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Occupational Projections for Skilled Trades in Kalamazoo County, 2023-2032

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Occupational Projections for Skilled Trades in Kalamazoo County, 2023–2032

An Analysis Based on Selected Kalamazoo Valley
Community College Training Programs

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Introduction

This study aims to estimate the projections of skilled trades occupations that would be impacted by the upgrades to Kalamazoo Valley Community College's (Kalamazoo Valley) skilled trades program, based on their current course and program offerings.

Kalamazoo Valley received \$19.5 million in state appropriations to renovate its 68,000-square-foot Advanced Technology Center at its Texas Township Campus. These funds, along with an additional \$19.5 million that Kalamazoo Valley plans to raise, aim to enable Kalamazoo Valley to meet changing technology needs and the ever-growing demand for trained workers in the skilled trades.¹ In addition, the college will add a 20,000-square-foot expansion to accommodate a new automotive program. This expansion will provide new opportunities for program offerings such as hybrid and electric vehicle technology training, renewable energy storage systems, and autonomous vehicle diagnostics and repair. In the renovated wing, the college will increase its footprint for Electrical Technology, Heating, Ventilation, and Air Conditioning (HVAC), Computer Aided Design and Manufacturing (CAD/CAM), Computer Information Systems (CIS), and Welding, further strengthening the college's ability to meet the increasing demand in these fields. This project will also create dedicated space to an energy systems program that is scheduled to start in the Winter 2024 semester, as well as additional academic offerings in additive manufacturing.²

Responding to Kalamazoo Valley's request to help estimate future demand for occupations affected by the renovation and expansion of the facilities and training programs, the W.E. Upjohn Institute for Employment Research conducted research resulting in occupational projections for the next 10 years. The research team used a technique that was developed at the Upjohn Institute and used in the study to align the courses the Kalamazoo Regional Educational Service Agency (KRESA) Education for Employment/Career and Technical Education (EFE/CTE) Program offers in Kalamazoo County with the needs of local businesses.³ This technique is being used in several other projects and is continuously being improved upon.

This study provides projections of the number of jobs in the skilled trades within Kalamazoo County that will be impacted by the upgrades to Kalamazoo Valley's skilled trades program. In addition, it provides estimates for annual job openings, various compensation measures, typical education requirements needed for each occupation's entry-level position, and typical on-the-job training.

The research team collaborated closely with Kalamazoo Valley Foundation's staff and is grateful for their input and assistance in providing data for this study.

¹ Press Release from Kalamazoo Valley Community College, https://www.kvcc.edu/news/stories/2023-12-18_SkilledTrades.php, retrieved on July 15, 2024.

² Ibid.

³ W.E. Upjohn Institute for Employment Research. 2020. *Aligning KRESA EFE/CTE Course Offerings with Local Business Needs: Results of Two Studies*. Report prepared for the KRESA Education for EFE/CTE Program.

Methodology and Data

The research team used the estimated growth of industries as well as the estimated growth of occupations relevant to currently offered training programs to develop occupational projections tailored to Kalamazoo County. The industry projection data originated from Moody's Economy.com. For this study, the research team used projected employment aggregated at major industrial sectors (grouped by North American Industrial Classification System (NAICS) at 2-digit level). These data were paired with the Bureau of Labor Statistics' (BLS) Occupational Employment and Wages Statistics (OEWS) and Michigan Labor Market Information's (MiLMI) Occupation Projections. From the OEWS data, the research team used the number of people who are employed in any given occupation within each industry for the year 2023. This data allows staffing patterns, or the share of individuals who serve in any occupation in each industry, to be calculated. The team used staffing patterns for Michigan, and in cases of suppressions or missing data, they used staffing patterns from Illinois, Indiana, Ohio, or the United States. From MiLMI's Occupation Projections, the research team used the employment levels of each occupation in 2020 and 2030 as well as annual job openings, typical education requirements, typical experience needed, and typical on-the-job training at the state level. Using the 2020 and 2030 employment data, the research team looked at how the share of these occupations are expected to change over the 10 years to determine a growth rate. For any missing or suppressed values, they used the BLS's U.S. employment projections for 2022–2032.

To calculate the projections, the research team took into account the industry-level employment, the staffing pattern, and the occupational growth rate for every occupation. For the annual estimated job openings, the state estimates were appropriately scaled down to the Kalamazoo County level, accounting for Kalamazoo's industry composition. The research team assumed that the technology and resources that influence industries and occupations at the state level hold for Kalamazoo County.

