Tower Crane Operator
Level 2
Tower Crane Operator

Unit: F1 Tower-Crane Assembly, Set-Up, and Inspection

Level: Two
Duration: 28 hours
Theory: 14 hours
Practical: 14 hours

Overview:
In contrast with most other kinds of crane and hoisting practice, the operation of tower cranes involves special requirements with regard to inspection, transport, and set-up. Unlike boom trucks and mobile cranes, tower crane equipment typically remains stationary on a special footing or foundation throughout the life of the large construction projects where this equipment is a favoured choice. This unit of instruction concentrates on the special skills, knowledge, and coordination requirements involved in preparing tower cranes for on-site operations, and for verifying their readiness.

Objectives and Content:

<table>
<thead>
<tr>
<th>Percent of Objectives and Content:</th>
<th>Unit Mark (%)</th>
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<tbody>
<tr>
<td>1. Describe procedures to prepare equipment and jobsite for tower-crane assembly.</td>
<td>40%</td>
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<tr>
<td>a. Review of earlier Technical training content on tower-crane equipment components and operation</td>
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<tr>
<td>b. Special hazards and precautions re: preparing tower-crane footings and securement</td>
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<td>c. Procedure for operator-level consultation(s) and monitoring re: footings and securement</td>
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<td>• Roles/responsibilities re: hoisting-jobsite personnel, including truck dispatcher, crane technician, service crane operator, transport driver, etc.</td>
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<td>• Preparation for/pouring of tower crane concrete pad of concrete</td>
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<td>• Securement of crane on footing (and/or rail base)</td>
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<td>• Leveling and securement of tower crane pad-feet</td>
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<td>• Verification of compliance with job specifications, manufacturer specifications, and other standards</td>
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<td>d. Assessment and adaptation of footings and set-up procedure to suit specific job-site conditions and equipment configurations</td>
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<td>e. Inspection procedure/criteria re: identifying and addressing possible damage to tower components during transport to jobsite</td>
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<td>f. Procedure/criteria re: ensuring access for tower crane equipment both to the jobsite and on the jobsite</td>
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<td>g. Other (specified by instructor)</td>
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<td>2. Describe procedure for assembling major components of tower-crane equipment.</td>
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<td>a. Component-specific hazards and precautions re: tower crane assembly</td>
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<td>b. General overview of tower-crane engineering and major components/attachments re: assembly procedure(s), including standards and order of operations</td>
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<td>c. Procedure for boom/trolley assembly, including:</td>
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<td>• Boom/trolley configurations, including selection/verification per specific job specifications and requirements</td>
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<td>• Rigging practices/standards re: taglines, cable size, use of personal protective equipment, etc.</td>
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<td>• Selection of suitable lay-down area of boom/trolley assembly</td>
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<td>d. Procedure for assembling tower, including:</td>
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• Specialized tools, equipment, fasteners, and hardware (e.g., hydraulic torque-wrench)
• Verifying compliance with standards (e.g. plumbness of tower)
e. Procedures for assembling counter-jib and counter-weight, including:
  • Typical configurations, and important variations
  • Identification of lay-down area for counter-jib assembly
  • Rigging practices and standards
  • Interpreting documentation, standards, and specifications re: boom configuration(s) and required counterweight(s)
f. Procedure for reeving tower-crane cables
g. Special considerations re: disassembly of major components
h. Other (specified by instructor)

3. Describe operator-level responsibilities/practices re: inspections and consultations 20% associated with tower-crane assembly and set-up on site.
   a. Review Level One content re: regulatory environment with special reference to tower crane assembly and /consultations, including
      • Roles and responsibilities re: documentation, scheduling, unsafe/damaged equipment, etc.
      • Special hazards/precautions of conducting inspections and working at heights
   b. Inspection procedures mandated by regulation
c. Inspection procedures mandated by owner/manufacturer specifications and other industry standards
d. Consultations with jobsite personnel re: inspection
e. Other (specified by instructor)

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Tower Crane Operator

Unit:  F2 Tower-Crane Coordination and Communications

Level:  Two
Duration:  14 hours
Theory:  7 hours
Practical:  7 hours

Overview:

As introduced in Level One Technical training, all crane and hoisting trade jobsites impose significant demands upon operators with respect to coordination and communication. These responsibilities encompass serious concerns regarding safety hazards and precautions affecting all personnel, but also extend to the issues of efficiency, productivity, and the quality of construction project teamwork. Tower crane coordination and communication has much in common with other kinds of hoisting work, and yet the nature of the equipment and the operator’s relationship with other jobsite personnel impose some special demands as well. General and specific consultation procedures routinely involved in tower crane work are one area where such special expectations apply. This unit of instruction offers Tower Crane Operator apprentices opportunities to refine theoretical knowledge and practical skills that are required to satisfy their specialty’s coordination, communication, and inspection requirements.

