SKILLEDTRADES BC

PROGRAM OUTLINE

Piledriver and Bridgeworker

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Piledriver and Bridgeworker

PROGRAM OUTLINE

APPROVED BY INDUSTRY

July 2016

Revisions Dec 2023

Developed By
SkilledTradesBC
Province of British Columbia

TABLE OF CONTENTS

Section 1

INTRODUCTION

Piledriver and Bridgeworker

Foreword

This revised Piledriver and Bridgeworker Program Outline is intended as a guide for instructors, apprentices, and employers of apprentices as well as for the use of industry organizations, regulatory bodies and provincial and federal governments. It reflects updated standards based on British Columbia industry and instructor subject matter experts.

Practical instruction by demonstration and student participation should be integrated with classroom sessions. Safe working practices, even though not always specified in each operation or topic, are an implied part of the program and should be stressed throughout the apprenticeship.

This Program Outline includes a list of recommended reference textbooks that are available to support the learning objectives and the minimum shop requirements needed to support instruction.

The Program Outline was prepared with the advice and assistance of Piledriver and Bridgeworker Review Committee and will form the basis for further updating of the British Columbia Piledriver and Bridgeworker Program and learning resources by the Construction Industry Training Organization on behalf of SkilledTradesBC.

Each competency is to be evaluated through the use of written examination in which the learner must achieve a minimum of 70% in order to receive a passing grade for that competency. The types of questions used on these exams must reflect the cognitive level indicated by the learning objectives and the learning tasks listed in the related competencies.

Achievement Criteria are included for those competencies that require a practical component. The intent of including Achievement Criteria in the program outline is to ensure consistency in training across the many training institutions in British Columbia. Their purpose is to reinforce the theory and to provide a mechanism for evaluation of the learner's ability to apply the theory to practice. It is important that these performances be observable and measureable and that they reflect the skills spelled out in the competency as those required of a competent journeyperson. The conditions under which these performances will be observed and measured must be clear to the learner as well as the criteria by which the learner will be evaluated. The learner must also be given the level of expectation of success.

The performance spelled out in the Achievement Criteria is a suggested performance and is not meant to stifle flexibility of delivery. Training providers are welcome to substitute other practical performances that measure similar skills and attainment of the competency. Multiple performances may also be used to replace individual performances where appropriate.

SAFETY ADVISORY

Be advised that references to the WorkSafeBC Safety Regulation contained within these materials do not/may not reflect the most recent Occupational Health and Safety Regulation. The current Standards and Regulation in BC can be obtained on the following website: http://www.worksafebc.com. Please note that it is always the responsibility of any person using these materials to inform him/herself about the Occupational Health and Safety Regulation pertaining to his/her work.

Acknowledgements

This Program Outline was prepared with the advice and direction from the Piledriver and Bridgeworker Review Committee with funding support from SkilledTradesBC.

- Kurt Kashuba, Pile Drivers, Divers, Bridge, Dock and Wharf Builders Local Union 2404
- Alf Leimert, Retired
- Bryan Longmuir, Retired
- Casey Nichols, Fraser River Pile & Dredge
- Tyler Patterson, Formula Contractors
- Steve Reid, Piledrivers JATC
- David Turenne, Mainroad South Island Contracting LP

Previous Contributors (2010):

- Ray Heaton
- Clancy Lannon
- Steven Reid
- Mike Bennie Sr.
- Darrell Hawk
- Donald Reid P. Eng.

SkilledTradesBC would like to acknowledge the dedication and hard work of the industry representatives appointed to identify the training requirements of the Piledriver and Bridgeworker occupation.

Section 2

PROGRAM OVERVIEW

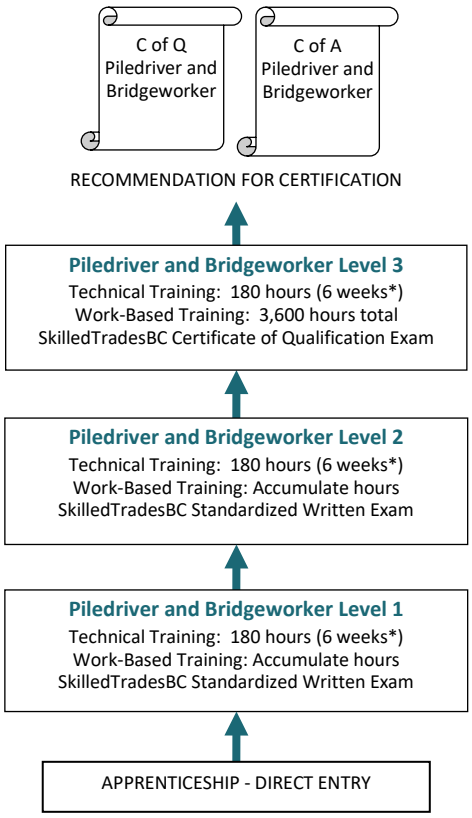
Piledriver and Bridgeworker

Program Credentialing Model

Apprenticeship Pathway

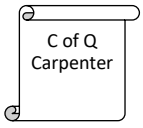
This graphic provides an overview of the Piledriver and Bridgeworker apprenticeship pathway.

C of Q = Certificate of Qualification
C of A = Certificate of Apprenticeship



**Suggested duration based on 30-hour week*

CROSS-PROGRAM CREDITS
Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program



Technical Training: Level 2
Work-Based Training: None

Occupational Analysis Chart

Piledriver and Bridgeworker

Occupation Description: "Piledriver and Bridgeworker" means a person who constructs, installs, repairs or removes all types of deep piles and caisson foundations and other types of marine installations: such as bridges, docks, wharves, tunnels and bulkheads. Skills required are fitting, welding, rigging, form-work and timber/concrete construction, seamanship, heavy-duty equipment operation and environmentally safe practices.

Competency	Task	Code					
Apply Safe Work Practices (A)	Apply Site Safety Practices	A1	1	2			
	Apply Personal Safety Practices	A2	1				
	Use Globally Harmonized System (WHMIS)	A3	1				
	Use Fire Safety Procedures	A4	1				
	Work Safely with Piledriving Equipment	A5	1		3		
	Work Safely with Marine Equipment	A6	1				
	Use Confined Space Entry Procedures	A7	1				
	Prevent Environmental Damage	A8	1		3		
	Use Fall Protection	A9	1				
Use Documentation and Organizational Skills (B)	Use Construction Drawings and Specifications	B1	1	2	3		
	Interpret Building Codes and Bylaws	B2	1				
	Use Trade Related Math	B3	1				
	Use Trade Related Science	B4	1		3		
	Interpret Contracts and Specifications	B5			3		
Use Tools and Equipment (C)	Use Hand Tools	C1	1				
	Use Portable Power Tools and Equipment	C2	1		3		
	Use Shop Equipment	C3	1				
	Use Oxy-Fuel Cutting Equipment	C4	1		3		
	Use Shielded Metal Arc Welding (SMAW) Equipment	C5	1		3		
	Use and Maintain Specialized Tools for Timber Construction	C6			3		
Use Survey Instruments and Other Levelling and Measuring Techniques (D)	Use Levelling Instruments and Equipment	D1	1	2	3		
	Use Levelling and Measuring Techniques	D2			3		

Use Access, Rigging and Hoisting Equipment **E**	Use Ladders, Scaffolds and Access Equipment E1	1	2	3			Use Rigging and Hoisting Equipment E2		2				Use Hoisting Equipment and Rigging Techniques E3	1		3			Use Support Equipment E4	1		3		
Perform Site Layout **F**	Lay out Bridge Abutment and Pier Locations F1	1	2				Prepare Job Site F2		2				Lay out a Foundation Piling Project F3			3			Apply Excavation and Shoring Practices F4		2			
Build Concrete Formwork **G**	Use Concrete Types, Materials, Additives and Treatments G1	1	2				Build Footing and Vertical Formwork G2	1	2				Select and Build Concrete Forming Systems G3		2	3			Build Slab-on-Grade Forms and Suspended Slab Forms G4		2			
	Install Reinforcement and Embedded Items G5		2	3			Place and Finish Concrete G6		2	3			Install Specialized Formwork G7		2				Install Pre-cast and Pre-stressed Concrete G8			3		
	Install Construction and Expansion Joints G9			3			Maintain and Repair Concrete Structures G10			3													
Describe the Piledriver and Bridgeworker Trade **H**	Identify Tasks Performed by Piledrivers and Bridgeworkers H1	1					Describe Types of Bridges H2	1					Describe Types of Marine Structures H3	1					Describe Exclusion and Retaining Structures H4	1				
Use Marine Work Procedures **I**	Follow Navigation Rules I1			3			Use Moving and Positioning Vessels I2	1		3			Interpret Tide Tables and Marine Charts I3	1										

Build Exclusion and Retention Structures — J

Code	Competency					
J1	Describe Exclusion and Retention Structures			3		
J2	Build Cofferdams			3		
J3	Build Bulkheads			3		
J4	Build Tieback Walls			3		

Use Pile and Foundation Procedures — K

Code	Competency					
K1	Describe the Properties and Testing of Soils			3		
K2	Use Unique Installation and Soil Improvement Techniques			3		
K3	Describe Types of Piles and Deep Foundations	1		3		
K4	Install and Extract Piles			3		
K5	Use Piledriving Equipment	1		3		
K6	Describe the Design, Testing and Inspection of Piles			3		
K7	Use Load Testing Procedures			3		
K8	Use Pile and Foundation Repair and Maintenance Procedures			3		

Build with Timber and Steel — L

Code	Competency					
L1	Build with Timber	1		3		
L2	Build with Structural Steel		2	3		

Install, Repair and Maintain Bridges, Ramps and Marine Structures — M

Code	Competency					
M1	Repair and Maintain Bridge Decks and Components	1		3		
M2	Repair and Maintain Bridge and Ramp Bearings			3		
M3	Assemble and Launch Bridges and Girders			3		

Training Topics and Suggested Time Allocation: Level 1

Piledriver and Bridgeworker – Level 1

			% of Time Allocated to:		
		%	Theory	Practical	Total
Line A	**Apply Safe Work Practices**	**15%**	**90%**	**10%**	**100%**
A1	Apply Site Safety Practices		✓		
A2	Apply Personal Safety Practices		✓		
A3	Use Globally Harmonized System (WHMIS)		✓		
A4	Use Fire Safety Procedures		✓		
A5	Work Safely with Piledriving Equipment		✓		
A6	Work Safely with Marine Equipment		✓		
A7	Use Confined Space Entry Procedures		✓	✓	
A8	Prevent Environmental Damage		✓		
A9	Use Fall Protection		✓		
Line B	**Use Documentation and Organizational Skills**	**10%**	**100%**	**0%**	**100%**
B1	Use Construction Drawings and Specifications		✓		
B2	Interpret Codes and Bylaws		✓		
B3	Use Trade Related Math		✓		
B4	Use Trade Related Science		✓		
Line C	**Use Tools and Equipment**	**15%**	**65%**	**35%**	**100%**
C1	Use Hand Tools		✓	✓	
C2	Use Portable Power Tools and Equipment		✓	✓	
C3	Use Shop Equipment		✓		
C4	Use Oxy-fuel Cutting Equipment		✓	✓	
C5	Use Shielded Metal Arc Welding (SMAW) Equipment		✓		
Line D	**Use Survey Instruments and Other Levelling and Measuring Techniques**	**5%**	**50%**	**50%**	**100%**
D1	Use Levelling Instruments and Equipment		✓	✓	
Line E	**Use Access, Rigging and Hoisting Equipment**	**15%**	**65%**	**35%**	**100%**
E1	Use Ladders, Scaffolds and Access Equipment		✓		
E3	Use Hoisting Equipment and Rigging Techniques		✓	✓	
E4	Use Support Equipment		✓	✓	
Line F	**Perform Site Layout**	**4%**	**70%**	**30%**	**100%**
F1	Lay out Bridge Abutment and Pier Locations		✓	✓	
Line G	**Build Concrete Formwork**	**10%**	**75%**	**25%**	**100%**
G1	Use Concrete Types, Materials, Additives and Treatments		✓		
G2	Build Footing and Vertical Formwork		✓	✓	
Line H	**Describe the Piledriver and Bridgeworker Trade**	**4%**	**100%**	**0%**	**100%**
H1	Identify Tasks Performed by Piledrivers and Bridgeworkers		✓		
H2	Describe Types of Bridges		✓		
H3	Describe Types of Marine Structures		✓		
H4	Describe Exclusion and Retaining Structures		✓		

			% of Time Allocated to:		
		%	Theory	Practical	Total
Line I	**Use Marine Work Procedures**	**8%**	**100%**	**0%**	**100%**
I2	Use Moving and Positioning Vessels		✓		
I3	Interpret Tide Tables and Marine Charts		✓		
Line K	**Use Pile and Foundation Procedures**	**7%**	**100%**	**0%**	**100%**
K3	Describe Types of Piles and Deep Foundations		✓		
K5	Use Piledriving Equipment		✓		
Line L	**Build with Timber and Steel**	**5%**	**100%**	**0%**	**100%**
L1	Build with Timber		✓		
Line M	**Install, Repair and Maintain Bridges, Ramps and Marine Structures**	**2%**	**100%**	**0%**	**100%**
M1	Repair and Maintain Bridge Decks and Components		✓		
	Total Percentage for Piledriver and Bridgeworker Level 1	**100%**			

Training Topics and Suggested Time Allocation: Level 2

Piledriver and Bridgeworker – Level 2

			% of Time Allocated to:		
		%	Theory	Practical	Total
Line A	**Apply Safe Work Practices**	**3%**	**100%**	**0%**	**100%**
A1	Apply Site Safety Practices		✓		
Line B	**Use Documentation and Organizational Skills**	**5%**	**50%**	**50%**	**100%**
B1	Use Construction Drawings and Specifications		✓	✓	
Line D	**Use Survey Instruments and Other Levelling and Measuring Techniques**	**15%**	**65%**	**35%**	**100%**
D1	Use Levelling Instruments and Equipment		✓	✓	
Line E	**Use Access, Rigging and Hoisting Equipment**	**25%**	**45%**	**55%**	**100%**
E1	Use Ladders, Scaffolds and Access Equipment		✓	✓	
E2	Use Rigging and Hoisting Equipment		✓	✓	
Line F	**Perform Site Layout**	**15%**	**80%**	**20%**	**100%**
F1	Lay out Bridge Abutment and Pier Locations		✓	✓	
F2	Prepare Job Site		✓		
F4	Apply Excavation and Shoring Practices		✓		
Line G	**Build Concrete Formwork**	**34%**	**70%**	**30%**	**100%**
G1	Use Concrete Types, Materials, Additives and Treatments		✓		
G2	Build Footing and Vertical Formwork		✓	✓	
G3	Select and Build Concrete Forming Systems		✓		
G4	Build Slab-On-Grade Forms and Suspended Slab Forms		✓	✓	
G5	Install Reinforcement and Embedded Items		✓	✓	
G6	Place and Finish Concrete		✓		
G7	Install Specialized Formwork		✓		
Line L	**Build with Timber and Steel**	**3%**	**100%**	**0%**	**100%**
L2	Build with Structural Steel		✓		
	Total Percentage for Piledriver and Bridgeworker Level 2	**100%**			

Training Topics and Suggested Time Allocation: Level 3

Piledriver and Bridgeworker – Level 3

			% of Time Allocated to:		
		%	Theory	Practical	Total
Line A	**Apply Safe Work Practices**	**5%**	**100%**	**0%**	**100%**
A5	Work Safely with Piledriving Equipment		✓		
A8	Prevent Environmental Damage		✓		
Line B	**Use Documentation and Organizational Skills**	**10%**	**65%**	**35%**	**100%**
B1	Use Construction Drawings and Specifications		✓		
B4	Use Trade Related Science		✓		
B5	Interpret Contracts and Specifications		✓	✓	
Line C	**Use Tools and Equipment**	**10%**	**65%**	**35%**	**100%**
C2	Use Portable Power Tools and Equipment		✓	✓	
C4	Use Oxy-fuel Cutting Equipment		✓	✓	
C5	Use Shielded Metal Arc Welding (SMAW) Equipment		✓	✓	
C6	Use and Maintain Specialized Tools for Timber Construction		✓		
Line D	**Use Survey Instruments and Other Levelling and Measuring Techniques**	**10%**	**50%**	**50%**	**100%**
D1	Use Levelling Instruments and Equipment		✓	✓	
D2	Use Levelling and Measuring Techniques		✓	✓	
Line E	**Use Access, Rigging and Hoisting Equipment**	**15%**	**90%**	**10%**	**100%**
E1	Use Ladders, Scaffolds and Access Equipment		✓		
E3	Use Hoisting Equipment and Rigging Techniques		✓	✓	
E4	Use Support Equipment		✓		
Line F	**Perform Site Layout**	**5%**	**50%**	**50%**	**100%**
F3	Lay out a Foundation Piling Project		✓	✓	
Line G	**Build Concrete Formwork**	**5%**	80%	**20%**	**100%**
G3	Select and Build Concrete Forming Systems		✓	✓	
G5	Install Reinforcement and Embedded Items		✓	✓	
G6	Place and Finish Concrete		✓		
G8	Install Pre-cast and Pre-stressed Concrete		✓		
G9	Install Construction and Expansion Joints		✓		
G10	Maintain and Repair Concrete Structures		✓		

			% of Time Allocated to:		
		%	Theory	Practical	Total
Line I	**Use Marine Work Procedures**	**5%**	**100%**	**0%**	**100%**
I1	Follow Navigation Rules		✓		
I2	Use Moving and Positioning Vessels		✓		
Line J	**Build Exclusion and Retention Structures**	**10%**	**75%**	**25%**	
J1	Describe Exclusion and Retention		✓		
J2	Build Cofferdams		✓	✓	
J3	Build Bulkheads		✓		
J4	Build Tieback Walls		✓		
Line K	**Use Pile and Foundation Procedures**	**15%**	**70%**	**30%**	**100%**
K1	Describe the Properties and Testing of Soil		✓		
K2	Use Unique Installation and Soil Improvement Techniques		✓		
K3	Describe Types of Piles and Deep Foundations		✓		
K4	Install and Extract Piles		✓	✓	
K5	Use Piledriving Equipment		✓	✓	
K6	Describe the Design, Testing and Inspection of Piles		✓		
K7	Use Load Testing Procedures		✓		
K8	Use Pile and Foundation Repair and Maintenance Procedures		✓		
Line L	**Build with Timber and Steel**	**5%**	**65%**	**35%**	**100%**
L1	Build with Timber		✓		
L2	Build with Structural Steel		✓	✓	
Line M	**Install, Repair and Maintain Bridges, Ramps and Marine Structures**	**5%**	**100%**	**0%**	**100%**
M1	Repair and Maintain Bridge Decks and Components		✓		
M2	Repair and Maintain Bridge and Ramp Bearings		✓		
M3	Assemble and Launch Bridges and Girders		✓		
	Total Percentage for Piledriver and Bridgeworker Level 3	**100%**			

Section 3
PROGRAM CONTENT

Piledriver and Bridgeworker

Level 1

Piledriver and Bridgeworker

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A1 Apply Site Safety Practices

Objectives

To be competent in this area, the individual must be able to:

- Describe safe work practices used in the Piledriver and Bridgeworker trade.
- Apply the safe work practices used in the Piledriver and Bridgeworker trade.

LEARNING TASKS	CONTENT
1. Use applicable sections of the WorkSafeBC Regulations	• Place of employment • Harmful substances • Health hazards and work environment controls • Personal protective equipment • Electrical safety • Powder actuated tools • Electrical systems • Temporary lighting • Ladders • Scaffolds, swing stages and miscellaneous stages • Construction procedures • Excavation • Demolition • Rigging • Welding, burning and soldering • Proximity to overhead power lines • Woodworking machinery and processing • Underground workings • Cranes, derricks and miscellaneous hoisting equipment • Pile driving and dredging • Wharves, dock and floating equipment • Lead and asbestos exposure • Diving procedures

2. Describe rights and responsibilities

- Employer
  - Provide a safe worksite
  - Provide training
  - Provide safety equipment
  - Perform job hazard analysis
  - Occupation Health and Safety Program
- Supervisor
  - Ensure the health and safety of all workers under their direct supervision
- Worker
  - Right to receive safety training
  - Right to refuse unsafe work
  - Must follow WorkSafeBC regulations

3. Describe general safety hazards and precautions

- Safety attitude
- Hazards of loose clothing and jewellery
- Inspecting condition of tools
- Using proper tools
- Awareness of potential hazards
  - Unstable objects
  - Falling objects
  - Tripping
  - Pinch points
- Guards and barriers
- Operating hazardous equipment
- Using hazardous materials and harmful substances
- Flammable, explosion, and electrical hazards
- Grounding of tools and equipment
- Lockout procedures
- Housekeeping
- Using compressed air
- Sound and light signals
- Entering confined spaces
- Location of emergency response items
- Personal protective equipment
- Avalanche hazard awareness

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A2 Apply Personal Safety Practices

Objectives

To be competent in this area, the individual must be able to:

- Select and use personal protective equipment (PPE).
- Select and use fall protection systems.
- Use proper lifting techniques.
- Use precautions when working in a variety of weather conditions.

