



**Program Review
Final Report**

Construction Technology

2022

OCCUPATIONAL ADVISORY COMMITTEE MEMBERS

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A. ANALYSIS OF LABOR MARKET DATA & OCCUPATIONAL OUTLOOK

According to the U. S. Department of Labor, Bureau of Labor Statistics Occupational Outlook Handbook (2021 – 2022 Edition), carpenters are employed throughout the country in almost every community and make up the second largest building trades occupation. They held about 948,500 jobs in 2021.

About 23 percent worked in the construction of residential buildings, and about 22 percent worked in building finishing or non-residential construction. Most of the rest of wage and salary carpenters worked for manufacturing firms, government agencies, retail establishments, and a wide variety of other industries. About 29 percent of all carpenters were self-employed. Some carpenters change employers each time they finish a construction job. Others alternate between working for a contractor and working as contractors themselves on small jobs, depending on where the work is available. Employment of carpenters is expected to increase by 2% percent during the 2021–31 decade. Job growth, coupled with replacement needs, will create numerous openings each year. Job opportunities should be best for those with the most training and skills.

According to the United States Bureau of Labor Statistics, the median annual wages for carpenters were \$48,260. The lowest 10 percent earned less than \$31,880 annually, and the highest 10 percent earned more than \$80,940 annually.

Median annual wages for carpenters in the top industries in which they worked were as follows:

Nonresidential building construction	\$59,020
Building finishing contractors	\$48,800
Residential building construction	\$47,820

The starting pay for apprentices usually is between 30 percent and 50 percent of what fully trained carpenters make. As apprentices learn to do more, they receive pay increases.

Nearly all carpenters work full time, which may include working evenings and weekends. Overtime is common in order to meet deadlines. Extreme temperatures or inclement weather may cause delays and limit the number of hours of work.

About 1 in 3 carpenters were self-employed in 2021. Self-employed workers often work in residential construction and may be able to set their own schedule.

Employment of carpenters is projected to grow 2 percent from 2021 to 2031. Population growth should result in more new-home construction—the largest segment employing carpenters—which will create some jobs. Construction of factories and other non-residential buildings is also projected to create new jobs over the decade.

In addition, the need to repair and replace roads and bridges should increase employment of carpenters. Much of this growth, however, depends on spending by federal and state governments as they attempt to upgrade existing infrastructure. The construction of factories and power plants also may result in some new jobs.

However, moderating some of the growth will be the increasing use of modular and prefabricated components. Roof assemblies, walls, stairs, and complete bathrooms are just a few of the prefabricated components that can be manufactured in a separate facility and then assembled onsite by carpenters. Installing prefabricated components replaces the most labor-intensive and time-consuming onsite building activities.

Job opportunities for carpenters should be good over the coming decade as construction activity continues to grow. Prospective carpenters with a basic set of carpentry tools will have better prospects. The number of job openings is expected to vary by geographic area. Because construction activity parallels the movement of people and businesses, areas of the country with the largest population increases will require the most carpenters.

Employment of carpenters, like that of many other construction workers, is sensitive to fluctuations in the economy. On the one hand, workers in these trades may experience periods of

unemployment when the overall level of construction falls. On the other hand, peak periods of building activity may produce shortages of carpenters.

The Occupational Advisory Committee reviewed the supply/ demand data and concluded that it fairly represents the state of the industry in Eastern's employment area.

B. STUDENT COMPLETION, PLACEMENT AND FOLLOW-UP INFORMATION

Graduate follow up data for the three-year period June 2017 through June 2020 indicates that the overall placement rate for entry into related occupations or related schooling immediately following graduation was approximately 75.5%. Based on the labor market data and the graduate placement data for EASTERN's students, it was agreed that the Construction Technology program should be continued.

