



JOB DEMANDS ANALYSIS

Company: City of Burnaby

Location: Works Yard

Job Title: Equipment Operator – Backhoe

Classification: Regular Duty

Purpose of Activities

The Equipment Operator – Backhoe is responsible for digging holes and ditches with the Backhoe and loading soil, gravel, salt mix, or debris to trucks from a work site with the front bucket.

Tools and Equipment

The Equipment Operator - Backhoe will use the following tools and equipment to perform his duties:

- Clothing – Steel Toe boots, ear protection, gloves
- JCB 1700B – 215 Series 3, Case 590 or 570 Backhoe
- 30 cm, 61 cm and 106 cm Backhoe buckets, front scoop and clam bucket, tamper and jackhammer attachments
- small hand tools

Usual Methods

The Equipment Operator – Backhoe will perform a pre-trip vehicle inspection every morning. This will include greasing the Backhoe, checking and topping up fluid levels, checking brakes, tire pressure and ensuring all lights are in working order. After the pre-trip inspection the Equipment Operator – Backhoe will load a second bucket, jack hammer and/or tamper into the front bucket of the Backhoe if they will be required during the day. He will then drive through traffic to a work site.

At the work site, the Equipment Operator – Backhoe will receive instructions from the Foreman as to what is expected. The Equipment Operator – Backhoe will then determine how he wants to set up the machine to dig the hole or ditch. At this time he will check for overhead obstructions (power lines, trees, etc.) that may impede his progress or cause injury. If there are any pieces of equipment in the front bucket they are set aside until they are required.

Usual Methods (Continued)

Once the Backhoe is in position, the Equipment Operator will swivel his chair from the front of the machine to the back. The digging position will have the front bucket and two rear stabilizers down on the ground while the wheels of the Backhoe may be suspended in the



air. He will then pull up and slide the back window over his head so he is able to communicate with the Padman.

The Equipment Operator – Backhoe will communicate (non-verbal and verbal cues) with the Padman to dig the ditch to the required level and to dig around any underground utilities. As each load of debris (asphalt, concrete, debris) is removed from the ground it is loaded into the back of a single or tandem axle truck or set to the side of the ditch. Two or four (depending on the machine) hand controls and one-foot pedal control the movements of the Backhoe.

As they are required, the different size Backhoe buckets, tamper and jackhammer attachments are used by the Equipment Operator – Backhoe. The Padman or a Labourer will assist with the change over and the Equipment Operator may or may not be required to get out of the Backhoe. The attachments are installed on the Backhoe arm by inserting large and small pins into each piece. Each attachment is maneuvered into position with the Backhoe arm

Administrative Issues

The Equipment Operator – Backhoe works an eight-hour day, Monday to Friday from 0700 to 1530 with a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. The Equipment Operator – Backhoe will occasionally work overtime. The Equipment Operator – Backhoe will dig holes or ditches from one to seven metres deep and use the Backhoe to raise and lower tools and equipment into the work area. Underground utilities (electric, streetlights, gas, water, sewer, etc.) are marked in advance but they can be damaged when the ditch is excavated.

Activity Demand Variables

These variables are tasks that must be carried out by the employee and are implicitly or explicitly required as objectives of the job.

- Sit to drive and operate the Backhoe
- Climb two steps approximately one metre high to get in and out of the Backhoe
- Crouch, kneel, bend and stoop to grease and perform Pre-trip Inspection on the Backhoe every morning
- Operate right and left hand controls simultaneously to operate Backhoe controls, operate right foot pedal to extend the hoe
- Drive the Backhoe through traffic between Works Yard and work site

Worker Decision Variables

These variables are the sub-routines and cognitive/physical decisions made by the worker in carrying out the objectives of the job.

- Sitting posture (neutral spine, shoulders, elbows slightly open, hips above knees are the desired postures)
- Take frequent rest breaks from sitting and static grip forces required to operate the Backhoe



Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required drive and operate the Backhoe.
2. People with shoulder injuries such as rotator cuff tendonitis, bursitis and instability may have difficulty with dynamic and static loading and reaching activities required to drive and operate the Backhoe.
3. People with nerve compression injuries in the upper extremities may have difficulty with operating the Backhoe controls.
4. Post-whiplash and other neck problems may have difficulty with this position.
5. People with hip and lower extremity injuries may have difficulty climbing in and out of the Backhoe cab (two steps to one metre from the ground).
6. Equipment Operator is ticket required to operate the Backhoe

Prepared By: Jeffrey J. McGinn, Kinesiologist

February 15, 1999



Summary of Stresses

Metabolic Stresses

The aerobic energy systems will provide the major source of energy for the Equipment Operator – Backhoe. This position is primarily sedentary with low level energy expenditure while operating the Backhoe and performing light labouring duties around the work site. It is not likely that the anaerobic energy system will be required to provide energy for the Equipment Operator – Backhoe.

