SKILLEDTRADES BC

PROGRAM OUTLINE

Ironworker (Generalist)

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SKILLED TRADES BC

IRONWORKER (GENERALIST)

PROGRAM OUTLINE

BASED ON RSOS 2025

Developed by
SkilledTradesBC
Province of British Columbia

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Section 1

INTRODUCTION

Ironworker (Generalist)

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

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- Tyrone Longstride — Ironworkers Local 97
- Mike McKoryk — BCIT

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Previous Contributors

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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

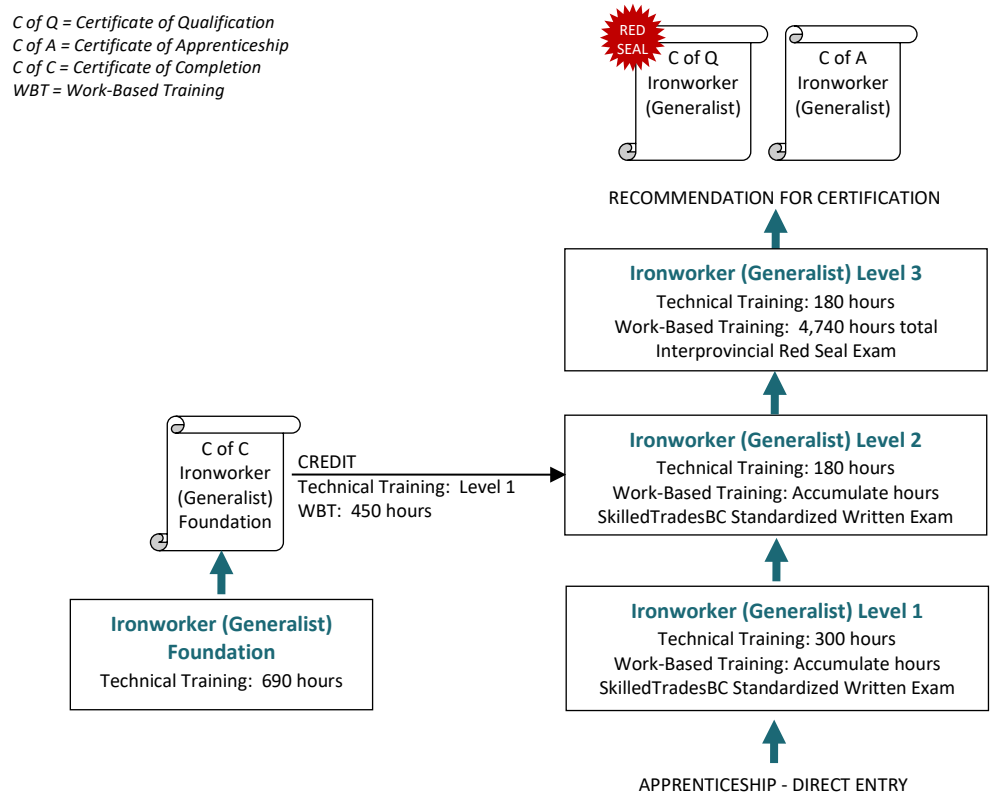
PROGRAM OVERVIEW

Ironworker (Generalist)

Program Credentialing Model

Apprenticeship Pathway

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



CROSS-PROGRAM CREDITS

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 (GENERALIST)

Occupation Description: Ironworker (Generalists) construct, install, maintain, and repair industrial, commercial, institutional, infrastructural, and residential structures made of steel, concrete, mass timber, and other materials. The Ironworker (Generalist) trade includes many aspects of building construction, such as structural, reinforcing, architectural/ornamental, mechanical, and specialized heavy lifting.

Ironworker (Generalists) are employed to work in a variety of projects, including on buildings, towers, bridges, stadiums, pre-engineered construction, wind turbines, solar panels, dams, and ornamental ironwork such as curtain walls, metal stairways, catwalks, railings, and metal doors. They erect scaffolding, cranes, hoists, and derricks on the construction site. They install conveyors, machinery, and automated material handling systems. They are involved in demolition and salvage duties involving all types of construction.

Ironworker (Generalists) prepare the construction site by assembling hoisting equipment. They unload reinforcing materials, structural and ornamental components, and organize the material for installation and hoisting. They inspect, select, and install rigging to components and direct crane operations. They position, align, and secure components using a variety of equipment and methods according to drawings and job specifications.

Ironworker (Generalists) join materials using a variety of methods, including bolting, pinning, welding, and tying. They place reinforcing material in a variety of reinforced products and structures, and perform post-tensioning operations.

Ironworker (Generalists) primarily work outdoors as a team and may be required to perform strenuous physical activities, often at heights and in remote locations. Due to their involvement in many aspects of building construction, experienced Ironworker (Generalists) may advance to supervisory and management positions.

Competency	Task	Code					
MAINTAIN SAFE AND HEALTHY WORKPLACE (A)	Maintain safe work environment	A1	1				
	Use personal protective equipment (PPE) and safety equipment	A2	1				
	Participate in healthy and respectful work environment	A3	1				
USE AND MAINTAIN TOOLS AND EQUIPMENT (B)	Use hand tools	B1	1				
	Use power tools	B2	1	2			
	Use access equipment	B3	1				
	Use material handling equipment	B4	1				
	Use measurement, layout, and surveying tools and equipment	B5	1	2	3		
	Use welding and thermal cutting equipment	B6	1	2	3		
ORGANIZE WORK (C)	Organize materials and supplies	C1	1				
	Perform layout	C2	1		3		
	Use drawings and documentation	C3	1	2	3		
	Plan tasks	C4			3		
	Use mathematics	C5	1	2	3		

USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES D	Use communication techniques D1 1	Use mentoring techniques D2 3	Maintain continuous learning D3 3		
PLAN LIFT E	Assess load E1 1	Perform pre-lift analysis E2 1, 3	Select rigging, hoisting, and positioning equipment E3 1	Secure lift area E4 1	
USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT F	Inspect rigging, hoisting, and positioning equipment F1 1, 2, 3	Use ropes and slings F2 1, 2, 3	Use rigging and hoisting equipment F3 1, 2, 3	Use mechanical moving equipment F4 3	Perform post-lift activities F5 1, 3
PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES G	Identify and mobilize cranes G1 1	Erect lattice boom cranes, tower cranes, derricks and components G2 2, 3	Perform demobilization and disassembly of cranes G3 3		
FABRICATE AND INSTALL REINFORCING MATERIALS H	Apply fundamentals of reinforcing concrete H1 1, 3	Cut and bend reinforcing materials H2 1, 2	Place, tie, splice, and pre-fabricate reinforcing materials H3 1, 2		
APPLY POST-TENSIONING TECHNIQUES I	Describe fundamentals of pre-stressed systems I1 1	Place unbonded post-tensioning systems I2 1	Place multi-strand and bonded post-tensioning systems I3 3		

INSTALL STRUCTURAL MEMBERS **J**	Apply fundamentals of erecting structural components J1	Erect structural members J2	Level, plumb, align, and complete installation of structural members J3	Use falsework J4	
	1	1 2 3	1 3	2	
INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS **K**	Install building envelope, curtain walls, precast walls, and window walls K1	Install miscellaneous components K2	Install steel cladding systems and components K3		
	3	2	3		
INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS **L**	Install mechanical systems L1	Install, align, and commission material handling systems L2	Perform maintenance and disassembly of mechanical systems L3		
	3	3	3		
MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS **M**	Make repairs and revisions M1	Dismantle and remove structural components M2			
	2	2 3			

Training Topics and Suggested Time Allocation – Level 1

IRONWORKER (GENERALIST) – LEVEL 1

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line A	**MAINTAIN SAFE AND HEALTHY WORKPLACE**	**6%**	**75%**	**25%**	**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**	**20%**	**25%**	**75%**	**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**	**10%**	**60%**	**40%**	**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**	**2%**	**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**	**12%**	**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**	**4%**	**70%**	**30%**	**100%**
G1	Identify and mobilize cranes		✓	✓	

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line H	**FABRICATE AND INSTALL REINFORCING MATERIALS**	**17%**	**40%**	**60%**	**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**	**6%**	**100%**	**0%**	**100%**
I1	Describe fundamentals of pre-stressed systems		✓		
I2	Place unbonded post-tensioning systems		✓		
Line J	**INSTALL STRUCTURAL MEMBERS**	**22%**	**30%**	**70%**	**100%**
J1	Apply fundamentals of erecting structural components		✓		
J2	Erect structural members		✓	✓	
J3	Level, plumb, align, and complete installation of structural members		✓	✓	
	Total Percentage for Ironworker (Generalist) Level 1	**100%**			

Training Topics and Suggested Time Allocation – Level 2

IRONWORKER (GENERALIST) – LEVEL 2

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**USE AND MAINTAIN TOOLS AND EQUIPMENT**	**18%**	**30%**	**70%**	**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**	**12%**	**50%**	**50%**	**100%**
C3	Use drawings and documentation		✓	✓	
C5	Use mathematics		✓		
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		✓	✓	
Line G	**PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES**	**5%**	**100%**	**0%**	**100%**
G2	Erect lattice boom cranes, tower cranes, derricks and components		✓		
Line H	**FABRICATE AND INSTALL REINFORCING MATERIALS**	**20%**	**40%**	**60%**	**100%**
H2	Cut and bend reinforcing materials		✓	✓	
H3	Place, tie, splice, and pre-fabricate reinforcing materials		✓	✓	
Line J	**INSTALL STRUCTURAL MEMBERS**	**3%**	**100%**	**0%**	**100%**
J2	Erect structural members		✓		
J4	Use falsework		✓		
Line K	**INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS**	**17%**	**40%**	**60%**	**100%**
K2	Install miscellaneous components		✓	✓	
Line M	**MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS**	**8%**	**50%**	**50%**	**100%**
M1	Make repairs and revisions		✓	✓	
M2	Dismantle and remove structural components		✓		
	Total Percentage for Ironworker (Generalist) Level 2	**100%**			

Training Topics and Suggested Time Allocation – Level 3

IRONWORKER (GENERALIST) – LEVEL 3

			% of Time Allocated to:		
		% of Time	Theory	Practical	Total
Line B	**USE AND MAINTAIN TOOLS AND EQUIPMENT**	**18%**	**25%**	**75%**	**100%**
B5	Use measurement, layout, and surveying tools and equipment		✓	✓	
B6	Use welding and thermal cutting equipment		✓	✓	
Line C	**ORGANIZE WORK**	**10%**	**70%**	**30%**	**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%**	**50%**	**50%**	**100%**
D2	Use mentoring techniques		✓		
D3	Maintain continuous learning		✓	✓	
Line E	**PLAN LIFT**	**3%**	**100%**	**0%**	**100%**
E2	Perform pre-lift analysis		✓		
Line F	**USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT**	**13%**	**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**	**5%**	**100%**	**0%**	**100%**
G2	Erect lattice boom cranes, tower cranes, derricks and components		✓		
G3	Perform demobilization and disassembly of cranes		✓		
Line H	**FABRICATE AND INSTALL REINFORCING MATERIALS**	**13%**	**50%**	**50%**	**100%**
H1	Apply fundamentals of reinforcing concrete		✓	✓	
Line I	**APPLY POST-TENSIONING TECHNIQUES**	**7%**	**100%**	**0%**	**100%**
I3	Place multi-strand and bonded post-tensioning systems		✓		
Line J	**INSTALL STRUCTURAL MEMBERS**	**15%**	**40%**	**60%**	**100%**
J2	Erect structural members		✓	✓	
J3	Level, plumb, align, and complete installation of structural members		✓	✓	

		% of Time	% of Time Allocated to: Theory	Practical	Total
Line K	**INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS**	**7%**	**100%**	**0%**	**100%**
K1	Install building envelope, curtain walls, precast walls, and window walls		✓		
K3	Install steel cladding systems and components		✓		
Line L	**INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS**	**3%**	**100%**	**0%**	**100%**
L1	Install mechanical systems		✓		
L2	Install, align, and commission material handling systems		✓		
L3	Perform maintenance and disassembly of mechanical systems		✓		
Line M	**MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS**	**3%**	**25%**	**75%**	**100%**
M2	Dismantle and remove structural components		✓	✓	
	Total Percentage for Ironworker (Generalist) Level 3	**100%**			

Section 3

PROGRAM CONTENT

Ironworker (Generalist)

Level 1

Ironworker (Generalist)

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 how worksite safety policies are established
- 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
- Ultra-violet (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 operating procedures (SOP) • Safe work procedures (SWP) • 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
	• 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
	  ○ Access/egress

