SKILLEDTRADES BC

PROGRAM OUTLINE

Ironworker (Reinforcing)

The latest version of this document is available in PDF format on the SkilledTradesBC website
www.skilledtradesbc.ca

SKILLED TRADES BC

IRONWORKER (REINFORCING)

PROGRAM OUTLINE

BASED ON RSOS 2025

Developed by
SkilledTradesBC
Province of British Columbia

TABLE OF CONTENTS

Section 1

INTRODUCTION

Ironworker (Reinforcing)

Foreword

This revised 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 the 2025 Red Seal Occupational Standard (RSOS). It was developed by 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.

Competencies are to be evaluated through written exams and practical assessments. A passing grade is achieved by getting an overall mark of 70%. See the Assessment Guidelines in Section 4 for more details.

Achievement Criteria are included for those competencies that require a practical assessment. 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 measurable and that they reflect the skills spelled out in the competency. 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 evaluation criteria.

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.

Qualifications in WHMIS, First Aid, Confined Space, Fall Protection and Aerial Boom Lift are all suggested and are required for some practical components of the program.

SAFETY ADVISORY

Be advised that references to the WorkSafe BC safety regulations 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 themselves about the Occupational Health and Safety Regulation pertaining to their work.

Acknowledgements

Industry and Instructor Subject Matter Experts retained to assist in the development and review of this Program Outline:

- Ryan Downey — British Columbia Institute of Technology (BCIT)
- Tyler Jack — Supreme Steel Ltd.
- Kevin Jefford — BCIT
- Paul Lahti — Supreme Steel Ltd.
- Tyrone Longstride — Ironworkers Local 97
- Mike McKoryk — BCIT

SkilledTradesBC would like to acknowledge the dedication and hard work of all the industry representatives appointed to identify the training requirements of the Ironworker (Reinforcing) occupation.

Previous Contributors

The 2010 Program Outline was prepared with the advice and direction of an industry steering committee convened initially by the Construction Industry Training Organization (CITO).

Industry Subject Matter Experts retained to assist in the development of the 2010 Program Outline content:

- Neil Basaraba
- Lucien Cloutier
- Neil Corley
- Ray Donison
- Maurice Lavallee
- Alphonse Lavallee
- Kirk Linardis
- Mike McKoryk
- Andrew Reid
- Ron Rollins

Industry Subject Matter Experts retained as outline reviewers for the 2010 Program Outline content:

- Mike McKoryk

How to Use this Document

This Program Outline has been developed for the use of individuals from several different audiences. The table below describes how each section can be used by each intended audience.

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Program Credentialing Model	Communicates program length and structure, and all pathways to completion	Illustrates the length and structure of the program	Illustrates the length and structure of the program, and pathway to completion	Illustrates the challenger pathway to Certificate of Qualification
OAC	Communicates the competencies that industry has defined as representing the scope of the occupation	Displays the competencies that an apprentice is expected to demonstrate in order to achieve certification	Displays the competencies apprentices will achieve as a result of program completion	Displays the competencies challengers must demonstrate in order to challenge the program
Training Topics and Suggested Time Allocation	Shows proportionate representation of general areas of competency (GACs) at each program level, the suggested proportion of time spent on each GAC, and percentage of time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the scope of competencies covered in the technical training, the suggested proportion of time spent on each GAC, and the percentage of that time spent on theory versus practical application	Shows the relative weightings of various competencies of the occupation on which assessment is based
Program Content	Defines the objectives, learning tasks, high level content that must be covered for each competency, as well as defining observable, measurable achievement criteria for objectives with a practical component	Identifies detailed program content and performance expectations for competencies with a practical component; may be used as a checklist prior to signing a recommendation for certification (RFC) for an apprentice	Provides detailed information on program content and performance expectations for demonstrating competency	Allows individual to check program content areas against their own knowledge and performance expectations against their own skill levels
Assessment Guidelines	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the general areas of competency covered in the technical training, the grading weight for each GAC, and the percentage of that time spent on theory versus practical application	Shows the general areas of competency covered in each level of technical training, the theory and practical grading weight, and the calculation method for final percentage marks	Shows the relative weightings of various general areas of competency within the occupation on which assessment is based

Section	Training Providers	Employers/ Sponsors	Apprentices	Challengers
Training Provider Standards	Defines the facility requirements, tools and equipment, reference materials (if any) and instructor requirements for the program	Identifies the tools and equipment an apprentice is expected to have access to; which are supplied by the training provider and which the student is expected to own	Provides information on the training facility, tools and equipment provided by the school and the student, reference materials they may be expected to acquire, and minimum qualification levels of program instructors	Identifies the tools and equipment a tradesperson is expected to be competent in using or operating; which may be used or provided in a practical assessment
Appendix A – Acronyms and Abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations	Defines program specific acronyms and abbreviations
Appendix B – Glossary	Defines program specific terms	Defines program specific terms	Defines program specific terms	Defines program specific terms
Appendix C – Summary of Achievement Criteria	Summarizes and organizes expected practical assessments by level	Summarizes and organizes expected practical assessments by level	Summarizes and organizes expected practical assessments by level	Summarizes and organizes expected practical assessments by level

Section 2

PROGRAM OVERVIEW

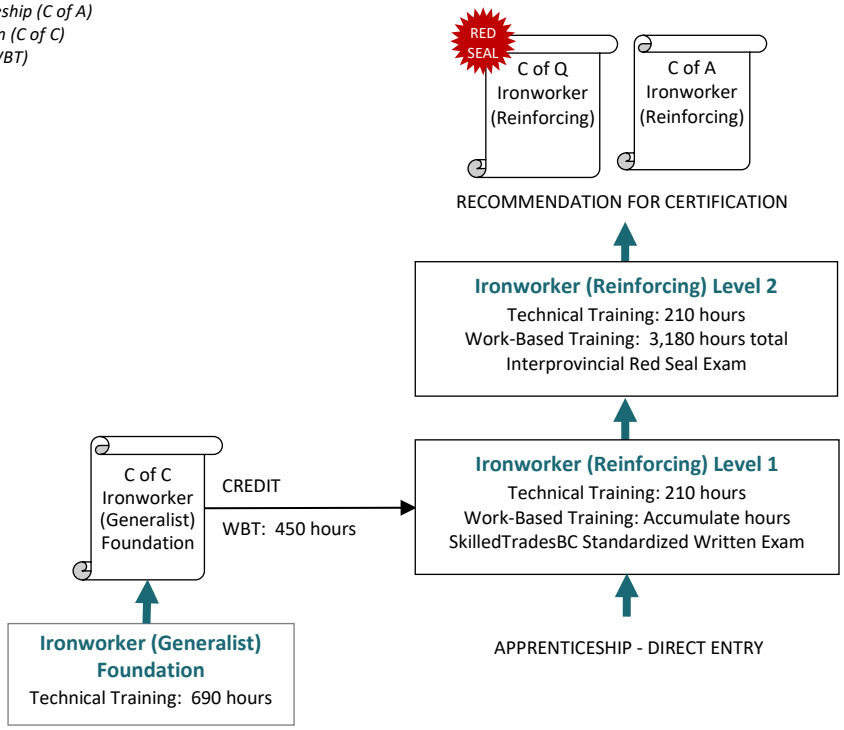
Ironworker (Reinforcing)

Program Credentialing Model

Apprenticeship Pathway

This graphic provides an overview of the Ironworker (Reinforcing) apprenticeship pathway.

Certificate of Qualification (C of Q)
Certificate of Apprenticeship (C of A)
Certificate of Completion (C of C)
Work-Based Training (WBT)



CREDIT FOR PRIOR LEARNING
Individuals who hold the credentials listed below are entitled to receive partial credit toward the completion requirements of this program

None

Occupational Analysis Chart

IRONWORKER (REINFORCING)

Occupation Description: Ironworkers (Reinforcing) are responsible for cutting, bending, hoisting, placing, and welding reinforcing materials in concrete structures such as buildings, wind turbines, bridges, stadiums, and dams. They may also install post-tensioning systems in a variety of structures.

Ironworkers (Reinforcing) unload reinforcing materials and organize the material for installation and hoisting. They inspect, select, and install rigging to components and direct crane operations. They place and secure components using a variety of equipment and methods according to drawings and job specifications.

Ironworkers (Reinforcing) primarily work outdoors in teams and are required to perform dynamic physical activities, often working at heights.

MAINTAIN SAFE AND HEALTHY WORKPLACE **A**	Maintain safe work environment A1	Use personal protective equipment (PPE) and safety equipment A2	Participate in healthy and respectful work environment A3
	1	1	1
USE AND MAINTAIN TOOLS AND EQUIPMENT **B**	Use hand tools B1	Use power tools B2	Use access equipment B3
	1	1 2	1
ORGANIZE WORK **C**	Organize materials and supplies C1	Perform layout C2	Use drawings and documentation C3
	1	1 2	1 2
USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES **D**	Use communication techniques D1	Use mentoring techniques D2	Maintain continuous learning D3
	1	2	2

Use material handling equipment B4	Use measurement, layout, and surveying tools and equipment B5	Use welding and thermal cutting equipment B6
1	1 2	1 2
Plan tasks C4	Use mathematics C5	
2	1 2	

PLAN LIFT **E**	Assess load E1	Perform pre-lift analysis E2	Select rigging, hoisting, and positioning equipment E3	Secure lift area E4	
	1	1 2	1	1	
USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT **F**	Inspect rigging, hoisting, and positioning equipment F1	Use ropes and slings F2	Use rigging and hoisting equipment F3	Use mechanical moving equipment F4	Perform post-lift activities F5
	1 2	1 2	1 2	2	1 2
PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES **G**	Identify and mobilize cranes G1	Participate in erecting lattice boom cranes, tower cranes, derricks and components G2	Participate in demobilization and disassembly of cranes G3		
	1	2	2		
FABRICATE AND INSTALL REINFORCING MATERIALS **H**	Apply fundamentals of reinforcing concrete H1	Cut and bend reinforcing materials H2	Place, tie, splice, and pre-fabricate reinforcing materials H3		
	1 2	1 2	1 2		
APPLY POST-TENSIONING TECHNIQUES **I**	Describe fundamentals of pre-stressed systems I1	Place unbonded post-tensioning systems I2	Place multi-strand and bonded post-tensioning systems I3		
	1	1	2		

Training Topics and Suggested Time Allocation – Level 1

IRONWORKER (REINFORCING) – LEVEL 1

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**MAINTAIN SAFE AND HEALTHY WORKPLACE**	**6%**	**70%**	**30%**	**100%**
A1	Maintain safe work environment		✓	✓	
A2	Use personal protective equipment (PPE) and safety equipment		✓	✓	
A3	Participate in healthy and respectful work environment		✓		
Line B	**USE AND MAINTAIN TOOLS AND EQUIPMENT**	**14%**	**40%**	**60%**	**100%**
B1	Use hand tools		✓	✓	
B2	Use power tools		✓	✓	
B3	Use access equipment		✓	✓	
B4	Use material handling equipment		✓	✓	
B5	Use measurement, layout, and surveying tools and equipment		✓	✓	
B6	Use welding and thermal cutting equipment		✓	✓	
Line C	**ORGANIZE WORK**	**14%**	**70%**	**30%**	**100%**
C1	Organize materials and supplies		✓	✓	
C2	Perform layout		✓	✓	
C3	Use drawings and documentation		✓	✓	
C5	Use mathematics		✓	✓	
Line D	**USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES**	**1%**	**100%**	**0%**	**100%**
D1	Use communication techniques		✓		
Line E	**PLAN LIFT**	**3%**	**100%**	**0%**	**100%**
E1	Assess load		✓		
E2	Perform pre-lift analysis		✓		
E3	Select rigging, hoisting, and positioning equipment		✓		
E4	Secure lift area		✓		
Line F	**USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT**	**17%**	**50%**	**50%**	**100%**
F1	Inspect rigging, hoisting, and positioning equipment		✓	✓	
F2	Use ropes and slings		✓	✓	
F3	Use rigging and hoisting equipment		✓	✓	
F5	Perform post-lift activities		✓	✓	
Line G	**PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES**	**7%**	**70%**	**30%**	**100%**
G1	Identify and mobilize cranes		✓	✓	

		% of Time	% of Time Allocated to: Theory	Practical	Total
Line H	**FABRICATE AND INSTALL REINFORCING MATERIALS**	**29%**	**50%**	**50%**	**100%**
H1	Apply fundamentals of reinforcing concrete		✓		
H2	Cut and bend reinforcing materials		✓	✓	
H3	Place, tie, splice, and pre-fabricate reinforcing materials		✓	✓	
Line I	**APPLY POST-TENSIONING TECHNIQUES**	**9%**	**100%**	**0%**	**100%**
I1	Describe fundamentals of pre-stressed systems		✓		
I2	Place unbonded post-tensioning systems		✓		
	Total Percentage for Ironworker (Reinforcing) Level 1	**100%**			

Training Topics and Suggested Time Allocation – Level 2

IRONWORKER (REINFORCING) – LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**USE AND MAINTAIN TOOLS AND EQUIPMENT**	**14%**	**40%**	**60%**	**100%**
B2	Use power tools		✓	✓	
B5	Use measurement, layout, and surveying tools and equipment		✓	✓	
B6	Use welding and thermal cutting equipment		✓	✓	
Line C	**ORGANIZE WORK**	**14%**	**75%**	**25%**	**100%**
C2	Perform layout		✓	✓	
C3	Use drawings and documentation		✓	✓	
C4	Plan tasks		✓	✓	
C5	Use mathematics		✓	✓	
Line D	**USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES**	**3%**	**75%**	**25%**	**100%**
D2	Use mentoring techniques		✓		
D3	Maintain continuous learning		✓	✓	
Line E	**PLAN LIFT**	**1%**	**100%**	**0%**	**100%**
E2	Perform pre-lift analysis		✓		
Line F	**USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT**	**23%**	**50%**	**50%**	**100%**
F1	Inspect rigging, hoisting, and positioning equipment		✓	✓	
F2	Use ropes and slings		✓	✓	
F3	Use rigging and hoisting equipment		✓	✓	
F4	Use mechanical moving equipment		✓		
F5	Perform post-lift activities		✓	✓	
Line G	**PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES**	**7%**	**100%**	**0%**	**100%**
G2	Participate in erecting lattice boom cranes, tower cranes, derricks and components		✓		
G3	Participate in demobilization and disassembly of cranes		✓		
Line H	**FABRICATE AND INSTALL REINFORCING MATERIALS**	**29%**	**30%**	**70%**	**100%**
H1	Apply fundamentals of reinforcing concrete		✓		
H2	Cut and bend reinforcing materials		✓	✓	
H3	Place, tie, splice, and pre-fabricate reinforcing materials		✓	✓	
Line I	**APPLY POST-TENSIONING TECHNIQUES**	**9%**	**100%**	**0%**	**100%**
I3	Place multi-strand and bonded post-tensioning systems		✓		
	Total Percentage for Ironworker (Reinforcing) Level 2	**100%**			

