Prince Edward Island
CANADA

Education and Early Childhood Development
English Programs

Prince Edward Island
Technology Education Curriculum

CURRICULUM

Career and Technical Education

Carpentry 801B
Structures, Shaping and Assembly

2010
Prince Edward Island
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Early Childhood Development
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Carpentry Technology
Structures, Shaping, and Assembly (CAR801B)

Course Description

Carpenters are employed in many aspects of the construction industry. Structures, Shaping, and Assembly will introduce students to various types of framing systems common throughout Canada. Students will develop knowledge in selecting and using fasteners and sealants. They will develop their knowledge of and ability to use cutting and shaping tools, with an emphasis on proper maintenance and care. They will also survey the heavy equipment commonly used on construction sites, learn to communicate through orthographic drawings, and build on their essential trades-math skills. A safety component focusses on fire prevention and control.

Classroom Component—Suggested time: 24 hours

This component of the curriculum is required to teach the knowledge and skills associated with the learning outcomes of the curriculum.

Skill Development Component—Suggested time: 86 hours

This component of the curriculum is required by the student to apply the knowledge and develop the skills related to the learning outcomes of the curriculum.

SCO - Identifies the **Specific Curriculum Outcome (SCO)**	
Column 1 **SCO - Delineations** Describes what the students are expected to know, be able to do, and value in order to achieve the SCO. The teacher is responsible for the planning and facilitation of learning as well as the assessment of each SCO - Delineation.	**Column 2** **Student Knowledge, Abilities, and Competencies** Provides clarity to the SCO by describing the **Knowledge, Abilities, and Competencies** that the students develop. This column is designed to indicate the depth and breadth of the SCO. It is not necessary to use all of these suggestions or that all of the students be engaged in the same learning activity.
Column 3 **Teacher Lessons / Demonstrations** Provides suggestions for developing and delivering the content for student learning. **Student Activities / Assessments** Provides suggestions for creating meaningful activities to allow the student to achieve the **SCO**.	**Column 4** **Resources** Lists a variety of **resources** that support the teaching and learning related to the SCO. These resources are suggested to support the teacher in developing an effective instructional package for delivery to the students.

Module 1: Fire Prevention and Control (~2 hours Classroom Component)

15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

Students will be expected to
15.1 describe the classes of fires and the appropriate fire extinguishers suitable to fight each of these fires
15.2 describe procedures and equipment related to preventing, detecting, and warning of fires

Module 2: Fasteners, Adhesives and Sealants (~2 hours Classroom Component)

16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

Students will be expected to
16.1 identify the types and functions of fasteners commonly used in construction
16.2 identify the types and functions of adhesives commonly used in construction
16.3 identify the types and functions of sealants commonly used in construction

Module 3: Cutters, Bits, and Abrasives (~4 hours Classroom Component)

17. Students will be able to describe the use and maintenance of cutting tools and abrasives.

Students will be expected to
17.1 describe the action of a cutting edge on a work piece
17.2 identify and describe the abrasive materials, machines, and tools used to maintain chisels, plane irons, and scrapers
17.3 describe the types and uses of sanding devices
17.4 identify and describe the types, uses, and maintenance of saw blades
17.5 identify and describe the types, uses, and maintenance of drill bits and router bits

Module 4: Construction Equipment (~2 hours Classroom Component)

18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

Students will be expected to
18.1 identify and describe typical construction equipment
18.2 identify and describe hoisting and rigging equipment, methods, and procedures

Module 5: Orthographic Drawing (~6 hours Classroom Component)

19. Students will be able to use principles of orthographic drawing to sketch orthographic projections of objects.

Students will be expected to
19.1 identify the concepts of orthographic presentation
19.2 develop the concepts of orthographic projection

Module 6: Calculate Perimeter and Centreline Perimeter (~4 hours Classroom Component)

20. Students will be able to use a calculator and the appropriate formulas to determine the perimeter and centreline perimeter for various shapes and buildings.

Students will be expected to
20.1 identify and use formulas dealing with perimeter
20.2 complete calculations for centerline perimeter

Module 7: Framing Systems (~4 hours Classroom Component)

21. Students will be able to describe the various wall framing systems for wood-frame buildings.

Students will be expected to
21.1 identify and describe different framing systems
21.2 describe how load transfer and material shrinkage affect these systems

Fire Prevention and Control

(~2 hours Classroom Component)

Introduction

Fire is always a risk on a construction site. The apprentice must be aware of fire and safety risks at all times. The ability to identify risks and correct any hazardous conditions is essential, and the ability to prepare for, and deal with, emergency fires must be understood developed.

Specific Curriculum Outcome

15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

SCO - Delineations

Students will be expected to

15.1 describe the classes of fires and the appropriate fire extinguishers suitable to fight each of these fires

15.2 describe procedures and equipment related to preventing, detecting, and warning of fires

Assessment Strategies

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020101b, *Fire Prevention and Control*

Fire Prevention and Control (~2 hours Classroom Component)

SCO 15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

SCO - Delineations

Students will be expected to

15.1 describe the classes of fires and the appropriate fire extinguishers suitable to fight each of these fires

Student Knowledge, Abilities, and Competencies

Topic: Basic Physical Properties of Fire

- Explain the basic properties of fire, using the example of how wood burns.
- Describe the fire triangle, identifying the three required elements: fuel, oxygen and heat. (Include a fire triangle diagram.)
- Explain the term "fuel" in relation to fire.
- Explain the role of air (oxygen) in relation to fire.
- Explain the term "heat of ignition" as it applies to fire.
- List and explain the three possible forms of ignition:
  - piloted
  - auto-ignition
  - spontaneous ignition
- List and explain the four classifications of fires:
  - class A—ordinary combustibles
  - class B—flammable liquids
  - class C—electrical
  - class D—metals
- Explain the designed purpose of portable fire extinguishers.
- Describe where fire extinguishers should be located.
- Explain the sizing and identification system for fire extinguishers.
- List and describe three common types of fire extinguishing agents (CO_2, dry chemical, water)
- Describe the four requirements to maintain fire extinguishers in good working order:
  - having safety lock in place
  - having tamper seal in place
  - checking/inspecting twice per year
  - checking pressure gauge regularly
- Interpret the ULC label.
- Demonstrate the proper use of a portable fire extinguisher, and practise using the PASS acronym (Pull, Aim, Sweep, Squeeze).