Objectives and Content:

1. Describe/demonstrate the tower crane operator’s general and specific Responsibilities for communication and coordination on the hoisting jobsite. 40%
   a. Review of Level One Technical training material re: coordination and communication systems/requirements associated with craning jobsites
   b. Special hazards and precautions associated with tower-crane coordination and communication.
   c. Operator-level roles, responsibilities, and procedure for consultation/coordination re: tower crane pre-lift planning with crane technician and crane technician’s crew, including:
      • Clarification of lift-/jobsite-specific roles and responsibilities, with particular reference to tower-crane erection, selection of communication methods/personnel
      • Assessment/contribution to assessment of specific safety hazards/requirements
      • Procedure for sequencing of lift, and for monitoring/adaptation of procedure as required
      • Selection and use of PPE including fall-protection gear (e.g., double-tie off)
      • Supervision of apprentices and other lift-area personnel as required (e.g., use of hand signals, clearances)
      • Communication with non-operators about lift-related technical matters
      • Other (specified by instructor)
   d. Operator level roles, responsibilities, and procedure for consultation/coordination with crew electrician re: energizing assembled tower-crane equipment
      • Use of tower crane levers and controls and set-up of computerized components (e.g., LMI)
      • Use of limit switches re: load moment, load limit, trolley-in/out limit switches, up/down hoist limits, etc.
      • Communicating about switches and other electromechanical safety devices
      • Procedure for verifying with electrician and crane technician that electrical connections are installed/functioning per all standards and manufacturer requirements
      • Procedure for verifying that tower crane functions properly in relation to controls
      • Other (specified by instructor)
   e. Operator level roles, responsibilities, and procedure for consultation/coordination with ironworkers and designated tradeworkers, including:
• Selection/use of specialty tools re: bolting procedures and standards
• Procedure for verifying with ironworkers that proper torque-force is being applied to bolts
• Procedure for consulting with crane technician and ironworker to ensure proper sequencing/coordination of tower-crane operation
• Other (specified by instructor)
f. Operator level roles, responsibilities, and procedure for consultation/coordination with labourers re: tower-crane blocking, taglines, hookups, etc.
• Procedure for coordinating selection/use of rigging equipment and accessories
• Procedure for interpreting/verifying rigging standards per specific lift requirements
• Procedure for coordinating efforts of all lift-area personnel as required
g. Other (specified by instructor)

2. Describe/demonstrate use of hand signals to coordinate tower-crane hoists and personnel. 25%
b. Special hazards, precautions, and technical requirements re: hand-signal use for communication about/coordination of tower-crane lifts.
c. Significance and scope of trade-specific variations re: hand-signal conventions and applications
d. Operator-level responsibilities and practical interventions when required
• Practical assessment of suitability/limitations of hand-signal use in specific tower-crane lift situations
• Negotiation re: trade-specific hand signals to establish an agreed-upon standard
• Assessment of abilities and lift-readiness of signaler and other lift-area personnel
• Provision of basic ‘just-in-time’ coaching re: hand-signal skills as may be required by other personnel
• Clarification of assigned roles and responsibilities for communication/coordination of tower crane operation
e. Other (specified by instructor)

3. Describe/demonstrate use of electronic communication technology to coordinate tower-crane lifts and personnel. 25%
b. Special hazards, precautions, and technical requirements re: use of electronic communication technologies for communication about/coordination of tower-crane lifts.
c. Applications/use of specified electronic communications technology in tower-crane lift situations, including:
• Use of Electronically generated/distributed trade documents
• Use of LMI and other computer technology as components of tower-crane engineering
• Use of radios
• Use of cell-phones
• Practical assessment of suitability/limitations re: use of electronic communications technology in specific tower-crane lift situations
• Other (specified by instructor)
d. Procedure for interpreting LMI and other electronic read-outs, including:
• Swing parameters
• Hoisting parameters
• Load chart data
• Radius/trolley position
e. Procedure for sending/receiving lift- and jobsite-related information using electronic communications technology
f. Other (specified by instructor)

4. Describe/demonstrate use and maintenance of logbooks and related documents per requirements to communicate information about tower-crane operation. 10%
a. variations in tower-crane logbook contents and format, including:
b. Maintenance schedules
c. Grease-points
d. Manufacturer/owner/client specifications
e. Regulatory requirements
e. Other (specified by instructor)
Tower Crane Operator

Unit: F3 Hammer-Head, Luffing-Jib, and Specialty Operations

Level: Two
Duration: 140 hours
Theory: 70 hours
Practical: 70 hours

Overview:

This unit offers Tower Crane senior apprentices opportunities to refine their theoretical understanding of major varieties of tower-crane operation, and to refine their practical skills under the supervision of a qualified instructor. Unit content concentrates on the two major varieties of tower-crane technology, but also includes material concerning the operation of relatively less-common equipment such as self-erecting tower cranes and rail-mounted units. A second focus of the unit concerns procedures for tower-crane hoisting of a variety of construction materials and components which are very significant in jobsite practice - for example, the manipulation of pour-buckets and of fly-forms, along with the special hazards and precautions these operations entail. Successful completion of the unit includes executing a senior-level Demonstration Project that tests the apprentice's mastery of a range of practical skills and applied theoretical knowledge against a set of instructor-provided evaluation criteria.