Section 3

PROGRAM CONTENT

Ironworker (Reinforcing)

Level 1

Ironworker (Reinforcing)

Line (GAC): A MAINTAIN SAFE AND HEALTHY WORKPLACE

Competency: A1 Maintain safe work environment

Objectives

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

- Manage workplace hazards
- Participate in workplace health and safety and emergency procedures
- Describe non-emergency injury reporting procedures
- Describe worksite safety policies
- Interpret OHS Regulations applicable to the Ironworker workplace
- Apply confined space procedures
- Identify various classes of fires
- Apply preventative fire safety precautions
- Use equipment to prevent various classes of fire
- Follow WHMIS requirements

LEARNING TASKS

1. Describe worksite hazards

CONTENT

- Obstructions
- Temporary supports
- Impalement
- Chemical
- Corrosive environments
- UV environments
- Musculoskeletal injury (MSI)
- Repetitive strain injury (RSI)
- Overexertion
  - Heat stroke
  - Dehydration
- Eye injuries
- Cuts
- Electrocution
- Toxic gases
- Liquids and materials
- Combustive reactions
- Fire
- Moving equipment
- Working at heights
  - Wind
  - Floor openings
  - Leading edges
  - Guard rails
  - Safety lines

LEARNING TASKS	CONTENT
	○ Weather ○ Stressed cables ○ Access and egress ○ Fall protection plan ○ Rescue from elevation ○ Emergency evacuation – Dedicated Evacuation Platform (DEP) • Confined spaces • Noise • Stored potential energy • Compressed gases • Environmental conditions • Overhead ○ Obstacles ○ Work • Underground utilities • Poor housekeeping • Tripping hazards • Trenching and shoring • Hot work • Asbestos • Silica dust • Vibration • Falls • Respiratory particulates
2. Participate in workplace health and safety, and emergency procedures	• Safety meeting • Toolbox • Job hazard analysis (JHA) • Field level risk assessment (FLRA) • Safe work procedures (SWP) • Safe operating procedures (SOP) • Site inspections • Emergency shutoffs ○ Lockout/tagout • Fire control systems • Eye wash facilities • Emergency exits • Emergency contact/phone numbers • Muster station

LEARNING TASKS	CONTENT

	• First aid facilities
	  ○ Regulations
	  ○ First aid certification
	• Reports
	• On-site documentation
	• Specific procedures
	  ○ Company
	  ○ Site
	  ○ Jurisdictional

3. Interpret OHS and Workers Compensation Act regulations, guidelines, and policies	• Location in document
	• Definitions
	• Application
	• Regulations
	  ○ Lock-out and tag-out
	  ○ Site-specific
	• Transportation of Dangerous Goods (TDG)
	• Rights and responsibilities
	  ○ Right to refuse work
	• Health and safety programs
	• Investigations and reports
	• Workplace inspections
	• Right to refuse work
	• OHS regulations, guidelines, and standards
	  ○ General conditions
	  ○ PPE
	  ○ Confined spaces
	  ○ De-energization and lockout
	  ○ Fall protection
	  ○ Tools, machinery and equipment
	  ○ Ladders, scaffolds and temporary work platforms
	  ○ Cranes and hoists
	  ○ Rigging
	  ○ Mobile equipment
	  ○ Construction, excavation and demolition

4. Describe confined space and procedures for work	• OHS Regulations
	• Responsibilities of worker and employer
	  ○ Training
	  ○ Certification
	• Procedures

LEARNING TASKS	CONTENT
	○ Access/egress ○ Hole watch ○ Air quality testing ○ Explosive environments ○ Lock out and isolation ○ Ventilation ○ Cleaning ○ Purging ○ Venting ○ Inerting ○ Rescue procedures • PPE • Rescue equipment • Entry permits ○ Qualifications
5. Identify hazards and procedures associated with hot work and fire suppression	• Classes of fire extinguishers ○ Class A ○ Class B ○ Class C ○ Class D ○ Symbols and colours • Conditions necessary to support a fire ○ Air ○ Fuel ○ Heat ○ Flashpoint • Hot work permits • Fire watch/spark watch • Site specific requirements • Preventative measures ○ Fuels – Diesel – Gasoline – Propane – Natural gas – Grain dust ○ Ventilation – Purging ○ Lubricants ○ Oily rags ○ Combustible metals

LEARNING TASKS	CONTENT
	○ Aerosols • Fire extinguisher ○ Extinguisher selection ○ P.A.S.S. – Pull – Aim – Squeeze – Sweep • Fighting a fire ○ Warning of others and fire department ○ Evacuation of others ○ Containment of fire ○ Personal method of egress ○ Training
6. Describe WHMIS legislation	• Purpose of legislation • Certification • Federal • Provincial • Responsibilities ○ Employers – Safety data sheets (SDS) – Worker training – Storage and handling of materials ○ Suppliers – SDS – Container labels ○ Workers – Understanding of • SDS • Labels • Information • WHMIS requirements
7. Describe the key elements of WHMIS	• SDS • Labels • Worker education programs
8. Identify symbols found on WHMIS labels and their meaning	• Compressed gases • Materials

LEARNING TASKS	CONTENT
	○ Flammable and combustible ○ Oxidizing ○ Corrosive ○ Dangerously reactive ○ Poisonous and infectious – Immediate and serious toxic effects – Other toxic effects – Biohazardous
9. Apply WHMIS regulations used in ironworking	• Hazardous materials ○ Use ○ Storage ○ Disposal

Line (GAC): A MAINTAIN SAFE AND HEALTHY WORKPLACE

Competency: A2 Use personal protective equipment (PPE) and safety equipment

Objectives

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

- Select personal protective equipment
- Use personal protective equipment
- Describe fall protection equipment
- Use fall protection equipment and systems

LEARNING TASKS	CONTENT

1. Describe personal protective equipment requirements	• Safety footwear
	• Eye protection
	• Ear protection
	• Head protection
	• Gloves
	• Hi-visibility vests
	• Respiratory protection
	• Fit test for respirator
	• Clothing
	  ○ Leathers
	  ○ Chaps
	  ○ Arm guards
	• Fall protection
	• Air testing monitors

2. Use personal protective equipment	• Use • Inspection • Maintenance • Storage • Disposal

3. Describe fall protection equipment	• OHS Regulations
	• Site standards
	• Worksite awareness
	• Inspection and maintenance
	• Hazards
	  ○ Impalement
	  ○ Falls
	  – Elevation
	  – Between levels

LEARNING TASKS	CONTENT
	○ Openings • Fall protection equipment ○ Harnesses – Types (A, D, E, L, P) ○ Hardware – Lanyard – Carabiner – Shock-absorbing devices – Retractable devices – Lifelines • Horizontal • Vertical • Retractable – Rope grabs – Anchors • Engineered • Portable • Improvised – Work positioning systems – Netting – Impalement protection ○ Standards – CSA
4. Describe fall protection systems	• Types ○ Arrest ○ Restraint ○ Positioning • Railings • Scaffolds • Nets • Hardware • Anchor points • Assembly • Ladder systems • Vertical and horizontal systems • Compatibility of equipment
5. Use fall protection equipment and systems	• OHS Regulations • Certification

LEARNING TASKS	CONTENT
	○ User ○ Equipment • Assembly/disassembly • Fall protection plan ○ Work area ○ Risks ○ Equipment selection ○ Rescue procedures • Fit test • Inspection ○ Daily ○ Periodic ○ Scheduled ○ Documentation • Maintenance • Storage • Disposal

Achievement Criteria

Performance	The learner will be able to use fall protection systems in compliance with safety regulations.
Conditions	The learner will be given • Fall protection plan • Personal fall protection equipment • Vertical or horizontal lifeline systems • Retractable lifelines • Anchors • Other applicable attachments
Criteria	The learner will be evaluated on • Inspection and care of equipment • Fit of equipment • Use of system (100% tie-off)

Line (GAC): A MAINTAIN SAFE AND HEALTHY WORKPLACE

Competency: A3 Participate in healthy and respectful work environment

Objectives

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

- Describe techniques to manage personal health and well-being
- Describe aspects of professionalism

LEARNING TASKS	CONTENT

1. Describe personal health and well-being	• Professional practice
	• Healthy work environment
	• Requirements
	  ○ Physical
	  ○ Emotional
	• Workplace stressors
	• Organizational cultures
	  ○ Collaboration
	  ○ Community
	• Physical and mental health
	  ○ Factors
	  – Diet
	  – Fitness
	  – Sleep
	• Management
	  ○ Stress
	  ○ Emotions

2. Describe techniques to manage personal health and well-being	• Management
	  ○ Stress
	  ○ Time
	• Supports
	• Substance usage
	  ○ Effects

3. Describe aspects of professionalism	• Professional ethics
	  ○ Values
	  ○ Codes of conduct

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B1 Use hand tools

Objectives

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

- Select hand tools appropriate to the task
- Use reinforcing hand tools
- Use structural hand tools
- Inspect and maintain tools

LEARNING TASKS

1. Describe and select hand tools

CONTENT

- Tape measure
- Marking device
- Striker
- Snipe
- Pry bar
- Pliers
- Hammers
- Bolt bag
- Sockets
- Wrenches
  - Adjustable
  - Saw
  - Pipe
  - Box end
  - Open end
  - Torque
- Knife
- Epoxy gun
- Caulking gun
- Tiger torch
- Hack saw
- Bolt cutter
- Reinforcing hand tools
  - Hickey bar
  - Tool belt
    - Holster/scabbard
    - Diagonal cutter (snips)
    - Pliers
      - End-cutting (nips)
      - Side-cutting (Ironworker)
        - Number 7

LEARNING TASKS	CONTENT
	• Number 9 – Tie wire reel – Keel marker • Post-tensioning hand tools ○ Screwdriver ○ Wedge-seating tool ○ Sheath cutter ○ Pocket former remover ○ Hex keys (Allen® wrenches) ○ Staple gun (pneumatic and manual) • Mechanical advantage tools ○ Grip hoist/come-along ○ Jacks – Lever – Ratchet – Port-a-power – Hydraulic – Screw – Pneumatic
2. Use hand tools	• Manufacturer's specifications • Drop proofing ○ Tool lanyard • Purpose • Uses • Procedures • Safety • Adjustment • Inspection • Maintenance • Storage • Job requirements

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B2 Use power tools

Objectives

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

- Identify potential power sources
- Use power tools
- Select powered bending tools and equipment
- Use powder-actuated tools
- Use mechanical cutting equipment
- Describe connecting and anchoring tools and equipment, and their uses in concrete
- Use a hammer drill to drill vertically or horizontally into concrete

LEARNING TASKS	CONTENT

1. Identify potential power sources	• Electrical
	  ○ Battery
	• Pneumatic
	• Hydraulic
	• Fuel powered
	  ○ Gas
	  ○ Mixed gas
	  ○ Diesel
	  ○ Propane

2. Select power tools	• Chisels
	• Saws
	  ○ Cut-off
	  ○ Portable band
	• Drills
	  ○ Hammer
	  ○ Hand
	  ○ Screw gun
	• Compressor
	• Generator
	• Grinder
	  ○ Angle
	  ○ Die/pencil
	  ○ Attachments
	• Impact wrench
	• Torque gun (calibrated wrench)
	• Hydraulic torque wrench
	• Shears

LEARNING TASKS	CONTENT
	○ Pocket ○ Rebar ○ Portable • Guns ○ Tie ○ Staple • Stressing jacks/pump • Grout machine
3. Use power tools	• Safety • Drop proofing ○ Tool lanyard • Manufacturer's specifications • Types • Parts • Purpose • Uses • Procedures • Adjustment • Inspection • Maintenance • Storage • Assured grounding • Lockout
4. Describe powered bending tools and equipment	• Manufacturers' specifications • Types of benders ○ Electric handheld ○ Hand-held hydraulic ○ Tabletop – Hydraulic – Manual • Operating principles • Uses • Limitations • Hazards ○ Flying debris ○ Pinch/crush points ○ Cuts ○ Punctures ○ Overexertion

LEARNING TASKS	CONTENT
	○ Struck by tools ○ Electrocution ○ Hydraulic pressures ○ Noise ○ Airborne particulates • Bending chart (table of dimensions)
5. Describe mechanical cutting equipment	• Manufacturers' specifications • Types ○ Saws – Electric cut-off – Portable band – Quick-cut – Reciprocating – Hole – Flush cut (cold cut) ○ Angle grinders (zip cuts) ○ Shears – Power – Pocket ○ Core drills • Components ○ Blades ○ Guards ○ Handles ○ Cords ○ Lubrication systems ○ Core bits ○ Twist drills • Characteristics • Applications • Operating principles • Hazards ○ Burns ○ Entanglement ○ Sparks ○ Combustibles ○ Toxic fumes ○ Respiratory particulates ○ Airborne irritants ○ Noise ○ Vibration

LEARNING TASKS	CONTENT

	• Inspection
	  ○ Deficiencies
	  ○ Removing from service
	• Maintenance
	• Storing
	• Securing

6. Select and use mechanical cutting equipment	• Manufacturers' specifications • Types • Components • Characteristics • Applications • Operating principles • Hazards • Inspection • Maintenance • Storing • Securing

7. Describe concrete anchors	• Area
	• Selection
	  ○ Anchor
	  ○ Drill and bit
	• Self-driller (self-tapping)
	• Pre-drilled
	  ○ Epoxy
	  ○ Wedge
	  ○ Grout

8. Describe procedures for drilling concrete	• Manufacturer's specifications
	• Preparation
	  ○ Cleaning
	  ○ Layout hole centres
	• Drills
	  ○ Pneumatic
	  ○ Rotary
	  ○ Hammer
	  ○ Core
	  ○ Drill and carbide bit
	• Concrete and masonry drilling
	  ○ Rebar contact

LEARNING TASKS	CONTENT
	○ Spalling ○ Concrete edge distance ○ Depth of hole ○ Starting the hole • Cleaning ○ Wire brushing/pump ○ Vacuuming
9. Use a hammer drill to drill vertically or horizontally into concrete	• Safety ○ Silica dust ○ PPE ○ Vibration • Tool orientation • Rebar contact • Dust control ○ Vacuuming ○ Wetting

Achievement Criteria

Performance — The learner will be able to cut rebar using a variety of cutting tools.