LEARNING TASKS

1. Describe personal protective equipment requirements

CONTENT

- WorkSafeBC regulations
- Fall protection
  - Fall restraint
  - Fall arrest
  - Harnesses, lanyards, lifelines
- Safety footwear
  - CSA Standards
- Eye protection
  - Glasses
  - Goggles
  - Face shields
- Hearing protection
  - Hearing testing
  - Earplugs and canal caps
  - Earmuffs
  - Class/grade selection based on exposure level
- Head protection
  - CSA and ANSI types
- Respiratory protection
  - Respirator types
  - Positive and negative seal check
  - Fit testing
  - Types of breathing hazards
  - Filters and cartridges
  - Protection factors
  - Warning signs of respirator failure
  - Hazard/product specific
- Clothing
  - High visibility
  - Hazard/product specific
- Hand protection
  - Gloves
  - Barrier creams

- Knee protection
- Specialty items
  - Power saw chaps
  - Personal flotation device (PFD)

2. Use personal protective equipment
   - Selection
   - Purpose
   - Training requirements
   - Inspection
   - Maintenance
   - Storage

3. Describe safety precautions for various weather conditions
   - Hypothermia
   - Dehydration
   - Heat stress and heat exhaustion
   - Slippery surfaces
   - High winds
   - Wave action

4. Lift and move objects safely
   - Rules for lifting and moving objects
   - Procedures for lifting objects
   - Plywood
   - Planks and beams
   - Steel pipe
   - Ladders
   - Wheelbarrows
   - Shoveling
   - Barrels and drums
   - Small pails
   - Boxes

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A3 Use Globally Harmonized System (WHMIS)

Objectives

To be competent in this area, the individual must be able to:

- Describe the purpose of the GHS (WHMIS) Regulations.
- Choose work strategies to minimize the exposure to and risks associated with hazardous materials found in the workplace.
- Explain the contents of Safety Data Sheets (SDS).
- Explain the contents of a GHS (WHMIS) label.
- Apply GHS (WHMIS) regulations.

LEARNING TASKS	CONTENT
1. Describe legislation	• Federal o Hazardous Product Act ‣ Controlled Products Regulations ‣ Ingredient Disclosure List o Hazardous Materials Information Review Act • Provincial o Use of hazardous materials in the workplace
2. Describe the purpose of the Globally Harmonized System (WHMIS)	• Protection • Responsibilities o Workers o Employers o Suppliers o Regulators
3. Describe the key elements of GHS (WHMIS)	• Safety data sheets (SDSs) • Labelling of containers of hazardous materials • Worker education programs
4. Describe responsibilities under GHS (WHMIS)	• Suppliers o Provide SDSs o Provide supplier labels • Employers o Provide worker access to SDSs o Work education programs in the workplace o Ensure proper storage and handling of materials • Workers o Comprehension of information on SDSs and labels

- Inform employers of missing or illegible labels

5.	Describe information disclosed on a Safety Data Sheet	• Hazardous ingredients • Preparation information • Product information • Physical data • Fire or explosion • Reactivity data • Toxicological properties • Preventive measures • First-aid measures
6.	Identify symbols found on GHS (WHMIS) labels	• Compressed gases • Flammable and combustible materials • Oxidizing materials • Poisonous and infectious materials o Materials causing immediate and serious toxic effects o Materials causing other toxic effects o Biohazardous infectious materials • Corrosive materials • Dangerously reactive materials
7.	Identify symbols on consumer product labels used in the workplace	• Toxic • Corrosive • Flammable • Explosive
8.	Apply GHS (WHMIS) regulations as they apply to hazardous materials used in the shop	• Use, storage and disposal of shop materials

Line (GAC): **A** **APPLY SAFE WORK PRACTICES**
Competency: **A4** **Use Fire Safety Procedures**

Objectives
To be competent in this area, the individual must be able to:

- Explain the theory of fires.
- Extinguish fires.
- Handle and store fuels and solvent based products.
- Install and maintain temporary heating.

LEARNING TASKS	CONTENT

1. List the three components that must be present before a fire can occur	• Fuel
	• Oxygen
	• Heat
	  o Open flame
	  o Sparks
	  o Welding and cutting processes
	  o Static discharge
	  o Electrical equipment

2. Identify classes of fires Class A, B, C and D fires and extinguishing methods	• Class A, B, C and D fires • Types of extinguishers • Welding blanket • Emergency fire blanket

3. Describe the procedure for using a fire extinguisher	• P.A.S.S.
	  o Pull
	  o Aim
	  o Squeeze
	  o Sweep

4. Describe the considerations and steps to take prior to fighting a fire	• Warning others • Phoning fire department • Personal method of egress

5.	Identify combustible and flammable materials	• WHMIS symbols
		• Flash point
		• Ignition temperature
		• Fuels
		  o Diesel
		  o Gasoline
		  o Propane
		  o Natural gas
		• Solvents
		• Lubricants
		• Oily rags
		• Combustible metals
		• Aerosols

6.	Use preventative fire safety procedures	• Training requirements
		• Handling and storing
		  o Flammable liquids and gases
		  o Combustible materials
		• Working near electrical apparatus
		• Responsibilities
		• Pre-planning
		• Evacuation procedures
		• Hot work permit (site specific)
		• Handling and storage of flammable materials
		• Ventilation
		• Electrical wiring and equipment
		• Static electricity
		• Controlling spills
		• Storage

7.	Describe the safe installation of temporary heating	• Propane heaters • Electric heaters • Fumes • Proximity to flammables and combustibles • Pilot lights
8.	Describe the hazards in dealing with forest and urban interface fires	• Training requirements • Assessment and escape

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A5 Work Safely with Piledriving Equipment

Objectives
To be competent in this area, the individual must be able to:

- Work safely with pile driving equipment.

LEARNING TASKS	CONTENT
1. Describe safety procedures when working with crane pile drivers	• Weight of lift • Crane charts • Level ground • Use of crane mats • Working distance from unstable slopes • Tag lines • Boom tie down • Inspection before and after use of vibro driver/extractor and crane boom • Inspect all attachments used for pile driving • Working distance from power lines • Underground utilities • Tail swing clearance
2. Describe working safely with pile hammers and leads	• Hammer connections • Line wear • Safety straps for hose connections • Maintaining stability of hammer with extended leads • Loads from using side battering leads
3. Apply safety practices	• Use WorkSafeBC Regulations during work procedures

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A6 Work Safely with Marine Equipment

Objectives
To be competent in this area, the individual must be able to:

- Work safely with marine equipment.

LEARNING TASKS	CONTENT
1. Describe the operation of a crane on a barge	• Reduced safe capacities of crane • Maintaining stability o Centre of gravity of load • Counterweight swing • Maintaining freeboard • Effects of free water surface • Reduced capacity and reach with list • Ballasting for heavy lifts • Position of anchors and spuds • Cautions for waves and vessel wakes • Change in radius as load is picked

2. Describe safe operation and mooring of marine equipment	• Draft and underwater obstructions
	• Sounding the bottom
	• Effect of waves and swells
	• Water current
	• Securing lines to docks and dolphins
	  o Breast
	  o Spring
	  o Slip
	• Securing lines to cleats, bollards, and tow bitts
	• Slacking spud lines for tide range
	• Checking hulls for leaks and bilge water

3. Describe safety precautions when working with marine equipment	• Personal floatation device • Life rings • Safety boat or skiff • Precautions when entering hulls/confined spaces • Ladders • Gangways for access

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A7 Use Confined Space Entry Procedures

Objectives

To be competent in this area, the individual must be able to:

- Recognize confined space hazards for pile drivers and bridgeworkers.
- Describe the safe entry procedures for confined space entry.
- Describe measures used to control hazards in confined spaces.
- Work safely in confined spaces.

LEARNING TASKS	CONTENT
1. Describe WorkSafeBC requirements for a confined space entry program	• Responsibilities of employers o Written confined space entry program o Assigning responsibilities o Hazard assessments o Minimizing hazards • Supervision of the entry • Listing of site confined spaces • Signage/identification of confined spaces • Securing against entry • Work procedures o Entry permits o Lockout and isolation o Verification and testing o Cleaning, purging, venting and inerting o Ventilation o Standby personnel o Rescue o Rescue equipment o PPE o Coordination of work activities
2. Identify confined spaces in the pile driver/bridgeworker trade	• Examples in the workplace • Low, moderate and high-hazard atmosphere ratings • Characteristics of confined spaces o Enclosed or partially enclosed o Intended uses o Entry and exit limitations o Size of confined space
3. Describe instruction and training requirements	• Workers entering the confined space • Standby workers • Rescue personnel

4.	Describe potential hazards	• Immediately Dangerous to Life or Health (IDLH) • Atmospheric • Thermal extremes • Engulfment and entrapment • Noise • Slipping and tripping • Electric shock
5.	Describe testing procedures	• Testing initial conditions • Continuous monitoring • Monitoring equipment
6.	Describe and use test procedures and equipment	• When to test • Where to test • Selection of monitoring equipment • Calibration of equipment • Testing records

7.	Describe control measures for safe entry	• Cleaning of space
		• Purging
		• Venting
		  o Local exhaust
		  o General ventilation
		  o Air moving devices
		• Controlling flammable substances
		• Preventing oxygen enrichment
		• Controlling sources of ignitions
		• Inerting

8.	Use rescue procedures	• Written rescue plan • Standby and rescue personnel • Rescue equipment

Achievement Criteria

Performance — The learner will be able to write a rescue plan for a confined space.
The learner will identify types of confined spaces.

Conditions — The learner will be given:

- A scenario for a worksite with confined spaces

Criteria — The learner will score 70% or better on a rating sheet that reflects the following criteria:

- Following safety procedures
- Use of PPE
- Identifying all spaces and hazards correctly
- All required information on rescue plan
- Completed within specified time

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A8 Prevent Environmental Damage

Objectives
To be competent in this area, the individual must be able to:

- Describe methods of protecting the environment while performing pile driver/bridgeworker work.

LEARNING TASKS	CONTENT
1. Describe causes of environmental damage	• Debris release • Leaching of materials • Spilling of chemicals • Leaky equipment
2. Describe the consequences of environmental damage	• Soil erosion • Disruption of water ways • Destruction of marine habitat • Destruction of spawning beds • Bubble curtain • Silting of spawning beds • Damage to vessels • Contamination of water systems • Soil contamination
3. Identify environmentally harmful construction products.	• Treated construction materials • Petroleum based products • Spoils and waste from work procedures

4. Describe methods of protecting the environment	• Emergency action plan and response procedures
	• Prevention of leakage and spillage
	• Adherence MSDS data sheets directions
	• Alternatives to hazardous products
	• Containment and storage of debris and waste from construction and sandblasting
	• Spill containment
	  o Spill kits
	  o Earth berms
	  o Silt curtains
	  o Containment booms
	  o Bag booms
	• Notification of appropriate authority
	  o Local port authority
	  o Environment Canada
	  o BC Ministry of Environment

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A9 Use Fall Protection

Objectives

To be competent in this area, the individual must be able to:

- Attain Fall Pro certification (in-house)

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B1 Use Construction Drawings and Specifications

Objectives

To be competent in this area, the individual must be able to:

- Interpret specific views of a set of drawings.
- Extract information from a set of construction drawings.

LEARNING TASKS	CONTENT
1. Describe the different types and uses of drawings	• Views • Types of drawings o Construction o Shop o Working sketches o Detail o Section o As-built
2. Describe the alphabet of lines, symbols and abbreviations used in drawings	• Lines • Symbols • Abbreviations
3. Describe the scales used in drawings	• Architect's scale • Metric scale • Engineer's scale
4. Describe drawing parts	• Title block • Revisions • Elevations • Schedules • Legends
5. Describe specifications	• Types and quality of materials • Construction procedures

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B2 Interpret Building Codes and Bylaws

Objectives
To be competent in this area, the individual must be able to:

- Explain codes affecting the pile driver/bridgeworker trade.
- Explain quality control procedures.

	LEARNING TASKS	CONTENT
1	Describe typical tolerances	• Installation of pile • Installation of structural steel • Concrete coverage over rebar
2	Describe material documentation	• Mill certificates for steel • Treatment certificates for timber • Concrete mix documentation • Lumber grades requirements
3	Describe the purpose of inspections	• Highway structures • Deficiencies
4	Use codes	• National Building Code • Provincial • Local • National Fire Code

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B3 Use Trade Related Math

Objectives
To be competent in this area, the individual must be able to:

- Use trade related math to solve problems.

LEARNING TASKS	CONTENT
1. Solve problems using whole numbers, fractions and decimal fractions	• Solving word problems • Key terms and concepts • Adding, subtracting, dividing and multiplying fractions and decimal fractions • Converting between decimals and fractions • Using calculator functions
2. Convert metric and Imperial measurements	• Converting within the Imperial system • Converting within the metric system • Converting between the Imperial and metric system
3. Solve ratio and proportional problems	• Key terms • Working with ratios • Working with proportions • Solving word problems with ratio and proportion
4. Solve problems involving roots and powers	• Key terms • Using scientific calculators
5. Interpret simple graphs	• Locating information on line, bar and circle graphs
6. Solve problems involving simple formulas	• Key terms • Order of operations in solving equations • Calculating perimeter, area and volume of geometric shapes • Pythagorean formula
7. Solve problems involving angles, triangles and geometric construction	• Using angles • Types of triangles • Using a protractor

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B4 Use Trade Related Science

Objectives
To be competent in this area, the individual must be able to:

- Describe loads and forces on structures.

LEARNING TASKS	CONTENT

1. Describe types of loads on structures	• Dead loads (DL)
	• Primary live loads (LL)
	• Secondary live loads (LL)
	• Application of loads
	  o Point loads
	  o Distributed loads
	• Uplifts

2. Describe dynamics of materials	• Effects of temperature on materials • Elastic and plastic states of materials • Stresses on materials

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C1 Use Hand Tools

Objectives

To be competent in this area, the individual must be able to:

- Describe the use of hand tools.
- Use and maintain measuring, layout and marking tools.
- Use and maintain cutting, boring and alignment tools.
- Use and maintain fastening tools.
- Sharpen tools.

LEARNING TASKS	CONTENT
1. Describe the care of hand tools	• Proper use • Adjustments • Maintenance • Storage • Safety precautions
2. Use measuring, layout and marking tools	• Metric and Imperial measurements • Tape measures and folding rules
3. Use layout and marking tools	• Care, maintenance and storage • Chalk line o Purpose o Procedures • Plumb bobs o Purpose o Procedures • Squares o Types o Uses o Procedures • Wraparounds o Purpose o Procedures • Levels o Types o Parts o Checking for accuracy • Builder's levels o Uses o Parts o Elevation points o Benchmarks

- Marking tools
  - Carpenter's pencil
  - Lumber crayon
  - Centre punch
  - Soapstone

4. Use hand tools

- Types and uses
- Knives
- Hammers
- Pliers
- Welding and cutting tools
- Wrenches
- Locking pliers
- Screwdrivers
- Hand saws
- Planes
- Chisels
- Drills and drill bits
- Small sledge hammers (beaters)

5. Use excavation tools

- Shovels
- Concrete scrapers
- Picks
- Mattocks
- Hand auger

6. Use timber tools

- Poleaxe
- Picaroon
- Peavey
- Pin maul hammer
- Pike pole
- Adze
- Wood auger

7. Use axes and hatchets

- Types and uses
- Safety hazards and precautions

Achievement Criteria

Performance	The learner will sharpen and use various hand tools.
Conditions	The learner will be given: • Hand tools • Sharpening instructions • Sharpening equipment
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Correct angle and edge sharpening • Use of proper tool for the work • Completed within specified time

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C2 Use Portable Power Tools and Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe the use of portable power tools.
- Use, adjust, and maintain portable power tools.

LEARNING TASKS	CONTENT

1. Describe the safe use of electric power tools	• Power supply
	• Safety precautions
	  o Ground fault interrupters (GFCIs)
	  o Grounding
	  o Condition of equipment
	  o Guards in place
	  o Operating rules
	  o Eye protection
	  o Appropriate clothing
	  o Avoiding common injuries
	• Maintenance and storage
	• Manufacturer's recommendations

2. Use and maintain grinders	• Applications • Types • Operating procedures

3. Use and maintain drills	• Operating procedures
	  o Handheld portable
	  o Magnetic
	  o Pneumatic
	  o Hammer
	  o Impact wrench

4. Use and maintain circular saws	• Applications • Types and size • Parts • Blade types • Operations • Accessories • Safety precautions • Adjustments • Maintenance and storage • Manufacturer's recommendations

5. Use and maintain chop saws	• Applications • Types and size • Parts • Blade types • Operations • Accessories • Safety precautions • Adjustments • Maintenance and storage • Manufacturer's recommendations
6. Use and maintain mitre saws	• Applications • Compound mitre saws • Types, sizes and capacities • Parts • Blade types • Operations • Accessories • Safety precautions • Adjustments • Maintenance and storage • Manufacturer's recommendations
7. Use electric drills and screw guns	• Applications • Types, sizes and speeds • Parts • Bit types • Fastener types • Operations • Accessories • Safety precautions • Adjustments • Maintenance and storage • Manufacturer's recommendations
8. Use and maintain pneumatic tools	• Supply system • Applications • Types, sizes and speeds • Parts • Fastener types • Operations • Accessories • Safety precautions

- Adjustments
- Maintenance and storage
- Manufacturer's recommendations

9. Use and maintain bench grinders

- Applications
- Wheel types, sizes and speed
- Dress wheels
- Parts
- Fastener types
- Operations
- Accessories
- Safety precautions
- Adjustments
- Maintenance and storage
- Manufacturer's recommendations

10. Use and maintain sabre and reciprocating saws

- Applications
- Types, sizes and speeds
- Parts
- Blade types
- Operations
- Accessories
- Safety precautions
- Adjustments
- Maintenance and storage
- Manufacturer's recommendations

11. Use battery-powered tools

- Applications
- Voltage
- Types, sizes and speeds
- Parts
- Fastener types
- Operations
- Accessories
- Safety precautions
- Adjustments
- Maintenance and storage
- Battery disposal
- Manufacturer's recommendations

12. Use and maintain powder-actuated tools	• Applications • Types • Parts • Fastener types and selection • Cartridge types and selection • Operations • Accessories • Safety precautions • WorkSafeBC Regulations • Training requirements • Hazard recognition • Adjustments • Maintenance and storage • Manufacturer's recommendations
13. Use and maintain chain saws	• Applications • Types and sizes • Parts • Chains • Operations • Accessories • Safety precautions • Kickback zone • Starting methods • WorkSafeBC Regulations • Protective clothing and equipment • Adjustments • Maintenance and storage • Manufacturer's recommendations

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C3 Use Shop Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe the use of a shop saw.
- Use, adjust and maintain a table saw.
- Describe the use of a radial-arm saw.
- Use, adjust and maintain a radial-arm saw.

LEARNING TASKS	CONTENT

1. Use and maintain stationary saws	• Types
	  o Table
	  o Radial arm
	• Applications
	• Sizes
	• Parts
	• Blade types and purpose
	• Accessories
	• Operations
	• Types of cuts
	• Safety precautions
	• Adjustments
	• Maintenance
	• Storage
	• Manufacturer's recommendations

2. Use drill press	• Applications • Safety precautions

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C4 Use Oxy-Fuel Cutting Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe the use of oxy-fuel cutting equipment.
- Use oxy-fuel cutting equipment to cut mild steel.

LEARNING TASKS	CONTENT
1. Describe safety requirements for using gas-burning equipment	• Manufacturer's recommendations • CSA codes • WorkSafeBC Regulations • BC Fire Services Act • Acceptable clothing • PPE • Containment control • Ventilation • Protection of equipment and components • Inspection of equipment • Handling and storage of cylinders • Marking of hot metal • Fire extinguishers • Wet down • Fire watch • Burn permits
2. Describe the oxy-fuel gas cutting process and its application	• Safety requirements for oxy-fuel gas cutting • Cutability of ferrous and non-ferrous metals • Thermal effects of oxy-fuel gases
3. Describe oxy-fuel gas cutting equipment	• Identify the gases used in oxy-fuel gas cutting • Oxygen and fuel gas cylinders • Pressure regulators and their functions • Oxy-fuel hoses and fittings • Cutting torches, cutting tips and heating tips • Oxy-fuel gas cutting accessories and machines • Gas manifold systems • Oxy-fuel gas cutting accessories and machines
4. Use oxy-fuel cutting equipment	• Assemble, ignite, shut down and maintain oxy-fuel gas cutting equipment • Maintain oxy-fuel gas cutting equipment

5.	Perform cuts on mild steel plate, sheet pile, H pile and pipe pile	• Characteristics of an acceptable cut • Freehand cuts on structural shapes and on round stock • Guided cuts on mild steel plate and sheet • Wash nuts off bolts and gouge weldments • Freehand cuts on mild steel pipe

Achievement Criteria

Performance	The learner will perform cuts on various shapes of mild steel.
Conditions	The learner will be given: • Various types of mild steel material • Oxy-fuel cutting equipment • Cutting instructions
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of cuts • Correct torch setup • Appropriate handling of equipment • Completed within specified time

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C5 Use Shielded Metal Arc Welding (SMAW) Equipment

Objectives

To be competent in this area, the individual must be able to:

- Describe the types of welding equipment used by pile drivers.