Objectives and Content:

1. Describe/demonstrate procedures for pre-operational inspections, cab-entry, start-up, and shut-down/securement of tower-crane equipment.
   a. Special hazards and precautions associated with tower-crane pre-op inspections, cab-entry/egress start-up, and shut-down procedures, including:
      • Falls, pinch-points, oil/grease spills, hazardous materials, electrocution, etc.
      • PPE selection/use for climbing/inspections
      • Techniques and preferred practices for climbing, maintaining balance/orientation, acclimatizing to extreme heights, etc.
   b. Procedure for complying with protocols re pre-operational inspection/maintenance requirements and schedules, including:
      • Daily/weekly visual inspections
      • Inspection criteria, targets, and sequences, including walkways/ladders, bolts, welds; apex, counter-/main-jib and other assemblies/components; reeving of cables (e.g., drums, sheaves, keys, gearboxes, keys, etc.)
      • Documentation and other response to maintenance needs as identified through pre-operational inspections (e.g., interpretation of coding re: size, type, construction, composition, etc.)
      • Common remedial actions (e.g., application of lubricant, respooling/replacement of cable, etc.)
   c. Cab-entry procedures, checks, and inspection targets, including:
      • Operational condition of communication devices and systems (e.g., checks for radio interference)
      • Mechanical and electrical safety devices, including horns, cut-outs, LEDs, warning devices, load-limit alarms/indicators, limit switches, etc.
   g. Other (specified by instructor)

2. Describe/demonstrate procedures for operating hammerhead tower cranes.
   a. Special hazards/precautions re: operation of hammerhead-type tower cranes

Percent of Objectives and Content: Unit Mark (%)

10%

25%
(e.g., when flying loads above jobsite personnel)

b. Hammerhead tower-crane functions, controls, capacities, and limitations

c. Procedure for traveling hammerhead tower-crane trolley to determine radius
   • Manipulation of controls to determine and achieve a required radius in accordance with job- and site-specific conditions
   • Interpreting interplay between site characteristics and equipment limitations/capacities, including load chart use
   • Assessing/monitoring relationship between trolley position and crane capacity, including load chart interpretation
   • Other (specified by instructor)

d. Procedure for synchronizing trolleying/slewing operations to maintain straight-line movement of load
   • Load chart use
   • Monitoring/recognition of special hazards
   • Practical exercises and instructor suggestions re: refining hand/eye coordination
   • Practical exercises and instructor suggestions re: recognition of special hazards
   • Other (specified by instructor)

e. Procedure for maintaining/restoring alignment of load under trolley, including:
   • Controls for maintaining/adapting operation re: alignment
   • Reference points and practical suggestions for recognizing deviations and restoring load-alignment

f. Procedure for executing hammerhead tower-crane hoist, including:
   • Working with load charts and load weights (including determination of unknown weight), load weight
   • Ensuring compliance with rigging standards and associated requirements (e.g., verification of required clearances)
   • Techniques re: monitoring and responding to conditions including swing-out, sideloading, dragging on boom/trolley, and significance of cut-out functions on some newer tower cranes
   • Practical exercises and instructor suggestions re: refining skills to ensure precise, consistently smooth movement of hammerhead tower-crane loads
   • Other (specified by instructor)

g. Procedure for adapting hammerhead operation to remote-control requirements, including
   • Controls/adaptation of operation re: remote-control hammerhead tower-crane lifts (e.g., communication/coordination with other personnel to compensate for change in lines of sight)
   • Practical exercises and instructor suggestions re: visualization of remote-control lift from multiple perspectives (e.g., from the ground; from inside the cab)

h. Procedure/requirements re: hammerhead tower-crane shut down and securement
   • Verifying swingbrake disengagement to permit weathervaning
   • Travel of trolley to required radius and securement of lift-hook at required height
   • Criteria/practices to verify shutdown and securement of tower crane per all regulatory requirements and industry standards
   • Other (specified by instructor)

i. Other (specified by instructor)

3. Describe/demonstrate procedures for operating luffing-jib tower cranes. 25%

a. Special hazards and precautions re: operation of luffing-jib tower cranes.

b. Luffing-jib tower crane functions, controls, capacities, and limitations, including:
   • Coordination of three functions (booming/hoisting/slewing) using a single lever
   • Relationship(s) between boom-tip position and crane capacity (load chart)
   • Determining and achieving required radius in accordance with interplay of equipment, site conditions, and luffing-jib lift specifications
   • Other (specified by instructor)

c. Procedure for booming up/down to determine radius, including:
   • Manipulation of controls (booming up/down) to determine and achieve a required radius in accordance with job- and site-specific conditions
   • Using luffing-jib tower crane load-chart

d. Procedure for maintaining constituent straight-line elevation of operation by slewing and by booming up/down, including:
   • Controls for maintaining/adapting operation re: straight-line elevation
   • Practical exercises and instructor suggestions re: coordination three functions (booming/hoisting/slewing) using single lever

 e. Procedure for maintaining/restoring alignment of tower-crane load under boom-tip
• Use of load charts
• Controls for maintaining/adapting operation re: alignment
• Reference points and practical suggestions for recognizing deviations and restoring load-alignment

f. Procedure for executing luffing-jib tower crane hoists, including:
• Working with luffing-jib tower-crane load charts and load weights (including determination of unknown weight), load weight
• Ensuring compliance with rigging standards and associated requirements (e.g., verification of required clearances)
• Techniques re: monitoring and responding to adverse or changing conditions
• Practical exercises and instructor suggestions re: refining skills to ensure precise, consistently smooth movement of luffing-jib tower-crane loads, including single-lever use
• Other (specified by instructor)

g. Procedure for adapting luffing-jib operation to remote-control requirements
• Controls/adaptation of operation re: remote-control hammerhead tower-crane lifts (e.g., communication/coordination with other personnel to compensate for change in lines of sight)
• Practical exercises and instructor suggestions re: visualization of remote-control lift from multiple perspectives (e.g., from the ground; from inside the cab)

h. Procedure/requirements for shut-down and securement of luffing-jib tower crane

i. Other (specified by instructor)

