

CONSTRUCTION
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National Occupational Standards For Operating Engineers

DRAGLINE CLAMSHELL OPERATOR





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Canada

Table of Contents

INTRODUCTION	2
FOREWORD	3
DEVELOPMENT OF THE OCCUPATIONAL ANALYSIS	4
SCOPE OF THE OCCUPATIONAL ANALYSIS	5
STRUCTURE OF THE OCCUPATIONAL ANALYSIS	6
A. EQUIPMENT	
1. Describes Equipment and Attachments	7
B. OPERATING PROCEDURES	
2. Assesses Site	9
3. Plans Dragline/Clamshell Operations	11
4. Performs Dragline/Clamshell Operations on Land	13
5. Performs Clamshell Operations in Water from Shore or Barge	15
DACUM CHART	19
ACKNOWLEDGEMENTS	21

Introduction

The Construction Sector Council (CSC) is one of 40 sector councils in Canada. Sector councils are industry-led, labour/management partnership organizations designed to address human resource development issues within specific industries.

The primary objective of the CSC is the development of a highly-skilled workforce and a safe workplace environment, contributing to the organizational productivity and individual prosperity of the members of the construction industry. The development of national occupational standards for operating engineer occupations is one of the many ways the CSC is meeting this objective.

The CSC acknowledges all of the subject matter experts who provided their valuable time and efforts toward the definition and validation of these national occupational standards. Without their combined contributions, the development of these occupational analyses (OAs) would not have been possible. A complete list of the subject matter experts can be found at the back of this document.

An OA has the following objectives:

- to identify and group the tasks performed by skilled workers in particular occupations
- to identify those tasks that are performed by skilled workers in every province and territory
- to develop instruments for use in the assessment and training leading to the certification of skilled workers
- to facilitate the mobility, in Canada, of trainees and skilled workers
- to supply employers and employees, and their associations, industries, training institutions, and governments with analysis of the tasks performed in particular occupations

Therefore, the standards define the skills, knowledge, and abilities required for an occupation and against which the qualifications of an individual in that occupation can be assessed.

The vision of the Construction Sector Council is to reach a point where operators who demonstrate the skills, knowledge, and abilities in the national occupational standards will possess the nationally recognized credentials and those credentials will assist the operator in obtaining employment anywhere in Canada.

Foreword

Operating engineer occupations can be grouped into three broad areas—hoist and crane operators, construction heavy equipment operators, and industrial equipment operators. Within each of these broad categories, there are several operating engineer occupations.

1. *Hoist and Crane Operators*

Crane operators' work tends to be centred in the construction industry. Operators work on a broad range of building sites including high-rise residential, institutional, and commercial structures, as well as most large industrial sites and many types of heavy engineering projects. The Statistics Canada Labour Force Survey (LFS) identifies around 4,000 crane operators in the construction industry across Canada. There are cyclical variations in employment, with low levels below 3,000 jobs in the mid-1990s and peak levels near 5,000.

2. *Construction Heavy Equipment Operators*

Heavy equipment operators are largely concentrated in the construction industry. Operators work on a variety of jobs from residential, institutional, and commercial structures to most large industrial sites and most types of heavy engineering. The LFS identifies around 37,000 equipment operators employed in the construction industry across Canada. This occupation is one of the larger trades in the industry, comparable in size to the workforce for electricians, pipe trades, and masonry trades. There are cyclical variations in employment, with low levels below 27,000 jobs in the early 1990s and peak levels near 40,000.

3. *Industrial Equipment Operators*

Industrial equipment operators encompass a variety of occupations ranging from forklift operators and environmental workers to tractor trailer drivers. The demand for environmental workers is increasing as knowledge, awareness, and regulations proliferate. Forklift training has taken on added importance due to safety regulations that require trained or certified forklift operators.

The mobility and accessibility of operating engineers is difficult if not impossible if there are no jurisdictional agreements on national occupational standards. The project to develop occupational analyses for national occupational standards for 29 operating engineer occupations began in January 2004 and was completed in March 2005.