LEARNING TASKS	CONTENT
1. Describe welding processes and their applications	• Shielded Metal Arc Welding (SMAW) • Flux Covered Arc Welding (FCAW) • Submerged Arc Welding (SAW) • Types and sizes of welds • Basic weld symbols • Weld positions

Line (GAC): D USE SURVEY INSTRUMENTS AND OTHER LEVELLING AND MEASURING TECHNIQUES

Competency: D1 Use Levelling Instruments and Equipment

Objectives
To be competent in this area, the individual must be able to:
- Use levels for piledriving/bridgework applications.

LEARNING TASKS	CONTENT

1. Describe the use of levels	• Types and uses of levels
	  o Water
	  o Rotary laser
	  o Spirit
	  o Digital
	• Parts of levels
	• Causes of incorrect measurements
	• Maintenance and storage

2. Set up and use levels	• Instrument set-up • Laser hazard classifications • Testing level
3. Use levelling rods and measuring chains and tapes	• Parts • Scales • Rod types • Datum mark • Stadia lines • Chain and tape types • Hand signals
4. Record elevations using levelling instruments	• Benchmark (BM) • Station (Stn) • Backsight (BS) • Turning point (TP) • Height of instrument (HI) • Foresight (FS) • Intermediate sight (IS) • Elevations (ELEV) • Field books

Achievement Criteria

Performance	The learner will transfer elevation mark to pile for cut-off.
Conditions	The learner will be given: • Builder's level • Benchmark • Soap stone • Cut-off elevation
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of rod readings and mark on pile for cut-off • Proper process for field book recordings • Proper instrument setup • Completed within specified time

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E1 Use Ladders, Scaffolds and Access Equipment

Objectives

To be competent in this area, the individual must be able to:

- Describe types and uses of ladders.
- Describe types and uses of scaffolds.
- Use ladders and scaffolds to perform pile driver/bridgeworker work.

LEARNING TASKS	CONTENT
1. Describe types of temporary ramp, runways and stairs	• WorkSafeBC Regulations • Slopes • Guards
2. Use portable and fixed ladders	• WorkSafeBC Regulations • Portable ladder safety • Ladder types • Carrying, setting-up and using ladders • Job-built ladder construction
3. Describe types of ground based scaffolds	• Tube and coupler • Steel frame • Components • Scaffold design
4. Describe scaffold erection procedures	• WorkSafeBC Regulations • Mud sills • Members plumb and level • Stability • Guardrails and toe-boards • Scaffold planks • Work platforms • Plank support • Scaffold loads • Ladder access to scaffolds

5. Describe swing stages and suspended platforms	• WorkSafeBC Regulations
	• Types
	  o Swing stages
	  o Spiders
	  o Man baskets
	  o Gilley boards
	  o Pork barrels
	• Components

6. Setup and use elevated work platforms	• Ladders • Scaffolds

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E3 Use Hoisting Equipment and Rigging Techniques

Objectives

To be competent in this area, the individual must be able to:

- Successfully complete the four day "Rigging Techniques for Pile Drivers" course.
- Explain how good rigging practices relate to the pile driver.
- Use safety and communication methods.
- Read load charts and perform calculations.
- Perform reeving calculations and use reeving equipment.
- Demonstrate hand rigging and hand rigging with crane assist procedures.

LEARNING TASKS	CONTENT
1. Use WorkSafeBC regulations	• Part 14 Cranes and Hoists • Part 15 Rigging
2. Determine load weights and centre of gravity	• Job plans and specifications • Geometric formulas • Material weight and shapes tables • Moving hook, load and sling to achieve balance
3. Inspect and use common rigging hardware combinations and configurations	• Inspecting of hardware • Types of attachment hardware o Shackles o Hooks o Eyebolts o Turnbuckles o Sheaves o Wedge sockets o Cable clamps o Rigging beams o Fibre ropes • Inspecting wire rope o Rope diameter reduction o Number of broken wires • Lays of wire rope o Right and left regular lay o Right and left lang lay o Rotation resistance o Use, maintenance and storage • Inspecting slings o Visual inspections o Recorded periodic inspections o Use, maintenance and storage

	• Properties and uses of chains
	  o Types
	  o Applications
	  o Grades and strengths
	  o Care and inspection
	  o Joining and connecting links
	  o Avoiding overload and impact loading

4. Perform rigging calculations	• Working load limit (WLL)
	• Factors of safety purpose/need
	• Variation for different materials and applications:
	  o Structural steel
	  o Rigging components
	  o Wear & tear
	  o Uncertainty of load
	  o Impact loading
	• Sling angle guidelines
	• Capacity charts for wire rope slings
	• Hardware ratings
	  o Shackle loading
	  o Hook loading

5. Plan a rigging job	• Key terms • Site survey • Mobilization of people, materials and equipment and costs involved • Layout of materials • Personnel requirements • Safety plan requirements • Care, storage and inspection of rigging equipment • PPE • Crane safety
6. Explain crane and rigging safety on water	• List • Landing the load • Hazards and precautions • Maximum list or trim of derricks • General marine safety rules

7. Use communication signals

- International communication signals
- Hand signal protocols
- Specialty hand signals for pile drivers
  - Call for the whip, auxiliary whip or main lines
  - Vibratory hammer signals
  - Jaw signals
  - Impact hammer signals
  - Spotter signals
  - Spotter and moonbeam signals
  - Drill signals
  - Fouled line signal
- Voice signals
  - Procedures for radio use
  - Clear verbal signals to crane operator in relationship to operator's positions

8. Use specialty hardware for pile driving

- Key terms
- Safety
- Chain connecting links
  - Master
  - Clevis
  - Missing
  - Links and rings
- Sockets
- Load binders
- Spreader bars
- Equalizer bars and plates
- Slings and hitches
- Lashing and binding hardware
- Attachment hardware
- Hooks
  - Standard
  - Swivel
  - Chain grab
  - Chain slip
  - Palm
  - Choker
  - Sorting
  - Safety latches
- Hoisting equipment
- Headache ball with hook
- Blocks
  - Crane hook
  - Construction rigging
  - Snatch fibre rope
- Wedge sockets
- Pear link
- Chain grab hook
- Man basket
- Swivels

9. Explain how a crane works

- Types and applications
- Crane stability
  - Lever
  - Fulcrum
- Lifting capacity of crane
  - Counterweights
  - Boom radius
  - Weight of the hook and hoist line
  - Number of parts in the reeving

10. Make calculations from a load chart

- How a load chart is created
- Areas of a load chart
  - Stability
  - Ultimate capacity
- Range diagrams
- Boom angle indicator
- Calculating radius
- Head height

11. Use reeving equipment

- Key terms
- Safety
- Mechanical advantage
- Drums
  - Wrap
  - Layer
  - Patterns for spooling wire rope
- Sheaves
  - Sheave to rope diameter
  - Inspecting sheaves
- Blocks
  - Parts
  - Inspecting blocks
- Square block reeving setups
  - Procedure for four-part system
  - Procedure for five-part system
  - Skip reeving
- Lacing

12. Perform reeving calculations

- Calculating friction loss
- Calculating hoist line needed for a crane
- Calculating line pats needed for the hoist
- Calculating maximum load for reeving arrangements

13. Use hand rigging techniques

- Key terms
- Safety
- Procedures for lashing and binding
  - Yard and stay
  - Tight lining
  - High lining
- Hand operated hoisting equipment
  - Tirfor/grip hoist
  - Come-alongs
  - Chain hoists

- Jacks

14. Use hand rigging with crane assist

- Key terms
- Potential hazards
- Safe operation of lifting equipment
- Work procedures
  - Using an adjustable leg to level a load
  - Using an adjustable leg with rollers to hoist a load
  - Using an adjustable leg with yard to hoist a load
  - Drifting a load under an overhang

15. Explain crane hoisting and their uses in the pile driving industry

- Key terms
- Crane lines
  - Main
  - Auxiliary
- Line speed and hook speed
- Haul-back lines
- Tuggers
- Single line hook work procedures
  - Hoisting a load
  - Loft a pile
  - Trip a load
- Multi-line hook work
  - Rotating a suspended load
  - Walking a load
- Critical hoist

16. Hoist common pile driving materials using safe work procedures

- Single wood pile
- Bundle of wood pile
- H-pile
- Circular steel pile
- Concrete pile
- Sheet pile
- Rebar bundle

Achievement Criteria

1. Performance — The learner will float a load.

   Conditions — The learner will be given:
   - PPE
   - An instruction sheet
   - Tools and equipment
   - Material

   Criteria — The learner will score 70% or better on a rating sheet that reflects the following criteria:
   - Following safety procedures
   - Use of PPE
   - Correct set up and use of equipment and material
   - Completed within specified time

2. Performance — The learner will loft a pile.

   Conditions — The learner will be given:
   - PPE
   - An instruction sheet
   - Tools and equipment
   - Material

   Criteria — The learner will score 70% or better on a rating sheet that reflects the following criteria:
   - Following safety procedures
   - Use of PPE
   - Correct set up and use of equipment and material
   - Completed within specified time

3. Performance — The learner will trip a load.

   Conditions — The learner will be given:
   - PPE
   - An instruction sheet
   - Tools and equipment
   - Material

   Criteria — The learner will score 70% or better on a rating sheet that reflects the following criteria:
   - Following safety procedures
   - Use of PPE
   - Correct set up and use of equipment and material
   - Completed within specified time

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E4 Use Support Equipment

Objectives

To be competent in this area, the individual must be able to:

- Successfully complete an IVES certification course for the operating aerial lift platforms.
- Successfully complete an IVES certification course for the operation of Class 5 and Class 7 forklifts.

Line (GAC): F PERFORM SITE LAYOUT

Competency: F1 Layout Bridge Abutment and Pier Locations

Objectives

To be competent in this area, the individual must be able to:

- Describe the layout pile locations.
- Lay out pile locations.

LEARNING TASKS	CONTENT
1. Use survey markers	• Hub • Benchmark • Datum point
2. Control excavation and grading procedures	• Grades • Grade line and grade stakes
3. Lay out square corners	• Measuring diagonals • 3-4-5 Method
4. Describe the use of batter boards in construction	• Location • Construction • Locating lines • Tying lines • Plumbing down from lines • Establishing offsets

Achievement Criteria

Performance	The learner will stake and mark pile locations.
Conditions	The learner will be given: • Plan • Tape measure • Plumb bob • Stakes
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Proper set up of instrument • Accurate layout of stakes • Proper calculations for pile locations • Completed within specified time

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G1 Use Concrete Types, Materials, Additives and Treatments

Objectives
To be competent in this area, the individual must be able to:

- Describe uses for concrete.
- Describe types of admixtures for concrete.

LEARNING TASKS	CONTENT
1. Describe uses for concrete	• Structural • Conduits
2. Describe the three basic elements of concrete	• Portland cement • Water • Aggregate
3. Describe the types of admixtures for concrete	• Workability agents • Bonding agents • Water reducing
4. Describe specialty concrete mixes	• Vertical patching • Quick setting • Expandable grouts • Bridge deck patching compounds
5. Describe concrete placing	• Tremie • Vibration

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G2 Build Footing and Vertical Formwork

Objectives
To be competent in this area, the individual must be able to:
- Describe the construction of footing and wall forms.
- Construct footing and wall forms.

LEARNING TASKS	CONTENT
1. Construct footing forms	• Footing forms • Wall footings • Column footings • Methods of construction
2. Place anchor bolts and reinforcing steel	• Types of anchor bolts • Placement of bolts and reinforcing steel • Templates • Dowels
3. Describe wall forms	• Built-in-place forms • Strap tie forms • Easy-Strip forms • Insulated concrete forming (ICF) • Snap tie forms • Form panels • Form ties (wedges) • Walers • Bracing • Corner construction • Bulkheads and door bucks • Corbels • Pilasters • Methods of construction
4. Construct wall forms	• Built-in-place forms • Easy-strip forms • Form panels • Form ties • Walers • Bracing • Corner construction • Methods of construction

5.	Construct concrete details	• Types of bucks • Keyways • Blockouts • Bulkheads • Corbels • Pilasters • Levelling strips • Chamfer strips • Rustication strips
6.	Calculate materials for footing and wall forms	• Contact area • Sheathing • Studs • Walers • Ties • Wedges • Braces
7.	Calculate the volume of concrete in foundations	• Footings • Walls • Slab

Achievement Criteria

Performance	The learner will build footings and wall forms to the required criteria.
Conditions	The learner will be given: • An instruction sheet • A drawing and specifications • Materials • Power tools
Criteria	Following safety procedures • Use of PPE • Build form according to specifications • Completed within specified time

Line (GAC): H DESCRIBE THE PILEDRIVER AND BRIDGEWORKER TRADE

Competency: H1 Identify Tasks Performed by Piledrivers and Bridgeworkers

Objectives
To be competent in this area, the individual must be able to:

- Describe tasks performed by piledrivers.

LEARNING TASKS	CONTENT
1. Describe the piledriving and bridgeworker trade	• History of pile driving • Pile driving crew classifications • Driving pile as part of a foundation system • Installing pile to hold up docks, wharves and bridges • Erecting, launching and dismantling bridges • Working with divers • Erecting and dismantling falsework • Building exclusion and retention structures • Driving pile for anchoring a structure • Displacement and non-displacement installation methods • Repair and maintenance of bridge structures
2. Describe the nature of skills and aptitudes required of a piledriver and bridgeworker	• Employability skills o Working with others o Using information in prints, shop drawings, verbal and written instructions o Planning time and resources o Communication and interpersonal skills o Following rules of conduct - Hygiene - Dress code • Basic construction skills from a variety of trades o Carpenter o Cement mason o Iron worker o Welder • Working in an outdoor environment o In fast flowing water o Over water o Weather extremes o Dirty and hazardous conditions o Working at heights
3. Use common pile driving terminology	• Glossary of terms • Common

Line (GAC): H DESCRIBE THE PILEDRIVER AND BRIDGEWORKER TRADE

Competency: H2 Describe Types of Bridges

Objectives
To be competent in this area, the individual must be able to:

- Describe types of bridges and use bridge terminology.

LEARNING TASKS

1. Use bridge terminology

CONTENT

- Bridge
- Viaduct
- Aqueduct
- Culvert
- Abutment
- Piers
- Caissons
- Piles
- Bents
- Trestles
- Substructure
- Superstructure
- Parapet
- Span
- Approach
- Footing
- Tunnels

2. Describe types of bridges and components	• Deck type
	• Through type
	• Semi-through type
	• Simple spans
	• Bridge forms
	• Beam and deck
	• Trestle
	• Plate girder
	• Truss
	• Bowstring
	• Arch
	• Suspension
	• Cable stay
	• Cantilever
	• Floating
	• Pontoon
	• Opening bridges
	  o Movable single opening
	  o Single span, centrally pivoted
	  o Double opening
	  o Swing
	  o Bascule
	  o Trunnion
	  o Vertical lift
	• Joints
	• Bearings

3. Identify bridge construction materials	• Log • Sawn timber • Masonry • Steel • Reinforced concrete • Pre-stressed concrete • Post tensioned concrete • Ice
4. Describe types of temporary trestles and work bridges	• Log spans • Timber trestle • Steel trestle • Pontoons or barges • Bailey or Acrow bridges • Gravel berms • Ice bridges

Line (GAC): H DESCRIBE THE PILEDRIVER AND BRIDGEWORKER TRADE

Competency: H3 Describe Types of Marine Structures

Objectives
To be competent in this area, the individual must be able to:

- Describe types of marine structures.

LEARNING TASKS	CONTENT

1. Describe wharves and piers	• Orientation
	  o Jetty or pier
	• Type of construction
	  o Pile supported
	  o Concrete caissons
	  o Timber cribs
	  o Cellular or single wall bulkheads
	• Materials
	  o Timber
	  o Steel
	  o Concrete
	• Fender systems

2. Describe ferry landings and ramps	• Ramps spans • Aprons • Hinges or bearings • Lift machinery and counterweights • Catwalks • Wingwalls

3. Describe dolphins	• Uses
	  o Mooring
	  o Berthing
	  o Guide
	  o Fender
	  o Turning (warping)
	• Types
	  o Cantilever
	  o Cluster
	  o Braced
	  o Cellular

4. Describe marinas

- Floats
- Mooring piles
- Anchors
- Gangways
- Breakwaters

5. Describe training walls, and breakwaters

- Timber pile
- Steel pile
- Floating
  - Bundled logs
  - Concrete

Line (GAC): H DESCRIBE THE PILEDRIVER AND BRIDGEWORKER TRADE

Competency: H4 Describe Exclusion and Retaining Structures

Objectives
To be competent in this area, the individual must be able to:

- Describe the uses of exclusion and retention structures.

LEARNING TASKS	CONTENT
1. Describe types of exclusion and retention structures and their uses	• Cofferdams • Shoring • Retaining walls and bulkheads • Single wall pile structures • Slurry trench walls • Cellular gravity structures of steel sheet piles
2. Describe types of loadings and requirement for bracing or anchors	• Loadings o Water pressure o Earth pressures o Live loadings o Equipment o Traffic o Seismic
3. Describe tieback or anchorage systems	• Tie rods or cable strands to deadmen, piling or other structures • Drilled and grouted soil or rock anchors of rods or strands • Driven brace piles as tension anchors • Screwed in disc tension anchors • Manta ray anchors
4. Describe internal bracing systems	• Materials o Timber o Steel o Concrete o Components o Walers o Horizontal struts between walers o Raker struts and thrust blocks • Tremie concrete diaphragms

5. Identify requirements for penetration in sheet pile structures	• Resisting pushout by passive earth pressure • Fixity for cantilever walls • Reducing bending in walls with bracing or anchors • Reducing inflow of water • Protection against scour • Shear capacity to resist sliding in cellular walls

Line (GAC): I USE MARINE WORK PROCEDURES

Competency: I2 Use Moving and Positioning Vessels

Objectives

To be competent in this area, the individual must be able to:

- Explain the inspection process for a skiff and tugboat.
- Identify towing methods.
- Explain how to place and set anchors from a barge, tugboat and skiff.
- Understand the safe operation of a punt/skiff.
- Attain in-house online boating certification.

LEARNING TASKS	CONTENT
1. Inspect a punt/skiff before use	• PFD • Leakage • Fuel • Engine starts and runs • Tie-up lines • Safety equipment • Pike pole • Poleaxe • Bailer • Oar • Knife
2. Describe the operation of a punt/skiff	• Placement of motor • Steering
3. Describe the operation of a work punt/skiff	• Applications • Safety precautions • Manoeuvring • Crewmember requirements and responsibilities

4. Explain the uses of a punt/skiff	• Applications
	• Safety precautions
	• Preparing for operation
	• Towlines
	• Procedures
	  o Towing astern
	  o Pushing ahead
	  o Towing from the hip
	  o Positioning objects with a punt/skiff
	  o Tying up a skiff

5.	Describe towing procedures using a punt/skiff	• Operating procedures • Types of punts/skiffs • Applications • Tow posts
6.	Explain how water affects a vessel	• Movement of water • Draft • Freeboard • Ballast • Buoyancy • Waves and swells • Water current • Tides
7.	Explain hazards when working with other vessels	• Effects of wakes
8.	Describe the procedures for boarding a vessel	• Egress and access points • Gangways and walkways • Docks • Piers • Wharves • Moving from vessel to vessel
9.	Describe working on a barge	• Safety concerns • Hoisting a load from land • Working with a crane on a barge • Pinch points • Welding on the water
10.	Describe emergency VHF radio use	• Correct channel setting • Correct terminology • Rules and regulations

Line (GAC): I USE MARINE WORK PROCEDURES

Competency: I3 Interpret Tide Tables and Marine Charts

Objectives
To be competent in this area, the individual must be able to:

- Describe the information found on marine charts and tide and current tables.
- Calculate the times of tides in primary and secondary ports.

LEARNING TASKS	CONTENT
1. Describe tides and currents	• Definitions • Effects on marine environment

2. Describe marine charts	• Datums
	  o Track chart datum
	  o Geodetic Survey Canada
	  o Local historical
	• Marine charts
	• Sounding plans

3. Explain the use of tide charts	• Information found on tide charts
4. Determine times of tide and elevation in primary and secondary ports	• Tide table • Current table • Correction for Pacific Daylight Savings Time (PDST)

Line (GAC): **K** **Use Pile and Foundation Procedures**

Competency: **K3** **Describe Types of Piles and Deep Foundations**

Objectives

To be competent in this area, the individual must be able to:

- Describe foundations, piles, and caissons.

LEARNING TASKS	CONTENT
1. Describe and classify piles	• Non-displacement and displacement • Pile orientation • Characteristic • Attachments

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K5 Use Piledriving Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe types of piledriving equipment.