Conditions — The learner will be given

- Cutting tools
- Operators' manual
- Equipment
- Materials
- Instructions

Criteria — The learner will be evaluated on

- Safety procedures when cutting
- PPE
- Hazard control
- Accuracy of cut

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B3 Use access equipment

Objectives

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

- Describe ladders, scaffolds, and elevated platforms
- Use ladders and platforms
- Select access equipment
- Describe a MEWP

LEARNING TASKS	CONTENT

1. Describe ladders, scaffolds, and elevated platforms	• Safety
	  ○ Hazard recognition
	  ○ OHS
	• Ladders
	  ○ Extension
	  ○ Step
	  ○ Rolling
	  ○ Fixed
	  ○ Platform
	• Scaffold types
	• Scaffold components
	  ○ Planking
	  ○ Guardrails
	  ○ Toe plates
	  ○ Tie-ins
	  ○ Bracing
	  ○ Cantilevered sections
	  ○ End frames
	  ○ Ledgers
	  ○ Bearers
	  ○ Screw jacks
	  ○ Wheels
	  ○ Casters
	  ○ Clamps
	  ○ Sills
	  ○ Fixed ladders
	  ○ Swing gates
	  ○ Access hatches
	• Mobile elevated work platforms (MEWPs)
	  ○ Electric
	  ○ Internal combustion engine (ICE)
	  – Gas

        - Diesel
        - Liquefied petroleum gas (LPG)
      - Power vertical (scissor lift)
        - On-slab
        - Rough terrain (RT)
      - Boom supported
        - Articulated
        - Straight boom
  - MEWP accessories
    - On-board AC power
    - Mounted welders
    - Extendable platforms
    - Lifting attachments
    - Air lines
  - Crane supported work platform

2. Use ladders and elevated platforms
   - Selection
   - Set up
   - Moving ladders
   - Limitations
   - Securing
   - Inspection
   - Maintenance
   - Storage
3. Describe access equipment certification
   - Certification types
     - Aerial work platform
     - Fall protection
4. Select access equipment
   - Ladders
   - Scaffolds
   - Aerial lifts
     - Boom supported
     - Crane supported
     - Power vertical (scissor)

Achievement Criteria

Performance — The learner will be able to demonstrate proper use of access equipment

Conditions — The learner will be given
- Instructions
- Access equipment

Criteria — The learner will be evaluated on
- Safe set up procedures
- General safety precautions

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B4 Use material handling equipment

Objectives

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

- Select material handling equipment
- Use material handling equipment

LEARNING TASKS	CONTENT

1. Describe material handling equipment	• OHS regulations
	• Certifications
	• Types
	  ○ Forklifts
	  ○ Telehandlers
	  ○ Pallet jacks
	  ○ Gantry crane
	  ○ Spider crane
	• Components
	  ○ Winch
	  ○ Various attachments
	  ○ Boom attachments
	  ○ Fork extensions
	  ○ Personnel platforms
	  ○ Spreader beams
	• Hazards
	  ○ Tipping
	  ○ Crush and pinch points
	  ○ Equipment overloaded
	  ○ Electrocution
	  ○ Injuries
	  – Contact with equipment or load
	  ○ Falls from heights
	  ○ Unstable and changing ground conditions
	  ○ Environmental conditions
	  ○ Equipment failure
	  ○ Operator error

2. Select material handling equipment	• Manufacturers' specifications • Task requirements • Types • Components • Hazards

LEARNING TASKS

3. Use material handling equipment

CONTENT

- OHS regulations
- Certification
- Company policy
- Manufacturers' specifications
- Hazards
- Task requirements
- Inspection
  - Deficiencies
  - Removing from service
- Maintenance
- Positioning
- Operation
  - Spotters
  - Refueling procedure

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B5 Use measurement, layout, and surveying tools and equipment

Objectives

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

- Select measurement and layout tools
- Use measurement and layout tools
- Maintain measurement and layout tools

LEARNING TASKS	CONTENT

1. Describe measurement and layout tools, and surveying equipment	• Tape measure
	• Squares
	  ○ Combination
	  ○ Framing
	  ○ Bevel
	• Levels
	  ○ Laser
	  ○ Builder's/auto
	  ○ Smart
	  ○ Spirit
	  ○ Line
	• Electronic distance measuring (EDM)
	• Straight edge
	• Centre punch
	• Plumb bob
	• String/piano wire
	• Survey equipment
	  ○ Transit
	  ○ Theodolite
	  ○ Total station
	  ○ Lidar
	• Marking devices
	  ○ Chalk line
	  ○ Scribe
	  ○ Soap stone
	  ○ Spray paint
	  ○ Paint pen
	  ○ Keel marker
	  ○ Construction pencil

2. Select measurement and layout tools, and surveying equipment	• Task requirements • Limitations

	• Environmental conditions
3. Use measurement and layout tools	• Manufacturer's specifications • Purpose • Uses • Procedures • Set-up • Usage • Storage • Adjustment • Verifying accuracy
4. Inspect and maintain measurement and layout tools	• Inspection • Maintenance

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B6 Use welding and thermal cutting equipment

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

- Describe methods of thermal cutting and heat treatment
- Use thermal cutting tools

LEARNING TASKS	CONTENT

1. Describe methods of thermal cutting and heat treatment	• Oxy fuel torch
	  ○ Purpose/uses
	  ○ Limitations
	  ○ Fuel types
	• Equipment
	  ○ Types
	  – Tiger
	  – Combination
	  – Standard hand
	  ○ Torch head
	  ○ Rose bud
	  ○ Striker
	  ○ Tip cleaner
	  ○ Cylinders
	  – Storage
	  – Transportation
	  ○ Regulators
	  ○ Reverse flow check valve/flashback arresters
	  ○ Hoses
	  ○ Fittings
	  ○ Repair kit
	• Materials
	  ○ Reinforcing steel
	  ○ Steel

2. Use thermal cutting tools	• Manufacturer's specifications
	• Safety
	• PPE
	• Hazards
	  ○ Spark control
	  ○ Combustibles
	  ○ Cylinders
	  ○ Heat/fires
	  ○ Burns

LEARNING TASKS	CONTENT
	○ Fumes ○ Flashback • Consumables • Basic procedures • Set-up • Adjustment • Take down • Inspection • Maintenance • Storage • Materials ○ Ferrous ○ Non-ferrous

Achievement Criteria

Performance — The learner will be able to

- Set up a torch from start to finish
- Cut a bar to required length
- Break down the torch for storage

Conditions — The learner will be given

- Instructions
- Tools
- Equipment

Criteria — The learner will be evaluated on

- Safety Procedures
  - Protection of hose
  - Fire extinguisher readiness
  - Hazard control
- Set-up sequence
- Hose repair, clamp replacement
- Proper length
- Proper shutdown
- Quality of cut

Line (GAC): C ORGANIZE WORK

Competency: C1 Organize materials and supplies

Objectives

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

- Describe considerations and responsibilities when handling, ordering, coordinating, organizing, and disposing materials
- Handle materials according to job requirements
- Organize laydown area

LEARNING TASKS	CONTENT

1. Describe considerations and responsibilities when handling, ordering, coordinating, organizing, and disposing materials	• OHS Regulations
	• Ergonomics
	• Storage
	• Schedules
	• Method of transportation
	• Off-loading
	• Leadership in Energy and Environmental Design (LEED)
	• SDS
	  ○ Labelling
	• Moving
	• Product protection
	• Identification of materials
	• Environmental
	  ○ Disposal
	  ○ Recycling
	• Bill of lading/shipping list
	• Material certifications
	  ○ Mill certification
	  – Lot numbers

2. Organize and handle materials according to job requirements	• Safety • Securing • Packaging/shipping • Pallets • Barrels • Cages • Containers • Storage

- Availability of equipment
- Site access

3. Organize laydown area

- Accessibility
- Shakeout/sorting
- Marking/labelling
- Organizing
  - Division
  - Placing sequence
  - Pour sequence
  - Bundles
  - Element
- Unloading
- Transferring

Line (GAC): C ORGANIZE WORK

Competency: C2 Perform layout

Objectives

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

- Describe regulations and standards
- Perform layout

LEARNING TASKS	CONTENT

1. Describe layout techniques	• Types
	  ○ String line
	  ○ Laser
	  ○ Chalk line
	  ○ Plumb line
	  ○ Limitations
	• Placing drawings interpretation
	  ○ Grid line locations
	  ○ Bar count
	  ○ Cover
	  ○ Splice lengths
	  ○ Spacings
	  – Marking bar

2. Describe regulations and standards	• Legal • Surveyor • Property lines • Permits • Setbacks • Tolerance

3. Perform layout techniques	• Tools
	• Procedure
	• Drawing interpretation
	• Application of drawing information
	  ○ Spacings
	  ○ Marking bar

Line (GAC): C ORGANIZE WORK

Competency: C3 Use drawings and documentation

Objectives

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

- Describe types of drawings
- Interpret drawings
- Identify views on drawings
- Use a drawing to prepare a material list
- Identify documents

LEARNING TASKS	CONTENT
1. Describe types of drawings	• Hierarchy of drawings • Architectural • Structural • Fabrication/details • Concrete reinforcing • Placing/detail sheet • Post tensioning • Civil • Mechanical • Procedural • Rigging

2. Interpret drawings	• Codes and standards
	• General notes
	• Lines
	• Blueprint symbols
	• Concrete dimensions
	• Legends
	• Title block
	• Abbreviations
	• Material list/cut sheet
	• Schedules
	• Marks
	  ○ Direction
	  ○ Placement marks
	• Centres and work points
	• Scale
	• Revisions
	• Grid lines

LEARNING TASKS	CONTENT

	• Details
	• Reference dimension point (running dimensions)
	• Elevations
	• Division number
	• Reinforcing requirements
	  ○ Grade
	  ○ Length
	  ○ Diameter
	  ○ Quantity
	  ○ Spacing

3. Identify views on drawings	• Orthographic projections • Pictorial • Isometric • Oblique • Plan • Elevation • Sections • Detail

4. Describe digital drawings	• Accessing
	• Software and hardware
	  ○ PC
	  ○ Tablet
	  ○ Phone
	• Types
	  ○ 2D (PDF)
	  ○ 3D (BIM)
	• Computer aided design (CAD)

5. Identify documents	• Standards
	  ○ Canadian Standards Association (CSA)
	  ○ Canadian Welding Bureau (CWB)
	  ○ American National Standards Institute (ANSI)
	  ○ American Society for Testing and Materials (ASTM)
	  ○ American Society of Mechanical Engineers (ASME)
	  ○ Post Tensioning Institute (PTI)

LEARNING TASKS	CONTENT
	○ Concrete Reinforcing Steel Institute (CRSI) ○ Reinforcing Steel Institute of Canada (RSIC) ○ Canadian Institute of Steel Construction (CISC) ○ International Organization for Standardization (ISO) • OHS Regulations • FLRA • Sign-in sheet • Employment forms • Apprentice progress report • Shipping list (bill of lading) • Manufacturers' specifications • Critical lift sign-off • Schedule • Tonnage report • Fall protection plan • Emergency response plan • Pre-use inspections ○ Equipment log • Safety meeting • Toolbox talks • JHA • Work reports • Work orders • Incident reports • Permits

Achievement Criteria

Performance — The learner will be able to

- Determine reinforcing requirements in a given area from a structural drawing
- Detail a simple component
- Complete detail sheet

Conditions — The learner will be given

- Instructions
- Structural drawing
- Blank detail sheet
- Trade rules

Criteria — The learner will be evaluated on

- Accuracy of
- Size
- Quantity
- Shape
- Grade
- Length of bent dimensions
- Overall lengths
- Spacing
- Remarks
- Weight
- Completeness of detail sheet

Line (GAC): C ORGANIZE WORK

Competency: C5 Use mathematics

Objectives

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

- Apply mathematical principles to solve problems

LEARNING TASKS	CONTENT

1. Use fractions to solve problems	• Order of operation
	  ○ Add
	  ○ Subtract
	  ○ Multiply
	  ○ Divide
	• Express in higher terms
	• Simplification

2. Use decimal fractions to solve problems	• Order of operation
	  ○ Add
	  ○ Subtract
	  ○ Multiply
	  ○ Divide
	• Conversion between decimals and fractions
	• Decimal notation

3. Solve problems of ratio and proportion	• Ratio ○ Equivalent • Proportion • Unknown quantities • Similar triangles

4. Use metric and imperial measurements	• Conversion between metric and imperial
	  ○ Feet, inches/metres, millimetres
	  ○ Pounds, tons/kilograms, tonnes
	• Conversation tables

5. Solve geometric problems	• Area • Perimeter • Volume • Angles

		• Radius and diameter
		• Formulas for area of:
		  ○ Square and rectangles
		  ○ Triangles
		  ○ Circle

6.	Solve problems of triangles	• Pythagorean theorem
		  ○ Sine
		  ○ Cosine
		  ○ Tangent

7.	Describe impact of mathematical calculations	• Safety • Profit and cost calculations • Material wastage • Estimation • Project delays

Achievement Criteria

Performance	The learner will be able to calculate the weight of a bundle of reinforcing steel in metric and imperial.
Conditions	The learner will be given • Instructions • Tape measure • Calculator • Reinforcing steel
Criteria	The learner will be evaluated on • Completeness • Accuracy of weight

Line (GAC): D USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES

Competency: D1 Use communication techniques

Objectives

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

- Describe methods of communication
- Demonstrate the role of the apprentice
- Describe the role of a mentor
- Describe workplace equity, diversity, and inclusion

LEARNING TASKS	CONTENT

1. Describe effective, inclusive, and respectful communication	• Professionalism
	  ○ Participation
	  ○ Punctuality
	  ○ Conflict resolution
	  ○ Respect
	• Modes of communication
	  ○ Face to face
	  ○ Phone
	  ○ Text-based
	• Verbal and written instructions
	• Trade terminology
	• Etiquette and target audience
	  ○ Coworkers
	  ○ Clients/customers
	  ○ Public
	  ○ Other trades
	  ○ Industry contacts
	• Harassment and discrimination
	  ○ Language free from prejudice, stereotype, and discrimination
	  – Racism
	  – Ageism
	  – Sexism
	  – Homophobia/Transphobia
	  – Religious prejudice
	  – Physical or mental disability prejudice
	  – Gender inclusive language
	  – Cultural misappropriation

2. Demonstrate the role of the apprentice	• Apprenticeship responsibilities

LEARNING TASKS	CONTENT
	○ Preparedness ○ Setting goals ○ Self-advocacy ○ Developing capabilities ○ Constructive feedback • Apprenticeship skills and attributes ○ Active listening ○ Compassion
3. Describe the role of the mentor	• Mentorship responsibilities ○ Preparedness ○ Setting apprentice up for success – Goal setting – Progress tracking ○ Developing capabilities ○ Confidentiality ○ Apprentice advocacy • Mentorship skills and attributes ○ Inclusiveness ○ Building trust ○ Fairness ○ Compassion ○ Leading by example
4. Describe workplace equity, diversity, and inclusion	• Workplace free from ○ Harassment ○ Discrimination ○ Violence ○ Gender microaggressions ○ Racial microaggressions ○ Unconscious bias • Allyship • Behaviour and conduct ○ Rights and responsibilities – Employee – Employer • Equity ○ Fair recruiting ○ Hiring ○ Promotion • Acceptance and inclusion ○ Cultural and psychological safety ○ Accommodations • Anti-harassment/anti-bullying policies