C. CURRENT PROGRAM STATUS /PLANS FOR FUTURE GROWTH

The Construction Technology program has had steady enrollment averaging 40 students each year. There has been a waiting list for each of the last three years. Since 2007, students have had a uniform requirement, enhancing the professional atmosphere of the program and the environment. Over the past three-year period, the percentage of students enrolling at a post-secondary trade school, college, or university after completing the program has increased. In addition, NOCTI scores have continued to exceed the goal each year. In 2007-2008, 10% of the students who completed the NOCTI earned a score of proficient or above. That number has increased to an average of 91.6% of students over the past three-year period. This percentage exceeds PDE's benchmark of 90% and EASTERN's goal.

D. INDUSTRY TRENDS

Between September and December of 2022, the Occupational Advisory Committee (OAC) examined trends in the industry as they relate to 1) Technology, 2) Business Operations, and 3) Types of employees/skills required for employment.

1. TECHNOLOGIES

Some of the demand for carpenters, however, will be offset by expected productivity

gains resulting from the increasing use of prefabricated components and improved fasteners and tools. Prefabricated wall panels, roof assemblies, and stairs, as well as prehung doors and windows can be installed very quickly. Instead of having to be built on the worksite, prefabricated walls, partitions, and stairs can be lifted into place in one operation; beams and, in some cases, entire roof assemblies, are lifted into place using a crane. As prefabricated components become more standardized, builders will use them more often. New and improved tools, equipment, techniques, and materials also are making carpenters more versatile, allowing them to perform more carpentry tasks.

Construction Technology is also a **Green Increased Demand** occupation, meaning that green economy activities and technologies are likely to increase the employment demand, but will not lead to significant changes in the work and employee requirements.

Construction Carpenters work in the green construction sector, constructing new green buildings, retrofitting residential and commercial buildings, and installing other green construction technology.

In addition, for those individuals who choose to own his or her own construction company or work for a large commercial construction company, they will need to acquire additional technological skills including accounting software, computer aided design (CAD) software, word processing and spreadsheet software (Office, QuickBooks), and project management software.

2. **BUSINESS OPERATIONS**

Availability and accessibility of tools is critical in today's industry. Presently in the program, we have two compound miter saws, one in the construction bay area and one in the shop area. Students are often waiting to use these saws. The OAC recommends the purchase of additional saws to meet student/program demands. The OAC also recommends purchasing new work tables/work benches as the existing ones are in poor condition.

3. TYPES OF SKILLS & CREDENTIALS REQUIRED FOR EMPLOYMENT

Students completing this program should have the opportunity to earn an industry recognized credential or certification, such as the OSHA 10 hour CareerSafe certification. Professional certifications and credentials offer excellent opportunities for skill acquisition and enhancement, career advancement, in addition to being recognized for one's commitment to professional growth.

In conjunction with professional certifications and credentials, articulations and post-secondary education can provide students opportunities to grow and excel in the construction industry. Students who choose to enter construction management, building science or emerging green careers will benefit from post-secondary credit. Many potential "jobs" in these career areas may require some post-secondary credit. Articulation agreements are one avenue to assist students to attain college credit while they are still in high school.

According to ONET, students graduating from the Construction Technology program should possess the following skills and abilities:

Skills:

- **Active Listening** — Giving full attention to what other people are saying, taking time to understand the points being made, asking questions as appropriate, and not interrupting at inappropriate times.
- **Critical Thinking** — Using logic and reasoning to identify the strengths and weaknesses of alternative solutions, conclusions, or approaches to problems.
- **Monitoring** — Monitoring/Assessing performance of yourself, other individuals, or organizations to make improvements or take corrective action.
- **Coordination** — Adjusting actions in relation to others' actions.
- **Quality Control Analysis** — Conducting tests and inspections of products, services, or processes to evaluate quality or performance.

Abilities:

- **Problem Sensitivity** — The ability to tell when something is wrong or is likely to go wrong. It does not involve solving the problem, only recognizing that there is a problem.
- **Visualization** — The ability to imagine how something will look after it is moved around or when its parts are moved or rearranged.
- **Finger Dexterity** — The ability to make precisely coordinated movements of the fingers of one or both hands to grasp, manipulate, or assemble very small objects.
- **Manual Dexterity** — The ability to quickly move your hand, your hand together with your arm, or your two hands to grasp, manipulate, or assemble objects.
- **Near Vision** — The ability to see details at close range (within a few feet of the observer).