The research team conducted an analysis of 35 skilled trades occupations using the Kalamazoo Valley-provided list of courses impacted by the upgrades. The list is relevant to Classification of Instructional Programs (CIP) identifiers to which the courses pertain. The U.S. Department of Education's National Center for Education Statistics (NCES) developed CIPs to standardize the tracking of educational concepts in courses. The NCES also provides a crosswalk of CIPs to occupations to indicate the coursework that is necessary to prepare individuals for certain occupations. The research team used Kalamazoo Valley's list of impacted courses with matching CIP identifiers and the CIP to occupational crosswalk to limit the occupations to those impacted by the upgrades. Additionally, any occupations that were projected to have zero individuals in all years were omitted from the analysis.

For more detailed methodology and additional data, please refer to the Appendix.

Projected Employment for Skilled Trades Occupations in Kalamazoo County, 2023–2032

The research team projected employment in each of the identified skilled trades occupations in Kalamazoo County for years 2023 and 2032 (Table 1). Additionally, the expected number of annual job openings was calculated for each occupation. For a more complete table that includes the years between 2023 and 2032, please consult Appendix Table 1.

Table 1: Projected Employment in Identified Skilled Trades Occupations in Kalamazoo County, Years 2023 and 2032

SOC code	SOC title	Projected employment		Expected annual job openings
		2023	2032	
17-3011	Architectural and Civil Drafters	39	39	4
17-3012	Electrical and Electronics Drafters	12	12	1
17-3013	Mechanical Drafters	62	58	6
17-3019	Drafters, All Other	8	8	1
17-3021	Aerospace Engineering and Operations Technicians	2	2	0
17-3023	Electrical and Electronics Engineering Technicians	72	70	7
17-3024	Electro-Mechanical Technicians	10	10	1
17-3026	Industrial Engineering Technicians	197	199	21
17-3027	Mechanical Engineering Technicians	186	191	19
17-3028	Calibration Technologists and Technicians	5	5	0
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	43	44	4
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	476	480	50
47-2152	Plumbers, Pipefitters, and Steamfitters	409	409	46
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	27	30	4
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	18	13	1
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	7	6	0
49-3023	Automotive Service Technicians and Mechanics	636	597	62
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	210	227	23
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	351	356	38
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	58	55	6

Table 1 (cont.): Projected Employment in Identified Skilled Trades Occupations in Kalamazoo County, Years 2023 and 2032

SOC code	SOC title	Projected employment		Expected annual job openings
		2023	2032	
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	41	34	3
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	40	36	4
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	924	859	94
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	8	7	1
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	186	169	21
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	89	80	9
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	65	54	6
51-4041	Machinists	837	851	99
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	228	239	28
51-4121	Welders, Cutters, Solderers, and Brazers	496	498	60
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	130	122	14
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	47	43	5
51-4192	Layout Workers, Metal and Plastic	8	7	1
51-4199	Metal Workers and Plastic Workers, All Other	35	33	4
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	950	822	100

The total employment across 35 skilled trades in 2023 is 6,912 and will decrease to 6,665 by 2032. This overall decrease is largely due to only a handful of skilled trades occupations. Out of the 18 declining skilled trades occupations, 12 are projected to lose no more than 8 individuals. At the same time, 10 of the 35 skilled trades occupations show increases, and 7 of the 35 are projected not to change.

The two occupations with the biggest losses between 2023 and 2032 are “*Inspectors; Testers; Sorters; Samplers; and Weighers*” and “*Cutting, Punching, and Press Machine Setters; Operators; and Tenders, Metal and Plastic.*” The firms that typically employ people in these

occupations include Eaton Corporation, Pfizer, Northern Biomolecular Services, Schupan and Sons, Graphic Packaging International, and Weber Specialties.⁴

The skilled trades occupations that are projected to increase in employment include “*Machinists*,” “*Mechanical Engineering Technician*,” and “*Heating; Air Conditioning; and Refrigeration Mechanics and Installers*.” Examples of companies in Kalamazoo County that hire employees for these occupations are Flowserve, Stryker, Aerotek, Boeing, and Aire Serv.⁵