LEARNING TASKS	CONTENT
	○ 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 – Access to 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

LEARNING TASKS	CONTENT
8. Describe information disclosed on an SDS	• Hazardous ingredients • Preparation information • Product information • Physical data • Fire or explosion • Reactivity data • Toxicological properties • Preventive measures • First-aid measures

9. Identify symbols found on WHMIS labels and their meaning	• Compressed gases
	• Materials
	  ○ Flammable and combustible
	  ○ Oxidizing
	  ○ Corrosive
	  ○ Dangerously reactive
	  ○ Poisonous and infectious
	  – Immediate and serious toxic effects
	  – Other toxic effects
	  – Biohazardous

10. 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
	• Hazards
	  ○ Impalement
	  ○ Falls from elevation
	  ○ Falls between levels
	  ○ Openings
	• Fall protection equipment
	  ○ Harnesses

LEARNING TASKS	CONTENT
	– 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 • Inspection and maintenance • Worksite awareness
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 ○ User

LEARNING TASKS	CONTENT
	○ Equipment • Daily inspection • Assembly/disassembly • Fall protection plan ○ Identify work area and risks ○ List and choose equipment ○ 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 and 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 general hand tools

CONTENT

- Tape measure
- Marking device
- Striker
- Snipe
- Pry bar
- Pliers
- Hammers
- Bolt bag
- Sockets
- Knife
- Epoxy gun
- Caulking gun
- Wedges and dogs
- Wrenches
  - Adjustable
  - Pipe
  - Saw
  - Torque
  - Slug
- Tiger torch
- Backer-outer
- Hack saw
- Bolt cutter
- Post-tensioning tools
  - Screwdriver
  - Wedge-seating tool
  - Sheath cutter
  - Pocket former remover
  - Hex keys (Allen® wrenches)
  - Staple gun (pneumatic and manual)
- Mechanical advantage tools

LEARNING TASKS	CONTENT
	○ Grip hoist/come-along ○ Port-a-power ○ Jacks – Lever – Ratchet – Port-a-power – Hydraulic – Screw – Pneumatic ○ Hydraulic ram
2. Describe and select structural hand tools	• Tool belt ○ Adjustable wrench ○ Sleever bar ○ Bull pin ○ Spud wrench/frogs • Alignment and leverage tools ○ Drift pin ○ Barrel pin ○ Threaded rod (Dywidag®) • Clamping tools ○ C-clamps ○ Locking pliers ○ F-clamps • Die nut/chaser nut
3. Describe and select reinforcing tools	• Hickey bar • Tool belt ○ Holster/scabbard ○ Diagonal cutter (snips) ○ Pliers – End-cutting (nips) – Side-cutting (Ironworker) • Number 7 • Number 9 ○ Tie wire reel ○ Keel marker
4. Use hand tools	• Drop proofing ○ Tool lanyard • Purpose

LEARNING TASKS	CONTENT
	• Uses • Procedures • Safety • Adjustment • Inspection • Maintenance • Storage • Job requirements • Manufacturer's specifications

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 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
	• Powder actuated
	• Fuel powered
	  ○ Gas
	  ○ Mixed gas
	  ○ Diesel
	  ○ Propane

2. Select power tools	• Chisels
	• Saws
	  ○ Cut-off
	  ○ Gas cut-off
	  ○ Portable band
	• Drills
	  ○ Hammer
	  ○ Hand
	  ○ Magnetic drill press
	  ○ Reamer
	  ○ Screw gun
	• Compressor
	• Generator
	• Grinder
	  ○ Angle
	  ○ Die/pencil
	  ○ Attachments
	• Tension control gun (shear wrench)

LEARNING TASKS	CONTENT

	• Impact wrench
	• Torque gun (calibrated wrench)
	• Turn of nut gun
	• Hydraulic torque wrench
	• Rivet buster
	• Shears
	  ○ Pocket
	  ○ Rebar
	  ○ Plate
	• 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 bending tools and equipment	• Manufacturers' specifications
	• Types
	  ○ Hickey bars
	  ○ Electric handheld benders
	  ○ Hand-held hydraulic bender
	  ○ Tabletop bender
	  – Hydraulic
	  – Manual
	• Operating principles

LEARNING TASKS	CONTENT

	• Uses
	• Limitations
	• Hazards
	  ○ Flying debris
	  ○ Pinch/crush points
	  ○ Cuts
	  ○ Punctures
	  ○ Overexertion
	  ○ Struck by tools
	  ○ Electrocution
	  ○ Hydraulic pressures
	• Bending chart (table of dimensions)

5. Describe powder-actuated tools	• OHS regulations
	• Company policies and procedures
	• Manufacturers' specifications
	• Certifications
	• Types
	• Components
	  ○ Piston
	  ○ Pin
	  ○ Trigger
	  ○ Magazine
	• Applications
	• Characteristics
	• Operating principles
	• Hazards
	  ○ Blow-through
	  ○ Ricochet
	  ○ Noise
	  ○ Flying debris
	  ○ Pinch and crush points
	  ○ Punctures
	  ○ Overexertion
	  ○ Working at heights

6. Select and use powder-actuated tools	• OHS regulations • Company policies and procedures • Certification • Manufacturers' specifications ○ Cleaning

LEARNING TASKS	CONTENT
	○ Lubricating ○ Storage ○ Securing • Types • Components ○ Piston ○ Pin ○ Trigger ○ Magazine • Applications • Characteristics • Operating principles • Maintenance • Inspection ○ Identifying deficiencies ○ Removal from service • Testing • Disposal of charges
7. Describe mechanical cutting equipment	• Manufacturers' specifications • Types ○ Electric cut-off saws ○ Portable band saws ○ Gas and battery powered quick-cut saws ○ Angle grinders (zip cuts) ○ Reciprocating saws ○ Power shears ○ Nibblers ○ Low-speed high-torque circular saws ○ Magnetic drills ○ Core drills ○ Pipe cutters • Components ○ Blades ○ Guards ○ Handles ○ Cords ○ Lubrication systems ○ Core bits ○ Annular cutters ○ Twist drills ○ Reamers

LEARNING TASKS	CONTENT
	○ Taps and dies • Characteristics • Applications • Operating principles • Hazards ○ Burns ○ Entanglement ○ Sparks ○ Combustibles ○ Toxic fumes ○ Respiratory particulates ○ Airborne irritants • Inspection ○ Identifying deficiencies ○ Removing from service • Maintenance • Storing • Securing
8. Select and use mechanical cutting equipment	• Manufacturers' specifications • Types • Components • Characteristics • Applications • Operating principles • Hazards • Inspection • Maintenance • Storing • Securing
9. Describe connecting and anchoring tools and equipment and their uses in concrete	• Types ○ Structural connectors and fasteners ○ Architectural connectors and fasteners • Purpose and procedures for use • Preparation for use • Safety considerations ○ PPE – Ear protection – Eye protection – Mouth and nose

LEARNING TASKS	CONTENT
	• Limitations • Inspection • Maintenance • Storage • Selection for job requirements • Equipment used with connectors and fasteners ○ Application

10. Describe concrete anchors	• Area
	• Selection
	  ○ Anchor
	  ○ Drill and bit
	• Self-driller
	• Pre-drilled
	  ○ Epoxy
	  ○ Wedge
	  ○ Grout

11. Describe procedures for drilling concrete	• Preparation
	  ○ Cleaning
	  ○ Wire brushing
	  ○ Layout hole centres
	• Drills
	  ○ Pneumatic
	  ○ Hand star
	  ○ Percussion
	  ○ Core
	  ○ Drill and carbide bit
	• Concrete and block wall drilling
	  ○ Rebar contact
	  ○ Spalling
	  ○ Concrete edge distance
	  ○ Depth of hole
	  ○ Starting the hole
	• Cleaning
	  ○ Wire brushing/pump

12. Use a hammer drill to drill vertically or horizontally into concrete	• Safety
	  ○ Silica dust
	  ○ PPE
	  ○ Vibration
	• Tool orientation
	• Rebar contact

Achievement Criteria

(Note: suggested to combine with Achievement Criteria #1, #2, and #3 in B6)

Performance	The learner will be able to use power tools to construct an assembly from a given structural steel shop drawing.
Conditions	The learner will be given • Shop drawing • Materials • Tools and equipment

Criteria	The learner will be evaluated on
	• Safety
	• Accuracy
	  ○ Component dimensions
	  ○ Overall dimensions
	  ○ Hole locations
	  ○ Squareness and quality of cut
	• Completeness of Assembly

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
- Use a MEWP to perform elevated work

LEARNING TASKS

1. Describe ladders, scaffolds, and elevated platforms

CONTENT

- Safety
  - Hazard recognition
  - OHS
- Ladders
  - Extension
  - Step
  - Rolling
  - Fixed
  - Platform
- Scaffolds
- 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
- Swing stages and spiders
- Angel wings
- Bridge brackets
- Floats

2. Use ladders and elevated platforms

- Selection
- Set up
- Moving ladders
- Limitations
- Securing
- Inspection
- Maintenance
- Storage

3. Describe access equipment certification

- Aerial work platform certification
- Fall protection certification

4. Select access equipment

- Aerial lifts
  - Boom supported
  - Crane supported
  - Power vertical (scissor)

Achievement Criteria

(Note: suggested to combine with Achievement Criteria in J2)

Performance	The learner will be able to use a MEWP to perform elevated work.
Conditions	The learner will be given • Instructions • MEWP
Criteria	The learner will be evaluated on • Safety • Inspection • Use • Access and egress • Documentation

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
	  ○ Panel or glass lifting equipment
	  ○ Rolling hydraulic gantry systems
	  ○ Pallet jacks
	  ○ Carry deck crane
	  ○ 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 • Types

LEARNING TASKS	CONTENT
	• Components • Hazards • According to task requirements

3. Use material handling equipment	• 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
	  ○ Tri square
	  ○ Two-foot square
	  ○ Bevel square
	  ○ Beam square/beam board
	  ○ Combination square
	• Levels
	  ○ Laser
	  ○ Builder's level/auto level
	  ○ Smart levels
	  ○ Spirit levels
	• 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	• According to use

		• Limitations • Environmental conditions
3.	Use measurement and layout tools	• Purpose • Squares • Levels • Instruments • Uses • Procedures • Set-up • Secure use and storage • Adjustment • Verifying accuracy • Manufacturer's specifications
4.	Inspect and maintain measurement and layout tools	• Inspection • Maintenance

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

Performance	The learner will be able to use a builder's level to verify consistent elevation at several locations.
Conditions	The learner will be given • Instructions • Builder's level • Partner • Benchmark • Tripod • Tape measure or Philadelphia rod • Elevation locations
Criteria	The learner will be evaluated on • Safety • Set up • Accuracy of findings • Care and handling of a builder's level

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
- Describe SMAW and FCAW welding
- Perform welding

LEARNING TASKS	CONTENT

1. Describe methods of thermal cutting and heat treatment	• Oxy fuel torch
	  ○ Purpose/uses
	  ○ Limitations
	  ○ Fuel types
	• Equipment
	  ○ Torch head
	  ○ Rose bud
	  ○ Tiger torch
	  ○ Combination torch
	  ○ Induction collars
	  ○ Standard hand torch
	  ○ Lance
	  ○ Striker
	  ○ Tip cleaner
	  ○ Cylinders
	  ○ Cylinder storage and transportation
	  ○ Regulators
	  ○ Reverse flow check valve/flashback arresters
	  ○ Hoses
	  ○ Fittings
	  ○ Repair kit
	• Materials to be cut
	  ○ Steel
	  ○ Non-ferrous
	  ○ Sheet
	  ○ Structural shapes
	• Purpose
	  ○ Pre-heat
	  ○ Post-heat
	  ○ Inter-pass heat
	  ○ Fabrication
	  ○ Demolition
	• Plasma
	  ○ Purpose

LEARNING TASKS	CONTENT
	○ Uses ○ Limitations ○ Equipment • Carbon arc ○ Purpose ○ Uses ○ Limitations ○ Equipment ○ Materials to be cut ○ Consumables
2. Use thermal cutting tools	• Safety • Manufacturer's specifications • Consumables • Basic procedures • Set-up • Adjustment • Take down • Inspection • Maintenance • Storage • Materials to be cut ○ Ferrous ○ Non-ferrous
3. Describe shielded metal arc welding (SMAW) and flux core arc welding (FCAW)	• CWB regulations/procedures • Purpose/uses • Equipment • Defects ○ Undercut ○ Convexity ○ Concavity ○ Porosity ○ Slag inclusions
4. Perform welding	• Safety • Manufacturer's specifications • SMAW • Consumables • Materials to be welded • Stud welding • Basic procedures/operations