LEARNING TASKS	CONTENT
1. Describe piledriving equipment	• Safety considerations • Types and uses

Line (GAC): L BUILD WITH TIMBER AND STEEL

Competency: L1 Build with Timber

Objectives
To be competent in this area, the individual must be able to:

- Describe types of fasteners and their uses.
- Describe lumber grading

LEARNING TASKS	CONTENT

1. Describe types of fasteners and their uses	• Types
	• Uses
	• Sizes
	• Material
	  o Steel
	  o Galvanized
	  o Stainless
	  o Alloys
	  o Treated
	• Nails
	  o Common
	  o Spiral
	• Spikes
	  o Spiral
	  o Bridge (cut)
	• Drift pins
	• Dowels
	• Screws and lag bolts
	  o Flathead
	  o Roundhead
	  o Ovalhead
	• Bolts
	  o Grades
	  o Eye
	  o Drop
	  o Economy head
	  o Carriage
	  o Hook
	• Nuts
	  o Square of hex
	  o Regular or heavy
	• Rods and studs
	  o Coil
	  o All-thread/ready rod
	  o Thread bars

	• Washers, shear plates and stress rings • Timber connectors • Threaded inserts embedded in concrete
2. Join timber using fasteners	• Safety precautions • Spacing • Length of bolts required • Size of holes • Pre-drilling
3. Describe lumber grades	• Construction grades • Nominal • Dimensional • Lumber types

Line (GAC): M INSTALL, REPAIR AND MAINTAIN BRIDGES, RAMPS AND MARINE STRUCTURES

Competency: M1 Repair and Maintain Bridge Decks and Components

Objectives

To be competent in this area, the individual must be able to:

- Describe bridge deck and components and their repair.

LEARNING TASKS	CONTENT
1. Describe types of bridge decks and components and repairs	• Components • Repairs

Level 2

Piledriver and Bridgeworker

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A1 Apply Site Safety Practices

Objectives
To be competent in this area, the individual must be able to:

- Describe safe work practices used on a construction site.
- Apply safe work practices used on a construction site.

LEARNING TASKS

1. Use OHS regulations and related materials

CONTENT

- Safety committees
  - Purpose
  - Membership
  - Role of members
  - Meetings and minutes
- Conduct site inspections
- Conduct toolbox meetings
  - Purpose
  - Content
  - Timing
- Conduct site inspections
  - Identification of hazards
  - Recommendations
  - Remedies

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B1 Use Construction Drawings and Specifications

Objectives

To be competent in this area, the individual must be able to:

- Interpret and extract information from a set of construction drawings.
- Use drawing instruments to create working drawings for construction details.

LEARNING TASKS	CONTENT
1. Describe construction drawings	• Site • Structural • Architectural • Mechanical • Electrical • Landscape • Shop drawings • As built
2. Interpret construction drawings and specifications	• Schedules • Specifications • Structural steel • Pre-cast units • Coordinate with other trades • Gridlines • Material schedules

3. Draw construction details	• Review drafting technique • Plan view • Section view • Component identification

4. Describe inspections required in the construction process	• Safety
	  o WorkSafeBC
	  o Contractor
	  o BC Safety Authority
	  o BC Forest Safety Council
	  o International Standards Organization (ISO)
	• Engineering
	  o Geotechnical
	  o Formwork
	  o Reinforcing steel
	  o Embedded materials
	  o Concrete
	  o Welding
	• Environmental
	• Archaeological
	• Mechanical
	• Structural
	• Quality assurance

Achievement Criteria

Performance	The learner will draw construction details, including plan and section views.
Conditions	The learner will be given: • Construction drawings and specifications
Criteria	The learner will be evaluated on: • Required construction details as per drawings • Proper drawing technique • A list of required inspections

Line (GAC): D USE SURVEY INSTRUMENTS AND OTHER LEVELLING AND MEASURING TECHNIQUES

Competency: D1 Use Levelling Instruments and Equipment

Objectives

To be competent in this area, the individual must be able to:

- Use and maintain levelling equipment.

LEARNING TASKS	CONTENT
1. Use levelling equipment	• Grade • Depth of cut • Instrument set-up • Testing level • Levelling rods and measuring chains and tapes • Record elevations • Electronic and laser levels • Common errors • Maintenance • Storage

Achievement Criteria 1

Performance	The learner will complete a survey circuit identifying elevations at various locations.
Conditions	The learner will be given: • Builders level and rod • Site plan including survey points • Field book
Criteria	The learner will be evaluated on: • Proper set up of instrument • Correct process for field book recordings • Accuracy of rod readings

Achievement Criteria 2

Performance	The learner will set up a laser level to slope and grades.
Conditions	The learner will be given: • Laser level and receiver • Site plan and slope percentage or grade • Field book
Criteria	The learner will be evaluated on: • Proper set up of instrument • Correct process for field book recordings • Accuracy of readings

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E1 Use Ladders, Scaffolds and Access Equipment

Objectives

To be competent in this area, the individual must be able to:

- Describe construction access equipment.
- Use construction access equipment.
- Build construction access equipment.

LEARNING TASKS	CONTENT

1. Describe scaffolds and temporary access structures	• OHS Regulation and WorkSafeBC Standards
	• General requirements
	• Construction and use
	• Scaffold types
	  o Staging
	  o Rosette style
	  o Tube and clamp
	  o Cuplock
	• Uses of wooden scaffolds
	• Parts of wooden scaffolds
	  o Single pole scaffolds
	  o Double pole scaffolds
	  o Lumber specifications
	• Assembly procedures
	• Dismantling procedures
	• Temporary ramps, walkways and stairs
	  o Slope regulations
	  o Guards

2. Plan scaffolds	• Safety • OHS Regulation and WorkSafeBC Standards • Scaffold design • Scaffold loads • Select scaffold type • Location and access

LEARNING TASKS	CONTENT

3. Build scaffolds	• Assembly
	  o Mud sills
	  o Members plumb and level
	  o Stability
	  o Guardrails and toe-boards
	  o Work platform
	  o Ladder access to scaffolds
	• Tagging systems
	• Dismantling

4. Describe access equipment	• OHS Regulation and WorkSafeBC Standards • Swing stages • Suspended power platform • Scissor lifts • Aerial lifts
5. Build wooden access stairs	• OHS Regulation and WorkSafeBC Standards • BC Building Code pertaining to temporary access stairs • Rise and run calculations • Layout of stringers

Achievement Criteria 1

Performance	The learner will assemble and dismantle a scaffolding system.
Conditions	The learner will be given: • Working space • A scaffolding plan • Materials
Criteria	The learner will be evaluated on: • Compliance with OHS Regulation and WorkSafeBC Standards

Achievement Criteria 2

Performance	The learner will construct an access stair with handrail.
Conditions	The learner will be given: • Working space • A stair plan • Materials
Criteria	The learner will be evaluated on: • Proper stair construction and calculations

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E2 Use Rigging and Hoisting Equipment

Objectives

To be competent in this area, the individual must be able to:

- Describe the safe use and maintenance of hoisting equipment.
- Use hoisting equipment.
- Use hand signals to communicate with the hoist operator.

LEARNING TASKS	CONTENT

1. Describe ropes	• Purpose
	• Rope types
	  o Fibre
	  o Wire
	• Use of ropes
	• Rope terms
	  o Breaking strength
	  o Working Load Limits (WLL)
	• Knots, bends and hitches
	  o Bowline
	  o Figure eight
	  o Reef or square knot
	  o Sheet bend
	  o Round turn and two half-hitches
	  o Clove hitch
	  o Timber hitch
	  o Trucker's knot
	• General rules for tying knots, bends and hitches

LEARNING TASKS	CONTENT
2. Describe rigging equipment	• Slings • Web slings • Turnbuckles • Eyes • Shackles • Cable clips and thimbles • Hooks • Spreader bars • Tag lines

3. Describe cranes and hoists	• Purpose
	• Use
	• Types of cranes
	  o Tower
	  o Self erect
	  o Mobile
	  o Boom truck
	  o Overhead gantry
	• Types of hoists
	  o Forklifts
	  o Telehandler
	  o Power ladder
	  o Come-along
	  o Wire rope winch
	  o Rollers

4. Describe safe methods of lifting loads with cranes and hoists	• OHS Regulation and WorkSafeBC Standards
	• Certification
	• Training
	• Lift plan
	• Critical Lifts
	• High voltage line clearance
	• Overhead hazards
	• Load stability
	• Centre of gravity
	• Sling locations
	• Use of tag lines
	  o OHS Regulation and WorkSafeBC Standards
	  o Rope for tag lines
	  o Length of rope
	  o Use of two tag lines
	  o Location of attachment for tag lines
	• Use of hand signals and designated signal person
	• Other means of communication
	  o Sound signals
	  o Radio communication
	  o Video systems

5. Use rigging equipment	• OHS Regulation and WorkSafeBC Standards • Safe rigging practices • Unsafe practices • Calculate weight of load • Calculate sling angle and working load limit (WLL) • Load Cells • Rigging structural shapes • Rigging complex shapes • Blocking and stacking
6. Use hoisting equipment	• OHS Regulation and WorkSafeBC Standards • Follow lift plan • Ground stability • Move and place load

7. Maintain and store rigging and hoisting equipment	• OHS Regulation and WorkSafeBC Standards • Care of slings and wire rope • Wire rope safety • Rejection criteria • Hook safety • Safety of other hardware • Rings, links and swivels • Eye bolts and ring bolts • Turnbuckles • Shackles • Synthetic web slings • Inspection

Achievement Criteria 1

Performance	The learner will use proper hand signals for communication with a Mobile Crane Operator.
Conditions	The learner will be given: • A series of crane operations to be signaled by the learner
Criteria	The learner will be evaluated on: • Proper hand signal for the application

Achievement Criteria 2

Performance	The learner will select and tie knots, bends and/or hitches.
Conditions	The learner will be given: • Work space • Rope and materials
Criteria	The learner will be evaluated on: • Correct tying techniques

Line (GAC): F PERFORM SITE LAYOUT

Competency: F1 Layout Bridge Abutment and Pier Locations

Objectives

To be competent in this area, the individual must be able to:

- Describe the layout of bridge abutment and pier locations.
- Lay out bridge abutment and pier locations.

LEARNING TASKS	CONTENT
1. Identify survey markers	• Work point • Hub • Offsets • Benchmark • Datum point
2. Describe abutment and pier locations	• Legal descriptions • Survey plans • Surveyor's Certificate
3. Layout abutment and pier locations	• Square corners • Trigonometry • Grade stakes • Gridlines • Slope

Achievement Criteria

Performance	The learner will layout a bridge abutment.
Conditions	The learner will be given: • Site plan • Theodolite • Work point(s)
Criteria	The learner will be evaluated on: • Accuracy of layout

Line (GAC): F PERFORM SITE LAYOUT

Competency: F2 Prepare Job Site

Objectives

To be competent in this area, the individual must be able to:

- Describe job site mobilization.
- Describe site preparation.
- Describe types and methods of constructing hoarding and fencing.

LEARNING TASKS	CONTENT

1. Describe job site considerations	• Job site location
	• Temporary facilities
	  o First Aid
	  o Tool storage
	  o Site offices
	  o Fuel storage
	  o Muster station
	  o Parking
	  o Wheel wash
	  o Sediment control
	• Temporary services
	• Water
	• Gas
	• Electrical
	• Material lay down services
	• Delivery areas
	• Temporary road ways
	• Demobilization

LEARNING TASKS	CONTENT
2. Describe items to be completed before mobilization	• Site layout • Permits • Environmental plan • Clearing the site • Tree protection • Sediment and erosion control • Geotechnical reports • BC One Call and Utility locates • Power line 30M33 form • Weather considerations • Identify and remove hazardous materials • Site services • Perimeter protection • Hoarding and Fencing • Dump site
3. Describe hoardings	• Building codes and bylaws • Methods of construction • Scaffold and plywood barricades • Vertical braced barricades • Covered walkways • Shored hoardings • Access lighting and signage • Welding arc screens
4. Describe drainage systems	• Dewatering system • Perimeter draining systems • Granular drainage layer systems • Drainage disposal • Rainwater leader system • Sumps

Line (GAC): F PERFORM SITE LAYOUT

Competency: F5 Apply Excavation and Shoring Practices

Objectives

To be competent in this area, the individual must be able to:

- Describe excavations and shoring.
- Plan excavations and shoring.
- Calculate excavation volumes.

LEARNING TASKS	CONTENT

1. Describe excavations	• Safety
	  o Describe precautions
	  o Describe blasting signals
	  o OHS regulation and WorkSafeBC standards
	• Bulk excavations
	• Trench excavations
	• Deep excavations
	• Soil conditions
	• Soil types
	• Bearing capacities of soils
	• Underpinning

2. Describe shoring	• Types of shoring
	  o Trench shoring
	  o Combined sloping and shoring
	  o Sheet piling
	  o Secant
	  o Combi walls
	  o Cut-off walls
	  o Soldiers and planking
	  o Shotcrete
	  o Rock anchors
	  o Raker struts
	• Engineered slope stabilization

LEARNING TASKS	CONTENT

3. Plan excavations and shoring	• Sloping, benching and shoring requirements
	  o WorkSafeBC
	  o Access to excavations
	• Weather conditions
	• Site survey
	• Grading
	• Grid lines and grade stakes
	• Excavation planning
	• Describe backfilling
	  o Preparation for backfilling
	  o Interior/exterior membranes
	  o Backfill material
	  o Placing backfill
	  o Compaction
	  o Lifts
	  o Interior backfill

4. Calculate excavations	• Estimate volume of excavated material

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G1 Use Concrete Types, Materials, Additives and Treatments

Objectives

To be competent in this area, the individual must be able to:

- Describe concrete types, materials, additives and treatments.

LEARNING TASKS	CONTENT
1. Describe the uses for concrete	• Structural • Architectural • Fire proofing • Insulating • Conduits • Pavements
2. Describe concrete mix designs	• Strength • Durability • Water tightness • Finishing ability
3. Describe the types of admixtures and treatments for concrete	• Air-entraining • Water-reducing • Plasticizers • Retardants • Accelerators • Colours • Dampproofing and permeability-reducing agents • Bonding agents • Release agents • Gas-forming agents • Pozzolans
4. Describe structural grout	• Purpose • Types • Procedures • Applications • Shelf life

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G2 Build Footing and Vertical Formwork

Objectives

To be competent in this area, the individual must be able to:

- Describe the construction of concrete forming systems.
- Construct concrete forming systems.

LEARNING TASKS	CONTENT
1. Describe footing forms for construction	• Types o Wall footings o Column footings
2. Describe pile foundations	• Types o Screw o Continuous flight auger (CFA) o H-pile o Wood pile o Concrete - Pre-stressed - Spun cast o Pipe pile o Ad-freeze pile • Accessories o Driving shoes o Shear rings o End plates o Baffles • Grade beams • Designs o End bearing o Friction o Drilled o Vibration o Socketed
3. Describe forms for concrete construction	• Wall forms • Built-in-place forms • Prefab forms • Single walers • Double walers • Engineered wall system o Proprietary forms

LEARNING TASKS	CONTENT

	• Gang forms
	  o Prefabricated form panels
	  o Form construction
	  o Lifting procedures
	  o Anchoring
	  o Core forming
	• Construction procedures
	• Form details
	  o Keys
	  o Blockouts
	  o Bulkheads
	  o Corbels
	  o Pilasters
	  o Levelling strips
	  o Chamfer strips
	  o Rustication strips

4. Describe column forms	• Types
	  o Fibre tubes
	  o Engineered column
	  o Job built
	  o Capital
	• Assembly of forms

5. Plan footing and vertical formwork	• Safety
	• Contract drawings
	• Engineered drawings
	• Procedures
	  o Form system
	  o Lift plan
	  o Pour sequencing
	• Material handling and storage
	• Schedule
	• Access

6. Calculate materials and concrete volume for footing and vertical formwork	• Contact area
	• Centerline perimeter
	• Concrete wall volume
	  o Battered
	  o Circular
	  o Octagonal
	  o Polygons
	• Sheathing and form ply

LEARNING TASKS	CONTENT
	• Walers and strongbacks • Hardware • Bracing • Form details

7. Construct vertical formwork	• Layout
	• Assemble
	• Support system
	• Form details
	  o Keys
	  o Blockouts
	  o Bulkheads
	  o Corbels
	  o Pilasters
	  o Levelling strips
	  o Chamfer strips
	  o Rustication strips
	• Brace
	• Align
	• Concrete placement
	• Stripping forms

Achievement Criteria

Performance	The learner will build a vertical column form complete with chamfer strip.
Conditions	The learner will be given: • A construction drawing which includes blockouts and keyways • Working space • Forming material and hardware
Criteria	The learner will be evaluated on: • Proper use of forms and hardware • Plumb and level • Dimensionally accurate, straight and square • Proper construction of blockouts, etc. • Proper installation of chamfer strip

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G3 Select and Build Concrete Forming Systems

Objectives

To be competent in this area, the individual must be able to:

- Describe the design of concrete construction.
- Describe the construction of concrete formwork systems.

LEARNING TASKS	CONTENT

1. Describe concrete formwork and falsework	• Safety
	• Efficiency
	• Architectural considerations
	• Glossary of terms
	• Interpret WorkSafeBC regulations and standards for concrete formwork
	• Definitions
	  o Responsibility of employer
	  o Responsibility of formwork designer
	  o Construction requirements
	  o Inspection requirements

2. Describe the factors affecting form design	• Safety • Architectural design • Concrete members • Efficiency • Environmental conditions • Form pressures • Slump • Temperature • Vibration • Placement method • Form size • Cantilever formwork • Concrete design mix

LEARNING TASKS	CONTENT
3. Describe formwork material and hardware	• Lumber • Plywood • Metal forms • Plywood forms • Ties • Wedges and brackets • Walers, strong backs and bracing • Reglets and inserts

4. Describe specialized formwork	• Specialized formwork
	• Sandblasted and tooled concrete
	• Rustication and form liners
	• Architectural
	• Engineered systems
	• Describe manufactured wall form panels
	  o Form design
	  o Steel forming systems
	  o Composite forming systems

5. Describe concrete joints	• Types and methods of construction
	  o Contraction
	  o Control
	  o Expansion
	  o Isolation
	  o Construction
	  o Cold

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G4 Build Slab-On-Grade Forms and Suspended Slab Forms

Objectives

To be competent in this area, the individual must be able to:

- Describe how to build suspended concrete slabs and slabs-on-grade.
- Build suspended concrete slabs.

LEARNING TASKS	CONTENT
1. Describe slab-on-grade	• Types of slabs • Ground preparation • Strength and durability • Reinforcement • Form system

2. Describe suspended slab	• Types of slabs
	  o Cast in place
	  o Pre-cast
	• Slab components
	  o Girder and beam forms
	  o Spandrel beam forms
	  o Slab soffit
	  o Drop panels
	  o Keyway strip
	• Suspended slab forming products
	  o Stay-in-place forms
	  o Proprietary slab forms

3. Plan suspended slab formwork	• Safety
	  o Fall protection
	• OHS regulation and WorkSafeBC standards
	• Contract drawings
	• Engineered drawings
	• Procedures
	  o Form system
	  o Lift plan
	  o Pour sequencing
	• Material handling and storage
	• Schedule
	• Sub-trades
	• Access

4. Calculate materials and concrete volume for suspended slab formwork	• Contact area • Soffit

LEARNING TASKS	CONTENT
	• Edgeform • Concrete volume • Slab • Girder • Beam • Blockouts • Form ply • Stringers and joists • Shoring • Hardware • Bracing • Form details • Reshoring

5. Construct suspended slabs	• Layout
	• Assemble
	• Support system
	  o Shoring
	• Falsework
	• Form ply and lumber formwork
	• Brace
	• Align
	• Form details
	  o Keys
	  o Blockouts
	  o Bulkheads or edgeforms
	  o Screeds
	  o Chamfer strips
	  o Rustication strips
	• Concrete placement
	• Stripping forms
	• Reshore

Achievement Criteria

Performance: The learner will build a suspended slab with a slab bulkhead and keyway.

Conditions: The learner will be given:

- Construction drawings and specifications
- Formwork materials
- Working space

Criteria: The learner will be evaluated on:

- Proper use of forms and hardware
- Plumb and level

- Dimensionally accurate, straight and square

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G5 Install Reinforcement and Embedded Items

Objectives

To be competent in this area, the individual must be able to:

- Describe the installation of reinforcing bar in concrete.
- Describe embedded metals and plastics.
- Install anchor bolts.

LEARNING TASKS	CONTENT
1. Describe reinforcing for concrete	• Purpose • Deformed bar • Smooth bar • Sheet or rolled mesh (WWR) • Size and spacing • Cutting • Splicing • Tying
2. Describe embedded materials	• Anchor bolts • Machine base bolts • Sleeves • Reglets • Dowels • Miscellaneous inserts o Terminators o Ferrule loops o Break out bars • Manhole cover frames • Grates, catch basins and drain troughs or trenches • Water stops o Uses o Materials o Size and configuration o Joining methods

LEARNING TASKS	CONTENT
3. Describe concrete fastening systems	• Screws • Bolts • Metal anchors • Grout • Adhesive anchors • Epoxy anchor • Join new concrete to existing

Achievement Criteria

Performance	The learner will layout and install an anchor bolt template complete with anchor bolts.
Conditions	The learner will be given: • Construction drawings and specifications • Materials
Criteria	The learner will be evaluated on: • Correct installation as per drawings

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G6 Place and Finish Concrete

Objectives

To be competent in this area, the individual must be able to:

- Describe methods of placing, finishing and curing concrete.
- Describe concrete treatments and sealers.

