



# **Ironworker**

## **(Structural/Ornamental)**

# **On-the-Job Training Guide**

## **2021**

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*Recognition:*

*To promote transparency and consistency, portions of this document has been adapted from the 2015 Ironworker (Structural/Ornamental) National Occupational Analysis (Employment and Social Development Canada).*

*A complete version of the Occupational Standard can be found at [www.red-seal.ca](http://www.red-seal.ca).*



# STRUCTURE OF THE ON-THE-JOB TRAINING GUIDE

To facilitate understanding of the occupation, this on-the-job training guide contains the following sections:

**Description of the Ironworker (Structural/Ornamental) trade:** an overview of the trade's duties and training requirements.

**Essential Skills Summary:** an overview of how each of the nine essential skills is applied in this trade.

**Harmonization:** a brief description on the pan-Canadian Harmonization Initiative for the Ironworker (Structural/Ornamental) trade.

**Task Matrix:** a chart which outlines graphically the major work activities, tasks and sub-tasks of this standard detailing the essential skills and the level of training where the content is covered.

**Major Work Activity (MWA):** the largest division within the standard that is comprised of a distinct set of trade activities.

**Task:** distinct actions that describe the activities within a major work activity.

**Sub-task:** distinct actions that describe the activities within a task.

**On-the-Job and In-school Training Content for the Ironworker (Structural/Ornamental) Trade:** a chart which outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for topics of technical training.

# DESCRIPTION OF THE IRONWORKER (STRUCTURAL/ORNAMENTAL) TRADE

(An overview of the trade's description, duties and training requirements)

Ironworkers (structural/ornamental) install and reinforce structural/ornamental steel components, precast structural concrete members and glued laminated timber products (glulam) in commercial, industrial, institutional and large residential buildings, towers, bridges and stadiums. They erect pre-engineered buildings, wind turbines, solar panels and ornamental ironwork such as curtain walls, metal stairways, catwalks, railings and metal doors. They also erect scaffolding, cranes, hoists and derricks on the construction site. Ironworkers (structural/ornamental) also install conveyors, machinery and automated material handling systems. They are also involved in demolition and salvage duties involving all types of construction.

They prepare the construction site by assembling the hoisting equipment. They unload structural and ornamental components and organize the material for hoisting as needed. They organize and sequence 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 blueprints using a variety of fastening methods.

Ironworkers (structural/ornamental) generally work outside in all weather, although some work indoors in manufacturing plants. They generally travel to and from the work site which may be in a variety of locations ranging from remote areas where they could be working on dams, bridges or mining projects to urban environments where they could work on high rise buildings or stadiums. 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 falls or falling objects. Ironworkers (structural/ornamental) typically work a 40-hour week; however, inclement weather such as rain, snow or high winds may shut down projects for extended periods and deadlines and priorities may involve overtime.

They are required to have good mechanical aptitude, the ability to lift heavy objects, the ability to maintain balance working at heights in varying extreme climates, a thorough knowledge of the principles of lifting, rigging and hoisting, and a familiarity with a variety of metal fastening and joining methods. They are all required to be competent in the use and care of a variety of hand and power tools and equipment such as wrenches, pry bars, torches, levelling and welding equipment. They also use crane charts and must be able to estimate and reconcile crane ability with load sizes.

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

Ironworkers (structural/ornamental) 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 (structural/ornamental) interact and work cooperatively with a wide variety of construction tradespeople such as ironworkers (reinforcing), crane operators, welders, carpenters, metal fabricators, millwrights, labourers and glaziers.

**Training Requirements:** 5400 hours and 3 years, including: two 8 week and one 7 week technical training sessions delivered by Saskatchewan Polytechnic in Moose Jaw.

Journey person to apprentice ratio for this trade is: 1:2

The information contained in this document serves as a guide for employers and apprentices. Apprenticeship training is mutually beneficial to both employer and apprentice. The employer's investment in training apprentices results in skilled and certified workers. The document summarizes the tasks to be covered by the apprentice during their on-the-job portion of apprenticeship training. An apprentice spends approximately 85% of their apprenticeship term training on-the-job.

**It is the employer's or journey person's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.**

#### **EMPLOYER TRAINING RESPONSIBILITY**

- promote safety in the workplace
- expose the apprentice to all appropriate tools and equipment
- provide guided, hands-on practice in rigging, hoisting, and crane signalling
- document hours of work and areas of work experience
- provided guided instruction setting up and dismantling various types of cranes

Employers should make every effort to expose their apprentices to work experience in as many areas of the trade as possible.

In the On-the-Job Training Guide, in-school instruction is listed first; on-the-job suggestions to help employers assist the apprentice to prepare for in-school training are listed next.

The content of the training components is subject to change without notice.

#### **Entrance Requirements for Apprenticeship Training**

Your grade twelve transcript (with no modified classes) or GED 12 is your guarantee that you meet the educational entrance requirements for apprenticeship in Saskatchewan. In fact, employers prefer and recommend apprentices who have completed high school. This ensures the individual has all of the necessary skills required to successfully complete the apprenticeship program, and receive journey person certification.

Individuals with "modified" or "general" classes in math or science do not meet our entry requirements. These individuals are required to take an entrance assessment prescribed by the SATCC.