LEARNING TASKS	CONTENT
	○ Set-up ○ Adjustment ○ Take down ○ Inspection ○ Maintenance ○ Storage

Achievement Criteria #1

(Note: suggested to combine with Achievement Criteria in B2)

Performance	The learner will be able to set up a welding machine for SMAW and perform single pass fillet and multi-pass fillet weld.
Conditions	The learner will be given • Instructions • Tools • Equipment • Materials
Criteria	The learner will be evaluated on • Safety • Machine set up • Weld size and profile • Weld free of discontinuities

Achievement Criteria #2

(Note: suggested to combine with Achievement Criteria in B2)

Performance	The learner will be able to set up a welding machine for FCAW and perform single pass fillet and multi-pass fillet weld.
Conditions	The learner will be given • Instructions • Tools • Equipment • Materials
Criteria	The learner will be evaluated on • Safety • Machine set up • Weld size and profile • Weld free of discontinuities

Achievement Criteria #3

(Note: suggested to combine with Achievement Criteria in B2)

Performance	The learner will be able to • Perform set up and break down of oxy fuel equipment. • Cut structural shapes and steel plate to prescribed size. • Pierce a hole to dimensions.
Conditions	The learner will be given • Instructions • Tools • Equipment • Materials

Criteria	The learner will be evaluated on
	• Safety
	• Set-up procedure
	• Accuracy
	  ○ Material cut to dimensions
	  ○ Hole cut to size
	  ○ 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
	• Timing
	• Method of transportation
	• Off-loading
	• Leadership in Energy and Environmental Design (LEED)
	• Labelling and SDS
	• Moving
	• Product protection
	• Identification of materials
	• Environmental
	  ○ Disposal
	  ○ Recycling
	• Bill of lading/shipping list
	• Material certifications

2. Organize and handle materials according to job requirements	• Safety • Securing • Packaging/shipping • Pallets • Barrels • Cages • Containers • Storage
3. Organize laydown area	• Accessibility • Shakeout • Marking/labelling

- Organizing
  - Division
  - Structural member
  - Erection sequence
  - Placing sequence
  - Pour sequence
  - Bundles
  - Element
- Unloading
- Transferring
- Bolt shed

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
	• Interpreting drawings
	  ○ Spacings
	  – Marking bar
	  – Joist
	  ○ Perimeter angle
	  ○ Fastener patterns
	  ○ Anchor locations

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

3. Perform layout techniques	• Tools
	• Procedure
	• Application of drawing information
	  ○ Spacings
	  ○ Marking bar
	  ○ Joist
	  ○ Perimeter angle
	  ○ Fastener patterns
	  ○ Anchor locations

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 • Steel erection • Fabrication/details • Concrete reinforcing • Placing/detail sheet • Post tensioning • Civil • Mechanical • Procedural • Rigging • Shop drawings
2. Interpret drawings	• Relevant codes and standards • General notes • Lines • Blueprint symbols • Welding symbols • Legends • Title block • Abbreviations • Material list/bill of materials • Direction marks and placement marks • Centres and work points • Scale • Pitch and gauge • Revisions • Grid lines

LEARNING TASKS	CONTENT
	• Details • Structural short designations • Reference dimension point (running dimensions) • Elevations • Edge distance • Hole size
3. Identify views on drawings	• Orthographic projections • Pictorial • Isometric • Oblique • Plan • Elevation • Sections • Detail

4. Describe digital drawings	• Accessing digital drawings
	• 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)
	  ○ Concrete Reinforcing Steel Institute (CRSI)
	  ○ Reinforcing Steel Institute of Canada (RSIC)
	  ○ Canadian Institute of Steel Construction (CISC)

LEARNING TASKS	CONTENT
	○ International Organization for Standardization (ISO) • OHS Regulations • FLRA • Sign-in sheet • Employment forms • Apprentice report • Shipping list (bill of lading) • Manufacturers' specifications • Critical lift sign-off • Schedule • Hot work permit • Piece count list • Tonnage report • Fall protection plan • Emergency response plan • Pre-use inspections ○ Equipment log • Safety meeting • Toolbox • JHA • Work reports • Work orders • Incident reports • Permits

Achievement Criteria

Performance	The learner will be able to locate information from a shop drawing and create a material list.
Conditions	The learner will be given • Blueprints • Instruction sheet • Blank material list
Criteria	The individual will be evaluated on a rating sheet that reflects the following criteria: • Accuracy of findings • Completeness

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	• Add, subtract, multiply and divide • Express in higher terms • Simplify fractions
2. Use decimal fractions to solve problems	• Add, subtract, multiply and divide • Convert 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	• Convert between metric and imperial
	  ○ Feet, inches/metres, millimetres
	  ○ Pounds, tons/kilograms, tonnes
	• Use conversion tables

5. Solve geometric problems	• Area
	• Perimeter
	• Volume
	• Angles
	• Radius and diameter
	• Formulas for area of:
	  ○ Square and rectangles
	  ○ Triangles
	  ○ Parallelogram
	  ○ Trapezoid
	  ○ Circle

6.	Solve problems of triangles	• Pythagorean theorem • Sine • Cosine • Tangent
7.	Describe impact of mathematical calculations	• Safety • Profit and cost calculations • Material wastage • Estimating • Project delays

Achievement Criteria #1

Performance: The learner will be able to calculate the weight of a structural steel member in metric and imperial using short designation and volumetric methods.

Conditions: The learner will be given

- Instructions
- Tape measure
- Steel designations table
- Calculator
- Structural steel

Criteria: The learner will be evaluated on

- Completeness
- Accuracy of:
  - Dimensions
  - Conversion
  - Weight
  - Records

Achievement Criteria #2

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:
  - Dimensions
  - Conversion
  - Weight
  - Records

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

1. Describe effective, inclusive, and respectful communication

CONTENT

- 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

LEARNING TASKS	CONTENT

2. Demonstrate the role of the apprentice	• Apprenticeship responsibilities
	  ○ Preparedness
	  ○ Setting goals
	  ○ Self-advocacy
	  ○ Developing capabilities
	  ○ Constructive feedback
	• Building apprenticeship skills and attributes
	  ○ Active listening
	  ○ Compassion

3. Describe the role of the mentor	• Mentorship responsibilities
	  ○ Preparedness
	  ○ Setting apprentice up for success
	  – Setting measurable goals
	  – Tracking progress
	  ○ Developing capabilities
	  ○ Maintaining 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, and violence
	  ○ Gender microaggressions
	  ○ Racial microaggressions
	  ○ Unconscious bias
	  ○ Allyship
	• Behaviour and conduct
	  ○ Rights and responsibilities
	  – Employee
	  – Employer
	• Equity
	  ○ 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 and material integrity
	  ○ Product residue
	  ○ Debris
	  ○ Build-up of foreign matter
	  ○ Corrosion
	  ○ Material damage
	  ○ Temporary bracing and fasteners

3. Calculate total weight of load	• Tools and equipment • Reference materials • Tags and marks • Formulas • Measuring load • Structural short designation • Unit rate

4. Verify total weight of load	• Reference materials
	  ○ Fabrication drawings
	  ○ Bill of lading

LEARNING TASKS	CONTENT
	○ Material take off ○ Detail sheet • Load cell ○ External • Crane
5. Determine centre of gravity (COG) of load	• Visual inspection of weight distribution • Formulas • Establish centre mark • 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	• According to task • 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

LEARNING TASKS	CONTENT
	○ Lead line pull • 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	• Determination of 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 ○ Weight of load ○ 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

LEARNING TASKS	CONTENT

7. Support members (connecting)	• According to drawings and engineering specifications
	• Methods
	  ○ Lashing
	  ○ Welding
	  ○ Fastening
	  ○ Shoring
	  ○ Bolting
	  ○ Guy line cables

8. Determine communication methods	• Visual
	  ○ Hand signals
	  ○ Line of sight
	• Audio
	  ○ Two-way radios
	  ○ Voice
	• Site-specific requirements

9. Identify personnel needed to perform rigging tasks	• Site-specific requirements
	• Jurisdictional regulations
	• Personnel
	  ○ Supervisor
	  ○ Operators
	  ○ Signaler
	  ○ Riggers
	  ○ Tag line persons

10. 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
	○ Air castors ○ Trailers – Self-propelled motor transport (SPMT) – Barges ○ Multi-rollers ○ Blocks • Considerations ○ Weight being hoisted ○ Radius and distance to be lifted ○ Parts of line used ○ 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 with personnel
	  ○ Leading edges
	  ○ Electrocution
	  ○ Overhead obstructions
	  ○ Environmental

2. Describe procedure to establish a safety perimeter	• Clearing non-essential personnel
	• Control zone
	• Mitigation of hazards
	• Signage
	  ○ Barricades
	  ○ Barrier tape
	  ○ Tags and signs

3. Describe procedure to secure lift area	• Regulations
	• Barriers
	  ○ Installation
	  ○ Tagging
	• Ground conditions assessment
	• Work area
	  ○ Congestion
	  ○ Emergency access
	• Limiting approach
	• Permits
	• Non-essential personnel

LEARNING TASKS	CONTENT
	• 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
	• Factors affecting capacity
	  ○ Tension efficiencies and reductions
	  ○ D-to-d ratio (Diameter of object to diameter of sling)
	• Safety considerations
	  ○ Inspection
	• Best practices

LEARNING TASKS	CONTENT

2. Describe fibres used in rigging manufacturing	• Construction and lays
	  ○ Round
	  ○ Web
	  ○ Kernmantle
	  ○ Twisted
	  ○ Braided
	• Materials
	  ○ Polyester
	  ○ Polyethylene
	  ○ Polypropylene
	  ○ Nylon
	  ○ Kevlar
	  ○ Manila
	• Uses and limitations
	• Methods and types of splicing
	• Properties of fibre ropes
	• 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 and limitations
	• Methods and types of splicing
	  ○ Efficiencies
	• Inspection
	• Storage
	• Handling
	• Maintenance
	• Safety considerations

LEARNING TASKS	CONTENT

	• 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 • Working load limits

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
	• Working load limits calculations
	• Terms
	• Reductions in capacity
	• Inspection

LEARNING TASKS	CONTENT
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 • Tag lines • Knot selection • Lifting • Lowering • According to job specifications

Achievement Criteria #1

Performance: The learner will be able to use wire rope slings to hoist a load.

Conditions: The learner will be given

- Instructions
- Tagged load and shop drawing
- Equipment
- Tag line
- Wire rope slings
- Shackles
- Hoisting equipment

Criteria: The learner will be evaluated on

- Safety
- Inspection
- Communicating weight of load
- Accuracy of rigging selection
- Attachment of rigging to load (hitch method)
- Balance (centre of gravity)
- Load control using tag line
- Hoisting
- Landing

Achievement Criteria #2

Performance	The learner will be able to use a synthetic sling to hoist a load.