Fire Prevention and Control (~2 hours Classroom Component)

SCO 15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

Teacher Lessons / Demonstrations

Topic: Basic Physical Properties of Fire

- Explain the basic properties of fire: fuel, oxygen, and heat.
- Describe the fire triangle, using a diagram.
- List and explain the three possible forms of ignition: piloted, auto-ignition, and spontaneous ignition.
- List and explain the four classifications of fires.
- Introduce fire extinguishers; identify and explain their locations in the facility.
- Explain the sizing and identification system for fire extinguishers (Underwriters Laboratories or ULC certification system).
- Identify the types of extinguishing agents (CO_2, dry chemical, water)
- Explain the maintenance requirements for extinguishers.
- Demonstrate the use of an extinguisher and explain the PASS acronym (Pull, Aim, Sweep, Squeeze).

Literacy

- *Anticipation Guide:* Create an anticipation guide to access students' knowledge of the properties of fires.

Student Activities / Assessments

- Identify the three requirements for fire.
- Draw and describe the fire triangle.
- Describe the three types of ignition.
- List the four classifications of fire.
- Interpret a ULC label.
- Identify the various extinguishing agents and describe their use on various types of fires.
- Describe maintenance procedures.
- Demonstrate how to use an extinguisher and explain the PASS acronym (Pull, Aim, Sweep, Squeeze).

Resources

Texts/Teacher Resources

Alberta Module 020101c
Fire Prevention and Control
pp. 1-18

SAS Resources

Visuals/Handouts/Tests

- Properties of fire

Internet

- News video

Fire Prevention and Control (~2 hours Classroom Component)

SCO 15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

SCO - Delineations

Students will be expected to

15.2 describe procedures and equipment related to preventing, detecting, and warning of fires

Student Knowledge, Abilities, and Competencies

Topic: Fire Safety

- Identify common fire hazards found on construction sites.
- Describe the hazard presented by oily rags.
- Describe the hazard presented by solvent-soaked rags.
- Explain the procedures for dealing with oily and solvent-soaked rags.
- Describe the hazards presented by welding or cutting on a construction site. (Explain what element of the fire triangle must be controlled during welding or cutting.)
- Explain the purpose of a fire-watcher on the construction site.
- Explain the purpose and components of an emergency action plan.
- Describe the procedure to follow while evacuating a burning building.
- Identify and describe the functions of building emergency systems:
  - sprinkler systems
  - emergency lighting
  - fire alarm systems
- Develop a fire safety checklist for a building or construction site.

Fire Prevention and Control (~2 hours Classroom Component)

SCO 15. Students will be able to identify and describe fire classes, extinguishers, prevention, and detection.

Teacher Lessons / Demonstrations

Topic: Fire Safety

- Describe fire drill procedures and routes, including a gathering area.
- Practise a fire drill, mock fire, and evacuation of the class/school.
- Use a graphic to describe the fire triangle.
- Post evacuation routes and gathering area location.
- Tour the facility in a walkabout to locate fire and safety equipment.
- Explain ULC certification, along with the size designations.
- Explain why it is desirable to have one large extinguisher (e.g., 10BC), as opposed to two small extinguishers (e.g., two 5BC). The fire could rebuild while you are getting the second extinguisher.

CBL

- Invite the local fire department in to demonstrate the use of a portable fire extinguisher.

Student Activities / Assessments

- Create a list of common fire hazards on the construction site.
- Explain the hazard of oily rags and the possibility of spontaneous combustion.
- Create a chart to explain the sizing, type, application, and ULC certification of portable fire extinguishers.
- Describe where extinguishers and fire safety equipment should be located.
- Map the locations of the fire safety equipment in the lab area.
- Create an emergency action plan.

Enrichment / Research Activities

- Develop a directory of local fire and safety equipment suppliers.
- Investigate local training opportunities in fire and safety.

Resources

Texts/Teacher Resources

Alberta Module 020101b
Fire Prevention and Control
pp. 1-18

- CMHC, *Canadian Wood-Frame House Construction*
- National Building Code

SAS Resources

Visuals/Handouts/Tests

- Fire extinguishers
- ILM Self-Test
  Fire Prevention and Control, pp. 17-18

Internet

- Fire safety tips
- Fire safety plans

Fasteners, Adhesives, and Sealants

(~2 hours Classroom Component)

Introduction

Three of the basic processes in construction are planning, fabrication, and assembly. The construction industry uses a variety of fasteners, adhesives, and sealants to create mechanical bonds in the assembly of building components. Carpenters must be familiar with the various products and understand their uses and limitations. Apprentices must have a working knowledge of these products, developing the ability to select the best product for each specific application, and demonstrate their safe use.

Specific Curriculum Outcome

16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

SCO - Delineations

Students will be expected to

16.1 identify the types and functions of fasteners commonly used in construction

16.2 identify the types and functions of adhesives commonly used in construction

16.3 identify the types and functions of sealants commonly used in construction

Assessment Strategies

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020102c, *Fasteners, Adhesives, and Sealants*

Fasteners, Adhesives, and Sealants (~2 hours Classroom Component)

SCO 16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

SCO - Delineations

Students will be expected to

16.1 identify the types and function of fasteners commonly used in construction

Student Knowledge, Abilities, and Competencies

Topic: Mechanical Fasteners

- List and identify eight common finishes and coatings used with fasteners.