Line (GAC): E PLAN LIFT

Competency: E1 Assess load

Objectives

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

- Inspect load
- Calculate total weight of load
- Verify total weight of load
- Determine centre of gravity of load

LEARNING TASKS	CONTENT

1. Identify load to be hoisted or lifted	• Regulations
	• Knowledge of weights and materials
	• Material properties
	• Lifting points
	  ○ Engineered
	  ○ Improvised
	  ○ Field installed

2. Inspect load	• Shape
	• Visible damage
	• Rigging points
	• Unknown weight factors
	• Material integrity
	  ○ Product residue
	  ○ Debris
	  ○ Build-up of foreign matter
	  ○ Corrosion
	  ○ Damage
	  ○ Temporary bracing and fasteners

3. Calculate total weight of load	• Tools and equipment • Reference materials • Tags and marks • Formulas • Load measurement

4. Verify total weight of load	• Reference materials
	  ○ Fabrication drawings
	  ○ Bill of lading
	  ○ Material take off
	  ○ Detail sheet

LEARNING TASKS	CONTENT
	• Load cell ○ External • Crane

5. Estimate centre of gravity (COG) of load	• Visual inspection of weight distribution
	• Establish centre of gravity
	  ○ Symmetrical load
	  ○ Non-symmetrical load

Line (GAC): E PLAN LIFT

Competency: E2 Perform pre-lift analysis

Objectives

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

- Determine type of lift
- Determine rigging factors
- Perform pre-lift site inspection
- Perform test lift

LEARNING TASKS	CONTENT
1. Determine final location and orientation of load	• Task requirement • Site conditions • Drawings

2. Determine type of lift	• Application
	• Site conditions
	• Weight of load
	• Drawings
	• Engineering specifications
	• Jurisdictional regulations
	• Type
	  ○ Simple
	  ○ Tandem
	  ○ Critical
	  ○ OHS definition
	  ○ Company specific
	  ○ Engineered
	  ○ Multi-piece

3. Determine rigging factors	• Obstacles
	• Head room
	• Opening size
	• Hazards
	• Weight of load
	• Fleet angles
	• Anchor points
	• Block loading
	• Mechanical advantage
	  ○ Parts of line
	  ○ Friction
	  ○ Lead line pull

LEARNING TASKS	CONTENT

	• Sling tension
	• Boom deflection
	• Centre of gravity
	• Hardware and hitch selection
	• Site specific environmental factors
	  ○ Caustic
	  ○ Acidic
	  ○ Abrasive
	  ○ Temperature

4. Perform pre-lift site inspection	• Travel path and rigging requirements
	  ○ Crane radius and sweep
	  ○ Counterweight radius
	  – Clearance to obstacles
	  ○ Crane load charts
	  ○ Hazards
	  – Overhead obstacles
	  – Boom interference
	  – Ground conditions
	  – Swing path
	  – Energized equipment
	  ○ Environmental
	  – Rain
	  – Wind
	  – Snow
	  – Working on water

5. Determine if permit and test lift are required	• Jurisdictional regulations • Site-specific requirements
6. Identify procedure and access equipment required for rigging attachment and removal	• Site conditions • Jurisdictional regulations • Mobile elevating work platform • Personnel baskets • Scaffolding • Fall arrest system • Ladders
7. Determine communication methods	• Site-specific requirements • Visual

LEARNING TASKS	CONTENT
	○ Hand signals ○ Line of sight • Audio ○ Two-way radios ○ Voice
8. Identify personnel needed to perform rigging tasks	• Site-specific requirements • Jurisdictional regulations • Personnel ○ Supervisor ○ Operators ○ Signaler ○ Riggers ○ Tag line persons
9. Perform test lift	• OHS regulations • Site-specific requirements • Engineering requirements

Line (GAC): E PLAN LIFT

Competency: E3 Select rigging, hoisting, and positioning equipment

Objectives

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

- Select rigging equipment
- Select hoisting and positioning equipment

LEARNING TASKS	CONTENT

1. Select rigging equipment	• Jurisdictional regulations
	• Manufacturer's specifications
	• Standards
	• Equipment
	  ○ Slings
	  ○ Blocks
	  ○ Hardware
	  ○ Hooks
	  ○ Softeners
	  ○ Below the hook lifting devices
	  – Spreader
	  – Equalizer beams
	  – Shackles
	  – Chokers
	• Rigging tag information
	  ○ Date
	  ○ Size
	  ○ Capacity
	  ○ Manufacturer
	  ○ Material
	  ○ Working load limit (WLL)
	  ○ Rigging configuration
	• Sling tension
	• Protection (softeners)

2. Select hoisting and positioning equipment	• Equipment
	  ○ Cranes
	  ○ Manual cable puller (grip hoist)
	  ○ Tuggers
	  ○ Chain falls
	  ○ Come-alongs
	  ○ Jacks
	  ○ Gantries

LEARNING TASKS	CONTENT
	○ Trailers ○ Multi-rollers ○ Blocks • Considerations ○ Weight ○ Radius ○ Distance ○ Parts of line ○ Hoisting location ○ Protection (softeners)

Line (GAC): E PLAN LIFT

Competency: E4 Secure lift area

Objectives

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

- Describe walk-around inspection
- Describe procedure to establish a safety perimeter
- Secure lift area

LEARNING TASKS	CONTENT

1. Describe walk-around inspection	• Communication with other trades
	• Hazard identification
	  ○ Slips, trips, falls
	  ○ Struck by material
	  ○ Overexertion
	  ○ Pinching
	  ○ Crushing
	  ○ Miscommunication
	  ○ Leading edges
	  ○ Electrocution
	  ○ Overhead obstructions
	  ○ Environmental

2. Describe procedure to establish a safety perimeter	• Non-essential personnel clearance
	• Control zone
	• Hazard mitigation
	• Signage
	  ○ Barricades
	  ○ Barrier tape
	  ○ Tags and signs

3. Describe procedure to secure lift area	• Regulations • Installing and tagging barriers • Ground conditions • Work area • Limiting approach • Permits • Non-essential personnel clearance • Emergency response plan • Documentation
4. Secure lift area	• Regulations • Procedure

Line (GAC): F USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT

Competency: F1 Inspect rigging, hoisting, and positioning equipment

Objectives

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

- Describe inspection of rigging, hoisting, and positioning equipment
- Identify removal criteria for damaged rigging, hoisting, and positioning equipment
- Describe removal of damaged rigging, hoisting, and positioning equipment

LEARNING TASKS	CONTENT
1. Describe inspection of rigging, hoisting and positioning equipment	• Regulations • Industry standards • Manufacturers' specifications • Company policies and procedures • Visual • Physical • Non-destructive • Destructive • Procedure • Documentation • Frequent and infrequent • Pre-use • Scheduled
2. Identify removal criteria for damaged rigging, hoisting, and positioning equipment	• Deformations • Kinks • Broken wires • Arc mark • Tears • Cuts • Cracks • Rust • Corrosion • Chemical burns • Bird caging • Contamination • Wear • Overload • Illegible/missing tag

LEARNING TASKS	CONTENT
3. Describe removal of damaged rigging, hoisting and positioning equipment from service	• Procedure • Tagging • Destruction • Disposal • Documentation

Line (GAC): F USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT

Competency: F2 Use ropes and slings

Objectives

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

- Use slings, hitches, and bends for rigging
- Describe fibre and wire rope
- Tie knots, bends, and hitches
- Use rope for hand lines and load control

LEARNING TASKS	CONTENT

1. Use slings and hitches	• OHS Regulations
	• Slings
	  ○ Construction
	  – Two-eye
	  – Grommet/endless
	  ○ Materials
	  – Synthetic
	  – Wire
	  – Mesh
	  – Chain
	  ○ Bridle
	  ○ Multi-piece/Christmas tree
	• Hitches
	  ○ Vertical
	  ○ Baskets
	  ○ Choker
	• Pennant lines
	• Tags
	• Sling tables
	• Sling tension and angles
	• Eye configuration and efficiency
	• Working load limits
	• Capacity factors
	  ○ Tension efficiencies and reductions
	  ○ D-to-d ratio (Diameter of object to diameter of sling)
	• Safety considerations
	  ○ Inspection
	• Best practices

2. Describe fibres used in rigging manufacturing	• Construction and lays

LEARNING TASKS	CONTENT
	○ Round ○ Web ○ Kernmantle ○ Twisted ○ Braided • Materials ○ Polyester ○ Polyethylene ○ Polypropylene ○ Nylon ○ Kevlar ○ Manila • Uses and limitations • Splicing ○ Methods ○ Types • Fibre ropes properties • Selection for use • Inspection • Storage • Handling • Maintenance • Safety considerations • Working load limits ○ Formulas
3. Describe wire rope	• Construction ○ Grades • Properties and uses • Characteristics • Lays and cores • Selection • Uses • Limitations • Splicing ○ Methods ○ Types ○ Efficiencies • Inspection • Storage

LEARNING TASKS	CONTENT

	• Handling
	• Maintenance
	• Safety considerations
	• Working load limits
	  ○ Quick recall
	  ○ Formulas

4. Describe and select ropes and slings based on strength, properties, wear resistance, environment, and use	• Fatigue • Abrasion • Weather/elements degradation • Temperature • Corrosion • Bending • Crushing • Rotation • Weight • Grade • Elasticity • Durability • Ultimate strength • Design factors • WLL

5. Use knots, bends, and hitches	• Knots
	  ○ Bowline
	  ○ Double figure eight
	  ○ Rethreaded figure eight
	  ○ Reef knot
	  ○ Harness hitch
	• Hitches
	  ○ Clove hitch
	  ○ Snubber
	  ○ Rolling
	  ○ Round turn and two half hitches
	• Double sheet bend
	• Rope types
	  ○ Use and limitations
	• WLL calculations
	• Terms

LEARNING TASKS	CONTENT
	• Capacity reductions • Inspection
6. Describe chain rigging	• Identification • Materials • Tags • Inspection requirements • Maintenance • Storage • Uses and limitations • Working load limits
7. Use rope for hand lines and load control	• Safety • Job specifications • Tag lines • Knot selection • Lifting • Lowering

Achievement Criteria

(Note: suggested to combine with Achievement Criteria in F3)

Performance	The learner will be able to use knots in a practical application.
Conditions	The learner will be given • Instructions • Equipment
Criteria	The learner will be evaluated on • Selection of knot for the given scenario. • Speed • Accuracy • Tail length and finish

Line (GAC): F USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT

Competency: F3 Use rigging and hoisting equipment

Objectives

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

- Describe hoisting and rigging equipment
- Describe rigging hardware components
- Identify auxiliary hoisting equipment
- Select and use hoisting and rigging equipment
- Use communication procedures for moving and hoisting
- Use safe lifting procedures

LEARNING TASKS	CONTENT

1. Describe hoisting and rigging equipment	• OHS Regulations
	• Standards
	  ○ ASME
	  ○ Manufacturer specific
	  ○ Company specific
	• Types
	  ○ Hoisting
	  ○ Rigging
	  ○ Rolling
	• Uses
	• Limitations and capacities
	• Safety

2. Describe rigging hardware and components	• Uses and limitations
	• Hooks
	  ○ Eye
	  ○ Swivel
	  ○ Chain
	  ○ Clevis
	• Headache balls
	• Wedge sockets/beckett
	• Blocks
	• Sheaves
	• Shackles
	• Wire rope clips
	• Thimbles
	• Eyebolts
	  ○ Shouldered

LEARNING TASKS	CONTENT
	○ Swivel • Tongs • Clutches • Load binders • Spreader bars • Equalizer bars • Turnbuckles • Drums • Chains • Softeners • Sway braces • Muffler clamps • Spines/stiffener • Welded lifting collars • Lifting lugs
3. Identify auxiliary hoisting equipment	• Forklifts • Crane supported work platform • Tugger winches • Hand winches • Powered chain hoists • Chain falls • Telehandler ○ Auxiliary hoist ○ Extensions ○ Jibs ○ Mobile rotational • Come-a-longs • Grip hoist
4. Use hoisting and rigging equipment	• Safety • Calculations ○ Weight ○ Sling/choker tension ○ Hold back ○ Mechanical advantage ○ Friction ○ Lead line pull • Centre of gravity

LEARNING TASKS	CONTENT

	• Equipment selection
	• Lifting location and point selection
	• Anchorage
	• Operating procedures
	  ○ Communication
	  – Hand signals
	  ○ Load securement
	  ○ Inspection
	  ○ Maintenance
	  ○ Storage
	  ○ Manufacturer's specifications
	  – Charts
	  – Tables

5. Use communication procedures for moving and hoisting	• OHS Regulations
	• Lift plan
	• Methods and precautions
	  ○ Hand signals
	  ○ Voice communication
	  – Two-way radio
	  ○ Relayed signals

6. Use safe lifting procedures	• OHS Regulations
	• Identification of load weight
	• Rigging configuration
	• Identification
	  ○ Radius
	  ○ Boom angle
	  ○ Head room
	• Pick and placement location
	• Load control
	• Load stability
	• Tag lines
	• Communication

Achievement Criteria #1

Performance — The learner will be able to calculate mass, choose appropriate size rigging and hardware, position rigging on the load, and ensure the crane is at an appropriate radius.

