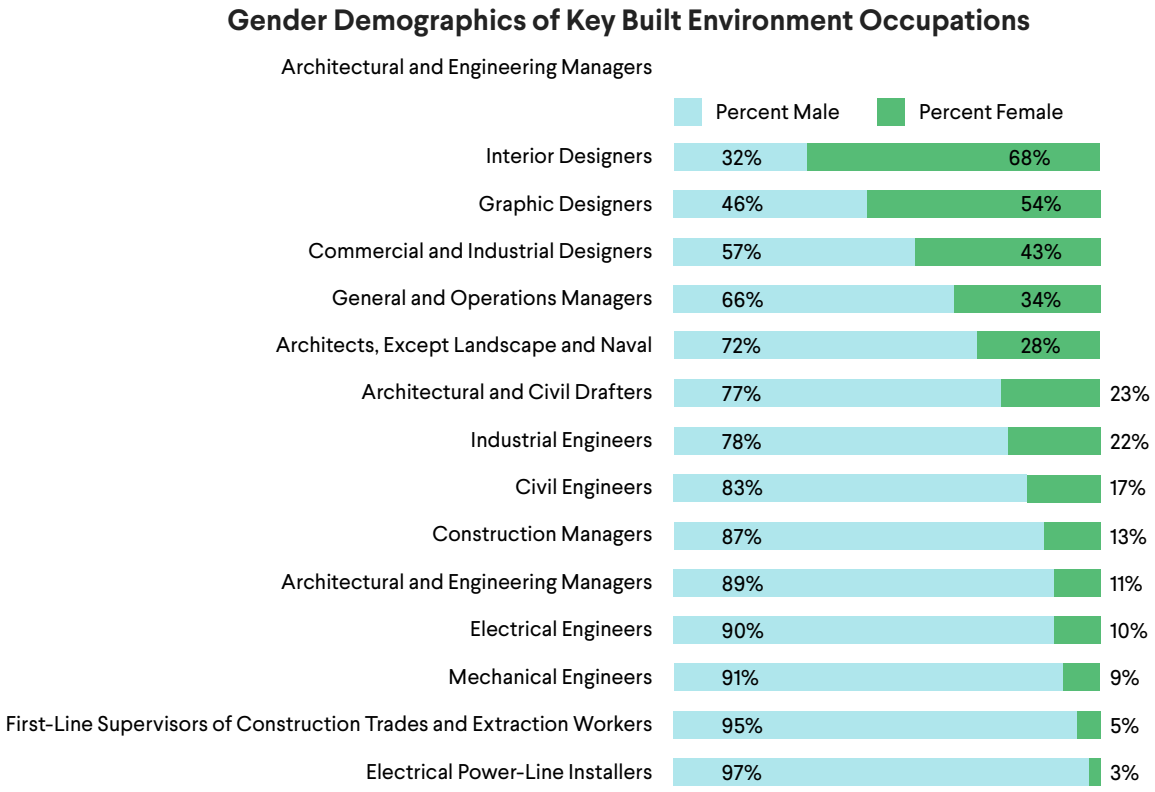
Occupation	Job Postings	In-Sector Employment	Total Employment	Projected Growth (through 2030)	Median Hourly Wages	Typical Ed Level Required
General and Operations Managers	259,236	9%	3,787,990	5%	$49.50	Bachelor's degree
Construction Managers	131,411	83%	367,569	7%	$51.43	Bachelor's degree
First-Line Supervisors of Construction Trades	20,880	79%	842,449	5%	$37.83	High school diploma or equivalent
Electrical Power-Line Installers and Repairers	10,754	38%	130,921	6%	$44.50	High school diploma or equivalent

Source: Lightcast 2025.4

Current Demographics

- **Male workers predominate in most top occupations of the built environment, indicating ongoing, structural challenges to attract and retain women.** Only two of the 14 top occupations are majority female (i.e., interior designers, graphic designers), and both are in design occupations with comparatively lower wages and growth prospects. Occupations in construction, such as construction managers and first-line supervisors, are particularly male-dominated.

CHART 3. GENDER DEMOGRAPHICS OF KEY BUILT ENVIRONMENT OCCUPATIONS



Source: Lightcast 2025.4[7]

- **White workers are overrepresented in every top occupation within the built environment.** As of 2024, non-Hispanic/Latine white people make up 57.5% of the U.S. population, but non-Hispanic/Latine whites make up anywhere from 66-79% of built environment occupations.[8] Two engineering occupations (electrical and civil engineers) have the largest population of non-white workers, boosted by higher participation from Asian workers. These figures may somewhat overstate the proportion of white workers due to underreporting of undocumented immigrants, especially in construction roles.

TABLE 7. RACE AND ETHNICITY DEMOGRAPHICS OF KEY BUILT ENVIRONMENT OCCUPATIONS

Occupation	Sector	Percent White	Percent Workers of Color*
Electrical Engineers	Engineering	66%	34%
Civil Engineers	Engineering	69%	31%
Commercial and Industrial Designers	Design	70%	30%
Graphic Designers	Design	70%	30%
Architectural and Civil Drafters	Architecture	71%	29%
Architects, except Landscape and Naval	Architecture	71%	29%
Industrial Engineers	Engineering	73%	27%
Architectural and Engineering Managers	Engineering	73%	27%
First-Line Supervisors of Construction Trades and Extraction Workers	Construction	74%	26%
General and Operations Managers	Construction	74%	26%
Mechanical Engineers	Engineering	74%	26%
Electrical Power-Line Installers and Repairers	Construction	76%	24%
Interior Designers	Design	76%	24%
Construction Managers	Construction	79%	21%

Source: Lightcast 2025.4[9]

Trends, Challenges, and Opportunities in the Built Environment Talent Ecosystem

A Note on Our Research

This section is organized around four stages of talent pipeline progression: career awareness and entry into built environment pathways, training and education experiences, transitions to employment, and workplace conditions and retention. Throughout, we highlight promising practices raised in interviews and focus groups and discuss implications for strengthening the structures, practices, and pathways that shape the built environment talent ecosystem. For a more complete list of promising practices across the built environment, see Appendix D.

To inform our analysis of the built environment talent pipeline, we sought to elevate the perspectives of people with firsthand experience in educational programs, CBOs, workplaces, and communities. Through this research, we aimed to understand what is working, identify gaps, and surface opportunities for the ecosystem and the Foundation's future activities. We drew on individual interviews and focus groups with stakeholders across built environment sectors and roles conducted from August 2025 through April 2026, as well as a national survey of current and recent college students in related majors conducted in fall 2025. We do not identify interview and focus group participants by name because conversations were conducted confidentially to encourage candor and to respect employer confidentiality needs.

Our interview and focus group sample included 58 participants representing a broad range of roles across the built environment ecosystem. Workers (15), workforce-focused CBOs (11), and secondary educators (10) made up the largest groups, alongside postsecondary educators (8), subject matter experts (8), employers (5), and one funder.

The sample also reflected a range of field perspectives. Construction was the most represented area (21), followed by education (9), engineering (7), and workforce development (7), with additional participants from architecture (5), design (3), urban planning (2), utilities (1), and other related areas (3). Participants were located across 21 states and Washington, DC, with the largest concentrations in Florida (10), Massachusetts (6), Michigan (6), and Ohio (5).

Our interview and focus group pool—drawn from JFF networks, recommendations from national leaders, and additional referrals that emerged during data collection—included more construction stakeholders than participants from other sectors, while the national survey included more students in design and engineering. See Appendices B and C for additional details.

1 Career Awareness and K-12 Education

Key Finding: A persistent lack of career awareness impedes many from entering built environment careers as many people have little exposure to the breadth of occupations, pathways, and economic opportunities the field offers.

A pre-apprenticeship director emphasized that "People don't even know that these jobs exist half the time and that they're very lucrative pathways. I mean, a construction project manager can make well into the six figures. People don't even know that that exists and it's a viable path." A subject matter expert added, "if you don't know a job exists, you don't know how to pursue it." A human resources professional in architecture and design likewise emphasized that career horizons are often shaped by what students see around them: They tend to think about "what's mom doing, what's dad doing, what does my aunt do, what does my uncle do?" and "might have never heard about design," underscoring the need to make those connections early and more broadly.

Several interviewees also pointed to a structural weakness in the guidance systems meant to help students and families navigate careers. Middle and high school counselors often have limited preparation to advise students on the full range of career options available, particularly outside the four-year college pathway. As one secondary educator put it, "Counselors are like goalies, they can block things. They often have a four-year college mentality, and many are dealing with student issues. They are very interested in social-emotional learning. They don't know about career counseling." The result is that students and families are too often left without the information needed to understand the diversity of built environment careers, the pathways into them, and the positive outcomes they can offer.

Key Finding: Efforts to strengthen the built environment talent pipeline are undermined when career messaging starts too late, competes with a dominant college-for-all narrative, and fails to communicate the breadth and value of these careers.

Awareness-building must begin earlier—well before young people are making decisions about high school programs, coursework, and postsecondary plans. Educators, employers, and workforce development professionals emphasized that by the time many students hear about built environment careers, other pathways and aspirations have already taken shape. As one leader of a CBO workforce agency put it, exposure "has to happen way younger. You know, that has to happen in junior high, that has to happen in high school… kids don't even know what a construction project manager is… most adults have no idea what a construction project manager is."

Another workforce development professional stressed that young people today are "having to make decisions much earlier and much younger than what we did," making early outreach increasingly important. A trades subject matter expert made a similar point, arguing that education about these careers "can't start

in high school or after high school" but must begin "much earlier than that, like in elementary school." An employer likewise emphasized the equity dimension of early exposure, noting that office tours for middle and high school students are "really about leveling the playing field, so they all have the opportunity to learn about the industry."

At the same time, the content of career messaging matters as much as its timing. Interviewees described a persistent college-for-all narrative that continues to shape how students, families, and counselors define success, often to the detriment of other viable pathways. As one youth apprenticeship leader observed, "We have told every kid if you go to college, you will be all set for life. We are now living in a reality where that is not really the case anymore." A national construction researcher similarly noted that many families still associate "better" with a four-year degree, despite the opportunities of built environment careers: "If I'm a construction worker and I'm a carpenter, I want something better for my child… they have associated being better with this four-year degree idea and I think that that's wrong."

Moreover, educators emphasize the need for modern, youth-focused marketing (e.g., TikTok, YouTube videos, compelling employer branding) that reaches all students, including high academic achievers, with messages about a full range of built environment careers. One subject matter expert suggested messaging that ties these occupations to a larger purpose:

"It's about like building your country, being a part of an industry that is building things and has generational impact… people need to identify with less about like the day-to-day and more about what my role is going to be in this great generational environment that I'm working in that's building things."

Among promising practices to help young people gain insight into careers, interviewees highlighted the value of opportunities for young people to hear directly from professionals to understand the context and realities of work environments. For example, Massachusetts Girls in Trades' annual conferences offer workshops and panel conversations with women working in the trades to female trades students in high school. Through these discussions, young women explore topics that range from early working hours to operating in a male-dominated environment, to managing personal finances within a cyclical industry. More sustained approaches, such as ACE mentors, give students opportunities to interact with professional mentors while engaging in hands-on projects that build skills along with awareness of a range of ACE-related careers.

Key Finding: Perceptions of skilled trades jobs remain mixed, so despite emerging interest among young people, opportunities remain to boost the appeal of these jobs to the broader public.

Attitudes toward the trades remain inconsistent and often contradictory. On one hand, external polling suggests substantial public support for expanding skilled trades education in high schools.[10] For instance, research led by Harbor Freight Tools for Schools has demonstrated strong voter support for skilled trades classes in high schools. Building on earlier national research showing support for trades education, they

found that 84% of those surveyed support increased funding for high school trades education, and 94% support expansion of skilled trades education at Los Angeles high schools.[11]

A subject matter expert at a national CTE organization pointed out that polling indicates "people are more aware and open to skills-based education and different pathways. But people don't think of trades as what they want kids to go into." Our stakeholder interviews highlighted persistent negative perceptions, as families and students continue to stigmatize and misunderstand work in the trades. One secondary educator described the situation as follows:

"In the '90s… it was kind of like you don't want to do vocational education… that was the last resort… There's still a misconception of a lack of opportunity in the skilled trades… It's not just hammering a nail… You can be a designer, you can be a consultant, a scheduler… The opportunities are vast and I think that's still widely misunderstood."