English is the language of instruction in all apprenticeship programs and is the common language for business in Saskatchewan. Before admission, all apprentices and/or "upgraders" must be able to understand and communicate in the English language. Applicants whose first language is not English must have a minimum Canadian Language Benchmark Assessment of six (CLB6).

Note: A CLB assessment is valid for a one-year period from date of issue.

Designated Trade Name	Math Credit at the Indicated Grade Level❶	Science Credit at Grade Level
Ironworker(Structural/Ornamental)	Grade 10	Grade 10
<p>❶ - (One of the following) WA – Workplace and Apprenticeship; or F – Foundations; or P – Pre-calculus, or a Math at the indicated grade level (Modified and General Math credits are not acceptable.).</p> <p>*Applicants who have graduated in advance of 2015-2016, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.</p> <p>For information about high school curriculum, including Math and Science course names, please see:  <a href="http://www.curriculum.gov.sk.ca/#">http://www.curriculum.gov.sk.ca/#</a></p> <p><b>Individuals not meeting the entrance requirements will be subject to an assessment and any required training</b></p>		

# ESSENTIAL SKILLS SUMMARY

(How each of the nine essential skills is applied in this trade)

Essential skills are needed for work, learning and life. They provide the foundation for learning all other skills and enable people to evolve with their jobs and adapt to workplace change.

Through extensive research, the Government of Canada and other national and international agencies have identified and validated nine essential skills. These skills are used in nearly every occupation and throughout daily life in different ways.

A series of CCDA-endorsed tools have been developed to support apprentices in their training and to be better prepared for a career in the trades. The tools can be used independently or with the assistance of a tradesperson, trainer, employer, teacher or mentor to:

- understand how essential skills are used in the trades;
- learn about individual essential skills strengths and areas for improvement; and
- improve essential skills and increase success in an apprenticeship program.

The tools are available online or for order at: [www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml](http://www.esdc.gc.ca/eng/jobs/les/profiles/index.shtml)

The application of these skills may be described throughout this document within the skills and knowledge which support each sub-task of the trade. The most important essential skills for each sub-task have also been identified. The following are summaries of the requirements in each of the essential skills, taken from the essential skills profile. A link to the complete essential skills profile can be found at [www.red-seal.ca](http://www.red-seal.ca).

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## READING

Ironworkers (Structural/Ornamental) require strong reading skills to consult installation procedures, reference manuals, Safety Data Sheets (SDS), and industry standards and safety requirements when installing, precast structural concrete members, pre-engineered buildings, wind turbines, solar panels and ornamental ironwork. They also refer to project specifications and work orders when planning a job.

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## DOCUMENT USE

Document use is important in the work of Ironworkers (Structural/Ornamental). Ironworkers (Structural/Ornamental) interpret diagrams to ensure compliance with regulatory standards. They interpret schematics and working drawings when planning the installation of recast structural concrete members, pre-engineered buildings, wind turbines, solar panels and ornamental ironwork. Ironworkers (Structural/Ornamental) read assembly drawings to install precast structural concrete members and pre-engineered buildings. They prepare sketches and drawings to plan a job.

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## WRITING

Writing skills are used by Ironworkers (Structural/Ornamental) to perform tasks such as writing lists of materials required for a job, completing order forms to request materials, and keeping daily logs to track work status and reminders. When required, they must write incident or accident reports. They may be required to communicate in writing to other trade professionals such as engineers and architects.

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## **ORAL COMMUNICATION**

Ironworkers (Structural/Ornamental) require good oral communication skills to interact with colleagues, apprentices, supervisors, suppliers, inspectors, clients and other tradespersons when coordinating work, resolving problems and ensuring safety.

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## **NUMERACY**

Ironworkers (Structural/Ornamental) work in both imperial and metric systems of measurement. They perform calculations pertaining to rigging equipment safe working loads and breaking strength. They perform a variety of calculations such as performing area, perimeter and volume calculations.

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## **THINKING**

Ironworkers (Structural/Ornamental) diagnose and solve problems. They decide on work priorities and plan and organize their work accordingly. Ironworkers (Structural/Ornamental) may determine the most cost effective way to use materials and supplies.

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## **WORKING WITH OTHERS**

During the course of a work day, Ironworkers (Structural/Ornamental) must interact with others such as co-workers, suppliers, clients and other trades.

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## **DIGITAL TECHNOLOGY**

Ironworkers (Structural/Ornamental) use computers and other digital devices more commonly as sources of resource information, communication and cost reporting. They are also used as a tool for design, layout, research, system diagnosis and estimating.

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## **CONTINUOUS LEARNING**

Advances in technology are also changing the design, applications and materials of systems. There is an increased emphasis on worker health and safety. These changes mean that related training and certification is often mandatory for both apprentices and journeypersons.

# ELEMENTS OF HARMONIZATION FOR APPRENTICESHIP TRAINING

At the request of industry, the Harmonization Initiative was launched in 2013 to *substantively align* apprenticeship systems across Canada by making training requirements more consistent in the Red Seal trades. Harmonization aims to improve the mobility of apprentices, support an increase in their completion rates and enable employers to access a larger pool of apprentices.

As part of this work, the Canadian Council of the Directors of Apprenticeship (CCDA) identified four main harmonization priorities in consultation with industry and training stakeholders:

## 1. Trade name

The official Red Seal name for this trade is Ironworker (Structural/Ornamental)

## 2. Number of Levels of Apprenticeship

The number of levels of technical training recommended for the Ironworker (Structural/Ornamental) trade is 3.