Conditions — The learner will be given:

- Equipment
- Instructions

Criteria — The learner will be evaluated on:

- Accuracy in mass calculation
- Selection of rigging and hardware
- Selection of tagline knot
- Hitch method and sling angle
- Control of load
- Appropriate crane positioning

Achievement Criteria #2

Performance — The learner will be able to

- Pick and place a load with a crane using appropriate communication
- Demonstrate control of a suspended load with a crane using appropriate communication

Conditions — The learner will be given

- Instructions
- Materials
- A crane and operator
- Rigging equipment

Criteria — The learner will be evaluated on

- Load control
- Quality of communication
- Radio commands
- Hand signals

Line (GAC): F USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT

Competency: F5 Perform post-lift activities

Objectives

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

- Describe post-lift activities
- Disassemble rigging, hoisting and positioning equipment
- Maintain rigging, hoisting and positioning equipment

LEARNING TASKS	CONTENT
1. Describe post-lift activities	• Re-installing grating and railing • Securing load • Installing bracing and temporary support • Verifying integrity of blocking and cribbing • Removal of softeners • Housekeeping • Post-lift meeting • Removal of barriers and signs

2. Disassemble rigging, hoisting and positioning equipment	• OHS Regulations
	• Manufacturers specifications
	• Company policies
	• Inspection
	  ○ Hardware
	  ○ Rigging
	  ○ Tools and equipment
	• Storage

3. Maintain rigging, hoisting and positioning equipment	• OHS Regulations
	• Manufacturers specifications
	• Company policies
	• Inspections
	  ○ Frequent and infrequent
	  ○ Pre-use
	  ○ Scheduled
	• Storage
	• General maintenance
	  ○ Cleaning
	  ○ Greasing
	• Function checks

Line (GAC): G PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES

Competency: G1 Identify and mobilize cranes

Objectives

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

- Identify types of cranes
- Identify hazards associated with cranes
- Describe crane components
- Describe crane assembly and breakdown location
- Describe moving cranes on site
- Set up a mobile crane

LEARNING TASKS	CONTENT

1. Identify types of cranes	• Mobile
	  ○ Carrier mounted
	  ○ Rough terrain
	  ○ Crawler/track mounted
	  ○ Rail mounted
	  ○ Barge
	• Tower
	  ○ Fixed jib
	  ○ Luffing jib
	  ○ Self-erecting
	• Gantry
	• Electronic overhead travelling (EOT)
	• Derrick
	• Lifting truss/girder
	• Helicopter
	• Self-erecting
	• Launching girder
	• Highline

2. Identify hazards	• OHS Regulations
	• Clearances
	  ○ Outrigger
	  ○ Headroom/two-blocking
	  ○ Access
	  ○ Boom
	  ○ Sweep
	  ○ Counterweight

LEARNING TASKS	CONTENT

	• Environmental/site hazards
	  ○ Power lines
	  ○ Underground services
	  ○ Obstructions to swing radius
	  ○ Other equipment in the area
	  ○ Ground/base conditions
	  ○ Weather
	  – Wind
	  – Lightning
	  – Rain
	  – Snow
	• Tides/wakes
	• Crush hazards
	• Suspended loads
	• Miscommunication

3. Describe mobile and tower crane components	• OHS Regulations
	• Manufacturers specifications
	• Uses and limitations
	  ○ Outriggers
	  – Pads/floats
	  – Levelling jacks
	  ○ Structure
	  – Frame
	  – Turntable
	  – Counterweight
	  – House/cab
	  ○ Drums and gantries
	  ○ Boom stops
	  ○ Boom types and sections
	  – Lattice
	  – Hydraulic
	  – Articulating
	  – Jibs
	  • Straight
	  • Luffing
	  ○ Drums, lines, and winches
	  – Main line
	  – Whip line
	  – Load block/headache ball

LEARNING TASKS	CONTENT
	– Wedge socket/beckett ○ Safety – Sensors and indicators ○ Trolley ○ Pennant lines ○ Pins/keepers ○ Sheave ○ Jacking sections ○ Tracks
4. Describe moving cranes on site	• OHS Regulations • Manufacturer's specifications • Pre-planning crane location and route • Hazards ○ Increase in size and weight ○ Overhead ○ Clearances ○ Ground conditions • Procedures • Communication
5. Set up mobile crane	• OHS Regulations • Safety • Communication • PPE • Manufacturers specifications • Configuration • Assessment ○ Ground conditions ○ Site conditions • Pad types ○ Selection • Tools and equipment • Procedure

Achievement Criteria

Performance	The learner will be able to set up a mobile crane.
Conditions	The learner will be given access to • Instructions • Crane and operator • Crane chart • Tools and accessories
Criteria	The learner will be evaluated on • Checklist • Crane is level, with wheels off the ground • Outriggers properly set • Proper sequence • Accuracy of position

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H1 Apply fundamentals of reinforcing concrete

Objectives

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

- Describe the fundamentals of concrete
- Identify where the forces on concrete are manifested in structures
- Describe the properties of reinforcing systems
- Describe the fundamentals of reinforced concrete

LEARNING TASKS	CONTENT

1. Describe the fundamentals of concrete	• Properties
	• Concrete structures
	  ○ Advantages
	  ○ Disadvantages
	• Hardening
	• Cure time
	• MPa value

2. Describe the forces on concrete	• General loads on concrete
	  ○ Dynamic
	  – Seismic
	  – Thermal
	  – Wind
	  – Water
	  – Traffic
	  ○ Static
	• Specific forces on concrete
	  ○ Compression
	  ○ Tension
	  ○ Shear
	  – Punching
	  – Vertical
	  – Horizontal
	  – Single

3. Identify where the forces on concrete are manifested in structures	• Subgrade
	  ○ Piles
	  ○ Pile caps
	  ○ Caissons

LEARNING TASKS	CONTENT

	• On grade
	  ○ Beams
	  ○ Slabs
	  ○ Footings
	  ○ Abutment
	  ○ Pile caps
	• Suspended
	  ○ Beams
	  ○ Slabs
	  ○ Cantilevers
	  ○ Headers
	• Columns
	• Walls
	• Lateral load resisting elements
	  ○ Zones
	  ○ Shear walls
	  ○ Headers
	  ○ Collector bars
	  ○ Expansion joints

4. Describe the properties of reinforcing systems	• Standards
	  ○ CSA
	  ○ RSIC
	  ○ CRSI
	  ○ American Concrete Institute (ACI)
	• Grades
	  ○ Weldable
	  ○ Non-weldable
	  ○ Tensile strength
	• Diameters
	• Weights
	• Types
	  ○ Deformed bar
	  ○ Stainless
	  ○ Glass fibre reinforced polymer (GFRP)
	  ○ Fibre reinforced polymer (FRP)
	  ○ Welded wire mesh
	  ○ Smooth bar
	  ○ Stud rails/shear studs
	  ○ Embeds
	• Corrosion protections

LEARNING TASKS	CONTENT
	○ Galvanized ○ Epoxy • Bend designations • Placement of steel
5. Describe the fundamentals of reinforced concrete	• Standards ○ CRSI ○ RSIC • Bonding of concrete to steel • Location and shape of steel • Concrete coverage ○ Classifications ○ Exposure • Development length ○ Splice ○ Projection ○ Embedment

Achievement Criteria

Performance	On a diagram of a typical concrete structure, the learner will be able to • Identify location of stress loads • Identify location of required reinforcing
Conditions	The learner will be given • Instructions • Diagram of concrete structures
Criteria	The learner will be evaluated on • Identifying correct location of stress loads and required reinforcing

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H2 Cut and bend reinforcing materials

Objectives

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

- Select and use cutting equipment for reinforcing material
- Select and use bending tools and equipment for reinforcing material
- Cut and bend a simple shape using reinforcing material

LEARNING TASKS	CONTENT

1. Select and use cutting equipment	• Manufacturers' specifications
	• Types
	  ○ Thermal
	  ○ Mechanical
	  ○ Hand
	  ○ Uses and limitations
	• Components
	• Characteristics
	• Operating principles
	• Hazards
	• Procedure

2. Select and use bending tools and equipment	• Manufacturers' specifications
	• Standards
	  ○ CSA
	  ○ CRSI
	  ○ RSIC
	• Types
	  ○ Hickey bars
	  ○ Hydraulic table-top benders
	  ○ Electric handheld benders
	  ○ Uses and limitations
	• Components
	  ○ Pin selection
	  – Charts
	  – Bend type
	  – Trade rule
	• Characteristics
	  ○ Bend angles
	• Operating principles
	• Hazards
	• Procedure

Achievement Criteria

Performance	The learner will be able to cut and bend simple shapes using various tools
Conditions	The learner will be given • Instructions • Detail sheet • Tools • Manual bender • Portable bender • Tabletop bender • Materials
Criteria	The learner will be evaluated on • Safety • Accuracy • Overall bar length • Bend lengths • Bend angle • Efficiency

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H3 Place, tie, splice, and pre-fabricate reinforcing materials

Objectives

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

- Splice reinforcing material
- Pre-fabricate reinforcing material
- Install reinforcing material

LEARNING TASKS	CONTENT

1. Identify reinforcing material	• Size
	• Grade
	• Length
	• Shape
	• Supplier identification markings
	  ○ Tags
	  ○ Colour codes
	  ○ Shipping list (bar list)
	• Detail sheets
	• Placing drawings

2. Install reinforcing material	• Proper lifting and handling
	• Dowel/end protection
	• Installation methods
	  ○ Built-in-place
	  ○ Pre-fabricated
	• Drawings
	• Layout
	• Procedures
	  ○ Measuring
	  ○ Marking
	  ○ Cutting
	  ○ Framing up
	  ○ Support
	  – Chairs
	  – Bolsters
	  – Bricks
	  – Standees
	  – Post and saddles
	  – Sway braces

LEARNING TASKS	CONTENT
	– Pin bracing – Box braces – Carry bars – Buried bars ○ Tying back ○ Installing balance of steel
3. Splice reinforcing material	• Types of rebar splices ○ Lap – Length requirements – Contact – Non-contact ○ Mechanical couplers – Threaded bar form-saver – Taper threaded – Threaded forged – Bolted steel coupler (snap off) ○ Welded ○ Compression ○ Tension
4. Secure reinforcing material	• Types of wire ○ Materials ○ Gauges ○ Coatings • Ties ○ Types ○ Purposes ○ Selection • Tying ○ Specifications ○ Percentages ○ Sequence • Tools and equipment • Muffler clamps • Welding

LEARNING TASKS	CONTENT

5. Pre-fabricate reinforcing material	• Safety
	  ○ MSI
	• Drawings
	• Temporary supports
	  ○ Horses
	  ○ Jigs
	• Procedure
	• Access
	• Orientation
	• Loading and unloading
	• Rigging
	  ○ Lifting points
	  – Establishment
	  – Integrity
	• Layout
	  ○ Template
	  ○ Measuring
	  ○ Marking
	• Installing balance of steel
	• Framing up
	• Tying
	• Preparation for installation
	  ○ Circular spacing clips
	  ○ Bolsters
	  ○ Sway braces
	  – Chain
	  – Wire rope
	  – Rebar
	  ○ Box braces

Achievement Criteria

Performance	The learner will be able to install reinforcing steel according to placing drawing and verbal instructions.
Conditions	The learner will be given • Instructions • Placing drawing • Documentation templates • Materials
Criteria	The learner will be evaluated on • Safety • Spacing • Clearance • Quantity • Quality and type of ties • Teamwork • Efficiency • Housekeeping • Documentation

Line (GAC): I APPLY POST-TENSIONING TECHNIQUES

Competency: I1 Describe fundamentals of pre-stressed systems

Objectives

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

- Describe purpose, application, and principles of pre-stressed systems
- Describe pre-stressed systems and accessories
- Describe pre-stressing equipment
- Describe organization and protection of tendons and accessories
- Describe pre-stressed members

LEARNING TASKS	CONTENT

1. Describe purpose, application, and principles of pre-stressed systems	• Purpose and advantages
	• Hazards
	  ○ Concrete blowout
	  ○ Tendon failure
	  ○ Structural failure
	• Principles
	  ○ Effects of rebar and cable on structure
	  ○ Forces
	  – Tension
	  – Compression
	  – Shear
	  – Uplift
	  – Force reversal
	• Terminology
	  ○ Eccentricity
	  ○ Drape
	  ○ Wobble
	  ○ Centre of gravity of concrete (CGC)
	  ○ Centre of gravity of steel (CGS)
	  ○ Add tendons (Additional tendons)
	• Material tracking (traceability)
	• Quality assurance
	• Applications
	  ○ Floor systems
	  ○ Girders
	  ○ Columns
	  ○ Bridges
	  ○ Temporary structures
	  ○ Cable supported structures

LEARNING TASKS	CONTENT
	○ Barricades
2. Describe pre-stressed members	• Types of members ○ Columns ○ Beams/girders – Box girders – Spandrel ○ Slab ○ Hollow core ○ Tee/double tee ○ Inverted tee ○ Segmental construction
3. Describe pre-stressed systems and accessories	• Pre-stressed systems ○ Pre-tensioned ○ Post-tensioned ○ Bonded ○ Unbonded • Stressing bed ○ Forms ○ Self-stressing ○ Fixed abutment • Tendons ○ Grades ○ Bar ○ Cable/strand ○ Sizes ○ Types – Uniform – Banded – Temperature • Accessories ○ Anchorages – Multi-strand – Mono-strand ○ Wedges ○ Nuts/plates ○ Bursting bars ○ Pocket former ○ Supports

LEARNING TASKS	CONTENT

4. Describe post-tensioning equipment	• Stressing equipment
	  ○ Jacks
	  ○ Grippers
	  ○ Pumps
	  ○ Gauges
	  ○ Hoses
	  ○ Wedge seating tools
	• Bullets
	• Shears
	• Iso-tensioning box
	  ○ Sequence
	• De-tensioning block
	• Winches
	• Strand pullers/pusher
	• String line/fish wire
	• Cutting bed
	• De-coiler/turntable
	• Sheath cutters
	• Power source
	• Troubleshooting anchor

5. Describe organization and protection of tendons and accessories	• Materials
	  ○ Duct tape
	  ○ Heat shrink
	  ○ Tarps
	  ○ Oil/grease/wax
	  ○ Caulking
	  ○ Tags and colour coding
	• Site storage
	• Potential contaminants
	• Faults
	  ○ Identification
	  ○ Correction
	• Installation of tendon protection
	• Considerations
	  ○ Rigging
	  ○ Handling

Line (GAC): I APPLY POST-TENSIONING TECHNIQUES

Competency: I2 Place unbonded post-tensioning systems

Objectives

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

- Describe unbonded post-tensioning systems
- Describe stressing tendons
- Describe cutting, capping, and grouting tendons

LEARNING TASKS	CONTENT

1. Describe unbonded post-tensioning systems	• Purpose
	• Advantages
	• Importance of material tracking
	  ○ Document tracking
	  ○ Mill certifications
	  ○ Bill of lading
	  ○ Shipping manifest
	• Storage requirements
	• Quality assurance/quality control
	• Structural applications
	• Reinforced concrete applications
	• Strand
	• Anchorage systems
	  ○ Multi-strand
	  ○ Mono-strand
	  ○ Encapsulated
	  ○ Intermediate
	• Accessories
	  ○ Pocket formers
	  ○ Staples
	  ○ Chairs/bolster
	  ○ Grease caps
	  ○ Grease sleeve
	  ○ Wedges
	  ○ Couplers