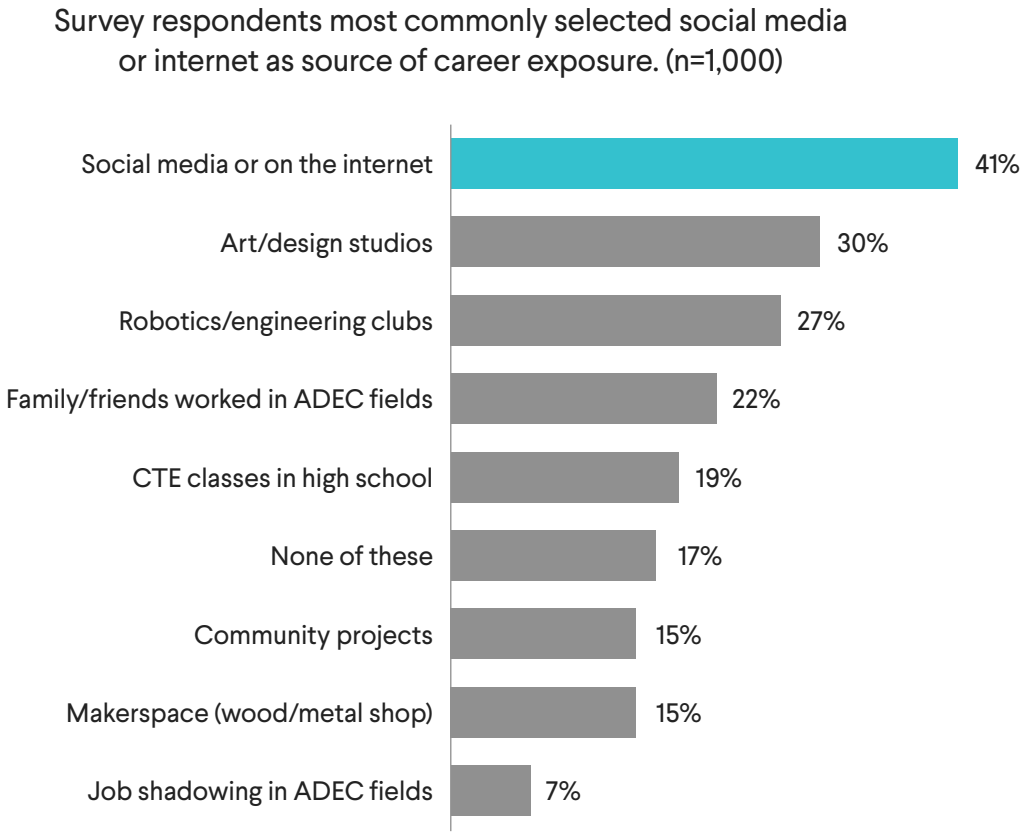
At the same time, in interview and focus group conversations, secondary trades educators reported growing student interest in these fields, particularly when students have opportunities to engage in hands-on, community-connected work. Interviewees described projects such as renovating parks, building benches, or contributing to housing construction as powerful hooks that help students see the relevance and value of these careers, as described by one pre-apprenticeship director:

"There's an emerging need…a big part of what we're doing is giving participants an opportunity to try out various things and learn more about themselves, as well as…different types of opportunities within these types of careers."

Key Finding: Limited secondary-system capacity constrains the field's ability to convert growing interest into durable pathways.

As prior JFF research has highlighted, CTE offerings vary across the country with some states offering well-resourced CTE high schools while others are limited to small, elective programs within comprehensive high schools.[12] In interviews with teachers and school district officials, restrictions in CTE offerings are mainly due to resource and staff constraints. Both local educators and national experts interviewed noted that many districts lack the capacity to sustain strong trades pathways given high equipment costs, uneven CTE infrastructure, and an instructor workforce being reduced by aging and limited by credential requirements. As one educator put it, "programs are drying up because they can't find a teacher… nobody from industry is going to leave and take one class, so they're shutting programs down."

CHART 4. EXPOSURE TO CAREERS IN THE BUILT ENVIRONMENT



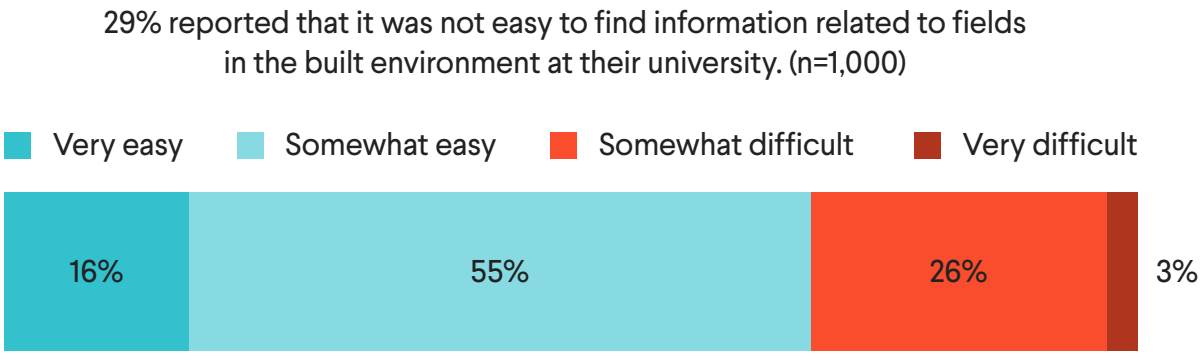
Source: College Pulse Survey 2025

Key Finding: At the postsecondary level, students' awareness of built environment careers is driven more by informal, self-directed, and uneven sources of information than by structured guidance.

Among college students surveyed, early awareness of built environment fields was largely shaped by informal channels, with social media and the internet (41%) being the most common means of career exposure, in addition to hands-on activities like design studios and robotics clubs.

Students' sources of exposure reveal uneven experiences that may prevent many young people from even considering careers in the built environment. While more needs to be done to strengthen online information quality and access, young people need expanded options for hands-on experience. A liberal arts architecture professor who was interviewed emphasized how creative experiences of all kinds—including art and design studios, makerspaces, and hands-on construction projects—can stimulate interest in careers related to the built environment, but there is a need to democratize such experiences so that they are widely available across economic and social lines.

CHART 5. FINDING INFORMATION RELATED TO FIELDS IN THE BUILT ENVIRONMENT



Source: College Pulse Survey 2025

Student access to career information is mixed. While most students (71%) found it "somewhat" or "very easy" to find information about built environment fields at their university, 29% reported that accessing such information was difficult.

Even with accessible information at the university level, student responses reflect gaps in the availability of career guidance. Eighty percent of students surveyed reported facing some kind of barrier in learning about a related career field. Forty-four percent of all students surveyed—including 51% of those interested in architecture—didn't know where to start accessing information about built environment careers. Students also noted a lack of personal connections that could provide career guidance—26% did not know anyone working in a built environment field, a situation that limits important opportunities to learn about career paths.

When asked what would have helped them learn more about these fields, 50% said being able to meet people in the field, and 45% said visiting workplaces, signaling students' desire for more work-based connections and experiences. Students also sought comprehensive information sources, including more useful information online (38%), teachers and counselors with supplemental information (35%), and campus events focused on entering these fields (30%). Across their responses, student perspectives reflect a significant gap in career information flow prior to college enrollment and an opportunity for implementing stronger communication in college.

2 Education and Training Program Content and Learner Experiences

Key Finding: Pre-apprenticeship, apprenticeship, and adult education can serve as important entry points into built environment careers, especially for adults and other nontraditional learners.

Interviewees pointed to adult learners and career switchers as an important but often underleveraged source of talent, especially for those who may be looking for clearer, more immediate connections between education and work. Adult education and pre-apprenticeship programs play a valuable role by helping learners build foundational academic and durable skills, explore career fit, and gain access to more structured next steps. As a mechatronics professor at a community college put it, "people keep looking at like middle school, K through 12," but "I would point at the people who are 18 to 35." An executive director of an apprenticeship intermediary similarly described pre-apprenticeship as a good fit for someone who wants to learn more about the trades but does not yet know "which trade to pursue or if it's right."

Interviewees across roles described these pathways as especially promising when they are tied directly to employment and allow participants to learn through work. One educator described a high school pre-apprenticeship with the Southwest Carpenters in which students can earn a certificate and "kind of slide right in" to the next step of union entry. Another interviewee described a pre-apprenticeship model as successful even when some participants decide not to continue because it gives them a chance to explore the field before making a long-term commitment to a job or training pathway. This emphasis on work-based exploration reflects a broader preference among adult learners for earn-and-learn models. As a director of a pre-apprenticeship program argued, "Our system is backwards," because too often people invest in education before they know what work they want to do. In his view, people are more interested in opportunities where they can "start work on Monday and start school on Tuesday."

Key Finding: The success of adult education, pre-apprenticeship, and apprenticeship programs depends on strong employer connections, wraparound supports, and sustained investment.

Interviewees described uneven funding, limited capacity for advising and contextualized instruction, and the need for stronger post-placement and supportive services. They also emphasized that quality varies substantially across pre-apprenticeship programs. As one interviewee noted, some programs place roughly 85% of participants into apprenticeships while others place closer to 20%, underscoring the lack of consistent standards and the importance of strong union and contractor relationships. A Green Corps pre-apprenticeship director also pointed to the fragility of these models, noting that federal funding cuts have already limited efforts to extend pre-apprenticeship into more advanced industry-specific academies.

Interviewees highlighted several models that illustrate how adult education, pre-apprenticeship, and apprenticeship can serve as stronger entryways into built environment careers. One is direct alignment between pre-apprenticeship and apprenticeship sponsors. For example, Building Pathways[13] is a Boston-based pre-apprenticeship program launched in 2011 to increase access to the construction trades for low-income women of all racial backgrounds and people of color in an industry that has historically been dominated by white men. The six-week program combines classroom instruction, hands-on exposure to multiple trades, site visits, and job-readiness training, then supports graduates' placement into apprenticeship programs or construction jobs. A key feature of the model is its formal relationship with local unions, which gives graduates preference for apprenticeship opportunities.

Louisiana Green Corps (LAGC) offers varied wraparound supports to trainees to ensure they can enroll and succeed in skills training programs. LAGC offers assistance in obtaining a driver's license, health care navigation, academic tutoring, and child care. Of LAGC grads, 100% leave with an industry-recognized credential, and more than 90% are placed into employment.[14]

Key Finding: Math impedes entry into built environment jobs, especially for engineering pathways, making earlier and more applied support critical to widening access.

Across multiple interviews, stakeholders identified math as a critical competency across the built environment, from measurement and estimation in the trades to the advanced coursework required in engineering and architecture. However, they described math as a barrier for many learners who may struggle or avoid it in their studies entirely. As one civil engineer noted, "I think one of the primary barriers to engineering, in particular, is going to be perceived difficulty due to requiring... [science, technology, engineering, and mathematics (STEM)] classes such as math, calculus, things like that." In other cases, the barrier reflects prior educational experiences and uneven preparation, particularly for adult learners and for students who previously struggled academically.

Interviewees emphasized that math challenges can begin early and accumulate over time. A national STEM leader stressed the importance of introducing engineering and architecture concepts as early as elementary school, when students are developing foundational math understanding and can begin to connect math to real-world problems. At the secondary level, educators described the value of integrating math with technical instruction so that students see its relevance and build confidence through application. They also noted that limited access to advanced math can make it harder for students to enter and persist in engineering and other postsecondary pathways. As one apprenticeship director explained, many students "want to be engineers, they want to be architects, but they don't realize that a lot of their math background from high school sometimes does not give them the necessary skills to be able to walk out of high school into Calculus I."

Stakeholders also pointed to promising strategies for reducing math-related barriers. One such effort is Northeastern University's Bridge to Calculus program, offered in partnership with Boston Public Schools (BPS) and the City of Boston.[15] The program is designed to expand high school students' access and preparation for calculus, improve readiness for postsecondary STEM pathways, and create a stronger pipeline accessible to all, from BPS classrooms to higher education opportunities at Northeastern and beyond. Through paid summer programming, students reinforce math skills and engage in project-based learning. Mentors provide career information that includes built environment fields and support students in next steps toward postsecondary education.

Key Finding: At the postsecondary level, students report that programs too often fall short in equipping students with the practical, work-based, and cross-disciplinary experience that employers demand.

Among students surveyed, most reported progress on skill development in both technical and professional (or "durable") skills. Half of students said courses and assignments "somewhat develop technical skills," while fewer (33%) indicated their programs "strongly developed" these skills. Similarly, 53% of students said courses and assignments "somewhat develop professional skills," (defined in the survey as communication, teamwork, and adaptability), while fewer (35%) indicated their programs "strongly developed" such skills.

Responses signaled gaps in career-focused, practical learning experiences. Only about half (49%) of students reported hands-on or project-based learning was part of their program. Smaller portions reported connections to careers and employers: 42% noted having assignments relevant to their career goals, and only 12% reported employer-integrated projects as part of their program.

The need for more practical learning was echoed by professionals in the field. A mechanical engineer we spoke with recalled learning about heat transfer in class yet never discussing insulation or real building systems. An urban planner we interviewed remarked that college did not cover "reviewing the plans and going out and doing the inspections and writing staff reports" and wished a course on public governance had been required rather than an elective. An employer interviewee noted that students may learn theories about project planning, but have no experience with staff or expense reports, core elements of on-the-job project management.

Some learners valued structured degree requirements that pushed them toward internships, capstone projects, or hands-on design courses. A planning student described how, in her program, she appreciated that "either you have to do a capstone project or an internship," which ensured applied experience before graduation. Despite this interest, only 17% of respondents reported having internship or co-op experience as a requirement in their programs. While providers may struggle to initially source opportunities for all learners, optional work-based learning will likely continue to reinforce inequities and reduce institutional support for learners.

Access to work-based learning matters, as students are entering a labor market that places a high value on relevant work experience. Recent Strada research[16] found that employers hiring college graduates rank related work experience, such as internships and project-based learning, as the strongest indicator of career readiness, above academic achievement alone. Students who cannot afford to participate in these experiences will lag peers in the transition from college to career.

Key Finding: The growth of "one-stop shops" combining design and construction services is leading to the need for more integration of architecture, design, and engineering skills and training.

One construction worker described this convergence as a recent trend:

"Lately in the last, I'd say four years… architects, engineers, and the design teams are getting more involved with the day-to-day activities on the project… nowadays I'm seeing… architects go in the field, engineers go in the field, the plumbers go there, electricians, whoever, and they're like, all right, this is what it looks like."

Interviewees described pressure for greater efficiency to drive demand for tighter collaboration across occupations and, in turn, the need for stronger teamwork skills and more integrated training experiences. These trends are pushing constructors, engineers, and designers to work together from the start of a project through integrated approaches such as design-build rather than in sequential roles.

