Tower Crane Operator On-the-Job Training Guide

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Recognition:
To promote transparency and consistency, portions of this document has been adapted from the 2010 Tower Crane Operator National Occupational Analysis (Employment and Social Development Canada).

A complete version of the Occupational Standard can be found at 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 Tower Crane Operator 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 Tower Crane Operator 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 Tower Crane Operator 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 TOWER CRANE OPERATOR TRADE

Tower crane operators operate tower cranes to lift, move, position and place materials and equipment. They perform pre-operational inspections. They calculate the crane's lifting capacities according to the crane's load chart and determine load weight, participate in setting up and dismantling cranes, and position and stabilize the crane before the lift. Tower crane operators work with other workers to make sure the load is placed exactly where they need it. They also perform regular inspections, and do minor repairs and maintenance on the equipment.

Tower crane operators work in the heavy industrial, commercial, residential and civil sectors.
They may be employed by construction, surface mining, shipbuilding, offshore drilling rigs, railway and crane rental companies.

Tower cranes are used for specific worksite requirements, as they have a smaller footprint and are productive on sites where they will be used for a lengthy period. Some tower cranes are constructed by bolting a base to a specially made concrete pad and then erecting a tower (mast) of latticed steel up from it. Engineered counterweights are used to provide stability. On a hammerhead crane a boom or jib extends horizontally across the top of the crane. A crane cab where the operator sits is installed where the mast and boom meet. Luffer cranes have a jib that can be raised and lowered. Self-erecting cranes are set on retractable outriggers for support, have a mast and boom, and they are designed to be more mobile and versatile on jobsites.

They work outdoors in all kinds of weather, at heights and in noisy environments. Tower crane operators may be required to work in remote job sites.

The key attributes for tower crane operators are that they should be mechanically inclined, comfortable with working at heights and have good hand-eye coordination, excellent eye sight, and math skills. Safety is the number one priority for tower crane operators. Tower crane operators need to work cautiously and with extreme precision to ensure the safety of others. Physical fitness and good balance are important as the job requires them to climb up great heights and the operation of some cranes and the handling of accessories are physically demanding. Another key attribute is communication skills to effectively communicate with site personnel, supervisors, riggers, signallers and other tradespeople.

The skills of tower crane operators are transferable to operating other types of cranes and heavy equipment. With experience, tower crane operators may move into careers such as business owners, supervisors, trainers and job coordinators. As with other trades, the ability to mentor apprentices is extremely important to pass on the skills, knowledge and expertise of the trade.

Training Requirements: 3000 hours and 2 years, including in-school technical training sessions. An apprentice must successfully complete the required technical training and compile enough on-the-job experience to total at least 1500 hours each year.

Journeyperson 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 journeyperson's responsibility to supervise an apprentice's practical skills development until a satisfactory level of proficiency has been reached.

EMPLOYER TRAINING RESPONSIBILITY

- promote a safety-conscious workplace
- provide mentored, hands-on practice in the use of rigging equipment
- demonstrate calculations of the load weights, rigging capacities and crane capacities
- provide the opportunity for apprentices to perform minor maintenance on cranes
- further the apprentice's ability to complete pre-operational inspections, checks and regular inspections
- ensure that the apprentice can perform craning operations

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 journeyperson 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
Tower Crane Operator	Grade 10	Grade 10

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.).

*Applicants who have graduated in advance of 2015-2010, or who do not have access to the revised Science curricula will require a Science at the minimum grade level indicated by trade.

For information about high school curriculum, including Math and Science course names, please see: http://www.curriculum.gov.sk.ca/#

Individuals not meeting the entrance requirements will be subject to an assessment and any required training

ESSENTIAL SKILLS SUMMARY

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

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.

READING

In their daily work, Tower Crane Operators read and comprehend several types of texts. These include safety and work procedures as well as more complex regulations and manufacturers' operating manuals.