## 3. Total Training Hours during Apprenticeship Training

The total hours of training, including both on-the-job and in-school training for the Ironworker (Structural/Ornamental) trade is 5400.

## 4. Consistent sequencing of training content (at each level) using the most recent Occupational Standard

Implementation for harmonization took place progressively. Level 1 was implemented in 2016/2017, Level 2 in 2017/2018 and Level 3 in 2018/2019.

# IRONWORKER (STRUCTURAL/ORNAMENTAL)

## TASK MATRIX

This chart outlines the major work activities, tasks and sub-tasks from the 2015 Ironworker (Structural/Ornamental) National Occupational Analysis (NOA). Each sub-task details the corresponding essential skill and level of training where the content is covered\*.

\* Sub Tasks with numbers in the boxes is where the content is delivered in technical training. Harmonization took place progressively with Level 1 implemented in 2016/2017, Level 2 in 2017/2018, and Level 3 in 2018/2019.

### A - OCCUPATIONAL SKILLS

<b>A-1 Performs occupational documentation</b>	<b>A-1.01 Interprets drawings and specifications.</b>  1, 2, 3	<b>A-1.02 Interprets standards, regulations and procedures.</b>  1 (2, 3 In Context)	<b>A-1.03 Performs lock-out and tag-out procedures.</b>  (2, 3 In Context)		
<b>A-2 Communicates in the workplace</b>	<b>A-2.01 Communicates with co-workers.</b>  1	<b>A-2.02 Communicates with others.</b>  1	<b>A-2.03 Communicates with apprentices.</b>  1	<b>A-2.04 Uses hand signals.</b>  1, 2, 3	<b>A-2.05 Communicates electronically.</b>  1, 2, 3
<b>A-3 Uses and maintains tools and equipment.</b>	<b>A-3.01 Uses hand tools and measuring equipment.</b>  1 (2, 3 In Context)	<b>A-3.02 Uses power tools.</b>  1 (2, 3 In Context)	<b>A-3.03 Uses powder-actuated tools.</b>  1 (2, 3 In Context)	<b>A-3.04 Uses aerial work platforms.</b>  1 (2, 3 In Context)	<b>A-3.05 Uses ladders</b>  1 (2, 3 In Context)
	<b>A-3.06 Uses scaffolding</b>  1 (2, 3 In Context)	<b>A-3.07 Uses Personal Protective Equipment (PPE).</b>  1 (2, 3 In Context)	<b>A-3.08 Uses surveying equipment.</b>  1, 2, 3	<b>A-3.09 Uses welding equipment.</b>  1,3 (2 In Context)	<b>A-3.10 Uses thermal and oxy-fuel cutting equipment.</b>  1 (2, 3 In Context)
<b>A-4 Organizes work.</b>	<b>A-4.01 Organizes materials and supplies.</b>  1, 2, 3	<b>A-4.02 Marks layouts.</b>  1, 2, 3	<b>A-4.03 Maintains safe work environment.</b>  1 (2, 3 In Context)	<b>A-4.04 Assesses site hazards.</b>  1 (2, 3 In Context)	<b>A-4.05 Plans work Tasks.</b>  1, 2, 3

## B – RIGGING AND HOISTING

<b>B-5 Selects rigging equipment.</b>	<b>B-5.01 Matches load to lift capability.</b> 1, 2 (3 In Context)	<b>B-5.02 Inspects rigging equipment.</b> 1, 2 (3 In Context)	<b>B-5.03 Maintains rigging equipment.</b> 1, 2 (3 In Context)
<b>B-6 Uses hoisting and lifting equipment.</b>	<b>B-6.01 Uses hoisting equipment.</b> 1, 2 (3 In Context)	<b>B-6.02 Uses lifting equipment.</b> 1, 2 (3 In Context)	<b>B-6.03 Attaches rigging to load.</b> 1, 2 (3 In Context)

## C – CRANES

<b>C-7 Assembles and erects cranes.</b>	<b>C-7.01 Assesses crane site limitations.</b> 1, 2, 3	<b>C-7.02 Determines crane position.</b> 1, 2, 3	<b>C-7.03 Prepares bases.</b> 1, 2, 3	<b>C-7.04 Erects cranes and components.</b> 1, 2, 3
<b>C-8 Disassembles Cranes.</b>	<b>C-8.01 Disassembles crane components.</b> 1, 2, 3	<b>C-8.02 Prepares crane for transport.</b> 1, 2, 3		

## D – ERECTION, ASSEMBLY AND INSTALLATION

<b>D-9 Installs primary and secondary structural members.</b>	<b>D-9.01 Erects falsework.</b> 1, 2, 3	<b>D-9.02 Attaches structural members</b> 1, 2, 3	<b>D-9.03 Levels, plumbs and aligns structural members.</b> 1, 2, 3	<b>D-9.04 Completes installation of structural members.</b> 1, 2, 3
<b>D-10 Installs ornamental components and systems.</b>	<b>D-10.01 Installs curtain walls and window walls.</b> 2, 3	<b>D-10.02 Installs miscellaneous components.</b> 3		
<b>D-11 Installs conveyors, machinery and equipment.</b>	<b>D-11.01 Installs material handling systems.</b> 2, 3	<b>D-11.02 Aligns material handling systems.</b> 2, 3	<b>D-11.03 Places machinery and equipment.</b> 2, 3	