Interviewees emphasized the need for professionals who can "speak each other's language." For example, architects with enough engineering and construction understanding (and vice versa) to participate in informed, productive conversations on interdisciplinary teams, so that collaboration is smoother and less burdened by basic cross-field explanations.

Key Finding: College students in built environment programs face demanding coursework and significant financial pressures that impact persistence and participation in work-based learning.

When asked what specific challenges they faced in participating in their programs, students' most common response was the time commitment and workload required, as noted by 36% of those surveyed. About a quarter of students reported struggling with difficult coursework (25%) or prerequisite requirements (28%).

These pressures are most pronounced among students interested in engineering, with 37% citing difficult courses, compared to 25% of all respondents, and 42% reporting challenging workloads, compared to 36% of all respondents. However, in interviews, course intensity was a shared experience across fields. One architecture graduate shared, "I wasn't prepared for how intense it was going to be. Like, I spent most of my weeks not sleeping for many years, and I have gray hair because of it."

Financial pressures compound these academic demands and shape not only whether students can persist, but also what opportunities they can pursue while enrolled. In survey comments, students described affordability as a gatekeeper influencing where they enroll, which majors feel viable, and whether a program seems worth the cost based on expected earnings after graduation. As one student explained, "I chose a major and career path that I felt would provide financial stability after graduation, rather than something I was more personally interested in, because I was worried about being able to pay back student loans." Program-related expenses also matter once students are enrolled: One-third of respondents (33%) reported financial strain related to required equipment and materials.

These financial constraints can also limit access to work-based learning experiences that help students translate education into labor market opportunities. In their comments, students described passing up internships or other experiential learning opportunities in favor of paid jobs needed to cover tuition and living expenses. One student reflected:

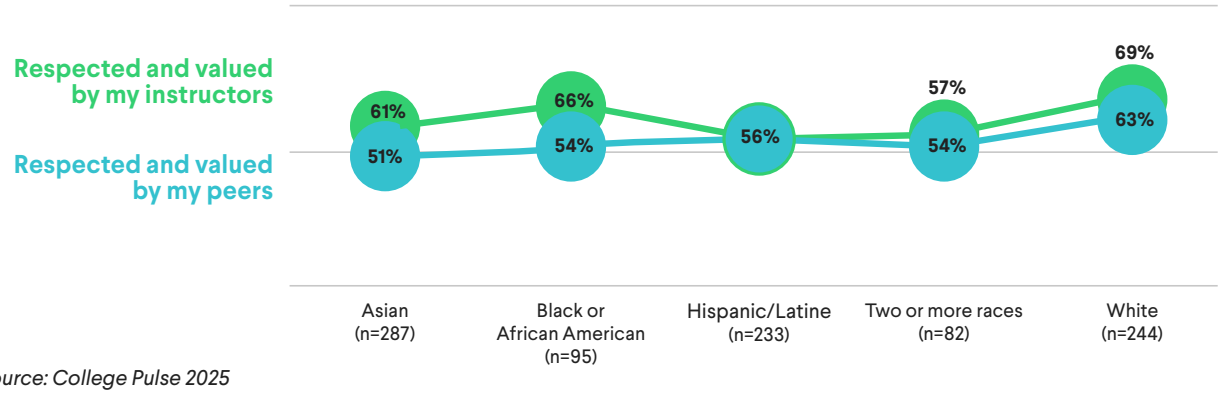
"I'm from a 'house-poor' family and background. I was able to go through fully with my education, but it was supplemented by help from family, applying for some scholarships, grants, and doing part-time work. I did not have the flexibility to pursue internships or co-op work opportunities."

Key Finding: Students' lack of belonging may be an important, under-addressed barrier to persistence in built environment programs, particularly for students of color.

Previous research shows that a sense of belonging can be critical to educational program persistence and completion.[17] College students in our survey report mixed experiences of belonging in their programs, and quality of experience can vary by race. Overall, 62% of respondents reported feeling "respected and valued" by their instructors, including 66% of Black learners. Slightly fewer students (55%) felt "respected and valued" by their peers overall, with similar percentages across racial groups.

CHART 6. STUDENT RATINGS OF RESPECT FROM INSTRUCTORS AND PEERS

66% of Black students felt respected by their instructors.

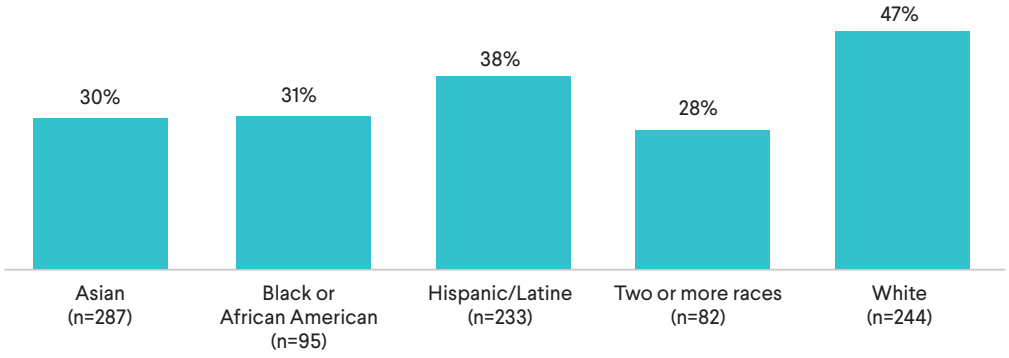


Source: College Pulse 2025

However, only 35% of students overall indicated that they "belong in (their) program." These experiences vary notably by race: 31% of Black, 30% of Asian, and 38% of Hispanic/Latine students reported feeling like they belong in their program, compared to 47% of white students.

CHART 7. FEELINGS OF BELONGING

A lower proportion of students of color reported that they felt like they belonged in their programs compared to white students.



Source: College Pulse 2025

Interviews with early-career workers revealed very mixed experiences of belonging in their college programs. One interviewee said faculty support helped them feel included: "there was belonging because… the professors…really wanted the students to learn…and…we could go to them if we were ever stuck."

Another enjoyed sharing a passion for the field but felt socially on the margins: "I felt respected among my peers, but…most of my friends I made through clubs and sports…I never felt like I really became close to anyone in [the program]." A third had the opposite experience, with strong peer ties but exposure to gender bias: "I did feel very connected to that engineering community…[but] there were some points where people would make comments specifically about gender." Another interviewee described almost no sense of belonging in engineering: "Absolutely not…no, I never felt like I belonged…there were like six girls out of 100 in my graduating class…so I also just felt like I didn't fit in there."

A director of a national nonprofit that supports people of color in STEM fields discussed the importance of authenticity as a dimension of belonging in school and the workplace and how work can suffer when there are barriers to emotional safety:

"If you can't be yourself, if you aren't comfortable to speak your mind and share your perspectives, then that inevitably will turn into stress, and that will inevitably put a cap on creativity in the workspace, in the classroom."

Student and worker identity-based affinity groups are one potential avenue for supporting women of all racial backgrounds and people of color in these programs and the workplace. One interviewee described a national identity-based membership organization whose largest constituency is college students in engineering and offers broader K-12-to-career pipeline programming. The interviewee highlighted that collegiate members need both financial support to persist in STEM majors and supportive communities that provide safety, wellness, representation, and a sense of belonging.

Key Finding: Child care, transportation, and other wraparound supports are core determinants of learner and worker success in built environment pathways.

Multiple interviews suggest that practical needs such as transportation, child care, and financial stability can significantly constrain success in built environment education and employment, even when tuition assistance or training opportunities are available. One community college professor described transportation as "a big hindrance," noting that even in a post-COVID environment with more virtual options, success still depends on reliable technology and a home environment that is "conducive for learning virtually." These challenges are not isolated. In communities with high levels of financial precarity, fragmented systems, and limited transit infrastructure, these needs can become a major barrier to upward mobility.

Child care and transportation emerged as especially significant barriers to both entering and remaining in training and employment, as noted in multiple interviews. While costs are a universal challenge across fields, particularly for people with low incomes, construction poses particular challenges. A trades subject matter expert noted how the "construction workforce is transitional. So, a worker may be on that project for two weeks and then go someplace else . . .I think the industry really has to wrap its arms around what to do in that regard." Another interviewee emphasized that transportation barriers are not simply about whether someone owns a car, but whether that car is reliable enough to support daily travel to work, particularly when jobs are located far from where workers live: "It's not that people don't want to work and they may have a car, but is it a reliable car?" These observations suggest that retention and advancement are shaped not only by wages and career opportunities, but by whether workers can realistically manage the logistics of getting to work and sustaining employment over time.

A few interviewees pointed to practical strategies that can help address these barriers. One example came from Columbus State Community College, where staff connect students to bus passes and even suggest local resources such as a bicycle co-op as a lower-cost transportation option. Another program described more robust supports: "For our trades academy, our students have up to $1,500 of supportive services available to them and we've been able to help a couple of them purchase vehicles... so that way... they can at least get to work." A trades expert described an early-hour childcare collaborative designed to serve the early morning needs of tradespeople: Care That Works[18] was created as a multiracial, feminist, working-class coalition of unions and community groups that organizes paid and unpaid child caregivers, including parents, relatives and friends, domestic workers, and family child care providers.

3 Transitions to Employment

Key Finding: The critical transition from postsecondary education into built environment employment lacks structured support, leaving career entry dependent on unequal social capital, work-based experience, and insider knowledge.

College student survey results and interviews with individuals who recently transitioned to the workforce suggest insufficient support exists for career planning and transition. Amid changing technologies and shifts in employer requirements, more needs to be done to equip young people for a job search in today's built environment labor market.

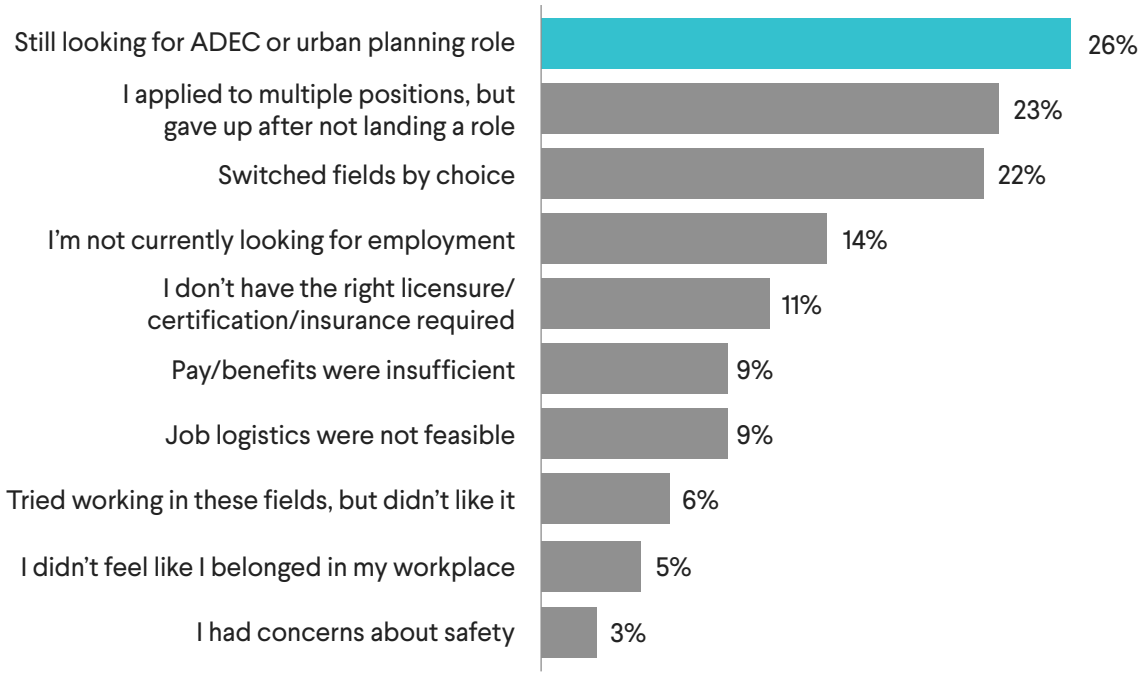
Available supports for career planning, job search preparation, and employer connection appear uneven and often insufficient for the demands of the current labor market. While 60% reported receiving "quite a bit" or "a great deal" of support for setting career goals and making a plan to reach them, 55% of students said they had not participated or weren't sure if they had participated in any career preparation services, such as career fairs, interview preparation, or internships. Just over half (53%) reported the availability of resume and interview preparation, but only about a quarter of students reported the availability of individual career

coaching from staff or faculty (26%) and mentoring from a professional working in their field of interest (24%). Only half noted the availability of internships, apprenticeships, co-ops, or other work-based learning—experiences that build relevant workplace skills and often yield professional contacts and job offers for students.

Findings from the alumni survey sample, while limited in size (n=174), reinforce concerns about the transition from education to employment. While 73% of overall survey respondents (1,000) said they were interested in a job in the built environment, among alumni, 50% of those interested in built environment fields were employed outside of those fields. A quarter of alumni respondents not employed in ADEC indicated they were still looking for a role in a built environment field, while another 23% gave up on their search after not landing a role.

CHART 8. REASONS BEHIND LACK OF BUILT ENVIRONMENT JOBS

Survey respondents not working in ADEC fields most commonly selected that they were still looking for ADEC roles. (n=141)



Source: College Pulse Survey 2025

Even among alumni who had obtained employment in the built environment (n=33), only 36% said their education had very well prepared them for their current work. Together, these findings suggest that interest in the field does not consistently translate into successful entry, and that postsecondary programs are not uniformly equipping students for the transition into work.

