

# *Construction Occupational Cluster*

## *Carpentry Framework (VCARP)*

### Strand 1: Safety and Health Knowledge and Skills

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#### **1.A Fundamentals of Health and Safety**

- 1.A.01 Describe and apply health and safety regulations.
- 1.A.01.01 Identify, describe and apply health and safety regulations that apply to specific tasks and jobs. Students must complete a safety credential program, e.g., Occupational Safety and Health Administration 10, CareerSafe and ServSafe.
  - 1.A.01.02 Identify, describe and apply Environmental Protection Agency (EPA) and other environmental protection regulations that apply to specific tasks and jobs in the specific occupational area.
  - 1.A.01.03 Identify, describe and apply Right-To-Know (Hazard Communication Policy) and other communicative regulations that apply to specific tasks and jobs in the specific occupational area.
  - 1.A.01.04 Explain procedures for documenting and reporting hazards to appropriate authorities.
  - 1.A.01.05 Identify and describe potential consequences for non-compliance with appropriate health and safety regulations.
  - 1.A.01.06 Identify and list contact information for appropriate health and safety agencies and resources.

#### 1. A.01 Performance Examples:

- List and define OSHA Health and Safety Regulations, EPA and other environmental protection regulations to occupational area.
- List and define Right-to-Know regulations and reporting of hazards and contact information for appropriate health and safety agencies.
- List the laws and rules of regulatory agencies governing sanitation and safety.
- Utilize OSHA as well as health and safety websites for purposes of research.

- 1.A.02 Demonstrate appropriate health and safety practices based on the specific occupational area.
- 1.A.02.01 Identify, describe and demonstrate the effective use of Safety Data Sheets (SDS).
  - 1.A.02.02 Read and interpret chemical, product and equipment labels to determine appropriate health and safety considerations.
  - 1.A.02.03 Identify, describe and demonstrate personal, shop and job site safety practices and procedures.
  - 1.A.02.04 Demonstrate safe dress and use of relevant safety gear, personal protective equipment (PPE) and ergonomics, e.g., wrist rests, adjustable workspaces, equipment, gloves, proper footwear, earplugs, eye protection and breathing apparatus.
  - 1.A.02.05 Demonstrate appropriate safe body mechanics, including appropriate lifting techniques and ergonomics.

- 1.A.02.06 Locate emergency equipment, first aid kit, SDS information directories and emergency action/response plan/escape routes in your lab, shop and classroom, including labels and signage that follow OSHA Hazard Communication Program (HAZCOM), eyewash stations, shower facilities, sinks, fire extinguishers, fire blankets, telephone, master power switches and emergency exits.
- 1.A.02.07 Demonstrate the safe use, storage, and maintenance of every piece of equipment in the lab, shop and classroom, e.g., the OSHA Lockout/Tagout Program (LOTO).
- 1.A.02.08 Describe safety practices and procedures to be followed when working with and around electricity, e.g., ground fault circuit interrupter (GFCI) and frayed wiring.
- 1.A.02.09 Handle, store, dispose of and recycle hazardous, flammable and combustible materials, according to EPA, OSHA and product specifications.
- 1.A.02.10 Demonstrate appropriate workspace cleaning, sanitation, disinfection and sterilization procedures required in specific occupational areas, e.g., Workplace Housekeeping OSHA Regulations.

1. A.02 Performance Examples:

- Identify, describe and demonstrate the use of SDS.
- List and demonstrate shop dress code, safety procedures and location of emergency equipment in labor classroom.
- Define and demonstrate safe storage and maintenance of equipment and proper disposal or recycling of hazardous, flammable and combustible materials.
- Identify, describe and demonstrate the Universal Precautions set of guidelines.