The skilled trades occupations that are projected to neither increase nor decrease in employment include “*Plumbers; Pipefitters; and Steamfitters*,” “*Architectural and Civil Drafters*,” and “*Welders; Cutters; Solderers; and Brazers*.” Companies that hire for these positions include Pfizer, the state of Michigan, SSOE, Aerotek, and Landscape Forms.⁶

The decline in the total number of individuals employed in certain occupations and collectively across all skilled trades does not necessarily present a problem for several reasons. First, innovation of tools and technology makes workers more efficient in their jobs, and as a result, a business may not need as many workers. This is an observation that U.S. Secretary of Treasury Janet Yellen made about U.S. manufacturing jobs.⁷ It means that there will be a need for workers who are knowledgeable about using these new tools and technologies, which in turn might increase new occupations in the skilled trades.

Second, this decrease in total skilled trades employment is primarily led by only two occupations: “*Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic*” and “*Inspectors, Testers, Sorters, Samplers, and Weighers*.” It is expected that these occupations will be subject to automation, which will increase the quality of products. Most of the other occupations facing a decrease in employment numbers are losing only a handful of people.

Third, prior research suggests that many of the skilled trades occupations are resistant to artificial intelligence (AI). This is primarily due to the physical nature of the occupations. This means that these occupations are simultaneously resistant to both replacement from AI but also productivity enhancement that some occupations may experience.⁸ These jobs will likely be impacted in some way, but the impact will likely be small.

Finally, all these occupations will experience vacancies that need to be filled as people retire from them or switch roles. On average, we expect there to be 743 job openings in the skilled trades in Kalamazoo County each year.

⁴ “Job Postings Tables.” Lightcast, August 2024.

⁵ Ibid.

⁶ Ibid.

⁷ Christopher Condon, “[Yellen Rebuffs Trump Argument on Dollar Hurting US Manufacturing](#),” Bloomberg, July 28, 2024.

⁸ Rakesh Kochhar, “[Which U.S. Workers Are More Exposed to AI on Their Jobs?](#)” Pew Research Center, July 26, 2023

Appendix Table 2 on p. 19 shows all the skilled trade occupations and their relevant CIPs and Kalamazoo Valley courses. The CIP that occurs most often is “*Machine Tool Technology/Machinist*,” suggesting that courses relevant to this program of study are relevant to many occupations. Most occupations have one key CIP associated with them, but a couple have two CIPs. “*Electrical and Electronics Drafters*,” “*Mechanical Drafters*,” “*Electro-Mechanical Technicians*,” and “*Automotive Service Technicians and Mechanics*” all have multiple CIPs associated with them. These occupations require learning an extensive set of skills or multiple areas of knowledge in order to meet job requirements. Many Kalamazoo Valley courses apply to several CIPs, and many CIPs apply to several occupations. This suggests a lot of overlap between the courses Kalamazoo Valley teaches and the potential occupations one could have after graduation.

Table 2: Skilled Trade’s Occupation’s Average and the 10th, 25th, 50th (Median), 75th, and 90th Percentile for Annual Income, Year 2023

SOC code	SOC title	Average annual salary (\$)	10th percentile annual salary (\$)	25th percentile annual salary (\$)	Median annual salary (\$)	75th percentile annual salary (\$)	90th percentile annual salary (\$)
17-3011	Architectural and Civil Drafters	60,600	36,780	38,970	52,260	71,580	98,690
17-3012	Electrical and Electronics Drafters	71,570	47,840	50,960	63,720	85,860	105,310
17-3013	Mechanical Drafters	62,490	40,450	48,470	57,990	73,490	94,470
17-3019	Drafters, All Other	56,300	38,720	41,230	54,160	65,600	78,500
17-3021	Aerospace Engineering and Operations Technicians	60,300	39,100	42,260	61,960	75,970	82,270
17-3023	Electrical and Electronics Engineering Technicians	66,130	39,480	48,270	62,790	79,160	96,120
17-3024	Electro-Mechanical Technicians	60,960	39,520	47,620	60,570	65,050	76,990
17-3026	Industrial Engineering Technicians	58,930	47,420	47,760	57,200	61,470	77,180
17-3027	Mechanical Engineering Technicians	52,130	30,000	36,550	47,760	62,030	77,330
17-3028	Calibration Technologists and Technicians	59,520	33,490	49,930	58,240	64,170	80,970
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	48,370	31,170	38,370	44,060	59,560	71,620
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	73,990	48,880	60,150	67,820	84,160	100,830
47-2152	Plumbers, Pipefitters, and Steamfitters	73,540	45,310	56,520	83,500	86,930	97,960