Conversations with a small group of recent alumni helped illuminate gaps in transitions to work. One graduate described a job search process in which cold applications yielded little traction, especially in a labor market increasingly mediated by automated hiring systems. Others described employer hiring processes in which software assessments functioned as high-stakes screening mechanisms. One architecture graduate recounted encountering firms that required applicants to take an assessment for Revit (a 3D modeling software used in engineering, design, and construction), despite the lack of comparable training in school. The interviewee shared her "huge disappointment" that after five years of study, getting a job came down to "if I pass a 30-minute assessment on a software."

When participants couldn't secure roles in the built environment, they pieced together careers in software, service, and creative fields. One interviewee shared, "I'm currently working as a software developer at Capital One" rather than staying on a construction- or building-focused path, after majoring in computational modeling and data analytics. Another interviewee described using a "bachelor's degree for graphic design" and an internship with a Japanese animation studio as a bridge into design and fashion-related roles, even as they continued looking for ways to reconnect with work related to the built environment.

Those who successfully entered positions in architecture, civil engineering, and project management described a process that relied on social capital, building connections and career awareness through family and mentors. A young civil engineer recounted landing her first job facilitated by a professional mentor she accessed through a college program. When her job application was rejected by human resources (HR) at her mentor's company, her parents encouraged her to discuss it with him. He contacted HR, and she was hired.

A pipeline that relies too heavily on personal networks and individual initiatives to cultivate social capital is inequitable and unsustainable. One pre-apprenticeship director echoed the need for more support around social capital, even for those who attend college and end up needing more training: "Colleges do a horrible job at actually job matching...they just assume you already have the social capital. So, when you get folks that come from the communities that I serve, where they don't have the social capital, and even if they were able to make it through the traditional route of going to college, they still find themselves in this space."

Recent social capital research on first-generation college students highlighted the importance of including senior professionals in job seekers' networks to support first job attainment. They found that those with more managers and mentors in their network got the best return on their job search activities.[19] Strengthening such supports would make the transition to employment more equitable, reduce reliance on chance and privilege, and improve the field's ability to retain talented graduates who are interested in built environment careers.

Key finding: Neurodiverse learners and workers represent an overlooked source of talent in the built environment, but many need more intentional transition and workplace supports to succeed and persist.

Few studies have explored prevalence of neurodiversity among the built environment workforce in the United States. One UK-based study found that one in four construction workers considered themselves to have a neurodiverse condition (such as ADHD, autism, and dyslexia).[20]

Interview and program evidence suggest that neurodiverse individuals can bring important strengths to built environment work, including technical ability, focus, and persistence, yet may face additional barriers in the transition to employment and early-career retention. As one higher education professional noted, neurodiverse students may struggle not because of a lack of capability, but because workplace transitions often rely heavily on social communication, self-advocacy, and adaptation to unfamiliar environments. This reinforces a broader point: When career entry depends heavily on informal navigation and unspoken expectations, students who need more structured support are placed at a disadvantage.

Some identified efforts demonstrate the value of differentiated transition supports. For example, Colorado-based Teaching the Autism Community Trades prepares young people for direct entry into trades employment, including welding, carpentry, and electrical careers, through hands-on, competency-based training pathways. Reported outcomes (83% placement)[21] suggest that such approaches can help connect neurodiverse learners to employment while broadening access to talent for employers.

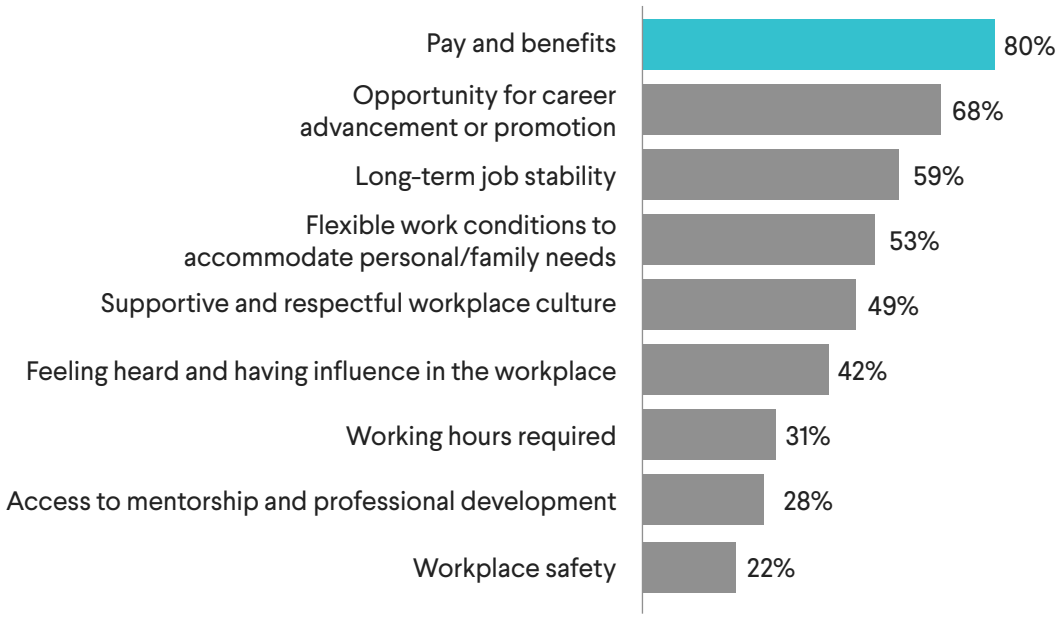
4 Workplace Conditions and Retention

Key Finding: Wages and benefits primarily drive retention in the built environment, but culture, belonging, and safety remain secondary forces for workers.

Once workers transition to the workplace, multiple factors influence their choice to stay with an employer. Among alumni in all fields, survey responses suggest that compensation and opportunity matter a great deal to early-career workers: pay and benefits (80%), career advancement (68%), job stability (59%), and flexibility (53%) were the strongest reported drivers of long-term commitment.

CHART 9. FACTORS DETERMINING WHETHER TO STAY IN CURRENT FIELD

When asked what factors will determine if they stay in their field, alumni alumni selected pay and benefits most often. (n=121)



Source: College Pulse Survey 2025

However, interview evidence suggests compensation is not the sole driver of employee retention. Cultural dynamics, representation, day-to-day treatment, schedule expectations, and workplace design all shape whether workers feel they can stay and thrive in built environment careers over time.

Workplace culture emerged as a particularly important determinant of retention, especially for women of all racial backgrounds and workers of color in the trades. As one trades equity specialist noted, "the history of skilled trades and its racist and checkered history…still shows up in who gets recruited and retained." Worker comments described job sites as harsh environments in which sexist and racist comments remain common. A mechanical engineer cautioned, "You go onto a construction site, be prepared to hear things that have been so outdated and politically incorrect." These dynamics can make work environments especially difficult for women and for anyone without a "tough skin," pushing some capable workers out of the field despite their interest in the work itself. As the equity specialist described it, the issue ultimately comes down to "respect," which remains unevenly realized across many work settings.

Formal pathways such as apprenticeship and licensure do not, on their own, ensure healthy work environments. A pre-apprenticeship leader in Chicago observed that in a strong union state one might think "apprenticeship would be the easiest thing to get people into," but it remains difficult because of persistent racist and sexist cultures. They described how many women supported by a women-in-trades organization end up "on the bench" in field roles, while some of the strongest success stories involve women moving instead into office-side and professional pathways.

Key Findings: Employee retention requires active investment in workplace culture, safety, mentoring, and family-supportive practices.

Workers and intermediaries pointed to the importance of affinity groups, employee resource groups, and identity-based professional communities as sources of safety, affirmation, and support when day-to-day work environments feel isolating or hostile. The Policy Group on Tradeswomen's Issues is a Massachusetts-based, multi-stakeholder collaborative formed in 2008 that brings together government agencies, unions, apprenticeship programs, contractors, advocates, researchers, and tradeswomen to increase women's access to and retention in construction careers. The group has helped to advance and monitor workforce participation goals for women of all racial backgrounds and people of color on public projects, while related access and opportunity committees on major construction projects have evolved into forums for accountability and shared learning. These efforts suggest that culture change is beginning to be treated as a core operational and business concern.

One interviewee argued explicitly that "harassment and discrimination are safety issues on the job" and should be treated with the same seriousness as physical safety hazards. She cited efforts, such as Green Dot bystander intervention workshops, that aim to equip workers to intervene when they witness hazing, bullying, or harassment, and RISE Up which describes itself as a respectful workplace campaign for the construction trades and offers customizable training and technical support aimed at helping organizations build workplaces marked by respect, inclusion, safety, and equity. To be most effective, the interviewee emphasized that this kind of training must reach workers, supervisors, and executive leaders, and must be reinforced regularly rather than treated as a one-time intervention.

Unions and contractors are also working to strengthen the mentorship function in apprenticeship, since journey workers are often expected to mentor apprentices without being trained to do so. Programs such as SkillPlan are attempting to address this gap by training both mentors and mentees so that apprenticeship supports not only the transfer of technical skills, but also the soft skills and workplace navigation needed to succeed in the industry.

The range of specific employer practices highlighted in interviews points to what stronger retention infrastructure can look like in practice. One architecture and design firm, facing what an HR leader called a local "talent war," has invested in flexibility, work-life balance, advancement, and belonging through flexible scheduling, a hybrid three-day-in-office model, and even discussion of a future four-day workweek. To help employees envision a longer-term future at the firm, it offers clear career pathways (for example, designer to architect to project manager), internal mobility across sectors and its 30-plus studios, and formal mentoring that pairs staff with a champion to discuss goals and opportunities. To sustain employee growth, the firm covers licenses, certifications, and conferences, and supports staff as tools evolve from AutoCAD to Revit and beyond. The firm also anchors its practice in sustainability and ecology through leadership roles (such as a director of ecology) and a living design framework that centers community, inclusion, sustainability, and beauty.

A workforce professional at a Midwestern utility company brings in new hires in small cohorts to create peer support and pairs each worker with a job-focused mentor and math tutor to address technical skill gaps, plus a second mentor who helps with "soft navigation," including workplace norms and expectations. Structured integration activities, such as check-in lunches, help new hires build networks and feel comfortable working alongside college-educated peers. To sustain advancement and inclusion, the company coaches managers on how to interview for skills, use inclusive language, and support nontraditional hires. It also runs a volunteer mentor program that recognizes mentoring hours as leadership development and signals visible support from senior leaders.

A director of a workforce development organization described a shared success-coaching model that helps employers expand their capacity to support workers. Under this approach, local employers purchase a portion of a success coach's time which is especially valuable for smaller employers that lack the resources for a full-time staff member. These coaches function as a hybrid career coach, case manager, and social services navigator, helping workers address retention barriers such as transportation and child care while connecting them to public benefits and other supports. The value for employers is reduced turnover, which can help avoid related hiring costs and project delays. Employer Resource Network USA is one example of this model. In 2024, it reported more than 650% return on investment (ROI) for employers investing in success coaches.[22]

Regional Perspectives

As part of our qualitative research, JFF identified two locations to host regional convenings. These sites were selected through desk research, advisor recommendations, and stakeholder interviews, with the goal of gaining deeper insights and exploring promising community-level practices within the built environment ecosystem. JFF hosted convenings in Columbus, Ohio (December 2025), and Phoenix, Arizona (February 2026), bringing together stakeholders across the ecosystem, including employers, education leaders (K-12, community colleges, and universities), training providers, workforce development organizations, local nonprofits, and local government agencies. The convenings sought to elevate successful efforts at the community level, surface common pain points in the built environment ecosystem, and identify opportunities for stronger collaboration.

When Demand Outpaces Coordination: Ohio

Ohio is facing a workforce inflection point. While overall employment in the state is projected to grow by just 1% from 2025-2030, the built environment sector is expanding more quickly, projected to grow by 3% during this period, driven largely by construction, which accounts for the majority of projected growth across occupations in this sector.[23] Rapid growth across advanced manufacturing, data centers, infrastructure, and housing, particularly in Central Ohio, is accelerating demand for this talent. Employers are already recruiting construction workers from neighboring states to keep pace.

ASPYR Workforce Innovation has emerged as a strong example of regional coordination in practice, helping align employers, workforce organizations, training providers, and public systems into a more connected talent ecosystem. Through its leadership of the WorkOhio Hub, the organization is advancing a workforce model that connects residents to career pathways in sectors like construction and infrastructure through a centralized process featuring coordinated intake, employer partnerships, referral networks, and wraparound supports. Their work demonstrates the important role regional intermediaries can play in helping fragmented workforce systems become more aligned, employer-responsive, and easier for residents to navigate.

However, participants in our regional convenings noted that coordinating efforts across the full ecosystem remains a challenge. Many lack the time and resources to develop meaningful partnerships, while some noted to JFF staff that our one-day convening was the first opportunity they've had to meet peer leaders in person and engage across distinct groups like nonprofits, government agencies, and employers. With all aiming to make productive contributions to Ohio's future workforce, this lack of coordination often creates more opaque pathways and options for state citizens.

Interview Spotlight:

Leader Urged Philanthropy to Back Adult Learners and Wraparound Services to Unlock Built Environment Careers

The JFF team interviewed a CBO workforce development leader in Ohio who oversees adult-focused programs that combine record sealing and expungement, workforce-readiness coaching, supportive services, and a trades academy designed to move people into construction and related roles. The leader described how many adults lacked awareness of lesser-known pathways in sectors like health care and the built environment and how training providers and employers were often misaligned on what counted as "workforce ready," leading them to call for employers to co-define clear, realistic baselines for entry-level hiring.

