Occupational Analyses Series

Ironworker (Reinforcing)

2015

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FOREWORD

The Canadian Council of Directors of Apprenticeship (CCDA) recognizes this National Occupational Analysis as the national standard for the occupation of ironworker (reinforcing).

Background

The first National Conference on Apprenticeship in Trades and Industries, held in Ottawa in 1952, recommended that the federal government be requested to cooperate with provincial and territorial apprenticeship committees and officials in preparing analyses of a number of skilled occupations. To this end, Employment and Social Development Canada (ESDC) sponsors a program, under the guidance of the CCDA, to develop a series of National Occupational Analyses (NOAs).

The NOAs have the following objectives:

- to describe and group the tasks performed by skilled workers;
- to identify which tasks are performed in every province and territory;
- to develop instruments for use in the preparation of Interprovincial Red Seal Examinations and curricula for training leading to the certification of skilled workers;
- to facilitate the mobility of apprentices and skilled workers in Canada; and,
- to supply employers, employees, associations, industries, training institutions and governments with analyses of occupations.

ACKNOWLEDGEMENTS

The CCDA and ESDC wish to express sincere appreciation for the contribution of the many tradespersons, industrial establishments, professional associations, labour organizations, provincial and territorial government departments and agencies, and all others who contributed to this publication.

Special acknowledgement is extended by ESDC and the CCDA to the representatives from the trade across Canada who contributed to the development of this document.

This 2015 edition of the NOA was reviewed, updated and validated by industry representatives from across Canada to ensure that it continues to represent the skills and knowledge required in this trade. The coordinating, facilitating and processing of this analysis were undertaken by employees of the NOA development team of the Trades and Apprenticeship Division of ESDC. The host jurisdiction of Alberta also participated in the development of this NOA.

Comments or questions about National Occupational Analyses may be forwarded to:

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To facilitate understanding of the occupation, the work performed by tradespersons is divided into the following categories:

Blocks	the largest division within the analysis that is comprised of a distinct set of trade activities
Tasks	distinct actions that describe the activities within a block
Sub-Tasks	distinct actions that describe the activities within a task
Supporting Knowledge and Abilities	the elements of skill and knowledge that an individual must acquire to adequately perform the sub-task

The analysis also provides the following information:

Trends	changes identified that impact or will impact the trade including work practices, technological advances, and new materials and equipment
Related Components	a list of products, items, materials and other elements relevant to the block
Tools and Equipment	categories of tools and equipment used to perform all tasks in the block; these tools and equipment are listed in Appendix A

The appendices located at the end of the analysis are described as follows:

Appendix A — Tools and Equipment	a non-exhaustive list of tools and equipment used in this trade
Appendix B — Glossary	definitions or explanations of selected technical terms used in the analysis
Appendix C — Acronyms	a list of acronyms used in the analysis with their full name
Appendix D — Block and Task Weighting	the block and task percentages submitted by each jurisdiction, and the national averages of these percentages; these national averages determine the number of questions for each block and task in the Interprovincial exam
Appendix E — Pie Chart	a graph which depicts the national percentages of exam questions assigned to blocks
Appendix F — Task Profile Chart	a chart which outlines graphically the blocks, tasks and sub-tasks of this analysis

DEVELOPMENT AND VALIDATION OF ANALYSIS

Development of Analysis

A draft analysis is developed by a committee of industry experts in the field led by a team of facilitators from ESDC. This draft analysis breaks down all the tasks performed in the occupation and describes the knowledge and abilities required for a tradesperson to demonstrate competence in the trade.

Draft Review

The NOA development team then forwards a copy of the analysis and its translation to provincial and territorial authorities for a review of its content and structure. Their recommendations are assessed and incorporated into the analysis.

Validation and Weighting

The analysis is sent to all provinces and territories for validation and weighting. Participating jurisdictions consult with industry to validate and weight the document, examining the blocks, tasks and sub-tasks of the analysis as follows:

BLOCKS	Each jurisdiction assigns a percentage of questions to each block for an examination that would cover the entire trade.
TASKS	Each jurisdiction assigns a percentage of exam questions to each task within a block.
SUB-TASKS	Each jurisdiction indicates, with a YES or NO, whether or not each sub-task is performed by skilled workers within the occupation in its jurisdiction.

The results of this exercise are submitted to the NOA development team who then analyzes the data and incorporates it into the document. The NOA provides the individual jurisdictional validation results as well as the national averages of all responses. The national averages for block and task weighting guide the Interprovincial Red Seal Examination plan for the trade.

This method for the validation of the NOA also identifies common core sub-tasks across Canada for the occupation. If at least 70% of the responding jurisdictions perform a sub-task, it shall be considered common core. Interprovincial Red Seal Examinations are based on the common core sub-tasks identified through this validation process.

Definitions for Validation and Weighting

YES	sub-task performed by qualified workers in the occupation in a specific jurisdiction
NO	sub-task not performed by qualified workers in the occupation in a specific jurisdiction
NV	analysis Not Validated by a province/territory
ND	trade Not Designated in a province/territory
NOT COMMON CORE (NCC)	sub-task, task or block performed by less than 70% of responding jurisdictions; these will not be tested by the Interprovincial Red Seal Examination for the trade
NATIONAL AVERAGES %	average percentage of questions assigned to each block and task in Interprovincial Red Seal Examination for the trade

Provincial/Territorial Abbreviations

NL	Newfoundland and Labrador
NS	Nova Scotia
PE	Prince Edward Island
NB	New Brunswick
QC	Quebec
ON	Ontario
MB	Manitoba
SK	Saskatchewan
AB	Alberta
BC	British Columbia
NT	Northwest Territories
YT	Yukon Territory
NU	Nunavut

ANALYSIS

Safe working procedures and conditions, accident prevention and the preservation of health are of primary importance to industry in Canada. These responsibilities are shared and require the joint efforts of government, employers and employees. It is imperative that all parties are aware of circumstances and conditions that may lead to injury or harm. Safe learning experiences and environments can be created by controlling the variables and behaviours that may contribute to accidents or injury.

It is generally recognized that a safety-conscious attitude and work practices contribute to a healthy, safe and accident-free working environment.

It is imperative to apply and be familiar with the Occupational Health and Safety (OH&S) Acts and Workplace Hazardous Material Information System (WHMIS) Regulations. As well, it is essential to determine workplace hazards and take measures to protect oneself, co-workers, the public and the environment.

Safety education is an integral part of training in all jurisdictions. As safety is an imperative part of all trades, it is assumed and therefore it is not included as a qualifier of any activities. However, the technical safety tasks and sub-tasks specific to the trade are included throughout this analysis.

SCOPE OF THE IRONWORKER (REINFORCING) TRADE

"Ironworker (Reinforcing)" is this trade's official Red Seal occupational title approved by the CCDA. This analysis covers tasks performed by an ironworker (reinforcing) whose occupational title has been identified by some provinces and territories of Canada under the following names:

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
Ironworker (Reinforcing)	✓	✓	✓						✓	✓			
Ironworker Reinforcing Rebar								✓					
Reinforcing Rodworker						✓							
Reinforcing Steel Erector					✓								

Ironworkers (reinforcing) cut, bend, lay out, hoist, place, tie, couple and weld reinforcing steel rods, welded wire fabric and composite materials in a wide variety of reinforced concrete products and structures such as buildings, highways, bridges, stadiums, wind turbines, solar panels and towers. They also place and stress various post-tensioning systems in structures such as parking garages, bridges and stadiums where longer unsupported spans are required.