Development of the Occupational Analysis

A draft analysis was developed by a knowledgeable team of consultants (process experts) who, with the assistance of a committee of subject matter experts in the field, identified all the tasks performed in the occupation. In order to facilitate an efficient and effective process, the 29 occupations were grouped according to commonalities. Profile meetings, with both process and subject matter experts, were held for each grouping between January and March 2004 in:

- Edmonton, Alberta
 - Excavating, Feb 5 & 6
 - Paving, Feb 9 & 10
- Morrisburg, Ontario
 - Grading, Feb 24 & 25
 - Crane and Hoisting, Mar 1 & 2
 - HAZMAT, Mar 3 & 4
 - Plant Operations, Mar 23 & 24
 - Concrete Pumping, Mar 25 & 26
- Montreal, Quebec
 - Hauling, Feb 26 & 27
- Vancouver, British Columbia
 - Utilities, Mar 16 & 17
 - Material Handling, Mar 18 & 19
- Quebec City, Quebec
 - Profile Completion Forum, Mar 29 – 31

The draft OAs were then distributed to more subject matter experts and stakeholders across Canada for review and input between June and September 2004. They were also posted on a website where subject matter experts were invited to provide feedback.

The combined input from the review was collated in October 2004. Recommendations were assessed and incorporated into the final draft, which included the identification of common core tasks performed in all occupations. Validation meetings were held for each grouping, with process and subject matter experts, between October 2004 and January 2005 in:

2004:

- Saskatoon, Saskatchewan
 - Utilities, Oct 20 – 22
 - Material Handling (including HAZMAT), Oct 26 – 29
- Halifax, Nova Scotia
 - Grading, Nov 2 – 5
- St John's, Newfoundland
 - Crane and Hoisting (including Concrete Pump), Nov 15 – 19
- Winnipeg, Manitoba
 - Excavating, Nov 23 – 25
 - Hauling, Nov 30 – Dec 3

2005:

- Vancouver, British Columbia
 - Paving, Jan 5 – 7
 - Plant Operations, Jan 10 – 12
- Victoria, British Columbia
 - Validation Forum, Feb 21 – 23

The OAs were then edited, translated, and published in both official languages.

Scope of the Occupational Analysis

This occupational analysis identifies all of the tasks that a qualified operator must be able to perform. The performance of these tasks is dependent on a range of related activities, described in the body of the analysis as subtasks. The analysis is composed mainly of tasks that operators perform frequently, including such tasks as cleaning, driving, and maintenance.

Most operators have a range of experience on different types of equipment. Regardless of the type of equipment, the duties of the operator remain relatively constant. Accomplishment of the operator's tasks depends largely on knowledge of the equipment and its components, experience in a wide variety of situations, and an ability to determine the most appropriate means of proceeding with the work.

Though not described in the analysis, other important attributes of operators include mechanical aptitude, mathematical ability, excellent vision, and a high degree of physical coordination. Operators are also often called upon to perform their jobs in extremely difficult conditions.

Although this analysis is not a training document, it is worthwhile noting that aspiring operators may find it useful to reflect on their own abilities to deal with lengthy periods of physical restriction and isolation coupled with frequent subjection to pressures of time and productivity. Operators are often required to demonstrate the ability to concentrate for long periods of time while enduring physical discomfort and inclement weather conditions.

Heavy equipment is used in virtually every facet of the construction sector. In some cases, an operator may work for years on a single site, such as a plant, and may, during that time, operate only one type of equipment and therefore perform similar and relatively constant tasks. Operators who work for contractors may rarely work on the same site more than once and may perform a tremendous variety of tasks using a wide range of equipment types and sizes. The work of an operator often overlaps with that of other equipment operators.

Structure of the Occupational Analysis

To facilitate the understanding of the nature of the occupation, the work performed is divided into the following divisions:

- A. BLOCK** the largest division within the analysis and reflects a distinct operation relevant to the occupation
- B. TASK** the distinct activity that, combined with others, makes up the logical and necessary steps the operator is required to perform to complete a specific assignment within a BLOCK
- C. SUBTASK** the smallest distinct, measurable, and observable activities into which it is practical to divide any work activity; combined with other SUBTASKS, these fully describe the logical steps required to complete a TASK

The importance of a task describes the benefits that operators, employers, and the public receive as a result of an operator's ability to perform the task.

Trends are any shifts or changes that are occurring in the industry and affect the task.

Supporting Knowledge and Abilities are the elements of skill and knowledge that an individual must acquire to perform the task adequately.

Tools and Supplies are those items that are needed to perform the skill.

Note: The tasks required to operate mobile cranes are described in other occupational analyses. This analysis focuses on additional tasks required when a competent operator uses a mobile crane to carry out dragline and clamshell operations.