They emphasized that structural barriers, including high child care costs, unreliable transportation, and criminal records continued to block access to these opportunities, especially in growing tech, engineering, and construction hubs. The interviewee argued that philanthropy should invest more directly in adult learners through multi-year, flexible funding for child care, transportation, stipends, and supportive services, and help build adult-focused training centers with income support and intentional diversity goals in fields like solar and construction.

> *"Programs and outcomes took time to build up. They didn't happen overnight."*

Rebuilding the Early Talent Pipeline: Arizona

In a state experiencing rapid growth across construction, infrastructure, and advanced manufacturing, where construction jobs alone are projected to increase by more than 12% between 2025 and 2030, adding over 28,000 roles, demand is not the constraint.[24] While growth is also occurring across engineering and design occupations, construction continues to account for most of the demand, reinforcing the need for a steady pipeline of skilled tradespeople. The issue is not whether jobs exist but whether students ever see, and stay on, a path toward them.

Across the ecosystem, convening attendees emphasized that career awareness is the earliest and most consequential point of intervention. Students and families are often aware of construction and trades at a surface level but lack a clear understanding of the range, stability, and upward mobility these roles can offer. As a result, many young people opt out before meaningfully exploring these pathways. This is not a failure of interest. It is a failure of exposure.

Viewed through the ecosystem lens, Arizona's strengths are concentrated in early pathway development and applied learning models, particularly in K-12 alignment and work-based training. However, gaps in career awareness, navigation, and system coordination limit the ability of these efforts to translate into a clear and continuous pathway from early exposure to employment.

Employers often lack the capacity to manage ongoing education partnerships, while educators lack the time, networks, and resources to sustain industry engagement. Without intermediaries, even well-intentioned efforts remain fragmented and episodic. With them, there is potential to move toward more durable, system-level alignment.

Mentorship also emerged as a critical but underused component of the ecosystem. Stakeholders highlighted the value of connecting experienced professionals, including retirees, with students and early-career workers to provide guidance, navigation support, and a clearer sense of progression within the field. These relationships help bridge another key gap: not just entry into careers but persistence and advancement within them.

Interview Spotlight:

Arizona District Reengineered CTE into Broad Career Academies to Expand Work-Based Pathways into High-Demand Fields

The JFF team interviewed a district-level CTE leader from an Arizona school district, who explained that the district had moved from narrow, specialized CTE programs to broader college-and-career academies that embedded CTE, dual-enrollment, and industry certifications. Supported by block scheduling and interdisciplinary teacher teams, the academies were intended to boost relevance, belonging—especially among female learners—and access to sectors such as health care, digital media, engineering, and the built environment, with work-based learning framed as the key lever.

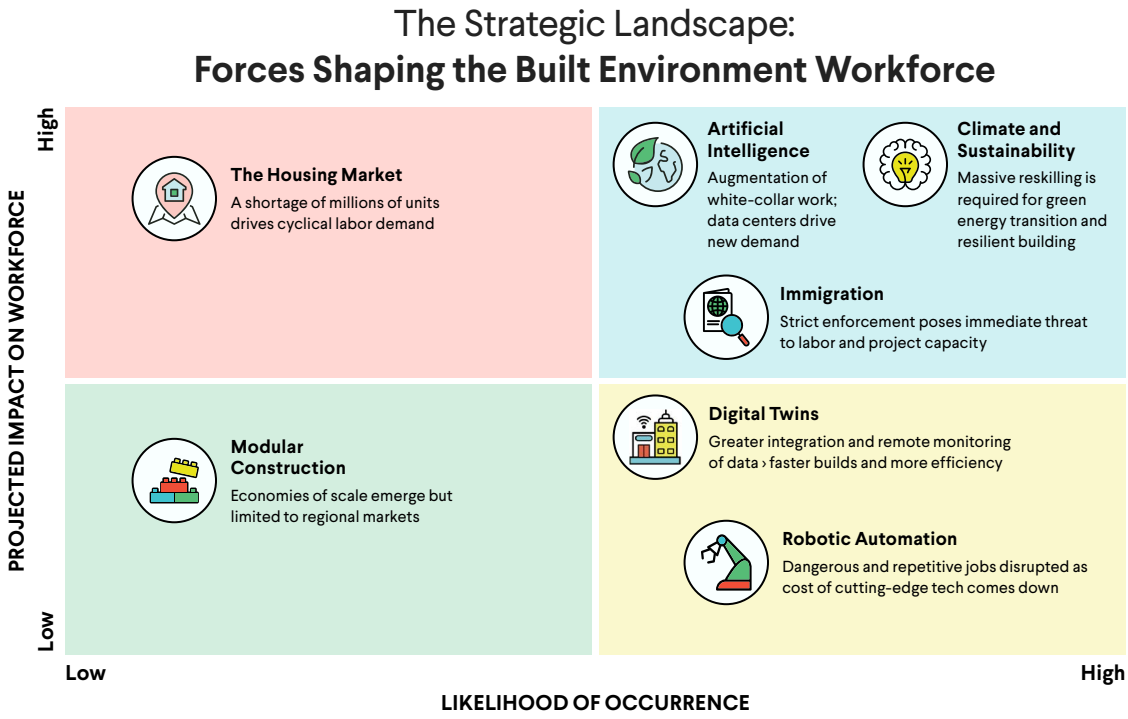
> *"Our goal is to have all kids have access to those types of careers they didn't even know existed."*

They also described implementation challenges, including resistance from a subset of more privileged parents, tension with a college-for-all mindset, and the difficulty of changing long-standing school structures. To recruit and support students, the district used a universal ninth-grade seminar, on-campus college-and-career fairs, and student-led communication with families about academy choices. Looking ahead, the interviewee said additional resources would go toward sustained professional learning for teachers and deeper employer partnerships to co-design curriculum and expand work-based learning, supported by external research and data to sustain the model.

Forces and Trends Shaping the Future of the Built Environment Workforce

This section examines the forces and trends reshaping the built environment workforce to understand how the industry is evolving and what that evolution means for its future workforce. It focuses on identifying the most significant drivers of change, from technological disruption and demographic shifts to climate imperatives and labor market dynamics, and assessing their implications across short-, medium-, and long-term time horizons. In addition, we explore how key stakeholders, including employers, educators, professional associations, and workforce organizations are influencing these changes while highlighting emerging opportunities and challenges for talent development and industry competitiveness.

This section synthesizes inputs from dedicated interviews, regional convenings, and secondary literature into a structured analysis that maps trends across time horizons, evaluates stakeholder influence, and identifies areas of opportunity, risk, and disciplinary convergence. The outcome of this work documents key forces shaping the built environment workforce but also offers strategic insights and actionable recommendations based on potential future states. This is by nature speculative, and by no means reflects concrete predictions of future events. By clarifying where the industry could be headed and how different actors can respond, this research aims to support more informed decision-making and more resilient, adaptive workforce strategies across the ecosystem.





Immigration

Immigration enforcement and policy represent one of the most significant and immediate threats to workforce capacity and project delivery in the built environment . Employers in the construction sector report that immigration enforcement in the summer of 2025 impacted their work.[25] Direct effects from worker deportations or detentions are compounded by the indirect chilling effect leading workers to stay home and skip work. In addition, the chilling effect impacts new entries into the United States, with new immigration dropping significantly in 2025.

Key indicators:

- 28% of construction firms reported impacts on their projects from immigration enforcement.[26]
- Immigrants make up an estimated 23% of the construction workforce.[27]
- More than half of the immigrant workforce in construction is undocumented, and hence more fearful of immigration action.[28]
- One in three construction workers in Texas, California, Florida, New York, and New Jersey is foreign-born.[29]
- The 10 states with the highest concentrations of undocumented immigrants in construction saw a minor drop in employment (0 .1%) while other states saw an increase of 1 .9%.[30]

Timing outlook:

- **Short term**—Enforcement starting in early 2025 created an immediate impact on the construction workforce. Large increases in funding for the Department of Homeland Security will likely enable further ramped-up enforcement in the coming months.
- **Medium term**—The current presidential administration could continue to ramp up enforcement or could be constrained by a shift in congressional control. A new administration with less overt enforcement emphasis may see a large wave of new immigration, especially across the southern U.S. border, like the one seen during the Biden administration.

Likelihood: Very likely

- The current administration is committed to a policy of stringent immigration enforcement. Resources have been committed to enforcement and expanding detention powers for federal agencies.
- Economic factors could put pressure on this policy if workforce impacts lead to further project delays or larger macroeconomic problems.

Workforce implications:

- Loss of frontline construction workers likely leads to increased competition among employers, driving up wages and project costs.
- Project delays lead to lower industry growth and profits.

- Construction industry faces the future problem of a "missing middle" where firms may lack experienced laborers based on those driven out of the industry right now.
- Most acute shortages are likely in trades reliant on immigrant labor, including plasterers (61%), drywall and ceiling installers (61%), roofers (52%), and painters (51%).[31]
- Labor shortages could drive increasing efforts to automate roles in the built environment, especially if rising labor costs converge with more cost-efficient technology.
- Potential for a more itinerant workforce that moves with projects across the country, covering labor shortages and supporting seasonal surges in demand, a short-term solution that would put upward pressure on wages and project costs. This dynamic is present in fields like nursing with supply-demand mismatches.

> *"You have whole companies that their whole crews are Eastern European or Latin American... and they're just not coming to work, you know, and I don't blame them."*
>
> **—Workforce organization leader**

Scenarios:

Scenario 1: Strict Enforcement of the New Normal

Enforcement continues at current or increased levels, at least through the end of the current administration. Reduction in workforce could reach 5 million workers or more, driven by deportations and voluntary departures. Meanwhile, the supply of new immigrant labor drops to nearly zero. Wages are likely to increase for remaining workers. Project costs and delays are likely to rise, leading to operational challenges for firms. The biggest companies will invest heavily in robotic automation and/or modular construction, reducing reliance on scarcer frontline labor. Largest firms with financial resources are most likely to weather industry disruption, which could lead to consolidation, while small business owners are more likely to suffer.

Scenario 2: A Policy Pivot to Targeted Enforcement

Economic and political pressure forces adjustments to current policy and enforcement intensity. Detention and deportation ramp down, focusing largely on those with criminal records. New immigration and border crossings remain low, but voluntary departures slow. The frontline workforce for the built environment stabilizes. Some workers return to the industry, mitigating some of the most acute challenges in states and occupations where immigrants are overrepresented. Wages may see moderate gains, but the return of a segment of the labor force mitigates cost increases. Employers must invest in new avenues to supplement the workforce (e.g., training programs, apprenticeships, etc.) to make up for reduced immigration.



Artificial Intelligence

AI has the potential to transform the built environment and its workforce . Adoption varies widely today, but private investment is surging . Today, AI tools augment many white-collar tasks and roles in this terrain, such as scheduling, estimates, and project management . Trades and construction jobs remain mostly insulated from automation for the moment, though some experts highlight near-term potential for automation of some building tasks . Data centers needed to power AI technology are also likely to drive demand for commercial construction and energy infrastructure .

Key indicators:

- 40% of general contractors are actively investing in AI tools and capabilities.[32]
- 48% of built environment industry leaders believe AI will destabilize their industry, while 46% report AI skills will be a top hiring priority over the next few years.[33]

Timing outlook:

- **Short term**—AI augments work more than it replaces workers in the short term. Firms ramp up investment in AI tools and technology, heightening demand for AI-related skills in white-collar roles.
- **Medium term**—Within five years, likely to see more significant role transformation and displacement. Firms see returns on investments in robotics, autonomous equipment, and more efficient workflows. Data center construction mitigates some job loss as large commercial projects and energy infrastructure investment keeps pace with AI tech adoption.
- **Long term**—Within the next decade, new roles emerge, potentially including building information modelers, digital twin technicians, drone operators, and AI specialists. A majority of back-office tasks may be automated, leading to significant workforce disruption concentrated in administration and planning.

Likelihood: Very likely

- Adoption driven by ongoing labor shortages and project delays. AI and construction technology mature with more investment and use cases in the field.
- Adoption could be slowed by workforce preparedness, especially among experienced mid-level managers and site superintendents who lack digital skills. Other forces that increase labor supply or decrease labor costs could slow adoption of costly tech tools.

Workforce implications:

- Lower-level roles in estimation, accounting, or project management may see diminished demand as firms manage more work with fewer employees.
- Trades and frontline construction roles are largely insulated in the short term, though displacement could ramp up with adoption of AI-supported robotics, especially for roles where labor shortages or worker safety concerns constrain labor supply.

- Creation of new roles, especially in midsized to large firms, such as autonomous equipment managers, drone operators, and systems integration specialists.
- Heightens need for thoughtful change management, as tech disruptions live and die with the ability of middle managers and frontline workers to understand and use new tech tools.
- Construction of needed data centers is likely to augment demand for a wide variety of built environment occupations, though projections vary widely and remain dependent on regional regulation and government collaboration.

> *"AI's transformative power lies in its ability to empower, not merely replace, human decision-making. However, organizations must make the conscious choice to create the connected systems AI needs to flourish. The question is not whether AI will revolutionize construction but whether companies will be ready when it does."*[34]

Scenarios:

Scenario 1: Augmentation Dominates

- AI enhances productivity without significantly impacting jobs. Firms meet growing demand without added workers, mitigating the impacts of the current workforce shortages. The paradox is that this transformation will require more tech-forward roles, where built environment firms have struggled to attract Gen Z and digital native workers.

Scenario 2: Accelerating Job Displacement

- Job roles in administration, project management, and accounting are severely displaced, replaced by some emerging tech-focused roles. A bifurcated, two-tier workforce emerges at large firms: a tech-savvy central team with high wages and growth versus trades professionals at increasing risk of displacement. AI technology also supports stronger entrepreneurial efforts and small business formation among trades workers.