Ironworkers (reinforcing) unload fabricated or straight reinforcing materials and place it for hoisting as needed. While the reinforcing material is usually pre-cut and fabricated off-site, ironworkers (reinforcing) may be called upon to cut and bend them in the field according to design specifications and drawings. Ironworkers (reinforcing) may pre-assemble reinforcing material by laying it out and connecting sub-assemblies on the ground prior to final placement. They organize the hoisting of the components by connecting cables and slings to the components and directing crane operators. They position, align and secure components according to drawings, using a variety of methods. After placing post-tensioning systems, they stress the tendons to predetermined forces using hydraulic jacks and pumps and then grout the tendons.

Ironworkers (reinforcing) work outside in all weather. They may also work in underground work sites. They work in a variety of locations ranging from remote areas where they could work on dams, bridges or mining projects, to urban environments where they could work on high-rise buildings, parking garages, transit systems, tunnels, stadiums, roads or highways. The work may require that they be away from home for extended periods of time. The work often requires considerable standing, bending, crawling, lifting, climbing, pulling and reaching and is often conducted in cramped, confined spaces or at heights. Hazards include injury from repetitive movements, electrocution, crushing, falls or falling objects.

Ironworkers (reinforcing) are required to have good mechanical aptitude, the ability to visualize finished products in three dimensions, and the ability to work at heights in varying extreme climates. A thorough knowledge of the principles of lifting and hoisting is required as is a familiarity with a variety of metal fastening and joining methods. All ironworkers (reinforcing) are required to be competent in the use and care of a variety of hand and power tools and equipment such as tying tools, pry bars, jacks, torches, cut-off saws, hydraulic benders, shears, welding equipment, stressing equipment and cranes.

Because of the nature of the work, a primary concern of the ironworkers (reinforcing) is workplace safety; therefore ironworkers (reinforcing) must be thoroughly familiar with the applicable sections of local, provincial and federal building and safety codes.

Ironworkers (reinforcing) tend to work in teams, and team coordination is a large component of the occupation especially when hoisting and placing large, heavy components high above the ground.

Ironworkers (reinforcing) interact and work cooperatively with a wide variety of construction tradespeople such as ironworkers (structural/ornamental), electricians, plumbers, crane operators, steel detailers, welders, carpenters, concrete finishers and metal fabricators.

OCCUPATIONAL OBSERVATIONS

Technology continues to contribute to many changes in equipment design and construction materials. These innovations require constantly changing methods and techniques governed by appropriate attitudes towards the current high standards for fabrication, erection and installation of components. Maintaining updated knowledge of these changes presents a daily challenge to the people of this trade.

The work of an ironworker (reinforcing), by its nature, possesses inherent hazards. Safe work procedures, best practices and job hazard analysis (JHA) assist in controlling or eliminating hazards. However, errors in judgment or in practical application of trade knowledge can be costly, both in terms of injury to workers and damage to equipment or materials. Workers must maintain constant attention to the application of safety and accident prevention at all times.

Personal protective equipment (PPE) such as fall arrest equipment, aerial lift platforms, breathing apparatus and fume extraction equipment have become an integral part of all worksites and places of employment.

Ironworkers (reinforcing) are increasingly being called on to document and maintain records due to more stringent laws and regulations. The end products in industrial and other applications must be appropriately installed, inspected and documented. This places more responsibility on supervisors, quality control personnel and the individuals who perform the installation and assembly of components. The tremendous variety in equipment, methods and materials means that the ironworker (reinforcing) must be more knowledgeable and adaptable than ever before.

ROLES AND OPPORTUNITIES FOR SKILLED TRADES IN A SUSTAINABLE FUTURE

Climate change affects all of us. Trades play a large role in implementing solutions and adjusting to changes in the world.

Throughout this standard, there may be specific references to tasks, skills and knowledge that clearly show this trade's role in a more sustainable future. Each trade has different roles to play and contributions to make in their own way.

For example:

- Construction tradespeople need to consider the materials they are using, building methods, and improvements to mechanical and electrical installations. There are important changes to codes and standards to help meet the climate change goals and commitments set for 2030 and 2050. Retrofits and new construction of low-energy buildings provide enormous opportunities for workers in this sector. Concepts, such as energy efficiency and regarding buildings as systems are foundational.

- Automotive and mechanical trades are seeing a shift towards the electrification of vehicles and equipment. As a result, new skills and knowledge will be required for tradespeople working in this sector. There are mandates for sales of new light-duty zero-emission vehicles (ZEV) in Canada, with the goal of achieving 100% ZEV sales by 2035. Due to this mandate, the demand for these vehicles is growing quickly among consumers and fleets. With this escalating demand, the need for skilled workers to maintain and repair these vehicles is also increasing.

- In industrial and resource sectors, there is pressure to move towards increased electrification of industrial processes. Many industrial and commercial facilities are also being upgraded to improve energy efficiency in areas such as lighting systems, and new production processes and technologies. There are also opportunities in carbon capture, utilization and storage (CCUS), as well as the production and export of low-carbon hydrogen.

- Trades in the service sector may also need to be aware of responsible sourcing, as well as efficient use of products and materials. New ways of working better are always a part of the job.

There are fast-moving changes in guidelines, codes, regulations and specifications. Many are being implemented for the purpose of energy efficiency and climate change. Those that affect specific trades may be mentioned within the standard. Examples of these guidelines and legislation include:

- The National Energy Code of Canada for Buildings (NECB).

- The Canadian Net-Zero Emissions Accountability Act (CNZEAA).

- programs that encourage sustainable building design and construction such as Leadership in Energy and Environmental Design (LEED) and the Zero Carbon Building (ZCB) standards.

- the Montreal Protocol for phasing out R22 refrigerants.

- energy efficiency programs such as ENERGY STAR.
- principles of the United Nations Declaration for the Rights of Indigenous Peoples pertaining to energy sector development.

Apprentices and tradespeople need to increase their climate literacy and reinforce their own understanding of energy issues and environmental practices. It is important for them to understand why these changes are happening and their effect on trades' work. While individual tradespeople and apprentices may not be able to choose certain elements like; the architectural design of buildings, building material selection, regulatory requirements, use of electric vehicles and technologies, they must understand the impact of using these elements in their work. Impacts include using environmentally friendly products and following requirements related to the disposal and recycling of materials.

In apprenticeship, as well as in ongoing professional development, employers and instructors should encourage learning about these concepts, why they are important, how they are implemented, and the overarching targets they are aiming to achieve.

All in all, it's about doing the work better and building a better world.

Trends

There is greater emphasis on training and upgrading of ironworkers (reinforcing). There is also a greater awareness of safety and safer working conditions and an increased emphasis on job coordination and scheduling. Also, there have been significant changes in the engineering and technology of ironworker (reinforcing) tools and equipment such as laser levels and electronic measuring instruments.