- 1.A.03 Demonstrate appropriate responses to situations that may threaten health and safety.
  - 1.A.03.01 Describe First Aid procedures for potential injuries and other health concerns in the specific occupational area.
  - 1.A.03.02 Describe the importance of emergency preparedness and an emergency action/response plan.
  - 1.A.03.03 Describe procedures used to handle emergency situations, defensive measures and accidents, including identification, reporting, response, evacuation plans and follow-up procedures.
  - 1.A.03.04 Identify, describe and demonstrate safety practices in specific occupational areas used to avoid accidents.
  - 1.A.03.05 Identify and describe fire protection, protection, precautions and response procedures.
  - 1.A.03.06 Discuss the role of the individual and the company/organization in ensuring workplace safety including transportation to and from school, school activities and the workplace.
  - 1.A.03.07 Discuss ways to identify, prevent and report school and workplace violence, discrimination, harassment and bullying.
  - 1.A.03.08 Demonstrate positive and appropriate behavior that contributes to a safe and healthy environment in school and the workplace.

1. A.03 Performance Example:

- Define first aid procedures and protocols used to handle emergency situations and practices used to avoid accidents.
- View safety videos and discuss the role of workplace safety.
- Attend or participate in a human rights alliance organization presentation.
- Observe and/or demonstrate the appropriate use of a fire extinguisher using the (PASS) technique: Pull, Aim, Squeeze, Sweep.
- Review and discuss specific policies, procedures and protocols regarding discrimination, harassment and bullying.
- Discuss and/or role-play proper and respectful behavior that contributes to a positive climate.
- Discuss and/or demonstrate behavior that contributes to a collaborative/teamwork environment.

### *Selected Websites*

- Bullying Prevention and Intervention Resources : [www.doe.mass.edu/bullying](http://www.doe.mass.edu/bullying)
- Centers for Disease Control and Prevention: [www.cdc.gov](http://www.cdc.gov)
- Environmental Protection Agency : [www.epa.gov](http://www.epa.gov)
- “Lost Youth – Four Stories of Injured Young Workers” – WorkSafeBC:  
<http://www2.worksafebc.com/Publications/Multimedia/Videos.asp?reportid=34291>
- Massachusetts Department of Elementary and Secondary Education. (2011). Career/Vocational Technical Education Safety Guide: [www.doe.mass.edu/cte](http://www.doe.mass.edu/cte)
- Massachusetts Department of Elementary and Secondary Education: [www.doe.mass.edu](http://www.doe.mass.edu)
- Massachusetts Emergency Management Agency: [www.mass.gov/eopss/agencies/mema](http://www.mass.gov/eopss/agencies/mema)
- Massachusetts General Law: [www.malegislature.gov](http://www.malegislature.gov)
- Massachusetts Health and Human Services: [www.mass.gov/dph](http://www.mass.gov/dph)
- Massachusetts Right to Know Law Summary:  
<http://www.mass.gov/lwd/docs/dos/mwshp/hib397.pdf>
- Safety Data Sheet: [www.sdsonline.com](http://www.sdsonline.com)
- National Fire Protection Association: [www.nfpa.org](http://www.nfpa.org)
- Protection of Student Rights: Massachusetts General Law:  
<https://malegislature.gov/Laws/GeneralLaws/PartI/TitleXII/Chapter76/Section5>
- Occupational Safety and Health Administration: [www.osha.gov](http://www.osha.gov)
- Readiness and Emergency Management for Schools: [www.rems.ed.gov](http://www.rems.ed.gov)
- Safe and Healthy Learning Environments: [www.doe.mass.edu/ssce/safety.html](http://www.doe.mass.edu/ssce/safety.html)

## Strand 2: Technical Knowledge and Skills

### 2.A Carpentry Safety and Health Knowledge and Skills

- 2.A.01 Successfully complete safety training on all related equipment and materials.
- 2.A.01.01 Demonstrate use, storage, and maintenance of all related hand and power tools, according to current industry and OSHA standards.
  - 2.A.01.02 Identify and describe scaffold safety practices and procedures.
  - 2.A.01.03 Use and maintain ladders, scaffolding, and fall protection according to current industry and OSHA standards.
  - 2.A.01.04 Identify the safety hazards associated with the use of ladder brackets, and suggest alternatives.
  - 2.A.01.05 Identify and apply OSHA and other health and safety regulations that apply to specific tasks and jobs in carpentry.

2.A.01 Performance Example:

- Students will successfully complete OSHA 10-hour certification training.