Structural Stresses

Spine – the sedentary nature of this work can place significant passive loads on the spinal structures. Prolonged sitting increases disc compression forces alone. It is not unusual to have people adopt a flexed spine posture while sitting. This sitting posture (flexed spine) requires no activity from the torso musculature, but increases asymmetrical disc compression, passive stretch on the posterior ligaments and disc fibres. This forward flexed posture can contribute to disc integrity problems over time as well as contributing to deconditioning of the torso support musculature. Jarring and bouncing that occurs in transit and at the job site will significantly increase the compressive forces on the discs.

Shoulders and Neck – due to the static positions required and the frequent reaching for the Backhoe controls and steering wheel, the muscles in the rotator cuff of the shoulder, the upper trapezius and scalene muscles of the neck, maintain significant and often constant static load. If the Equipment Operator - Backhoe is too low in his seat with respect to the Backhoe controls and steering wheel, the load on the neck and shoulders is increased as the arms must be lifted and held in a static position to operate the Backhoe. Constant left and/or right rotation of the cervical spine, specifically when loading the trucks, will increase the static tension in the upper trapezius and scalene muscles as well.

Shoulders and Upper Extremity– Serious risk of injury to the shoulders, elbows and hands will result from poor sitting posture and an improperly adjusted seat. The upper extremities are primarily used in a static concentric movement pattern and impingement and inflammatory injuries to the shoulder and upper extremities are likely. Nerve compression injuries to the upper extremities (tunnel syndromes, nerve entrapment, etc.) are likely as a result of the prolonged and constant static grip forces required to operate the Backhoe controls.

Hips and Lower Extremities – prolonged sitting is likely to shorten the hamstring muscle group of both legs. This in turn will pull the pelvis under the body and prevent the Equipment Operator - Backhoe from sitting on the sit bones (Ischeal Tuberosity) and promote the undesirable forward flexed spinal posture. Slip and fall injuries while getting in or out (two small steps to one metre) of the truck or dump box are increased during wet weather or wet working conditions.

INTERVENTIONS

Recommendations that could be implemented to increase productivity and lessen the risk of injury are listed below:



1. Encourage the Equipment Operator – Backhoe to stand and walk around the work site at every available opportunity to decrease the time spent sitting.
2. Teach the Equipment Operator – Backhoe to set up the adjustable seat to adopt neutral sitting postures which will decrease the risk of injury to the spine and upper extremities.
3. Ensure all seats in any Backhoe are adjustable (forward seat pan tilt, height, seat pan depth, etc.).
4. Investigate the use of larger or a different shaped handles for the Backhoe controls. This may decrease the static grip forces required to operate machine.
5. Encourage the Equipment Operator – Backhoe to take frequent micro and rest breaks from the static grip forces and shoulder flexion required to operate the Backhoe controls. Static load on the muscles of the upper extremities, shoulders and neck will be significantly reduced by placing his hands in his lap when he is not actively operating the Backhoe controls.
6. Encourage the Equipment Operator - Backhoe to maintain an increased level of fitness away from work that will focus on cardiovascular endurance, muscular strength, muscular endurance and flexibility.

PJDC-Backhoe Operator

Referral: Lana Ho			Organization: Burnaby						Title: Equipment Operator - Backhoe Operator		
Dept.: Engineering			Division: Public Works						Contact:		
			FREQUENCY*						Date: February 10, 1999		
PHYSICAL DEMANDS			R E Q D	S I D E	Sel 1	Low 2	Mod 3	High 4	Max. Weight (kg)	Usual Weight (kg)	COMMENTS
S T R E N G T H	Lifting - Floor to Knuckle	X				X			20	<1-5	possibly during labouring
	Lifting - Knuckle to Waist	X				X			20	<1-5	possibly during labouring
	Lifting - Waist to Shoulder	X				X			20	<1-5	possibly during labouring
	Lifting - Over Head	X				X			20	<1-5	open sliding window, some labouring
	Carrying - With Handles										
	Carrying - Without Handles	X				X			20	<1	grease gun, shovel
	Pushing - Upper Extremity	X						X			operate Backhoe controls, turn drive
	Pushing - Hip/Leg Assist	X	R				X				gas/brake, boom extension foot pedal
	Pulling - Upper Extremity	X						X			operate Backhoe controls, turn drive
	Pulling - Hip/Leg Assist	X				X					swing seat around from front to back
	Reach - Shoulder or Above	X				X					open/close sliding (up) window
	Reach - Sho. or Above extnd	X				X					open/close sliding (up) window
	Reach - Below Shoulder	X						X			drive and operate backhoe
	Reach - Bel. Shoulder extnd						X				operate controls driven by sit posture
E N R G	Handling	X						X			backhoe controls, grease gun
	Gripping	X						X			controls, balls/levers, static grip
	Fine Finger Movements	X				X			mod	low	grease/maintain Backhoe
	Aerobic (percent)	X						X	sit to drive and operate Backhoe, light labouring		
P O S T U R E + M O B I L I T Y G E N E R A L	Anaerobic (percent)										
	High Energy Expenditure										
	Low Energy Expenditure	X						X	sit to drive and operate backhoe, light labouring		
	Neck - Static Flexion								operate Backhoe controls, watch padman, look into ditch		
	Neck - Static Neutral	X						X	sit to operate Backhoe, stand, walk, maintenance		
	Neck - Static Extension	X					X		operate Backhoe controls, dump bucket into truck		
	Neck - Rotation	X	L/R					X	drive and operate Backhoe, visual inspection of area		
	Throwing	X		X					dirt from shovel when labouring		
	Sitting	X						X	drive and operate backhoe, slightly adjustable seat		
	Standing	X				X			possibly at job site, light labouring		
	Walking	X				X			possibly at job site, grease/maintain Backhoe, labouring		
	Running/Jumping	X				X			down from Backhoe step 1/2 metre high		
	Climbing - Arms and Legs	X				X			climb in/out of Backhoe, 2-3 steps to 1 metre high		
	Climbing - Legs Only										
	Bending/Stooping	X				X			grease and maintain Backhoe, climb in/out of Backhoe		
G E N E R A L	Crouching	X				X			grease and maintain Backhoe		
	Kneeling	X				X			grease and maintain Backhoe		
	Crawling										
	Twisting	X						X	look around hoe and bucket to dig or watch padman		
	Balancing	X				X			on steps to get in/out of Backhoe, some maintenance		
	Traveling	X				X			drive Backhoe to work site in city of Burnaby		
	Work Alone	X		X					possibly dig without a Padman in some locations		
	Interact with Public	X				X			drive in traffic, possible at work site		
	Operate Equip/Machinery	X						X	JCB&Case Backhoe with buckets,tamper&jack hammer		
	Irregular/Extended Hours								8 hour day, 2X10 min.rest period, 1X30 min lunch, OT		

