

TASK ANALYSIS WORKSHEET

Company: The Corporation of Delta
 Job Title: Backhoe Driver

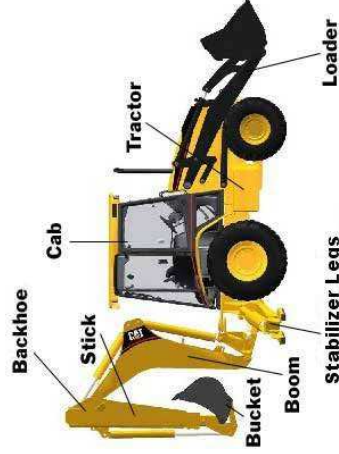
Department: Engineering Operations
 Date: July 18, 19, 26, Aug. 9, 2002

Job Summary: The Backhoe driver is required perform a combination of the following precision tasks:

- Driving (between work sites and at / or around the work site).
- Loader (lifting, pushing, scraping/smoothing),
- Backhoe (digging),
- Material Handling (lifting and/or transporting various heavy pieces of equipment, tools, parts and other assorted material required at the work site). Forks can be added to the loader end for specific lifting tasks (not observed).

The Backhoe's used vary in age but are similar in use and function. The cab's are enclosed (windows can be opened). The base of the cab is 92 cm. (36.25") high requiring a 50 cm. high initial step and a 42 cm. final step into the cab. The Loader end has a traditional steering wheel, brake and gas pedals and a single right sided joystick for loader movement. The Backhoe end has two joystick controls for the boom, stick and bucket movement with stabilizer controls on the left side. The seat swivels between both ends. The tires can be compared to a tractor with smaller diameter tires on the Loader (front) end. While the tires are required for traction and movement over uneven ground and for ascending or descending slopes, drivers are required to travel up to 10 kilometers between job sites on paved roads through traffic.

Duration of tasks will vary depending on the job required and the Backhoe driver may remain at one work site for a full shift or move between sites. Three Backhoe Drivers were observed on 3 different work sites. All workers were experienced Backhoe Drivers.



(Note: not a picture of the Corporation of Delta Backhoe, intended as pictorial sample only)

Tasks & Description of Activities	Frequency	Duration
<p>The Backhoe Driver's job tasks will vary in frequency and duration based on the job required. The Construction Backhoe was in constant use providing a variety of Loader and Material Handling tasks (the excavator provided the digging), while the two other Utilities Backhoe jobs required more dedicated Backhoe digging of up to 15 minute duration and occasional Loader and Material Handling Tasks.</p> <p>Driving:</p> <ul style="list-style-type: none"> ▪ Between job sites ▪ At the job site 	<p>> 3 hours / day (constant)</p>	<p>> 66% of shift</p>
<p>Loader:</p> <ul style="list-style-type: none"> ▪ Pickup and carry loose material e.g. sand, soil, gravel or debris ▪ Pushing loose material (like a plow) ▪ Scraping or smoothing loose material 	<p>1 – 3 hours/day (frequent)</p>	<p>34-66% of shift</p>
<p>Backhoe:</p> <ul style="list-style-type: none"> ▪ Digging 	<p>1 – 3 hours/day (frequent)</p>	<p>34-66% of shift</p>
<p>Material Handling:</p> <ul style="list-style-type: none"> ▪ Lifting and transporting equipment, tools, parts or material e.g. cement bags, pipes, etc. 	<p>1 – 3 hours/day (frequent)</p>	<p>34-66% of shift</p>

Risk Factors considered:

- Joint posture: wrist, elbow, shoulder, neck, back, knees, ankles
- Awkward posture: reach, twist, bend, stoop, squat, climb, static, dynamic
- Force: lift, lower, carry, push/pull, pinch or power grip
- Repetition: frequency, duration
- Contact Stress
- Object weight, location, size, shape, handles, stability of load
- Work height, layout, seating, space
- Tool/equipment use
- Environment: layout, flooring, temperature, noise, light, glare, vibration
- Work Organization: recovery, schedule, workload, task variability, pace, PPE use, interruptions