Nails and Staples

- List and identify five common nail shank textures.
- Identify and describe the applications of various types of nails.
- Determine the size of nail to be used.
- Identify various types of staples and describe their applications.

Screws

- Explain the advantages of using screws over nails.
- Explain the three basic criteria used in the designation system for screws.
- Identify the various types and shapes of screw heads and screw-drivers.
- Identify various specialty screws and fasteners.

Bolts and Nuts

- Explain the purposes of bolts, nuts, and washers in assembly procedures.
- Describe the various bolt products available:
  - ready rod
  - stove bolts
  - machine screws
  - sex screws (Chicago screws)
  - machine bolts
  - carriage bolts
- Explain the classification system for bolts.
- Describe the various types of nuts and washer products available.
- Describe the various types of anchors available, and list their uses.

Fasteners, Adhesives, and Sealants (~2 hours Classroom Component)

SCO 16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

Teacher Lessons / Demonstrations

Topic: Mechanical Fasteners

- Identify various common mechanical fasteners.
- Identify fasteners used for special applications. (Use a "What am I?" activity to identify fasteners.)
- Introduce NBC tables to select the size and number of nails used to fasten specific construction members together.
- Demonstrate the procedure used to pre-drill holes for screws.
- Demonstrate the procedure used to shorten a bolt or rod.
- Develop a display of various anchors and specialty fasteners.

Literacy

- *Freewrite:* Have students write what they know about mechanical fasteners.
- *Anticipation Guide:* Create an anticipation guide to assess students' knowledge of fastners.

Student Activities / Assessments

Numeracy

- Measure and identify common bolts, nuts, and screws (use vernier calipers).
- Demonstrate how to shorten a bolt.
- Identify specialty fasteners.
- Demonstrate the ability to select the proper fastener.
- Demonstrate the procedure to pre-drill for screw installation.

Enrichment / Research Activities

- Create a display of mechanical fasteners.
- Demonstrate the ability to drill and tap/die for fasteners.

Resources

Texts/Teacher Resources

Alberta Module 020102c
Fastners, Adhesives, and Sealants
pp. 1-39

- CMHC, *Canadian Wood-Frame House Construction*
- National Building Code

SAS Resources

Visuals/Handouts/Tests

- Fastener charts
- Tap and die charts
- ILM Self-Test
  Fastners, Adhesives, and Sealants, pp. 36-39

Fasteners, Adhesives, and Sealants (~2 hours Classroom Component)

SCO 16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

SCO - Delineations	Student Knowledge, Abilities, and Competencies
Students will be expected to	*Topic: Adhesives*
16.2 identify the types and functions of adhesives commonly used in construction	• List four factors to consider when choosing an adhesive. • List the three main categories of adhesives. • Identify two types of natural glues. • Identify the various common types of synthetic (non-reactive) adhesive: - polyvinyl-acetate glue (yellow and white) - contact cement - hot melt adhesives - construction adhesives (panel and floor) • Identify the various types of synthetic (reactive) adhesives: - plastic (urea) resin - resorcinol - epoxy • Source and interpret the MSDSs for various products.
16.3 identify the types and functions of sealants commonly used in construction	*Topic: Sealants* • Explain the use of mastics and sealants in construction. • Identify some of the various sealants used in construction: - moisture barriers, surface coatings, and sealers - roofing cements - acoustical sealants • Explain the use and application of caulking in the construction industry. • Identify some of the various types of caulking available: - acrylic caulking - silicone - latex caulk - butyl caulk - polyurethane foam • Describe the process for preparing a joint for caulking. • Identify and describe the purpose of backing rod. • Identify types of caulking guns. • Demonstrate the proper techniques for applying caulking.

Fasteners, Adhesives, and Sealants (~2 hours Classroom Component)

SCO 16. Students will be able to identify different types, functions, and applications of some of the more common fasteners, adhesives, and sealants.

Teacher Lessons / Demonstrations

Topic: Adhesives and Sealants

- Create a display of various adhesives and glues.
- Demonstrate the applications and uses of adhesives and glues.
- Introduce and interpret product information and MSDSs.
- Create a display of various caulking products.
- Demonstrate the proper application of caulking.
- Explain the difference between an adhesive and a sealant.

Literacy

- Read and interpret product information.
- Demonstrate how to source MSDS information from the Internet.

Student Activities / Assessments

- Select the appropriate glue, adhesive, or caulking for specific applications.
- Interpret manufacturers' instructions.
- Interpret MSDSs.
- Select and use appropriate PPE for using these products.
- Demonstrate the proper applications of various adhesives, glues, and caulkings.
- Obtain MSDS information from the Internet.
- Demonstrate the proper methods to apply caulking.
- List safety precautions which apply to various adhesives.

Enrichment / Research Activities

- Visit a local hardware store to obtain information on a specific fastener, adhesive, sealant product, or group of products.
- Present a report to the class on a selected product.

Resources

Texts/Teacher Resources

Alberta Module 020102c
Fastners, Adhesives, and Sealants
pp. 1-39

- CMHC: *Canadian Wood-Frame House Construction*
- National Building Code

SAS Resources

Visuals/Handouts/Tests

- ILM Self-Test
  Fastners, Adhesives, and Sealants, pp. 36-39

Cutters, Bits, and Abrasives

(~4 hours Classroom Component)

Introduction

Cutting, shaping, and fabricating materials are some of the basic operations that carpenters perform on a daily basis. The apprentice must develop the knowledge and ability to select and use the appropriate tool for each task. Tool maintenance is also imperative in order to ensure high standards of quality and efficiency, along with safety.