* Frequency Legend 1 = Seldom; Not Daily 2 = Low Daily Activity; < 1hr
 3 = Moderate Demand; Repetition 1 - 3 hrs daily 4 = High Frequency Demand; Repetition > 3 hrs daily
 The following shading denotes a HIGH RISK TASK: Modifications should be considered

REQD is marked with an X if the particular demand or category is relevant to the purpose of the job.

SIDE refers to the side or limb required to execute a task. If it is marked **E**, it indicates either side, the most common choice is listed first. **D** refers to dominant and **B** to both sides.

PJDC-Backhoe Operator

Referral:		Organization:						Title: see 1st page header	
Dept.:		Division:						Contact:	
PHYSICAL DEMANDS		R E Q D	S I D E	FREQUENCY*				COMMENTS	
				Sel. 1	Low 2	Mod. 3	High 4		
P E R C E P T I O N	Hearing - Conversations	X				X		Padman and crew	
	Hearing - Other Sounds	X					X	backhoe, truck horn, traffic	
	Vision - Far	X					X	drive and operate Backhoe, dig hole/ditch	
	Vision - Near								
	Vision - Colour	X					X	soil composition in ditch/hole, utilities, traffic lights	
	Vision - Depth	X					X	operate backhoe, drive backhoe	
	Perception - Spatial	X					X	operate backhoe, dig around utilities	
	Perception - Form	X					X	soil conditions, utilities	
	Feeling (Tactile)	X					X	operate backhoe controls, dig ditch/hole	
	Reading								
W O R K E N V I R O N M E N T	Writing								
	Speech	X				X		Padman and crew	
	Inside Work	X					X	in cab of backhoe, air conditioned cab, window open	
	Outside Work	X					X	at job site, backhoe window usually open	
	Hot Conditions >25 deg. C	X		X				surrounded by glass, air conditioned cab	
	Cold Conditions <10 deg.C	X		X				back window of Backhoe open to Padman	
	Humid	X		X				rain conditions	
	Dust	X		X				depends on time of year and soil conditions	
	Vapor Fumes	X					X	diesel fumes from backhoe and trucks, natural gas	
	Hazardous Machines	X					X	operate Backhoe with bucket, tamper or jack hammer	
	Proximity to Moving Object	X					X	in traffic, Backhoe bucket, around overhead wires	
	Noise	X					X	Backhoe, Trucks, ear protection worn	
	Electrical Hazard	X					X	underground utilities, overhead wires	
	Sharp Tools	X					X	backhoe buckets, jack hammer	
	Radiant/Thermal Energy	X		X				hot oil from hydraulic lines, sun burn	
	Slippery Conditions	X			X			climb in/out of Backhoe on steps, at work site	
	Vibration and Related	X					X	jarring from Backhoe Op., shoulders, spine, elbows, hands	
	Chemical Irritants	X			X			grease, hydraulic oil	
	Organic Substances	X		X				dig sewers, bacteria contaminates equipment	
	Medical Waste								
	Blood Products								
	Congested Worksite	X					X	in cab of backhoe, dig at work site	
	Lighting - Direct	X					X	sun light	
	Lighting - Indirect	X					X	sun light	
	Lighting - Adjustable								
	Lighting - Fluorescent								
	Lighting - Incandescent								
	Lighting - Shadows etc.								

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For detailed descriptions of each of the different categories, please refer to the reference guide or inquire with Human Effort at 1-888-4EFFORT