LEARNING TASKS	CONTENT

1. Describe the delivery and placement of concrete	• Safety
	• Manufacture and delivery
	  o Planning and scheduling for truck delivery
	• Placement methods
	  o Concrete pumps
	  o Chutes
	  o Buggies
	  o Wheelbarrow
	  o Concrete bucket ($1M^3$)
	  o Placement boom
	  o Underwater placement/Tremie
	• Guidelines for placing concrete
	  o Consolidation/Vibration
	  o Discharge
	  o Weather considerations
	  o Segregation
	  o Rate of pour
	  o Environmental considerations

LEARNING TASKS	CONTENT

2. Describe concrete finishing	• Tools and equipment
	  o Floats and trowels
	  o Accessories
	  - Edgers
	  - Dividers
	  - Stamps
	  - Slab cutters
	  - Brooms
	  o Power trowels
	  o Power screed
	• Walls
	• Flatwork
	• Finishing procedure
	  o Exposed aggregate
	  o Broom finished
	  o Colour
	  o Stamped
	  o Sand blasting
	  o Joints
	• Surface treatments
	  o Safety
	  o Environment
	  o Protective treatments
	  o Curing compounds
	  o Hardeners
	  o Damp and water proofing

3. Describe the process of concrete curing	• Hydration • Curing • Sealers and hardeners • Adjusting for weather conditions

LEARNING TASKS	CONTENT

4. Strip concrete forms	• Safety
	  o OHS regulation and WorkSafeBC standards
	  o Removal of handrails
	  o Fall protection
	  o Stripping procedure
	• Concrete design strength
	  o According to engineered specifications
	• Form removal
	  o Edge protection during stripping
	• Re-shoring

5. Describe concrete defects	• Causes of defects
	  o Construction practices
	  o Materials
	  o Design
	• Surface defects
	  o Cold joints
	  o Segregation
	  o Honeycomb
	  o Crazing and map cracking
	  o Dusting
	  o Spalling
	  o Scaling
	  o Efflorescence
	• Concrete repair
	  o Patching materials
	  o Patching procedures
	  - Parging
	  - Rebar exposure

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G7 Install Specialized Formwork

Objectives

To be competent in this area, the individual must be able to:

- Describe pre-cast concrete.
- Describe tilt-up construction.
- Describe pre-stressed concrete.
- Describe slip-forming.
- Describe mass concrete.

LEARNING TASKS	CONTENT
1. Describe tilt-up construction	• OHS regulation and WorkSafeBC standards • Tilt-up drawings • Uses of tilt-up construction • Formwork procedures • Lifting sequence • Lifting and bracing procedures

2. Describe pre-cast concrete	• Purpose
	• Types
	  o Girders
	  o Columns
	  o Tees
	  o Hollow core
	  o Stairs
	  o Vaults
	• Sequencing assembly
	• Handling and storage
	• Construction methods

3. Describe pre-stressed concrete	• Pre-tensioning • Post-tensioning

LEARNING TASKS	CONTENT

4. Describe slip-form construction	• Planning
	• Types
	  o Vertical
	  o Horizontal
	• Construction procedures
	• Jacks and yokes
	• Concrete placement
	• Concrete finishing
	• Dismantling procedures

5. Describe mass concrete	• Heat of hydration
	• Types
	  o Dams
	  o Retaining walls
	  o Locks
	  o Caissons
	  o Pontoons/Graving docks
	• Placement methods

6. Describe sealing joints	• Types of caulking compounds • Backer rods • Sealers and primers

Line (GAC): L BUILD WITH TIMBER AND STEEL

Competency: L2 Build with Structural Steel

Objectives

To be competent in this area, the individual must be able to:

- Describe a multi-plate culvert
- Describe the purpose of a multi-plate culvert

.

LEARNING TASKS	CONTENT
1. Describe types of multi-plate culverts	• Round pipe • Arch pipe • Elliptical • Low height arch
2. Identify components of multi-plate culverts	• Plates • Bolts • Ribs • Footing channel • Headwall types o Concrete o Gabion o Mechanically stabilized earth (MSE)
3. Describe the purpose of multi-plate culverts	• Transportation efficiency • Job specific design • Ease of installation o No specialized equipment required

Level 3

Piledriver and Bridgeworker

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A5 Work Safely with Piledriving Equipment

Objectives

To be competent in this area, the individual must be able to:

- Work safely with piledriving equipment.

LEARNING TASKS	CONTENT
1. Use safe work practices while working with a crane and piledriving attachments	• Weight of lift • Crane charts • Level ground • Use of crane mats • Working distance from unstable slopes • Tag lines • Boom tie down • Inspect all attachments used for pile driving • Working distance from power lines • Underground utilities • Tail swing clearance
2. Work safely with pile hammers and leads	• Hammer connections • Line wear • Safety straps for hose connections • Maintaining stability of hammer with extended leads • Loads from using side battering leads
3. Apply safety practices	• Use WorkSafeBC Regulations during work procedures

Achievement Criteria

Performance	The learner will attach piledriving equipment to a hoisting device.
Conditions	The learner will be given: • Hoisting device • Piledriving equipment
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Correct attachments of equipment • Completed within specified time

Line (GAC): A APPLY SAFE WORK PRACTICES

Competency: A8 Prevent Environmental Damage

Objectives
To be competent in this area, the individual must be able to:

- Describe causes of environmental damage.
- Use methods to protect the environment.

LEARNING TASKS	CONTENT
1. Describe methods of protecting the environment	• Consequences of environmental damage • Minimize leaching • Protection from spillage • Safer chemicals • Alternatives to petroleum products • Earth berms • Placing contaminated material and debris in containers • Following directions on MSDSs • Silt curtains • Directing of flow • Containing sandblast material • Pre-emergency planning • Oil spill containment booms • Bag booms for floating debris • Bubble curtains
2. Identify sources of information and notification requirements in cases of accidental spillage of hazardous materials	• Sources of information o MSDS data sheet o Employer's Emergency Action Plan • Government agencies • Notification procedures
3. Identify relevant authorities	• Environment Canada • Federal Fisheries & Oceans • Canadian Coast Guard • Provincial Ministry of the Environment, Fish and Wildlife Branch • Provincial Ministry of the Environment, Water Management Branch • Port Authorities o Port of Vancouver o Fraser Port o North Fraser

		○ Prince Rupert ○ Local Harbour Masters • Fraser River Estuary Management Program (FREMP) • Burrard Inlet Environment Action Program (BIEAP)
4.	Describe specific regulations and cost factors	• River closures • Restrictions on types of work • Pre-preparation • Oil Spill contingency plan • Clean up and enhancement • Soil Remediation (removing and/or containing contaminated soil) • Debris entrapment and appropriate disposal • Fines and penalties ○ Personal ○ Corporate
5.	Describe methods of disposing of hazardous wastes	• Importance of separating various hazardous materials ○ Easier identification ○ More economical disposal • Types of hazardous materials ○ Treated piles and timbers ○ Petroleum products ○ Paints and coatings ○ Sandblasting grit • Safe methods of storing and disposing of hazardous materials

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B1 Use Construction Drawings and Specifications

Objectives
To be competent in this area, the individual must be able to:
- Identify construction details.
- Estimate material quantities.

LEARNING TASKS	CONTENT
1. Read and interpret pile foundation drawings	• Take offs (numbers and lengths) • Plan layouts • Construction sequence
2. Read and interpret marine construction drawings	• Plan • Wharf • Dolphin • Ferry terminal
3. Read and interpret steel sheet pile drawings	• Retaining wall • Braced cofferdam • Cellular cofferdams • Standard specification (ASTM, API, CSA) • Grade (strength) • Type of manufacture

4. Read and interpret schedules and various drawings	• Bridge
	• Welding
	  o CSA W59
	  o CSA W47.1
	• Coating schedules
	  o Shop
	  o Field touch up

5. Perform take-off quantities for projects	• Foundation piling project • Marine timber structure • Sheet pile cofferdam

Achievement Criteria

Performance	The learner will specify material, equipment and crew to build the structure from drawings and specification. The learner will list all relevant details.
Conditions	The learner will be given: • Drawings • Specifications • All relevant technical documents
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Accurate list of material, equipment, crew required and relevant details • Completed within specified time

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B4 Use Trade Related Science

Objectives

To be competent in this area, the individual must be able to:

- Identify loads on structures.
- Use simple machines for mechanical advantage.
- Calculate the centre of gravity for simple shapes.

LEARNING TASKS

1. Identify types of loads on structures

CONTENT

- Dead loads
- Live loads
- Secondary live loads
  - Impact loads
  - Braking loads
  - Collision and berthing loads
  - Snow loads
  - Wind loads
  - Seismic loads
  - Loads from moving water
  - Loads from static fluid
  - Earth pressure loads
  - Thermal loads
  - Shrinkage forces
  - Construction loads
- Concentrated
- Distributed loads
  - Point load
  - Uniformly distributed line load
  - Uniformly distributed area load or pressure
  - Non-uniformly distributed area load or pressure

2. Describe materials response to loadings	• Reactions
	  o Equilibrium
	  o Vertical reactions
	  o Horizontal reactions
	  o Moment reactions
	• Deformation
	• Strain
	• Elastic/plastic deformation
	• Stress strain relationship
	• Materials failure modes
	  o Ductile fracture
	  o Brittle fracture
	• Fatigue
	• Creep
	• Buckling failure
	  o Column buckling
	  o Buckling of girders

3. Describe types of forces and stresses	• Axial loads
	  o Tensile force
	  o Compressive force
	• Eccentricity
	• Bending forces and moments
	• Beam-columns
	• Shearing forces
	• Torsional forces
	• Friction forces

4. Describe fluid (static) pressures and buoyancy forces	• Properties of liquids • Horizontal hydrostatic pressures and forces • Buoyancy
5. Use simple machines for mechanical advantage	• Levers • Pulleys or blocks • Inclined planes or ramps • Winch drums • Hydraulic jacks

6. Calculate centre of gravity	• Definition
	• Key terms
	  o Fulcrum
	  o Lever arm
	• Formulas

7. Describe the principles of triangles in truss	• Transmission of load
	• Arrangement of parts
	  o Four-sided
	  o Braced frame
	  o Triangular frame

Line (GAC): B USE DOCUMENTATION AND ORGANIZATIONAL SKILLS

Competency: B5 Interpret Contracts and Specifications

Objectives
To be competent in this area, the individual must be able to:
- Read and interpret contracts and specifications.

LEARNING TASKS	CONTENT

1. Describe the documents relevant to a construction project	• Tender form
	• Contract agreement
	• Drawings
	• Scope of work
	• Specifications
	  o CSA
	  o ASTM
	• General conditions
	• Special provisions
	• Terms of payment
	• Insurance
	  o General liability
	  o Equipment
	  o Marine liability (P&L)
	  o Course of construction
	  o Marine transport
	• Bonds
	• Schedules
	• Sub trade contracts

2. Describe methods of payment	• Lump sum • Unit price • Cost plus • Combination of methods
3. Identify the importance of field records	• Pile driving logs for engineering records and payment purposes • Time & materials for payment • Delays • Possible future claims for changes

4. Describe specifications	• Types and quality of materials and fixtures
	• Construction procedures
	• Standard specifications
	  o CSA
	  o ASTM
	• Conflict and precedence

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C2 Use Portable Power Tools and Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe the use and maintenance of power tools.
- Use and maintain portable power tools.

LEARNING TASKS	CONTENT
1. Describe storage of tools, fuel and equipment	• Tool cribs • Safety • Security • Accessibility • Cool and dry • Periodic checks
2. Operate and maintain outboard motors	• Fuel • Spark plugs • Cooling vents • Prop protection • Safe strap

3. Operate and maintain air compressors	• Cubic feet per minute (cfm)
	• Pressure per square inch (psi)
	• Length of hoses
	• Inside diameter of hoses
	• Power sources
	• Regulators
	• Line lubricators and oilers
	• Maintenance
	  o Oil
	  o Filters
	  o Belts
	  o Draining
	• Receiver tanks

4. Operate and maintain generators	• Weather variables • Oil • Fuel Connections (electrical ground) • Maintenance schedules

5. Operate and maintain pumps	• Types of pumps • Systems • Operating hazards and precautions • Servicing

6. Describe the operating of air tools	• Lubrication
	• Volume of air
	• Air pressure
	• Size and lengths of hoses
	• Maintenance
	• Securing hose connections with safety straps or chains
	• Avoiding chafing, cuts and bruises of hoses
	  o Securing with half round supports at suspension points
	  o Half round supports at suspension points
	• Safety precautions

7. Describe types of air tools used by piledrivers	• Impact wrenches • Rock drills • Jack hammers • Chipping hammers • Nailers • Air saws • Needle scaler • Air auger

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C4 Use Oxy-Fuel Cutting Equipment

Objectives

To be competent in this area, the individual must be able to:

- Describe the use of oxy-fuel cutting equipment.
- Make cuts using oxy-fuel cutting equipment.

LEARNING TASKS	CONTENT
1. Describe the oxy-fuel gas cutting process and its application	• Identify safety requirements for oxy-fuel gas cutting
2. Describe oxy-fuel gas cutting equipment	• Identify the gases used in oxy-fuel gas cutting • Oxygen and fuel gas cylinders • Pressure regulators and their functions • Oxy-fuel hoses and fittings • Cutting torches, cutting tips and heating tips • Oxy-fuel gas cutting accessories and machines • Gas manifold systems • Oxy-fuel gas cutting accessories and machines
3. Use oxy-fuel equipment	• Assemble, ignite, shut down and maintain oxy-fuel gas cutting equipment • Maintain oxy-fuel gas cutting equipment
4. Perform cuts on mild steel plate, sheet and pipe	• Characteristics of an acceptable cut • Freehand cuts on structural shapes and on round stock • Guided cuts on mild steel plate and sheet • Wash nuts off bolts and gouge weldments • Freehand cuts on mild steel pipe
5. Perform cuts with oxy-fuel cutting machines	• Straight-line cutting machine • Pipe-bevelling machine

Achievement Criteria

Performance: The learner will perform a freehand straight line cut, bevelled and ground to a finished product as per instructions.

Conditions: The learner will be given:

- Instructions
- Cutting equipment
- Material

Criteria: The learner will score 70% or better on a rating sheet that reflects the following criteria:

- Following safety procedures
- Use of PPE
- Cut to specifications
- Completed within specified time

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C5 Use Shielded Metal Arc Welding (SMAW) Equipment

Objectives
To be competent in this area, the individual must be able to:
- Describe the use of shielded metal arc welding (SMAW) equipment
- Use of shielded metal arc welding.

LEARNING TASKS	CONTENT
1. Describe welding processes and their applications	• Gas fusion • Braze welding • Arc welding
2. Identify types of electrodes	• Tensile strength • Position of weld • Electrode coatings
3. Identify types of material joints	• Butt • Corner • Lap • Edge • Tee

4. Identify types of welds	• Fillet
	• Groove or bevel
	• Plug
	• Standard symbols
	  o Type
	  o Size
	  o Length
	  o Field
	  o Other details

5. Identify and use welding positions	• Flat • Horizontal • Vertical • Overhead

6. Describe the applications for welds	• Fillet welds
	  o Shear strength
	• Butt welds
	  o Tension and compression
	  o Use of backer bars and back welding

7. Inspect welds	• Defects
	  o Cracking
	  o Inclusions
	  o Porosity
	  o Undercut
	  o Lack of fusion
	  o Lack of penetration
	• Methods of Inspection
	  o Visual
	  o Magnetic particle
	  o Ultrasonic
	  o Radio graphic

8. Estimate strength of welded connections	• Size and length • Base material • Filler material (weldments)
9. Identify special procedures for welding	• Hi tensile and alloy steels • Large, heavy wall sections • Cold weather conditions • Windy conditions • Preheating and postheating
10. Identify stresses and distortion in welded structures	• Stresses • Distortion (from heat)
11. Design simple butt welded connections	• Size of weld required • Length of weld required • Type of rods required
12. Prepare equipment and material for welding	• Equipment • Steel plates • Welding rods • Gases for cutting • Pre-bevelling and fit up of plates
13. Make weld connections	• Complete simple butt weld

Achievement Criteria

Performance	The learner will complete a simple butt weld using SMAW.
Conditions	The learner will be given: • Welding equipment • Material • Specification sheet
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Welded to specifications • Completed within specified time

Line (GAC): C USE TOOLS AND EQUIPMENT

Competency: C6 Use and Maintain Specialized Tools for Timber Construction

Objectives
To be competent in this area, the individual must be able to:

- Describe and use specialized tools for timber construction.
- Maintain specialized tools used for timber construction.

LEARNING TASKS

1. Describe and demonstrate use of timber tools

CONTENT

- Applications
- Safety precautions
- Maintenance
- Sharpening and lubricating
- Types and uses
- Handling tools
  - Peavey and canthooks
  - Picaroons
  - Pike pole/gaff hook
  - Timber carriers
  - Timber tongs
  - Timber dollies
  - Pry bars
- Cutting and shaping tools
  - Slicks and chisels
  - Poleaxe
  - Adzes
  - Teco cutters
  - Boom augers
  - Auger bit
- Specialty wrenches
  - Spud
  - Slug
  - Socket sets
  - Chain
  - Slugging
- Torque
  - Terms
  - Law of the lever formula
- Striking tools
  - Sledgehammer
  - Pin maul hammer
  - Wire rope cutter

2. Describe and demonstrate use of tools to move heavy objects vertically and horizontally	• Porta power o Setup and use • Hydraulic jacks

3. Describe and demonstrate use of piledriving power/bridgeworker tools	• Circular saws
	  o Power sources
	  o Blade guards
	  o Kickback
	  o Procedure for changing blade
	  o Setup and adjustments
	  o Cutting procedures
	• Chain saws
	  o Applications
	  o Power sources
	  o Parts of the saw and blade
	  o Kickback zone
	  o Chain break
	  o Automatic oiler
	  o Sling or 3-point start positions
	  o Procedures for inspection and use of saw

4. Use and maintain augers	• Applications • Power sources • Auger bit types and sizes

Line (GAC): D USE SURVEY INSTRUMENTS AND OTHER LEVELLING AND MEASURING TECHNIQUES

Competency: D1 Use Levelling Instruments and Equipment

Objectives
To be competent in this area, the individual must be able to:

- Describe the use of levelling instruments.

LEARNING TASKS

1. Use optical and laser levels

CONTENT

- Types
  - Builder's level/automatic levels
  - Laser levels
    - Laser hazard classifications
  - Total stations
  - Levelling rods and targets
- Calculations
- Set-up
- Adjustment
- Readings
- Layout
- Maintenance
- Storage

Line (GAC): D USE SURVEY INSTRUMENTS AND OTHER LEVELLING AND MEASURING TECHNIQUES

Competency: D2 Use Levelling and Measuring Techniques

Objectives
To be competent in this area, the individual must be able to:

- Use levelling and layout equipment.
- Use non-electronic levelling and measuring techniques.

LEARNING TASKS	CONTENT

1. Describe steps to take prior to performing layout work	• Site safety procedures
	  o Laser
	  o Excavation
	  o Rebar
	  o Fall protection
	• Print and jobsite familiarization
	  o Dimensions
	  o Total multiple dimensions
	  o Prints
	  o Current revisions

2. Describe basic skills required to perform site layout	• Measuring • Plumbing with plumb bobs, sprit levels • Marking for layout o Staking and marking • Verbal and written communication • Hand and arm signals • Use of scales

3. Use building layout processes	• Working within tolerances
	• Proper measuring and marking
	  o Using control lines and points
	  o Using offset lines
	• Preparing site
	  o Erecting batterboards

4. Describe layout procedures for footings, pile, caissons and piers	• Transferring from dry lines • Transfer using grid lines • Laying out of embedments

Achievement Criteria

Performance	The learner will layout two pile positions from a shop drawing.
Conditions	The learner will be given: • A shop drawing • Measuring tape • Stakes and hammer • Plumb bob
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of measurements • Completed within specified time

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E1 Use Ladders, Scaffolds and Access Equipment

Objectives
To be competent in this area, the individual must be able to:

- Use ladders, scaffolds and elevated work platforms.

LEARNING TASKS	CONTENT
1. Use ladders, scaffolds and elevated work platforms to perform pile driving tasks	• Setup • Applications for pile drivers • Pre-use inspection • Safe use • PPE • Maintenance

Achievement Criteria

Performance	The learner will inspect, set up and use ladders, scaffolds and elevated platforms.
Conditions	The learner will be given: • Equipment • PPE Equipment manual
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of inspection reports • Proper set up and use of equipment • Completed within specified time

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E3 Use Hoisting Equipment and Rigging Techniques

Objectives

To be competent in this area, the individual must be able to:

- Use the correct verbal and hand signals for hoisting operations.
- Use safety and communication methods.
- Read load charts and perform calculations.
- Perform reeving calculation and use reeving equipment.
- Demonstrate hand rigging and hand rigging with crane assist procedures.