4. Describe/demonstrate procedures for operating self-erecting tower cranes. 10%

a. Special hazards and precautions re: operation of self-erecting tower cranes.
• Regulatory requirements re: transport of vehicles, including those regarding load characteristics (e.g., dimensions, weighs, axes, and materials)
• Regulatory requirements re: operator qualifications (e.g., licensing requirements/endorsements such as Air Brake, Class 1, etc.)

b. Self-erecting tower-crane functions, controls, capacities, and limitations, including:
• Comparison/contrast with other varieties of tower-crane equipment
• Comparison/contrast with other varieties of mobile crane equipment, boom trucks, etc.

c. Procedure for transporting self-erecting tower crane
• Interpreting requirements re: weights, materials, axles, etc. to suit specific jobs and jobsites (e.g., variation in provincial and other regulatory environments)
• Coordinating and communicating with driver, dispatcher, and delivery personnel as required

d. Procedure for establishing/verifying required clearances and footings, including:
• Components, controls, and standards re: levelling and stabilization of self-erecting tower crane (e.g., outriggers)
• Assessing/verifying required clearances, location of utilities, limits of approach, etc.
• Procedure/inspection targets re: pre-job audit of site hazards and necessary precautions
• Coordination with jobsite personnel

e. Procedure for executing self-erecting tower crane lift
• Working with self-erecting tower-crane load charts and load weights (including determination of unknown weight),
• Ensuring compliance with rigging standards and associated requirements (e.g., verification of required clearances)
• Techniques re: monitoring and responding to adverse or changing conditions
• Practical exercises and instructor suggestions re: refining skills to ensure precise, consistently smooth movement of self-erecting tower-crane loads
• Other (specified by instructor)

f. Procedure for adapting self-erecting tower-crane operation to remote-control requirements

g. Procedure/requirements for shut-down and securement of self-erecting tower crane

h. Other (specified by instructor)

5. Describe/demonstrate procedures for participating in tower-crane multi-lifts, including an engineered lift requiring interpretation of a lift-plan. 10%

a. Special hazards/precautions associated with performing tower-crane tandem lifts (multi-lifts), and engineered lifts (including those that require lift-plan interpretation)
• Operators’ roles and responsibilities (e.g., designation of single signalperson for both cranes)
• Special regulations, options, and requirements re: use of a second unit and re: tandem lifts (e.g., limits of approach, load limits, permissible tolerances, etc.)
• Design, coordination, and assessment of tandem-lift ‘dry run’
b. Special considerations and procedures re: executing tower-crane multi-lifts involving mobile cranes, including:
   • Assessing interplay of tower crane and mobile crane operational characteristics, including interpretation of load charts (e.g., two or more sets of operational quadrants)
   • Communication/coordination re: all personnel
   • Other (specified by instructor)

c. Special considerations and procedures re: executing tower-crane multi-lifts involving other tower cranes, including:
   • Assessing interplay of one tower crane’s operational characteristics with those of other units, including interpretation of load charts
   • Assessing interplay of one tower crane’s operational characteristics with other tower crane equipment, including interpretation of load charts (e.g., mobile crane’s operational quadrants)

d. Other (specified by instructor)

6. Describe/demonstrate procedures for performing specialty lifts as specified by instructor.
   a. Special hazards/precautions associated with adapting standard tower-crane operating procedures to instructor-specified requirements of specialty lifts
      • Varieties of specialty lift
      • Practical implications of specialty-lift specifications and requirements
   b. Special considerations and procedures re: tower-crane hoisting of pre-cast concrete products, including:
      • Hazards and precautions re: tower-crane hoisting of pre-cast products (e.g., breakage, pinch-points, shock-loading, breakage, chipping, etc.)
      • Determination of balance points, weights, and special rigging requirements for hoisting pre-cast products
      • Practical adaptation of tower-crane operation to suit instructor-specified lift situations re: pre-cast products
   c. Special considerations and procedures re: tower-crane hoisting of concrete/materials re: poured-in-place components, including:
      • Tower-crane hoisting of flyforms, building materials, whalers, strongbacks, pour-buckets, etc., including designation of swamper/signalperson
      • Use of electric hoist, come-along, Tirfor jacks, etc. in conjunction with fly-form lifts
      • Special options, hazards, and requirements re: use of second unit for pre-cast product hoists (e.g., use of electric chain-hoist)
      • Techniques to achieve fine adjustment of trolleying when hoisting/manoeuvering column/wall/gang forms
      • Practical exercises and instructor suggestions re: achieving efficiencies/maximized productivity during concrete forming
   d. Manipulation of pour-bucket to place concrete in forms
      • Special hazards and precautions (e.g., human traffic; techniques for maintaining task-focus during extended periods of fast-pace, intense, repetitive activity requiring continuous coordination with personnel)
      • Practical exercises (including crew coordination) re: lifting/positioning and placement of concrete pour-bucket
      • Practical exercises and instructor suggestions re: achieving efficiencies/maximized productivity during concrete placement
   e. Special considerations and procedures re: tower-crane hoisting of structural/reinforcing steel components and ornamental ironwork
      • Special hazards and precautions
      • Determining lift-specific balance points, weights, and special rigging requirements re: reinforcing-steel (rebar) bundles and cages; structural steel specialty products (girders, stair pans, roof trusses, purlins, beams, etc.)
      • Practical exercises re: trolleying/slewing/swinging/hoisting of steel components
      • Coordination with ironworker(s), including re: alignment of structural steel member(s) for bolting/connecting, etc.
      • Determining lift-specific and product-specific balance points, rigging, and coordination requirements re: ornamental ironwork products
      • Other (specified by instructor)
   f. Special considerations and procedures re: tower-crane hoisting of machinery and mechanical systems
components
• Using and generating required information (e.g., special directions, bills of lading, and shipping/technical documents) re: tower-crane hoisting of mechanical components (e.g., escalator/elevator assemblies, HVAC units, switchgear, generators, etc.)
• Assisting/coordinating efforts with millwrights, electricians, mechanical workers, plumbers, and other trades
• Practical adaptation of operation to suit instructor-specified lift situations re: tower-crane hoists of machinery and mechanical components
• Other (specified by instructor)
g. Procedure for adapting operation to rail-mounted tower-crane configuration, including:
• Requirements (including regulations) for adapting tower-crane operation to rail-mounted configuration (e.g., ballast requirements; verifying/monitoring soundness of rails, etc.)
• Practical techniques re: ensuring smooth, consistent operation when in rail-mounted configuration
• Special shutdown/securement requirements (e.g., use of wheel-dogs; wind effects on free-wheeling/fixed, rail-mounted tower crane, etc.)