Task 1 Interprets occupational documentation.

Related Components (including, but not limited to)

Drawings (structural, architectural, mechanical, engineering, detail and layout), codes (American National Standards Institute [ANSI], Canadian Standards Association [CSA], Concrete Reinforcing Steel Institute [CRSI], Reinforcing Steel Institute of Canada [RSIC], Post Tensioning Institute [PTI], American Society of Testing and Materials [ASTM] and WHMIS), specifications, shipping documentation, manufacturers' manuals and OH&S legislation.

Tools and Equipment

Architectural scales, calculator, measuring tape.

Sub-task A-1.01 Interprets drawings and specifications.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-1.01.01	knowledge of types of drawings such as placement drawings, structural drawings, architectural drawings and bar list fabrication
A-1.01.02	knowledge of welding symbols
A-1.01.03	knowledge of abbreviations and technical vocabulary
A-1.01.04	knowledge of drafting techniques
A-1.01.05	ability to interpret drawing symbols

A-1.01.06	ability to correlate types of drawings such as structural drawings, architectural drawings, engineering drawings, detail drawings and erection drawings
A-1.01.07	ability to distinguish types of views
A-1.01.08	ability to relate drawings to worksite

Sub-task

A-1.02 Interprets standards, regulations and procedures.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-1.02.01	knowledge of standards such as CSA, ANSI, CRSI, RSIC, PTI and ASTM
A-1.02.02	knowledge of regulations such as OH&S Act, WHMIS, fall protection, mobile equipment and confined space
A-1.02.03	knowledge of the location of standards, regulations and procedures
A-1.02.04	ability to apply welding, assembly, placing, hoisting, post-tensioning and grouting procedures
A-1.02.05	ability to apply written work procedures

Task 2 — Communicates in the workplace.

Related Components (including, but not limited to)	Manufacturers' documentation, manuals, record books.
Tools and Equipment	Communication devices (fax, cellular phone, telephone, photocopier, computer, cameras, headsets, two-way radios, printers), flags, signage.

Sub-task

A-2.01 Communicates with co-workers.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-2.01.01	knowledge of types of communication
A-2.01.02	knowledge of interpersonal communication techniques
A-2.01.03	knowledge of trade vocabulary
A.2.01.04	knowledge of barriers to communication
A.2.01.05	ability to write clearly and concisely
A.2.01.06	ability to actively listen
A.2.01.07	ability to check to confirm understanding

Sub-task

A-2.02 Communicates with others.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-2.02.01	knowledge of job-related terminology
A-2.02.02	knowledge of report formats
A-2.02.03	ability to actively listen

A-2.02.04	ability to translate technical terms into layperson language
A-2.02.05	ability to address others' concerns
A-2.02.06	ability to write reports in prescribed formats
A-2.02.07	ability to check to confirm understanding

Sub-task

A-2.03 Communicates with apprentices.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-2.03.01	knowledge of capability of apprentice
A-2.03.02	ability to listen, teach, coach and mentor
A-2.03.03	ability to supervise
A-2.03.04	ability to assess and record ongoing progress

Sub-task

A-2.04 Uses hand signals.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-2.04.01	knowledge of types of signals such as crane signals
A-2.04.02	knowledge of hand signals
A-2.04.03	knowledge of signal terminology
A-2.04.04	ability to select types of signals
A-2.04.05	ability to interpret signals
A-2.04.06	ability to select signals for type of equipment

Sub-task

A-2.05 Communicates electronically.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-2.05.01	knowledge of types of electronic communication devices such as cellular/smart phones, two-way radios, andlap-top computers and tablets
A-2.05.02	knowledge of communication protocols and company reporting policies
A-2.05.03	ability to operate electronic communication devices
A-2.05.04	ability to send, receive and retrieve information from computers
A-2.05.05	ability to communicate through two-way radios and cellular phones

Task 3 Uses and maintains tools and equipment.

Related Components (including, but not limited to) Manufacturers' manuals, cleaning supplies, lubricating supplies.

Tools and Equipment See Appendix A.

Sub-task

A-3.01 Uses hand tools and measuring equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.01.01	knowledge of types and uses of hand tools
A-3.01.02	knowledge of hand tool safety
A-3.01.03	knowledge of manufacturers' specifications on the use and care of hand tools
A-3.01.04	knowledge of types of measuring equipment

A-3.01.05	ability to select hand tools required for a task
A-3.01.06	ability to identify damaged, worn or otherwise unsafe hand tools
A-3.01.07	ability to clean and store hand tools
A-3.01.08	ability to maintain hand tools

Sub-task

A-3.02 Uses surveying equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.02.01	knowledge of types of layout instruments such as theodolite, transit, scales, laser level and builders level
A-3.02.02	knowledge of measurement techniques
A-3.02.03	knowledge of blueprint interpretation
A-3.02.04	knowledge of marking techniques
A-3.02.05	ability to select equipment for a task
A-3.02.06	ability to calculate angles and distances
A-3.02.07	ability to transfer blueprint information to site
A-3.02.08	ability to set up and check calibration of equipment
A-3.02.09	ability to store surveying equipment

Sub-task

A-3.03 Uses power tools.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.03.01	knowledge of types and uses of power tools such as pneumatic, electric, gas powered and hydraulic
A-3.03.02	knowledge of power tool components
A-3.03.03	knowledge of operating procedures for power tools
A-3.03.04	knowledge of power tool safety

A-3.03.05	knowledge of manufacturers' recommended uses, limitations and maintenance of power tools
A-3.03.06	ability to select power tools required for a task
A-3.03.07	ability to identify damaged, worn or otherwise unsafe power tools
A-3.03.08	ability to clean and store power tools
A-3.03.09	ability to maintain power tools

Sub-task

A-3.04 Uses bending tools and equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.04.01	knowledge of types and uses of bending equipment
A-3.04.02	knowledge of manufacturers' recommended uses and limitations
A-3.04.03	knowledge of potential hazards and safety issues
A-3.04.04	ability to select bending equipment
A-3.04.05	ability to set up and check calibration of bending equipment
A-3.04.06	ability to identify damaged, worn or otherwise unsafe bending equipment

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Sub-task

A-3.05 Uses aerial work platforms.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.05.01	knowledge of types and uses of aerial work platforms
A-3.05.02	knowledge of aerial work platform safety
A-3.05.03	knowledge of aerial work platform regulations and certification requirements
A-3.05.04	knowledge of aerial work platform components and accessories
A-3.05.05	knowledge of operating procedures of aerial work platforms
A-3.05.06	knowledge of manufacturers' specifications for use of aerial work platforms

A-3.05.07	ability to identify damaged, worn or otherwise unsafe aerial work platforms and equipment
A-3.05.08	ability to position aerial work platforms
A-3.05.09	ability to store aerial work platforms

Sub-task

A-3.06 Uses ladders.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.06.01	knowledge of types and uses of ladders
A-3.06.02	knowledge of safe operating procedures for ladders
A-3.06.03	knowledge of manufacturers' specifications for use and care of ladders
A-3.06.04	ability to position ladders
A-3.06.05	ability to secure ladders
A-3.06.06	ability to dismantle and store ladders
A-3.06.07	ability to identify damaged, worn or otherwise unsafe ladders

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Sub-task

A-3.07 Uses scaffolding.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.07.01	knowledge of regulations pertaining to scaffolding
A-3.07.02	knowledge of types of scaffolding
A-3.07.03	knowledge of installation and dismantling procedures
A-3.07.04	knowledge of manufacturers' recommended uses and limitations of scaffolding
A-3.07.05	ability to position, level and erect scaffolding and install planking, guardrails and toe plates

A-3.07.06	ability to secure scaffolding, planking, guardrails, toe plates and related components
A-3.07.07	ability to dismantle and store scaffolding
A-3.07.08	ability to identify damaged, worn or otherwise unsafe scaffolding and planking

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Sub-task

A-3.08 Uses personal protective equipment (PPE).