DOCUMENT USE

Tower crane operators use workplace documents such as log books, load charts, hazard assessments and workplace policies and procedures to carry out their job. They must be familiar with regulations relating to hoisting, rigging and safe work environments. They must have the ability to read and interpret manufacturers' specifications and load charts for the model of crane they are using. Depending on site-specific requirements, they may obtain information from engineered and construction drawings and plans such as climbing schematics and schedules.

WRITING

Tower crane operators use writing skills to record comments or notes in logbooks or work records. They write messages to colleagues or management to give work details or reply to requests for technical information. They may also write longer descriptions and explanations for various reporting and data collection forms.

ORAL COMMUNICATION

Tower crane operators use oral communication skills to coordinate work with site crews. Clear communication of technical and complex information is very important to avoid injuries and promote efficiency. Tower crane operators also use communication skills instructing apprentices, co-workers and on-site work crews. Good listening and visual skills are also required to communicate with riggers, signallers and other operators during lifts. Tower crane operators use verbal communication and hand signals to communicate the pace of lift movements and precise positioning of loads.

NUMERACY

Tower crane operators use a range of math skills in their daily work. These include mathematical and physics concepts such as conversions, geometry, algebraic calculations, measurement and calculating load and lift requirements. They use load charts and manufacturers' specifications to further determine procedures, limits, and the necessary equipment for rigging and hoisting.

THINKING

Tower crane operators must use decision making skills to perform work planning and prioritizing. The decisions they make about the sequence of work have implications for everyone on site. Tower crane operators require strong analytical skills to effectively use their equipment.

Tower crane operators use problem solving skills to choose set-up locations and crane configurations for specific jobs. During lifts tower crane operators make operational decisions to start, stop and vary the speed and direction of lifts to ensure safe movement and placement of a load. They evaluate the safety of lifts before and during lifts and stop work if necessary.

WORKING WITH OTHERS

To be effective, tower crane operators must establish close and ongoing job-task coordination with other workers on the job site. They work closely with clients and co-workers to plan lifts and ensure that their activities are coordinated with those of on-site crews. The operator may be located high in the operator's cab and physically removed from their co-workers; however they are in close communication with riggers, signallers and supervisors to coordinate lifts and load placements. Tower crane operators work in close coordination with other operators when performing multiple crane lifts and when in close proximity with other cranes and heavy equipment.

DIGITAL TECHNOLOGY

Tower crane operators are increasingly required to interpret electronic data transmitted to them from LMI, anemometers and electronic scales located in the cab of the crane. Controls for the tower crane may also involve computerized applications.

CONTINUOUS LEARNING

As construction methods and crane technology are advancing, tower crane operators must keep abreast of these developments. Regulatory changes may require additional certification such as for service work, erection and climbing, and ongoing learning to ensure compliance and safe working conditions.

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 Tower Crane Operator.

2. Number of levels of apprenticeship

The number of levels of technical training recommended for the Tower Crane Operator trade is two.

3. Total training hours during apprenticeship training

The total hours of training, including both on-the-job and in-school training for the Tower Crane Operator trade is 3000.

4. Consistent sequencing of training content (at each level) using the most recent occupational standard

Harmonization for the Tower Crane Operator trade has been fully implemented for each level of technical training.

TOWER CRANE OPERATOR TASK MATRIX CHART

This chart outlines the major work activities, tasks and sub-tasks from the 2010 Tower Crane Operator National Occupational Analysis. 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 will be delivered in training. Level one to be implemented in 2016/2017 and level two in 2017/2018.

A – COMMON OCCUPATIONAL SKILLS

Task A-1 Performs safety-related functions	**1.01 Maintains safe work environment** 1, 2	**1.02 Uses personal protective equipment (PPE) and safety equipment** 1, 2
Task A-2 Contributes to workplace organization	**2.01Communicates with others** 1, 2	**2.02 Uses documentation** 1, 2

B – CRANE INSPECTION AND MAINTENANCE

Task B-3 Performs pre-operational checks and regular inspections	**3.01 Inspects structural components** 1, 2	**3.02 Inspects mechanical components** 1, 2	**3.03 Inspects lines and wire ropes** 1, 2	**3.04 Inspects hydraulic system components** 1,2	**3.05 Inspects electrical system components** 1, 2	**3.06 Inspects supports components** 1, 2
	3.07 Inspects support components 1,2	**3.08 Inspects cab components** 1,2	**3.09 Inspects cab components** 1,2	**3.10 Completes inspection documentation** 1,2		