Robotic Automation

Robotic jobsite automation is reshaping physical construction work at an accelerating pace, though adoption remains in an earlier stage than software-based AI. The global construction robotics market is expected to grow at a compound annual growth rate of 17% through 2035, potentially reaching over $1 trillion.[35] Unlike AI's immediate white-collar job impacts, robotics could primarily threaten blue-collar trades through displacement of routine manual tasks such as bricklaying, demolition, material handling, and welding. However, near-term reality diverges from headlines. Robots today largely augment rather than replace workers, addressing severe labor shortages and reducing workplace safety incidents. The complexity and variability of built projects limit the total impact of robotics, in contrast to more controlled environments like manufacturing, where robots are more likely to displace jobs at scale.

Key indicators:

- Total workforce labor shortages—As a partial alternative to human workers, robotic investment will become more attractive to firms as workforce gaps potentially grow.
- Cost per unit—As technology matures, lower-priced entry points will allow more firms to invest in robots.
- Supply of technicians—Emerging use of robotics will require a growing workforce of robotic technicians to use and maintain.

Timing outlook:

- **Short term—**Robots handle specific, dangerous, and repetitive tasks such as demolition, transport, or remote surveying. Employer demand for autonomous equipment operators grows.
- **Medium term—**Over the next few years, added use cases are likely to emerge as technology matures, offering greater output and cost effectiveness. Welding, assembly, and prefabrication could all see increased robotic operations.
- **Long term—**By the end of the decade, a bifurcation in the workforce may emerge; tech-enabled operators could work remotely or in factory settings and command wage premiums, while on-site labor for building projects skews toward lower-skill, lower-wage roles.

Likelihood: Moderate to high

- Workforce challenges, declining robotics costs, and increased robotic productivity will all likely drive greater market penetration in the built environment. Capital investment challenges will likely skew implementation toward larger, better-resourced firms. Lagging supply of robotic technicians could dampen implementation.

Workforce implications:

- Blue-collar roles in the trades and construction may see declining employer demand, though displacement at scale is not imminent.
- Augmentation of jobs with robotics is more likely to automate certain tasks. Demand for workers with skills manipulating and maintaining robotic systems is likely to grow.
- Robotics could revolutionize worker safety, replacing the majority of the most dangerous roles or tasks.

Scenarios:

- Augmentation and safety gains—Robots aid in addressing workforce shortages without displacing existing workers. Worker safety improves as dangerous human work is replaced by skilled robots purpose-built for certain tasks. Technology use could create new jobs that appeal to younger workers. Specialized firms evolve from equipment rental to robotics as a service.
- Selective displacement with uneven regional impact—Large firms invest heavily in robotics, displacing large proportions of blue-collar jobs over a decade. New tech-enhanced roles emerge but cluster in big metro areas where skilled labor supply is higher and larger firms maintain offices. Remaining trades workers are likely to see wages stagnate or decline as demand wanes.



Digital twins

Digital twins, real-time virtual replicas of physical assets, are transforming construction workflows from reactive to predictive. Unlike AI's white-collar focus or robotics' blue-collar displacement, digital twins fundamentally reshape collaboration across the built environment by creating shared data environments.[36] The technology enables teams to simulate scenarios, predict failures, and optimize resources before physical implementation. Workforce implications center on skills transformation rather than direct displacement. Success requires digitally fluent workers who can interpret complex data, manage IoT integrations, and coordinate across disciplines in virtual environments.

Key indicators:

- Market growth: Construction digital twin market estimated to expand at a 17% compound annual growth rate.[37]
- Challenges: Worker skill gaps could impede more rapid adoption. Uneven data and technical infrastructure lead to diminished financial ROI. Upfront investment limits early adoption to larger, heavily capitalized firms.
- ROI: Typical ROI within 12 to 36 months in adjacent industries like oil and gas.[38]

Timing outlook:

- **Short term—**Digital twins primarily deployed by large, well-capitalized firms for big infrastructure projects. Projects demonstrate ROI, but scarcity of expertise and upfront capital costs limit near-term adoption of digital twins. Training programs and infusion in existing programs continue but struggle to keep pace with emerging demand.
- **Medium term—**Digital twins increasingly become standard for commercial construction, infrastructure projects, and climate-focused construction. Universities and technical programs infuse more digital twin training and experience, augmenting workforce capacity. However, adoption remains concentrated, and laggards persist within small firms and residential construction.
- **Long term—**Use of digital twins across the project life cycle becomes the operating standard. Push for greater climate resilience boosts utilization as digital twins support remotely monitored and cloud-based, building system controls. Digital twins become a baseline competency for many design, engineering, and construction professionals, much as computer-aided design has replaced drafting boards in previous generations.

Likelihood: Moderate

- Cost of implementation is likely to decline as underlying technology matures, especially for remote sensors, cloud computing, and AI. Overlap with smart city initiatives and climate resilience would likely augment demand and potentially boost access for upfront capital needs. Skill adoption will likely lag demand in the market and slow adoption. Data interoperability and standardization challenges could also slow implementation.

Workforce implications:

- New specialized roles—Digital twins specialists, data analysts, and systems integrations specialists could all emerge as roles with increasing employer demand, especially among larger firms. Employers will likely need to train their own from the existing workforce until education and training pipelines can increase capacity to keep up with demand.
- Transformation of existing roles—Architects, designers, and engineers will increasingly need to think of buildings not just as structural or aesthetic projects but also as data-generating systems. Construction managers and superintendents coordinate physical work on site with virtual model updates, requiring some digital fluency to oversee expert staff.

Scenarios:

- Elite adoption, workforce bifurcation—Digital twins become standard for large commercial projects . Large firms develop internal expertise, attract top tech-enabled talent, and achieve ROI through gains in productivity and build quality. Smaller firms lack capital, expertise, and emerging talent, further reinforcing a two-tier system. Gen Z gravitates toward the more digitally embedded construction approach, further amplifying shortages in areas like the trades, where training could continue to emphasize core building process over digital literacy.

- Democratization through cloud platforms—Cloud-based digital twins platforms and solutions mature, offering market entry even for smaller firms that lack capital or strong digital expertise. Turnkey solutions emerge in the market that embed training for professionals without deep experience in remote sensing, data analysis, or system monitoring. As a result, use of digital twins scales beyond mega projects and commercial builds to multi-unit and higher-end residential construction. As training and education pathways adapt and scale up offerings, new roles such as digital twins specialists emerge at smaller firms.



The Housing Market

The housing market in the United States is a key driver of workforce demand in the built environment. An estimated 3.4 million construction workers in the United States work on residential projects, accounting for more than a third of all workers in this category.[39] The United States also faces an ongoing structural shortage of affordable housing. Researchers estimate that the United States will need to construct between 3 million and 4 million additional homes beyond the current build rate to boost supply and address affordability issues.[40] The volatility of the housing market can create whiplash for workers and businesses as recession-driven building slowdowns can rapidly shift into periodic surges in construction demand.

Key indicators:

- Housing shortage—A national deficit of an estimated 4 million homes with household formation outpacing new housing starts.[41]
- Employment trends—Construction employment declined precipitously during the early months of the Great Recession. Over 800,000 jobs were lost from late 2008 to June 2009, accounting for 27% of employment in construction at the time.[42] Based on previous recessions, declining employment in construction can sometimes be a leading indicator of economic slowdowns.
- Public policy discourse—While the impact is difficult to fully quantify, future midterm and presidential election cycles could elevate policy discussions about housing supply and affordability, particularly as Millennial and Gen Z voters grow as a proportion of the electorate. Increasing political pressure to address housing may drive federal investment or other policy interventions.

Timing outlook:

- **Short term—**Residential construction continues to struggle to keep up with demand. Labor shortages further impede new supply of housing. Jobs remain vulnerable to cyclical market swings.
- **Medium term—**Paths could diverge depending on policy and market conditions. Housing policy initiatives could drive a major increase in housing construction, which could contribute to higher wages but would require greater workforce training investment. In contrast, sustained high interest rates could depress future construction, leading to more workers leaving the built environment for higher-growth fields.

Likelihood: Moderate

- While increasing demand for housing of all types should drive further private sector investment, the scale of new building remains highly dependent on policy choices from the federal to the local level. In addition, workforce limitations could continue to drive up prices for housing, limiting demand for lower-income and first-time homebuyers.

Workforce implications:

- Boom-bust vulnerability—Residential construction workers face extreme cyclical exposure. Workers laid off during recessions may never return and the demand whiplash may create perceptions that construction jobs lack the stability many workers desire.
- Pipeline disruption—Chronic volatility impedes alignment between training programs and employer demand. New programs may struggle to scale up or down with demand, leaving longer-term labor market gaps for employers to navigate.
- Wage pressure and affordability paradox—While wages in residential construction are rising faster than inflation, those labor costs feed into rising home prices, which in turn amplify affordability concerns that dampen demand for new construction.[43]
- Labor mobility constraints—The housing shortage itself hinders labor mobility, as workers may struggle to relocate for jobs in high-demand regions if housing costs are seen as unaffordable.

> *“We simply don’t have enough construction workers to build the homes America needs.”*
>
> **—Angelo Farooq**
>
> Former chair of the National Association of State Workforce Board Chairs[44]

Scenarios:

- Another housing-driven recession—Macroeconomic conditions drive down demand for new housing, perhaps based on rising unemployment or continued high interest rates to protect against inflation. As demand slows, new construction craters, leading to large losses in employment, anywhere from a few hundred thousand to one million workers. When housing demand recovers, the industry is ill-equipped to respond, with ever-larger workforce gaps and training pipelines that need to be restarted.

- Massive government-funded construction boom—Billions of dollars in federal investment are earmarked as incentives for new housing construction, especially for starter homes and missing-middle housing in denser urban areas. Increased demand for housing construction leads to higher wages, which, complemented by heightened investment in training pathways, further augments the built environment workforce. Millions of projects ranging from single-family homes to commercial apartment complexes generate $1 million-plus in new jobs, bringing in a whole new generation of workers into the built environment.



Climate and Sustainability

Climate change, transitions to greener energy sources, and sustainability mandates are fundamentally reshaping workforce demand in the built environment. Climate disasters such as wildfires and hurricanes arrive with greater fury and frequency than ever, driving changes to the built environment itself. While a full-scale economic transition to clean energy and resilient building design will require massive capital investment, it will also require significant reskilling of the workforce as projects incorporate new materials and processes, as well as wide-scale electrification of transportation.

Key indicators:

- Employment signals—Employer demand outpaces the supply of newly skilled workers as training programs struggle to scale to meet fast-growing need.[45] Occupations like wind turbine service technicians and solar photovoltaic installers, while smaller in employment today, are projected to be the fastest-growing occupations in the United States through 2034, indicating the scale of future demand.[46]
- Market growth—For example, 95% of new energy production in the United States in 2024 came from carbon-free sources such as solar, wind, and nuclear.[47]
- Policy drivers—Federal investment can also drive employment gains. Almost 150,000 clean energy jobs were created in the first year alone after passing the Inflation Reduction Act (IRA) .[48]

Timing outlook:

- **Short term—**Accelerating demand for green skills in the built environment continues to outpace workforce readiness. Buildout of clean energy infrastructure amplifies demand for some trades occupations, especially electricians. Training programs attempt to grow to match demand but may struggle to scale while maintaining effectiveness for workers.
- **Medium term—**Green skills increasingly become a baseline expectation across most occupations in the built environment. Building codes in the United States increasingly mandate net-zero or near-zero energy performance. Climate adaptation infrastructure to deal with more frequent and powerful climate events drives the need for more specialized expertise (e.g., fire-resilient building, flood management, etc.).

- **Long term—**Potential for transformation of the workforce, especially driven by emergence of more new specialized roles. Building deconstruction, material recovery, and adaptive reuse of built materials grow as necessary skills in the workforce. Carbon accounting expands in demand. Regional variations in climate adaptation are likely to drive more regional specialization in workforce needs.

Likelihood: Very high

- Extreme weather events heighten public awareness and drive policy action to mitigate the worst effects on the built environment, economy, and public health. Increasing energy costs make efficiency improvements more cost-effective, accelerating adoption. Younger generations focus on sustainability and drive significant shifts in consumer behavior, emphasizing clean energy and sustainable building practices.

Workforce implications:

- New role creation—Unique jobs emerge in response to market demand for new skills. Green building architects could see increasing demand for services. Sustainability consultants, environmental engineers, and carbon accountants continue to grow as well, signaling the need for new education and training pathways to keep up with employer demand.
- Existing role transformation—Most roles in the built environment will likely require some additive skills related to green energy, sustainability, or climate.[49] Construction managers will need greater experience with sustainable materials and trades professionals will need training in heat pump installation and electrification. This will require greater emphasis on sustainability in existing education and training pathways and more employer investment in reskilling their existing workforce.
- Geographic distribution—Workers employed in carbon-intensive energy industries like oil and natural gas may not be able to access emerging green jobs where they live. Even if the national energy transition is net positive for jobs, not all workers will experience accessible job growth.

Scenarios:

- The workforce adapts to the green transition—Policy momentum from the IRA under the Biden administration resumes and accelerates over the next decade, coupled with more intensive federal investment in training programs. A focus on a "just transition" emerges that emphasizes supporting workers who will be displaced from carbon-intensive industries and giving back to communities that suffer disproportionate impacts of pollution and environmental disasters. Wage premiums and corporate investment amplify demand, drawing more interested workers to these fields. Training programs grow and aim for greater scale through targeted use of digital tools like virtual reality (VR). Even in this scenario, geographic disparities persist unless the government creates incentives to move workers to regions with stronger job growth.