## E – MAINTENANCE AND UPGRADING

<b>E-12 Repairs components.</b>	<b>E-12.01 Assesses current condition of components.</b>  <b>1, 2, 3</b>	<b>E-12.02 Field fabricates components.</b>  <b>1, 2, 3</b>	<b>E-12.03 Replaces components.</b>  <b>1, 2, 3</b>	<b>E-12.04 Performs preventative maintenance.</b>  <b>1, 2, 3</b>
<b>E-13 Decommissions disassembles and removes structural, mechanical and miscellaneous components.</b>	<b>E-13.01 Ensures decommissioning of structure or components.</b>  <b>1, 2, 3</b>	<b>E-13.02 Plans sequence of disassembly.</b>  <b>1, 2, 3</b>	<b>E-13.03 Removes components.</b>  <b>1, 2, 3</b>	

# ON-THE JOB AND IN-SCHOOL TRAINING

## CONTENT FOR THE IRONWORKER

### (STRUCTURAL/ORNAMENTAL) TRADE

This chart outlines on-the-job examples for apprentices to achieve relevant work experience to prepare for the topics of technical training. Topics of technical training are provided with the associated learning outcomes.

Level One	8 weeks	240 hours
<b>Safety Awareness</b> <ul style="list-style-type: none"> <li>discuss safety equipment applications, maintenance and procedures for use</li> <li>discuss safe work practices</li> <li>discuss regulatory requirements pertaining to safety</li> <li>discuss lock out tag out procedures</li> </ul> <p><b>Mentors can assist the apprentice to prepare for this section of technical training by:</b></p> <ul style="list-style-type: none"> <li>identifying types of personal protective equipment (PPE) and clothing</li> <li>describing PPE and clothing applications and limitations</li> <li>demonstrating the selection, use and maintenance of PPE for worksite applications</li> <li>identifying hazards and describing safe work practices such as lockout/tag out, confined space awareness and environmental considerations (heat and cold)</li> <li>describing expected attitudes in relation to housekeeping, PPE and emergency procedures</li> <li>explaining industry practices for hazard assessment and control procedures</li> <li>describing the roles, responsibilities, features and practices related to the workplace hazardous materials information system (WHMIS) program</li> <li>describing the contents and importance of the OH&amp;S Regulations</li> <li>demonstrating how to apply the OH&amp;S regulations to day-to-day work activities</li> </ul>		18 hours
<b>Access Equipment</b> <ul style="list-style-type: none"> <li>understand ladder, scaffolding and aerial work platform (AWP) applications, limitations and procedures for use</li> <li>set up and use of scaffolds, ladders and angel wings</li> <li>demonstrate safe work practices</li> <li>discuss swing stages, sky climbers and crane man baskets</li> <li>apply WHMIS</li> <li>discuss aerial work platform operation</li> </ul> <p><b>Mentors can assist the apprentice to prepare for this section of technical training by:</b></p> <ul style="list-style-type: none"> <li>discuss fall arrest procedures</li> <li>describing the requirements to use and the use of fall arrest equipment</li> <li>attending shop safety meetings</li> <li>insisting on appropriate work clothes and personal protective equipment</li> <li>having the apprentice attend training for WHMIS</li> <li>demonstrating how lock out and tag out procedures work and why</li> <li>defining terminology associated with ladders, scaffolding and AWP</li> <li>identifying hazards and describing safe work practices pertaining to ladders, scaffolding and AWP</li> <li>identifying OH&amp;S Regulations pertaining to all types of access equipment</li> </ul>		15 hours

- *describing the procedures used to erect, secure, dismantle and inspect access equipment*
- *providing opportunities to set up and use various types of access equipment*

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## **Tools and Equipment**

**20 hours**

- explain types of hand, electric, hydraulic, pneumatic and gas tools
- use leveling and alignment instruments
- discuss tool and equipment applications, maintenance, storage and procedures for use
- understand explosive actuated tools

### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *identifying types of hand and power tools and describing their applications and procedures for use*
- *providing opportunities to use and maintain basic hand and power tools commonly used in the trade*
- *providing opportunities to use and maintain power, hydraulic, pneumatic and gas tools used in structural steel construction and fabrication*
- *describing equipment storage and maintenance requirements*
- *demonstrating how to sharpen drill bits and the selection and use of taps and dies*
- *demonstrating the use of laser levels and transits to find differences in elevation, and how to perform reverse shot calculations*
- *providing opportunities to use various levelling instruments, including the set up and use of transits*
- *identifying hazards and describing safe work practices pertaining to using explosive actuated tools*
- *providing instruction on safe operating procedures of explosive actuated tools*

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## **Hoisting and Lifting**

**33 hours**

- discuss hoisting, lifting and rigging equipment applications, limitations and procedures for use
- explain procedures for hoisting and lifting operations
- demonstrate International crane hand signals
- practice calculations for hoisting and lifting operations
- discuss knots and hitches

### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *describing the terminology associated with hoisting, lifting and rigging*
- *identifying hazards and describing safe work practices pertaining to hoisting, lifting and rigging*
- *identifying types of rigging equipment and accessories and describing their limitations, applications and procedures for use*
- *demonstrating and then having the apprentice perform calculations pertaining to rigging equipment safe working loads and breaking strength*
- *providing opportunities to select and install various wire rope hardware*
- *identifying types of hoisting and lifting equipment and accessories and describing their applications and procedures for use*
- *describing the procedures used to inspect, maintain and store hoisting, lifting and rigging equipment*
- *identifying types of knots, hitches and bends and describing their applications and the procedures used to tie them*
- *describing the procedures used to rig material/equipment for hoisting and lifting*
- *describing the procedures used to ensure the work area is safe for hoisting and lifting operations*
- *demonstrating how to calculate sling tension and sling angle when preparing for hoisting and lifting*
- *describing the procedures used to determine the weight and weight distribution of loads*
- *identifying the factors to consider when selecting rigging equipment such as weight, shape and centre of gravity*

- *describing the procedures used to perform a lift such as load determination, pre-lift checks and placement of load*
- *providing instruction on how to perform international crane hand signalling*

## **Cranes I**

**18 hours**

- demonstrate the safe use of cranes
- discuss crane types, applications and limitations
- perform crane lifting operations
- understand how to interpret basic load charts

### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with cranes and crane lifting operations*
- *identifying hazards and describing safe work practices pertaining to cranes and crane lifting operations*
- *identifying types of cranes and describing their components, characteristics and applications*
- *discussing safety considerations for the assembly/installation of cranes such as overhead power lines, underground services and soil/ground conditions*
- *discussing crane positioning with regard to crane radius/swing area and headroom*
- *introducing the apprentice to basic load charts and demonstrating how to interpret them*

## **Drawing Interpretation and work Planning**

**40 hours**

- discuss procedures used to interpret and extract information from drawings
- discuss preparation and use of trade related documentation
- explain types of drawings and their application
- discuss the preparation and use of trade related documentation
- demonstrate how to organize work tasks to facilitate effective handling of work materials
- display effective communication practices

### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with drawings*
- *identifying types of drawings and describing their applications*
- *identifying drawing projections and views and describing their applications*
- *providing instruction on interpreting and extracting information from drawings*
- *providing opportunities to read and interpret specifications and details from structural steel drawings*
- *identifying types of trade related documentation and describing their applications and procedures for use*
- *describing the procedures used to prepare and complete trade related documentation*
- *identifying sources of information relevant to work task planning*
- *describing the procedures used to plan work tasks*
- *describing the procedures used to organize and store tools, equipment, materials and supplies on-site*
- *providing and practicing calm, clear and consistent communications in all aspects on the worksite*

## **Structural Components**

**36 hours**

- discuss structural component characteristics and applications
- demonstrate fastening methods related to structural steel erection
- discuss falsework characteristics and applications
- demonstrate procedures for the erection and dismantling of falsework

### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with structural components*
- *identifying hazards and describing safe work practices pertaining to structural components*
- *demonstrating how to interpret information pertaining to structural components found on drawings and specifications*
- *identifying types of structures and describing their characteristics*
- *identifying structural steel shapes and describing their designations, characteristics and applications*
- *identifying types of structural components such as secondary steel, girts and lintels and describing their purpose*
- *identifying fastening methods associated with structural steel and describing their characteristics, applications and limitations*
- *describing the procedures used to install fasteners for securing structural steel members*
- *identifying types of falsework and describing their characteristics and applications*
- *providing opportunities to construct and dismantle falsework*

### **Building Erection**

**12 hours**

- explain full erection and partial dismantling of a structural steel structure using a crane
- discuss interpretation of drawings
- demonstrate identification of structural components
- demonstrate safe worksite practices
- demonstrate rigging techniques

#### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *having the apprentice identify structural steel members from drawings during erection operations*
- *assisting the apprentice to select the correct rigging equipment and accessories relating to structural steel erection*
- *providing opportunities to apply safe rigging practices and procedures to work as a team to erect structural steel components*
- *providing opportunities to select and install fasteners according to application and manufacturers specifications*

### **Welding I**

**18 hours**

- discuss oxy fuel equipment and accessories
- Perform oxy-fuel cutting procedures
- Discuss shielded metal arc welding equipment and accessories
- Perform shielded metal arc welding procedures

#### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with oxy-fuel and welding equipment*
- *identifying hazards and describing safe work practices pertaining to cutting and welding procedures*
- *identifying oxy-fuel and welding equipment and accessories and describing their applications*
- *describing the procedures used to inspect and maintain oxy-fuel and welding equipment*
- *demonstrating the procedures used to set up, adjust and shut down oxy-fuel equipment*
- *providing opportunities to set up and operate oxy-fuel cutting equipment to perform cutting operations*
- *demonstrating the procedures used to set up and adjust SMAW equipment*
- *providing opportunities to set up and operate SMAW equipment to perform welds*
- *describing common weld faults and procedures to prevent and correct these fault*

### **Industrial Mathematics**

**30 hours**

- explain whole numbers, common and decimal fractions

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- discuss conversions and comparisons with fractions, decimals and percent's
  - practice calculations and conversions using the metric and imperial systems
  - perform calculations for average, perimeter, area and volume
  - perform basic problems involving common and decimal fractions