Specific Curriculum Outcome

17. **Students will be able to describe the use and maintenance of cutting tools and abrasives.**

SCO - Delineations

Students will be expected to

17.1 describe the action of a cutting edge on a work piece

17.2 identify and describe the abrasive materials, machines, and tools used to maintain chisels, plane irons, and scrapers

17.3 describe the types and uses of sanding devices

17.4 identify and describe the types, uses, and maintenance of saw blades

17.5 identify and describe the types, uses, and maintenance of drill bits and router bits

Assessment Strategies

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020103d, *Cutters, Bits, and Abrasives*

Cutters, Bits, and Abrasives (~4 hours Classroom Component)

SCO 17. Students will be able to describe the use and maintenance of cutting tools and abrasives.

SCO - Delineations	Student Knowledge, Abilities, and Competencies
Students will be expected to	*Topic: Planing Wood*
17.1 describe the action of a cutting edge on a work piece	• Demonstrate an understanding of wood as a natural and complex material. • Identify the grain of a board and explain how it is formed. • Identify the direction of the grain in a board. • Identify the three cutting directions: - with the grain - across the grain - end grain • Demonstrate planing in the direction of the grain. • Demonstrate chiselling with and across the grain. • Demonstrate planing end grain. • Select the appropriate tool to perform each operation.
17.2 identify and describe the abrasive materials, machines, and tools used to maintain chisels, plane irons, and scrapers	*Topic: Sharpening Tools* • Identify the parts of a chisel. • Explain why a dull tool is more dangerous than a sharp tool (because you must apply more pressure to make a cut). • Identify and describe a hollow ground tool. • Identify and describe a flat ground tool. • Describe the tools used to grind a chisel or plane iron. • Explain why a chisel would need to be ground. • Identify the proper angle to grind a chisel or plane iron. • Demonstrate the proper method to grind a chisel. • Take precautions to keep a chisel cool and prevent burning. • Explain the process and tools used to dress a grinding wheel. • Explain why you should NEVER grind aluminum, brass, or copper. (These metals stick in the stone—plugging the surface—and may be thrown off the stone as a projectile.) • Explain why a chisel edge should be honed. • Describe the various types of sharpening stones. • Demonstrate the procedure used to whet or hone a chisel. • Identify and describe the use of a scraper.

Cutters, Bits, and Abrasives (~4 hours Classroom Component)

SCO 17. Students will be able to describe the use and maintenance of cutting tools and abrasives.

Teacher Lessons / Demonstrations

Topic: Planing Wood

- Describe wood grain and how it is formed.
- Display various examples of wood species to show the grain.
- Identify the direction of wood grain.
- Demonstrate cutting and planing:
  - with the grain
  - across the grain
  - against the grain
  - end grain
- Display and demonstrate various cutting and planing tools.

Topic: Sharpening Tools

- Explain the hazards of working with dull tools.
- Demonstrate the process to sharpen chisels and plane irons.

Literacy

- *Anticipation Guide*: Cutting Tool Identification

Student Activities / Assessments

- Identify grain directions.
- Identify various wood species.
- Identify and demonstrate the procedure to make cuts:
  - with the grain
  - across the grain
  - end grain
- Sharpen a chisel (grind, hone, strop).
- Measure the cutting angle of their chisel.

Enrichment / Research Activities

- Demonstrate the development of proficiency using hand tools:
  - cut a hinge gain
  - cut a dado
  - fabricate a half-lap joint
  - fabricate a mortise joint
  - plane a board flat and straight to specifications

Resources

Texts/Teacher Resources

Alberta Module 020103d
Cutters, Bits, and Abrasives
pp. 1-44

SAS Resources

Visuals/Handouts/Tests

- Chisels and planes
- Sharpening chisels and plane irons
- ILM Self-Test
  Cutters, Bits, and Abrasives, pp. 36-43

Cutters, Bits, and Abrasives (~4 hours Classroom Component)

SCO 17. Students will be able to describe the use and maintenance of cutting tools and abrasives.

SCO - Delineations	Student Knowledge, Abilities, and Competencies
Students will be expected to	
17.3 describe the types and uses of sanding devices	*Topic: Sanding* • Define the term "sandpaper." • Explain the composition of sheet abrasives. • Explain the grit coarseness classification system (grit/linear inch). • List the three most common abrasives used by carpenters (garnet, silicone carbide, aluminum oxide). • List the most common grits used. • Demonstrate the process used to sand from a rough to a smooth surface. • Describe "open-coat" and "closed-coat"sandpaper. • Demonstrate various hand sanding techniques. • Identify the various forms of sanding abrasives (belt, disc, sheet). • Identify the various power sanding tools and describe their sanding action.
17.4 identify and describe the types, uses, and maintenance of saw blades	*Topic: Saws* • Identify the two basic classifications of handsaws (rip, crosscut). • Describe the configuration and cutting action of the ripsaw. • Describe the configuration and cutting action of the crosscut saw. • Explain the terms "saw set" and "saw kerf." • Identify several types of specialty saws (back, hole, coping, Gyproc, dovetail). • Identify various circular saw blades: - ripsaw - crosscut - combination - dado - carbide • Explain the various components of the saw blade design. • Identify and explain the various types of specialty blades.
17.5 identify and describe the types, uses, and maintenance of drill bits and router bits	*Topic: Drill and Router Bits* • Identify various types of general purpose twist drill bits. • Identify the parts of the twist drill bit. • Describe the associated angles and common sizes of twist drill bits. • Demonstrate the procedure used to sharpen a twist drill bit. • Identify and describe other common types of drill bits: - brad-point drill bits - auger bits - ship auger bits - spade bits - multispur bits - Forstner bits • Identify several specialty drill bits (masonry, countersink, fly cutter, hole saw). • Identify several common router bits (straight, bead, cove, ogee, dovetail, chamfer, v-groove, bearing guide). • Identify the parts of a router bit (shank, cutter, carbide insert, anti-kickback). • Demonstrate how to change and maintain router bits.