Conditions	The learner will be given
	• Instructions
	• Tagged load and shop drawing
	• Equipment
	  ○ Tag line
	  ○ Synthetic slings
	  ○ Shackles
	  ○ Hoisting equipment

Criteria	The learner will be evaluated on
	• Safety
	• Inspection
	• Communicating weight of load
	• Accuracy of rigging selection
	• Attachment of rigging to load (hitch method)
	• Balance (centre of gravity)
	• Load control using tag line
	  ○ Hoisting
	  ○ Landing

Achievement Criteria #3

(Note: suggested to combine with Achievement Criteria in J2)

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
	• Equipment types
	  ○ Hoisting
	  ○ Rigging
	  ○ Rolling
	• Uses
	• Limitations and capacities
	• Safety

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

LEARNING TASKS	CONTENT
	○ Shouldered ○ Swivel • Plate clamps • Beam clamps • 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

LEARNING TASKS	CONTENT
	○ Friction ○ Lead line pull • Centre of gravity • Selection ○ Equipment ○ Lifting location or point • Anchorage • Operating procedures ○ Communication and hand signals ○ Securing of loads ○ 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

Performance	The learner will be able to 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 signals • Quality of communication

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-installation of grating and railing • Securing of load • Installation of bracing and temporary support • Verification of 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)
	• Straddle carrier
	• Derrick
	• Lifting truss/girder
	• Gin pole
	• Helicopter
	• Self-erecting
	• Launching girder
	• Highline

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

LEARNING TASKS	CONTENT
	○ Sweep ○ Counterweight • 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 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

LEARNING TASKS	CONTENT
	– Whip line – Load block/headache ball – Wedge socket/becket ○ 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 ○ Soil 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
- Describe where the forces on concrete are manifested in structures
- Describe the fundamentals 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 forces on concrete
	  ○ Dynamic loads (live loads)
	  ○ Static loads (dead loads)
	• Specific forces on concrete
	  ○ Compression
	  ○ Tension
	  ○ Shear

3. Describe where the forces on concrete are manifested in structures	• Subgrade
	  ○ Piles
	  ○ Pile caps
	  ○ Caissons
	• On grade
	  ○ Beams
	  ○ Slabs
	  ○ Footings
	  ○ Abutment
	  ○ Pile caps
	• Suspended
	  ○ Beams
	  ○ Slabs
	  ○ Cantilevers
	  ○ Headers

LEARNING TASKS	CONTENT

	• Columns
	• Walls
	• Seismic resisting elements
	  ○ Zones
	  ○ Shear walls
	  ○ Headers
	  ○ Collector bars

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

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
	• Characteristics
	  ○ Bend angles
	• Operating principles
	• Hazards
	• Procedure

Achievement Criteria

Performance	The learner will be able to cut and bend a simple shape (dowel or U-bar)
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:

- 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 ○ Tying back ○ Installing balance of steel
3. Splice reinforcing material	• Types of rebar splices ○ Lap – Length requirements – Contact – Non-contact ○ Mechanical ○ Welded
4. Secure reinforcing material	• Types of wire ○ Materials ○ Gauges ○ Coatings • Types of ties • Purposes/selection of ties • Tying ○ Specifications ○ Percentages ○ Sequence • Tools and equipment • Muffler clamps • Welding
5. Pre-fabricate reinforcing material	• Safety ○ MSI • Drawings • Temporary supports (horses) • Procedure • Access • Orientation • Loading and unloading • Rigging ○ Lifting points – Establishment – Integrity

LEARNING TASKS

CONTENT

- 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 • Materials
Criteria	The learner will be evaluated on • Safety • Rebar • Spacing • Quantity • Tying • Quality and type of ties • Teamwork • Efficiency • Housekeeping

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 and application of pre-stressed systems
- Describe pre-stressed systems and accessories
- Describe pre-stressing equipment
- Describe installation of anchorages
- Describe organization and protection of tendons and accessories
- Describe pre-stressed members

LEARNING TASKS	CONTENT

1. Describe purpose and application of pre-stressed systems	• Purpose and advantages
	• Principles
	  ○ Effects of rebar and cable on structure
	• Material tracking (traceability)
	• Quality assurance
	• Applications
	  ○ Floor systems
	  ○ Girders
	  ○ Columns
	  ○ Bridges
	  ○ Temporary structures
	  ○ Cable supported structures
	  ○ 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

LEARNING TASKS	CONTENT

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
	• Accessories
	  ○ Anchors
	  ○ Wedges
	  ○ Nuts/plates
	  ○ Bursting bars
	  ○ Bullets

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

LEARNING TASKS	CONTENT

5. Describe installation of anchorages	• Layout
	  ○ Tolerances
	• Attachments
	• Anchorages
	  ○ Single strand
	  ○ Multi strand
	• Types of anchor zone reinforcement
	  ○ Bursting steel
	  ○ Spiral/coil
	  ○ Grillage

6. 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
	• Fault identification and 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 the stressing of tendons
- Describe the cutting, capping, and grouting of tendons

LEARNING TASKS	CONTENT

1. Describe unbonded post-tensioning systems	• Purpose
	• Advantages
	• Principles
	  ○ Effects of rebar and cable on structure
	• Importance of
	  ○ Material tracking
	  ○ Quality assurance
	• 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	• Sequence of work
	  ○ Placing order
	  ○ Considerations
	  – Layout
	  – Measuring
	  – Marking

LEARNING TASKS	CONTENT
	○ Anchor and pocket formers considerations ○ Bursting steel installation considerations ○ Installation of tendons – Manual rolling out – Power feeding ○ Securing dead ends ○ Supporting tendons – Securing tendons to supports – Spacing considerations • Ensuring adequate projection on live ends • Quality assurance as per project specifications
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 of sheathing • Installation of wedges • Cleaning of tendon • Debris removal • Elongation marking
4. Describe stressing tendons	• Safety ○ Tie off jack ○ Setup of control zone • Equipment ○ Preparation ○ Inspection ○ Cleaning ○ Function verification

LEARNING TASKS	CONTENT
	• Calibrated equipment pairing • Identification of sequence • Installation of jack • Stressing to required pressure • Checking of elongation • Documentation • 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

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

7. Describe reasons and procedures for de-stressing	• Blowout in concrete
	• Procedures
	  ○ Potential hazards
	  ○ Work zone access
	  ○ Engineered shoring
	• Follow engineering procedures
	• Requirements
	  ○ Regulations
	  ○ Certifications
	  – PTI

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J1 Apply fundamentals of erecting structural components

Objectives

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

- Identify structural components, members, and functions
- Describe the principles of skeletal construction
- Describe common building materials
- Describe general forces/stresses on structural components
- Describe methods of controlling forces on structures

LEARNING TASKS	CONTENT

1. Identify structural components, members, and functions	• Universal structural members
	  ○ Columns
	  ○ Girders
	  ○ Beams
	  ○ Joists
	  ○ Trusses
	  ○ Girts
	  ○ Purlins
	  ○ Diaphragms
	  ○ Rafter
	  ○ Bracing
	  ○ Drag strut
	• Steel structural members and components
	  ○ Open web steel joist (OWSJ)
	  ○ Frames
	  ○ Tub girder
	  ○ Box beam girder
	  ○ Components
	  – Gussets
	  – Stiffeners
	  – End plates
	  – Sag rod
	• Pre-cast concrete members
	  ○ Hollow core
	  ○ Tilt up
	  ○ Box beam
	  ○ Girder
	• Mass timber members and components
	  ○ Shear wall

LEARNING TASKS	CONTENT
	○ Suspended slab ○ Braces ○ Diaphragms ○ Beams ○ Columns ○ Components – Dowels – Engineered Connectors
2. Describe building materials used in erecting structural components	• Structural steel • Precast concrete • Mass timber ○ Glue-laminated timber (GLT) ○ Cross-laminated timber (CLT) ○ Dowel-laminated timber (DLT) ○ Nail-laminated timber (NLT) • Aluminum • Teflon/plastics ○ Bearing pads • Composites ○ FRP ○ GFRP • Coatings • Material hazards • Handling considerations for architecturally finished structural materials ○ Procedures ○ Specialized rigging ○ Hand protection ○ Cross-contamination ○ Staining ○ Touch ups ○ Deficiencies
3. Describe general forces and stresses on structural components	• Moment • Cantilever • Uplift • Dynamic forces ○ Cyclic loading ○ Seismic

LEARNING TASKS	CONTENT
	○ Resonance ○ Vibration ○ Torque ○ Environmental – Temperature – Precipitation – Wind • Static forces ○ Gravity ○ Weight • Stresses ○ Compression ○ Tension ○ Shear ○ Torsion
4. Describe methods of controlling forces on structures	• Connection design ○ Moment ○ Shear ○ Direct tension ○ Slip critical ○ Direct bearing • Bracing • Shear wall • Shear studs • Diaphragms • Stiffeners • Drag struts • Gussets • Dampeners/isolators
5. Describe principles of structural erection	• Physical properties • Advantages and disadvantages ○ Efficiencies ○ Safety • Material standards • Construction methods ○ Skeletal ○ Modular ○ Pre-fabricated

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J2 Erect structural members

Objectives

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

- Attach structural members
- Install structural members
- Finalize the installation of structural members

LEARNING TASKS	CONTENT

1. Describe standard structural steel shapes	• Channel (C)
	• Wide flange (W)
	• Welded wide flange (WWF)
	• Standard beam (S)
	• Angle (L)
	• Hollow structural section (HSS)
	• Bar
	  ○ Round (RB)
	  ○ Flat (FB)
	  ○ Square (SB)
	• Plate (PL)
	• Pipe
	• Tubing
	• Structural Z
	• Structural T

2. Describe fastening of structural steel members	• Steel to steel
	• Steel to concrete
	• Steel to timber
	• Standards
	  ○ ASTM - structural
	  ○ ISO – screws
	  ○ CSA
	  ○ CWB
	• Types of connections
	  ○ Bearing
	  ○ Shear
	  ○ Friction
	  ○ Slip critical
	  ○ Direct tension (hanger)

LEARNING TASKS	CONTENT
	○ Moment ○ Advantages and disadvantages • Fastening methods ○ Bolts ○ Pins ○ Welded ○ Combination ○ Expanding anchors ○ Chemical anchors ○ Dywidag®/PT strand ○ Powder actuated ○ Screws ○ Button punch/crimper ○ Shear stud ○ Stud rail ○ Rivets ○ Advantages and disadvantages
3. Describe fastening of structural mass timber members	• Timber to timber • Timber to steel • Timber to concrete • Standards ○ ASTM - structural ○ ISO – screws ○ CSA ○ CWB • Types of connections ○ Bearing ○ Shear ○ Direct tension (hanger) ○ Moment • Fastening methods ○ Bolts – Nuts – Washers ○ Pins ○ Welded ○ Proprietary engineered ○ Chemical anchors ○ Screws ○ Nails

LEARNING TASKS	CONTENT
	○ Dowels ○ Spline ○ Lag bolt ○ Glue
4. Describe fastening of structural pre-cast members	• Concrete to concrete • Concrete to steel • Standards ○ ASTM – Structural ○ CSA ○ CWB • Types of connections ○ Bearing – Grout ○ Shear ○ Moment – Cast-in-place diaphragm ○ Advantages and disadvantages • Fastening methods ○ Structural embeds ○ Welded ○ Expanding anchors ○ Chemical anchors ○ Dywidag®/PT strand ○ Powder actuated ○ Screws ○ Shear stud ○ Stud rail ○ Shear links • Advantages and disadvantages
5. Erect structural members	• Erection plan • Site specific fall protection plan • Organization of ○ Material ○ Tools ○ Equipment – Telehandler – MEWP – Crane

LEARNING TASKS	CONTENT

	• Handling considerations
	• Communication
	• Working at elevations
	• Unloading
	• Shake out
	  ○ Access to members
	  ○ Mark centres
	  ○ Piece identification
	• Sequence of erection
	  ○ Verify elevations and grid lines
	  ○ Establishing shim heights
	  ○ Setting
	  – Columns or bents
	  – Temporary bracing (as required)
	  – Primary framing
	  – Intermediate beams or joists
	  – Bracing
	  – Purlins and girts
	  – Miscellaneous/supports
	• Securing members during erection
	  ○ Temporary fastening requirements
	  ○ Erection aids
	  ○ Shared/double connections
	  ○ Fastener location
	  ○ Best practices
	• Fit and modification of members
	• Fastener selection and installation

6. Describe the procedure to pre-assemble and install modular structural components	• Safety
	• Advantages and disadvantages
	• Material handling
	• Access
	• Procedures
	  ○ According to plan
	  ○ Rigging
	• Site conditions
	• Installation
	• Erection

LEARNING TASKS	CONTENT
7. Describe finished building	• Building envelope • Ornamental and miscellaneous components • Architectural finishes • Cladding • Relationship to other systems ○ Mechanical, electrical, plumbing (MEP)

Achievement Criteria

(Note: suggested as a group activity. Criteria also evaluates content in Competency J3)

Performance: The learner will be able to erect structural steel.