Task B-4 Performs continual checks	4.01 Monitors site conditions 1, 2	4.02 Monitors lines and wire ropes 1, 2	4.03 Monitors equipment performance and conditions 1,2	4.04 Monitors structural and support components 1, 2
Task B-5 Performs minor crane maintenance	5.01 Maintains mechanical components 1,2	5.02 Lubricates wire ropes and crane components 1,2		

C – CRANE SET-UP, HOISTING CALCULATIONS AND LIFT PLANNING

Task C-6 Participates in tower crane assembly, disassembly and transportation	6.01 Participates in crane assembly 1	6.02 Participates in crane disassembly 1	6.03 Transports self-erecting tower crane (Not common core) 1	6.04 Participates in assembly and disassembly of self-erecting tower cranes (Not common core) 1
Task C-7 Plans lifts	7.01 Interprets load charts 1, 2	7.02 Plans work procedures 1, 2	7.03 Prepares for specialty lifts 1,2	

D – RIGGING

Task D-8 Inspects and maintains rigging equipment	8.01 Identifies deficiencies in slings and hardware 1,2	8.02 Lubricates slings and hardware 1,2	8.03 Stores rigging equipment 1,2

Task D-9 Manages rigging	9.01 Selects required rigging equipment 1, 2	9.02 Rigs load 1, 2	9.03 Monitors rigging 1,2

E – CRANE OPERATIONS

Task E-10 Performs pre-lift (warm-up) activities	10.01 Performs function test 1, 2	10.02 Confirms limits 1, 2				
Task E-11 Operates tower cranes	11.01 Trolleys carriage 1, 2	11.02 Booms (luffs) up and down 1, 2	11.03 Swings (slews) jib 1,2	11.04 Hoists load 1,2	11.05 Travels crane 1,2	11.06 performs functions simultaneously 1, 2
Task E-12 Climbs (raises) tower cranes	12.01 Performs bottom-climbing procedures 1, 2	12.02 Performs top-climbing procedures 1, 2				
Task E-13 Performs specialty tower crane operations	13.01 Participates in multi-crane lifts 2	13.02 Operates in multi-crane site 2	13.03 Hoists personnel 1			
Task E-14 Shuts down and secures tower cranes	14.01 Secures crane while leaving controls 1, 2	14.02 Secures crane while unattended 1, 2	14.03 Secures crane for extended periods 1,2			

ON-THE-JOB AND IN-SCHOOL TRAINING CONTENT FOR THE TOWER CRANE OPERATOR 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

Safety/Tools and Equipment

- safety
- communications for hoisting
- high voltage electrical fundamentals
- trade related documents
- tools and equipment
- fasteners and retaining devices

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

- *ensuring the apprentice follows safe work practices and has knowledge of CSA standards, OH&S regulations and company safety policies*
- *demonstrating the use of safety equipment such as PPE, first aid kits, fire extinguishers and fall protection*
- *allowing the apprentice to attend company safety meetings*
- *demonstrating tower crane safety and possible hazards*
- *demonstrating, then supervising the apprentice when using hand signalling procedures during actual lifts of materials and equipment*
- *explaining safety procedures as it relates to high voltage electrical equipment*
- *explaining limits of approach when working near high voltage equipment*
- *ensuring the apprentice knows the safety procedures associated with electrical contact*
- *reviewing and explaining technical information from manufacturer's manuals*
- *explaining the personal responsibility for tower crane operators to maintain log books*
- *demonstrating the use of the tower crane log book*
- *allowing the apprentice to use written communication, such as log book time sheets and accident reports*
- *ensuring the apprentice has knowledge of various hand and power tools*

ensuring the apprentice is exposed to various types of tower crane hardware/fasteners and their usages