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.08.01	knowledge of types and uses of PPE such as hard hats, safety glasses, hearing protection, high-visibility clothing, welding PPE, safety footwear and fall arrest equipment
A-3.08.02	knowledge of PPE safety
A-3.08.03	knowledge of manufacturers' recommended uses, limitations and maintenance of PPE
A-3.08.04	knowledge of workplace rules and regulations
A-3.08.05	ability to select PPE for conditions encountered
A-3.08.06	ability to use fall protection equipment such as harnesses, safety belts (double D rings), belly/work positioning hooks and safety lines
A-3.08.07	ability to identify damaged, worn or otherwise unsafe PPE
A-3.08.08	ability to store PPE

Sub-task

A-3.09 Uses welding equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	no	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.09.01	knowledge of provincial/territorial and applicable welding regulations
A-3.09.02	knowledge of Canadian Welding Bureau (CWB) standards and CSA
A-3.09.03	knowledge of welding processes and procedures

A-3.09.04 knowledge of welding symbols
A-3.09.05 knowledge of welding hazards
A-3.09.06 knowledge of welding equipment
A-3.09.07 knowledge of welding consumables
A-3.09.08 knowledge of welding defects
A-3.09.09 ability to set up welding equipment
A-3.09.10 ability to perform welding processes
A-3.09.11 ability to adjust welding parameters to suit site conditions
A-3.09.12 ability to identify damaged, worn or otherwise unsafe welding equipment
A-3.09.13 ability to store welding equipment

Sub-task

A-3.10 Uses oxy-fuel cutting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-3.10.01 knowledge of cutting processes
A-3.10.02 knowledge of cutting equipment
A-3.10.03 knowledge of cutting consumables
A-3.10.04 ability to set up equipment
A-3.10.05 ability to inspect equipment
A-3.10.06 ability to adjust cutting parameters
A-3.10.07 ability to recognize cutting hazards
A-3.10.08 ability to identify damaged, worn or otherwise unsafe cutting equipment
A-3.10.09 ability to store cutting equipment and consumables

Task 4 — Organizes work.

Related Components (including, but not limited to)	Company standards, safety manuals, company policies, procedures and regulations, schedules/calendars, drawings, specifications.
Tools and Equipment	See Appendix A.

Sub-task

A-4.01 Organizes materials and supplies.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-4.01.01	knowledge of placing and assembly
A-4.01.02	knowledge of equipment capabilities and limitations
A-4.01.03	knowledge of site preparation
A-4.01.04	knowledge of shipping documentation
A-4.01.05	knowledge of storage principles
A-4.01.06	knowledge of types of materials and their identification requirements
A-4.01.07	ability to schedule material and supplies required for job
A-4.01.08	ability to unload materials
A-4.01.09	ability to place and sort materials and supplies
A-4.01.10	ability to reconcile load with shipping documents
A-4.01.11	ability to secure equipment and materials

Sub-task

A-4.02 Marks layouts.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-4.02.01	knowledge of drawings
A-4.02.02	ability to interpret drawings
A-4.02.03	ability to use measuring devices and layout tools
A-4.02.04	ability to apply marking and layout techniques
A-4.02.05	ability to visualize finished product
A-4.02.06	ability to transfer drawing information to accommodate site conditions

Sub-task

A-4.03 Maintains safe work environment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-4.03.01	knowledge of safety regulations
A-4.03.02	knowledge of building codes
A-4.03.03	knowledge of applications of safety equipment such as fall arrest, fall restraint and work positioning
A-4.03.04	knowledge of safe work practices and limitations
A-4.03.05	ability to apply safety standards applicable to workplace
A-4.03.06	ability to install safety equipment such as guardrails, static lines, lifelines, screens, temporary flooring, warning signs and barriers
A-4.03.07	ability to maintain good housekeeping

Sub-task

A-4.04 Assesses site hazards.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-4.04.01	knowledge of policies and procedures
A-4.04.02	knowledge of codes and regulations
A-4.04.03	ability to recognize hazards such as floor openings, leading edges, and obstructions, temporary supports, dowels, and chemical/corrosive/UV environments
A-4.04.04	ability to control hazards
A-4.04.05	ability to perform and document a JHA or a task hazard analysis (THA)

Sub-task

A-4.05 Plans work tasks.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

A-4.05.01	knowledge of procedures, specifications and drawings
A-4.05.02	ability to interpret specifications and drawings
A-4.05.03	ability to improvise to suit site conditions
A-4.05.04	ability to maintain schedule
A-4.05.05	ability to select materials and supplies required for task
A-4.05.06	ability to select equipment and tools required for task

Trends The occupation has seen an increase in the development and deployment of new technologies such as specialty rigging and the use of synthetic materials.

Task 5 Selects rigging equipment.

Related Components (including, but not limited to) Charts, working load limits, safety factors, rigging capacities.

Tools and Equipment Chokers, slings, chains, hooks, shackles, thimbles, guy lines, clips, wire rope, spreader, equalizer, Tirfor® (cable puller), come-along, fibre rope, blocks, softeners, turn buckles, tugger, tag lines.

Also see Appendix A

Sub-task

B-5.01 Matches load to lift capability.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-5.01.01 knowledge of types of lifting equipment
B-5.01.02 knowledge of the capacity of lifting equipment
B-5.01.03 knowledge of basic geometry
B-5.01.04 knowledge of weights and measures
B-5.01.05 ability to calculate weights of loads
B-5.01.06 ability to select rigging equipment
B-5.01.07 ability to calculate choker tension based on choker angle and load

Sub-task

B-5.02 Inspects rigging equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-5.02.01 knowledge of types of rigging equipment
B-5.02.02 knowledge of manufacturers' specifications
B-5.02.03 knowledge of policies and procedures
B-5.02.04 knowledge of tools and materials
B-5.02.05 ability to identify defects and damage
B-5.02.06 ability to report defects and damage

Sub-task

B-5.03 Maintains rigging equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-5.03.01 knowledge of types of rigging equipment
B-5.03.02 knowledge of manufacturers' specifications
B-5.03.03 knowledge of policies and procedures
B-5.03.04 knowledge of tools and materials
B-5.03.05 ability to perform maintenance procedures
B-5.03.06 ability to store rigging equipment

Task 6 — Uses hoisting and lifting equipment.