Cutters, Bits, and Abrasives (~4 hours Classroom Component)

SCO 17. Students will be able to describe the use and maintenance of cutting tools and abrasives.

Teacher Lessons / Demonstrations

Topic: Sanding
- Display various types, grits, and forms of sandpaper.
- Explain composition and grit classification.
- Display and demonstrate various sanding tools.
- Demonstrate the appropriate PPE required.

Topic: Saws
- Demonstrate various types of handsaws.
- Demonstrate the use and maintenance of various power saws.

Topic: Drill and Router Bits
- Display various types of twist drills, and list and explain their parts.
- Demonstrate the sharpening of twist drills.
- Display and explain the uses of other common and specialty drill bits.
- Display and demonstrate the use of various router bits.

Student Activities / Assessments

- Demonstrate the proper selection and use of sandpaper.
- Demonstrate the procedure used to obtain a quality sanded finish on various materials.
- Demonstrate the proper use of power sanding machines.
- Demonstrate the proper selection and use of handsaws.
- Cut a block to specified dimensions.
- Demonstrate safe practices and the proper use of PPE in the use of handsaws and power saws.
- Demonstrate proficiency with various handsaws.
- Demonstrate proficiency in the use of power saws.
- Demonstrate safe practices and the proper use of PPE while using drills and routers.
- Demonstrate proficiency in the selection and safe use of drills and routers.

Enrichment / Research Activities

- Demonstrate proficiency in the use of cutting tools and abrasives through relevant projects in the workshop.
- Class challenge: Who can measure and cut to the highest standards?
- Research available products and their various qualities.
- Identify suppliers of cutting tools and abrasives.

Resources

Texts/Teacher Resources
Alberta Module 020103d
Cutters, Bits, and Abrasives
pp. 17-36

SAS Resources

Visuals/Handouts/Tests
- Sanding
- Handsaws
- Types of drill bits
- ILM Self-Test
  Cutters, Bits, and Abrasives, pp. 36-43

Internet
- Manufacturers' sites

Construction Equipment

(~2 hours Classroom Component)

Introduction

Carpenters must work with other tradespeople and co-ordinate the work of other trades and occupations. Often these co-operative efforts involve the use of construction equipment and their associated rigging. The size and power of these machines present safety hazards that all workers should be aware of. The apprentice must become familiar with the various types of construction equipment. Developing an awareness of and respect for this equipment is essential to ensuring a safe working environment. Clear communication, using common terminology and proper signals is equally important.

Specific Curriculum Outcome

18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

SCO - Delineations

Students will be expected to

18.1 identify and describe typical construction equipment

18.2 identify and describe hoisting and rigging equipment, methods, and procedures

Assessment Strategies

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020104b, *Construction Equipment*

Construction Equipment (~2 hours Classroom Component)

SCO 18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

SCO - Delineations

Students will be expected to

18.1 identify and describe typical construction equipment

Student Knowledge, Abilities, and Competencies

Topic: Identifying Construction Equipment

- Identify and describe common earthmoving equipment:
  - backhoes
  - excavators
  - front-end loaders
  - bulldozers
  - skid-steer loaders
  - graders
  - scrapers
  - trenchers
  - compactors
  - augers and drilling equipment
- Identify and describe material handling equipment:
  - forklifts
  - material skips and man hoists
  - aerial platform hoists
  - telescoping lifts
  - boom trucks
- Identify and describe concrete equipment:
  - concrete trucks
  - power trowels
  - concrete pump trucks
  - concrete saws, drills, and coring machines
  - jack hammers
- Identify other construction equipment:
  - air compressors
  - generators
  - water pumps
  - heaters
  - garbage bins and trucks
- Explain general safety precautions to take while working with and around earthmoving equipment.

Construction Equipment (~2 hours Classroom Component)

SCO 18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

Teacher Lessons / Demonstrations

Topic: Identifying Construction Equipment

- Identify and describe common earthmoving equipment.
- Identify and describe material handling equipment.
- Identify and describe equipment for working with concrete.
- Identify and describe other construction equipment.

Literacy

- Develop a pre-test to assess students' prior knowledge of construction equipment.

Student Activities / Assessments

Literacy

- Identify various pieces of equipment, using the proper terminology.
- Source machine brochures for product information.
- Create a safety list for working with or around heavy equipment.

Enrichment / Research Activities

- Investigate the requirements to become a heavy equipment operator.
- Identify training facilities.

Resources

Texts/Teacher Resources

Alberta Module 020104b
Construction Equipment
pp. 1-53

SAS Resources

Videos

- Selected videos on construction equipment

Visuals/Handouts/Tests

- Manufacturer's brochures
- ILM Self-Test
  Construction Equipment, pp. 46-53

Cable in the Classroom

- Discovery Channel
- National Geographic Channel

Internet

- Manufacturers' sites

Construction Equipment (~2 hours Classroom Component)

SCO 18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

SCO - Delineations

Students will be expected to

18.2 identify and describe hoisting and rigging equipment, methods, and procedures

Student Knowledge, Abilities, and Competencies

Topic: Identifying Hoisting and Rigging Equipment

- Identify and describe the various types of cranes:
  - boom trucks
  - industrial cranes
  - rough terrain cranes
  - carrier-mounted, lattice, and telescopic boom cranes
  - tower cranes
- List and describe five criteria to be considered before ordering a crane for a specific job.
- Explain general safety precautions to take while working with and around cranes.
- Identify and describe other hoisting equipment:
  - come-alongs
  - tirfor
  - jacks
  - block and tackle

Topic: Safety and On-Site Considerations

- Explain the reason for and the procedure of blocking under the outrigger floats of cranes.
- Explain the use of tag lines in directing a load.
- Explain the term “whip line” and explain what the worker should do to ensure safety.
- Identify the hazards associated with operating near electrical power lines.
- Explain the possible hazard of electrical arcing from a power line.