Rigging

- wire rope
- rigging hardware
- introduction to rigging and hoisting sling configurations

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

- *demonstrating inspection procedures and identifying damage to wire rope*

- *allowing the apprentice to choose the appropriate hardware for various lifts*
- *identifying various block classifications and their applications*
- *discussing the effects of sling angles*
- *exposing the apprentice to lifts requiring different sling configurations*
- *allowing the apprentice to choose the rigging configuration for a basic lift such as sling type, size, use of hardware and quantity*
- *discussing the effects of different types of sling configurations such as vertical, choker and basket hitches or two leg bridles*

Load Weight Calculations

- load weight calculations I

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

- *allowing the apprentice to calculate load weights for basic shaped loads*
- *allowing the apprentice to determine and calculate center of gravity*

Tower Crane Operations

- lifting theory and forces
- introduction to crane operations
- introduction to computerized operational aids
- job planning
- introduction to tower cranes

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

- *discussing the components of leverage and their applications*
- *having the apprentice look through manufacturer's manuals*
- *allowing the apprentice to interpret technical information gathered from multiple sources*
- *demonstrating operating procedures such as swing, raise/lower load and using multiple functions at the same time*
- *ensuring the apprentice performs basic tower crane operations such as programming range limiting devices and LMI*
- *explaining job site layouts and hazards to consider*
- *allowing the apprentice to attend a site meeting*
- *exposing the apprentice to tower crane operations*
- *supervising the apprentice during the completion of a walk around inspection prior to operation*

Level Two | 8 weeks | 240 hours

Rigging

- advanced rigging and hoisting

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

- *identifying the various types of non-routine rigging such as the use of unequal length slings or a snatch block*
- *ensuring the apprentice can select the rigging configuration for non-routine lifts*

Load Weight Calculations

- load weight calculations ii

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

- *ensuring the apprentice can complete basic load weight calculations*
- *supervising the apprentice when needing to calculate load weights requiring multi step calculations*

Load Charts

- tower crane load charts

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

- *ensuring the apprentice can gather information from multiple locations within a load chart*
- *discussing the factors reducing rated capacities such as wind, weather and personnel experience*

Pre-operational Checks, Inspections and Maintenance

- tower crane components
- access equipment
- hydraulic systems
- electrical systems
- mechanical systems
- continual checks

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

- *supervising the apprentice conducting maintenance of tower crane components*
- *supervising the apprentice during an inspection of access equipment such as ladders, catwalk and scaffolding*
- *having the apprentice view the crane manufacturer's requirements for inspections/maintenance*
- *supervising the apprentice during an inspection of tower crane hydraulic, electrical and mechanical systems and their components*
- *exposing the apprentice to maintenance procedures and checklists for rigging and tower crane maintenance*
- *demonstrating daily interval checks such as site conditions, running lines, hoist lines and tower crane condition*

Tower Crane Set-up

- assembly and disassembly
- positioning and stabilizing self-erecting tower cranes
- climbing and lowering

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

- *allowing the apprentice to help in the assembly/disassembly of a tower crane and components*
- *describing regulations for the setup and positioning of self-erecting tower cranes*
- *explaining the consideration when climbing or lower a tower crane such as length of power cable, weather and balance*

allowing the apprentice to help when climbing or lowering a tower crane

Tower Crane Operations

- pre-lift activities
- hammerhead tower crane
- luffing jib tower crane
- self-erecting tower crane
- specialty crane operations

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

- *allowing the apprentice to perform pre-lift activities such as a risk assessment or site assessment*
- *allowing the apprentice to perform warm-up activities*
- *ensuring the apprentice understands the legal responsibilities of the workers involved in crane operation*
- *supervising the apprentice during the operation of various types of tower cranes such as hammerhead, luffing jib, and self-erecting*
- *explaining the level of awareness required while operating a tower crane such as watching the load and surrounding environment*
- *discussing specialty craning operations such as multi-crane lifts, critical capacity lifts and professional engineer specifications*
- *ensuring the apprentice considers variables affecting a lift such as wind, weather, site conditions and obstacles*

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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