Table 2 (cont.): Skilled Trade's Occupation's Average and the 10th, 25th, 50th (Median), 75th, and 90th Percentile for Annual Income, Year 2023

SOC Code	SOC title	Average annual salary (\$)	10th percentile annual salary (\$)	25th percentile annual salary (\$)	Median annual salary (\$)	75th percentile annual salary (\$)	90th percentile annual salary (\$)
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	47,720	37,780	43,330	47,460	50,480	59,570
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	93,970	49,290	81,040	101,450	108,520	119,270
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	52,590	22,400	22,400	47,990	86,260	86,260
49-3023	Automotive Service Technicians and Mechanics	50,000	31,050	36,550	46,890	61,180	74,720
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	54,340	39,590	47,150	52,520	61,310	69,520
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	59,000	37,160	46,140	55,060	75,240	83,400
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	44,950	38,900	42,920	46,830	46,830	46,830
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	49,450	38,860	46,210	47,660	53,600	62,020
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	48,130	35,730	41,410	48,980	52,030	61,300
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	38,980	31,250	34,420	36,550	43,730	47,420
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	48,390	31,560	33,280	43,580	60,890	73,860
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	39,750	33,590	35,220	35,860	43,410	48,600

Table 2 (cont.): Skilled Trade’s Occupation’s Average and the 10th, 25th, 50th (Median), 75th, and 90th Percentile for Annual Income, Year 2023

SOC code	Soc title	Average annual salary (\$)	10th percentile annual salary (\$)	25th percentile annual salary (\$)	Median annual salary (\$)	75th percentile annual salary (\$)	90th percentile annual salary (\$)
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	43,230	37,040	37,090	37,130	48,050	48,220
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	42,230	33,150	37,100	44,560	44,680	57,780
51-4041	Machinists	49,190	37,090	37,710	49,410	59,000	61,780
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	46,220	32,980	36,210	40,680	55,700	65,260
51-4121	Welders, Cutters, Solderers, and Brazers	51,510	36,040	40,850	47,510	58,430	64,600
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	42,750	38,780	38,780	38,780	46,700	47,290
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	46,030	36,740	38,900	46,800	49,610	56,720
51-4192	Layout Workers, Metal and Plastic	55,230	36,020	45,700	52,400	64,110	73,520
51-4199	Metal Workers and Plastic Workers, All Other	42,760	32,370	34,970	37,630	48,680	60,690
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	46,050	33,140	37,790	45,850	51,820	60,260

Table 2 shows each skilled trades occupation’s average salary for the year 2023 and for the 10th, 25th, 50th (median), 75th, and 90th percentiles. The median income for all these occupations is comparable to \$36,115,⁹ and the median income for all but one of these occupations is more than that; only the “*Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic*” occupation reports a median annual income of \$35,860,¹⁰ which is less

⁹ The most recent data from the U.S. Census’s American Community Survey is 2022, and the data used for wages from the BLS is from 2023. The 2022 household median income for Kalamazoo County in 2022 is \$69,584 for two working adults. Half of that, if we assume that only one spouse works in the household, is \$34,792. When adjusting for inflation to appropriately compare 2022 and 2023 dollars, the median household income becomes \$72,230, of which half is \$36,115 in 2023 dollars.

¹⁰ “*Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic*” reports a median annual income of \$35,860. Table 2 is based on data from the U.S. Bureau of Labor Statistics.

than 1 percent smaller than the adjusted median income. The median income for all (but one) projected occupations is higher than half of the inflation-adjusted 2022 median income for residents in Kalamazoo County.¹¹ This means any individual who has been employed long enough in any of these occupations to have been promoted beyond entry-level compensation can likely match or surpass the typical household income as long as there is a second working individual in the household earning similar amounts each year.