Related Components (including, but not limited to)	Load charts, lift diagrams, working load limits, safety factors, fabricated members and construction materials.
Tools and Equipment	Hooks, clips, headache ball, wire rope, Tirfor® (cable puller), come-along, fibre rope, blocks, tugger, tag lines, wedge socket (beckett), hydraulic jacks, chain fall, telehandler, derricks, mobile equipment, cranes. Also see Appendix A.

Sub-task

B-6.01 Uses hoisting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-6.01.01	knowledge of provincial/territorial and applicable regulations and certification requirements
B-6.01.02	knowledge of types of hoisting equipment such as come-alongs, Tirfors® (cable pullers), chain block hoists and tuggers, telehandlers and cranes
B-6.01.03	knowledge of anchorage locations and capabilities
B-6.01.04	knowledge of policies and procedures
B-6.01.05	ability to select hoisting equipment
B-6.01.06	ability to select anchorage locations
B-6.01.07	ability to follow manufacturers' specifications
B-6.01.08	ability to participate in engineered (critical) lifts

Sub-task

B-6.02 Uses lifting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-6.02.01 knowledge of types of lifting equipment

B-6.02.02 knowledge of policies and procedures

B-6.02.03 ability to select lifting equipment

B-6.02.04 ability to follow manufacturers' specifications and recommendations

Sub-task

B-6.03 Attaches rigging to load.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

B-6.03.01 knowledge of hoisting procedures such as engineer's plan and tandem lift

B-6.03.02 knowledge of placement and attachment location

B-6.03.03 knowledge of hoisting specifications

B-6.03.04 ability to follow lifting procedures

B-6.03.05 ability to use and tie knots, bends and hitches

B-6.03.06 ability to follow rigging procedures

B-6.03.07 ability to use rigging equipment

Trends

Modern cranes have greater lifting capacity and are more precise in the positioning of their loads, often within millimetres of specifications. The erection of cranes has also become more automatic, with modern cranes greatly assisting in their own assembly.

Task 7 Selects, assembles and erects cranes and components.

Related Components (including, but not limited to)

Mats, pads, dunnage, boom sections and jib, counterweight, pins and cotter pins, bolts, blocks and sheaves, headache ball, clips, hook, anti-two block, wedge socket, mast, outriggers, gantry, cable components (pendant lines, jib lines, guide lines, load lines).

Tools and Equipment

Types of cranes (assist cranes, rough terrain cranes, all terrain, crawler, hydraulic, tower, boom truck, electric overhead travelling [EOT], heavy lift, gantries, knuckle boom) and specialty heavy lift components.

Also see Appendix A.

Sub-task

C-7.01 Assesses crane site limitations.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

C-7.01.01	knowledge of types of hazards such as overhead power lines, underground services, ground conditions, other workers and obstructions to swing radius
C-7.01.02	knowledge of swing area (radius) of crane
C-7.01.03	knowledge of crane limitations due to inclement weather
C-7.01.04	ability to calculate crane radius
C-7.01.05	ability to identify potential hazards
C-7.01.06	ability to read load charts
C-7.01.07	ability to minimize overhead dangers

Sub-task

C-7.02 Determines crane position.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

C-7.02.01 knowledge of crane types

C-7.02.02 knowledge of crane capacity

C-7.02.03 knowledge of crane radius

C-7.02.04 knowledge of maximum weight of lifts

C-7.02.05 knowledge of crane limitations due to inclement weather

C-7.02.06 ability to determine weights of components

C-7.02.07 ability to calculate the available headroom

C-7.02.08 ability to select crane for required task

Sub-task

C-7.03 Erects cranes and components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

C-7.03.01 knowledge of sequence of assembly

C-7.03.02 knowledge of crane components such as boom sections, counterweights and jibs

C-7.03.03 knowledge of crane signals

C-7.03.04 knowledge of tools used in assembly of cranes components

C-7.03.05 knowledge of safe rigging practices

C-7.03.06 ability to ensure adequate space for assembly

C-7.03.07 ability to install components

C-7.03.08 ability to reeve/lace blocks

C-7.03.09 ability to participate in engineered (critical) lifts

Task 8 — Disassembles cranes.

Related Components (including, but not limited to)	Mats, pads, dunnage, boom sections and jib, counterweight, pins and cotter pins, bolts, blocks and sheaves, headache ball, clips, hook, anti-two block, wedge socket, mast, outriggers, gantry, cable components (pendant lines, jib lines, guide lines, load lines).
Tools and Equipment	Types of cranes (assist cranes, rough terrain cranes, all terrain, crawler, hydraulic, tower, boom truck, electric overhead travelling [EOT], heavy lift, gantries, knuckle boom) and specialty heavy lift components. Also see Appendix A.

Sub-task

C-8.01 Disassembles crane components.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

C-8.01.01	knowledge of method of disassembly
C-8.01.02	knowledge of sequence of disassembly
C-8.01.03	knowledge of equipment and tools required for task
C-8.01.04	knowledge of rigging
C-8.01.05	ability to recognize hazards of disassembly such as tensioned pins and overloads
C-8.01.06	ability to disconnect components
C-8.01.07	ability to rig crane components
C-8.01.08	ability to block boom sections

Sub-task

C-8.02 Prepares crane and components for transport.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	no	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

C-8.02.01	knowledge of safe rigging practices
C-8.02.02	knowledge of jurisdictional transportation regulations
C-8.02.03	ability to select type of rigging
C-8.02.04	ability to place and secure components on transportation deck

Trends

The occupation has seen the increased development and use of composite materials such as stainless steel. New technologies are being developed and introduced to the occupation allowing for greater automation such as automated benders and tiers. More intricate and elaborate, non-linear building design has led to an increase in creative and innovative reinforcing techniques. The occupation has also seen an increase in the demand for compliance to new seismic codes.

Task 9 Fabricates on-site.

Related Components (including, but not limited to)

Rebar, welded wire mesh fabric, composite materials, tie wire, bar supports (bolsters, chairs and concrete blocks), dunnage, coupling devices.

Tools and Equipment

See Appendix A.

Sub-task

D-9.01 Cuts material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

D-9.01.01	knowledge of reinforcing material such as rebar, welded wire mesh fabric and composite materials
D-9.01.02	knowledge of material specifications
D-9.01.03	knowledge of cutting techniques
D-9.01.04	ability to measure and mark material for cutting
D-9.01.05	ability to use cutting equipment

Sub-task

D-9.02 Bends material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

D-9.02.01	knowledge of reinforcing material such as rebar and welded wire mesh fabric
D-9.02.02	knowledge of material specifications
D-9.02.03	knowledge of bending techniques
D-9.02.04	ability to measure and mark material for bending
D-9.02.05	ability to maintain bend standards

Task 10 Installs reinforcing material.

Related Components (including, but not limited to)	Rebar, welded wire mesh fabric, composite materials, tie wire, bar supports (bolsters, chairs and concrete blocks).
Tools and Equipment	Hand tools (sledge hammer, pliers, cutters, measuring tape, chalk, shears, bolt cutters, hickey), quick-cut saws, power wrench, pneumatic gun, portable grinder, rebar bender, power bender, hammer drill, rigging equipment, cutting torch, come-alongs, wire reel, work positioning hook, fall arrest equipment, belly, hack saw. Also see Appendix A.