<p>Department/Work Area: Engineering Operations Specific Location: Ladner Trunk Road, Sungod, Delta Secondary Assessed By: B. De Jong</p>	<p>Occupation: Backhoe Driver Contact Name: Assessment Date: July 18th, 19th, 26th, Aug. 9th, 2002</p>
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Description of work areas: 1) Grassy area alongside a two lane highway. Roadside flat with 10-15 degree shoulder slope. **2) & 3)** Flat grassy area. Weather sunny and dry, temperature 20-25 degrees Celsius.
Hours of Work/Shift Schedule: 7:00 a.m. to 2:30 p.m. (hours will alter through winter months based on daylight)
MSI signs / symptoms noted: back, neck, shoulder, knee and ankle

Tasks for Ergonomics Risk Assessment (from Task Analysis worksheet):				Frequency / Duration of Task:
1. Driving				> 3 hours/day > 66% of shift
2. Loader				1-3 hours/day 34-66% of shift
3. Backhoe				1-3 hours/day 34-66% of shift
4. Material Handling				1-3 hours/day 34-66% of shift
Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
<p>1. Driving</p> <p>Note: the seat measurements are within recommended guidelines for industrial vehicles.</p>	<p>Awkward Postures:</p> <ul style="list-style-type: none"> Neck rotation Back rotation Shoulder flexion (both) Ankle extension (toes pointing down) Hip flexion (with bent knee) 	> 3 hours / shift	<p>Static Work:</p> <ul style="list-style-type: none"> Reach of 18 to 24 inches Ankle extension up to 50° <p>Dynamic Work:</p> <ul style="list-style-type: none"> Neck rotation >45° Back rotation up to 45° Hip flexion >90° when climbing into cab 	<ul style="list-style-type: none"> Driving occurs when the driver is facing the loader end of the backhoe. It is static seated work. Visual requirements are high resulting in dynamic neck and back rotation or twisting. The arm/shoulder reaches to the wheel ranges from 18 to 24 inches based on the forward seat adjustment. Guidelines recommend a reach distance of 14 to 16 inches to the primary hand control or wheel (Humanscale). Ankle extension occurs while depressing the gas pedals. Guidelines recommend <30 degrees (Eastman Kodak). The seat has air compression to reduce jarring to the spine. The seat does not have adjustable lumbar support or height adjustment for individual sizes. The 19 inch step creates hip flexion which may exceed 90 degrees and create risk for the knee area. <p>May experience neck, shoulder and lower back fatigue or pain. This may be exacerbated by jarring movements. May experience leg fatigue from static pedal depression.</p>
Identification			Assessment	

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>Driving continued...</p>	<p>Force: Depression of brake pedal</p>	<p>Unable to measure frequency. Duration < 60 seconds</p>	<p>Force: <ul style="list-style-type: none"> ▪ 14 to 17 kg. of push force </p>	<p style="text-align: center;">Assessment</p>	<ul style="list-style-type: none"> ▪ One worker complained of left knee and leg discomfort related to brake pedal depression. ▪ Whole leg movement is generally required to depress the brake pedal. ▪ Guidelines for pedal counter pressures are exceeded if the ankle is used. The recommended design value is for 1.5 kg. (minimum) to 9.18 kg. (maximum) if the <u>ankle is used</u>. (Eastman Kodak). <p>May experience knee or leg fatigue with frequent brake application – especially if the ankle is being extended and flexed.</p>
	<p>Grip force: Wheel</p>	<p>Constant</p>	<p>Unable to measure</p>		<ul style="list-style-type: none"> ▪ The wheel diameter meets recommended guidelines for hand grip.
	<p>Contact Stress to back of thighs</p>	<p>Constant</p>	<p>Unable to measure</p>		<ul style="list-style-type: none"> ▪ The seat height (19 inches) is not adjustable which may cause contact stress on the back of the thighs for some users. ▪ Recommended guidelines indicate a nominal seat height for industrial vehicles of 13.5 – 17 inches (Humanscale).
<p>Identification</p>	<p>Vibration: <ul style="list-style-type: none"> ▪ Whole body </p>	<p>Constant</p>	<p>Unable to measure</p>	<p style="text-align: center;">Assessment</p>	<ul style="list-style-type: none"> ▪ Vibration can occur at many different frequencies and in different directions. The effects depend on factors such as the nature, duration of exposure, posture, work-rest ratios and individual susceptibility (Eastman Kodak). <p>Low back pain has been associated with whole-body vibration.</p>