Table 3: Typical Minimum Education Requirements, Prior Experience, and On-the-Job Training Associated with Each Job

SOC code	SOC title	Typical minimum education requirement	Typical minimum experience requirement	Typical on-the-job training
17-3011	Architectural and Civil Drafters	Associate degree	None	None
17-3012	Electrical and Electronics Drafters	Associate degree	None	None
17-3013	Mechanical Drafters	Associate degree	None	None
17-3019	Drafters, All Other	Associate degree	None	None
17-3021	Aerospace Engineering and Operations Technicians	Associate degree	None	None
17-3023	Electrical and Electronics Engineering Technicians	Associate degree	None	None
17-3024	Electro-Mechanical Technicians	Associate degree	None	None
17-3026	Industrial Engineering Technicians	Associate degree	None	None
17-3027	Mechanical Engineering Technicians	Associate degree	None	None
17-3028	Calibration Technologists and Technicians	Associate degree	None	None
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	Associate degree	None	None
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	High school diploma or equivalent	5 years or more	None
47-2152	Plumbers, Pipefitters, and Steamfitters	High school diploma or equivalent	None	Apprenticeship
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	High school diploma or equivalent	None	Moderate-term on-the-job training

¹¹ U.S. Census’s American Community Survey, Table S1901, 5-year Estimates, year 2022; and BLS, “All items in Midwest urban, all urban consumers, not seasonally adjusted,” series: CUUR0200SA0.

Table 3 (cont.): Typical Minimum Education Requirements, Prior Experience, and On-the-Job Training Associated with Each Job

SOC code	SOC title	Typical minimum education requirement	Typical minimum experience requirement	Typical on-the-job training
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	Postsecondary nondegree award	Less than 5 years	Moderate-term on-the-job training
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	High school diploma or equivalent	None	Moderate-term on-the-job training
49-3023	Automotive Service Technicians and Mechanics	Postsecondary nondegree award	None	Short-term on-the-job training
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	High school diploma or equivalent	None	Long-term on-the-job training
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	Postsecondary nondegree award	None	Long-term on-the-job training
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training

Table 3 (cont.): Typical Minimum Education Requirements, Prior Experience, and On-the-Job Training Associated with Each Job

SOC code	SOC title	Typical minimum education requirement	Typical minimum experience requirement	Typical on-the-job training
51-4041	Machinists	High school diploma or equivalent	None	Long-term on-the-job training
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4121	Welders, Cutters, Solderers, and Brazers	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4192	Layout Workers, Metal and Plastic	High school diploma or equivalent	None	Moderate-term on-the-job training
51-4199	Metal Workers and Plastic Workers, All Other	High school diploma or equivalent	None	Moderate-term on-the-job training
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	High school diploma or equivalent	None	Moderate-term on-the-job training

Table 3 shows the typical minimum education requirements, prior experience, and on-the-job training associated with each job. Most of the jobs (21 out of 35) indicate that the minimum level of education needed is a high school diploma. All these jobs additionally require either prior experience, an apprenticeship, moderate on-the-job training, or long-term on-the-job training. This need for experience or training suggests that the average high school graduate lacks skills. Although a high school diploma might be the minimum required level of education, it is not necessarily the desired level. Community college coursework can help equip individuals with the necessary skills to expedite these on-the-job trainings and support employers. Additionally, all occupations that typically do not require on-the-job training or prior experience require an associate degree.

Appendix

This study used Moody's proprietary data for two main reasons. First, Moody's industry data are estimates and not subject to suppression at the county level, unlike publicly available data, which is often suppressed for confidentiality reasons. Second, Moody's provides industry projections that are leveraged in this study to assess the impact of industry growth or decline on occupational employment. We assume that these projections appropriately account for any relevant influences, such as technology-related impacts from businesses incorporating AI into their operations. The industry data from Moody's is aggregated at the BLS Major sector level, which generally corresponds with the NAICS 2-digit industry level for non-farm and privately owned industries.¹²

Additionally, Occupational Employment and Wage Statistics (OEWS) data for the state of Michigan is used because of Kalamazoo's location within the state and minimized data suppression at the state level. Although OEWS offers datasets that break down occupational employment by industry at the Metropolitan Statistical Area (MSA) level, the MSA datasets frequently contain suppressed observations for confidentiality purposes. For this study, OEWS data for Michigan is employed to calculate the proportion of employees in specific occupations within industries at the 2-digit NAICS level. It is assumed that the technology and resources influencing occupational staffing patterns at the state level are also present and exert a similar impact at the county level.

If a suppression still occurs, the value is imputed from Illinois, Indiana, or Ohio. The selection of the donor state is based on the similarity of the employment level of the relevant industry in that state to Michigan. If suppression is also present in the donor states for the same occupation within the same industry, the value is then imputed from national data. Should the value remain suppressed at the national level, that observation is left as missing.