2. Describe placing tendons	• Safety • PPE • Rigging • Handling • Sequence of work

LEARNING TASKS	CONTENT
	○ Determining placing order – Uniform – Banded – Temperature – Add ○ Considerations – Layout – Measuring – Marking ○ Anchors – Dead end – Live end (stressing end) – Intermediate ○ Pocket formers ○ Bursting steel installation considerations ○ Securing dead ends ○ Supporting tendons – Securing tendons to supports – Spacing considerations • Live end projection • Quality assurance
3. Describe stressing preparation	• Safety ○ Barricading ○ Communication • Identifying timelines • Concrete strength • Weather considerations • Inspections ○ Concrete deficiencies ○ Anchorages ○ Tendons ○ Stressing equipment • Removal of pocket formers • Cutting and removal sheathing • Installation of wedges • Cleaning of tendon • Debris removal • Elongation marking

LEARNING TASKS	CONTENT

4. Describe stressing tendons	• Safety
	  ○ Tie off jack
	  ○ Body positioning
	• Equipment
	  ○ Preparation
	  ○ Inspection
	  ○ Cleaning
	  ○ Function verification
	• Calibrated equipment pairing
	• Identification of sequence
	• Installation of jack
	• Stressing to required pressure
	• Checking of elongation
	• Lift-off
	• Documentation
	  ○ Stressing record
	  ○ Elongation
	  ○ Gauge pressure
	• Approval of results

5. Describe cutting and capping tendons	• Cutting methods
	  ○ Torch
	  ○ Pocket shear
	  ○ Abrasive cut-off
	  ○ Plasma cutter
	• Cleaning of pocket
	• Capping
	  ○ Grouting
	  ○ Waxing
	  ○ Greasing
	  ○ Plastic cap

6. Describe specifications and standards	• PTI
	  ○ Anchor spacing
	  ○ Double live ends
	  ○ Intermediate anchorage
	• Engineering
	  ○ Project specific
	  ○ Manufacturer specific
	• Tolerances
	  ○ Placing

LEARNING TASKS	CONTENT
	○ Elongation ○ Gauge reading
7. Describe reasons and procedures for de-stressing	• Reasons ○ Blowout in concrete ○ Yield of pre-stressing steel ○ Breakage of pre-stressing steel ○ Safe dismantling and deconstruction • Procedures ○ Potential hazards ○ Work zone access ○ Engineered shoring ○ Qualified personnel • Follow engineering procedures • Requirements ○ Regulations ○ Certifications – PTI

Level 2

Ironworker (Reinforcing)

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B2 Use power tools

Objectives

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

- Use bending tools and equipment

LEARNING TASKS

1. Use bending tools and equipment

CONTENT

- Manufacturers' specifications
- Procedures
  - Set-up
  - Inspection
    - Identifying deficiencies
    - Removal from service
  - Calibration
- Operating principles
- Uses
- Limitations
- Hazards
  - Flying debris
  - Pinch/crush points
  - Cuts
  - Punctures
  - Overexertion
  - Struck by tools
  - Electrocution
  - Hydraulic pressures
  - Bending table

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B5 Use measurement, layout, and surveying tools and equipment

Objectives

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

- Use levelling equipment

LEARNING TASKS	CONTENT

1. Use levelling equipment	• Builder's level
	  ○ Parts and components
	  ○ Set up procedure
	  ○ Checking of instrument accuracy
	  ○ Positioning
	  ○ Determining instrument height
	  ○ Procedures
	  – Determination of object elevation
	  – Transferring elevations
	  – Multiple set ups
	  ○ Care
	  ○ Storage
	  ○ Handling
	• Laser level
	  ○ Set up procedure
	  ○ Positioning
	  ○ Care
	  ○ Storage
	  ○ Handling

Achievement Criteria #1

Performance	The learner will be able to verify accuracy of equipment (peg test)
Conditions	The learner will be given • Instructions • Builder's level and tripod • Partner • Tape measure • Vertical surfaces to mark
Criteria	The learner will be evaluated on • Safety • Set up • Procedure • Interpretation of results

Achievement Criteria #2

(Note: Suggested to combine with Achievement Criteria #1 and perform in sequence)

Performance — The learner will be able to
- Verify accuracy of instrument
- Reference a known benchmark to establish various elevations
- Transfer an elevation in a total circuit requiring multiple set ups

Conditions — The learner will be given
- Instructions
- Builder's level
- Rod holder
- A benchmark

Criteria — The learner will be evaluated on
- Accuracy

Achievement Criteria #3

Performance — The learner will be able to
- Set up a rotating laser level
- Verify level of existing surface

Conditions — The learner will be given
- Instructions
- Laser level
- Receiver

Criteria — The learner will be evaluated on
- Set up
- Procedure
- Equipment handling
- Interpretation of results

Line (GAC): B USE AND MAINTAIN TOOLS AND EQUIPMENT

Competency: B6 Use welding and thermal cutting equipment

Objectives

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

- Describe SMAW
- Perform SMAW
- Identify welding joints and positions
- Describe weld testing and defects

LEARNING TASKS	CONTENT

1. Describe Shielded Metal Arc Welding (SMAW)	• Standards
	  ○ CWB
	  – Regulations/procedures
	  ○ CSA
	  ○ American Welding Society (AWS)
	• Purpose/uses
	• Equipment
	• Defects
	  ○ Undercut
	  ○ Convexity
	  ○ Concavity
	  ○ Porosity
	  ○ Slag inclusions

2. Perform SMAW	• Safety
	• Manufacturer's specifications
	• Consumables
	• Materials
	• Basic procedures/operations
	  ○ Set-up
	  ○ Adjustment
	  ○ Take down
	  ○ Inspection
	  ○ Maintenance
	  ○ Storage
	  ○ Trouble shooting
	  ○ Storage and handling

3. Identify welding joints and positions	• Joints
	  ○ Tee
	  ○ Lap
	  ○ Butt

LEARNING TASKS	CONTENT
	○ Corner ○ Edge • Positions ○ Flat ○ Horizontal ○ Vertical (up) ○ Overhead • Groove • Fillet • Puddle • Symbols

Achievement Criteria

Performance	The learner will be able to set up a portable welder and perform a lap weld on reinforcing steel.
Conditions	The learner will be given: • Tools • Equipment • Instructions
Criteria	The learner will score 70% or better on a rating sheet that reflects the following criteria: • Safety • Machine set-up • Weld defects • Accuracy of splice and welds

Line (GAC): C ORGANIZE WORK

Competency: C2 Perform Layout

Objectives

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

- Verify as-built dimensions

LEARNING TASKS

1. Verify as-built dimensions

CONTENT

- Existing structural drawings
  - Locations
    - Anchor bolts
    - Embed plate
  - Gridline orientation
  - Template
- Documentation
  - Conformance
  - Non-conformance
- Validating installation
  - Bolts
  - Welds
  - Orientation
  - Elevation
- Creation of offset lines
- Field measuring

Line (GAC): C ORGANIZE WORK

Competency: C3 Use drawings and documentation

Objectives

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

- Interpret welding symbols
- Identify reinforcing requirements based on reinforcing steel drawings
- Interpret structural drawings
- Interpret post-tensioning drawings

LEARNING TASKS	CONTENT
1. Interpret welding symbols	• Symbols • Orientation • Weld specification • Preparation • Field weld
2. Identify reinforcing requirements based on reinforcing steel drawings	• Quantity • Location • Spacing • Size • Shape/type • Placing order • Clearances • Splice lengths • Projection • Embedment

3. Identify drawing quality control and revision processes	• Terminology
	  ○ Issued for approval (IFA)
	  ○ Issued for fabrication (IFF)
	  ○ Issued for construction (IFC)
	  ○ Quality assurance/quality control (QA/QC)
	  – Deficiency list
	  ○ Request for information (RFI)
	• Revisions
	  ○ Tracking
	• Change orders
	• Change directives

		○ Extra work order (EWO)
4.	Interpret structural drawings	• Abbreviations • General notes • Revisions • Orientations • Details • Gridlines • Title block • Dimensions • Sections • Views and elevations • Specifications • Schedules • Navigating multi-page drawing • Relationship to additional drawings ○ Architectural ○ MEP (mechanical, electrical, plumbing) ○ Placing ○ Detail ○ Post-tensioning
5.	Interpret post-tensioning drawings and documentation	• Anchorages ○ Live end ○ Dead end ○ Intermediate • Tendon placing order • Stressing sequence • Anticipated elongation • Tendon schedule • Tendon profile • Support systems • General zone reinforcing • Anchor zone reinforcing • Vent and drain locations • Duct sizes • Wedge dimensions • Anchor dimensions • Stressing records • Material certifications • Calibration records

Achievement Criteria #1

Performance	The learner will be able to • Determine reinforcing requirements in a given area from a structural drawing using codes and standards • Detail multiple interconnected components • Complete detail sheet
Conditions	The learner will be given • Instructions • Structural drawing • Blank detail sheet • RSIC/CSA codes and standards
Criteria	The learner will be evaluated on • Accuracy of • Size • Quantity • Shape • Grade • Length of bent dimensions • Overall lengths • Spacing • Remarks • Placing order • Weight • Completeness of detail sheet

Achievement Criteria #2

Performance	The learner will be able to analyse a post-tensioning drawing and interpret specifications as required.
Conditions	The learner will be given: • Instruction • Materials
Criteria	The learner will be evaluated on: • Interpreting of specification • Accuracy of finding

Line (GAC): C ORGANIZE WORK

Competency: C4 Plan tasks

Objectives

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

- Describe project planning
- Apply project planning practices

LEARNING TASKS	CONTENT

1. Describe project planning	• Determining requirements
	• Hazard assessment
	• Establishing site specific safety standards
	• Access and egress
	• Sequence of operation
	• Prioritization
	• Coordination with other trades
	• Coordinating construction materials
	• Estimating labour requirements
	• Procurement
	  ○ Tools
	  ○ Equipment
	  ○ Required facilities
	  ○ Time management
	• Inventory requirements
	  ○ Secure storage
	  ○ Organization
	  ○ Consumables
	  ○ Maintenance
	• Project specifications
	• Protection of product
	• Ethical disposal

2. Apply project planning practices	• Material cost • Labour estimation • Tools and equipment list • Access equipment • Safety equipment • Consumables • Documentation • Permits

Achievement Criteria

Performance	The learner will be able to estimate cost and coordinate the details for a small project.
Conditions	The learner will be given • Instructions • Drawings
Criteria	The learner will be evaluated on • Accuracy of material cost • Feasibility of plan • Communication of plan • Completeness of plan

Line (GAC): C ORGANIZE WORK

Competency: C5 Use mathematics

Objectives

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

- Apply mathematical principles to solve problems

LEARNING TASKS	CONTENT
1. Solve mathematical problems	• Working bevel • Metric and imperial • Arc • Chord • Degrees, minutes, and seconds

2. Apply mathematical principles to daily projects	• Lift plan
	  ○ Dimensions
	  ○ Head room
	  ○ Capacity
	  ○ Weight
	  ○ Angles
	• Building layout
	  ○ Dimensions
	  ○ Angles
	  ○ Elevations
	• Pressure displacement (force over area)
	  ○ Area
	  ○ Weight

3. Solve multi-step math problems	• Material weights
	• Triangulation of cranes
	• Below-the-hook rigging triangles
	  ○ Combined centre of gravity (CCOG)
	  ○ Pick points
	  ○ Unequal sling tension
	• Capacity

Line (GAC): D USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES

Competency: D2 Use mentoring techniques

Objectives

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

- Describe the role of mentor
- Describe mentoring skills and attributes
- Describe workplace diversity and inclusion

LEARNING TASKS	CONTENT
1. Describe the role of mentor	• Apprentice appreciation • Goal setting • Encouragement • Risk management • Providing feedback • Development of capabilities • Confidentiality
2. Describe mentoring skills and attributes	• Inspiration • Active listening • Building trust • Encouragement • Preparedness • Approachability • Objectiveness • Fairness • Compassion • Leading by example
3. Describe workplace diversity and inclusion	• Codes of Conduct • Fair recruiting and hiring practices • Equity in promotion • Acceptance • Accommodations • Anti-harassment/anti-bullying policies

Line (GAC): D USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES

Competency: D3 Maintain continuous learning

Objectives

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

- Identify continuous learning methods
- Identify supports and resources for learning
- Describe personal and professional development plan
- Identify factors that may impact learning needs and goals
- Interpret information about latest advancements and emerging technologies
- Identify information to share with colleagues and management

LEARNING TASKS	CONTENT

1. Identify continuous learning methods	• Performance review processes
	  ○ Seeking feedback
	  ○ Addressing feedback
	  ○ Assessing personal learning needs
	• Learning opportunities
	  ○ Seminars
	  ○ Webinars
	  ○ Training courses
	  ○ Podcasts
	  ○ Videos
	  ○ Independent research
	• Maintenance of required certifications and training
	• Upgrading and maintenance of computer and technology skills
	• Sharing learning outcomes and concepts with others
	• Transferring knowledge into practice
	  ○ Link between professionalism and continuous learning
	• Staying current on new trade practices and procedures

2. Identify supports and resources for learning	• Professional networks and associations • Manufacturers' seminars • Collaboration with colleagues and community members • Counselling • Mentoring • Peer support groups

LEARNING TASKS	CONTENT
	• Online resources • Individual education plan (IEP) • Language supports • Accommodations

3. Describe personal and professional development plan	• Elements of a professional portfolio
	  ○ Resume
	  ○ Certificates
	  ○ Licenses
	  ○ Diplomas
	  ○ Degrees
	  ○ Transcripts
	  ○ Marketable skills
	  ○ Professional accomplishments
	  ○ Work samples
	  ○ Awards
	  ○ References

4. Identify factors that may impact learning needs and goals	• New technology • Trade and sector trends and practices • Skills updating • Legislative and regulatory changes • Barriers to learning
5. Interpret information about latest advancements and emerging technologies	• Manufacturer's literature • Online resources • Trade journals and magazines • Trade shows • Conferences

6. Identify information to share with colleagues and management	• Advantages of sharing information
	• Emerging technology
	  ○ Advantages
	  ○ Disadvantages

Achievement Criteria

Performance	The learner will be able to create a draft of a resume outlining their work history and education.
Conditions	The learner will be given • Instructions • Template • Resources
Criteria	The learner will be evaluated on • Completeness • Professionalism • Content

Line (GAC): E PLAN LIFT

Competency: E2 Perform pre-lift analysis

Objectives

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

- Analyse critical lift plans

LEARNING TASKS

1. Analyse critical lift plans

CONTENT

- Safety procedures
- Documentation
  - Lift procedure
  - Rigging diagram
- Hoisting personnel
- Lifts
  - Counterbalanced
  - Tandem/multi-crane
  - Non-routine
  - Near limit capacities
- Coordination
  - Pre-planning
  - Pre-lift meeting
  - Equipment conflicts
  - Changing weather conditions
- Centre of gravity
  - Components
  - Configurations

Line (GAC): F USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT

Competency: F1 Inspect rigging, hoisting, and positioning equipment

Objectives

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

- Inspect fibre rope, wire rope and slings
- Inspect hardware and equipment
- Inspect hoisting and positioning equipment