BLOCK A EQUIPMENT

Task 1 Describes Equipment and Attachments

This task is important because it helps to:

- use equipment and attachments properly and safely
- communicate with others using correct terms
- ensure that attachment is appropriate for task

Trends:

- Manufacturers are placing sensors on crane sheaves to track the amount of material being moved.

Subtasks	Supporting Knowledge and Abilities	<i>Tools and Supplies</i>
1.01 Describes types and applications of dragline attachments	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for dragline attachment types, such as perforated bucket, morman board • applications of different dragline bucket types, such as that morman boards can be used for backfilling and spreading, perforated buckets can be used for lifting material out of water 	<i>Manufacturers' manuals and literature</i>
1.02 Describes types and applications of clamshell attachments	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for clamshell attachments, such as orange peel bucket, wood grapple, clamshell bucket • applications of different clamshell attachment types, such as that orange peels can be used to pick up objects, such as large boulders; clamshell bucket can be used to dig or move material 	<i>Manufacturers' manuals and literature</i>
1.03 Describes wire ropes	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for types, lengths, and sizes of wire ropes 	<i>Manufacturers' manuals and literature</i>

1.04 Describes components of dragline and clamshell attachments

Knowledge of:

- manufacturers' specifications for dragline and clamshell attachments
- main components of dragline attachments, such as fairlead, drag chain, upper and lower ball chain, spread bar, teeth or scraper blade
- main components of clamshell attachments, such as automatic or live tag line, counterweight, sheaves, hinge

Manufacturers' manuals and literature

BLOCK B OPERATING PROCEDURES
Task 2 Assesses Site

This task is important because it helps to:

- ensure proper pick up and placement of load
- prevent damage to load and equipment
- ensure efficient use of time and equipment

Trends:

N/A

	Subtasks	Supporting Knowledge and Abilities	Tools and Supplies
2.01	Assesses site hazards	<p>Knowledge of:</p> <ul style="list-style-type: none"> • job and engineering specifications • company policies and procedures • applicable legislation, such as Occupational Health and Safety • authorities having jurisdiction • factors affecting stability of equipment • actual and potential hazards, such as overhead utilities, guide wires, personnel, vehicular/marine traffic, rough water, location of other equipment <p>Ability to:</p> <ul style="list-style-type: none"> • inspect site visually • identify unsafe site practices • find information about factors that affect stability • communicate with site personnel and authorities having jurisdiction 	<i>Manufacturers' manuals and literature, PPE, personal floatation device (PFD) for marine operations</i>
2.02	Discusses environmental concerns with site personnel	<p>Knowledge of:</p> <ul style="list-style-type: none"> • company policies and procedures • applicable legislation, such as Coast Guard, Fisheries and Oceans, environmental • environmental concerns • site characteristics and boundaries <p>Ability to:</p> <ul style="list-style-type: none"> • identify environmental concerns, such as moving material under water, soil disturbance, silt seepage into waterways, disturbance of fish habitat • communicate questions and concerns to employer, site personnel, or authorities having jurisdiction 	<i>PPE, PFD for marine operations</i>

2.03 Reviews job specifications and safety considerations with site personnel

Knowledge of:

- job and engineering specifications
- applicable legislation
- actual and potential site hazards
- safe work practices
- other construction equipment on site
- roles of personnel on site, such as foreman, inspector, other tradespeople
- hand signals and radio use

Ability to:

- communicate with site personnel to confirm job specifications and determine relevant safety information, such as job- or site-specific PPE needed, traffic patterns, procedures

PPE, PFD for marine operations, utility locate document

BLOCK B OPERATING PROCEDURES
Task 3 Plans Dragline/Clamshell Operations

This task is important because it helps to:

- ensure proper pick up and placement of loads
- prevent damage to equipment
- ensure efficient use of time and equipment

Trends:
 N/A

	Subtasks	Supporting Knowledge and Abilities	Tools and Supplies
3.01	Selects appropriate dragline/clamshell attachment	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for crane and attachments • job and engineering specifications • gross load Ability to: <ul style="list-style-type: none"> • match attachment to crane and job specifications 	<i>Manufacturers' manuals and literature, PPE, PFD for marine operations</i>
3.02	Calculates gross load	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for attachment • characteristics of material being moved, such as composition, density, moisture content • bucket/clamshell attachment size and type • weight of attachment Ability to: <ul style="list-style-type: none"> • refer to weight-of-materials charts • add weight of material and weight of attachment to determine anticipated gross load 	<i>Manufacturers' manuals and literature, PPE, weight-of-materials charts, PFD for marine operations</i>
3.03	Plans work procedures	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for crane and attachment, such as duty cycle chart • job and engineering specifications • company policies and procedures • applicable legislation • gross load • radius • other personnel involved in task • hand signals and radio use 	<i>Manufacturers' manuals and literature, PPE, PFD for marine operations</i>