LEARNING TASKS	CONTENT
1. Use WorkSafeBC regulations	• Cranes and Hoists • Rigging
2. Plan a rigging job	• Key terms • Site survey • Mobilization of people, materials and equipment and costs involved • Layout of materials • Personnel requirements • Safety plan requirements • Car, storage and inspection of rigging equipment • PPE • Crane safety • Load weight calculations • Rigging equipment WLL
3. Explain crane and rigging safety on water	• List • Landing the load • Hazards and precautions • Maximum list or trim of derricks • General marine safety rules

4. Use communication signals	• International communication signals
	• Hand signal protocols
	• Specialty hand signals for pile drivers
	  o Vertical travel lead signals
	  o Call for the whip, auxiliary whip or main lines
	  o Vibratory hammer signals
	  o Jaw signals
	  o Impact hammer signals
	  o Spotter signals

- Spotter and moonbeam signals
- Drill signals
- Fouled line signal

- Voice signals
  - Procedures for radio use
  - Clear verbal signals to crane operator in relationship to operator's positions

5. Use specialty hardware for pile driving

- Chain connecting links
  - Master
  - Clevis
  - Missing
  - Links and rings
- Sockets
- Load binders
- Spreader bars
- Equalizer bars and plates
- Slings and hitches
- Lashing and binding hardware
- Attachment hardware
- Hooks
  - Standard
  - Swivel
  - Chain grab
  - Chain slip
  - Palm
  - Choker
  - Sorting
  - Safety latches
- Hoisting equipment
- Headache ball with hook
- Blocks
  - Crane hook
  - Construction rigging
  - Snatch fibre rope
- Wedge sockets
- Pear link
- Chain grab hook
- Man basket
- Swivels
- Ground release shackles

6. Explain how a crane works	• Types and applications
	• Crane stability
	  o Lever
	  o Fulcrum
	• Lifting capacity of crane
	  o Counterweights
	  o Boom radius
	  o Weight of the hook and hoist line
	  o Number of parts in the reeving

7. Make calculations from a load chart	• How a load chart is created
	• Areas of a load chart
	  o Stability
	  o Ultimate capacity
	• Range diagrams
	• Boom angle indicator
	• Calculating radius
	• Head height

8. Use reeving equipment	• Key terms
	• Safety
	• Mechanical advantage
	• Drums
	  o Wrap
	  o Layer
	  o Patterns for spooling wire rope
	• Sheaves
	  o Sheave to rope diameter
	  o Inspecting sheaves
	• Blocks
	  o Parts
	  o Inspecting blocks
	• Square block reeving setups
	  o Procedure for four-part system
	  o Procedure for five-part system
	  o Skip reeving
	• Lacing

9. Perform reeving calculations	• Calculating friction loss • Calculating hoist line needed for a crane • Calculating line pats need for the hoist • Calculating maximum load for reeving arrangements

10. Use hand rigging techniques	• Key terms
	• Safety
	• Procedures for lashing and binding
	  o Yard and stay
	  o Tight lining
	  o High lining

11. Use hand rigging with crane assist	• Key terms
	• Potential hazards
	• Safe operation of lifting equipment
	• Work procedures
	  o Using an adjustable leg to level a load
	  o Using an adjustable leg with rollers to hoist a load
	  o Using an adjustable leg with yard to hoist a load
	  o Drifting a load under an overhang

12. Explain crane hoisting and their uses in the piledriving industry	• Key terms
	• Crane lines
	  o Main
	  o Auxiliary
	• Line speed and hook speed
	• Haul-back lines
	• Tuggers
	• Single line hook work procedures
	  o Hoisting a load
	  o Loft a pile
	  o Trip a load
	• Multi-line hook work
	  o Rotating a suspended load
	  o Walking a load
	• Critical hoist

13. Handle, load, and store materials	• Steel beams
	  o Planning, slinging and securing
	  o Dunnage and chocks
	• Timbers and treated materials
	  o Planning
	  o Protection from slings, weather and other material
	  o Blocking
	  o Stickers
	• Concrete beams and piles
	  o Pick points and dunnage locations
	  o Manufacturer specifications and engineered procedures
	  o Handling long piles
	• Loading and unloading rail cars
	  o Types and sizes of cars
	  o Maintaining load limit and stability
	  o Maintaining height and width clearances
	  o Securing the load
	  o Railway inspections
	• Loading and unloading trucks and trailers
	  o Gross vehicle and tare weights
	  o Allowable axle weights
	  o Securing load
	  o Highway regulations
	  o Direction of traffic
	• Use of hand lines to control load

14. Hoist common piledriving materials using safe work procedures	• Single wood pile • Bundle of wood pile • H-pile • Circular steel pile • Concrete pile • Sheet pile • Rebar bundle

Achievement Criteria

Performance	The learner will perform a piledriving rigging task.
Conditions	The learner will be given: • Piledriving hoisting and rigging equipment • PPE • An instruction sheet
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Correct weight and load chart calculations • Selection of rigging components • Correct use of equipment • Completed within specified time

Line (GAC): E USE ACCESS, RIGGING AND HOISTING EQUIPMENT

Competency: E4 Use Support Equipment

Objectives

To be competent in this area, the individual must be able to:

- Successfully complete a recertification course for the Class 5 forklifts.
- Successfully complete a certification course for the operation of all terrain zoom booms.
- Describe excavators used in the piledriving trade.

LEARNING TASKS	CONTENT
1. Describe excavator used in the pile driving trade	• Types of excavators • Safe work practices • Typical tasks performed • Pinch points • Accessories

Line (GAC): F PERFORM SITE LAYOUT

Competency: F3 Layout a Foundation Piling Project

Objectives
To be competent in this area, the individual must be able to:

- Lay out out a foundation piling project

LEARNING TASKS	CONTENT
1. Lay out a foundation piling project	• Layout equipment o Builder's level o Level rod • Gridlines and batter boards o From bench mark o Using tape measure and 3-4-5 triangles o From intersecting lines • Numerical designations for identification of each pile o For pile driving logs or records • Stake out of each pile location o Wooden hubs or spikes o Coloured flags to identify different types of piles (sizes or batters)
2. Describe offsets for slope correction	• Locations of batter piles when cut-off is above or below grade

Achievement Criteria

Performance	The learner will layout a foundation piling project.
Conditions	The learner will be given: • Plan and specifications • Materials • Tools and equipment
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Correct calculations and layout • Completed within specified time

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G3 Select and Build Concrete Forming Systems

Objectives
To be competent in this area, the individual must be able to:

- Build specialized false and formwork.

LEARNING TASKS	CONTENT
1. Describe techniques for construction of soffit support falsework for suspended caps and piers	• Friction collars on piles • Brackets & beams bolted or welded to piles or inserted from previous pours • Hangers from piles • Spud pins & overhead beams • Independent pile supported falsework • Stage construction • Special precautions required
2. Describe methods of dealing with floatation due to submergence	• Steel falsework • Steel forms • Weighing of soffits and forms • Anchoring to piles
3. Describe use of steel plate girder structural forms	• Applications • Side forms acting as girders or beams • Modular design
4. Identify safety issues for suspended cap & pier construction	• Scaffolding • Access • Fall protection

Achievement Criteria

Performance	The learner will build specialized formwork for a suspended pile cap.
Conditions	The learner will be given: • PPE • Drawing • Specifications • Tools and equipment • Materials
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of form construction • Completed within specified time

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G5 Install Reinforcement and Embedded Items

Objectives
To be competent in this area, the individual must be able to:

- Install anchor bolts and embedded metals in concrete.

LEARNING TASKS	CONTENT
1. Describe the purpose of installing anchor bolts and embedded metals in concrete	• Templates • Plates or angles • Anchor bolts • Alternative to projecting bolts
2. Describe the purpose of installing reinforcing steel in concrete	• Purpose • Specifications, grades and sizes • Cutting and bending o Schedules o Minimum bend radius o Field bending • Handling and storage • Development length and splicing • Placing
3. Place reinforcing steel in concrete	• Spacing of bars • Supports • Tying • Consideration of anchor bolt and embed locations • Pre-assembly of components

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G6 Place and Finish Concrete

Objectives

To be competent in this area, the individual must be able to:

- Describe procedures for placing concrete underwater.
- Place concrete underwater using tremies.

LEARNING TASKS	CONTENT
1. Describe procedures for placing underwater concrete	• Sounding • Tremie pipe/systems • Pump • Bucket • Prepak system • Concrete rich in cement • High slump mix • Avoiding segregation • Latence formation and removal • Smaller aggregates
2. Identify procedures for cold construction joints	• Engineer's approval • Avoidance and removal of latence o Retardant spray o Green cutting • Prepour o Dampening o Cement past o Bonding agent • First pour or falsework to carry succeeding pour • Extra top reinforcing steel
3. Describe transportation methods of concrete on marine sites	• Ferrying of ready mix trucks • Ferry buckets • Floating pump line • Helicopter
4. Describe methods of maintaining quality control of concrete	• Testing of fluid concrete o Temperature test o Slump test o Cylinder taking and curing to test for strength • Testing of solid concrete o Schmidt hammer test o Coring and testing • Cross-hole sonic logging

5. Explain the importance of water cement (W/C) ratio	• Effects
	  o Strength
	  o Shrinkage
	  o Workability
	  o Durability
	• Use of super plasticisers and retardants

6. Describe the curing of concrete	• Hydration process and heat of hydration • Effects of dehydration from sun and wind • Effect of temperature on initial set and curing rate

7. Describe methods of protecting concrete and affecting curing rates	• Hot weather concreting
	• Cold weather concreting
	• Heated water or ice in mix
	• Protection of exposed surfaces from dehydration
	  o Chemical sealants
	  o Sprinklers
	  o Wet burlap
	• Acceleration of curing rate
	  o Chemicals and mixtures
	  o Richer mix
	  o High early cement
	  o Steam curing

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G8 Install Pre-cast and Pre-stressed Concrete

Objectives
To be competent in this area, the individual must be able to:

- Install pre-cast and pre-stressed concrete.

LEARNING TASKS	CONTENT
1. Identify purposes of precasting	• Offsite or onsite advantages • Modular construction • Minimization of in-situ forming and falsework
2. Describe principal of pre-stressing and post-tensioning	• Compensation for weakness of concrete in tension
3. Describe methods of pre-stressing and post-tensioning	• Pre-stressing o Slabs o Beams o Piles o Wharf and bridge deck systems
4. Identify precautions related to the erection and handling of precast elements and piling	• Special handling procedures • Overstressing

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G9 Install Construction and Expansion Joints

Objectives
To be competent in this area, the individual must be able to:

- Form a footing with a control joint.

LEARNING TASKS	CONTENT

1. Describe concrete joints	• Construction
	  o Structural integrity
	  o Water tightness
	  o Hiding joints
	  o Horizontal joints in suspended caps and beams
	• Control joints
	  o Tooled
	  o Embedment of plastic strips
	  o Saw cuts
	• Expansion and contraction joints
	• Isolation joints

2. Describe preparation of surfaces for grout	• PPE • Cleaning surface for adhesion and bonding • Preparing surface for adhesion and bonding • Forming • Surface and air temperature
3. Describe types of grout	• Dry pack • Non-shrinking • Expanding • Epoxy

Line (GAC): G BUILD CONCRETE FORMWORK

Competency: G10 Maintain and Repair Concrete Structures

Objectives
To be competent in this area, the individual must be able to:
- Maintain and repair concrete structures.

LEARNING TASKS	CONTENT

1. Describe defects, deterioration and damage to concrete structures	• Causes of defects
	  o Chemical
	  o Freeze/thaw
	  o Corrosion
	  o Physical
	• Honeycombing
	• Bug holes
	• Spalling
	• Popouts
	• Scaling
	• Delaminations
	• Cracks

2. Repair damaged concrete	• Assessment of damage
	• Procedures for removal
	  o Propping and shoring
	  o Tools
	• Environmental concerns
	• Substrate preparation
	• Forming
	• Repair materials
	  o Concrete mixes
	  o Grout
	  o Bonding agents
	  o Surface sealing
	  o Finishing
	  o Epoxy injection
	• Records required

3. Inspect and repair reinforcing steel	• Inspection of structural integrity • Corrosion • Maintaining correct clearance • Repairing protective coating on steel • Maintaining correct overlap of reinforcing steel • Using mechanical splicing

Line (GAC): I USE MARINE WORK PROCEDURES

Competency: I1 Follow Navigation Rules

Objectives
To be competent in this area, the individual must be able to:
- Describe types of navigation aids.
- Follow navigation rules and regulations.

LEARNING TASKS	CONTENT
1. Describe navigational aids	• Aids to navigation system (ATON) • Key Terms • Buoys • Daybeacons • Lights • Numbering system
2. Describe types of buoys	• Shapes and colours o Can o Nun o Banded and striped o Sound o Lighted o Combination o Exposed location o Hazard o Mooring
3. Describe types of beacons	• Daybeacon • Daymark • Minor light • Lighthouse
4. Describe types of lights	• Flashing • Occulating • Morse Code
5. Use nautical charts	• Purpose • Information included on charts • Unit of measure • Light abbreviations • Notice to mariners

6. Follow navigation rules	• Rules of the road (COLREGS)
	• Day shapes
	  o Types and purposes
	• Navigation lights
	  o Purpose
	  o Running and riding lights
	  o Determining right of way
	  o Colours, shape and arrangement
	• Navigation Sounds
	  o Purpose
	  o Short and prolonged blasts
	  o Signals in restricted visibility
	• Distress signals

7. Avoid collisions	• Coast Guard "Rule of Good Seamanship" • Right of way • Safe speed • Lookout • Sounding • Meeting another vessel • Crossing another vessel • Overtaking a vessel • Traffic lanes • Navigating narrow channels

Line (GAC): I USE MARINE WORK PROCEDURES

Competency: I2 Use Moving and Positioning Vessels

Objectives

To be competent in this area, the individual must be able to:

- Understand the safe operation of a punt/skiff.
- Understand the safe operation of a tugboat.
- Explain how to place and set anchors from a barge, tugboat and skiff.

LEARNING TASKS	CONTENT
1. Describe the operation of a punt/skiff	• Inspection before use • Applications • Safety precautions • Preparing for operation • Towing • Work procedures • Calculating tides and water depths
2. Describe the operation of a tugboat	• Applications • Safety precautions • Preparing for operation • Moving a barge with a tugboat o Towing astern o Pushing ahead o Towing from the hip • Emergency breakaway systems • Signals used for positioning a barge • Positioning a barge • Placing and setting anchors o From the barge o From the tugboat o From the skiff • Calculating tides and water depths
3. Explain how weather affects a vessel	• Wind • Cold • Rain and snow
4. Explain hazards when working with other vessels	• Effects of wakes
5. Describe the procedures for boarding a vessel	• Docks • Piers • Wharves • Moving from vessel to vessel

6. Describe working on a barge

- Safety concerns
- Hoisting a load from land
- Working with a crane on a barge
- Pinch points
- Welding on the water
  - Isolated grounding

Line (GAC): J BUILD EXCLUSION AND RETENTION STRUCTURES

Competency: J1 Describe Exclusion and Retention Structures

Objectives

To be competent in this area, the individual must be able to:

- Use safe work practices.
- Describe the hardware, material and equipment used to build exclusion and retention structures.
- Describe the function of a template.
- Explain site preparation.
- Describe the handling, setup and driving sheet and h-pile.

LEARNING TASKS	CONTENT
1. Describe exclusion and retention structures	• Purposes o Keeping material in o Keeping materials out • Types of structures
2. Describe equipment used to build structures	• Cranes and rigs • Hammers o Impact and vibratory o Winches o Welding and cutting o Pumps o Generators
3. Describe safety hazards and precautions	• Working at heights • Moving heavy materials • Working with cranes • Motorized machinery • Working around water and vessels • Alert and alarm signals • Weather conditions
4. Work safely around water and vessels	• Personal flotation device • Currents • Vessel identification lights • Pinch points on barges • Egress and access • Material handling • Rescue procedures
5. Describe types of pile used to build structures	• Sheet pile o Shapes - Z, U, straight and arched o Materials - Steel, aluminum, plastic, concrete and wood

- H-pile
- Precast concrete
- Auger cast
- Specialty

6. Describe environmental protection tools
   - Turbidity curtain
   - Silt fence
7. Describe site preparation requirements
   - Pre-job conference
     - Review of building plans
     - Establishment of control joints and benchmarks
   - Installation of batter-boards
   - Offsets
   - Location and marking of utilities
   - Access for emergency and deliver vehicles
   - Identification of soil conditions
   - Storage area for tools, materials and equipment
   - Crane assembly
8. Describe preparation for marine construction
   - Dredging
   - Marine traffic
   - Location of material barges and work floats
   - Securing of tools, materials and equipment
9. Describe the handling and storage of sheet pile
   - Roles and responsibilities of the crew
   - Rigging pile for lifting
   - Landing the pile and placing dunnage
10. Describe the preparation of sheet pile
    - Marking
    - Sniping
    - Threading
11. Describe templates
    - Parts of a template
      - Spuds and spud pockets
      - Walers
      - Cross braces
      - Face
      - Walkway
      - Legs
    - Calculations for weight of the template

12. Describe the building of exclusion and retention structures	• Boom tip elevation and drift • Headroom calculations • Hoisting the first sheet pile • Moving the pile • Checking plumb and rack against template • Securing pile to the template • Setting the second sheet
13. Describe the use hammers drive sheet pile	• Vibratory hammers o Crew assignments o Preparing the hammer o Hoisting the sheet pile o Driving the sheet pile o Castle driving • Impact hammers o Crew assignments o Preparing the hammer o Driving the sheet pile
14. Describe the installation of sheet pile by jetting	• Purpose of air and water jetting • Single and double jets • Pre-cast concrete sheet pile with jets
15. Describe the use of hammers to drive H-pile	• Vibratory hammers o Hoisting the pile o Driving the pile • Impact hammers o Hoisting the pile o Driving the pile
16. Describe the excavating of the structure	• Open ended structures • Closed ended structures
17. Describe excavation equipment	• Excavators • Backhoes • Clam buckets • Bulldozers • Front end loaders
18. Describe pumps used to dewater cofferdams	• High volume/low lift • High volume/high lift • Low volume/high lift
19. Describe the installation of a waler system	• Layout, measuring and planning the construction of waler system • Cutting, fitting and welding and fitting the waler system • Trimming, grinding and assembling material

20. Cut sheet pile to grade

- Survey equipment
- Cutting tools
  - Torches
  - Saws and special blades

Line (GAC): J BUILD EXCLUSION AND RETENTION STRUCTURES

Competency: J2 Build Cofferdams

Objectives

To be competent in this area, the individual must be able to:

- Describe the types of cofferdams and their uses.
- Build a template and set it in position.
- Describe the steps required to build and removed different types of cofferdams on land and water.
- Layout and build a template and cofferdam.

LEARNING TASKS	CONTENT

1. Describe characteristics of cofferdams	• Temporary and permanent
	• Closed ended structures
	  o Box
	  o Cellular
	• Exclusion and retention structures
	• Types
	  o Box
	  o Cellular
	  o Cellular with arcs or intermediates
	• Components
	  o Closed wall formed by sheet pile
	  o Templates
	  o System of braces

2. Describe the building and removal of cofferdams on land	• Size considerations
	• Building and placing the template
	• Setting multiple-ring templates
	  o Two-crane method
	  o Knee-brace method
	  o Spud-template method
	• Setting and driving the sheet pile
	• Closing the cofferdam
	• Excavation and installation of the waler system

3. Describe the removal of a cofferdam	• Methods of pulling sheet pile
	  o Vibratory hammer with single crane line
	  o Vibratory hammer with two crane line
	• Fluffing the sheet pile
	• Flooding the cofferdam to equalize water pressure

4. Describe the building of cofferdams in water	• Size considerations • Building and placing the template

  - Two barge method
- Setting and driving the sheet pile
- Excavating and dewatering the cofferdam
- Removing the cofferdam
  - Removing the template
  - Pulling the sheet pile

5. Describe the building of cells

- Building the template
- Placing the template
- Setting and driving he sheet pile
  - Staying on the marks
  - Plumbing the sheet pile
  - Back snapping
  - Closing the cell
- Building cells with intermediates
  - Fabricated connectors
  - Flow and reduction gates
  - Setting intermediate sheet pile

6. Build a cofferdam

- Template
- Layout of sheets
- Hoisting and lacing

Achievement Criteria

Performance: The learner will layout and build a template and cofferdam.