7. **Complete the Senior Level Tower-Crane Lift Demonstration Project *per instructor* specifications.**
Tower Crane Operator

Unit: F4 Tower-Crane Jacking and Climbing

Level: Two

Duration: 14 hours
  Theory: 7 hours
  Practical: 7 hours

Overview:

This unit of instruction concentrates on the theoretical and practical understanding required to take advantage of tower-crane equipment’s unique capabilities to climb to required elevations both inside and outside built structures. Although this is an aspect of Tower Crane operation, its importance and special requirements warrant special treatment as a distinct focus of Tower Crane apprenticeship learning.

Objectives and Content:

1. Describe procedure for tower-crane jacking from inside built structures. 25%
   a. Special hazards and precautions re: upward/downward tower-crane jacking, including:
      • Hazards associated with climbing, using tools, and positioning/assembling tower crane components at extreme heights (e.g., dropped tools; disorientation; vertigo, etc.),
      • Wind factors
      • Pinch points
      • Ensuring sufficient length of cab-tire cable
      • Clearing jacking area of all non-essential personnel
      • Designation/briefing of all essential personnel re: roles/responsibilities
      • Other (specified by instructor)
   b. Identification of upward/downward jacking procedure re: major tower-crane components and functions, including:
      • Footings, shoring, bracing, and anchoring
      • Jacking frame
      • Wedges/levelling devices
      • Ladders
      • Corner-shoe bolts
      • Hydraulic cylinder (including tower crane controls re: jacking)
      • Beams/supporting devices
      • Other (specified by instructor)
   c. Jacking procedures, accessories, and standards
   d. Other (specified by instructor)

2. Demonstrate procedures re: interpreting specifications, inspecting shoring, and assembling/installing specified tower-crane jacking components. 25%
   a. Procedure re: ensuring and verifying integrity/stability of tower-crane shoring down to the footings, including:
      • Inspection standards and protocols re: shoring and anchoring components associated with jacking
      • Inspection targets, including footings, bracing, shoring, wedging, etc.
      • Remedial action re: substandard conditions
   b. Procedure for assembling jacking frame, wedges, ladders, and jacking accessories, including:
      • Selection/use of levels, tapes, and other tools/equipment for jacking
      • Practical suggestions re: maintaining balance/orientation while using tools and positioning jacking-related components at extreme heights
• Other (specified by instructor)
c. Procedure for installing wedging, including:
  • Selection, use, and inspection of material(s)
  • Selection/use of wedging installation tools (e.g., hammer drill; measuring devices)
d. Procedure for balancing crane, including:
  • Practical hazards, precautions, and standards re: balancing of tower crane
  • Hoisting of test block and traveling of trolley to achieve/verify balanced condition
  • Coordination/communication requirements when balancing tower crane
e. Procedure for unfastening corner-shoe bolts, including:
  • Practical hazards, and precautions re: unsecured (unbolted) tower crane
  • Use of hydraulic torque wrench
f. Procedure for extending hydraulic cylinder to raise crane incrementally
  • Interpreting and complying with manufacturer specifications
  • Practical techniques for monitoring/adapting operation to maintain balanced condition of crane during extension(s) of hydraulic cylinder to raise unbolted crane incrementally
  • Use/interpretation of manual to respond to job-specific conditions/requirements
g. Procedure for installing beams and supporting devices to secure crane at specified height, including:
  • Practical hazards/precautions re: selection and use of supporting devices
  • Ensuring/verifying that beams and supporting devised have been installed per manufacturer specifications
h. Procedure for using wedges and leveling devices to securing crane in required orientation and at required level
  • Selection/use of required tools (e.g., sledgehammer, wrenches, levels, etc.)
  • Interpretation of manufacturer specifications/standards re: achievement of required orientation, leveling, and securement via tower-crane jacking procedures
i. Other (specified by instructor)