Ability to:

- identify most efficient starting position
- read and interpret appropriate load chart
- determine boom position and angle
- discuss work plans with site personnel, such as divers, barge captain, engineers

BLOCK B OPERATING PROCEDURES
Task 4 Performs Dragline/Clamshell Operations on Land

This task is important because it helps to:

- prevent damage to property and equipment
- prevent injury to personnel
- fulfill job specifications
- co-ordinate dragline or clamshell operations with other construction activities on site

Trends:
 N/A

	Subtasks	Supporting Knowledge and Abilities	Tools and Supplies
4.01	Configures crane for dragline/clamshell operations	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications for configuration Ability to: <ul style="list-style-type: none"> • configure crane, such as extend/retract tracks, remove counterweights, change lengths of wire ropes 	<i>Manufacturers' manuals and literature, PPE</i>
4.02	Ensures that work area is cleared of unauthorized equipment and personnel before starting tasks	Knowledge of: <ul style="list-style-type: none"> • applicable legislation • safe operating procedures • safe limits approach Ability to: <ul style="list-style-type: none"> • communicate with site personnel • place or arrange for barriers, such as caution tape, pylons 	<i>PPE</i>
4.03	Handles earth/material with dragline/clamshell attachment	Knowledge of: <ul style="list-style-type: none"> • manufacturers' specifications • job and engineering specifications, such as where to stockpile earth, what material to remove • gross load • effect of materials being removed on equipment performance and lifting capacity Ability to: <ul style="list-style-type: none"> • operate dragline attachment, such as position boom, cast, drag, hoist, swing, deposit load • operate clamshell attachment, such as position boom, open and close bucket, swing, deposit load 	<i>Manufacturers' manuals and literature, PPE</i>

- carry out tasks simultaneously and in synchronized manner
- adjust to unstable ground by using mats or hard, dry material

4.04 Inspects and maintains equipment and attachment components affected by dragline/clamshell operations

Knowledge of:

- manufacturers' specifications
- components most affected, such as brakes, clutches, wire rope, boom point sheaves, drum bearings
- effects of extreme conditions, such as need to lubricate bushing and bearings more often

Manufacturers' manuals and literature for crane, PPE, basic tools and supplies, cable cutters, sledge hammer, cutting torch

Ability to:

- identify service needs, defects, and hazardous conditions through visual inspection
- select proper tools to make adjustments
- maintain equipment, such as adjust brakes and clutches, grease pivot points, cut off damaged ends of wire rope
- reeve bucket
- perform or arrange for repairs or replacement of defective components

BLOCK B OPERATING PROCEDURES

Task 5 Performs Clamshell Operations in Water from Shore or Barge

This task is important because it helps to:

- prevent damage to property and equipment
- prevent injury to personnel
- minimize impact on environment
- fulfill job specifications
- co-ordinate operations with other site personnel

Trends:

- There is increased legislation regulating clamshell work in water.
- There is increased due diligence when addressing environmental impacts and reducing liability.

	Subtasks	Supporting Knowledge and Abilities	Tools and Supplies
5.01	Positions crane on barge	<p>Knowledge of:</p> <ul style="list-style-type: none"> • job and engineering specifications • company policies and procedures • applicable legislation, such as Coast Guard • stability factors • factors affecting water conditions and movement • loading procedures <p>Ability to:</p> <ul style="list-style-type: none"> • communicate with crew • follow loading procedures suited to situation, such as use mats to create ramp • position crane in designated location • secure crane on barge if necessary 	<i>PPE, PFD</i>
5.02	Determines and stays within work area	<p>Knowledge of:</p> <ul style="list-style-type: none"> • job and engineering specifications • orientation techniques, such as landmarks, markers, laser, Global Positioning System (GPS), edge of barge <p>Ability to:</p> <ul style="list-style-type: none"> • determine work area • maintain orientation to stay within work area 	<i>PPE, GPS, PFD</i>
5.03	Monitors depth of work	<p>Knowledge of:</p> <ul style="list-style-type: none"> • marked wire ropes to determine working depth, such as position of wire rope markings relative to surface of water 	<i>PPE; PFD; pieces of wire rope; pipe markers for wire rope, such as pipe wrenches, paint or rags</i>