Topic: Crane and Hoisting Signals

- Explain why hand signals are used while working with cranes and hoists.
- List the requirements and responsibilities of the signal person.
- Identify and demonstrate the various standard signals:
  - stop signals
  - standard movement signals
  - slow signals
- Identify hoisting equipment and rigging hardware (e.g., shackles, wire rope clips, thimbles, hooks).
- Identify and describe spreader bars and equalizer beams.
- Identify and explain the uses of chain, wire rope, and slings.
- Explain the effect of sling angle on lifting capacity.
- Identify several types and sizes of ropes.
- Demonstrate tying four types of knots (bowline, figure eight, clove hitch, and half hitch).

Construction Equipment (~2 hours Classroom Component)

SCO 18. Students will be able to identify light and heavy equipment used in construction and employ safe procedures when working with cranes and hoisting equipment.

Teacher Lessons / Demonstrations

Topic: Identifying Hoisting and Rigging Equipment

- Identify and describe the various types of cranes (using pictures, models, or video).
- Demonstrate crane and hoisting signals (p. 25 of ILM).
- Demonstrate rigging with shackles, clips, and thimbles (p. 30 of ILM).
- Demonstrate sling configurations and sling angles to show balance and pressure on rigging.
- Demonstrate how to tie a minimum of four knots:
  - bowline
  - clove hitch
  - half hitch
  - figure eight
- Show a video about heavy equipment.
- Arrange a site visit to an equipment training facility.

Literacy

- *KWL*: Develop a KWL entitled "Working Around Cranes—An Up-Lifting Experience".
- *Read Aloud*: Use a Read Aloud strategy to help students improve their knowledge of crane rigging and angles.
- Brainstorm with the class to create a general list of safe practices for working around equipment.

Student Activities / Assessments

Topic: Identify Hoisting and Rigging Equipment

- Create a list of local heavy equipment contractors.
- Collect pictures or models of equipment, compile the pictures and create a class bulletin board display.
- Demonstrate how to tie a minimum of four knots.
- Demonstrate crane hoisting signals.

Enrichment / Research Activities

- Develop a career pathway to obtain training and certification for a specific piece of equipment.

Resources

Texts/Teacher Resources
Alberta Module 020104b
Construction Equipment
pp. 1-53

SAS Resources

Visuals/Handouts/Tests

- Manufacturer's brochures
- Hoisting signals
- ILM Self-Test
  Construction Equipment, pp. 46-53

Cable in the Classroom

- Discovery Channel
- National Geographic Channel

Internet

- Manufacturers' sites
- Crane safety video

Orthographic Drawing

(~6 hours Classroom Component)

Introduction

Effective communication is of the utmost importance to all tradespersons. The principal form of communication on the job site is through the creation and interpretation of drawings and specifications. All projects begin with the drawing of plans. Orthographic drawings are most commonly used to produce accurate plans for a construction project. The apprentice must become familiar with the use and drawing of orthographic plans if he/she is to be an effective member of the construction team.

Specific Curriculum Outcome

19. Students will be able to use principles of orthographic drawing to sketch orthographic projections of objects.

SCO - Delineations

Students will be expected to

19.1 identify the concepts of orthographic presentation

19.2 develop the concepts of orthographic projections

Assessment Strategies

Paper/Pencil
Self/Peer Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020107bA, *Orthographic Drawing - Part A*
Alberta Module 020107bB, *Orthographic Drawing - Part B*

Orthographic Drawings (~6 hours Classroom Component)

SCO 19. Students will be able to use principles of orthographic drawing to sketch orthographic projections of objects.

SCO - Delineations	Student Knowledge, Abilities, and Competencies
Students will be expected to	
19.1 identify the concepts of orthographic presentation	*Topic: Orthographic Views* • Explain that an object may be viewed from six sides (e.g., a die). • Explain that in orthographic projection an object is viewed straight on at 90◦ to the face. • Explain that most objects may be described in three views: - front - top - right side • Illustrate how the front, top, and right-side views must be aligned. • Construct a two-dimensional orthographic model. • Project between the three views. • Demonstrate an understanding that any single view does not depict depth. • Identify object and hidden lines.
19.2 develop the concepts of orthographic projection	*Topic: Orthographic Projection* • Recognize the proper placement and alignment of the orthographic views. • Lay out the orthographic views (front, top, right side). • Measure the assigned and equal distance between views. • Develop the views, using construction lines. • Project between the views. • Demonstrate projecting from the top view to the right-side view through the 45◦ mitre, or projection line. • Illustrate hidden surfaces by using dashed hidden lines.

Orthographic Drawings (~6 hours Classroom Component)

SCO 19. Students will be able to use principles of orthographic drawing to sketch orthographic projections of objects.

Teacher Lessons / Demonstrations

Topic: Orthographic Views

- Illustrate the six orthographic views, using a die.
- Demonstrate laying out the orthographic views.
- Develop the orthographic model (front, top, and right-side views).

Topic: Orthographic Projection

- Demonstrate the method to "project" between the three views (emphasize the importance of lining up the views).
- Use wooden blocks to demonstrate the 3-D model.
- Reinforce the concept of looking at an object "straight-on."
- Demonstrate the concept of projection by using examples with missing lines and having students fill in the missing lines.
- Develop several examples of orthographic drawings to reinforce the concept.

Student Activities / Assessments

- Identify the six orthographic views.
- Identify the three main orthographic views.
- Develop the orthographic model.
- Complete exercises found in the ILM (pp. 21-58).
- Sketch orthographic projections of objects that have
  - surfaces parallel to the viewing plane
  - hidden edges or surfaces
  - sloped surfaces
  - oblique surfaces
  - curved surfaces or holes.