3. Describe procedures for tower-crane climbing from outside built structures. 25%
a. Special hazards and precautions re: tower-crane upward/downward climbing
b. Identification of tower-crane climbing procedures and associated components, controls, and standards
c. Other (specified by instructor)

4. Demonstrate climbing procedures. 25%
a. Procedure for installation of climbing unit, including:
  • Practical requirements and jobsite protocols for re: communication with/coordination of personnel
  • Practical assessment/remedial action re: hazards and required precautions
  • Monitoring/adaptation of climbing procedures per manufacturer, employer, jobsite, and regulatory standards
  • Selection/use of assembly tools/equipment and measuring devices
  • Interpretation of assembly diagrams
b. Procedure for balancing crane and installing tie-in assembly, including:
  • Hoisting of test-block and trolleying to n necessary radius to achieve/verify balanced condition
c. Procedure for installing tower-crane section(s), including:
  • Compliance with manufacturer-prescribed, step-wise sequence for assembling sections
  • Verification that completed assembly complies with regulatory, manufacturer, and employer requirements
d. Other (specified by instructor)
Tower Crane Operator

Unit: E5 Orientation II: The Job of Journeywork (AC Board Standard)

Level: Two
Duration: 14 hours
Theory: 7 hours
Practical: 7 hours

Overview:

Technical training offers an entry-level orientation to the challenges of apprenticeship learning. The present unit introduces senior apprentices to the responsibilities of workplace teaching that they will assume as supervising journeypersons. Tradeworkers have a particularly rich tradition of refreshing and sharing their skills from one generation of practitioners to the next. This unit orient senior apprentices to some of the practical and conceptual tools that can enable them to contribute to this trade heritage when they themselves become certified journeypersons. The journeyperson’s obligation to assist trade learners to develop skills and knowledge is complex and challenging. It involves safety considerations, employer expectations, provincial regulations, as well as the tradition of skills stewardship that links modern practice with the long history of workplace teaching and learning that defines the apprenticeable trades. The ability to offer timely, appropriate support to apprentices is itself an important area of trade learning. This unit presents material intended to help refine this ability through reflection and discussion by senior apprentices, and dialogue with their instructor. The detailed descriptors under each unit objective reflect Manitoba and Canadian standards prescribed for journey-level supervisory capabilities, as well as key topics in current research on the importance of workplace teaching and learning in trades-apprenticeship systems. Thus, descriptors represent suggested focal points or guidelines for potentially-worthwhile exploration. Delivery of this content will vary with the discretion of individual instructors, and with the experiences senior apprentices bring forward for group/individual reflection on the skills-stewardship dimension of their own future practice as journeypersons.

Objectives and Content:

1. Describe the scope, substance, and significance of journey-level status. 10%
   a. Historical background and trade traditions
      • Origin, definition, and examples of journey-level status
      • Obligations to employers, trade clients, and apprentices
      • Concept of skills stewardship, and its rationale
      • Customary responsibilities of journeyperson as workplace trainer/supervisor
      • Overview development of formal systems for regulating/recognizing journey-level competence in designated apprenticeable trades, including compulsory certification trades
      • Achievements/limitations of informal systems for workplace training
      • Canadian/other trends (e.g., succession planning in the trades; recognition of credentials and prior learning; regulation of persons entitled to practice prescribed tasks of a trade; defined standards for on-the-job trades education and training)
   b. Regulatory/legal dimensions of journey-level status in designated trades
      • Manitoba provincial requirements [e.g., Apprenticeship and Trades Qualifications Act; General Regulation; the Crane and Hoisting Equipment Operator Trade Regulation; relevant policies of the Apprenticeship and Trades Qualifications Board of Manitoba]
      • Trade-specific requirements re: Practical Training supervision and documentation (e.g., 'limited supervision' provisions of the 2006 revised Trade Regulation; entitlements/obligations re: compulsory certification-trade status; importance of quality assurance and broad-scope coverage of prescribed task-content; ratios, etc.)
c. Other (as may be specified by instructor)

2. Compare/contrast role-options and responsibilities of the supervising journeyperson. 15%
   a. Recognizing the variability of supervision assignments, situations, and roles, with special reference to the ‘limited supervision’ clause of the revised Trade Regulation (2006)
   b. Source and specification of the supervision assignment
   c. Formal vs. informal roles (e.g., mandated by an employer’s succession plan)
   d. Implicit vs. explicit standards and content: training goals are/are not codified; assessment measures are/are not used
   e. Accountability for results: subject/not subject to third-party notification; completion of supervision assignment itself is/is not assessed by third party; journeyperson is/is not required to prepare performance evaluation that could affect apprentice’s employability or wage-rate, etc.
   f. General vs. task- or job-specific supervision assignments: e.g., scope of expectations re: content of supervisory task(s)
   g. Long-term vs. short-run supervision assignments – e.g., considerable latitude/little latitude for apprentice to learn from mistakes
   h. Formally vs. informally structured – e.g., supervision assignment is part of a prescribed cycle of assignments involving coordination among multiple journeypersons; apprentice is trained according to an individual Training Plan negotiated with employer
   i. Typology of common supervisory role-options and what is implied by each:
      • Coach role: is often initiated by someone other than apprentice, and limited to a particular skill set, task, or production requirement
      • Mentor role: often initiated by apprentice, and relatively open-ended regarding content, duration, etc.
      • Peer role: typically involves individual upgrading or cross-training of one journeyperson by another; can include senior apprentice assisting less-experienced trade learner
      • Managerial role(s): can shade over into hire/fire issues as lead-hand or site-boss
      • Coordinator role: often a senior-level journeyperson appointed by an organization to assume responsibilities for monitoring progression of groups of apprentices
      • Other roles: may be improvised by journeyperson
   j. Possibilities, perils, and likelihood of role-overlap in ‘real-life’ trade practice
   k. Importance of clarifying all roles, expectations, and implications involved in accepting a supervision assignment
   l. Role of Apprenticeship Training Coordinator (ATC), Apprenticeship Manitoba
   m. Resources for developing skills and knowledge re: providing journey-level supervision
      • Books and journals (not always trade-specific)
      • Websites
      • Conversation with trade instructors, journeypersons, and peers
      • Workshops
   n. Other (as may be specified by instructor)