### 2.B Technical Plans and Prints

- 2.B.01 Describe the basic layout of a set of construction documents.
- 2.B.01.01 Identify and describe a site plan from a basic set of construction plans.
  - 2.B.01.02 Identify and describe a floor plan from a basic set of construction plans.
  - 2.B.01.03 Identify and describe a framing plan from a basic set of construction plans.
  - 2.B.01.04 Identify and describe elevations from a basic set of construction plans.
  - 2.B.01.05 Identify and describe cross sections from a basic set of construction plans.
  - 2.B.01.06 Identify and describe details from a basic set of construction plans.

2.B.01 Performance Examples:

- Describe how orthographic projections apply to elevation views.

- 2.B.02 Define basic abbreviations, line types, symbols and notes.
- 2.B.02.01 Identify and define abbreviations found on construction plans.
  - 2.B.02.02 Identify and define object lines and dimension lines.
  - 2.B.02.03 Identify and define hidden lines and centerlines.
  - 2.B.02.04 Identify and define break line, extension line and leader line.
  - 2.B.02.05 Identify and define window, door and stair floor plan symbols.
  - 2.B.02.06 Identify and define basic electric floor plan symbols.
  - 2.B.02.07 Identify and define basic plumbing floor plan symbols.
  - 2.B.02.08 Define and describe the purpose of the north symbol.

2.B.02 Performance Example:

- Describe the alphabet of lines.

- 2.B.03 Determine true measurements from prints.
- 2.B.03.01 Calculate missing dimensions on a plan without the use of a scale.
  - 2.B.03.02 Calculate finish floor to finish floor dimensions from cross section or elevations.

2.B.03 Performance Example:

- Determine overall length from outside corner of the building to centerline of front door using carpentry related math.

- 2.B.04 Describe detail views and schedules.
- 2.B.04.01 Locate a detail view on a drawing.
  - 2.B.04.02 Describe the detail of the view.
  - 2.B.04.03 Locate the door schedule on a drawing.
  - 2.B.04.04 Identify the door sizes and types.
  - 2.B.04.05 Locate the window schedule on a drawing.
  - 2.B.04.06 Identify the window sizes and types.
  - 2.B.04.07 Locate a finish schedule on a drawing.
  - 2.B.04.08 Identify the room finishes on the schedule.

2.B.04 Performance Example:

- Generate a door and window stock list.

- 2.B.05 Calculate material take off.
- 2.B.05.01 Develop a stock list.
  - 2.B.05.02 Develop a true cost for the items on the stock list.
  - 2.B.05.03 Determine the delivery method and time frame for the stock list.
  - 2.B.05.04 Identify the supplier and contact information.

2.B.05 Performance Example:

- Develop a material quantity takeoff for the project and/or job.

- 2.B.06 Apply state and local building codes.
- 2.B.06.01 State the purpose of zoning regulations.
  - 2.B.06.02 Describe the relationship of the Massachusetts Building Code to the IBC.
  - 2.B.06.03 Compare the differences between residential and commercial codes.
  - 2.B.06.04 Explain how a building permit incorporates local building codes.
  - 2.B.06.05 Outline the building inspection process.
  - 2.B.06.06 Explain the purpose and procedure for obtaining a Certificate of Occupancy.

2.B.06 Performance Example:

- Identify maximum guardrail balusters spacing for residential construction.

2.B\* Advanced Performance Example:

- Develop a complete cost estimate for a residential building project.

## 2.C Specifications

- 2.C.01 Identify, explain, and use specifications for a construction project.
- 2.C.01.01 Describe the importance of project specifications and their use.
  - 2.C.01.02 Define the divisions that are related to the carpentry field.

2.C.01 Performance Example:

- Describe what Division 2 addresses in a set of specifications.

2.C\* Advanced Performance Example:

- Develop a complete set of the specifications for a residential building project.

## **2.D Demonstrate the Fundamentals of Carpentry**

2.D.01 Recognize and describe the use of building materials.

2.D.01.01 Identify and describe the types of building materials.

2.D.01.02 Describe the use of different types of building materials.

2.D.01 Performance Examples:

- Determine the actual size of a 2 x 4.

2.D.02 Recognize and describe the use of engineered materials.

2.D.02.01 Identify engineered building materials.

2.D.02.02 Define the use of engineered materials.