LEARNING TASKS	CONTENT

1. Inspect fibre rope, wire rope, and slings	• OHS Regulations
	• Manufacturers specifications
	• Standards
	  ○ ASME
	• Damage
	  ○ Deformations
	  ○ Cuts and abrasions
	  ○ Broken wires
	  ○ Corrosion
	  ○ Chemical
	  ○ UV
	• Wear indicators
	• Rigging tags
	  ○ Date
	  ○ Size
	  ○ Capacity
	  ○ Manufacturer
	  ○ Configuration
	• Inspection report
	• Action required

2. Inspect hardware and equipment	• OHS Regulations • Manufacturers specifications • Standards ○ ASME • Tags and placards • Shackles • Hooks • Snatch blocks • Master links • Wedge sockets • Eye bolts • Below-the-hook lifting devices

LEARNING TASKS	CONTENT

3. Inspect hoisting and positioning equipment	• Spreader bars
	• Types
	  ○ Cranes
	  ○ Manual cable puller (grip hoist)
	  ○ Tuggers
	  ○ Chain falls
	  ○ Come-alongs
	  ○ Jacks
	  ○ Gantries
	  ○ Blocks

Achievement Criteria

(Note: suggest combining with Achievement Criteria #1 and #2 in F3)

Performance	The learner will be able to perform a rigging inspection and complete a written inspection report.
Conditions	The learner will be given • Instructions • Sample rigging • Log sheet/book • Manufacturers specifications
Criteria	The learner will be evaluated on • Accuracy of inspection • Description of rejection criteria • Written communication • Completeness

Line (GAC): F USE RIGGING, HOISTING AND LIFTING EQUIPMENT

Competency: F2 Use ropes and slings

Objectives

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

- Use ropes, slings and hitches (fibre and wire) for rigging
- Select appropriate slings based on application

LEARNING TASKS	CONTENT
1. Use slings and hitches according to configurations and appropriate formulas	• Vertical/multiple leg • Baskets/D-to-d ratio (Diameter of object to diameter of sling) • Choker hitches/angle of choke • Bridle hitches/multiple leg bridles • Tension and safe working loads according to multiple configurations • Multiple leg bridle tensions • Eye configuration and efficiency • Inspection and storage
2. Select appropriate slings based on application	• Unequal leg lengths • Unsymmetrical loads • Dynamic loads

Achievement Criteria

Performance: The learner will be able to apply minimum size rigging required for a given task.

Conditions: The learner will be given:

- Materials
- Equipment
- Instructions
- Manufacturer's specifications

Criteria: The learner will be evaluated on:

- Configuration
- Mass
- Physical condition

Line (GAC): F USE RIGGING, HOISTING AND LIFTING EQUIPMENT (OLD)

Competency: F3 Use rigging and hoisting equipment

Objectives

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

- Describe rigging hardware
- Select and use hoisting and rigging equipment
- Calculate redirected and reeved systems
- Install a reeve system
- Install a redirected wire rope system

LEARNING TASKS	CONTENT

1. Describe rigging hardware	• Drums
	  ○ Drums/fleet angle
	  ○ Installation of rope on grooved and plain drums
	  ○ Transfer of line from spool to drum
	• Blocks
	  ○ Snatch blocks
	  ○ Multi-sheaved blocks
	  – Laced
	  – Reeved
	  ○ Traveling blocks/standing blocks
	  ○ Sheave size
	  ○ Bushing/bearing

2. Select and use hoisting and rigging equipment	• Calculation of weight
	• Length of material
	• Transfer of load
	• Selection of lifting location or point
	• Anchorage and hold back
	• Mechanical advantage
	• Lead line pull
	• Compound friction
	• Angle factors
	• Operating procedures
	• Inspection
	• Manufacturer's specifications
	  ○ Charts
	  ○ Tables

3. Calculate redirected and reeved systems	• Calculations
	  ○ Theoretical mechanical advantage
	  ○ Actual mechanical advantage
	  ○ Lead line pull
	  ○ Static line
	  ○ Holdbacks
	• Friction
	• Charts
	• Tables

4. Describe equipment based on transfer of load	• Safety
	• Transfer of loads
	  ○ Distance of transfer
	  ○ Calculation of size/weight
	  ○ Communication
	  ○ Securing of loads
	  ○ Dynamic loading of transfer point
	• Operating procedures
	• Inspection
	• Maintenance
	• Storage
	• Selection of lifting location or point
	• Drifting
	• Anchorage and holdbacks

Achievement Criteria #1

(Note: suggested as a group activity)

Performance	The learner will be able to design a plan and work with a group to install a reeve system for a given task.
Conditions	The learner will be given • Instructions • Block and tackle • Variety of available equipment
Criteria	The learner will be evaluated on • Calculations • Lead line pull • Actual mechanical advantage • Hold back force • Appropriate reeve up • Appropriate mechanical advantage • Load control • Selection of slings and attachments • Communication (written and verbal) • Teamwork

- Documentation
- Project report
- FLRA
- Equipment list
- Photographs

Achievement Criteria #2

(Note: suggested as a group activity and done at the same time as Achievement Criteria #1)

Performance	The learner will be able to design and install a redirected wire rope system
Conditions	The learner will be given: • Instructions • Task objective • Variety of available equipment
Criteria	The learner will be evaluated on • Calculations • Lead line pull • Actual mechanical advantage • Hold back force • Block position • Proper alignment of routing • Appropriate plan • Lead block location • Routing of cable • Selection of block design and capacity • Load control • Selection of slings and attachments • Headroom • Communication (written and verbal) • Teamwork • Documentation • Project report • FLRA • Equipment list • Photographs

Line (GAC): F USE RIGGING, HOISTING, AND LIFTING EQUIPMENT

Competency: F4 Use mechanical moving equipment

Objectives

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

- Describe types of mechanical moving equipment
- Describe uses for mechanical moving equipment
- Describe considerations when using mechanical moving equipment

LEARNING TASKS	CONTENT

1. Describe types of mechanical moving equipment	• Jacks
	  ○ Hydraulic
	  ○ Lever
	  ○ Screw
	  ○ Ratchet
	  ○ Pneumatic
	  ○ Pallet

2. Describe uses for mechanical moving equipment	• Lifting/pulling • Post tensioning • Positioning • Moving materials • Blocking and cribbing • Providing clearance • Compressing or spreading • Pin/object removal
3. Describe considerations when using mechanical moving equipment	• Procedures • Location/positioning of jacks • Holdback considerations • Size, type and number of jacks depending on load • Weight distribution • Rigging • Blocking/cribbing • Centre of gravity • Safety • Communication • Handling

Line (GAC): F USE RIGGING, HOISTING, AND LIFTING EQUIPMENT

Competency: F5 Perform post-lift activities

Objectives

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

- Conduct post-lift activities

LEARNING TASKS

1. Conduct post-lift activities

CONTENT

- Inspection
  - Damage
    - Reporting procedure
- Collection and filing of documentation
- Re-installing grating and railing
- Securing load
- Installing/removing bracing or temporary supports
- Verifying integrity of blocking and cribbing
- Removal of softeners
- Housekeeping
- Post-lift meeting
- Removal of barriers and signs
- General maintenance
  - Greasing
  - Cleaning
- Storage

Line (GAC): G PERFORM MOBILIZATION, ERECTION AND DEMOBILIZATION OF CRANES

Competency: G2 Participate in erecting lattice boom cranes, tower cranes, derricks and components

Objectives

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

- Describe conventional crane assembly/disassembly for crawler/mobile
- Describe tower crane assembly

LEARNING TASKS	CONTENT

1. Describe lattice boom crawler crane assembly and disassembly	• OHS Regulations
	• Manufacturers specifications
	• Transportation considerations
	• Components
	• Tools and equipment
	• Assembly area/disassembly area
	• Hazards
	• Assembly/disassembly sequence
	  ○ Blocking/cribbing location
	• Rigging procedures
	  ○ Selection of rigging material
	  ○ Connection locations
	• Jib installation and stowage
	• Signals/communication with crane operator
	• Reeve/lace blocks
	• Finalizing the set up
	• Inspection

2. Describe tower crane assembly	• OHS Regulations • Manufacturer's specifications • Personnel • Hazards • Tools and equipment • Assembly/disassembly sequence • Rigging procedures • Installation of components • Bolting and torquing procedures • Finalize the set up • Inspection • Procedures

Line (GAC): G PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES

Competency: G3 Participate in demobilization and disassembly of cranes

Objectives

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

- Describe demobilization and disassembly of lattice boom crawler cranes
- Describe demobilization and disassembly of tower cranes

LEARNING TASKS	CONTENT

1. Describe demobilization and disassembly of lattice boom crawler cranes	• OHS Regulations
	• Manufacturers' specification
	• Hazards
	• Tools and equipment
	• Sequence of disassembly
	• Rigging procedures
	• Components
	• Bolting and pinning procedures
	• Inspection
	• Communication
	• Transport
	  ○ Cribbing
	  ○ Lashing

2. Describe demobilization and disassembly of tower cranes	• OHS Regulations
	• Manufacturers' specification
	• Hazards
	• Tools and equipment
	• Sequence of disassembly
	• Rigging procedures
	• Components
	• Bolting and torquing procedures
	• Inspection
	• Communication
	• Transport
	  ○ Cribbing
	  ○ Lashing

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H1 Apply fundamentals of reinforcing concrete

Objectives

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

- Apply reinforcing codes and standards
- Calculate bend allowances
- Detail reinforcing materials

LEARNING TASKS	CONTENT

1. Apply reinforcing codes and standards	• Standards
	  ○ CSA
	  ○ CRSI
	  ○ RSIC
	  ○ Engineering
	  ○ Fabrication
	  – Bending tolerances
	  – Standard shapes
	  – Pin diameters
	  – Tail lengths
	• Clearance
	• Development length
	  ○ Embedment
	  ○ Projection
	  ○ Splices
	  – Types
	  – Classes

2. Calculate bend allowances	• Cut sheet
	• Overall length of bar
	  ○ Detailed dimensions
	  ○ Bend angles
	  ○ Tail length
	• Pin diameter
	• Tables
	• Charts

3. Detail reinforcing materials	• Standards • Structural drawings • Entering information on cut sheet

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H2 Cut and bend reinforcing materials

Objectives

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

- Cut and bend a complex shape with reinforcing materials

LEARNING TASKS	CONTENT

1. Cut and bend a complex shape with reinforcing materials	• Safety
	• Tools
	  ○ Tabletop bender
	  ○ Power shear
	  ○ Cut-off saw
	  ○ Layout and marking
	• Materials
	• Procedure

Achievement Criteria

Performance	The learner will be able to cut and bend a complex shape (stirrup or tie).
Conditions	The learner will be given • Instructions • Detail sheet • Tools • Materials
Criteria	The learner will be evaluated on • Safety • Accuracy • Overall bar length • Bend lengths • Bend angle • Efficiency

Line (GAC): H FABRICATE AND INSTALL REINFORCING MATERIALS

Competency: H3 Place, tie, splice, and pre-fabricate reinforcing materials

Objectives

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

- Install reinforcing material using drawings and standards

LEARNING TASKS	CONTENT

1. Install reinforcing material using drawings and standards	• Work location
	• List of materials
	• Placing order
	• Support requirements
	• Procedure
	  ○ Measure
	  ○ Mark
	  ○ Place
	  ○ Tie
	• Standards
	  ○ CSA
	  ○ RSIC
	  ○ CRSI
	  ○ Engineered

Achievement Criteria

Performance	The learner will be able to install reinforcing material using drawings and standards.
Conditions	The learner will be given • Instructions • Drawings • Documentation templates • Materials
Criteria	The learner will be evaluated on • Safety • Accuracy • Rebar spacing • Clearance (cover) • Quantity • Embedment • Splices • Support • Quality and type of ties • Quality control • Teamwork • Efficiency • Housekeeping • Documentation

Line (GAC): I APPLY PRE-STRESSING/POST-TENSIONING TECHNIQUES

Competency: I3 Place multi-strand and bonded post-tensioning systems

Objectives

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

- Describe multi-strand and bonded post-tensioning systems
- Describe placing ducts, anchors, and tendons
- Describe preparation of tendons for stressing
- Describe stressing tendons
- Describe cutting, capping, and grouting tendons

LEARNING TASKS	CONTENT

1. Describe multi-strand and bonded post-tensioning systems	• Purpose and advantages
	  ○ Creation of longer span without support
	  ○ Reduction of required material
	  ○ Increased number of floors and space per floor
	  ○ Lighter structures
	  ○ Protection
	  ○ Insulated from heat, abrasion, and vibration
	• Principles
	  ○ Effects of rebar and pre-stressed steel on structure
	  ○ Tolerances
	  – Specifications
	• Importance of material tracking
	• QA/QC
	• Structural applications
	  ○ Cable stay structures
	  ○ Segmental construction
	• Reinforced concrete applications
	• Tendon
	  ○ Grade
	  ○ Bar
	  ○ Cable
	• Anchorage systems
	  ○ Multi-strand
	  ○ Mono-strand
	  ○ Bell/plate
	  ○ Nut
	• Accessories

LEARNING TASKS	CONTENT
	○ Duct ○ Chairs/bolster ○ Caps ○ Trumpet ○ Trumplate ○ Grout vents ○ Grout tubes ○ Wedges ○ Wedge plate ○ Bearing plate
2. Describe placing ducts and anchors	• Safety • PPE • Rigging • Handling • Adequate support • Profile of duct • Sealing/attaching • Taping/heat sealing • Couplers and clamps • Attaching grout tubes • Securing the ducts • Confinement steel installation considerations • Location of anchorages ○ CGC ○ Spacing ○ As per placing drawing • Adequately securing anchors to bulkhead
3. Describe placing bonded tendons	• Safety • Handling and rigging techniques • Use of slings • Storage ○ Off ground ○ Tarped • Sequence of work • Installation methods ○ Power feeding – Push – Pull

LEARNING TASKS	CONTENT
	• Ensuring adequate projection on live ends • Cutting tendons to length • Quality assurance as per project specifications

4. Describe preparation of tendons for stressing	• Ensuring concrete strength
	• Inspection of
	  ○ Concrete deficiencies
	  ○ Anchorage
	  ○ Tendon
	• Separation of tendons
	• Cleaning tendon
	• Installing anchors and wedges
	• Debris removal
	• Marking tendon

5. Describe stressing tendons	• Safety
	  ○ Securing jack
	  ○ Body positioning
	• Equipment
	  ○ Preparation
	  ○ Inspection
	  ○ Cleaning
	  ○ Function verification
	• Calibrated equipment pairing
	• Identification of sequence
	  ○ Installation of jack
	  ○ Stressing to remove slack
	  ○ Mark for elongation
	  ○ Stressing to required pressure
	  ○ Checking elongation
	• Documentation
	• Approval of results