- Skill gaps, policy, and pricing pressures constrain growth—Training infrastructure struggles to keep up with demand given reliance on small, cohort-based instructional models. Employers are forced to rely on under-skilled workers, impacting project timelines and profitability. Green jobs grow, but many roles remain unfilled, dampening the long-term growth trajectory of the whole industry. A two-tier market emerges: one tier where large, well-capitalized firms capture the green talent and capture market share of sustainable building projects and another tier where smaller contractors can't compete for scarce green talent and increasingly compete in a shrinking segment of non-sustainable building projects.



Modular Construction

Modular construction, where building components are manufactured offsite in controlled factory settings and assembled on site, represents a fundamental shift in how structures are built and who builds them. The United States currently lags behind countries like Singapore, Sweden, and Denmark in the use of modular construction. Modular construction can shorten construction timelines, decrease project costs, and address the shortfall of skilled labor on traditional construction and infrastructure projects. However, it requires fundamentally different skilled labor, supply chains, and logistics operations to function and turn a profit.

Key indicators:

- Market growth—Currently a $10 billion to $20 billion market in the United States but projected to grow at a 5% compound annual growth rate. Regional variation is strong since building relies on regional suppliers that must be able to transport built components.[50]
- Adoption rates—Roughly 5% of building in the United States is modular compared to 30-40% in leading markets like Singapore and Scandinavia.[51]
- Project performance—Modular construction projects can be completed 20-50% faster than traditional construction since site prep can run concurrently with factory building of components.[52]

Timing outlook:

- **Short term—**Niche adoption continues in proven market segments like student housing, health care facilities, and affordable housing. The entry of major developers (i.e., Greystar) creates a demonstration effect that potentially amplifies future experimentation and adoption.[53] Workforce demand grows for modular workforce, including specialized engineers and manufacturing technicians.
- **Medium term—**As manufacturing capacity expands and market-proof points gain exposure, growth is amplified. Workforce bifurcates as skilled factory technicians require very different preparation and training from on-site construction workers. Market share of construction could rise to 5-10% of the total construction market, though growth depends on the supply of talent.

- **Long term—**Should adoption approach 20% or more of construction, a fundamental transformation of the workforce could occur, requiring specialized training programs for designers, engineers, and manufacturing technicians. Even on-site laborers and supervisors require additional training and experience. But despite broader adoption, modular is unlikely to break into upmarket commercial or residential construction due to aesthetic concerns and desire for customized-built projects.

Likelihood: Moderate

- More transformational adoption of modular construction remains dependent on other forces and variables. Federal investment in affordable housing could boost demand for modular apartments. Regions with high housing costs and focused development of dense housing (e.g., California and Oregon) may see development of resilient local supply chains that boost cycles of growth. Workforce needs may conflict with those of other industries like advanced manufacturing and semiconductors, which could impede company growth or drive up wages to unsustainable levels.

Workforce implications:

- The factory vs. field divide—Modular construction creates distinct employment pathways and worker experiences. Factory workers operate in more controlled, safe, and comfortable environments year-round, potentially creating more attractive roles for underrepresented groups like women and older workers of all racial backgrounds. Demand for some skilled trades may diminish as on-site labor shifts more toward assembly.
- New roles and specializations emerge—Modular design architects and engineers develop expertise working within the limitations of modular components, client needs, and site conditions. Factory production relies on workers mastering lean production and quality control. Logistics is also amplified, requiring supply chain management expertise and potentially more drivers and heavy equipment operators.

Recommendations and Opportunities for Investment

In the following sections we highlight key recommendations for future investments in the built environment workforce ecosystem. They address collaborative needs across organizations as well as efforts to prime future career interest, support learners through all types of education and training, and provide opportunities for retention and advancement in built environment careers.

First, cross cutting principle for how philanthropy can support a strong workforce for the built environment:

- **Regional focus—**Local variations in labor market conditions and diverse stakeholders require a more nuanced approach than broad national efforts allow. Invest in in-sector partnerships and other systemic approaches to addressing labor market need.
- **Employer co-investment —**Require industry "skin in the game" through hiring commitments and advising on curricula, mentoring, and investing in up-to-date equipment and resources for education and training.
- **Incumbent worker access —**Many pathways target entry-level professionals. Don't overlook working adults with skills or desire to pivot careers.
- **Credential stackability —**Ensure all training and credentials offer workers and learners the opportunity to pursue further education/training in the future that recognizes their current skills and achievements.
- **Diversity by design—**Don't add diversity as an afterthought. Invest in programs and solutions with a population focus to properly address the unique barriers that women of all racial backgrounds, people of color, and immigrants face in this space.
- **Incentivize collaboration—**Where possible, make funding contingent on active collaboration between employers, education institutions, training providers, and workforce organizations so that individual efforts still drive stronger system alignment.

Build Awareness and Early-Career Intent

- **Invest in hands-on learning experiences for learners starting as early as elementary school to build awareness for careers in the built environment.** Awareness isn't just about knowing that careers exist; it's about building learners' skills and self-efficacy to set them on the path to future success. Maker spaces, robotics clubs, and project-based STEM programs abound but need further support, especially in low-income schools.
    - Addressing equity issues requires sustained funding targeting low-income schools. One-time grants often lead to programs that quietly close when funding dries up.
    - Investments should monitor interim milestones that could correlate with future workforce impact, such as CTE enrollment or pre-apprenticeship participation.

- **Support dual-enrollment programs and high school-based CTE curricula to set learners on the path to career success in the built environment.** Dual-enrollment programs should not only focus on offering college credit but should also align pathways into high-demand careers like engineering and architecture. CTE programs that offer rigorous, high-quality options to learners as an alternative to college preparatory tracks must be scaled to ensure broad access. External funding could help equalize access to CTE programming and supplement the scarce supply of qualified instructors.
    - Ensure dual-enrollment credit articulates into apprenticeships, stackable credentials, and degree programs to sharpen the value proposition for a wider subset of learners.
    - Target geographies that lack instructor capacity, especially rural areas and smaller districts that may lack resources to compete with private sector wages.

- **Build career navigation tools and support counseling in schools to better educate learners on the numerous pathways and options into built environment careers.** The college-for-all movement biases advice toward college enrollment and away from programs like apprenticeships. School counselors need better support to understand the array of non-college options for training and career entry. Philanthropy can support building of tech-enabled tools that build school-to-career maps so learners can understand and pursue the path that works for them.
    - Don't overlook training and engagement with counselors; tools will only be as useful as the trusted adults who can contextualize them for learners.
    - Understand the incentives and metrics used to evaluate schools and identify roadblocks that may impede a move away from college-for-all advising.

- **Develop a national campaign to build awareness about career opportunities in the built environment.** To complement career navigation tools and K-12 learning opportunities, funders should consider the power of broad multimedia campaigns to shape mindsets about built environment careers. Target investments to states with large projected workforce gaps and leverage social media to reach younger, up-and-coming generations of workers and learners. Ensure that content highlights diverse workers and emphasizes possible career growth while addressing common negative perceptions about

jobsite safety and harassment.

    - Don't consider this an isolated, standalone strategy; awareness building of built environment careers should be complemented by workplace culture change and enhanced opportunities for advancement.
    - Establish baseline metrics for career awareness and perception before launching to allow for evaluating campaign effectiveness.

Support Learners & Workers Through Programs & Pathways

- **Fund innovative training models that focus on the integration of emerging technologies into built environment fields.** Employers report that they are able to build more with fewer workers supported by technology, but access to technology-focused training is not widespread or equitably distributed. Programs for incumbent workers to help them leverage AI, robotics, or digital twin technology will help them develop the skills needed for long, resilient careers.
    - Incumbent worker training could generate more immediate ROI than efforts targeting career entry or early pipeline development.
    - Under-resourced training centers don't just need access to digital technology and tools; they also require capital for purchasing hardware and equipment for real-world training.

- **Support organizations and initiatives that help workers build professional social capital.** Given that so many built environment workers get jobs through who they know, it's imperative that all education and training programs are complemented by structured opportunities to develop professional networks across the industry. Affinity groups (e.g., National Society of Black Engineers, Women in STEM, etc .) play a key role in expanding social capital in previously underrepresented groups and contributing to a greater sense of personal belonging in the industry. Philanthropy could also support efforts to bring in industry speakers and mentors to work with students in built environment fields to better equalize access to professional networks in industry.
    - Funding affinity groups is potentially high leverage, as they can address social capital gaps, provide mentorship, and support belonging across the career continuum.
    - Social capital impact can be difficult to measure, but proxy indicators such as network referrals or retention rates for mentees can be valuable signals of value.

- **Invest in training stipends and wraparound supports for learners progressing through trades training programs, including those that provide pathways for working adults to pivot career paths.** Even proven models like apprenticeships can suffer from retention issues, reducing the potential impact of these programs. Supports like flexible child care, transportation solutions, housing navigators, and emergency savings accounts can mitigate many of the life challenges that lead people to leave training programs and ensure they can complete the transition to the workforce. Development of financial

literacy and other life skills can equip trainees with capacities that increase their resilience over the course of their careers.

    - Complement wraparound supports with flexible program delivery (online, evening, weekend) to maximize reach among working adults.
    - Survey learners to understand wages available in adjacent industries to better quantify the opportunity cost of program participation.

- **Drive the creation of industry-aligned, tech-infused interdisciplinary degree programs at universities.** Emerging examples like the new construction engineering bachelor's program at the University of North Carolina at Charlotte suggest an approach for more programs that intentionally blur traditional boundaries between construction, engineering, and digital technology, driven by employer demand for more cross-disciplinary skills. Overall, universities lack the capital and employer insight to drive the creation of these programs that can serve vital industry needs.
    - Employer input and co-design are critical for program success. Without them, programs may be pulled toward alignment with existing academic disciplines that don't reflect industry practice.
    - New degree programs take years to move from initial ideation through approval to enrollment and student completion, so financial incentives should identify interim milestones for funding and support.

- **Support scholarships or other funding that ensures low-income college students can benefit from critical work-based learning opportunities like internships and co-ops.** Survey data indicates that students forgo these opportunities to prioritize short-term earning, likely impacting their future skill development and employability. Philanthropy can support scholarship funding to ensure that earn-and-learn opportunities are available to all students in built environment fields, regardless of race or income.
    - Stipend parity with competing jobs is the threshold that determines whether low-income students can realistically participate.
    - Geographic targeting should focus on areas with already robust work-based learning infrastructure but lower participation rates for low-income students.

- **Provide supplementary funding for CTE programs for both youth and working adults in the built environment workforce.** Existing labor shortages can drive up wages in the short term, meaning skilled workers don't see the financial benefit of working as teachers, instructors, or mentors. This dynamic further impedes workforce development efforts, contributing to a self-reinforcing cycle of shortage. Philanthropic funds can help incentivize further instructor participation.
    - Supplementing wages for instructor-practitioners is a direct lever that avoids re-negotiation of faculty or instructor salary bands.
    - Philanthropy can demonstrate successful interventions, but systemic impact likely requires sustained public funding.

Drive Opportunities for Worker Belonging, Retention, and Advancement

- **Model a national movement among employers to promote belonging and safety on job sites and offer professional advancement opportunities to workers without a college degree.** Some workers self-select out of built environment fields due to perceptions about belonging and potential harassment on the job. Many employers also still place an unspoken ceiling on advancement opportunities for non-college-educated workers. Large employers can shift common practice by promoting from within, investing in leadership and management training, and highlighting these practices to boost frontline worker recruitment. Such strategies could unlock opportunities for workers entering the industry as trades professionals or office support staff, and better signal openness to career opportunities for women of all racial backgrounds and people of color.
    - Balance the signal value of changing practice among large employers with the implementation challenges that are unique to the thousands of smaller businesses and employers.
    - Employer commitment requires transparency to understand advancement, demographic breakdowns, and ROI from internal investment.

- **Fund degree-focused lifelong learning opportunities for workers who do wish to pursue a higher education.** With a greater emphasis on trades education and doubts about the ROI of college, more learners may forgo college enrollment in the future. Employers should provide tuition reimbursement and scheduling support to make college degree attainment feasible for employees. This strategy will likely lead to improved worker retention and engagement.
    - Direct employer billing removes a financial burden for employees, something that is particularly prohibitive for low-income workers.
    - Ensure employers have systems in place to recognize degree attainment, especially for trades professionals looking to enter engineering or management roles.

Ecosystem Investments

- **Fund place-based, systems-level efforts through national and regional intermediaries that align key stakeholders across the built environment ecosystem.** No one organization holds a holistic and comprehensive view of the built environment workforce, so funding should bring together talent suppliers (e.g., colleges, training organizations) with talent seekers (e.g., employers) and intermediaries (e.g., workforce organizations, professional associations) to truly drive employment outcomes for workers.
    - Ensure regional partners see funding tied to interim milestones beyond engagement, such as work-based learning partnerships, hiring commitments, or new employer-driven training offerings.

    - Initial funding should allow intermediaries to build more sustainable revenue from employer

fees, public contracts, or membership dues.

- **Host regional convenings that bring together key stakeholders.** Over the course of our JFF-hosted regional convenings, participants mentioned they lack opportunities to come together, share information, and collaborate. Semi-annual meetings could drive better alignment across the system and help build better connections that ultimately lead to better employment opportunities for learners and workers.
    - Ensure convenings set goals and follow up on progress and results; otherwise these can turn into networking events with less impact.
    - Structured problem-solving sessions with grounding data will produce more alignment than speakers, panels, and high-level discourse.