- depth of water
- marking options for wire rope, such as insert wire rope or rag, paint open/close lines on wire rope

Ability to:

- mark wire ropes
- monitor position of wire ropes during operation

5.04 Handles earth/materials with clamshell bucket

Knowledge of:

- job and engineering specifications, such as where to stockpile earth, what material to remove
- estimated weight of load
- reduced capacity of equipment and appropriate load charts
- type and size of bucket
- roles of other personnel, such as divers, signallers, barge captain, deck hands
- barge stabilization features if available
- hand signals and radio use

PPE, PFD

Ability to:

- operate clamshell attachment, such as position boom, open and close bucket, swing and deposit load
- adjust operation to compensate for type and characteristics of material and water motion on crane performance and lifting capacity
- carry out tasks simultaneously and in synchronized manner
- communicate with site personnel

5.05 Inspects and maintains equipment and attachment components affected by clamshell operations

Knowledge of:

- manufacturers' specifications
- applicable legislation
- components most affected, such as brakes, clutches, wire rope, boom point sheaves, drum bearings
- effects of extreme conditions, such as need to lubricate parts more often
- spill kit

Manufacturers' manuals and literature for crane, PPE, basic tools and supplies, cable cutters, sledge hammer, cutting torch, spill kit, PFD

Ability to:

- identify service needs, defects, and hazardous conditions through visual inspection
- select proper tools to make adjustments

- maintain equipment, such as adjust brakes and clutches, grease pivot points, cut off damaged ends of wire rope
- reeve bucket
- clean up spills
- perform or arrange for repairs or replacement of defective components

5.06 Secures crane at end of shift

Knowledge of:

- manufacturers' specifications
- company policies and procedures
- applicable legislation
- weather forecast

Manufacturers' manuals and literature, PPE, PFD

Ability to:

- place attachment on solid surface
- lower boom
- use safety devices, such as flashing lights, port and starboard lights
- secure barge if necessary, such as jack it up, move it to shore

5.07 Unloads crane from barge

Knowledge of:

- job and engineering specifications
- company policies and procedures
- applicable legislation, such as Coast Guard requirements
- stability factors
- factors affecting water conditions and movement
- unloading procedures
- hand signals and radio use

PPE, PFD

Ability to:

- follow unloading procedures suited to situation, such as use mats to create ramp
- communicate with crew

Dragline Clamshell Operator DACUM Chart

Block	Task	Subtask				
A. EQUIPMENT	1. Describes Equipment and Attachments	1.01 Describes types and applications of dragline attachments	1.02 Describes types and applications of clamshell attachments	1.03 Describes wire ropes	1.04 Describes components of dragline and clamshell attachments	
B. OPERATING PROCEDURES	2. Assesses Site	2.01 Assesses site hazards	2.02 Discusses environmental concerns with site personnel	2.03 Reviews job specifications and safety considerations with site personnel		
	3. Plans Dragline/Clamshell Operations	3.01 Selects appropriate dragline/ clamshell attachment	3.02 Calculates gross load	3.03 Plans work procedures		
	4. Performs Dragline/Clamshell Operations on Land	4.01 Configures crane for dragline/ clamshell operations	4.02 Ensures that work area is cleared of unauthorized equipment and personnel before starting tasks	4.03 Handles earth/material with dragline/ clamshell attachment	4.04 Inspects and maintains equipment and attachment components affected by dragline/ clamshell operations	

Dragline Clamshell Operator DACUM Chart

Block	Task	Subtask					
<p>B. OPERATING PROCEDURES, cont'd</p>	<p>5. Performs Clamshell Operations in Water from Shore or Barge</p>	<p>5.01 Positions crane on barge</p>	<p>5.02 Determines and stays within work area</p>	<p>5.03 Monitors depth of work</p>	<p>5.04 Handles earth/materials with clamshell bucket</p>	<p>5.05 Inspects and maintains equipment and attachment components affected by clamshell operations</p>	<p>5.06 Secures crane at end of shift</p>
		<p>5.07 Unloads crane from barge</p>					

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