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *having the apprentice complete the online math program available on the apprenticeship website at [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca)*
  - *ensuring the apprentice can work in both the metric and imperial systems of measurement*
  - *demonstrating how to convert between metric and imperial dimensions*
  - *providing opportunities to perform basic area, perimeter and volume calculations*
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**Level Two****8 weeks****240 hours**

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**Hoisting, Lifting and Rigging****22 hours**

- perform calculations of weights of beams, angles, channels and hollow structural steel
- perform calculations related to inclined planes and mechanical advantage
- discuss hoisting chains, rollers, hydraulic jacks, beam clamps, air castors, tuggers and tirlors
- explain hydraulic gantry systems and their components

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *demonstrating and then having the apprentice perform calculations to determine the weights of single and multiple piece structural steel components*
- *describing the requirements associated with hoisting equipment such as chain grade, chain markings and chain inspection*
- *identifying types of hoisting equipment and describing their limitations, applications and procedures for use*
- *identifying hazards and describing safe work practices pertaining to hoisting operations*
- *demonstrating the applications for various types of hoisting equipment such as hoisting chains, rollers, hydraulic jacks, beam clamps, air castors, tuggers and tirlors*
- *identifying the components of a hydraulic gantry system*
- *describing the system support and load distribution factors of a hydraulic gantry system*
- *describing various types of lifts possible using a hydraulic gantry system*
- *identifying hazards and describing safe work practices pertaining to hoisting with a hydraulic gantry system*

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**Drawing Interpretation****48 hours**

- discuss specifications and details on structural steel drawings
- explain specifications and details on miscellaneous steel drawings
- learn welding symbols
- discuss specifications and shop fabrication drawings
- interpret ornamental drawings
- discuss reinforcing rebar drawings

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *discussing specifications and details on various structural steel drawings (site plans, shop drawings, cut sheets)*
- *describing the characteristics of welding symbols*
- *providing drawings showing welding symbols and describing their relationship to the work*
- *providing opportunities to interpret specifications and details on curtain wall drawings*
- *providing opportunities to interpret specifications and details on drawings depicting miscellaneous steel components, handrails, platforms, and stairs*
- *providing opportunities to interpret drawings for curtain wall systems and associated hardware as specified*
- *providing opportunities to interpret drawings to fabricate miscellaneous steel, hand railings, and stairs as specified*
- *providing opportunities to interpret drawings to place concrete reinforcing as specified*

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**Crane II****60 hours**

- explaining crane and lifting operation terminology and safe work practices
- discuss codes and regulations for cranes and crane lifting operations
- describe drawings, specifications; and tables and charts for crane lifting operations

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- explain principles of leverage and their applications to cranes
  - describe the types, components, characteristics and applications for cranes
  - discuss considerations for crane assembly and on-site installation

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with hydraulic, conventional and tower cranes*
- *identifying and describing procedures used to communicate during crane operations*
- *identifying hydraulic, conventional and tower crane components, accessories and attachments and describing their characteristics and applications*
- *identifying considerations for crane assembly/installation on-site such as site hazard assessment and crane position*
- *describing the procedures used to assemble and set up hydraulic, conventional and tower cranes*
- *describing the procedures used to climb/jump tower cranes*
- *describing the procedures used to disassemble hydraulic, conventional and tower cranes, their components, accessories and attachments*
- *describing the procedures used to prepare hydraulic, conventional and tower cranes for transport*
- *providing opportunities to assist with set up, placement, moving, and dismantling of hydraulic, conventional and tower cranes*

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## **Erection and Dismantling**

**12 hours**

- explaining structural steel member characteristics and applications
- discussing erection procedures for structural steel members and components
- performing dismantling, removing and storing procedures for structural steel members and components

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with structural steel erection and dismantling*
- *identifying hazards and describing safe work practices pertaining to erection and dismantling such as temporary bracing, environmental conditions and sequence*
- *ensuring the apprentice can select the correct tools and equipment relating to structural steel erection and dismantling, and that these tools and equipment are used safely and correctly*
- *asking the apprentice to identify structural steel members and describe their characteristics and applications*
- *assisting the apprentice to level, plumb and align structural steel members*
- *describing the procedures used to inspect erected structural steel to ensure conformity to standards*
- *describing the procedures used to repair, replace, dismantle and remove structural steel members and components*

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## **Building Erection II**

**18 hours**

- perform erection of interior structural steel components using power rigging equipment
- interpret drawings
- identify structural components
- demonstrate safe worksite practices
- perform rigging techniques

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *identifying steel components from drawings*
- *ensuring the apprentice can select the correct rigging and lifting equipment relating to structural steel erection and dismantling, and that this equipment is used safely and correctly*
- *providing opportunities to assist with winch installation procedures in various applications*

- *providing opportunities to apply safe rigging practices and procedures to work as a team to erect structural steel components*
- *providing opportunities to select and install fasteners according to application and manufacturers specifications*

### **Pre-engineered Structures**

**20 hours**

- interpret drawings specific to engineered structures
- discuss pre-engineered structures and their components
- erect pre-engineered structures

#### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with pre-engineered structures*
- *identifying hazards and describing safe work practices pertaining to pre-engineered structures*
- *assisting apprentice to interpret information pertaining to pre-engineered structures found on drawings and specifications*
- *identifying tools and equipment relating to pre-engineered structures and describing their applications and procedures for use*
- *identifying types of pre-engineered structures such as tapered beam, single-span and multi-span rigid frame and lean-to, and describing their characteristics and applications*
- *identifying pre-engineered structure components and describing their characteristics and applications*
- *describing the procedures used to plan and prepare for the erection of pre-engineered structures*
- *providing opportunities to erect pre-engineered structures and their components*

### **Reinforcing Rebar**

**12 Hours**

- explain types of reinforcing materials and accessories
- perform procedures to prepare for reinforcing concrete
- demonstrate reinforcing rebar installation and tying techniques

#### **Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with reinforced concrete*
- *explaining the purpose for reinforcing concrete*
- *explaining the forces and stresses associated with reinforced concrete such as compression, tension shear and live and dead loads*
- *identifying hazards and describing safe work practices pertaining to reinforcing such as dowel protection, work positioning and proper packing and carrying techniques*
- *describing standards and identification systems relating to reinforcing steel such as grades, diameters, colour codes and tags*
- *identifying tools and equipment related to reinforcing and describing their applications and procedures for use*
- *identifying types of reinforcing materials such as welded wire mesh, tie wires and bar supports and describing their characteristics and applications*
- *explaining the importance of maintaining proper reinforcing clearances and tolerances for reinforcing materials*
- *demonstrating the various knots used to install reinforcing rebar, describing their applications and limitations*
- *providing opportunities to assist in installing and tying rebar for various applications*
- *providing opportunities to assist in the installation of welded wire fabric*
- *providing instruction on safe handling, hoisting, moving and storage of rebar*
- *providing experience working with and handling various types of rebar (steel, epoxy coated, composite)*
- *providing opportunities to identify rebar grade and composition, and use code to identify various types and sizes of rebar*

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## Welding II

18 Hours

- discuss welding and gouging equipment and accessories
- explain welding and gouging processes and procedures
- perform flux cored arc welding procedures

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with various types of welding and gouging processes*
- *identifying hazards and describing safe work practices pertaining to welding and gouging activities*
- *identifying the various different welding processes and describing their characteristics and applications*
- *identifying different welding and gouging equipment, consumables and accessories and describing their applications*
- *demonstrating the procedures used to set up and adjust welding and gouging equipment*
- *describing the procedures used to inspect, maintain and store welding and gouging equipment and supplies*
- *identifying types of welds and joint preparations used during welding operations*
- *providing opportunities to select and set up various types of electric arc welding equipment to weld assorted thicknesses of materials in various positions*

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## Ironworker Mathematics

30 Hours

- practice basic word problems
- perform conversions and comparisons with percent, rates, ratios and proportions
- demonstrate angle measurement and calculations
- perform calculations involving circles and partial circles
- discuss basic geometry
- perform basic problems involving perimeter, area and volume

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *providing opportunities to determine weights, volumes, area, and turning radius*
- *providing opportunities to perform trade related mathematical calculations that require the application of basic geometric formulas such as the Pythagorean formula*
- *if necessary, having the apprentice spend time on the online math program available on the apprenticeship website at [www.saskapprenticeship.ca](http://www.saskapprenticeship.ca) in order to work through any areas of difficulty*
- *allowing the apprentice to work out worksite problems and perform calculations in both the metric and imperial systems of measurement*
- *continuing to provide opportunities to perform basic area, perimeter and volume calculations*

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**Level Three****7 weeks****210 hours**

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**Equipment Certifications**

- discuss aerial work platform operations
- demonstrate telefork operations

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *demonstrating the operating procedures for various types of aerial work platforms*
  - *demonstrating the operating procedures for telefork equipment*
  - *discussing the hazards and safe work practices pertaining to these types of access equipment such as site conditions and equipment limitations*
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**Building, Dismantling and Storage****12 Hours**

- explain the dismantling of a structural steel structure using a crane
- discuss safe worksite practices
- perform advanced rigging procedures
- display correct sequence of component storage
- discuss correct trailer loading and storage of components

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *describing the sequence of dismantling a structural steel building with respect to the order of re-installation*
  - *describing the procedures used to stack and secure structural steel components for storage or for transport*
  - *providing opportunities to select materials and equipment for rigging systems*
  - *providing opportunities to learn about calculating load weights, using load charts to determine crane capacity, measuring boom deflection, and determining weight displacement*
  - *providing opportunities to dismantle steel buildings*
  - *providing opportunities to apply safe rigging practices and procedures to work as a team to dismantle structural steel components*
  - *providing opportunities for the apprentice to perform the signalling during crane lifting operations*
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**Cranes III****40 Hours**

- discuss terminology associated with electric overhead traveling cranes (EOT cranes)
- explain communication procedures during EOT crane operations
- discuss hazards and safe work practices for EOT cranes and EOT crane lifting operations
- explain EOT crane components, accessories and attachments
- explain types of EOT crane controls
- demonstrate assembly and installation procedures for EOT cranes

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with EOT cranes*
- *identifying and describing the procedures used to communicate during EOT crane operations*
- *identifying hazards and describing safe work practices pertaining to EOT crane and EOT crane operations*
- *identifying EOT crane components, accessories and attachments and describing their characteristics and applications*
- *identifying types of EOT controls such as cab operated, remote operated and pendant and describing their characteristics and applications*
- *describing the procedures used to assemble and install EOT cranes*