Sub-task

D-10.01 Places reinforcing material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

D-10.01.01	knowledge of reinforcing material such as rebar, welded wire mesh fabric and composite materials
D-10.01.02	knowledge of installation sequencing such as laying out and placing ties and supports
D-10.01.03	knowledge of pre-assembly and pre-fabrication procedures
D-10.01.04	ability to apply manual and mechanical lifting and carrying techniques
D-10.01.05	ability to place material within tolerances
D-10.01.06	ability to apply covers as per specifications

Sub-task

D-10.02 Ties material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

D-10.02.01	knowledge of types of wire ties such as figure-8, snap tie and saddle tie
D-10.02.02	knowledge of tying specifications
D-10.02.03	knowledge of tying tools and equipment
D-10.02.04	knowledge of tying sequence
D-10.02.05	ability to select wire type and gauge depending on application
D-10.02.06	ability to tie variety of ties such as figure-8, snap tie and double wire tie depending on the application

Sub-task

D-10.03 Joins material.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

D-10.03.01	knowledge of CSA and applicable welding regulations
D-10.03.02	knowledge of welding techniques
D-10.03.03	knowledge of splicing techniques
D-10.03.04	knowledge of mechanical splicing and coupling techniques
D-10.03.05	knowledge of specialty anchoring systems and their installation
D-10.03.06	ability to select joining tools and equipment
D-10.03.07	ability to operate joining tools and equipment

BLOCK E PRE-STRESSES/POST-TENSIONS

Trends

The occupation has seen an increase in the use of composite materials resulting in changes to the pre-stressed and post-stressed tensioning systems. An increased awareness of environmental concerns has resulted in the development of new handling techniques and procedures. Due to the aging of major structures nationwide, the occupation continues to see an increase in repair and restoration. Advancements in technology have allowed for the construction of longer spans and larger open spaces.

Task 11 Places pre-stressed/post-tensioning systems.

Related Components (including, but not limited to)

Bulkheads, coils, anchors (barrel, cable), pocket former, cable tendons, bar tendons, dead heads, trumpets, trumplates, wedges, wedge plates, blocks, duct, duct tape, bursting steel components, couplers, bearing plate, grout.

Tools and Equipment

Measuring tape, marking tools (crayons, soapstone, pencil), threaded rod, nuts, bolts, setting tools, grease, caulking, carousel, cable feeder, hammer, heat shrink, cutting tools, drill bits, pliers, wrenches, sockets, tie wire, knife, tiger torch, winches, air tugger, strand pushers.

Also see Appendix A.

Sub-task

E-11.01 Lays out profile.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-11.01.01 knowledge of types of pre-stressed/post-tensioning systems such as bonded, and un-bonded, mono-strand and multi-strand

E-11.01.02 knowledge of pre-stressed/post-tensioning materials such as duct, strand, bar and anchors

E-11.01.03 knowledge of pre-stressed/post-tensioning installation practices

E-11.01.04 knowledge of placement tolerances of tendons, anchors and supports

E-11.01.05 knowledge of benchmarks and elevations

E-11.01.06 ability to lay out anchorage and tendon position

Sub-task

E-11.02 Places tendons and accessories.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-11.02.01 knowledge of types of pre-stressed/post-tensioning systems such as bonded, and un-bonded, mono-strand and multi-strand

E-11.02.02 knowledge of pre-stressed/post-tensioning materials such as strand, bar and anchors

E-11.02.03 knowledge of pre-stressed/post-tensioning installation and storage practices

E-11.02.04 knowledge of pre-stressed/post-tensioning installation sequences

E-11.02.05 knowledge of tolerances

E-11.02.06 ability to position tendons and accessories

E-11.02.07 ability to secure tendons and accessories

E-11.02.08 ability to recognize and repair damage to ducts and tendons

E-11.02.09 ability to operate winching equipment

Sub-task

E-11.03 Installs bursting steel and anchorages.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-11.03.01 knowledge of types of bursting steel

E-11.03.02 knowledge of types of anchorages

E-11.03.03 knowledge of types of components such as blocks, wedges, anchors and coils

E-11.03.04 knowledge of bursting steel and anchorage installation procedures and placing tolerances

E-11.03.05 ability to place, modify and tie bursting steel

E-11.03.06 ability to install anchorages

Sub-task

E-11.04 Connects tendons to anchors.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-11.04.01 knowledge of types of anchors such as barrel (trumpet) and cable

E-11.04.02 knowledge of types of tendons

E-11.04.03 knowledge of tendon and anchor connection procedures

E-11.04.04 knowledge of fastening techniques

E-11.04.05 ability to install anchors

E-11.04.06 ability to secure wedges

Sub-task

E-11.05 Protects exposed tendons.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-11.05.01 knowledge of tendon protection materials such as duct tape, heat shrink and grease/caulking

E-11.05.02 knowledge of protection techniques

E-11.05.03 knowledge of potential contaminants

E-11.05.04 ability to select tendon protection material

E-11.05.05 ability to identify and correct faults

E-11.05.06 ability to install tendon protection materials

Task 12 Stresses tendons.

Related Components (including, but not limited to)	Stressing plates, caps, tendons, ducts, anchorage, blocks, wedges, lock nuts, bars.
Tools and Equipment	See Appendix A.

Sub-task

E-12.01 Sets up stressing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-12.01.01	knowledge of types of stressing equipment
E-12.01.02	knowledge of stressing sequence
E-12.01.03	knowledge of limitations of equipment
E-12.01.04	knowledge of power supplies
E-12.01.05	ability to position equipment
E-12.01.06	ability to connect components
E-12.01.07	ability to inspect equipment

Sub-task

E-12.02 Tensions tendons.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-12.02.01	knowledge of stressing sequence and procedures
E-12.02.02	knowledge of standards and specifications of stressing equipment
E-12.02.03	knowledge of potential deficiencies of tendons

E-12.02.04 knowledge of tolerance
E-12.02.05 knowledge of tendon locking methods
E-12.02.06 ability to connect stressing equipment to tendons
E-12.02.07 ability to operate stressing equipment
E-12.02.08 ability to document elongation and gauge reading

Sub-task

E-12.03 Cuts and caps tendons.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-12.03.01 knowledge of standards and procedures
E-12.03.02 knowledge of cutting methods
E-12.03.03 knowledge of capping methods
E-12.03.04 ability to operate cutting equipment
E-12.03.05 ability to secure caps to anchors

Sub-task

E-12.04 Removes stressing equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-12.04.01 knowledge of dismantling and disconnecting procedures
E-12.04.02 knowledge of storage procedures
E-12.04.03 knowledge of methods of disconnecting equipment from tendons
E-12.04.04 ability to troubleshoot hung up jack
E-12.04.05 ability to disconnect equipment from tendons
E-12.04.06 ability to clean and maintain equipment
E-12.04.07 ability to store equipment

Sub-task

E-12.05 De-stresses tendons.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-12.05.01	knowledge of engineered procedures and specifications
E-12.05.02	knowledge of methods of restricting access to work zones
E-12.05.03	knowledge of possible structure failure during de-stressing procedure
E-12.05.04	ability to identify and rectify potential hazards such as equipment failure, material failure and danger zones

Task 13 Grouts tendons.