3. Describe/demonstrate common requirements re: providing journey-level supervision. 25%
   a. Review Unit A1 content re: challenges/opportunities opportunities of Apprenticeship learning adapted to journey-level supervision assignments and a journey-level standpoint
      • Application of adult education concepts to trades teaching/learning (e.g., responsibilities and expectations of adult learners)
      • Practical significance of ‘styles’ of adult learning and teaching
      • Helping apprentices to integrate technical training (in school) and Practical Training (on-the-job) learning experiences
      • Providing help and guidance re: new tasks and skills
      • Providing help and guidance re: fixing mistakes
      • Learning/teaching “the ropes” – socialization of learner within a community of trade practice (e.g., how to borrow a tool, interrupt a journeyperson, ‘recruit’ an advisor)
      • Coverage/documentation of prescribed tasks and subtasks (Mobile Crane Operator NOA), including responsibility re: logbook sign-off (where applicable)
      • Consultation with Apprenticeship Training Coordinator (ATC), Apprenticeship Manitoba
      • Communicating with apprentices and employers about supervision assignments and assignment specifications, including the limits of the trainers’ own responsibilities and competence (e.g., substance-abuse intervention)
      • Benefits of maintaining a personal record of achievements, ideas, and needs as a workplace trainer

Rev. October 2006
b. Individual reflection and guided group discussion re: personal experiences of workplace learning as an apprentice
   • Identification of best and worst practices of supervising journeypersons
   • Assessment of personal experiences (if any) to date in supervising, coaching, or guiding other people to learn or improve their skills (e.g., entry-level apprentices, members of athletic team, younger family members, etc.), and how this might compare/contrast with the journey-level support of apprenticeship learning
   • Identification of workplace and other factors that can contribute to good and bad trades teaching/learning experiences
   • Development of personal standards re: responsibility to share one’s knowledge and skill with others in the workplace (e.g., use/misuse of humour, rigour, discretion, craft-pride, etc.)

   c. Comparison/contrast of discussion results with current knowledge/resources re: workplace skills coaching methods as applicable to journey-level supervision assignments
      • Qualities of a good workplace coach
      • Components of workplace skills coaching
      • Processes and recommended practices re: workplace coaching
      • Troubleshooting problems re: supervision assignments

   d. Other (as may be specified by instructor)


   a. Identifying purpose of the lesson
      • explaining the point of the lesson
      • role of the coach in specific coaching situation
      • Other (specified by instructor)

   b. Linking the lesson
      • Learner needs
      • Lesson sequence
      • Focus on learner
      • Selection/timing of coaching opportunities

   c. Demonstration of skill/task to be learned
      • Starting the coaching session
      • Demonstration
      • Hands-on trial
      • Recap for learner


   a. Practice of skill/task to be learned
      • Nature and importance of practice
      • Setting up for learner practice
      • Types of practice
      • Recycling and reinforcing skill/task learning

   b. Providing feedback to the learner
      • Value of feedback
      • Kinds of feedback
      • Guidelines and tips

   c. Assessment
      • Value of assessing learner progress
      • Assessing level of skill
      • Planning further steps toward skill/task mastery

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Tower Crane Operator

Unit: E6 Provincial Certification Exam Preparation (CEP) Review

Level: Two
Duration: 35 hours
Theory: 35 hours
Practical: 0 hours

Overview:
This unit offers senior apprentices a systematic review of skills and knowledge required to pass the Interprovincial ‘Red Seal’ Examination. It promotes a purposeful personal synthesis between on-the-job learning and the content of in-school technical training. The unit includes pertinent information about the broad significance of certification and the main features of the certification exam. Trade-specific content is enriched with information about practical strategies/resources for mastering study materials. It is intended that apprentices who seriously tackle the objectives of this unit should be able to approach the certification exam with well-founded confidence. But the unit also encourages consolidation of study practices, trade knowledge, and self-awareness to help meet the longer-term requirements of further learning throughout one’s working life as a certified journeyperson.

Note: No percentage-weightings for test purposes are prescribed for this unit’s objectives. Instead, a ‘Pass/Fail” grade will be recorded for the unit in its entirety.