Conditions: The learner will be given

- Instructions
- Material
- Equipment

Criteria: The learner will be evaluated on

- Adherence to safety
- Accuracy of assembly
- Rigging practices
- Communication
- Signaling
- Radio
- Verbal
- Listening
- Crane work procedures
- Teamwork
- Leadership
- Ability to work at elevations
- Interpretation of site plan and erection drawings
- Housekeeping

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J3 Level, plumb, align, and complete installation of structural members

Objectives

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

- Level, plumb, and align structural members
- Finalize installation of structural members

LEARNING TASKS	CONTENT

1. Level, plumb, and align structural members	• Tools
	• Equipment
	• Techniques
	• Allowances
	• Tolerances
	• Temporary
	  ○ Alignment
	  ○ Bracing
	• Surveying equipment

2. Finalize installation of structural members	• Pre installation verification
	• Quality controls
	• Inspection
	• Welding
	• Revisions and modifications
	• Torque sequence
	• Bolt sequence
	• Equipment
	• Procedures
	  ○ Tolerance specifications
	  ○ Welding specifications
	  ○ Torque methods
	  ○ Bolt verification
	  ○ Inspection

Level 2

Ironworker (Generalist)

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 a 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

Achievement Criteria

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

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 welding processes
- Perform SMAW
- Perform oxy fuel cutting
- Perform carbon arc gouging
- Perform carbon arc cutting
- Identify welding joints and positions
- Describe weld testing and defects

LEARNING TASKS	CONTENT

1. Describe welding processes	• Standards
	  ○ CWB
	  ○ CSA
	  ○ American Welding Society (AWS)
	• Flux core arc welding (FCAW)
	• Tungsten inert gas welding (TIG)
	• Metal inert gas welding (MIG)
	• Submerged arc welding (SAW)
	• Shielded metal arc welding (SMAW)
	• Stud welding (SW)

2. Perform SMAW	• Materials • Consumables • Procedures • Set up • Adjustment • Maintenance • Inspection • Trouble shooting • Storage and handling

LEARNING TASKS	CONTENT
3. Perform plasma cutting	• Safety • Equipment • Set up • Adjustment • Maintenance • Inspection • Trouble shooting • Storage and handling
4. Perform gouging	• Equipment • Materials • Consumables • Procedure • Set up • Adjustment • Maintenance • Inspection • Storage and handling

5. Identify welding joints and positions	• Joints
	  ○ Tee
	  ○ Lap
	  ○ Butt
	  ○ Corner
	  ○ Edge
	• Positions
	  ○ Flat
	  ○ Horizontal
	  ○ Vertical (up)
	  ○ Overhead
	• Groove
	• Fillet
	• Puddle
	• Symbols

6. Identify weld defects	• Cracking • Porosity • Undercut

LEARNING TASKS	CONTENT
	• Fusion • Inclusions • Overlap • Lack of fusion
7. Recognize conditions that could cause weld defects	• Pre-heat • Post-heat • Proper penetration of joints

Achievement Criteria #1

(Note: suggested to combine with Achievement Criteria in K2)

Performance	The learner will be able to weld with SMAW in context (Stairs – K2)
Conditions	The learner will be given • Instructions • Material • Grinder • Welder
Criteria	The learner will be evaluated on • Weld size • Defects • Finish

Achievement Criteria #2

Performance	The learner will be able to set up and use a carbon arc gouge to fillet weld.
Conditions	The learner will be given • Instructions • Prepared plate • Welder • Electrodes • Gouging equipment and grinder
Criteria	The learner will be evaluated on • Setup • Removal of parts • Finish

Achievement Criteria #3

Performance	The learner will be able to set up and use a plasma cutter to cut steel with a minimum thickness of 3/8" (10mm).
Conditions	The learner will be given • Instructions • Prepared plate • Welder • Electrodes • Gouging equipment and grinder
Criteria	The learner will be evaluated on • Setup • Quality of cut • Dimensional accuracy

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 structural requirements based on erection drawings
- Interpret welding symbols
- Identify reinforcing requirements based on reinforcing steel drawings
- Identify drawing quality control and revision processes

LEARNING TASKS	CONTENT
1. Interpret structural requirements based on erection drawings	• Bolt list/schedule • Weld symbols • Piece orientation/location/direction • Piece number • Elevations • Connection types • Structural designations • Material types • Material finish
2. Interpret welding symbols	• Orientation • Weld specification • Preparation • Field weld
3. Identify reinforcing requirements based on reinforcing steel drawings	• Quantity • Location • Spacing • Size • Shape/type • Placing order • Clearances • Splice lengths • Projection • Embedment
4. 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) reports
        - Punch list
        - Deficiency list
    - Request for information (RFI)
- Revisions
- Revision tracking
- Change orders
- Change directives
- Extra work order (EWO)

Achievement Criteria #1

Performance	The learner will be able to determine reinforcing requirements from a drawing and determine quantity, size, spacing and placing order.
Conditions	The learner will be given • Instructions • Drawing
Criteria	The learner will be evaluated on • Size • Quantity • Location • Placing order

Achievement Criteria #2

Performance	The learner will be able to determine structural requirements from an erection drawing and determine quantity, piece count, location and sequence for erection.
Conditions	The learner will be given • Instructions • Drawing
Criteria	The learner will be evaluated on • Piece numbers • Piece count • Location • Elevation • Orientation • Sequence • Bolt list

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
	  ○ Area
	  ○ Weight

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

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 • Spreader bars

Achievement Criteria ***(Suggest combining with F3 Achievement Criteria #1 and #2)***

Performance	The learner will be able to perform a rigging inspection and create 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 • 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

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

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:

- Select and use hoisting and rigging equipment

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

Achievement Criteria #1

Performance	The learner will be able to perform a multi-part fibre rope reeve-up to hoist a load.
Conditions	The learner will be given • Instructions • Two multi-sheave blocks • Load • Fibre rope
Criteria	The learner will be evaluated on • Safety • Routing of rope • Anchoring of rope • Controlled suspension of load • Functionality of system • Documentation

Achievement Criteria #2

Performance	The learner will be able to set-up a redirect system to hoist a load using a grip hoist.
Conditions	The learner will be given • Instructions • Grip hoist complete with wire rope • Snatch blocks • Holdback rigging
Criteria	The learner will be evaluated on • Safety • Routing of rope • Anchoring of hold backs • Calculation of: • Lead line pull • Holdbacks • Load weight • Functionality of system • Documentation

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

Competency: G2 Erect 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

LEARNING TASKS	CONTENT

1. Describe lattice boom crawler assembly and disassembly	• OHS Regulations
	• Manufacturers specifications
	• Transportation considerations
	• Components
	• Required tools and equipment
	• Assembly area/disassembly area
	• Hazards
	• Sequence of assembly/disassembly
	  ○ 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

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 • Materials
Criteria	The learner will be evaluated on • Safety • Accuracy • Rebar spacing • Placing sequence • Clearance (cover) • Quantity • Embedment • Splices • Support spacing and types • Quality and type of ties • Quality control and deficiency list • Teamwork • Efficiency • Housekeeping

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J2 Erect structural members

Objectives

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

- Describe metal decking installation and its function

LEARNING TASKS

1. Describe metal decking installation and its function

CONTENT

- Diaphragm
- Material support
- Types
- Gauges, profiles and finishes
- Fastening methods
- Installation procedures
- Hoisting
- Handling
- Fall arrest procedures
- Quality assurance

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J4 Use falsework

Objectives

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

- Describe falsework components, characteristics, and applications

LEARNING TASKS	CONTENT

1. Describe falsework components, characteristics, and applications	• Types
	  ○ Temporary support steel
	  ○ Shipping steel
	  ○ Spreader bar
	• Characteristics
	• Drawings
	• Specifications
	• Applications
	• Components
	  ○ Seat clips
	  ○ Shore posts
	  ○ Foundations
	  ○ Modular shoring frames
	  ○ Staging
	  ○ Cribbing
	  ○ Blocking
	  ○ Horizontal shoring
	  ○ Jacks
	  ○ Temporary bracing
	  ○ Guy lines

2. Describe falsework erection and dismantling procedures	• OHS regulations
	• Standards
	• Erection
	  ○ Tools and equipment
	  ○ Hazards
	  ○ Layout procedures
	  ○ Construction procedures
	• Inspection
	• Dismantling
	  ○ Hazards
	  ○ Removal procedures
	  ○ Storage

Line (GAC): K INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS

Competency: K2 Install miscellaneous components

Objectives

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

- Describe installation techniques for ornamental and miscellaneous components
- Apply installation techniques for miscellaneous components and systems

LEARNING TASKS	CONTENT

1. Describe installation techniques for ornamental and miscellaneous components	• OHS Regulations
	• Standards
	• Types
	  ○ Railings
	  ○ Exposed stairs
	  ○ Catwalks and gangways
	  ○ Landings
	  ○ Canopies
	  ○ Trellis
	  ○ Gazebo
	  ○ Doors, gates, and fences
	• Materials
	  ○ Steel
	  – Expanded metals
	  – Bar grating
	  – Checkered plate
	  ○ Stainless steel
	  ○ Aluminum
	  ○ Concrete
	  ○ Mass timber
	• Parts
	• Installation procedures
	  ○ Measurement
	  ○ Roughing in
	• Rigging considerations
	• Fastening methods
	• Modifications
	• Field fabrication
	• Degree of finishing
	• Protection of surrounding materials

2. Apply installation techniques for miscellaneous components and systems	• According to job specifications

Achievement Criteria

Performance	The learner will be able to plan and field build stairs and a railing.
Conditions	The learner will be given • Instructions • Materials • Tools • Drawing
Criteria	The learner will be evaluated on • Safety • Teamwork • Template • Calculations • Meets deadline • Accuracy of layout • Accuracy of fit-up • Degree of finish • Integrity of welds

Line (GAC): M MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS

Competency: M1 Make repairs and revisions

Objectives

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

- Describe the revision process
- Identify current condition of components
- Field-fabricate components

LEARNING TASKS	CONTENT

1. Describe the revision process	• Identify problem
	  ○ Fabrication errors
	  ○ Material properties
	  ○ Handling damage
	  ○ Design change
	  ○ Site condition errors
	  ○ Tolerances
	• Approval process
	  ○ Field engineer
	  ○ Designer
	  ○ Supervisor
	  ○ Engineer on record (EOR)
	• RFI
	• Change order
	• Change directive
	• Back charge
	• Policies and procedures
	• Revised drawings
	• Documentation
	• Temporary supports
	  ○ Columns
	  ○ Falsework
	  ○ Hangars
	  ○ Rigging
	• Access and egress
	• Labour requirements
	• Timeline

LEARNING TASKS	CONTENT
2. Field-fabricate components	• Standards • Specifications • Tools and equipment • Fabrication tolerances • Material requirements • Documentation • Quality assurance

Line (GAC): M MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS

Competency: M2 Dismantle and remove structural components

Objectives

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

- Describe decommissioning process
- Describe component disassembly and removal process

LEARNING TASKS	CONTENT

1. Describe the decommissioning process	• Regulations
	• Standards
	• Tools and equipment
	• Causes
	  ○ Wear and tear
	  ○ Corrosion
	  ○ Structural damage
	  ○ Impact
	  ○ Natural disaster
	  ○ Scheduled
	  ○ Change of ownership
	• Engineered take-down
	• Demolition
	• Decommissioning sequence
	• Policies and procedures
	• Hazards and controls
	  ○ Lock out/tagout
	  ○ Materials
	  ○ Exposure
	  ○ Specialized PPE
	  ○ Abatement
	• Hot work
	• Sequence
	  ○ Structure
	  ○ Components
	• Marking
	• Documentation
	• Records

2. Describe component disassembly and removal process	• Temporary support techniques
	• Disassembly sequence
	• Disassembly technique
	• Storage and placement
	• Additional rigging considerations
	  ○ Weight
	  ○ Potential energy
	• Disposal
	• Recycling

Level 3

Ironworker (Generalist)

Line (GAC): B USE 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 offset lines to layout around an existing object

LEARNING TASKS	CONTENT

1. Use offset lines	• Drawing
	• Gridlines
	• Work point (datum)
	• Obstructions
	• Theodolite
	  ○ Parts and components
	  ○ Setting up instrument over a given point
	  ○ Checking the instrument for accuracy
	  ○ Selection of best position for set up based on task
	  ○ Procedures for determining object elevation based on vertical triangulation
	  ○ Care/storage and handling

2. Use layout equipment to verify the accuracy of the layout provided	• Laser level • Line laser • Remaining within clearance tolerances • Proper setup and placement of level

Achievement Criteria

Performance — The learner will be able to:

- Layout offset lines using a theodolite
- Transfer building locations from the offset line using a line laser

Conditions — The learner will be given

- Instructions
- Work point
- Drawing
- Theodolite
- Partner

Criteria — The learner will be evaluated on

- Proper set-up
- Accuracy of the layout

Line (GAC): B USE TOOLS AND EQUIPMENT

Competency: B6 Use welding and thermal cutting tools

Objectives

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

- Perform CWB weld

LEARNING TASKS	CONTENT

1. Perform CWB weld	• Flat 1FG
	• Non-destructed testing (NDT)
	  ○ Ultra sonic
	  ○ Meg particle
	  ○ X-ray
	• Destructive testing (DT)
	  ○ Guided bend test
	• Defects
	  ○ Cracking
	  ○ Porosity
	  ○ Undercut
	  ○ Fusion
	  ○ Inclusions
	  ○ Overlap
	  ○ Lack of fusion

2. Perform oxy fuel cutting	• Equipment
	  ○ Standard hand torch
	  ○ Track burner
	  ○ Manifold system
	• Set up
	• Adjustment
	• Maintenance
	• Inspection
	• Trouble shooting
	• Storage and handling