Enrichment / Research Activities

- Demonstrate the development of orthographic drawings on a drafting board, using a model or isometric drawings.
- Demonstrate an understanding of orthographic drawing through the development of woodworking project plans.
- Demonstrate the development of orthographic drawings using a CAD program.

Resources

Texts/Teacher Resources

Alberta Module 020107bA
Orthographic Drawings - Part A
Alberta Module 020107bB
Orthographic Drawings - Part B
pp. 1-73

- *Mechanical Drawing*
  McGraw-Hill

SAS Resources

Visuals/Handouts/Tests

- Orthographic model
- Complete the third view
- ILM Exercises 1-5
  pp. 21-58

Internet

- Orthographic drawings

Calculate Perimeter and Centreline Perimeter

(~4 hours Classroom Component)

Introduction

Carpenters must make materials estimates and calculations almost every day. These calculations are used to order materials needed to keep the job site functioning in an effective and efficient manner. This module will help the apprentice develop the skills to calculate the perimeter of objects, buildings, and components. These skills may be transferred to the field where the apprentice will apply them in ordering and installing building components.

Specific Curriculum Outcome

20. Students will be able to use a calculator and the appropriate formulas to determine the perimeter and centreline perimeter for various shapes and buildings.

SCO - Delineations

Students will be expected to

20.1 identify and use formulas dealing with perimeter

20.2 complete calculations for centreline perimeter

Assessment Strategy

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020108b, *Calculate Perimeter and Centreline Perimeter*

Calculate Perimeter and Centreline Perimeter (~4 hours Classroom Component)

SCO 20. Students will be able to use a calculator and the appropriate formulas to determine the perimeters and centreline perimeters for various shapes and buildings.

SCO - Delineations	Student Knowledge, Abilities, and Competencies
Students will be expected to	*Topic: Perimeter Calculations*
20.1 identify and use formulas dealing with perimeter	• Define the term "perimeter." • Define "equilateral shapes." • State the formulas to determine the perimeter of an equilateral shape. • Calculate the perimeter of rectangles. • Calculate the perimeter of parallelograms. • Calculate the perimeter of a trapezoid. • Calculate the perimeter of a triangle. • Identify the parts of a circle. • Develop the ratio to determine pi (3.1416) by measuring the circumference and dividing by the diameter. • Calculate the perimeters of other complex shapes. • Calculate the perimeters of combination shapes with straight and rounded edges.
20.2 complete calculations for centreline perimeter	*Topic: Centreline Perimeter Calculations* • Identify outside and inside perimeters and determine the centreline perimeter. • Calculate the centreline perimeter. • Explain the basic rules for centreline perimeter calculation.

Calculate Perimeter and Centreline Perimeter (~4 hours Classroom Component)

SCO 20. Students will be able to use a calculator and the appropriate formulas to determine the perimeters and centreline perimeters for various shapes and buildings.

Teacher Lessons / Demonstrations

Topic: Perimeter Calculations
Numeracy

- Define the term "perimeter."
- Explain the parameters of equilateral shapes.
- Develop formulas for various equilateral shapes.
- Complete examples of problems to reinforce learning.
- Introduce parallelograms and develop formulas.
- Complete examples of problems to reinforce learning.
- Review the parts of a circle.
- Develop formulas for circles.
- Complete circle problems to reinforce learning.
- Expand knowledge to develop perimeters of various shapes and combinations of shapes.

Topic: Centreline Perimeter Calculations
Numeracy

- Develop formulas to determine centreline perimeter.
- Review rules of centreline perimeter calculation.

Student Activities / Assessments

Numeracy

- Determine the perimeters of objects by measuring and calculating.
- State the formulas to determine the perimeters of equilateral shapes.
- Calculate pi (3.1416) by measuring the circumference and dividing by the measured diameter.
- Complete material estimates from blueprints.

Enrichment / Research Activities

Numeracy

- Measure the foundation of your house and determine the amount of concrete required to construct the
  - walls
  - footings
  - floors.

Resources

Texts/Teacher Resources
Alberta Module 020108b
Calculate Perimeter and Centreline Perimeter
pp. 1-34

SAS Resources

Visuals/Handouts/Tests

- ILM Self-Test
  Calculate Perimeter and Centreline Perimeter, pp. 35-46

Framing Systems

(~4 hours Classroom Component)

Introduction

Framing is one of the basic skills that carpenters must develop. Various systems are used in the framing of buildings. Five of these systems will be examined in this module. The apprentice must become familiar with the design and framing of these systems and understand how structures transfer loads through the building and into the ground.

Specific Curriculum Outcome

21. Students will be able to describe the various wall framing systems for wood-frame buildings.

SCO - Delineations

Students will be expected to

21.1 identify and describe different framing systems

21.2 describe how load transfer and material shrinkage affect these systems

Assessment Strategies

Paper/Pencil
Self/Peer-Assessments
Skills Performance
Teacher Observation
Career Portfolio

Resources

Alberta Module 020202a, *Framing Systems*

Framing Systems (~4 hours Classroom Component)

SCO 21. Students will be able to describe the various wall framing systems for wood frame buildings.

SCO - Delineations

Students will be expected to

21.1 identify and describe different framing systems

Student Knowledge, Abilities, and Competencies

Topic: Framing Systems

- Identify and list five wall framing systems.
- Demonstrate an understanding of platform framing:
  - Describe the basic concept of platform framing.
  - Explain the load distribution in a platform framing system.
  - Identify and describe the components of platform framing.
  - Explain the fabrication and assembly of lintels and cripple studs, used in wall openings.
  - Explain the size, spacing, and placement of studs.
- Explain wood shrinkage in lumber, and how this may affect a framed structure.
- Use charts to interpret data required to size various framing members.
- Demonstrate an understanding of balloon framing:
  - Describe the basic concept of balloon framing.
  - Identify and describe the components of balloon framing.
  - Describe the history and use of balloon framing.
- Demonstrate an understanding of post and beam construction:
  - Describe the basic concept of post and beam construction.
  - Identify and describe the components of post and beam.
  - Demonstrate an understanding of the history and use of post and beam construction.
- Demonstrate an understanding of pole buildings.
  - Describe the basic concept of pole building construction.
  - Describe common applications of pole construction.
- Demonstrate an understanding of structural insulated panels.
  - Describe the design concept of structural panels, and compare them to built-on-site components.
- List three common uses of structural insulated panels.