2.D.02 Performance Example:

- Describe a bottom chord as it pertains to a roof truss.

2.D.03 Describe pre-fabricated panelized systems.

2.D.03.01 Identify, define, and describe pre-fabricated construction systems.

2.D.03.02 Describe construction techniques for pre-fabricated building materials.

2.D.03.03 Describe the installation procedures for pre-fabricated building materials.

2.D.03 Performance Example:

- Define modular as it pertains to panelized construction.

2.D.04 Apply carpentry math principles.

2.D.04.01 Read a tape measure to 1/16th of an inch.

2.D.04.02 Add/subtract fractions.

2.D.04.03 Use a calculator to multiply, divide and perform basic trigonometric functions.

2.D.04.04 Define the importance of a 3-4-5 triangle to carpentry calculations.

2.D.04.05 Convert cubic feet to cubic yards.

2.D.04.06 Convert fractions to decimals.

2.D.04.07 Calculate the area of circles, triangles, squares, rectangles and trapezoids.

2.D.04 Performance Example:

- Determine the line length of a common rafter using the Pythagorean Theorem.

2.D.05 Describe layout procedures.

2.D.05.01 Describe and demonstrate the installation of batter board.

2.D.05.02 Layout sills.

2.D.05.03 Check for square.

2.D.05.04 Layout floor/ceiling joists.

2.D.05.05 Layout exterior wall plates and shoes residential.

2.D.05.06 Layout exterior wall plates and shoes commercial.

2.D.05.07 Layout roof rafter.

2.D.05.08 Layout stair stringer.

2.D.05.09 Layout a story pole.

2.D.05 Performance Example:

- List three ways of laying out a 90 degree angle.

- 2.D.06 Describe lumber storage techniques.  
2.D.06.01 Describe the best practices for storing materials.

2.D.06 Performance Example:  
▪ Demonstrate and understanding of proper lumber storage.

- 2.D.07 Check installed items for square, plumb and level.  
2.D.07.01 Check walls for plumb using a level and a plumb bob.  
2.D.07.02 Check floors and walls for square.  
2.D.07.03 Demonstrate and describe how to check floors and ceilings of varying distances for level.

2.D.07 Performance Example:  
▪ Define plumb.

2.D\* Advanced Performance Example:  
▪ Compare and contrast light gauge construction to wood framed construction.

## 2.E Hand Tools

- 2.E.01 Describe and demonstrate the use and care of hand tools.  
2.E.01.01 Demonstrate use and maintenance of layout, marking, and measuring tools.  
2.E.01.02 Demonstrate use and maintenance of fastening, clamping, and dismantling tools.  
2.E.01.03 Demonstrate use and maintenance of sawing tools.  
2.E.01.04 Demonstrate use and maintenance of drilling and boring tools.  
2.E.01.05 Demonstrate use and maintenance of planing, smoothing, and shaping tools.

2.E.01 Performance Example:  
▪ Sharpen a chisel.

2.E\* Advanced Performance Example:  
▪ Disassemble, sharpen, and reassemble a block plane.

## 2.F Power Tools

- 2.F.01 Demonstrate the use, storage, and maintenance of sawing tools.  
2.F.01.01 Demonstrate the use and maintenance of a portable circular saw.  
2.F.01.02 Demonstrate the use and maintenance of a portable power miter box.  
2.F.01.03 Demonstrate the use and maintenance of a portable table saw.  
2.F.01.04 Demonstrate the use and maintenance of reciprocating saws.

2.F.01 Performance Examples:  
▪ Cross a 2 x 4 with a circular saw.

- 2.F.02 Use, store, and maintain drilling and boring tools.  
2.F.02.01 Demonstrate the use and maintenance of portable drills.

2.F.02 Performance Example:  
▪ List 5 common types of drill bits used in construction.

- 2.F.03 Use, store, and maintain routers and sanders.  
 2.F.03.01 Demonstrate the use and maintenance of a portable router.  
 2.F.03.02 Demonstrate the use and maintenance of portable sanders.

2.F.03 Performance Example:  
 ▪ Change a router bit in a portable router.