Conditions: The learner will be given:

- PPE
- Drawings and instructions
- Tools and equipment
- Materials

Criteria: The learner will score 70% or better on a rating sheet that reflects the following criteria:

- Following safety procedures
- Use of PPE
- Accuracy of measurements
- Material preparation
- Lacing procedures
- Cofferdam closes without problems
- Completed within specified time

Line (GAC): J BUILD EXCLUSION AND RETENTION STRUCTURES

Competency: J3 Build Bulkheads

Objectives
To be competent in this area, the individual must be able to:

- Describe the designs and uses of bulkheads.
- Explain the steps to build a template for a bulkhead.
- Identify the steps to build a bulkhead.

LEARNING TASKS	CONTENT

1. Describe the types and uses of bulkheads	• Purpose of bulkheads
	  o Protection of shorelines
	  o Docks and mooring points
	• Straight, curved and combination designs

2. Describe templates used for bulkheads	• Materials used • Shape, location and dimensions • Size and shape
3. Describe template construction	• Height requirements • Installation of knee braces • Installation of template beam • Interlocking methods
4. Identify the steps to build a bulkhead using anchor pile	• Template installation • Starting point • Installation of fabricated connector • Setting the sheet pile • Installing the movable template • Installing the anchor sheets
5. Identify the steps to build a bulkhead using master pile	• Template installation • Installing the master pile • Setting the sheet pile • Closing the section • Anchoring the master pile

Line (GAC): J BUILD EXCLUSION AND RETENTION STRUCTURES

Competency: J4 Build Tieback Walls

Objectives

To be competent in this area, the individual must be able to:

- Explain types of tieback walls and their uses.
- Identify materials used when building tieback walls.
- Describe how to build and stress tieback walls.

LEARNING TASKS	CONTENT

1. Describe the types and uses of tieback walls	• Types and components
	  o Sheet pile wall
	  o Lagging
	  o Contact sheeting
	  o Secant pile walls
	  o Anchors
	  o Miscellaneous materials

2. Describe the installation of soldier pile for tieback walls	• Driving soldier pile with vibratory hammer
	• Driving soldier pile with an impact hammer
	  o Crew assignments
	  o Checking plumb and rack
	• Driving soldier pile with impact hammer
	  o Hoisting
	  o Driving
	• Drilled solder pile
	  o Crew assignments
	  o Location of soldier pile
	  o Assembly and use of drill or auger
	  o Insertion and plumbing of pile

3. Describe the installation of retaining material	• Excavating equipment used • Installing lagging • Installing contact sheeting • Installing a waler system

4. Describe the installation of anchors

- Types and uses of anchors
- Installing of helix anchors
  - Crew assignments
  - Drilling the first section
  - Installing the extension rods
  - Stressing helix anchors
- Installing of bar tendon anchors
  - Crew assignments
  - Preparations
  - Drilling casings into the soil
  - Drilling soil out of the casing
  - Inserting the anchors
  - Removing the casing or drill steel
  - Stressing the anchors
- Installing strand tendon anchors
  - Crew assignments
  - Preparations
  - Drilling casings into the soil
  - Drilling soil out of the casing
  - Inserting the anchor
  - Removing the casing
  - Stressing the anchors
- Installing a gravity anchor system
  - Location and installation of deadman
  - Excavation
  - Placing the tension rods
  - Installing the walers

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K1 Describe the Properties and Testing of Soils

Objectives
To be competent in this area, the individual must be able to:

- Describe the properties of soils.
- Describe soil testing procedures.

LEARNING TASKS	CONTENT
1. Identify purposes of geotechnical investigation	• Assessment of ability to support structure • Short and long term behaviour of soils under structure • Effects on adjacent properties and structures • Estimation of costs • Determining soil properties

2. Describe soil properties and classifications	• Unified Soils Classification System (USCS)
	• Properties
	  o Size and gradation
	  o Densities and strengths

3. Identify the properties of soils	• Course grained (non-cohesive)
	  o Particle size
	  o Compactness
	  o Angle of internal friction
	  o Permeability
	• Fine grained (cohesive)
	  o Particle size
	  o Stiffness
	  o Cohesion
	  o Compressibility
	  o Permeability
	• Fill
	  o Random
	  o Obstructions

4. Describe methods of investigation of soils

- Advantages and disadvantages of test methods
- Bore tests
- Test pits
- Rotary drilling tests
- Auger Tests
- Pile tests
  - Dynamic
  - Axial compression
  - Static load
- Penetrometer test
  - Standard penetrometer test (N value)
  - Cone penetrometer tests
- Test pits
- Seismic refraction and seismic reflection
- Laboratory tests

5. Describe soils stratigraphy

- Formation
- Effects on settlement and length of piles

6. Describe the phenomenon related to soils

- Causes
- Prevention methods
- Consequences
- Soil liquefaction
- “Boiling” in cofferdams
- Uplift or pile heave
- Negative skin friction and down drag
- Set-up and relaxation

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K2 Use Unique Installation and Soil Improvement Techniques

Objectives
To be competent in this area, the individual must be able to:

- Identify requirements for soil improvement.
- Describe soil improvement methods.

LEARNING TASKS	CONTENT

1. Explain the importance of dewatering a site	• Key terms
	• Application and procedures
	• Advantages and disadvantages
	• Dewatering techniques
	  o Wick drains
	  o Sand columns
	  o Well point system
	  o Ditch and drainage systems
	  o Relief wells

2. Describe densification (compaction) techniques	• Key terms
	• Applications and procedures
	• Advantages and disadvantage
	• Methods
	  o Dynamic compaction
	  o Vibro-compaction and vibro-replacement
	  o Vertical drains and surcharge loading
	  o Compaction pile
	  o Replacing soil
	  o Surcharge technique
	  o Stone columns
	  o Grouting

3. Describe shear control techniques	• Applications and procedures
	• Advantages and disadvantage of different techniques
	• Methods
	  o Soil nailing
	  o Soil anchor systems
	  o Soil freezing

4. Describe soil and rock anchoring procedures	• Applications • Types of soil and rock anchors • Installation techniques

5. Describe methods and applicability of soil improvements methods	• Purposes • Vertical drains and surcharge loading

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K3 Describe Types of Piles and Deep Foundations

Objectives

To be competent in this area, the individual must be able to:

- Describe foundations, piles and caissons.
- Describe and classify piles by purpose, material, section and orientation.

LEARNING TASKS

1. Describe and classify piles

CONTENT

- Purposes
  - Structural member for transferring loads to and from underlying soil stratum
  - Implement used to improve certain properties in a soil stratum
- Orientation
  - Vertical (plumb)
  - Batter (brace)
- Applications
  - Foundation or bearing
  - Fender
  - Sheet (shoring)
  - Dolphin
  - Brace
  - Soldier
  - Tension (anchor)
  - Compaction
  - Drainage
- Material composition
  - P/C or P/S concrete
  - Timber
  - Steel
  - Concrete
  - Plastic
  - Gravel or stone
  - Composite
  - Cast-in-place concrete
- Methods of soil-pile load transfer
  - Bearing
  - Friction
- Non-displacement or displacement type
- Shape or section
  - Pipe
  - H-section
  - P/C or P/C - P/S concrete
  - Expanded base piles/CIP concrete piles

- Methods of installation
  - Shelless cast-in-place
  - Auger cast
  - Jetted
  - Drilled caissons
  - Step tape/mandrel driven
  - Mini piles

2. Describe steel H piles

- Properties
  - Grades and strength of steel
  - Sizes and weights (thickness)
  - Lengths available from mill
- Applications
  - Bearing piles for land and marine structures
  - Fender piles for marine structures
  - Soldier piles in bulkheads
  - Falsework walers, beams, and struts
- Advantages
  - Consistent quality
  - Can be cut or splices
  - Non displacement
  - Attachment connections can be welded or bolted
- Subject to corrosion
- Not good for long columns

3. Describe steel pipe piles

- Grades and strengths of steel
- Applications
  - Bearing piles for land and marine
  - For brace piles for land and marine
  - Extended columns in bridges and trestles
  - Dolphins of all types
  - Bulkheads (shoring)
  - Temporary casings in the installation of cast-in-place concrete piles
- Types of pipe
  - By specification
  - By method of manufacture
- Sizes and weights (thickness)
- Lengths available from mills
- Advantages
  - Lengths can be adjusted
  - Consistent quality
  - Can be reinforced

- Easy to make structure/connections by welding
- Can be socketed into rock by drilling
- Can be bottom driven

- Subject to corrosion

4. Describe steel sheet piles

- Properties
  - Grades and strengths of steel
  - Shapes
  - Types of interlocks
  - Method of manufacture
  - Sizes
- Applications
  - Single wall bulkheads or retaining walls on land and waterfront structures
  - Closed shoring and cofferdams structures on land
  - Single wall or closed cofferdams for construction of marine works
  - Cellular cofferdam structures for marine works (temporary)
  - Cellular dolphins, wharf, and pier structures (permanent)
- Advantages
  - Interlocks aid in maintaining pile alignment
  - Interlocks aid in making cofferdams impervious
  - Availability of shapes, sizes and lengths
  - Can be locally reinforced to increase strength
- Subject to corrosion

5. Describe of precast and prestressed-precast piles

- Differences between precast and prestressed-precast
- Shapes and sizes
- Number of strands or reinforcing steel
- Length limitations
- Applications
  - Foundation bearing piles on land
  - Bearing and batter piles in marine structures
  - Extended columns on bridges and trestles
  - Sheet piling for bulkhead walls
- Advantages of precast-prestressed concrete piles
  - Corrosion resistance
  - Shapes and sizes available
  - Can be cast on site

6. Describe cast-in-place expanded base concrete piles	• Properties • Load capacities • Applications o Foundation unit for installation in loose saturated, cohesionless soils

7. Describe composite piles	• Properties
	• Applications
	• Advantages and disadvantages
	• Types
	  o Treated and untreated timber
	  o Steel pipe and untreated timber
	  o Shell cast-in-place concrete and untreated lumber
	  o P.C. concrete and untreated lumber
	  o Pipe and thin shell cast-in-place concrete

8. Describe timber piles	• Properties • Advantages and disadvantage • Installation
9. Describe miscellaneous types of piles	• Uncased cast-in-place concrete piles • Mini/pin piles • Thin-shell cast-in-place concrete piles • Screw piles • Fin piles

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K4 Install and Extract Piles

Objectives
To be competent in this area, the individual must be able to:

- Rig up a crane piledriving rig.
- Install pile for marine structures.

LEARNING TASKS	CONTENT
1. Describe mobilization and rigging up of piledriving equipment	• Rigging of a crane pile driver • Positioning of equipment and aligning leads for driving of piles • Techniques for driving batter piles • Marine techniques
2. Describe pile installation procedures	• General requirements for handling and installing piles o Delivery o Unloading, storing, and picking o Ground conditions to support stacked pile o Proper use of dunnage and chocks o Installing in the correct location and alignment o Energy input limits o Preparing the head for driving o Tip protection • Handling and installation techniques for types of piles o Timber piles o H piles o Pipe pile o P/C concrete - Cushioning requirements o Steel sheet piles - Limitations of driving individually - Guide falseworks - Pitching, racking or lacing - Driving in stages - Sealing of interlocks in cofferdams o Expanded base pile o Auger cast piles o Special installation techniques - Excavation and removal of obstructions - Pre-spudding - Predrilling

- Jetting
- Churning
- Blasting
- Battering

3. Describe special pile installation techniques
   - Through dense layers and obstructions
   - Under water
   - To sloping rock surfaces
   - Socketing piles to rock
   - Improving tension capacity of driven piles
   - Installations with limited headroom
   - Installation by casing oscillation
   - Specialized hydraulic jacking systems for installing steel H and sheet piles

4. Describe splicing, cutting off, protecting and reinforcing piles
   - Methods of splicing and extending piles
   - Methods and tools for cutting piles
   - Protecting the tips of piles
   - Methods of reinforcing piles

5. Describe pre-boring, cleaning out and filling of piles
   - Drilling equipment
     - Mounts
     - Drives
     - Drill bits and tools
     - Bailers
     - Pumps
   - Air lift

6. Describe methods of dewatering piles
   - Submersible pumps
   - Forced air
   - Suction pumps

7. Describe techniques for extracting piles
   - Methods
   - Special extraction techniques
   - Safe practices
     - Appropriate rigging
     - Plan for disconnection from extraction rigging

8. Describe and install pile for marine structures

- Timber cluster dolphins
- Braced timber pile dolphins
- Braced steel pile dolphins and wing walls
- Braced pipe pile tower substructures
- Staying of piles for wharf and pier structures
- Timber pile wharf substructures
- Timber crib wharves and piers
- Pre-cast caisson wharves
- Fender systems

Achievement Criteria

Performance: The learner will hoist and drive a pile.

Conditions: The learner will be given:

- PPE
- An instruction sheet
- Tools and equipment
- Materials

Criteria: The learner will score 70% or better on a rating sheet that reflects the following criteria:

- Following safety procedures
- Use of PPE
- Inspection of pile driving equipment
- Plumbness of driven pile
- Penetration of pile
- Equipment manufacturer specifications followed
- Completed within specified time

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K5 Use Piledriving Equipment

Objectives
To be competent in this area, the individual must be able to:
- Describe types of piledriving equipment.
- Install pile.

LEARNING TASKS	CONTENT
1. Describe piledriving equipment	• Advantages and disadvantages • Applications • Types • Safety • Drop hammers • Air/steam hammers • Diesel hammers • Hydraulic hammers • Lacing or hairpin hammer • Impact extractors
2. Describe procedures for rigging and positioning of piles and driving equipment	• Rigging of a crane piledriver • Positioning of equipment and aligning leads for driving of piles

3. Describe types of marine piledriving equipment	• Applications
	• Safe operation
	• Advantages and disadvantages
	  o Crane on a barge
	  o Pedestal mounted derricks
	  o Fixed frame and moon beam water drivers
	  o A-frame with crane rigs

4. Describe guiding systems for piledriving equipment	• Piledriving leads
	  o Types
	  o Cross sections
	  o Parts
	  o Lead cross sections
	  o Accessory equipment used in leads
	• Applications of guide templates
	  o Purposes
	  o Types
	• Offshore system and pants or skirts

5. Describe the use of driving accessories for impact hammers, their application and operation	• Applications
	• Operations of accessories
	• Helmets or drive caps
	• Templates
	  o Types and shapes
	  o Securing hammers
	• Packing or cushioning for pile cap
	  o Purpose
	  o Types of packing or cushioning material
	• Cushioning required between drive cap and pile when driving precast concrete piles
	  o Purposes
	  o Types
	• Followers
	  o Uses
	  o Impedence properties
	• Mandrels
	• Spuds
	• Jetting

6. Describe vibro drives/extractors	• Principal of vibro driver/extraction
	• Vibrator parameters
	• Power systems
	• Advantages
	• Operation and servicing
	  o Mandatory inspection of crane booms after use
	  o Operation procedures
	  o Size of unit for various applications

7. Describe types of piledriving hoists	• Applications • Safety • Advantages and disadvantages • Truck crane • Crawler crane • Skid rig • Specialty hydraulic rigs • Guyed mast • Fork lift

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K6 Describe the Design, Testing and Inspection of Piles

Objectives
To be competent in this area, the individual must be able to:
- Inspect piles.

LEARNING TASKS	CONTENT
1. Describe the principal factors which influence design of piles	• Density and capacity of soil o End bearing o Friction o Compressibility • Size of loads • Type of loading o Axial compression loading o Axial tension loading o Lateral loading o Unsupported lengths • Life expectancy • Effects of a group of fraction piles
2. Identify factors which determine the required depth of embedment or penetration	• End bearing capacity in a dense stratum • Sufficient compressive or tensile load carrying capacity in friction • Fixity • Prevent loss of capacity through scour • Provide a water barrier • Prevent boiling
3. Describe the methods of determining the load carrying capacity of pile	• Theoretical analysis • Dynamic driving formulas: o ENR o Hiley o Norland • Static load testing • Pile analyser • Statnamic testing
4. Describe purpose of test piles	• To determine lengths • To determine drivability • To determine load capacity
5. Describe procedures for testing of piles	• Visual inspection

- Physical tests
  - Tensile tests of steel
  - Hardness tests for P.C. concrete
- Chemical tests for steel
- Pile integrity tester
- Pile analyzer
- Increment borer
- Recording pile driving history
  - Purposes to confirm pile integrity
  - To identify extra-ordinary circumstances which may be a change of conditions
  - Provide length records
- Minimum information to be recorded
  - Pile identification (by number and/or location)
  - Description of pile (type, size, weight, etc.)
  - Driving equipment (type, model, weight, height of drop, etc.)
  - Final set (penetration, infor, last five blows)
  - Net-in-place lengths
  - Notes regarding any exceptional circumstances or interruptions during driving
- Additional information for pile record
  - Number of blows per unit of length over entire driven length
  - Elevations of ground at time of driving
  - Cut off elevations
  - Tip elevations
- Photography and or sketches to illustrate unusual occurrences
- Forms for recording pile driving information
  - Detailed single pile record
  - Simplified multi-pile

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K7 Use Load Testing Procedures

Objectives
To be competent in this area, the individual must be able to:

- Describe load testing procedures

LEARNING TASKS	CONTENT
1. Identify purpose of load testing	• Determining bearing capacity • Predicting settlements

2. Perform a load test	• Types of load
	  o Static testing
	  o Tension
	  o Lateral
	  o Dynamic testing/PDA
	• How loads are measured
	• How movements are measured
	• Testing procedures
	• Construction requirements

Line (GAC): K USE PILE AND FOUNDATION PROCEDURES

Competency: K8 Use Pile and Foundation Repair and Maintenance Procedures

Objectives
To be competent in this area, the individual must be able to:

- Explain the difference between a shallow and a deep foundation.
- Identify types of foundation repairs.
- Repair a foundation.

LEARNING TASKS	CONTENT

1. Describe types of foundations	• Key terms
	• Applications
	• Advantages and disadvantage of various types of foundations
	• Shallow foundations
	  o Spread footing
	  o Strip footing
	  o Combined floor and foundation footings
	  - Conventional slab-on-grade
	  - Post-tensioned slab-on-grade
	  o Mat
	  o Pad
	  o Floating
	• Deep foundations
	  o Driven pile
	  o Drilled pile shaft
	  o Caisson boxes
	  o Excavated foundations
	  - Slurry walls

2. Describe reasons for foundation repairs	• Structure modifications • Design flaws • Changing soil mechanics • Lowering of water tables • Loads from adjacent structures • Seismic upgrading requirements • Decay or marine borer attack of timber pile • Corrosion of steel members • Deterioration of concrete and corrosion of reinforcing and prestress strands • Physical damage

3. Identify methods of inspection	• Visual • Extraction of sample piles for examination • Spike or increment boring of timber • Coring samples of concrete piles • Drilling of steel piles to determine wall thickness

4. Describe methods for repairing piles	• Timber
	  o Grouting cavities
	  o Tape wraps and sleeves
	  o Grouted plastic jackets
	  o Posting
	• Steel
	  o Impressed current
	  o Reinforcing plates
	  o Wrapping with tape or plastic
	  o Grouted jackets
	• Concrete
	  o Gout patching of surface spalls
	  o Grouted jackets
	  o Epoxy injections

5. Describe stabilization techniques	• Needle and beam jacking • Cantilever systems • Cribbing and jacking
6. Describe underpinning	• Jacking against a static load • Mini-pile installation • Low-overhead auger-cast piling • Installing pile with low-headroom impact hammers • Installing pile through existing structures
7. Explain methods of erosion control	• Sheet pile installation • Riprap placement

Line (GAC): L BUILD WITH TIMBER AND STEEL

Competency: L1 Build with Timber

Objectives
To be competent in this area, the individual must be able to:

- Identify types of timber and their uses.
- Work safely with timber preservatives.
- Identify fasteners types and uses.
- Perform repair work on timber structures.