The Michigan Statewide Long-Term Occupation Projections are utilized for reasons similar to those for using the OEWS data for the state of Michigan: Kalamazoo County is located in Michigan, and the state-level data are minimally suppressed. These data account for occupational trends and allow for calculating an occupational growth rate based on the evolution of occupational shares over time. Additionally, the dataset provides information on the expected number of job openings for each occupation, considering both new job creations and replacements due to retirements or transitions to different occupations. The use of the Michigan Statewide Long-Term Occupation Projections assumes that the technology and resources influencing occupational growth or decline at the state level are the same for Kalamazoo County and account for all resource- and technology-related innovations.

If an occupational share growth rate was suppressed or missing in this data set, then the research team imputed the rate and the job openings using U.S. data.

Employment levels for each occupation were estimated and projected using data from the three datasets. This process was accomplished by first multiplying the industry employment data for each given year by the industry-occupation share. Next, the resulting figures were multiplied by the

¹² When performing the same procedure with 3-digit NAICS, there were more imputations needed, and when the projection estimates were compared to unsuppressed occupation data at the MSA level, the model using the 2-digit industry level performed best when consulting the sum of squared errors measure.

occupation-specific growth rate, raised to the appropriate power corresponding to the year associated with the industry employment. Finally, all estimates were summed up by year and by occupation. The final results provided estimates and projections of occupations that accounted for both changing industry dynamics and evolving occupational trends.

$$occupation_emp_{i,y} = \sum_{n=j}^k (industry_emp_{n,y} * industry_occupation_share_{i,n} * growth_rate_i^y)$$

Where i represents a unique occupation; y represents the projected year with 0 being the base year, 1 being the first projected year, etc.; n represents the list of all unique industries, j through k ; $occupation_emp$ is the employment level for occupation i in year y ; $industry_emp$ is the level of employment in industry n in year y ; $industry_occupation_share$ is the share of employment in occupation i in industry n in the base year; and $growth_rate$ is the growth rate for occupation i 's share of employment raised to the y th year.

Additionally, with the projection estimates calculated, the research team also calculated the annual projected job openings using the following formula (since the only unknown variable in the below formula was $annual_openings_county$):

$$\frac{annual_openings_state_i}{employed_state_i} = \frac{annual_openings_county_i}{employed_county_i}$$

Where $annual_openings_state$ is the annual job openings for any given occupation i in the base year; $employed_state$ is the number of people employed in occupation i in the base year at the state level; $annual_openings_county$ is the annual openings that one can expect at the county level for any given occupation i ; and $employed_county$ is the number of people employed in occupation i in the base year at the county level.

To investigate the projections for skilled trades, the occupations analyzed were restricted based on relevance to the skilled trades. Relevance for skilled trades was determined by a list of Classification of Instructional Programs (CIP) codes provided by Kalamazoo Valley Community College as being relevant to their skilled trades courses, which was then matched to various occupations via a CIP to SOC occupation crosswalk provided by the NCES. Only occupations with a matched course from Kalamazoo Valley's skilled trades program and occupations with non-zero projections in any year were kept for this study.

Appendix Table 1: Projected Employment in Identified Skilled Trades Occupations in Kalamazoo County, 2023–2032

SOC code	SOC title	Projected employment										Expected annual job openings
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
17-3011	Architectural and Civil Drafters	39	39	40	40	40	40	40	39	39	39	4
17-3012	Electrical and Electronics Drafters	12	12	12	12	12	12	12	12	12	12	1
17-3013	Mechanical Drafters	62	60	60	60	60	60	59	59	58	58	6
17-3019	Drafters, All Other	8	8	8	8	8	8	8	8	8	8	1
17-3021	Aerospace Engineering and Operations Technicians	2	2	2	2	2	2	2	2	2	2	0
17-3023	Electrical and Electronics Engineering Technicians	72	71	71	71	71	71	71	71	71	70	7
17-3024	Electro-Mechanical Technicians	10	10	10	10	10	10	10	10	10	10	1
17-3026	Industrial Engineering Technicians	197	196	198	199	199	199	199	199	199	199	21
17-3027	Mechanical Engineering Technicians	186	183	185	187	188	188	189	190	190	191	19
17-3028	Calibration technologists and technicians	5	5	5	5	5	5	5	5	5	5	0
17-3029	Engineering Technologists and Technicians, Except Drafters, All Other	43	42	43	43	43	44	44	44	44	44	4
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	476	493	497	497	495	492	489	486	482	480	50
47-2152	Plumbers, Pipefitters, and Steamfitters	409	421	424	424	422	420	417	414	412	409	46