LEARNING TASKS	CONTENT

6. Describe cutting and capping tendons	• Cutting methods
	  ○ Torch
	  ○ Abrasive cut-off
	• Capping
	  ○ Grouting
	  ○ Caulking

7. Describe grouting tendons	• Safety ○ PPE • Storage and handling • Purpose • Composition/mixing • Equipment • Testing • Venting • Pumping • Capping • Grout types • Grout properties

8. Describe specifications and standards	• PTI
	  ○ Anchor spacing
	  ○ Double live ends
	  ○ Intermediate anchorage
	• Engineering
	  ○ Project specific
	  ○ Manufacturer specific
	• Tolerances
	  ○ Placing
	  ○ Elongation
	  ○ Gauge reading

Section 4

ASSESSMENT GUIDELINES

Assessment Guidelines – Level 1

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	IRONWORKER (REINFORCING) LEVEL 1		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	MAINTAIN SAFE AND HEALTHY WORKPLACE	10%	10%
B	USE AND MAINTAIN TOOLS AND EQUIPMENT	15%	15%
C	ORGANIZE WORK	12%	15%
D	USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES	0%	0%
E	PLAN LIFT	3%	0%
F	USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT	15%	20%
G	PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES	10%	10%
H	FABRICATE AND INSTALL REINFORCING MATERIALS	25%	30%
I	APPLY POST-TENSIONING TECHNIQUES	10%	0%
	Total	100%	100%
In-school theory/practical subject competency weighting		50%	50%
Final in-school percentage score		IN-SCHOOL %	

In-school Percentage Score Combined theory and practical subject competency multiplied by	80%
Standardized Level Exam Percentage Score The exam score is multiplied by	20%
Final Percentage Score	FINAL%

Assessment Guidelines – Level 2

Level 2 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	IRONWORKER (REINFORCING) LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	USE AND MAINTAIN TOOLS AND EQUIPMENT	15%	20%
C	ORGANIZE WORK	15%	20%
D	USE COMMUNICATION, MENTORING, AND CONTINOUS LEARNING TECHNIQUES	0%	5%
E	PLAN LIFT	2%	0%
F	USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT	20%	25%
G	PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES	10%	0%
H	FABRICATE AND INSTALL REINFORCING MATERIALS	25%	30%
I	APPLY POST-TENSIONING TECHNIQUES	13%	0%
	Total	100%	100%
In-school theory/practical subject competency weighting		60%	40%
Final in-school percentage score Apprentices must achieve a minimum 70% as the final in-school percentage score to be eligible to write the Interprovincial Red Seal exam.		IN-SCHOOL %	

All apprentices who complete Level 2 of the Ironworker (Reinforcing) program with a FINAL level mark of 70% or greater will write the Interprovincial Red Seal examination as their final assessment.

SkilledTradesBC will enter the apprentices Ironworker (Reinforcing) Interprovincial Red Seal examination mark in SkilledTradesBC Portal. A minimum mark of 70% on the examination is required for a pass.

Section 5

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 (digital or computerized) 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/internet (one computer per instructor; one computer per two students)
- Trade-related reference material for student and instructor use

Shop Area

- 10,000 square feet including:
  - Indoor area for workshop and storage
  - Outdoor area with cover storage
  - Outdoor area for crane and large equipment/material
  - Ceiling height sufficient to allow safe movement of material
  - Adequate lighting and lighting control
  - Ventilation as per WorkSafeBC standards
  - Refuse and recycling bins for used shop materials
- Access required for:
  - Tool crib large enough to contain all necessary supplies
  - Appropriate storage for gases and fuels/bottles
  - First-aid facilities, as per WorkSafeBC requirements

Lab Requirements

- N/A

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

Shop Equipment

Required (both levels)

- Compressor
- Eyewash
- Fire blankets
- First aid equipment
- Ladders
- Mobile and/or tower crane
- Pre-fab horses
- Rigging equipment
  - Wire rope slings
  - Fibre rope
  - Shackles
  - Chain bridles
  - Synthetic slings
  - Equalizers and spreaders
  - Snatch blocks
  - Wedge anchors
  - Grip hoist and cable
  - Come-a-longs
- Scaffold
- Tabletop hydraulic rebar bender
- Telehandler

Required (Level 1 only)

- Oxy/fuel cutting equipment
  - Cylinders
  - Hoses
  - Regulators
  - Strikers
  - Torches

Required (Level 2 only)

- Portable welder/generator

Recommended Consumable Materials

- In sufficient quantity to complete practical requirements of the outline:
  - 16 gauge annealed tie wire
  - Prestressing steel
  - Standard rebar diameters (10,15, 20, 25M)
  - Steel plate (1/2 in.)

Shop (Facility) Tools

Standard Tools (both levels)

- Gas powered cut off saw
- Grinder/zip cut
- Hacksaw
- Hammer drill and vacuum
- Portable band saw
- Portable hydraulic/electric bender
- Portable hydraulic/electric shear
- Power drill (cord and cordless)

Standard Tools (Level 2 only)

- Builders level/theodolite
- Laser level
- Port-a-power and attachments

Specialty Tools (both levels)

- Chair stapler (air/slide)
- De-tensioning equipment (nose piece, stool, etc.)
- Hand seating tools
- Hickey bars
- Post-tensioning strand jack, gauges, pump, hoses

Recommended (both levels)

- Plasma torch

Recommended (Level 1 only)

- Pocket shear

Student Equipment (supplied by school)

Required (both levels)

- 25 ft. (6 m) combination metric and imperial tape measure
- Chalk lines
- Chipping hammer
- Dust masks
- Eye protection
- Face shields
- Flame resistant burning/welding jackets
- Hearing protection
- Lanyards
- Leather work gloves
- Lifelines (horizontal, static, vertical, etc.)
- Needle nose pliers
- Personal fall protection/work positioning gear
- Retractable lanyards
- Spirit levels (torpedo, two foot, etc.)
- Welding and burning shields/glasses
- Wire brush
- Wrenches/screwdrivers

Required (Level 1 only)

- Tip cleaner

Required (Level 2 only)

- Tin snips

Student Tools (supplied by student)

Required (both levels)

- CSA approved hard toed boots
- CSA approved hardhat
- Hi-visibility vest/shirt
- Pocket knife
- Puncture/flame resistant clothing
- Toolbelt
  - Bolt bag
  - Pliers and diagonal cutters with scabbard
  - Tie wire reel
  - Keel marker
  - Tape measure

Recommended (both levels)

- Fall protection harness (Class AP)
- Positioning chain

Reference Materials

Required Reference Materials

- IPT's crane and rigging handbook (IPT)
- CRSI placing reinforcing bars manual
- RSIC manual of standard practice

Recommended Resources

- Concrete reinforcing Level 1 (BCIT)
- WorkSafeBC: https://www.worksafebc.com/en
- SkillPlan: https://skillplan.ca/
- BC Open Collection: https://collection.bccampus.ca/subjects/trades/ (trades common core textbooks)

Suggested Texts

- PTI Level 1 Unbonded PT Field Installation
- PTI Post-tensioning manual
- CSAO rigging manual
- CSAO crane manual
- BC Welder Training Program: Foundations and Apprenticeship Levels 1 and 2: P2: Oxy-Fuel Gas Cutting (OFC): Theory Competencies (Line B) (2017)

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:

- Ironworker (Reinforcing) – Certificate of Qualification from BC, preferably with an Interprovincial Red Seal endorsement, *or*
- Ironworker (Reinforcing) – Certificate of Qualification from another Canadian jurisdiction with an Interprovincial Red Seal endorsement, *or*
- Ironworker (Generalist) (or Ironworker) – Certificate of Qualification from BC, preferably with an Interprovincial Red Seal endorsement, *or*
- Ironworker (Generalist) – Certificate of Qualification from another Canadian jurisdiction with an Interprovincial Red Seal endorsement

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 of the following:

- Instructors Diploma or equivalent
- Bachelor's Degree in Education

Appendices

Appendix A
Acronyms and Abbreviations

AC	alternating current
ACI	American Concrete Institution
ANSI	American National Standards Institute
ASME	American Society of Mechanical Engineers
ASTM	American Society for Testing and Materials
AWS	American Welding Society
BIM	building information modeling
CAD	computer aided design
CCOG	combined centre of gravity
CGC	centre of gravity of concrete
CGS	centre of gravity of steel
CISC	Canadian Institute of Steel Construction
COG	centre of gravity
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DEP	dedicated evacuation platform
DTI	direct tension indicator
EDM	electronic distance measuring
EOT	electronic overhead travelling
EWO	extra work order
FLRA	field level risk assessment
FRP	fibre reinforced polymer
GFRP	glass fibre reinforced polymer
ICE	internal combustion engine
IEP	individual education plan
IFA	issued for approval
IFC	issued for construction
IFF	issued for fabrication
ISO	International Organization for Standardization
JHA	job hazard analysis
LEED	Leadership in Energy and Environmental Design
LPG	liquefied petroleum gas
MEP	mechanical, electrical, plumbing
MEWP	mobile elevating work platform
MIG	metal inert gas welding
MSI	musculoskeletal injury
OHS	Occupational Health and Safety
P.A.S.S.	pull, aim, squeeze, sweep
PC	personal computer
PDF	portable document format
PPE	personal protective equipment

PTI	Post Tensioning Institute
QA/QC	quality assurance/quality control
RFI	request for information
RSIC	Reinforcing Steel Institute of Canada
RT	rough terrain
SDS	safety data sheets
SMAW	shielded metal arc welding
SOP	safe operating procedures
SWP	safe work procedures
TDG	Transportation of Dangerous Goods
UV	ultra-violet
WHMIS	Workplace Hazardous Material Information Systems
WLL	working load limit

Appendix B
Glossary

Note: this glossary is sourced from the 2025 Red Seal Occupational Standard (RSOS) as a reference.

drawings	a visual representation of a design, including sketches and illustrations (e.g., blueprints, sketches, structural, structural erection, architectural, engineered, detail, erection, precast shop, shop, fabrication, reinforcing placing, post-tensioning placing, weld procedures)
dunnage	wooden boards and timbers used to hold material in place when being transported or stored
falsework	temporary steel or wooden supports upon which structural components are erected or pre-assembled
hoisting	raising, lowering and moving a rigged and suspended load.
placing accessories	items used in conjunction with reinforcing steel such as bar chairs, slab bolsters, post tensioning specific (bullets and fingerforks, pocket formers), etc.
positioning	moving rigged loads into position (other than vertical, which is considered hoisting)
precast	concrete product that is fabricated and cast in a location different than its intended permanent location (normally offsite in a pre-cast yard)
steel cladding	corrugated sheet metal used in the building envelope.
thermal cutting equipment	equipment using either electric arc or catalyzed combustion of pressurized gasses to cut or gouge materials

Appendix C
Summary of Achievement Criteria

Achievement Criteria are included for competencies that require a practical assessment. 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 measurable and that they reflect the skills spelled out in the competency. 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 evaluation criteria.

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.

The tables on the following pages summarize the practical assessments for each level. **For details, please refer to the Achievement Criteria following the competency in the Program Content section.**

IRONWORKER (REINFORCING) – LEVEL 1 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
A2 Use personal protective equipment (PPE) and safety equipment	The learner will be able to use fall protection systems in compliance with safety regulations.
B2 Use power tools	The learner will be able to cut rebar using a variety of tools.
B3 Use access equipment	The learner will be able to demonstrate proper use of access equipment.
B6 Use welding and thermal cutting equipment	The learner will be able to • Set up a torch from start to finish • Cut a bar to required length • Break down the torch for storage
C3 Use drawings and documentation	The learner will be able to • Determine reinforcing requirements in a given area from a structural drawing • Detail a simple component • Complete detail sheet
C5 Use mathematics	The learner will be able to calculate the weight of a bundle of reinforcing steel in metric and imperial.
F2 Use ropes and slings	The learner will be able to use knots in a practical application. ***(Note: suggested to combine with Achievement Criteria in F3)***
F3 Use rigging and hoisting equipment	1. The learner will be able to calculate mass, choose appropriate size rigging and hardware, position rigging on the load, and ensure the crane is at an appropriate radius.
	2. The learner will be able to • Pick and place a load with a crane using appropriate communication • Demonstrate control of a suspended load with a crane using appropriate communication
G1 Identify and mobilize cranes	The learner will be able to set up a mobile crane.
H1 Apply fundamentals of reinforcing concrete	On a diagram of a typical concrete structure, the learner will be able to • Identify location of stress loads • Identify location of required reinforcing
H2 Cut and bend reinforcing materials	The learner will be able to cut and bend simple shapes using various tools
H3 Place, tie, splice, and pre-fabricate reinforcing materials	The learner will be able to install reinforcing steel according to placing drawing and verbal instructions.

IRONWORKER (REINFORCING)– LEVEL 2 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
B5 Use measurement, layout, and surveying tools and equipment	1. The learner will be able to verify accuracy of equipment (peg test).
	2. The learner will be able to • Verify accuracy of instrument • Reference a known benchmark to establish various elevations • Transfer an elevation in a total circuit requiring multiple set ups ***(Note: Suggested to combine with Achievement Criteria #1 and perform in sequence)***
	3. The learner will be able to • Set up a rotating laser level • Verify level of existing surface
B6 Use welding and thermal cutting tools	The learner will set up a portable welder and perform a lap weld on reinforcing steel.
C3 Use drawings and documentation	1. The learner will be able to • Determine reinforcing requirements in a given area from a structural drawing using codes and standards • Detail multiple interconnected components • Complete detail sheet
	2. The learner will be able to analyse a post-tensioning drawing and interpret specifications as required.
C4 Plan tasks	The learner will be able to estimate cost and coordinate the details for a small project.
D3 Maintain continuous learning	The learner will be able to create a draft of a resume outlining their work history and education.
F1 Inspect rigging, hoisting, and positioning equipment	The learner will be able to perform a rigging inspection and complete a written inspection report. ***(Note: suggest combining with Achievement Criteria #1 and #2 in F3)***
F2 Use ropes and slings	The learner will be able to apply minimum size rigging required for a given task.
F3 Use rigging and hoisting equipment	1. The learner will be able to design a plan and work with a group to install a reeve system for a given task. ***(Note: suggested as a group activity)***
	2. The learner will be able to design and install a redirected wire rope system ***(Note: suggested as a group activity and done at the same time as Achievement Criteria #1)***
H2 Cut and bend reinforcing materials	The learner will be able to cut and bend a complex shape (stirrup or tie)
H3 Place, tie, splice, and pre-fabricate reinforcing materials	The learner will be able to install reinforcing material using drawings and standards.