- **Support ongoing research and evaluation to pressure test emerging practices and disseminate promising models more widely.** While regional networks may be best for driving innovation in job pathways, replicable patterns may emerge that merit greater exploration. National organizations and philanthropies play an important role in evaluating what works and promoting those practices to other parts of the country's workforce ecosystem.
    - Research is most actionable when embedded in programs from the start rather than commissioned after the fact; consider adding evaluation funds to other types of program support mentioned above.
    - Dissemination is as valuable as the research itself, as many of valuable efforts don't reach the audiences needed to shift industry practice.

Appendices

Appendix A: Labor Market Analysis Methodology Notes

Labor Market Intelligence (LMI) and "Top Occupation" Selection

The team used a combination of desk research, labor market analysis, and manual coding and selection of occupations, thereby allowing us to navigate some of the nuances of ADEC roles and define a set of top built environment occupations.

Identifying Occupations and Developing Scoring Framework

We identified an initial list of 29 occupations based on desk research and initial review of labor market data. Next, we analyzed staffing patterns for each of the ADEC sectors to overlay occupational data. Using the NAICS codes noted in the table, any occupations with at least 1,000 people employed were also added to the working definition of built environment occupations. This expanded the list of built environment roles to about 245 occupations.

TABLE 8. INDUSTRY CODES

Area	Industry/subsector	NAICS code
Architecture	Architectural Services	54131
Design	Drafting Services Interior Design Services Industrial Design Services	54134 54141 54142
Engineering	Engineering Services	54133
Construction	Construction	23

From this analysis, occupations were further filtered down to a list of 99 occupations using a combination of O*NET, Lightcast, targeted desk research, and emerging themes from stakeholder interviews to select occupations with high demand, concentration of employment, or those that serve a key function in built environment roles.

Finally, the selection of 14 priority occupations was finalized through the scoring of the following elements:

- Job Posting Volume (March 2025-August 2025)—to gauge short-term demand.
- Projected Average Annual Openings (2025-2030)—to measure long-term demand (both new positions and replacements needed due to retirement, transitions, etc.).
- Turnover—to contextualize annual openings figures and whether openings are due to new jobs, turnover, or a combination.
- Wage—indicator of whether jobs provide strong wages. (Regional analyses benchmark median wages against living wages and family sustaining wages for the region. For the national analysis, wages in the fourth and fifth quintile of wages were generally prioritized where possible.)
- While not scored, jobs were tagged by whether or not typical entry-level education requires a Bachelor of Arts degree.
- Quintile scores along each of the four elements noted that are allowed for scoring out of a possible 20 points. Occupations scoring 15 or above were prioritized, though some occupations that scored below 15 were included based on qualitative factors such as being identified as critical occupations in stakeholder interviews.

Appendix B: Stakeholder Interviews

The JFF team interviewed over 50 stakeholders from across the ecosystem, including learners, workers, employers, workforce development professionals, university and training leaders, and industry experts.

Interviews explored the following, with questions adapted to interviewee perspectives:

- Workforce trends (e.g., supply and demand) and strengths and challenges facing different areas of the built environment ecosystem
- Barriers to entering and persisting in related careers
- Successful strategies and programs to bring more diverse talent to the field and ensure their success
- Significant trends facing the field that have implications for the workforce
- Opportunities for investments

The interviews were analyzed through a collaborative, mixed, inductive-deductive qualitative approach supported by AI-based tools. A core qualitative team jointly developed an initial analytic framework grounded in the project's research questions (deductive), then expanded and refined that framework through open coding of interview data (inductive).

To increase consistency and manage volume, we used AI tools as analytic assistants rather than decision-makers. For example, we used AI to generate first-pass segmenting of transcripts, identify recurring phrases, cluster similar excerpts, and quickly retrieve illustrative quotes while the research team iteratively checked, corrected, and re-coded this output and made all final judgments about code assignment, patterning, and interpretation. This combination of multiple human coders, transparent coding memos, and AI-augmented retrieval strengthened data reliability while preserving the depth, context, and equity-centered lens of qualitative analysis.

TABLE 9. INTERVIEWS BY ROLE

Role	Number
Worker	15
Educator—secondary	10
Workforce CBO	11
Educator—postsecondary (higher education and adult ed)	9
Subject Matter Expert	8
Employer	5
Funder	1
Total	**58**

TABLE 10. INTERVIEWS BY AREA

Area	Number
Construction	21
Education	9
Engineering	7
Workforce Development	7
Architecture	5
Design	3
Other	3
Urban Planning	2
Utilities	1
Total	**58**

TABLE 11. INTERVIEWS BY STATE

State	Number
Alabama	2
Arizona	2
Arkansas	1
California	4
Colorado	2
Florida	10
Illinois	1
Indiana	2
Iowa	1
Louisiana	1
Massachusetts	6
Michigan	6
New York	2
North Carolina	1
Ohio	5
Oregon	1
Tennessee	1
Texas	3
Virginia	4
Washington	1
Washington, DC	2

Appreciative Inquiry Approach

To assume an assets-based approach to our research, we used a four-step appreciative inquiry framework as follows:

1. Discover (appreciating)—What are the best elements and assets of the built environment ecosystem that should be preserved and/or expanded? What does success look like in these fields?
2. Dream (envisioning results)—What might be? Building on current successes and assets, what might the ecosystem look like in the future?
3. Design (co-constructing)—What should the ideal built environment ecosystem look like? How can the possibilities identified in step two be integrated to build a better future?
4. Destiny (deliver)—As the ecosystem moves to innovate and implement change, how can we ensure continuous learning, elevation of learner and worker voice, and sustainability of what is best?

This framework informed interview protocols and guided discussions held in regional convenings.

Appendix C: College Pulse Survey

College Pulse administered the survey, "Future Builders Initiative: A Workforce Readiness Study" to 1,000 current college students and alumni attending 154 institutions in 30 states, with field dates of November 3–December 28, 2025. We oversampled for Black and Hispanic/Latine-serving institutions and included 132 public (16 two-year colleges, 116 four-year universities) and 22 private institutions. Student respondent characteristics are provided in the tables below.

TABLE 12. COLLEGE PULSE SURVEY SAMPLE

Field of Interest		Race/Ethnicity	
Architecture	10%	Asian	29%
Design	33%	Black/African American	10%
Engineering	35%	Hispanic/Latine	23%
Construction	6%	Mixed Race	8%
Urban Planning	17%	White	24%

**6% reported as Other or Prefer Not to Say*

Gender		Level	
Female	56%	Undergraduate	746
Male	39%	Graduate	80
Other	5%	Alumni	174

Appendix D: Practice and Solutions

The following synthesizes all interventions and programs surfaced around the built environment workforce ecosystem during the interviews. Within each area, interventions are grouped by function (exposure/navigation, training/work-based learning, supports, culture/equity, and systems/policy).

EXISTING OR ACTIVE INTERVENTIONS

A. Early Exposure, Exploration, and Career Navigation

1. **ACE Mentor Association**
   After-school mentoring program that brings architects, engineers, and contractors into high schools; integrates ACE, offers scholarships and multiple pathways.
2. **Girls in Trades (Massachusetts)/Girls in the Shop (California)**
   Girls build projects in wood shops while mentored by current female trades students at Harbor Freight's Tools for Schools' "Girls in the Shop" events. High school Girls in Trades clubs with student officers; statewide Girls in Trades conferences, union hall visits, and exposure to multiple crafts.
3. **Future Leaders in Planning (FLiP)**
   A youth program run by a regional planning agency that pairs students with planners, engineers, and transportation professionals; includes school visits and group projects.
4. **National Society of Black Engineers (NSBE) Pipeline**
   Free summer STEM camps, NSBE Jr. chapters, and collegiate chapters that track students over time from elementary school through engineering degrees.
5. **Design Firm Office Tours and Job and Economic Development Impact (JEDI) Pipeline Work**
   Large design firms host office tours for middle and high school students, plus partner with ACE and similar programs to widen exposure beyond legacy networks.
6. **Noncredit Exploratory STEM/Tech Programs**
   Short, noncredit programs such as Women in Sustainable Employment Pathways (WISE) that expose adults to robotics, electronics, and related technologies so they can test interest before committing to degrees.

B. Secondary and CTE Program Models

7. **Integrated Geometry-Construction Courses**
   High school classes that blend geometry with construction projects so students "see math come to life" on site; improve engagement and shows ADEC relevance.
8. **Career Academy/9-12 Progression Models**
   Structured pathways where ninth grade is exploration, grades 10 and 11 are leveled technical courses, and grade 12 is work-based learning in the chosen field.
9. **Regional Career Trades Academies**

Multi-district trades campuses such as Western Maricopa Education Center (West-MEC), offering welding, HVAC, diesel mechanics, and electrical, enabling schools without full labs to provide robust construction training.

10. **Authentic Campus Projects and Design-Build Competitions**
    Students build real structures on campus (e.g., tennis sheds) and participate in 2.5 day design-build competitions judged by employers.
11. **"Dig Day" Heavy Equipment Events**
    Events where contractors bring heavy equipment to school sites, allow students to operate machines under supervision, and use the day to recruit.

C. Pre-Apprenticeship, Apprenticeship, and Earn-and-Learn Models

12. **Multi-Craft Pre-Apprenticeship Networks (TradesFutures)**
    A national network of roughly 270 **multi-craft pre-apprenticeship programs** linked to building trades, all using a shared Multi-Craft Core Curriculum, reporting outcomes, and aligning with local trades councils.
13. **Building Pathways and Similar Pre-Apprenticeships**
    Union linked multi-craft pre-apprenticeships that give underrepresented workers an immersive introduction, weed out mismatches, and build basic skills before entry into Registered Apprenticeship.
14. **Green Corps/Conservation Corps Models (e.g., Louisiana Green Corps)**
    Full-time, four-month, paid pre-apprenticeships combining **green infrastructure work, stormwater projects, safety and industry credentials**, and case-managed supportive services.
15. **Youth Apprenticeships (CareerWise and others)**
    High school-level apprenticeships in both white-collar and ADEC-adjacent roles (e.g., financial services, advanced manufacturing) that show **higher retention than traditional college hires.**
16. **Construction Professional Pathways**
    A 14-week evening and weekend office-side apprenticeship-like model designed to move adults without college degrees into **entry-level jobs at ACE management firms.**
17. **Engineering Apprentice Model (The Apprentice School)**
    Apprentices work in **engineering departments** while they complete their college degrees, integrating classroom education with long-term, paid, discipline-specific experience.

D. Workforce Training and Curriculum Models

18. **Large-Scale Contractor Training Centers**
    Owner- or contractor-run centers that train thousands of workers daily on safety and both soft and technical skills before they go to major project sites.
19. **Central Employability Skills Training**
    Utility and large employer programs that explicitly train on **teamwork, punctuality, and basic workplace behaviors**, recognizing them as the main gap.
20. **Noncredit Exploratory STEM/Robotics**
    Short, noncredit workshops that allow adults to experiment with robotics or electronics before enrolling in longer certificates.
21. **Sector-Based Ecosystem Training (e.g., Broadband workforce)**
    Statewide sector partnerships that treat **workforce as infrastructure** and build training aligned with large-scale broadband, energy, or infrastructure rollouts.

E. Employer-Based Supports and HR Practices

22. **Employer Resource Network (ERN) Success Coaches**
    Multi-employer networks that co-fund on-site success coaches to address workers' life challenges (transportation, child care, housing, finances) to reduce turnover.
23. **On-Site Life Navigation and Mobility Mentoring**
    Embedding mobility mentoring methodologies in coaching to support long-term income mobility.
24. **Reduced Degree Requirements ("Education or experience")**
    Public-sector employers revise job qualifications from "education and experience" to **"education OR equivalent experience"** to open hiring to nondegree candidates.

F. Supportive Service and Whole-Person Interventions

25. **Whole-Person, Housing-Inclusive Models (e.g., Tiny Home villages)**
    Integrating transitional housing, counseling, workforce services, and banking/financial partners into a single site for people experiencing housing crises.
26. **Employer-Funded Shuttle/Van Services**
    Exploring vans or shuttles that employers collectively fund so workers without cars can reach distant union halls, trainings, and work sites.
27. **Early-Hour Family Childcare Models (Care That Works pilot)**
    Recruiting family child care providers to open as early as **5-5:30 a.m.** to serve trades workers on early shifts; an example of targeted child care adaptation (though sustainability challenges surfaced).
28. **Comprehensive Case Management and Barrier Removal**
    CBOs and corps programs providing holistic case management, including help with transportation, child care, fines, documents, and housing, integrated with training.
29. **Digital Initiatives (Devices and training)**
    Efforts to distribute thousands of devices across counties, connect residents to broadband, and couple device distribution with **digital literacy training** so workers can access online training and job platforms.

G. Culture Interventions

30. **Access and Opportunity Committees**

    Committees tied to public or large private projects that monitor adherence to hiring goals for women of all racial backgrounds and people of color, enforce policies, and convene stakeholders.

31. **Rise Up Anti-Harassment Curriculum**

    A structured program used in pre-apprenticeship and union contexts that trains workers and supervisors on harassment prevention, bystander roles, and creating respectful work sites.

32. **Finishing the Job Best Practices Manual**

    A manual with cheat sheets for each stakeholder (owners, unions, contractors, workforce providers) outlining steps to create harassment-free jobsites.

33. **Industry-wide Mental Health and Suicide Prevention Efforts**

    Mental health weeks, recovery programs, expanded employee assistance programs, and trade-specific mental health initiatives recognizing construction's high suicide rates.

34. **Varied Personal Protective Equipment (PPE) and Workwear**

    Efforts to provide gloves, masks, and PPE that fit women's hands and faces, acknowledging that basic equipment design is important.

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