Appendix Table 1 (cont.): Projected Employment in Identified Skilled Trades Occupations in Kalamazoo County, 2023–2032

SOC code	SOC title	Projected employment										Expected annual job openings
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	27	27	27	27	28	28	29	29	29	30	4
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	18	17	16	16	15	15	14	14	13	13	1
49-2096	Electronic Equipment Installers and Repairers, Motor Vehicles	7	7	7	7	6	6	6	6	6	6	0
49-3023	Automotive Service Technicians and Mechanics	636	627	626	622	617	613	609	605	601	597	62
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	210	210	212	215	217	219	221	224	225	227	23
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	351	362	366	366	364	363	361	359	358	356	38
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	58	58	58	57	57	57	56	56	55	55	6
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	41	40	39	39	38	37	36	36	35	34	3
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	40	39	39	39	38	38	37	37	36	36	4
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	924	910	909	905	899	892	884	876	868	859	94
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	8	8	8	8	8	8	8	7	7	7	1
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	186	183	182	181	179	178	176	174	171	169	21

Appendix Table 1 (cont.): Projected Employment in Identified Skilled Trades Occupations in Kalamazoo County, 2023–2032

SOC code	SOC title	Projected employment										Expected annual job openings
		2023	2024	2025	2026	2027	2028	2029	2030	2031	2032	
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	89	88	87	86	85	84	83	82	81	80	9
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	65	63	62	61	60	59	58	56	55	54	6
51-4041	Machinists	837	832	840	844	847	849	850	850	851	851	99
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	228	227	230	232	233	235	236	237	238	239	28
51-4121	Welders, Cutters, Solderers, and Brazers	496	494	498	499	500	500	500	500	499	498	60
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	130	128	128	127	127	126	125	124	123	122	14
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	47	46	46	46	45	45	44	44	43	43	5
51-4192	Layout Workers, Metal and Plastic	8	8	8	8	8	8	8	8	8	7	1
51-4199	Metal Workers and Plastic Workers, All Other	35	34	34	34	34	34	33	33	33	33	4
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	950	925	917	905	893	879	865	851	836	822	100

Appendix Table 2: Skilled Trade Occupations and Their Relevant CIPs and Kalamazoo Valley Community College Courses

SOC Code	SOC Title	CIP Course Code 1	CIP Title	KVCC Courses												
				1	2	3	4	5	6	7	8	9	10	11	12	13
17-3011	Architectural and Civil Drafters	15.1302	CAD/CADD Drafting and/or Design Technology/Technician.	Auto CAD	CAD Specialist	CAD-CAM Certificate	Computer Aided Design	Computer Aided Design and Manufacturing	Drafting/CAD Drafter	Inventor	ProEngineer	SolidWorks				
17-3012	Electrical and Electronics Drafters	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
		15.1302	CAD/CADD Drafting and/or Design Technology/Technician.	Auto CAD	CAD Specialist	CAD-CAM Certificate	Computer Aided Design	Computer Aided Design and Manufacturing	Drafting/CAD Drafter	Inventor	ProEngineer	SolidWorks				
17-3013	Mechanical Drafters	15.0805	Mechanical/Mechanical Engineering Technology/Technician.	Engineering Technology	Industrial Lab Technician	Mechanical Engineering technology	Senior Lab Technician									
		15.1302	CAD/CADD Drafting and/or Design Technology/Technician.	Auto CAD	CAD Specialist	CAD-CAM Certificate	Computer Aided Design	Computer Aided Design and Manufacturing	Drafting/CAD Drafter	Inventor	ProEngineer	SolidWorks				
17-3019	Drafters, All Other	15.1302	CAD/CADD Drafting and/or Design Technology/Technician.	Auto CAD	CAD Specialist	CAD-CAM Certificate	Computer Aided Design	Computer Aided Design and Manufacturing	Drafting/CAD Drafter	Inventor	ProEngineer	SolidWorks				
17-3021	Aerospace Engineering and Operations Technicians	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
17-3023	Electrical and Electronics Engineering Technicians	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
17-3024	Electro-Mechanical Technicians	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
		15.0805	Mechanical/Mechanical Engineering Technology/Technician.	Engineering Technology	Industrial Lab Technician	Mechanical Engineering technology	Senior Lab Technician									
17-3026	Industrial Engineering Technicians	15.0699	Industrial Production Technologies/Technicians, Other.	Production Technician academy												
17-3027	Mechanical Engineering Technicians	15.0805	Mechanical/Mechanical Engineering Technology/Technician.	Engineering Technology	Industrial Lab Technician	Mechanical Engineering technology	Senior Lab Technician									
17-3028	Calibration technologists and technicians	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
17-3029	Engineering technologists and technicians, except drafters, all other	15.0501	Heating, Ventilation, Air Conditioning and Refrigeration Engineering Technology/Technician.	Heating, Ventilation & Air Conditioning												
47-1011	First-Line Supervisors of Construction Trades and Extraction Workers	46.0503	Plumbing Technology/Plumber.	Plumbing												
47-2152	Plumbers, Pipefitters, and Steamfitters	46.0503	Plumbing Technology/Plumber.	Plumbing												
47-4071	Septic Tank Servicers and Sewer Pipe Cleaners	46.0503	Plumbing Technology/Plumber.	Plumbing												