LEARNING TASKS	CONTENT
1. Describe types of timber material	• Key terms • Size and shape of timber cuts o Solid sawn timber o Beams and stringers o Posts • Natural wood timbers o Advantages and disadvantages • Manufactured timber o Glue-laminated and parallel strand o Advantages and disadvantages • Calculation of timber volumes • Properties of timber species o Strengths o Weights o Fire resistance o Resistance to decay and insect attack
2. Describe the construction of marine structures using timber	• Advantages and disadvantages of timber construction • Applications • Building foundation piles • Wharves o Fender systems o Dolphins o Bullrails o Cribs o Bulkheads o Seawalls o Jetties
3. Describe the construction of bridges using timber	• Trestles • Deck arch and deck truss • Girder and log stringer • Log cribs

4. Describe the construction of temporary structures using timber	• Frame work • Falsework • Underpinning • Shoring • Needle beams

5. Describe post and beam construction using timber	• Advantages and disadvantages
	• Uses
	  o Needle beams and supports
	  o Scaffolding

6. Identify principal parts of a structure	• Bents
	• Spans
	• Substructure
	  o Mud sills
	  o Posts or columns
	  o Bracing
	  o Caps and subcaps
	  o Corbets or bolsters
	  o Fillers
	  o Firewalls
	• Superstructure
	  o Trusses
	  o Beams or girders
	  o Stringers
	  o Joists
	  o Ties
	  o Fish plates or scabs
	  o Diaphragms and stringer/joist blocking
	  o Decking systems and nailing requirements
	  o Guardrails or curbs and raisers
	  o Handrails

7. Describe types of timber trusses and their uses	• Truss forms • Types of trusses • Components of truss structures
8. Describe the uses and construction of timber floats	• Floatation • Framing and superstructure • Rubbing boards • Connections • Mooring wells and hoops
9. Describe types of wood used for timber	• Key terms • Physical structure and growth defects in trees • Dressing and applications for timbers • Sizes

- CSA specifications
- Timber grades
  - Stress and non-stress
- Species of trees used
  - Advantages and disadvantages

10. Describe types of timber damage

- Key terms
- Types of timber damage
  - Decay
  - Fungi and bacterial
  - Weathering
  - Insects
  - Marine borers and crustaceans

11. Describe types of preservatives and their uses

- Advantages and disadvantages
- Oil-borne preservatives
  - Creosote
  - Pentachlorophenol (Penta)
- Water-borne preservatives
  - Chromated copper arsenate (CCA)
- Surface coatings
- Fumigants
  - Identifying materials injected
  - Evaluating hazards
  - Developing safe work procedures

12. Describe how preservatives are used

- Seasoning
- Incising
- Pressure treatments
- Non-pressure treatments
- Fire protection
- Field treatment of timber

13. Use treated timber

- Handling hazards
- MSDSs
- PPE
  - Gloves
  - Respirators
  - Barrier creams
- Preventing damage to material
  - Tool use
  - Use of synthetic slings and softeners
  - Removal of debris and sawdust
  - Disposal of treated waste
  - Sealing of holes
- Protection of the environment

14. Describe types of fasteners

- Key terms
- Types of fasteners and their uses
- Drilling holes for bolts us augered bit
  - Advantage of using air and gas augers
  - Causes of auger bit jamming
- Rods and studs
  - Coil rod
  - All-thread rod (ready rod)
  - Thread bars (dywidag)
- Hi tensile bolts and rods hazards
- Washers
  - Purpose
  - Standard cut
  - Bevel
  - Cup
  - Segmental
  - Square steel plate, malleable and ogee
- Timber connectors
  - Purposes
  - Shear plates and split ring connectors
  - Tentacle cutter
  - Pipe sleeves
  - Spike grid timber connectors and toothed rings
  - Claw plates
  - Clamping plates
  - Timber rivets
- Precautions when working with hi-tensile bolts and rods

15. Describe erection of timber structures

- Handling and framing practices
- Construction procedures for substructure of bridges
- Construction procedures for superstructure of bridges and marine structures
- Erection of long span girder structures

16. Fasten and join timbers

- Tools
  - Framing square
  - Saws
  - Chisels
  - Mallets
  - Auger
- Types of joints, uses and fastening methods
  - Butt
  - Lap
  - Half-lap
  - Scarf
  - Notched scarf
  - Tee
  - Lap tee
  - Mortise and tenon
  - Bird's-mouth
  - Step
  - Keyed
- Joint failures

17. Describe forces, loads and timber orientation

- Key terms
- Forces on a structure
  - Compression
  - Tension
  - Shear
  - Torsion
  - Deflection
- Types of loads
  - Lateral
  - Dead
  - Live
  - Point
  - Distributed
  - Allowable span for load capacity
  - How loads affect timber
- Orientation of timber
  - Dimension
  - Crown
  - Knots

18. Describe maintenance of timber structures	• Problems
	  o Loose fasteners
	  o Decay of wood
	  o Insect damage
	  o Physical damage
	• Maintenance
	  o Regular inspections
	  o Visual and coring
	  o Checking connections and contact points
	  o Field treatment of end grain
	  o Maintaining air flow

19. Describe common marine structure repairs	• Common causes of damage • Repairing a timber fender system • Replacing a damaged pile cap • Replacing a timber cap • Repairing a damaged pile cap • Replacing curbs, chocks and walers • Replacing damaged pile with new timber pile • Field treating • Underwater repairs
20. Describe common bridge repairs	• Common causes of damage • Timber stringer replacement • Temporary cap repair with fishplates

21. Plan the repair of a timber structure	• Use after structure is repaired
	  o Repair
	  o Rehabilitation
	• Inspection of structure
	• Determination of support requirements
	• Hazard analysis
	• Types of timber and fasteners required
	• Repair materials
	• Appropriate replacement materials
	• Tool requirements
	• Repair records required

22. Detail a suitable structure for a project	• Creating a drawing • Take off and material selection

Line (GAC): L BUILD WITH TIMBER AND STEEL

Competency: L2 Build with Structural Steel

Objectives

To be competent in this area, the individual must be able to:

- Identify applications of structural steel.
- Describe handling and erection procedures and precautions.
- Describe types of joints and connections.
- Inspect steel structures.
- Assemble a splice plate.

LEARNING TASKS	CONTENT
1. Identify applications of structural steel	• Advantages as a construction material • Applications in marine construction • Applications in temporary and permanent steel sheet pile structures

2. Describe properties of steel and ferrous metals	• Mild steel
	• High tensile
	• Alloy steels
	• Molecular structure
	• Tensile strengths
	• Consistency
	  o Strength
	  o Hardened
	  o Malleable
	• Cast

3. Describe workability	• Cutability
	• Weldability
	• Toughness
	• Low temperature ductility
	• Machinability
	• Determining properties
	  o Torch cutting
	  o Grinding
	  o Physical tests
	  o Chemical analysis
	  o Non-destructive tests

4. Describe heat treatments	• Annealing • Stress relieving of welds • Case hardening

5. Describe handling and erection precautions	• Lateral buckling • Rigging requirements • Erection plan • PPE • Repair of damaged steel members • General precautions • Precautions with steel falsework
6. Describe joints and connections for steel	• Joint configuration • Moment shear splices • Friction type and bearing type bolted connections
7. Describe the assembly of structural joints using high strength bolts	• Bolt shank and thread lengths • STM standards o Metric o Imperial • Installation of fasteners • Torque • CSA Standards •
8. Identify corrosion protection systems for steel	• Cathodic • Anodic • Protective coatings
9. Inspect steel structures	• Safety precautions • Previous inspections • Construction drawings • Surface preparation • Document inspection
10. Assemble a bolted splice plate	• Drawings • Material requirements • Tools required • Calibration of torque wrenches • Turn of nut method
11. Describe protective coatings for steel	• Primers • Lead oxide paint • Water-based paints • Bituminous coating • Epoxy coating systems • Urethane and vinyl paint systems • Zinc rich paint • Hot dip galvanizing • Metallizing • Vinyl wrap & heat shrink sleeves

12.	Perform field touch up procedures	• Preparation
		• Suitable coatings considerations
		  o Damp environment
		  o Compatibility
		  o Curing temperatures

Achievement Criteria

1.	Performance	The learner will assemble a splice plate joint.
	Conditions	The learner will be given: • PPE • An instruction sheet • Tools and equipment • Materials
	Criteria	Following safety procedures • Use of PPE • Proper selection of bolts • Assembled and tightened according specifications • Time

Line (GAC): M INSTALL, REPAIR AND MAINTAIN BRIDGES, RAMPS AND MARINE STRUCTURES

Competency: M1 Repair and Maintain Bridge Decks and Components

Objectives

To be competent in this area, the individual must be able to:

- Describe the installation, maintenance and repair of bridge deck joints.
- Identify and inspect bridge joints.

LEARNING TASKS	CONTENT
1. Describe types of bridge deck joints	• Functions • Types • Hinge transfer plates
2. Describe installation of bridge deck joints	• Deck joint armouring • Spacing requirements • Poured, compression and strip seals • Expansion joints
3. Describe maintenance and repair of bridge deck joints	• Inspection and maintenance • Routine maintenance and repair procedures • Requirements for major repairs or replacements

Achievement Criteria

Performance	The learner will identify and inspect bridge joints.
Conditions	The learner will be given: • PPE • An inspection sheet • Bridge to inspect
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of identifying bridge joints and defects • Completed within specified time

Line (GAC): M INSTALL, REPAIR AND MAINTAIN BRIDGES, RAMPS AND MARINE STRUCTURES

Competency: M2 Repair and Maintain Bridge and Ramp Bearings

Objectives

To be competent in this area, the individual must be able to:

- Describe types of the installation, maintenance and repair of bridge and ramp bearings.

LEARNING TASKS	CONTENT
1. Describe types of bridge and ramp bearings	• Functions of bearings • Types of bridge bearings • Ramp and apron bearings • Other load supports
2. Describe the installation of bridge and ramp bearings	• Requirements for bearing seats • Installation procedures
3. Describe the maintenance and repair of bridge and ramp bearings	• Routine maintenance and repair procedures • Requirements for major repairs or replacements

Achievement Criteria

Performance	The learner will identify and inspect bridge bearings.
Conditions	The learner will be given: • PPE • Inspection sheet • Bridge to inspect
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Following safety procedures • Use of PPE • Accuracy of identifying bridge bearings and defects • Completed within specified time

Line (GAC): M INSTALL, REPAIR AND MAINTAIN BRIDGES, RAMPS AND MARINE STRUCTURES

Competency: M3 Assemble and Launch Bridges and Girders

Objectives
To be competent in this area, the individual must be able to:

- Describe the tools and equipment required for launching.

LEARNING TASKS	CONTENT
1. Describe types of tools and equipment to launch bridges or girders	• Tools and equipment o Rollers o Jacks o Support equipment
2. Describe launching procedures	• Span distance • Weight of the structure
3. Describe assembly of modular bridges	• Common types o Acrow o Bailey • Assembly procedures

Section 4

TRAINING PROVIDER STANDARDS

Facility Requirements

Classroom Area

- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/Air conditioning for comfort all year round
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow audibility of the instructor
- Computer lab complete with 16 computers and internet access
- Library complete with reference material for student and instructor use

Shop Area

- 4,000 square feet of workshop space per class of 16 students with a minimum ceiling height of 16 feet, including space for a tool crib
- Adequate lighting and lighting control
- Ventilation as per WorkSafeBC standards
- Refuse and recycling bins for used shop materials
- First-aid facilities

Outside Work Space

- 1,500 square feet of fenced outside work space
- Improved surface

Student Facilities

- Adequate lunch room as per WorkSafeBC requirements
- Adequate washroom facilities as per WorkSafeBC requirements
- Personal storage lockers

Instructor's Office Space

- Desk and filing space
- Computer

Tools and Equipment

Hand Tools

Level	
1,2,3	• Adjustable wrench
1,2,3	• Allen wrenches
2,3	• Aviation snips
1,2,3	• Builder's level
1,2,3	• Callipers (inside and outside)
1,2,3	• Caulking gun
1,2,3	• Chalk line
1,2,3	• Chamfer cutters
1,2,3	• Clamps
1,2,3	• Combination square
1,2,3	• Concrete bits
1,2,3	• Cone/tie wrench
1,2,3	• Cordless drill
1,2,3	• Drawing Instruments
1,2,3	• Dry line
1,2,3	• File
1,2,3	• Framing square
1,2,3	• GFCIs
1,2,3	• Hack saw
1,2,3	• Hammers (framing)
1,2,3	• Hand level – 24" and 48"
1,2,3	• Hand saws
1,2,3	• High speed drill set
1,2,3	• Hole saw
1,2,3	• Knives
1,2,3	• Measuring tape
1,2,3	• Nail puller
1,2,3	• Peavey
1,2,3	• Picaroon
1,2,3	• Pike pole
1,2,3	• Pencil/marking instrument
1,2,3	• Pipe wrench
1,2,3	• Pliers and side cutter
1,2,3	• Plumb bob
1,2,3	• Pry bars
1,2,3	• Putty knife
3	• Scale rulers
1,2,3	• Screwdrivers (Robertson, Phillips, straight)
1,2,3	• Scriber
1,2,3	• Scribing compass
1,2,3	• Set of chisels
1,2,3	• Spud wrench
2	• Stair gauges
1	• Stones (oil and water)
1,2,3	• Speed square
1,2,3	• Tape measure 100 ft.
1,2,3	• Tape measure 25 ft.
1,2,3	• Torpedo level
3	• Torque wrench
1,3	• Try square
1,3	• Wire rope spool stand
1,3	• Wire spool
1,2,3	• Wood boring bits
1,2,3	• Wood spade bit set
1,3	• Wrap around
1,2,3	• Wrecking bar

Survey Instruments

2	• Laser level
1,2	• Optical levels
2,3	• Theodolite
2	• Three-axis laser level

Standard Safety Equipment

1,3	• Cutting goggles
1,2,3	• Dust mask
1,2,3	• Fall protection
1,2,3	• First aid kit
1,2,3	• Gloves
1,2,3	• Hard hat
1,2,3	• Hearing protection
1,2,3	• Lanyard
1,2,3	• Reflective vest
1,2,3	• Rope grab
1,2,3	• Safety boots
1,2,3	• Safety glasses and goggles
1,2,3	• Safety lifeline
1,3	• Welding gloves
1,3	• Welding mask

Portable Power Tools and Portable Equipment

1,2,3	• Air compressor
1,2,3	• Calculator
1,3	• Chainsaw
1,2,3	• Circular saw
1,2,3	• Concrete vibrator
1,2,3	• Cordless drill and bits
1,2,3	• Electric drill
1,2,3	• Extension cords
1,3	• Grinder
1,3	• Hammer drill
3	• Hydraulic jack
1,3	• Igniter / Striker
1,2	• Jackhammer
1	• Jigsaw
1,2,3	• Ladders
1,3	• Magnetic Drill Press
3	• Metal cut-off saw
1	• Mini-grinder
2	• Mitre saw
1,3	• Pipe bevel cutter
1,2,3	• Pneumatic tools
1,3	• Radio graph oxy-fuel cutter
1	• Reciprocating saw
1,2,3	• Scaffold
1,2,3	• Sprayers
1,2,3	• Step ladders
1,2,3	• Tiger torch
1,3	• Torches
1,2,3	• Wet/dry vacuum
1,2,3	• Wheelbarrow
1,2,3	• Pile driving equipment o Vibratory hammer o Diesel hammer o Leader system

Rigging and Hoisting Equipment

1,3	• Blocks and 3-part hoisting blocks
1,3	• Chokers
1,3	• Come-alongs
1,3	• Eyebolts
1,2,3	• Forklift
3	• Lattice boom mobile crane
1,3	• Nylon lifting straps
1,2,3	• Pinch bar
1,2,3	• Ropes
1	• Tirfors
1,3	• Turnbuckles

Stationary Equipment

1,3	• Band saw
1	• Drill press
1,3	• Dust collection equipment
1,3	• Grinder
1,3	• Oxy-fuel cutting equipment

Form Work

1,2,3	• Anchor bolts
2	• Beam saddles
1	• Burke clamp
2	• Coil bolts
2	• Coil nuts (1/2")
2	• Coil rod (1/2")
3	• Coil rod (1")
2	• Coil ties (1/2")
2	• Coil tie plate washers (4")
2	• Levelling jacks
3	• Pipe pile (24")
3	• Pipe pile hanger brackets
2	• Plastic cones
1,2	• Snap ties and wedges
2	• Support beams
2	• Suspended slab support frames

Reference Materials

Piledriver and Bridgeworker Texts

BC Ministry of Transportation Bridge Maintenance Manual
Design and Control of Concrete Mixtures
IPT's Crane and Rigging Handbook
Mobile Cranes WorkSafeBC
Level 1 Ironworking
ACROW Panel Bridge Technical Handbook
American Piledriving Equipment Glossary of Pile Driving Terms
American Piledriving Equipment Manuals

Carpentry * Gasper Lewis – Delmar (2001)
ISBN 0-7668-1081-X

This text is the main carpentry text for the province of British Columbia. It describes the construction of woodframe buildings from the installation of the foundation to the finishing.

Modern Carpentry * Wagner – Goodheart – Wilcox (1996)
ISBN 1-56637-569-X

This is the traditional carpentry text that has been used across Canada for years. It includes many diagrams and photographs along with simple explanations of how a woodframe building is constructed.

Carpentry and Building Construction * Wagner – Goodheart – Wilcox (1996)
ISBN 1-56637-569-X

This text used to be the main carpentry text for BC. The new edition of this text includes colour photographs and diagrams. It explains the construction of woodframe buildings.

* Only one of these three texts is required, the other two can be considered as additional reference textbooks.

Building Trades Blueprint Reading Sandberg – Copp Clark (1982)
ISBN 0-7730-2900-1

This text is required to complete the technical training component of the carpentry apprenticeship program. It describes blueprint-reading techniques for the construction of residential buildings. A limited number of copies may be available at the college library.

Principles and Practices of Commercial Construction Smith – Prentice-Hall (2000)
ISBN 0-13-026162-9

This text is required to complete the technical training component of the carpentry apprenticeship program. It covers construction techniques for the construction of large buildings. A limited number of copies are available at the college library.

British Columbia Building Code

The BC Building Code is the building regulation text for all buildings built in BC except for those built in the city of Vancouver. Building inspectors in BC use this text. All carpenters should have a copy of this text when working in British Columbia. This text is available at public libraries and at the college library and is also available on CD-ROM.

Occupational Health & Safety Regulation Worker's Compensation Board (1989)
ISBN 0-8269-0403-3

All carpenters in British Columbia are required to have this regulation. It is available free from WorkSafeBC. The OHS Regulations is always changing to meet the needs of the construction industry. Use the WorkSafeBC website to keep up-to-date with changes to the regulation and to be informed of new workplace hazards.
www.worksafe.bc.com

Building Trades Dictionary Toenjes – American Technical Publishers (1989)
ISBN 0-8269-0403-3

The Building Trades Dictionary explains the meaning of many construction terms. The text makes good use of diagrams. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Practical Problems in Mathematics Huth – Delmar (1991)
ISBN 0-8273-4579-8

Harry Huth, the author of this text, uses many diagrams and sample problems to lead the learner through the methods used to solve carpentry related math problems. The text is useful as an auxiliary reference text that may be available at the public library or at the college library.

Permanent Wood Foundations Canadian Wood Council (1992)
ISBN 0-921628-19-6

The Canadian Wood Council publishes this text. It includes many diagrams and does an excellent job of describing wood foundations. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Formwork for Concrete Hurd – American Concrete Institute SP-4 (1989)
LCC 89-81442

Formwork for Concrete, Principals and Practices of Commercial Construction is the definitive text on the construction of formwork. The explanations and diagrams are excellent. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Concrete Technology White – Delmar (1991)
ISBN 0-8273-3635-7

Concrete Technology is a simplified version of Design and Control of Concrete Mixtures. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Hand Woodworking Tools McDonnell – Delmar (1978)
ISBN 0-8273-1098-6

Hand Woodworking Tools gives a wonderful description of the traditional hand woodworking tools used in carpentry. It is an older text that may be out of print but is listed here because of the quality of the diagrams used in the text. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Design and Control of Concrete Mixtures Canadian Portland Cement Association (1991)
ISBN 0-89312-094-4

The Design and Control of Concrete Mixtures gives a thorough description of the components of concrete and how they work together. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Understanding Wood Hoadley – Taunton Press (2000)
ISBN 1-56158-358-8

Understanding Wood is a very well written text on the properties of wood. It describes how the properties of wood can be predicted and controlled. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Canadian Woodframe House Construction CMHC (1997)
ISBN 0-660-16699-2

The Central Mortgage and Housing Corporation (CMHC) publish this useful book. It describes all aspects of woodframe construction. It is useful as an auxiliary reference text that may be available at the public library or at the college library and is also available on CD-ROM.

National Building Code of Canada

The National Building Code (NBC) is the main building regulation text for Canada. Local Building Codes are based on this text. When working in British Columbia it is useful to be aware of the differences between the BC Code and the NBC. This text is available at public libraries and at the college library and is also available on CD-ROM.

Construction Spence – Delmar
ISBN 0-314-20537-3

This text does an excellent job of describing the properties of construction materials. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Why Buildings Stand Up Salvadori – Norton (1990)
ISBN 0-393-30676-3

Why Buildings Stand Up does a great job of describing the physics of building construction. It uses many historical references and truly simplifies the forces acting on a building. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Architectural and Graphic Standards Ramsey – American Institute of Architects (1981)
ISBN 0-471-04683-3

The construction details shown in this text are wonderful. Both residential and commercial construction details are shown. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

Rigging Manual Dickie – Construction Safety Association of Ontario (1981)

The Ontario Safety Association published this manual. It provides a good description of safe rigging practices. It is useful as an auxiliary reference text that may be available at the public library or at the college library.

NOTE:

This list of Reference Materials is for training providers. Apprentices should contact their preferred training provider for a list of recommended or required texts for this program.

Instructor Requirements

Occupation Qualification

The instructor must possess:

- A BC Certificate of Qualification
- Certificate of Qualification from another Canadian jurisdiction complete with Interprovincial Red Seal endorsement only

Work Experience

- A minimum of 5 years experience working in the industry as a journeyperson.

Instructional Experience and Education

It is preferred that the instructor also possesses one or more of the following:

- An Instructor's Diploma or equivalent
- A Bachelor's Degree in Education
- A Master's Degree in Education