Related Components (including, but not limited to)	Grout, water, admixtures, grout tubes and caps, tie wire, duct tape.
Tools and Equipment	Compressor, air compressors, hand tools, cleaning equipment (scrapers, wire brushes, hammers), PPE (respirators, rubber gloves, goggles, protective clothing), grouting machine, hoisting and rigging equipment, buckets, safety barriers, screens, hoses (grout, air, water), generator, power cords, knife, grease gun, communication equipment, tarps. Also see appendix A.

Sub-task

E-13.01 Sets up grouting equipment.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-13.01.01	knowledge of types of grouting equipment
E-13.01.02	knowledge of grouting procedures
E-13.01.03	knowledge of equipment inspection procedures
E-13.01.04	knowledge of types of testing equipment
E-13.01.05	knowledge of material storage procedures
E-13.01.06	ability to organize material and equipment
E-13.01.07	ability to clean and maintain equipment
E-13.01.08	ability to troubleshoot grouting systems
E-13.01.09	ability to test systems and equipment

Sub-task

E-13.02 Installs grouts.

NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU
NV	yes	yes	yes	NV	yes	ND	yes	yes	yes	ND	ND	ND

Supporting Knowledge and Abilities

E-13.02.01	knowledge of grouting procedures
E-13.02.02	knowledge of measuring quantities and ratios
E-13.02.03	knowledge of types of grouting equipment
E-13.02.04	knowledge of environmental concerns of grouting
E-13.02.05	knowledge of sequence of mixing
E-13.02.06	knowledge of cleaning and maintaining procedures
E-13.02.07	ability to identify and rectify obstructions in ducts and hoses
E-13.02.08	ability to operate grouting equipment
E-13.02.09	ability to maintain grouting equipment
E-13.02.10	ability to use precision instruments to set machines

APPENDICES

Safety Equipment

air movers (fans)
anchor points
cables
eye wash facilities
fire blankets
fire extinguishers
first aid equipment
fume and toxic gas detector
guard rails
life lines
perimeter cables
portable lighting
ropes (fibre, wire)
safety barriers
screens
signage
stanchion posts
warning tape
welding flash screens

Personal Protective Equipment (PPE)

breathable air pack
belly/work positioning hook
chin straps
coveralls (fire retardant)
ear plugs
face shields
fall arresters
full body harness
gloves
goggles
hard hat
insulated gloves
knee pads
lock-out kit
respirators
retractable lanyard
rope grabs
rubber gloves
safety belt
safety belt (double D rings)
safety glasses
safety vest
steel toe boots
welding apron
welding gloves
welding helmet
welding jacket
welding shield

Hand Tools

adjustable wrench
aligning bar (sleever bar)
Allen key set
B&O hammer
bar clamps
beam clamps
bolt bag
bolt cutters
button pump
cable cutters
centre punch
chalk line
chipping hammer
cold chisel
combination square
combination wrench set
drill bits
files
finger clamps
flashlight
grease gun
hack saw
hammers
hickey bar

Hand Tools (continued)

hoses (water, air, grout)
knives
knocker wrench
marlinspike
measuring tape
needle nose pliers
nut drivers
pins (drift, bull)
pipe cutters
pipe wrench
pliers
prybar
punch
reamers
reel holder
rod bag
scrapers
screwdrivers — Robertson; Phillips, flat blades
shears
side/diagonal cutters
sledge hammer
slip joint pliers
socket set
spud wrench
tap set
tarps
tie wire reel
tin snips
tool belt
tool bucket
wire brush

Power Tools and Equipment

air chisel
band saw
chop saw
circular saw
compressor
disk
electric hacksaw
gas cut-off saw
gas deck saw
generator
grinder
grouting machine
hammer drill
hydraulic jacks (and accessories)
impact drill
impact gun
mag drill
peening tool
pencil grinder
percussion drill
pneumatic gun
porta band
powder-actuated tool
power bender
power cords
power drill
power wrench
reciprocating saw
rivet buster
riveting gun
strand pusher
tension control gun

Measuring and Layout Equipment

bevel squares
builders level
chalk
chalk line
crayon
distometers
laser level
laser square
measuring chain
measuring tape
micrometers
optical levels
paint pen
pencil
piano wire
plumb line
prism
rod level
scale
soapstone
spirit levels
spraypaint
squares (framing, combination)
straight edges
string line
theodolite
total station
torpedo level
transit
tripods
vernier
water level

Specialty Tools and Equipment (Welding and Cutting Tools)

air lance
arc air (gouger)
arc welding machine
chipping hammer
cutting tools (oxygen, acetylene, propane)
MIG welder
plasma cutter
radiograph
stud welding equipment
stud welding gun
submerged arc machine
thermal cutting machine
thermite welding machine
tiger torch

Scaffolding and Access Equipment

aerial work platforms
aluminium framed platform
aluminium planks
boom lifts
bosun chair
electrical articulated boom lift
electrical scissor lifts
electrical vertical lifts
end frames
extension ladder
floats (angel's wings)
gas powered articulated boom lift
gas powered scissor lifts
ladder jack scaffolds
ladders
mechanical scaffolds
ramps
rolling scaffolds
sawhorses
scissor-lift
stationary scaffolds
stepladders
swing stages
temporary access/freight elevator
tube and clamps

Rigging Equipment

balance beam
beam clamps
binders
blocks
bridle hitch
cable clamps
chain
chain falls
clips
come-alongs
dunnage
equalizer beam
eye bolts
fibre rope
guy lines
hooks
mechanical/hydraulic jacks
multi-bearing rollers
multiple-leg bridle sling
ring and lines
rope clips
shackles
sheaves
simple roller
softeners
spreader beam
spreaders
swivel
synthetic slings
tackle blocks
tag lines
thimbles
Tirfor® (cable puller)
tugger
turnbuckles
Vernier calipers
wedge sockets
winches
wire rope
wire rope slings

Handling Equipment

boom trucks
cradle
forklifts (telescopic, electric, gas powered)
glass cups
multi-bearing rollers
pallet jack
power cups
rollers
stretcher
tugger

Pre-stresses/Post-tensioning Equipment

cable feeder
carousel
caulking
centre-hole jack
de-tensioning stool
duct tape
gauges
grease
grout machine
heat shrink
knife
mono-strand jack
multi-strand jack
pocket shear
pump
seating tools
sheath cutting tool
troubleshooting anchor

APPENDIX B GLOSSARY

accessories	items used in conjunctions with reinforcing steel such as bar chairs, slab bolsters, etc.
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 iron products	any steel product or component that is not main structural supporting member
ornamental components	non-structural steel, precast or composite members

APPENDIX C ACRONYMS

ANSI	American National Standards Institute
ASTM	American Society of Testing and Materials
CRSI	Concrete Reinforcing Steel Institute
CSA	Canadian Standards Association
CWB	Canadian Welding Bureau
JHA	Job hazard analysis
OH&S	Occupational Health and Safety
PPE	Personal protective equipment
PTI	Post Tensioning Institute
RSIC	Reinforcing Steel Institute of Canada
THA	Task hazard analysis
WHMIS	Workplace Hazardous Materials Information System