E. RECOMMENDATIONS

CURRICULUM/INDUSTRY CERTIFICATIONS

- The OAC recommends that the strategies and initiatives to support the previously mentioned trends should continue to be adopted and implemented. New articulation agreements should be considered and pursued, to support increasing number of students who desire to earn a post-secondary degree. This will assist those students who are using the knowledge and training they received in Construction Technology as the foundation for a career in construction management, building sciences & sustainable design, or residential construction technology – emerging *green* careers which require an associates or bachelor’s degree.

EQUIPMENT / TOOLS:

- OAC members recommend the purchase of two (2) new DeWalt Sliding Compound Miter Saws with stands.
- OAC members recommend the purchase of four (4) new workbenches with vices for the 2023-2024 school year
- New tables and chairs for the theory room

EQUIPMENT RECOMMENDATIONS WITH PURCHASING TIMELINE:

<u>ITEM & DESCRIPTION</u>	<u>COST</u>	<u>YEAR</u>
1. (2) DeWalt Compound Sliding miter saws w/stand	\$950.00 ea.	23-24
2. (4) workbenches with vices (replacement)	\$2,500.00 ea.	23-24
3. Teacher Lab Desk (replacement)	\$1,500	23-24
4. Theory room tables and chairs	\$5,000	24-25
5. Paint and refresh lab and bay	\$6,000	24-25
6. Hand tool replacement	\$1,000	25-26
	Total	\$25,400

**Competency Task List – Secondary Component
Carpentry/Carpenter CIP 46.0201
High School Graduation Years 2022, 2023, 2024**

100 Safety/Occupational Orientation

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
101	Follow basic, lab, and construction industry safety practices and procedures.		
102	RESERVED		
103	RESERVED		
104	Follow procedures in Safety Data Sheets (SDS) system.		
105	Identify and follow all OSHA safety standards at the construction site.		
106	RESERVED		
107	RESERVED		

200 Hand Tools

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
201	Use and maintain small hand tools.		
202	Use and maintain sawing tools.		
203	Use and maintain fastening tools.		
204	Use and maintain measuring tools.		
205	Use and maintain cutting tools.		
206	RESERVED		
207	Use and maintain ladders.		
208	Use and maintain finishing tools.		
209	RESERVED		
210	Construct scaffolding.		

300 Power Tools

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
301	Use and maintain stationary electric power tools.		
302	Use and maintain pneumatic/fastening tool systems.		
303	Use and maintain portable electric power tools.		
304	RESERVED		
305	RESERVED		

400 Blueprints Reading

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
401	Interpret blueprints.		
402	Interpret and comprehend standard symbols and abbreviations.		
403	Interpret building specifications.		
404	Interpret a plot plan.		
405	Interpret a foundation plan.		
406	Interpret elevation plans.		
407	Interpret details and section views.		
408	Interpret floor, wall, and roof framing plans.		
409	Interpret building and zoning codes.		
410	Interpret Americans with Disabilities Act (ADA) regulations.		

500 Site Preparation and Layout

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
501	Determine factors needed to be considered before the start of a building project.		
502	Acquire a building permit.		

503	Use PA One Call System.		
504	Establish elevations and grades from benchmarks using leveling instruments.		
505	Stake out a building foundation using the Pythagorean Theorem.		
506	Layout and construct batter boards.		

600 Footings and Foundations

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
601	Identify footer and foundation materials.		
602	Use leveling instruments.		
603	Establish footer lines and elevations.		
604	RESERVED		
605	Layout and construct forms for footers.		
606	Layout foundations.		
607	Layout and construct forms for concrete slabs.		
608	Install reinforcing materials.		
609	Construct vertical and horizontal formwork.		