Framing Systems (~4 hours Classroom Component)

SCO 21. Students will be able to describe the various wall framing systems for wood frame buildings.

Teacher Lessons / Demonstrations

Topic: Framing Systems

Platform Framing

- Explain that platform framing is the most common type of framing used in residential construction.
- Describe the components of platform framing.
- Explain the common spacing of studs and sizing of lintels.
- Demonstrate the method used to lay out walls.
- Describe the load distribution through walls.
- Demonstrate how to use codes and charts to obtain data to design and build walls.

Balloon Framing

- Define the structural features in balloon framing.
- Explain the need to install fire breaks.

Post and Beam

- Describe the structural features of post and beam construction.
- Demonstrate an understanding of the history and use of post and beam construction.

Pole Buildings

- Describe the structural features of pole buildings, along with local applications.
- List pros, and cons of pole buildings.

Structural Insulated Panels

- List uses of structural panels.

Literacy

- *KWL:* Tap students' prior to brainstorm examples of the five framing systems. Have them search for local examples (e.g., photos).
- *Brainstorm*: To share knowledge of other alternative types of framing systems.

CBL

- Visit a local building site to see the framing system.

Student Activities / Assessments

- Identify structural components for platform framing.
- Determine spacing of studs from NBC.

Numeracy

- Calculate the height of studs.
- Compile a nailing schedule.
- Determine the sizing for various lintels.
- Calculate cripple stud sizing for window openings.

Enrichment / Research Activities

- Complete a research project on one of the following:
  - post and beam construction
  - structural insulated panels
  - pole barn construction
  - alternative framing methods (straw bale, cob, cordwood, rammed earth, log, insulated concrete forms)

Resources

Texts/Teacher Resources

Alberta Module 020202a
Framing Systems
pp. 1-15

- CMHC: *Canadian Wood-Frame House Construction*
- National Building Code

Videos

- Selected videos from provincial library

Visuals/Handouts/Tests

- Platform framing
- Balloon framing
- Post and beam
- ILM Self-Test
  Framing Systems, pp. 23-25

Internet

- Stud wall framing
- Manufacturers' sites
- Alternative house construction

Framing Systems (~4 hours Classroom Component)

SCO 21. Students will be able to describe the various wall framing systems for wood frame buildings.

SCO - Delineations

Students will be expected to

21.2 describe how load transfer and material shrinkage affect these systems

Student Knowledge, Abilities, and Competencies

Topic: Lumber Grading and Moisture Content

- Interpret lumber grade stamps.
- Describe the process of lumber shrinkage and explain how each dimension is affected.
- Explain that lumber used for framing should be below 19% moisture content.
- Explain that kiln-dried lumber must be below 19% moisture content.
- Explain how lumber shrinkage will affect house framing and how it will show up.
- Demonstrate an understanding that lumber shrinks across the grain but very little along the grain.

Topic: Load Transfer

- Explain the transfer of loads from the roof system, through the walls, and into the ground.
- Describe the load transfer in common roof trusses and conventional lumber framing.
- Explain how the load is transferred through the walls in platform framing systems.
- Define the terms “knee wall” and “pony wall.” Explain how lateral loads affect these walls.
- Explain how the loads are transferred through balloon framing, post and beam, and structural insulated panels.
- Explain how wind loads affect structures.
- Identify the loads on a building:
  - dead loads
  - live loads
  - snow loads
  - wind loads
  - earthquake loads
- Describe and explain various methods for bracing buildings:
  - stressed skin sheathing
  - wood diagonal bracing
  - steel bracing
  - specialty fasteners (joist hangers, hurricane ties)
  - knee braces
  - buttresses

Framing Systems (~4 hours Classroom Component)

SCO 21. Students will be able to describe the various wall framing systems for wood frame buildings.

Teacher Lessons / Demonstrations

Topic: Lumber Grading and Moisture Content
- Show examples of lumber grade stamps.
- Demonstrate lumber shrinkage.
- Explain drying process at the cellular level.
- Explain requirements for kiln-dried lumber (19% mc.).

Literacy:
- *Read Aloud*: Read and interpret a lumber stamp.
- *Think Aloud:* Use a Think Aloud strategy to help students understand the wood drying process at the cellular level.

Topic: Load Transfer
- Describe the transfer of loads through a truss system.

Literacy
- *Brainstorm:* With the class, brainstorm possible loads on a building, and categorize as live or dead loads.
- *Read Aloud*: Use a Read Aloud strategy to facilitate students' understanding of building load transfer.

Student Activities / Assessments

- Identify lumber drying defects.
- Interpret lumber grade stamps.
- Complete a lab on determining moisture content.
- Determine and calculate building loads.
- Interpret from charts the appropriate size and spacing of framing members.

Enrichment / Research Activities

- Complete a project on designing structures for
  - hurricanes
  - earthquakes
  - floods
  - frost
- Research disasters caused by poor construction methods.

Resources

Texts/Teacher Resources
Alberta Module 020202a
Framing Systems
pp. 16-25

- CMHC, *Canadian Wood-Frame House Construction*
- National Building Code

SAS Resources

Visuals/Handouts/Tests
- Lumber shrinkage
- Lumber warpage
- ILM Self-Test
  Framing Systems, pp. 23-25

Internet
- Canadian Wood Council
- Lumber defects