Achievement Criteria #1

Performance	The learner will be able to prepare and weld a 1FG coupon using SMAW for a destructive bend test.
Conditions	The learner will be given • Instructions • Materials • Equipment • Track burner • Welding machine • Consumables • Carbon arc gouging torch • Grinder
Criteria	The learner will be evaluated on • Safety • Preparation and fit up of coupon • Angle of bevel • Width of root opening • Plate sizes • Preparation of coupon for bending • Gouging quality • Finish quality • Coupon width • Coupon thickness • Visual inspection • Guided bend test inspection • Adherence to CWB specifications

Achievement Criteria #2

Performance	The learner will be able to prepare and weld a 1FG coupon using FCAW for a destructive bend test.
Conditions	The learner will be given • Instructions • Materials • Equipment • Track burner • Welding machine • Consumables • Carbon arc gouging torch • Grinder
Criteria	The learner will be evaluated on • Safety • Preparation and fit up of coupon • Angle of bevel • Width of root opening • Plate sizes • Preparation of coupon for bending • Gouging quality • Finish quality • Coupon width • Coupon thickness • Visual inspection • Guided bend test inspection • Adherence to CWB specifications

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 drawing and documentation

Objectives

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

- Interpret structural drawings
- Interpret post-tensioning drawings

LEARNING TASKS	CONTENT

1. 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
	  ○ Erection
	  ○ Shop

2. Interpret post-tensioning drawings	• 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

3. Describe documentation

- Permits
- Work reports
- Work orders
- Incident reports
- Stressing records
- Material certifications
- Calibration records

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
	• Estimate 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 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
	• Calculate hopper dimensions

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 of learning outcomes and concepts with others
	• Transferring knowledge into practice
	  ○ Linkage 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 • Explaining advantages and disadvantages of emerging technology

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 LIFTING EQUIPMENT

Competency: F1 Inspect rigging, hoisting, and positioning equipment

Objectives

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

- Inspect hoisting and positioning equipment

LEARNING TASKS

1. Inspect hoisting and positioning equipment

CONTENT

- Types
  - Cranes
  - Manual cable puller (grip hoist)
  - Tuggers
  - Chain falls
  - Come-alongs
  - Jacks
  - Gantries
  - Air castors
  - Trailers
  - Multi-rollers
  - Blocks

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:

- Select appropriate slings based on application

LEARNING TASKS	CONTENT
1. Select appropriate slings based on application	• Unequal leg lengths • Unsymmetrical loads • Dynamic loads

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

Competency: F3 Use rigging and hoisting equipment

Objectives

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

- Select equipment based on transfer of load
- Calculate and select highline equipment based on loads
- Calculate a reeve system
- Identify marine hoisting equipment
- Describe marine loading and unloading
- Identify safety practices for heavy rigging and marine rigging

LEARNING TASKS	CONTENT

1. Select equipment based on transfer of load	• 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
	• Incline plane
	• Drifting
	• Anchorage and holdbacks
	• Safety

2. Calculate and select highline and load transfer equipment	• Calculations
	  ○ Capacity
	  ○ Weight
	  ○ Highline tensions
	  ○ Holdback
	  ○ Inverted sling tensions
	  ○ Mechanical advantage
	• Securing of loads
	• Incline plane
	• Anchorage and holdbacks
	• Safety

3. Identify marine hoisting equipment	• Floating derricks • Barge crane • Spud barges • Ship cranes • Container cranes • Slew winches • Gantry cranes

4. Identify marine hoisting considerations	• Barge movement
	  ○ List
	  ○ Trim
	• Free board
	• Environmental
	• Tide lifts
	• Currents
	• Wakes
	• Tide book
	• Crane charts based on barge configuration

5. Describe marine loading and unloading	• Equipment • Dockside • Ramps • Trestle • Shoreline oceans • Rivers • Load types • Load placement • Balance of load • Ballasting

6. Identify safety practices for marine rigging	• Regulations
	  ○ Life jackets
	  ○ Boat certification
	  ○ Emergency preparedness
	• Adherence to engineered plan
	• Awareness of surroundings
	  ○ Cables, winch lines
	• Site-specific considerations

Achievement Criteria #1

Performance: The learner will be able to analyse a dual lift rigging plan.

Conditions: The learner will be given

- Instructions
- A complete dual lift rigging plan
- Manufacturers specifications

Criteria: The learner will be evaluated on

- Accuracy
- Completeness
- Information
- Headroom
- Boom clearances
- Percentage of capacity
- Coordinated movement
- Communication method

Achievement Criteria #2 ***(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
- Tugger
- Variety of available equipment

Criteria: The learner will be evaluated on

- Appropriate plan
- Securing lift area
- Winch/power source placement
- Appropriate fleet angle
- Lead block location
- Routing of cable
- Appropriate mechanical advantage
- Selection of block design and capacity
- Accurate determination of holdbacks
- Load control
- Selection of slings and attachments
- Headroom
- Communication

Achievement Criteria #3 ***(Note: suggested as a group activity)***

Performance	The learner will be able to design and work with a group to implement a rigging plan to transfer a load horizontally and/or between elevations.
Conditions	The learner will be given • Instructions • Variety of available equipment
Criteria	The learner will be evaluated on • Selection of equipment • Selection of rigging and attachments • Accurate hold back calculation • Load control • Headroom • Communication

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
- Use mechanical moving equipment
- Move a load using jacks and rollers

LEARNING TASKS	CONTENT

1. Describe types of mechanical moving equipment	• Jacks
	  ○ Hydraulic
	  ○ Lever
	  ○ Screw
	  ○ Ratchet
	  ○ Pneumatic
	• Rollers
	• Pipe
	• Skates
	• Dollies
	• Multi-roller
	• Pallet jack

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/rollers
	• Holdback considerations
	• Base conditions
	  ○ Decline/incline
	  ○ Friction
	  ○ Surface capacity

LEARNING TASKS	CONTENT
	• Size, type and number of jacks/rollers depending on load • Weight distribution • Rigging • Blocking/cribbing • Centre of gravity • Safety • Communication • Handling
4. Use mechanical moving equipment	• According to job requirements • Stability of load • Length of travel • Uses and limitations • Path of travel • Surface conditions • Safety • Storage and handling • Maintenance

5. Move a load using jacks and rollers	• Procedures
	• Location/positioning of jacks/rollers
	• Holdback considerations
	• Base conditions
	  ○ Decline/incline
	• Coefficients of friction
	  ○ Methods of reduction
	• Jacks/rollers
	  ○ Size
	  ○ Type
	  ○ Quantity
	  ○ Capacity
	  ○ Control
	• Considerations
	  ○ Surface
	  ○ Travel
	  ○ Rigging
	• Blocking
	• Centre of gravity
	• Safety

LEARNING TASKS	CONTENT
	• Communication • Maintenance • Storage • Handling

Achievement Criteria

Performance	The learner will be able to jack and move an object between two positions at different angle orientations.
Conditions	The learner will be given • Instructions • Variety of equipment and materials • Manufacturers specifications
Criteria	The learner will be evaluated on • Safety • Quality of communication • Use of equipment • Accuracy of findings • Stability of load throughout activity

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
- Installation/removal of bracing or temporary supports
- Verification of integrity of blocking and cribbing
- Removal of softeners
- Housekeeping
- Post-lift meeting
- Removal of barriers and signs

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

Competency: G2 Erect lattice boom cranes, tower cranes, derricks, and components

Objectives

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

- Describe tower crane assembly

LEARNING TASKS	CONTENT
1. 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 Perform demobilization and disassembly of cranes

Objectives

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

- Describe demobilization and disassembly of mobile cranes
- Describe demobilization and disassembly of tower cranes

LEARNING TASKS	CONTENT
1. Describe demobilization and disassembly of mobile cranes	• OHS Regulations • Manufacturers' specification • Hazards • Tools and equipment • Sequence of assembly/disassembly • Rigging procedures • Components • Bolting and torquing procedures • Finalize the set up • Inspection • Communication • Transport
2. Describe demobilization and disassembly of tower cranes	• OHS Regulations • Manufacturers' specification • Hazards • Tools and equipment • Sequence of assembly/disassembly • Rigging procedures • Components • Bolting and torquing procedures • Finalize the set up • Inspection • Communication

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
	• Splices
	  ○ Types
	  ○ Classes

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

3. Detail reinforcing materials	• Standards • Structural drawings • Cut sheet ○ Data entry

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

Criteria — The learner will be evaluated on

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

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 bonded post-tensioning systems.
- Describe the placing ducts and anchors and tendons.
- Describe the preparation of tendons for stressing.
- Describe the stressing of tendons.
- Describe the cutting, capping, and grouting of tendons.
- Apply procedures for placing post-tensioning systems.

LEARNING TASKS	CONTENT

1. Describe multi-strand and bonded post-tensioning systems	• Purpose and advantages
	• Principles
	  ○ Effects of rebar and cable on structure
	• Importance of material tracking
	• Importance of quality assurance
	• Structural applications
	  ○ Cable stay structures
	• Reinforced concrete applications
	• Tendon
	  ○ Grade
	  ○ Bar
	  ○ Cable
	• Anchorage systems
	  ○ Multi-strand
	  ○ Mono-strand
	  ○ Bell/plate
	• Accessories
	  ○ Duct
	  ○ Pocket formers
	  ○ Chairs/bolster
	  ○ Caps
	  ○ Trumpet
	  ○ Grout vents
	  ○ Grout tubes
	  ○ Wedges

LEARNING TASKS	CONTENT
2. Describe placing ducts and anchors	• 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 • Adequately securing anchors to bulkhead

3. Describe placing tendons	• Sequence of work
	• Installation methods
	  ○ Manual rolling out
	  ○ Power feeding
	• Ensuring adequate projection on live ends
	• 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
	  ○ Setup of control zone
	• Equipment
	  ○ Preparation
	  ○ Inspection
	  ○ Cleaning
	  ○ Function verification

LEARNING TASKS	CONTENT

	• Calibrated equipment pairing
	• Identification of sequence
	  ○ Installation of jack
	  ○ Stressing to remove slack
	  ○ Stressing to required pressure
	  ○ Checking elongation
	• Documentation
	• Approval of results

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

7. Describe grouting tendons	• Purpose • Composition/mixing • Equipment • Testing • Venting • Pumping • Capping
8. Describe specifications and standards	• PTI • Project specific • Manufacturer specific • Double live ends

9. Apply procedures for placing post-tensioning systems	• Regulations
	• Supervision
	• Quality Assurance
	• Inspection
	• According to job requirements
	  ○ Procedures
	  ○ Equipment
	• Safety

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J2 Erect structural members

Objectives

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

- Describe types of wooden structural components
- Describe types of pre-cast structures and components
- Layout and fabricate a structural assembly

LEARNING TASKS	CONTENT

1. Describe mass timber erection considerations and procedures	• Types
	  ○ GLT
	  ○ CLT
	  ○ DLT
	  ○ NLT
	• Considerations
	  ○ Regulations
	  ○ Standards
	  ○ Safety
	  ○ Shipping
	  ○ Site storage
	  ○ Just in time delivery
	  ○ Organization of fasteners
	  ○ Bracing
	  ○ Hoisting access
	  ○ Temporary barriers
	• Rigging procedures
	• Fastening details
	• Installation sequence
	  ○ Bracing sequence
	  ○ Access between levels
	  ○ Movement of access equipment
	  ○ Relocation of tools and equipment

2. Describe pre-cast erection considerations and procedures	• Types
	• Considerations
	  ○ Regulations
	  ○ Standards
	  ○ Safety
	  ○ Shipping
	  ○ Site storage

  - Just in time delivery
  - Bracing
  - Hoisting access
  - Temporary barriers
  - Embedded anchors
  - Blocking plans
  - Pockets
  - Inserts
  - Sealants
  - Chemical anchor
- Rigging procedures
  - Engineered lifting points
- Fastening details
- Installation sequence
  - Bracing sequence

Achievement Criteria

(Note: suggested as a group activity. May be combined with Achievement Criteria in J3 and M2)

Performance	The learner will be able to layout and fabricate a structural assembly that includes columns, beams, braces, and connection plate locations.
Conditions	The learner will be given • Instructions • Drawing • Materials • Tools and equipment
Criteria	The learner will be evaluated on • Safety • Communication • Teamwork • Rigging • Accuracy and quality of fabricated assembly • Adherence to schedule • Completeness of erection plan

Line (GAC): J INSTALL STRUCTURAL MEMBERS

Competency: J3 Level, plumb, align, and complete installation of structural members

Objectives

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

- Use levelling, plumbing and alignment techniques for structural assemblies
- Pre-tension bolts
- Apply quality assurance