700 Framing – Floor Construction

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
701	RESERVED		
702	RESERVED		
703	Layout and install sill plates.		
704	Layout and install floor joists, including manufactured floor joists.		
705	Layout and install joists for a cantilever floor.		
706	Construct and install cross and solid bridging.		
707	Layout and install sub-flooring.		

708	Layout and construct floor openings.		
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800 Framing – Wall Construction

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
801	RESERVED		
802	Layout and construct a wall.		
803	RESERVED		
804	Layout and construct door openings.		
805	Layout and construct window openings.		
806	Construct a load bearing header.		
807	Layout and install sheathing.		
808	Plumb, align and brace walls.		
809	Layout and install metal studs.		

900 Framing – Roof Construction

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
901	RESERVED		
902	RESERVED		
903	Layout and install a ridgeboard.		
904	Layout and install common rafters.		
905	RESERVED		
906	Layout and install roof trusses.		
907	Layout and install roof sheathing.		
908	Layout and construct roof openings.		
909	RESERVED		
910	RESERVED		
911	Layout and install roofing materials.		

912	Layout and install capping.		
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1000 Exterior Finish

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
1001	RESERVED		
1002	RESERVED		
1003	Install house wrap.		
1004	Install exterior doors.		
1005	Install windows.		
1006	Layout and install siding.		
1007	Layout and install soffits and fascias.		
1008	Layout and install gutters and downspouts.		
1009	Layout and install exterior deck, stair, and railing systems.		

1100 Interior Finish

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
1101	RESERVED		
1102	RESERVED		
1103	Layout, install and finish drywall.		
1104	Layout and install suspended and tile ceilings.		
1105	Layout and install interior doors.		
1106	Layout and install door trim, casings, and hardware.		
1107	Layout and install window trim, casings, and hardware.		
1108	Layout and install baseboard and molding.		
1109	Layout and install flooring materials.		
1110	Layout and install interior stair systems.		
1111	Install various types of insulation.		

1200 Estimation

Item	Task	(X) Indicates Proficiency ¹	Secondary Course Crosswalk
1201	Estimate the amount and cost of bricks and blocks needed to complete a given task.		
1202	Estimate the amount and cost of concrete needed to complete a given task.		
1203	Estimate the amount and cost of materials to finish an exterior wall.		
1204	Estimate the amount and cost of materials to finish an interior wall.		
1205	Estimate the amount and cost of materials to construct a finished floor.		
1206	Estimate the amount and cost of materials to construct a finished roof.		
1207	Estimate the amount and cost of materials to install siding for a house.		

¹ Student Demonstrated Entry-Level Industry Proficiency as Indicated by (X)

Secondary CTE Instructor Signature _____

Date _____

Student Signature _____

Date _____



CARPENTRY/CARPENTER

CIP 46.0201

Revised July 2021

46.0201 CARPENTRY/CARPENTER

Introduction –Carpenters are skilled workers who are responsible for the construction of buildings and projects. They are able to study and to interpret blueprint specifications in order to prepare the project site, and to determine the dimensions and materials required. Carpenters are able to use power tools safely, in order to shape and cut materials for the project. These individuals may be required to perform many tasks, such as installing windows, doors, floors, millwork, and cabinetry. The ability to accurately measure and read a tape measure, level, and plumb bob are essential to this profession. Carpenters are also skilled in the repair and restoration of many existing buildings. They may be responsible for the removal and replacement of damaged or defective building sections. In addition, they should be able to fabricate replacement frameworks, inspect building components to determine damage, and estimate the cost for repair of replacement parts. Carpenters may also work on scaffolding, install roofing materials, hang spouting and downspouts, and install roof vents. Within buildings, carpenters build or repair cabinets, floors, windows, and doors. Woodworking machines, small hand tools, and all types of power tools can be found in every carpenter’s toolbox. Large construction companies may assist carpenters in the purchase of many tools; however, independent carpenters need to be able to finance tools on their own budget. Generally, carpenters receive training in one of the following methods: developing and demonstrating competencies as a secondary student in a career and technical education program; earning an associate degree in building construction technology; earning an undergraduate or graduate degree in construction management or completing a certified craft training and apprenticeship program. Carpenters are expected to keep current with any new technology or codes related to the building/construction industries, recognize the various types of materials and methods available to the construction trade, and understand the complex interrelationships among numerous trades and professions within the industry. Those individuals completing the program may be employed as carpenters, carpenter assistants or apprentices, lead carpenters, finish carpenters, maintenance carpenters, stair builders, production workers, concrete carpenters, house repairers, door installers, cabinet and trim installers, framers, assemblers, and woodworkers. Building a safe, productive and sustainable workforce of carpentry professionals and helping to address the critical workforce shortage facing the construction industry is vital to the economy. It is extremely important for an individual to develop a strong carpentry/carpenter framework that produces portable credentials through a well-designed educational foundation.