- 2.F.04 Use, store, and maintain fastening tools.  
 2.F.04.01 Demonstrate the use and maintenance of a screw gun.  
 2.F.04.02 Demonstrate the use and maintenance of pneumatic equipment.  
 2.F.04.03 Demonstrate the use and maintenance of power fastening tools and systems.

2.F.04 Performance Example:  
 ▪ Clean and oil a nail gun according to manufacturer's specification and current industry and

2.F\* Advanced Performance Example:  
 ▪ Demonstrate the safe use, storage, and maintenance of concrete sawing tools.  
 ▪ Demonstrate the safe use, storage, and maintenance of ceramic tile cutting tools.

## 2.G Ladders and Scaffolds

- 2.G.01 Describe and demonstrate the use and maintenance of ladders and brackets.  
 2.G.01.01 Identify and describe ladder safety practices and procedures.  
 2.G.01.02 Demonstrate the use and maintenance of extension ladders.  
 2.G.01.03 Demonstrate the use and maintenance of step ladders.  
 2.G.01.04 Identify the safety hazards associated with the use of ladder brackets, and suggest alternatives.  
 2.G.01.05 Demonstrate the use and maintenance of wall brackets.  
 2.G.01.06 Demonstrate the use and maintenance of roof brackets.

2.G.01 Performance Examples:  
 ▪ Student sets up an extension ladder at the proper angle, etc.

- 2.G.02 Use and maintain wood, metal, and pump jack scaffolds.  
 2.G.02.01 Identify and describe scaffold safety practices and procedures.  
 2.G.02.02 Erect tubular pipe staging.  
 2.G.02.03 Erect light duty rolling scaffolds.  
 2.G.02.04 Erect pump jack staging.  
 2.G.02.05 Demonstrate the use and maintenance of fall arrest systems.

2.G.02 Performance Example:  
 ▪ Properly set up baker staging according to current industry and OSHA standards.

2.G\* Advanced Performance Example:  
 ▪ Demonstrate the use and maintenance of construction hoists.  
 ▪ Demonstrate the use and maintenance of Tube and Clamp scaffolds.



## 2.H Framing

2.H.01 Describe and apply the factors in the construction of floor framing systems.

- 2.H.01.01 Explain the importance of layout at 16 inches on center.
- 2.H.01.02 Identify floor framing members.
- 2.H.01.03 Explain why and demonstrate how to crown joists.
- 2.H.01.04 Explain the purpose of sill seal.
- 2.H.01.05 Demonstrate accurate layout to receive floor joists.
- 2.H.01.06 Fabricate floor frame and stairwell openings.
- 2.H.01.07 Describe the purpose for bridging and apply bridging.
- 2.H.01.08 Identify subfloor material thickness.
- 2.H.01.09 List the purpose of construction adhesive.
- 2.H.01.10 Explain and apply nail spacing and nail sizing.
- 2.H.01.11 Apply subfloor material.

2.H.01 Performance Examples:

- Create a materials list and calculate total cost for 8x12 foot floor from specifications.
- Layout and frame an 8 x 12 deck using 2 x 8s.

2.H.02 Demonstrate practices related to framing exterior walls.

- 2.H.02.01 Layout and construct bearing walls.
- 2.H.02.02 Layout and construct bearing wall openings.
- 2.H.02.03 Frame a gable end.
- 2.H.02.04 Sheath a wall.
- 2.H.02.05 Erect and brace wall systems.
- 2.H.02.06 Identify opening sizes and components for walls.
- 2.H.02.07 Identify sizes for door headers.
- 2.H.02.08 Identify wall framing members.

2.H.02 Performance Example:

- Students will discuss and identify characteristics of bearing walls.

2.H.03 Demonstrate practices related to framing interior walls.

- 2.H.03.01 Layout and construct non-bearing walls.
- 2.H.03.02 Layout and construct non-bearing wall openings.

2.H.03 Performance Example:

- Frame an interior rough opening.

2.H.04 Demonstrate practices related to framing ceilings and roofs.

- 2.H.04.01 Layout a ceiling frame.
- 2.H.04.02 Layout a roof frame.
- 2.H.04.03 Cut and install ceiling frame systems.
- 2.H.04.04 Cut and install common rafter systems.
- 2.H.04.05 Sheath a gable roof.
- 2.H.04.06 Layout and install strapping.
- 2.H.04.07 Identify hip and valley roof systems.
- 2.H.04.08 Identify roof truss systems.