LEARNING TASKS	CONTENT

1. Use levelling, plumbing and alignment techniques for structural assemblies	• Techniques
	• Tolerances
	• Considerations for multi-bay structures
	• Temporary brace
	  ○ Installation
	  ○ Procedure
	• Removal of temporary lines
	• Off-set lines
	• Equipment
	  ○ Rigging
	  ○ Surveying
	  – Lasers
	  – Theodolite
	  – Total stations

2. Pre-tension bolts	• Standards
	• Specifications
	• Pre-tensioning of bolts
	  ○ Turn of the nut method
	  ○ Calibrated wrench
	  ○ Direct tension indicator (DTI)
	  ○ Tension control (TC)

3. Apply quality assurance	• Techniques • Tools and equipment • Procedures • Weld inspection • Bolt inspection • Documentation

Achievement Criteria

(Note: suggested as a group activity. May be combined with Achievement Criteria in J2 and M2)

Performance	The learner will be able to perform a pre-installation verification of bolt assemblies.
Conditions	The learner will be given • Instructions • Bolt assemblies • Hydraulic load cell (Skidmore) • Material certifications
Criteria	The learner will be evaluated on • Safety • Accuracy and range of findings • Consistency • Marking of bolts • Set-up of equipment • Use of tools • Documentation

Line (GAC): K INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS

Competency: K1 Install building envelope, precast walls, window walls, and curtain walls

Objectives

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

- Identify types of building envelope
- Describe components of curtain wall and window wall
- Describe building envelope installation procedures

LEARNING TASKS	CONTENT

1. Identify types of building envelope	• Types
	  ○ Curtain wall
	  ○ Window wall
	  ○ Precast wall
	  ○ Insulated panel
	  ○ Composite
	• Materials
	  ○ Aluminum
	  ○ Glass
	  ○ Concrete
	  ○ Steel
	  ○ Mass timber
	  ○ Composites
	• Unitized
	• Stick-built

2. Describe components of curtain wall and window wall	• Glazing • Mullions • Horizontal rails • Shear blocks • Anchors • Setting blocks • Infills • Pressure pads, plates, and bars • Face caps • Gaskets • Sealants • Barriers • Cladding

	• Steel stud • Structural steel headers • Insulation
3. Describe building envelope installation procedures	• Safety • Standards • Manufacturers specifications • Shipping and receiving • Rigging • Material handling ○ Specialized equipment • Layout • Survey • Installation sequence • Caulking • Sealants • Support members • Fastening • Dissimilar metals • Job specifications • QA/QC

Line (GAC): K INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS

Competency: K3 Install steel cladding systems and components

Objectives

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

- Describe steel cladding and roofing systems
- Lay out steel cladding and roofing
- Describe the installation of steel cladding, roofing, and metal decking

LEARNING TASKS	CONTENT
1. Describe steel cladding and roofing systems	• Standing seam • Screw-down • Sandwich panels • Composite field-assembled wall systems • Metal decking • Fastening • Sealants
2. Lay out steel cladding and roofing	• Interpretation of drawings and specifications • Benchmark • Gridlines • Control lines

3. Describe the installation of steel cladding, roofing, and metal decking	• Tools and equipment
	• Sequence
	• Shake-out and landing
	• Types of tie-off
	• Maintenance of layout lines
	• Procedure
	  ○ Lapping
	  ○ Fastening
	• Sealants
	• Pour stops

Line (GAC): L INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS

Competency: L1 Install mechanical systems

Objectives

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

- Describe mechanical systems
- Describe adjustments for mechanical systems

LEARNING TASKS	CONTENT

1. Describe mechanical systems	• Related industries
	  ○ Oil and gas
	  ○ Hydroelectric
	  ○ Mining
	  ○ Renewables
	  ○ Shipping
	  ○ Manufacturing
	  ○ Forestry
	  ○ Waste treatment
	  ○ Smelting
	• Safety
	  ○ Site
	  ○ Company policies
	  ○ Lockout procedures
	  ○ Emergency stop
	  ○ Sirens and lights
	  ○ Personnel guards
	  ○ Specialized PPE
	  ○ Confined space
	• General types
	  ○ Dams
	  ○ Crushers
	  ○ Dumpers
	  ○ Wind turbines
	  ○ Export facilities
	  ○ Silos
	  ○ Tanks and vessels
	  ○ Separators
	  ○ Overhead cranes
	  ○ Kilns
	  ○ Specialized transportation
	• Composite crews

LEARNING TASKS	CONTENT
2. Describe adjustments for mechanical systems	• According to manufacturer's specifications • Realignment • Calibration • Removal and replacement

Line (GAC): L INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS

Competency: L2 Install, align, and commission material handling systems

Objectives

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

- Describe mechanical conveyance systems
- Describe adjustments for mechanical conveyance systems
- Describe fabricating a hopper

LEARNING TASKS

1. Describe mechanical material handling systems

CONTENT

- Related industries
- Safety
- Conveyance types
  - Bulk
    - Belt conveyors
    - Screw conveyors
    - Shakers
    - Drag conveyors
    - Crushers
    - Air slides
  - Precision
    - Power and free conveyor
    - Electrified monorail
    - Automated guided vehicle
    - Robot cells
  - Bucket
  - Belt
  - Chain
  - Screw
  - Personnel
  - Direction of movement
    - Vertical
    - Horizontal
    - Incline
    - Decline
    - Circular
  - Parts
    - Idlers
    - Pulleys
    - Take ups
    - Belts

LEARNING TASKS	CONTENT
	– Chains – Chutes – Drives – Motors – Hopper – Chutes – Support structures • Composite crews ○ Commissioning – Procedure – Troubleshooting
2. Describe adjustments for mechanical conveyance systems	• Conveyance equipment • Tension • Alignment • Elevation
3. Describe fabricating a hopper	• Hoppers ○ Equal side ○ Unequal side • Layout of sides ○ Elevations ○ Calculated true length of sides ○ Fit – Inside – Outside – Corner

Line (GAC): L INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS

Competency: L3 Perform maintenance on mechanical systems

Objectives

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

- Describe maintenance of mechanical systems

LEARNING TASKS

1. Describe maintenance of mechanical systems

CONTENT

- Preventative maintenance
  - Greasing and rotating bearings
  - Removal and replacement of worn parts
- Safety
- Working at heights
- Working in confined spaces
- Tools and equipment
- Lock-out/tag out
- Rigging
- Falsework
- Procedure
  - Manufacturers specifications
  - Company
  - Quality assurance
  - Documentation
- System specific
  - Wind turbines
    - Replacing blades
  - Dams
    - Changing gates
  - Crushers
    - Realignment
    - Replacing
      - Steel
      - Wear plates
      - Hoppers
      - Chutes
    - Reinforcing
  - Kilns
    - Changing motors
    - Relining
    - Replacing wear plates

LEARNING TASKS	CONTENT

2. Describe disassembly of mechanical systems	• Safety
	• Working at heights
	• Working in confined spaces
	• Tools and equipment
	• Lock-out/tag out
	• Rigging
	• Falsework
	• Procedure
	  ○ Manufacturers specifications
	  ○ Company
	  ○ Documentation
	• Disposal
	• Recycling and reuse
	  ○ Documentation
	  ○ Environmental regulations

Line (GAC): M MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS

Competency: M2 Dismantle and remove structural components

Objectives

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

- Plan procedure to remove a structural member
- Remove a structural component from an existing structure

LEARNING TASKS	CONTENT

1. Plan procedure to remove a structural member	• Safety
	  ○ Airborne hazards
	  ○ Falling objects
	  ○ Fire hazards
	  ○ Pinch points
	  ○ Stored energy
	  ○ Control zones
	• Parts to be removed
	• Implication of removal
	  ○ Structural integrity
	  ○ Miscellaneous components
	• Equipment resources
	• Properties of components
	  ○ Piece weight
	  ○ Material integrity
	  ○ Additional weight factors
	• Identification of fastening
	• Coordination/sequence
	• Required permits/approval
	• Temporary falsework
	  ○ Support
	  ○ Bracing

Achievement Criteria

(Note: suggested as a group activity. May be combined with Achievement Criteria in J2 and J3)

Performance — The learner will be able to work with a group to

- Plan the removal of a structural component from an existing structure.
- Remove a structural component from an existing structure.

Conditions — The learner will be given

- Instructions
- Drawing
- Equipment
- Access to existing structure

Criteria — The learner will be evaluated on

- Safety
- Teamwork
- Communication
- Calculation of weight
- Documentation of plan
- Control of hazards
- Calculation of rigging requirement

Section 4

ASSESSMENT GUIDELINES

Assessment Guidelines – Level 1

Level 1 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	IRONWORKER (GENERALIST) LEVEL 1		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
A	MAINTAIN SAFE AND HEALTHY WORKPLACE	6%	6%
B	USE AND MAINTAIN TOOLS AND EQUIPMENT	10%	10%
C	ORGANIZE WORK	10%	10%
D	USE COMMUNICATION, MENTORING, AND CONTINUOUS LEARNING TECHNIQUES	2%	0%
E	PLAN LIFT	6%	0%
F	USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT	20%	23%
G	PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES	4%	6%
H	FABRICATE AND INSTALL REINFORCING MATERIALS	18%	22%
I	APPLY POST-TENSIONING TECHNIQUES	4%	0%
J	INSTALL STRUCTURAL MEMBERS	20%	23%
	Total	100%	100%
In-school theory/practical subject competency weighting		40%	60%
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 (GENERALIST) LEVEL 2		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	USE AND MAINTAIN TOOLS AND EQUIPMENT	8%	15%
C	ORGANIZE WORK	8%	15%
F	USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT	18%	20%
G	PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES	6%	0%
H	FABRICATE AND INSTALL REINFORCING MATERIALS	20%	25%
J	INSTALL STRUCTURAL MEMBERS	10%	0%
K	INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS	20%	25%
M	MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS	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 3

Level 3 Grading Sheet: Subject Competency and Weightings

PROGRAM: IN-SCHOOL TRAINING:	IRONWORKER (GENERALIST) LEVEL 3		
LINE	**SUBJECT COMPETENCIES**	**THEORY WEIGHTING**	**PRACTICAL WEIGHTING**
B	USE AND MAINTAIN TOOLS AND EQUIPMENT	8%	12%
C	ORGANIZE WORK	10%	12%
D	USE COMMUNICATION, MENTORING, AND CONTINOUS LEARNING TECHNIQUES	0%	6%
E	PLAN LIFT	4%	0%
F	USE RIGGING, HOISTING, AND POSITIONING EQUIPMENT	16%	20%
G	PERFORM MOBILIZATION, ERECTION, AND DEMOBILIZATION OF CRANES	6%	0%
H	FABRICATE AND INSTALL REINFORCING MATERIALS	13%	10%
I	APPLY POST-TENSIONING TECHNIQUES	8%	0%
J	INSTALL STRUCTURAL MEMBERS	18%	30%
K	INSTALL ORNAMENTAL, MISCELLANEOUS, AND STEEL CLADDING SYSTEMS AND COMPONENTS	6%	0%
L	INSTALL, MAINTAIN, AND DISASSEMBLE MECHANICAL SYSTEMS	6%	0%
M	MAINTAIN AND UPGRADE STRUCTURAL STEEL AND COMPONENTS	5%	10%
	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 3 (Final Level) of the Ironworker (Generalist) 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 (Generalist) 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

- N/A

Shop Area

- Comfortable seating and tables suitable for learning
- Compliance with the local and national fire code and occupational safety requirements
- Overhead and multimedia projectors with a projection screen
- Whiteboard with marking pens and erasers
- Lighting controls to allow easy visibility of the projection screen while allowing students to take notes
- Windows must have shades or blinds to adjust sunlight
- Heating/air conditioning for comfort all year round
- In-room temperature control to ensure comfortable room temperature
- Acoustics in the room must allow audibility of the instructor
- Computer lab complete with 16 computers and internet access
- Library complete with reference material for student and instructor use
- 1,100 square foot workshop with ceiling height sufficient to allow safe movement of materials
- 15,000 square foot outdoor practical area which includes:
  - Sufficient area to set up a mobile crane
  - Sufficient area for a rebar mock-up
  - Sufficient area to set up a structural mock-up
    - Multi-level structure in excess of 35 ft.
    - Cast anchor bolts
    - A variety of structural members and connections
- Tool room
- Lockers
  - Adequate lighting and lighting control
  - 16 individual welding booths (30 sq. ft. each) with UV partitions and adequate air exchange
  - Ventilation as per WorkSafeBC standards
  - Refuse and recycling bins for used shop materials
  - First-aid facilities