CIP Code /SOC Code Alignment:

High Priority Occupation Statewide

47-2031.00 – Carpenter

Job Titles and Tasks - O*NET/SOC
Secondary Career and Technical Programs

47-2031.01 - Construction Carpenter

- Measure and mark cutting lines on materials, using ruler, pencil, chalk, and marking gauge.
- Follow established safety rules and regulations and maintain a safe and clean environment.
- Verify trueness of structure, using plumb bob and level.
- Shape or cut materials to specified measurements, using hand tools, machines, or power saw.
- Study specifications in blueprints, sketches or building plans to prepare project layout and determine dimensions and materials required.
- Assemble and fasten materials to make framework or props, using hand tools and wood screws, nails, dowel pins, or glue.
- Build or repair cabinets, doors, frameworks, floors, and other wooden fixtures used in buildings, using woodworking machines, carpenter's hand tools, and power tools.
- Erect scaffolding and ladders for assembling structures above ground level.
- Remove damaged or defective parts or sections of structures and repair or replace, using hand tools.
- Install structures and fixtures, such as windows, frames, floorings, and trim, or hardware, using carpenter's hand and power tools.

47-2031.02 - Rough Carpenters

- Study blueprints and diagrams to determine dimensions of structure or form to be constructed.
- Measure materials or distances, using square, measuring tape, or rule to layout work.
- Cut or saw boards, timbers, or plywood to required size, using handsaw, power saw, or woodworking machine.
- Assemble and fasten material together to construct wood or metal framework of structure, using bolts, nails, or screws.
- Anchor and brace forms and other structures in place, using nails, bolts, anchor rods, steel cables, planks, wedges, and timbers.
- Mark cutting lines on materials, using pencil and scribe.
- Erect forms, framework, scaffolds, hoists, roof supports, or chutes, using hand tools, plumb rule, and level.
- Install rough door and window frames, subflooring, fixtures, or temporary supports in structures undergoing construction or repair.
- Examine structural timbers and supports to detect decay, and replace timbers as required, using hand tools, nuts, and bolts.
- Bore boltholes in timber, masonry or concrete walls, using power drill.

47-3012.00 - Helpers

- Position and hold timbers, lumber, and paneling in place for fastening or cutting.
- Erect scaffolding, shoring, and braces.
- Select tools, equipment, and materials from storage and transport items to work site.
- Fasten timbers and/or lumber with glue, screws, pegs, or nails, and install hardware.
- Clean work areas, machines, and equipment, to maintain a clean and safe jobsite.
- Hold plumb bobs, sighting rods, and other equipment, to aid in establishing reference points and lines.
- Align, straighten, plumb and square forms for installation.
- Cut timbers, lumber and/or paneling to specified dimensions, and drill holes in timbers or lumber.
- Smooth and sand surfaces to remove ridges, tool marks, glue, or caulking.
- Perform tie spacing layout, then measure, mark, drill and/or cut.

National Assessments Which Qualify for the Pennsylvania Skill Certificate

National Occupational Competency Testing Institute (NOCTI) - Carpentry

NCCER

Entry-Level Assessments

Journey-Level Assessments

Residential Construction Academy instructor, program, and student credentialing