Appendix Table 2 (cont.): Skilled Trade Occupations and Their Relevant CIPs and Kalamazoo Valley Community College Courses

SOC Code	SOC Title	CIP Course Code 1	CIP Title	KVCC Courses												
				1	2	3	4	5	6	7	8	9	10	11	12	13
49-2095	Electrical and Electronics Repairers, Powerhouse, Substation, and Relay	15.0303	Electrical, Electronic, and Communications Engineering Technology/Technician.	Electrical Technology	Electrical control	Maintenance Mechanic-facility	Maintenance mechanic-industrial	Electrical construction								
49-3023	Automotive Service Technicians and Mechanics	47.0604	Automobile/Automotive Mechanics Technology/Technician.	Advanced Electronic Vehicle Ctl Systems	Automatic Transmission/transaxle	Automotive drivability systems	Automotive undercar systems	Brakes	Driveline	Electrial/electronic systems	General automotive service	Heating and Air conditioning	Manual Drive train/axles	Suspension and Steering systems	Engine performance	Engine repair
		47.0614	Alternative Fuel Vehicle Technology/Technician.	Battery replacement and repair	Hybrid and Advanced Tech vehicles											
49-3031	Bus and Truck Mechanics and Diesel Engine Specialists	47.0605	Diesel Mechanics Technology/Technician.	Auto light duty diesel engines												
49-9021	Heating, Air Conditioning, and Refrigeration Mechanics and Installers	15.0501	Heating, Ventilation, Air Conditioning and Refrigeration Engineering Technology/Technician.	Heating, Ventilation & Air Conditioning												
51-4021	Extruding and Drawing Machine Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4022	Forging Machine Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4023	Rolling Machine Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4031	Cutting, Punching, and Press Machine Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4032	Drilling and Boring Machine Tool Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4033	Grinding, Lapping, Polishing, and Buffing Machine Tool Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4034	Lathe and Turning Machine Tool Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4035	Milling and Planing Machine Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							

Appendix Table 2 (cont.): Skilled Trade Occupations and Their Relevant CIPs and Kalamazoo Valley Community College Courses

SOC Title	CIP Course Code 1	CIP Title	KVCC Courses													
			1	2	3	4	5	6	7	8	9	10	11	12	13	
51-4041	Machinists	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4081	Multiple Machine Tool Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4122	Welding, Soldering, and Brazing Machine Setters, Operators, and Tenders	48.0508	Welding Technology/Welder.	Welding CC processes	Welding CV Processes	Welding technologies										
51-4191	Heat Treating Equipment Setters, Operators, and Tenders, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4192	Layout Workers, Metal and Plastic	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-4199	Metal Workers and Plastic Workers, All Other	48.0501	Machine Tool Technology/Machinist.	CNC Operator	CNC academy	Machine Tool Operator	Machine tool automation	Machine tool technology	Machinist							
51-9061	Inspectors, Testers, Sorters, Samplers, and Weighers	15.0702	Quality Control Technology/Technician.	Quality Control and Inspection												