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## Machinery and Equipment

30 Hours

- discuss types and characteristics of machinery and equipment
- demonstrate interpretation installation information from drawings
- perform identification of structural components for installation and removal
- perform installation and removal procedures
- demonstrate safe work practices

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with machinery and equipment installation and removal*
- *identifying hazards and describing safe work practices pertaining to the installation and removal of machinery and equipment*
- *assisting apprentice to interpret information pertaining to the installation and removal of machinery and equipment found on drawings and specifications*
- *identifying tools and equipment relating the installation and removal of machinery and equipment and describing their applications and procedures for use*
- *identifying types of machinery and equipment installed and removed by Ironworkers such as storage tanks, hoppers and conveyors and describing their characteristics*
- *describing the procedures used to install or remove machinery and equipment*
- *providing opportunities for the apprentice to assist with the installation and removal of machinery and equipment*

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## Miscellaneous and Ornamental Work

36 Hours

- discuss interpretation of shop drawings
- explain components, characteristics and applications
- demonstrate fabrication and installation procedures
- perform floor and roof decking procedures
- discuss wood glulam handling and erection

### Mentors can assist the apprentice to prepare for this section of technical training by:

- *defining terminology associated with miscellaneous and ornamental ironwork*
- *identifying hazards and describing safe work practices pertaining to miscellaneous and ornamental ironwork*
- *providing opportunities to interpret information used to fabricate and install miscellaneous and ornamental ironwork found on drawings and specifications*
- *providing opportunities to interpret drawings to install curtain wall systems and associated hardware as specified*
- *identifying tools and equipment relating to miscellaneous and ornamental ironwork and describing their applications and procedures for use*
- *describing the procedures used to fabricate and install miscellaneous and ornamental ironwork*
- *describing the procedures used for the finishing or ornamental ironwork*
- *describing the procedures used to repair or remove ornamental ironwork*
- *providing opportunities to layout and fabricate jigs for special applications*
- *providing opportunities to layout and fabricate ornamental steel projects*
- *providing opportunities to assist in the construction, installation/assembly of various types of curtain walls*
- *providing opportunities to rig up and assist with the hoisting and installation of laminated wood products such as glulam beams*

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## Precast Concrete

24 Hours

- explain pre-cast concrete members and their components
- discuss procedures used to erect pre-cast concrete
- discuss procedures used to dismantle pre-cast concrete

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with pre-cast concrete erection and dismantling*
- *identifying hazards and describing safe work practices pertaining to pre-cast concrete erection and dismantling*
- *assisting apprentice to interpret information pertaining to pre-cast concrete erection and dismantling found on drawings and specifications*
- *identifying tools and equipment relating to pre-cast concrete erection and dismantling and describing their applications and procedures for use*
- *identifying types of pre-cast concrete members and components and describing their characteristics and applications*
- *describing the procedures used to prepare, erect, finish and dismantle pre-cast concrete members and components*
- *providing opportunities to assist with the erection and dismantling of pre-cast concrete members and components*
- *providing opportunities to choose appropriate rigging and perform hook up procedures for slinging various pre-cast components into position*

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**Pre-engineered Structures**

**20 hours**

- demonstrate interpretation of drawings specific to engineered structures
- discuss pre-engineered structures and their components
- perform erection of pre-engineered structures

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *defining terminology associated with pre-engineered structures*
- *identifying hazards and describing safe work practices pertaining to pre-engineered structures*
- *assisting apprentice to interpret information pertaining to pre-engineered structures found on drawings and specifications*
- *identifying tools and equipment relating to pre-engineered structures and describing their applications and procedures for use*
- *identifying types of pre-engineered structures such as tapered beam, single-span and multi-span rigid frame and lean-to, and describing their characteristics and applications*
- *identifying pre-engineered structure components and describing their characteristics and applications*
- *describing the procedures used to plan and prepare for the erection of pre-engineered structures*
- *providing opportunities to erect pre-engineered structures and their components*

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**Welding III**

**6 Hours**

- discuss plasma arc cutting equipment and accessories
- demonstrate plasma arc cutting procedures

**Mentors can assist the apprentice to prepare for this section of technical training by:**

- *identifying terminology associated with plasma arc cutting*
- *identifying hazards and describing safe work practices pertaining to plasma arc cutting*
- *describing the plasma arc cutting process and its applications*
- *identifying plasma arc cutting equipment and accessories and describing their applications*
- *describing the procedures used to set up, adjust and shut down plasma arc cutting equipment*
- *describing procedures used to inspect, maintain and store plasma arc cutting equipment*
- *describing the procedures used to cut using plasma arc cutting equipment*
- *identifying common cutting faults and describing the procedures used to prevent and correct these faults*
- *providing opportunities for the apprentice to set up, operate and shut down plasma arc cutting equipment*

**Consider apprenticeship training as an investment in the future of your company and in the future of your workforce. Ultimately, skilled and certified workers increase your bottom line.**

**Get involved in the apprenticeship training system. Your commitment to training helps to maintain the integrity of the trade.**

**Do you have employees who have been working in the trade for a number of years but don't have trade certification?**

**Contact your local apprenticeship office for details on how they might obtain the certification they need.**

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