Lab Requirements

- N/A

Student Facilities

- Adequate lunchroom 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

Other

- N/A

Tools and Equipment

Shop Equipment

Required

- Mobile and/or tower crane
- Telehandler
- Tabletop hydraulic rebar bender
- Portable welder/generator
- 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
- Oxy/fuel cutting equipment
  - Cylinders
  - Hoses
  - Regulators
  - Torches
  - Strikers
- Ladders
- Scaffold
- Pre-fab horses
- Compressor

Shop (Facility) Tools (all levels)

Standard Hand Tools

- Adjustable wrench
- Aligning bar (sleever bar)
- Hex key set (Allen® key set)
- Back and out (B & O)
- Bar clamps
- Beam clamps
- Bolt bag
- Bolt cutters
- C clamp
- Cable cutters
- Centre punch
- Chalk line
- Chipping hammer
- Cold chisel
- Combination square
- Combination wrench set
- Dogs
- Drill bits
- Files
- Flashlight
- Hack saw
- Hammers
- Hickey bar
- Keel marker
- Locking clamp
- Locking pliers
- Needle nose pliers
- Nose bag
- Nut drivers
- Pins (drift, bull)
- Pipe cutters
- Pipe wrench
- Pliers
- Pry bar
- Punch
- Reamers
- Rod bag
- Scrapers
- Screwdrivers
- Side/diagonal cutters
- Sledgehammer
- Slip joint pliers
- Slug wrench
- Socket set
- Spud wrench
- Tap set
- Tin snips
- Tool belt
- Tool bucket
- Torque wrench
- Wedges
- Wire brush

Measuring and Layout Tools

- Angle finders
- Bevel squares
- Builders level
- Calipers
- Chalk line
- Electronic distance measurer (EDM)
- Hydraulic load cells (for bolts)
- Laser level
- Laser square
- Load cells (for rigging)
- Measuring chain
- Measuring tape
- Micrometers
- Optical levels
- Piano wire
- Plumb line
- Prism
- Protractor
- Receiver
- Rod level
- Scale
- Smart levels
- Spirit levels
- Squares (framing, combination)
- Straight edges
- String line
- Theodolite
- Torpedo level
- Total station
- Transit
- Tripods

Power Tools

- Air chisel
- Band saw
- Chop saw
- Circular saw
- Compressor
- Die grinder
- Electric hacksaw
- Gas cut-off saw
- Generator
- Grinder
- Hammer drill
- Hydraulic jacks (and accessories)
- Impact gun
- Mag drill
- Percussion drill
- Porta band
- PT jack and pump
- Powder actuated tool
- Power drill
- Reciprocating saw
- Rivet buster
- Riveting gun
- Tension control gun
- Torque gun
- Turn-of-nut gun
- Vacuum

Safety Equipment

- Air movers (fans)
- Cables
- Eye wash facilities
- Fire blankets
- Fire extinguishers
- First aid equipment
- Fume and toxic gas detector
- Fume and toxic gas vents
- Life lines
  - Vertical
  - Horizontal
  - Retractable
- Perimeter cables
- Portable lighting
- Ropes (fibre, wire)
- Signage
- Smoke eater
- Stanchion posts
- Warning tape
- Welding flash screens
- Guard rails

Personal Protective Equipment

- Beamer
- Carabiners
- Dog leash
- Double lanyard
- Face shields
- Full body harness
- Hearing protection
- Gloves
- Goggles
- Respirators
- Retractable lanyard
- Rope grabs
- Safety glasses
- Safety vest
- Welding PPE
  - Apron
  - Gloves
  - Helmet
  - Jacket
  - Shield

Specialty Tools (Welding and Cutting Tools)

- Arc air (gouger)
- Arc welding machine
- Cutting tools (oxygen, acetylene)
- Plasma cutter
- Stud welding equipment
- Tiger torch

Recommended Consumable Materials

In sufficient quantity to complete practical requirements of the outline:

- 16 gauge annealed tie wire
- Curtain wall components
- Mass timber components
- Prestressing steel
- Standard rebar diameters (10,15, 20, 25M)
- Steel plate (1/2 in.)
- Structural steel shapes

Student Equipment (supplied by school) (all levels)

Required

- Tool box
  - Adjustable wrench
  - Bevel square
  - Centre punch
  - Cold chisel
  - Chipping hammer
  - Combination square
  - Wire brush
  - Tip cleaner
  - Pliers
  - Ball peen hammer
  - Tape measure

Student Tools (supplied by student) (all levels)

Required

- Puncture/flame resistant clothing
- CSA-approved hard toed boots
- CSA-approved hardhat
- Hi-visibility vest/shirt
- Reinforcing tool belt
  - Bolt bag
  - Pliers and diagonal cutters with scabbard
  - Tie wire reel
  - Keel marker
  - Tape measure
- Pocket knife
- Structural tool belt
  - Spud wrench
  - Frog (spud wrench holder)
  - Adjustable wrench
  - Bull pin
  - Tape measure
  - Sledgehammer (beater)
  - Connecting bar (sleever)
  - Bolt bag
  - Clip

Reference Materials

Required Reference Materials

- Steel Erection Level 1 (BCIT)
- IPT's Crane and Rigging Training Manual
- CRSI Placing Reinforcing Bars Manual
- RSIC Manual of Standard Practice
- SSTC Structural Bolting Handbook

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
- IPT's Guide to Blueprint Interpretation
- IPT's Metal Trades and Welding 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 (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
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
CISC	Canadian Institute of Steel Construction
CLT	cross-laminated timber
COG	centre of gravity
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
DEP	dedicated evacuation platform
DLT	dowel-laminated timber
DT	destructive testing
DTI	direct tension indicator
EDM	electronic distance measuring
EOR	engineer on record
EOT	electronic overhead travelling
EWO	extra work order
FCAW	flux core arc welding
FLRA	field level risk assessment
FRP	fibre reinforced polymer
GFRP	glass fibre reinforced polymer
GLT	glue-laminated timber
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
NDT	non-destructive testing
NLT	nail-laminated timber

OHS	Occupational Health and Safety
OWSJ	open web steel joist
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
RSI	repetitive strain injury
RSIC	Reinforcing Steel Institute of Canada
RT	rough terrain
SAW	submerged arc welding
SDS	safety data sheets
SMAW	shielded metal arc welding
SOP	safe operating procedures
SPMT	self-propelled motor transport
SSTC	Steel Structures Technology Centre
SW	stud welding
SWP	safe work procedures
TC	tension control
TDG	Transportation of Dangerous Goods
TIG	tungsten inert gas welding
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.

building envelope	the physical separator between the conditioned and unconditioned environment of a building, including the resistance to air, water, heat, light, and noise transfer
curtain wall	a form of building envelope, normally produced as unitized panels of aluminum and glass, that is suspended entirely on the exterior of a building
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.
girts	horizontal or vertical framing member to which sash, siding or other finished material is attached
grating	an arrangement of parallel or latticed bars which serve as the floor of a platform, walkway, etc.
miscellaneous products	any product or component that is not a main structural supporting member (e.g., stairs, railings, canopies, solar screens, building signage, doors and wall supports)
ornamental components	non-structural steel, precast or composite members
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)
primary structural member	structural members essential to the overall integrity of the building or structure, such as columns, beams, girders, trusses, tie joists, footings, corbels and piers
precast	concrete product that is fabricated and cast in a location different than its intended permanent location (normally offsite in a pre-cast yard)
secondary structural member	structural members that support themselves and transfer loading to primary structural members (e.g., infill walls, horizontal and vertical bracing, girts, purlins, flange braces, framed openings and joists)
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
window walls	a form of building envelope that may be stick-built or produced as unitized panels of aluminum and glass, that bears on a floor level and spans from that floor to the ceiling

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 below and 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 (GENERALIST) – 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 use power tools to construct an assembly from a given structural steel shop drawing. ***(Note: suggested to combine with Achievement Criteria #1, #2, and #3 in B6)***
B3 Use access equipment	The learner will be able to use a MEWP to perform elevated work. ***(Note: suggested to combine with Achievement Criteria in J2)***
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 use a builder's level to verify consistent elevation at several locations.
B6 Use welding and thermal cutting equipment	1. The learner will be able to set up a welding machine for SMAW and perform single pass fillet and multi-pass fillet weld. ***(Note: suggested to combine with Achievement Criteria in B2)***
	2. The learner will be able to set up a welding machine for FCAW and perform single pass fillet and multi-pass fillet weld. ***(Note: suggested to combine with Achievement Criteria in B2)***
	3. The learner will be able to • Perform set up and break down of oxy fuel equipment. • Cut structural shapes and steel plate to prescribed size. • Pierce a hole to dimensions. ***(Note: suggested to combine with Achievement Criteria in B2)***

C3	Use drawings and documentation	The learner will be able to locate information from a shop drawing and create a material list.
C5	Use mathematics	1. The learner will be able to calculate the weight of a structural steel member in metric and imperial using short designation and volumetric methods.
		2. The learner will be able to calculate the weight of a bundle of reinforcing steel in metric and imperial.
F2	Use ropes and slings	1. The learner will be able to use wire rope slings to hoist a load.
		2. The learner will be able to use a synthetic sling to hoist a load.
		3. The learner will be able to use knots in a practical application. ***(Note: suggested to combine with Achievement Criteria in J2)***
F3	Use rigging and hoisting equipment	The learner will be able to 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.
H2	Cut and bend reinforcing materials	The learner will be able to cut and bend a simple shape (dowel or U-bar).
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.
J2	Erect structural members	The learner will be able to erect structural steel. ***(Note: suggested as a group activity. Criteria also evaluates content in Competency J3)***

IRONWORKER (GENERALIST) – LEVEL 2 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
B5 Use measurement, layout, and surveying tools and equipment	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.
B6 Use welding and thermal cutting tools	1. The learner will be able to weld with SMAW in context (Stairs – K2) ***(Note: suggested to combine with Achievement Criteria in K2)***
	2. The learner will be able to set up and use a carbon arc gouge to fillet weld. ***(Note: suggested to combine with Achievement Criteria in K2)***
	3. The learner will be able to set up and use a plasma cutter to cut steel with a minimum thickness of 3/8" (10mm).
C3 Use drawings and documentation	1. The learner will be able to determine reinforcing requirements from a drawing and determine quantity, size, spacing and placing order.
	2. The learner will be able to determine structural requirements from an erection drawing and determine quantity, piece count, location and sequence for erection.
F1 Inspect rigging, hoisting, and positioning equipment	The learner will be able to perform a rigging inspection and create a written inspection report. ***(Note: suggested to combine with Achievement Criteria #1 and #2 in F3)***
F3 Use rigging and hoisting equipment	1. The learner will be able to perform a multi-part fibre rope reeve-up.
	2. The learner will be able to set-up a redirect system to hoist a load using a grip hoist.
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.
K2 Install miscellaneous components	The learner will be able to plan and field build stairs and a railing.

IRONWORKER (GENERALIST) – LEVEL 3 SUMMARY OF ACHIEVEMENT CRITERIA	
SUBJECT COMPETENCY	**ACHIEVEMENT CRITERIA TASK**
B5 Use measurement, layout, and surveying tools and equipment	The learner will be able to: • Layout offset lines using a theodolite • Transfer building locations from the offset line using a line laser
B6 Use welding and thermal cutting tools	1. The learner will be able to prepare and weld a 1FG coupon using SMAW for a destructive bend test.
	2. The learner will be able to prepare and weld a 1FG coupon using FCAW for a destructive bend test.
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.
F3 Use rigging and hoisting equipment	1. The learner will be able to analyse a dual lift rigging plan.
	2. 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)***
	3. The learner will be able to design and work with a group to implement a rigging plan to transfer a load horizontally and/or between elevations. ***(Note: suggested as a group activity)***
F4 Use mechanical moving equipment	The learner will be able to jack and move an object between two positions at different angle orientations.
H1 Apply fundamentals of reinforcing concrete	The learner will be able to • Determine reinforcing requirements in a given area from a structural drawing. • Detail a simple component. • Complete detail sheet.
J2 Erect structural members	The learner will be able to layout and fabricate a structural assembly that includes columns, beams, braces, and connection plate locations. ***(Note: suggested as a group activity. May be combined with Achievement Criteria in J3 and M2)***
J3 Level, plumb, align, and complete installation of structural members	The learner will be able to perform a pre-installation verification of bolt assemblies. ***(Note: suggested as a group activity. May be combined with Achievement Criteria in J2 and M2)***
M2 Dismantle and remove structural components	The learner will be able to work with a group to • Plan the removal of a structural component from an existing structure. • Remove a structural component from an existing structure. ***(Note: suggested as a group activity. May be combined with Achievement Criteria in J2 and J3)***