2.H.04 Performance Example:

- Identify common roof types.

2.H\* Advanced Performance Example:

- Demonstrate practices related to composite wall systems and their total R-value.
- Demonstrate practices related to sound deadening materials.
- Demonstrate practices related to Flitch beams.

## 2.I Finish Carpentry

- 2.I.01 Demonstrate practices related to exterior finish.
- 2.I.01.01 Install room trim.
  - 2.I.01.02 Install roofing materials.
  - 2.I.01.03 Install windows and doors.
  - 2.I.01.04 Apply siding and finish trim.
  - 2.I.01.05 Identify proper installation of platforms, guardrails and handrails.
  - 2.I.01.06 Apply caulking and weatherization materials.

- 2.I.01 Performance Examples:
- Install a window.

- 2.I.02 Demonstrate practices related to interior finish.
- 2.I.02.01 Identify insulation material systems.
  - 2.I.02.02 Install wall board products.
  - 2.I.02.03 Install door and window trim.
  - 2.I.02.04 Install interior doors.
  - 2.I.02.05 Install underlayment.
  - 2.I.02.06 Install baseboard trim.
  - 2.I.02.07 Install closet interiors.
  - 2.I.02.08 Install stair trim.
  - 2.I.02.09 Identify kitchen and bath cabinets, counter tops, and installation procedures.

- 2.I.02 Performance Example:
- Cope an inside corner.

- 2.I\* Advanced Performance Example:
- Identify residential and commercial types of roofing systems.
  - Identify kitchen and bath cabinets, counter tops and installation procedures.

## 2.J Commercial Carpentry

- 2.J.01 Demonstrate commercial carpentry tasks.
- 2.J.01.01 Frame metal stud partitions.
  - 2.J.01.02 Install suspended ceiling systems.
  - 2.J.01.03 Identify basic concrete form work principles and applications.

- 2.J.01 Performance Example:
- Layout and erect a metal stud partition at 16" on center using appropriate fasteners.

- 2.J\* Advanced Performance Example:
- Describe commercial scaffolding applications and their use.

## 2.K Energy Efficient Systems

- 2.K.01 Identify energy efficient materials and their use.
- 2.K.01.01 Describe an energy efficient building envelope.

- 2.K.01 Performance Example:
- Describe the necessity of the air exchange system.

- 2.K\* Advanced Performance Example:
- Design an energy efficient exterior wall that complies with the Massachusetts energy code.

- 6.A.03.04 Evaluate school and work environments in terms of ergonomic practices.
- 6.A.03.05 Describe and use safe and appropriate practices when participating in online communities (e.g., discussion groups, blogs, social networking sites).
- 6.A.03.06 Explain and use practices to protect one's personal safety online (e.g., not sharing personal information with strangers, being alert for online predators, reporting suspicious activities).
- 6.A.03.07 Explain ways individuals can protect their technology systems and information from unethical users.
- 6.A.04 Demonstrate the ability to use technology for research, critical thinking, problem solving, decision making, communication, collaboration, creativity, and innovation.
  - 6.A.04.01 Devise and demonstrate strategies for efficiently collecting and organizing information from electronic sources.
  - 6.A.04.02 Compare, evaluate, and select appropriate electronic resources to locate specific information.
  - 6.A.04.03 Select the most appropriate search engines and directories for specific research tasks.
  - 6.A.04.04 Use a variety of media to present information for specific purposes (e.g., reports, research papers, presentations, newsletters, Web sites, podcasts, blogs), citing sources.
  - 6.A.04.05 Demonstrate how the use of various techniques and effects (e.g., editing, music, color, rhetorical devices) can be used to convey meaning in media.
  - 6.A.04.06 Use online communication tools to collaborate with peers, community members, and field experts as appropriate (e.g., bulletin boards, discussion forums, listservs, Web conferencing).
  - 6.A.04.07 Plan and implement a collaborative project with students in other classrooms and schools using telecommunications tools (e.g., e-mail, discussion forums, groupware, interactive Web sites, video conferencing).