APPENDIX D BLOCK AND TASK WEIGHTING

BLOCK A OCCUPATIONAL SKILLS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	20	20	19	NV	12	ND	5	18	18	ND	ND	ND	16%

Task 1 Interprets occupational documentation.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	37	20	40	NV	20	ND	30	35	30	ND	ND	ND	32%

Task 2 Communicates in the workplace.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	20	30	15	NV	10	ND	15	10	10	ND	ND	ND	14%

Task 3 Uses and maintains tools and equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	18	30	25	NV	50	ND	20	45	30	ND	ND	ND	31%

Task 4 Organizes work.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	25	20	20	NV	20	ND	35	10	30	ND	ND	ND	23%

BLOCK B RIGGING AND HOISTING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	20	20	26	NV	27	ND	20	20	25	ND	ND	ND	23%

Task 5 Selects rigging equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	50	50	50	NV	40	ND	60	50	50	ND	ND	ND	50%

Task 6 Uses hoisting and lifting equipment.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	50	50	50	NV	60	ND	40	50	50	ND	ND	ND	50%

BLOCK C CRANES

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	5	0	5	NV	6	ND	5	10	5	ND	ND	ND	5%

Task 7 Selects, assembles and erects cranes and components

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	70	0	80	NV	57	ND	60	70	75	ND	ND	ND	69%

Task 8 Disassembles cranes.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	30	0	20	NV	43	ND	40	30	25	ND	ND	ND	31%

BLOCK D REINFORCING

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	50	50	45	NV	50	ND	60	45	35	ND	ND	ND	48%

Task 9 Fabricates on-site.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	30	30	25	NV	17	ND	20	10	30	ND	ND	ND	23%

Task 10 Installs reinforcing material.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	70	70	75	NV	83	ND	80	90	70	ND	ND	ND	77%

BLOCK E PRE-STRESSES/POST-TENSIONS

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	National Average
%	NV	5	10	5	NV	5	ND	10	7	17	ND	ND	ND	8%

Task 11 Places pre-stressed/post-tensioning systems.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	50	40	50	NV	35	ND	40	45	60	ND	ND	ND	46%

Task 12 Stresses tendons.

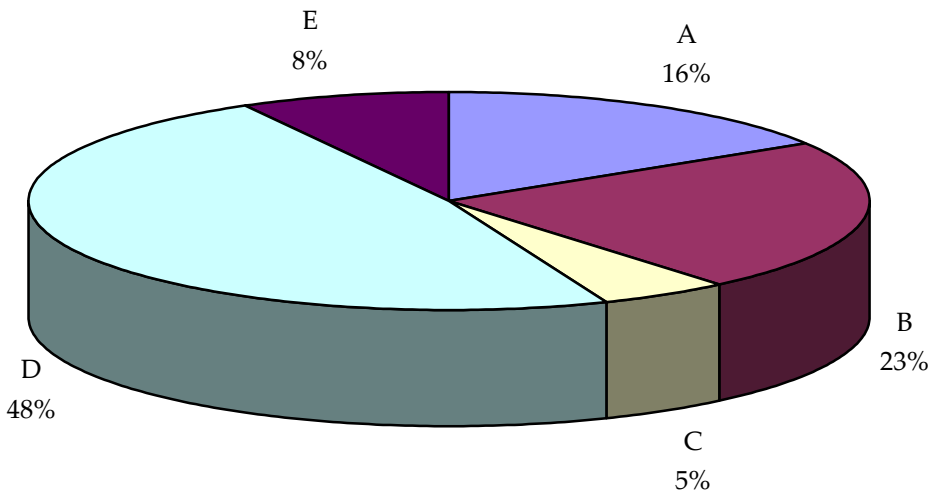
	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	40	40	49	NV	35	ND	40	35	30	ND	ND	ND	38%

Task 13 Grouts tendons.

	NL	NS	PE	NB	QC	ON	MB	SK	AB	BC	NT	YT	NU	
%	NV	10	20	1	NV	30	ND	20	20	10	ND	ND	ND	16%

APPENDIX E

PIE CHART*



TITLES OF BLOCKS

BLOCK A	Occupational Skills	BLOCK D	Reinforcing
BLOCK B	Rigging and Hoisting	BLOCK E	Pre-Stresses/Post-Tensions
BLOCK C	Cranes		

*Average percentage of the total number of questions on an interprovincial examination, assigned to assess each block of the analysis, as derived from the collective input from workers within the occupation from all areas of Canada. The Interprovincial examination for this trade has 120 questions.

APPENDIX F

TASK PROFILE CHART — Ironworker (Reinforcing)

BLOCKS	TASKS	SUB-TASKS				
A - OCCUPATIONAL SKILLS	1. Interprets occupational documentation.	1.01 Interprets drawings and specifications.	1.02 Interprets standards, regulations and procedures.			
	2. Communicates in the workplace.	2.01 Communicates with co-workers.	2.02 Communicates with others.	2.03 Communicates with apprentices.	2.04 Uses hand signals.	2.05 Communicates electronically.
	3. Uses and maintains tools and equipment.	3.01 Uses hand tools and measuring equipment.	3.02 Uses surveying equipment.	3.03 Uses power tools.	3.04 Uses bending tools and equipment.	3.05 Uses aerial work platforms.
		3.06 Uses ladders.	3.07 Uses scaffolding.	3.08 Uses personal protective equipment (PPE).	3.09 Uses welding equipment.	3.10 Uses oxy-fuel cutting equipment.
	4. Organizes work.	4.01 Organizes materials and supplies.	4.02 Marks layouts.	4.03 Maintains safe work environment.	4.04 Assesses site hazards.	4.05 Plans work tasks.
B - RIGGING AND HOISTING	5. Selects rigging equipment.	5.01 Matches load to lift capability.	5.02 Inspects rigging equipment.	5.03 Maintains rigging equipment.		
	6. Uses hoisting and lifting equipment.	6.01 Uses hoisting equipment.	6.02 Uses lifting equipment.	6.03 Attaches rigging to load.		

BLOCKS	TASKS	SUB-TASKS				
C - CRANES	7. Selects, assembles and erects cranes and components.	7.01 Assesses crane site limitations.	7.02 Determines crane position.	7.03 Erects cranes and components.		
	8. Disassembles cranes.	8.01 Disassembles crane components.	8.02 Prepare crane and components for transport.			
D - REINFORCING	9. Fabricates on-site.	9.01 Cuts material.	9.02 Bends material.			
	10. Installs reinforcing material.	10.01 Places reinforcing material.	10.02 Ties material.	10.03 Joins material.		
E - PRE-STRESSES/ POST-TENSIONS	11. Places pre-stressed/post-tensioning systems.	11.01 Lays out profile.	11.02 Places tendons and accessories.	11.03 Installs bursting steel and anchorages.	11.04 Connects tendons to anchors.	11.05 Protects exposed tendons.
	12. Stresses tendons.	12.01 Sets up stressing equipment.	12.02 Tensions tendons.	12.03 Cuts and caps tendons.	12.04 Removes stressing equipment.	12.05 De-stresses tendons.
	13. Grouts tendons.	13.01 Sets up grouting equipment.	13.02 Installs grouts.			