Objectives and Content:

Percent of
Objectives and Content: Unit Mark (%)  

1. Describe the significance, format, and general content of the Provincial Certification Examination for the trade of Tower Crane Operator.
   a. Scope, aims, and value of certification
   b. Obligations/entitlements of candidates for Provincial certification
      • Relevance of Certification Examination to current, accepted trade practices; industry-based national validation of test items
      • Supplementals Policy (retesting) of the Apprenticeship Branch
      • Confidentiality of examination content; the certified journeyperson’s own stake in examination security (value of credential)
      • Limitations on use of calculators (e.g., dedicated, pre-programmed builders’ calculator not allowed)
   c. Multiple-choice (four-option) item format; Apprenticeship Branch standards for acceptable test items (e.g., no “trick”-type questions; specifications for use of metric/Imperial units)
   d. Important materials relevant to Manitoba Certification Exam for Boom Truck Operators
      • National Occupational Analysis (NOA); prescribed scope of the skills and knowledge which comprise the trade, especially with reference to Level 1 ‘Common Core’ Technical training content
      • Provincial Occupational Analysis (POA); prescribed scope of the skills and knowledge which comprise the trade
      • POA Task Block weightings, and their relationship to content-distribution of Examination items
      • Special significance of subtask-level POA descriptors re: exam content
      • Manitoba Apprentice Program materials

2. Identify resources, strategies, and other key considerations for maximizing successful completion of written exams used in certifying tradeworkers.
   a. Personal preparedness
• Proper rest/nutrition; eye-testing
• Making room for a personal study regimen: appropriate prior communication with family members, friends, and employers about exam-related commitments/needs; identifying – and concluding – all necessary arrangements for minimizing distractions/disruptions
• Focused reflection on prior experience – good and bad – in test situations (e.g., Unit Tests), especially with respect to what the apprentice already has learned re: personal characteristics, learning styles, exam anxiety, and strategies (e.g., time management) for effective performance in test situations.

b. Self-assessment, consultation, and a Personal Study Plan
• Preliminary self-assessment of individual strengths/weaknesses in trade-related skills and knowledge; usefulness of old tests and Apprenticeship Program materials; personal reflection re: in-school and on-the-job components of the Program, as well as the relationship between these two components; usefulness of consultation with journeypersons, appropriate peers, the Apprenticeship Training Coordinator (ATC), and/or personal mentors
• Use(s) of approved textbooks, chapter tests, study guides, and note-taking in preparing for an examination
• Study groups: perils and possibilities
• Formulation, and submission for instructor’s comments, of a personal study plan, including an approximate timetable, which describes/schedules a course of action for reviewing all relevant material(s) and for strengthening areas of deficient skills/knowledge in anticipation of the Red Seal Examination

c. Other (specified by instructor)

3. Review program content re: the foundations of the crane and hoisting trade.
   a. Structure and scope of the crane trades
   b. The trade regulatory environment
   c. Trade safety awareness
   d. Workplace skills-coaching of apprentices

4. Review program content re: trade mathematics, load charts, and lift planning.
   a. Application of math skills in crane-trade practice
   b. Lift planning and preparation (including re: tandem lifts)
   c. Load chart use (including re: tandem lifts)

5. Review program content re: trade technology and troubleshooting hoisting equipment.
   a. Varieties of hoisting equipment
   b. Computer technology in the hoisting trades
   c. Crane technology and mechanical systems
   d. Procedures/techniques for equipment maintenance and troubleshooting

6. Review program content re: operation, rigging and other jobsite specialties.
   a. Assembly/disassembly of hoisting equipment
   b. Rigging theory and practices
   c. Jobsite communication for hoisting operations
   d. Mobile crane operation

7. Review program content re: Tower Crane assembly, set-up, and inspections.
   a. Procedures to prepare equipment and jobsite
   b. Procedure for assembling major components driving Tower Cranes
   c. Inspections and consultations re: assembly and set-up

8. Review program content re: coordination and communication for Tower Crane lifts.
   a. Operator-level responsibilities
   b. Procedures for consultation and communication with lift-area and other jobsite personnel
   c. Use of hand signals
   d. Use of electronic communications technology
   e. Use/maintenance of logbooks and related documentation
9. **Review program content re: hammerhead, luffing-jib, and specialty operations.**
   a. Procedure for pre-operational inspections, cab-entry, start-up and shutdown/securement of tower crane equipment
   b. Operation of hammerhead tower cranes
   c. Operation of luffing-jib tower cranes
   d. Operation of self-erecting tower
   e. Procedure for participating in tower crane multi-lifts, including lift-plan interpretation
   f. Procedure for specialty lifts. Including those involving:
      • Concrete products, materials, and accessories for forming
      • Manipulation of pour bucket
      • Structural/reinforcing steel and ornamental ironwork
      • Machinery and mechanical systems components
      • Adaptation of tower crane equipment to rail-mounted configuration

10. **Review program content re: boom-truck specialty operations.**
    a. Procedure and special considerations re: boom-truck lifts of personnel
    b. Procedure and special considerations re: boom-truck lifts of construction materials, structural members, and built structures/sub-structures
    c. Procedure and special considerations re: tandem/multi-lifts involving Tower Cranes and/or other hoisting equipment
    d. Procedure and special considerations re: engineered and other specialty lifts involving Tower Cranes and/or other hoisting equipment
    e. Procedure and special considerations re: operation of differ-derrick Tower Cranes and components/attachments.

10. **Review program content re: tower crane jacking and climbing.**
    a. Procedure for tower-crane jacking inside built structures
    b. Procedure for tower-crane climbing outside built structures
    c. Procedures for interpreting specifications, inspecting shoring, and assembling/installing jacking components
    d. Procedure for operating climbing unit

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