Identification	Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
	<p>2. Loader</p>	<p>Awkward Postures:</p> <ul style="list-style-type: none"> ▪ Shoulder flexion (reaching) ▪ Neck Rotation ▪ Neck Flexion ▪ Back Rotation ▪ Back Flexion 	<p>1 – 3 hours/ day</p>	<p>Static Work:</p> <ul style="list-style-type: none"> ▪ Reach of 18 to 24 inches ▪ Neck Flexion > 20° ▪ Back Flexion > 20° <p>Dynamic Work:</p> <ul style="list-style-type: none"> ▪ Neck rotation >45° ▪ Back rotation up to 45° 	<p>Assessment</p>	<ul style="list-style-type: none"> ▪ The shoulder reach includes bilateral reaching to the wheel and to the right side Loader controls. WCB limit values indicate an increased risk for frequent forward reaches >12 inches and frequent sideway reaches of >16 inches. ▪ Static neck and back flexion observed while operating the loader primarily due to the visual requirements of the tasks. ▪ Dynamic neck and back twisting were observed while moving backwards and while picking up and depositing loads.
	<p>Grip Force:</p> <ul style="list-style-type: none"> ▪ Right hand power grip 	<p>1 – 3 hours/day</p>	<p>Power grip</p>			<p>The hand controls meet recommended guidelines for hand grip.</p>
	<p>Vibration: Whole Body</p>	<p>1 – 3 hours/day</p>	<p>Unable to measure</p>			<ul style="list-style-type: none"> ▪ Vibration can occur at many different frequencies and in different directions. The effects depend on factors such as the nature, duration of exposure, posture, work-rest ratios and individual susceptibility (Eastman Kodak). <p>Low back pain has been associated with whole-body vibration. This may be exacerbated by jarring movements while using the loader.</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>3. Backhoe</p>	<p>Awkward Postures:</p> <ul style="list-style-type: none"> ▪ Shoulder flexion (reaching) ▪ Neck Rotation ▪ Neck Flexion ▪ Back Rotation ▪ Back Flexion 	<p>1 – 3 hours/ day</p>	<p>Static Work:</p> <ul style="list-style-type: none"> ▪ Reach of 12 to 16 inches ▪ Shoulder flexion of 20° ▪ Neck Flexion > 30° ▪ Back Flexion > 20° ▪ Neck rotation >45° ▪ Back rotation up to 45° 	<p style="text-align: center;">Assessment</p>	<ul style="list-style-type: none"> ▪ The shoulder reach includes bilateral reaching to the joystick controls and to the left side stabilizer controls. WCB limit values indicate an increased risk for frequent forward reaches >12 inches and frequent sideway reaches of >16 inches. ▪ Shoulder flexion is within recommended guidelines, however, the static nature of the task may create arm and shoulder fatigue. ▪ Static neck and back flexion observed while operating the backhoe primarily due to the visual requirements of the tasks. ▪ Static neck and back twisting were observed while viewing the bucket with visual obstruction from the stick and boom. <p>May experience shoulder, neck and low back fatigue or pain. This may be exacerbated by jarring movements while using the backhoe. The duration of the tasks will also be a consideration.</p>
	<p>Grip Force:</p> <ul style="list-style-type: none"> ▪ Right hand power grip 	<p>1 – 3 hours/day</p>	<p>Power grip</p>		<ul style="list-style-type: none"> ▪ The hand controls meet recommended guidelines for hand grip.
	<p>Vibration: Whole Body</p>	<p>1 – 3 hours/day</p>	<p>Unable to measure</p>		<ul style="list-style-type: none"> ▪ Vibration can occur at many different frequencies and in different directions. The effects depend on factors such as the nature, duration of exposure, posture, work-rest ratios and individual susceptibility (Eastman Kodak). <p>Low back pain has been associated with whole-body vibration. This may be exacerbated by jarring movements while using the backhoe.</p>

Task	Risk Factors	Freq/Dur	Mag/Range		Assessment/Observations/Comments
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Ergonomic Risk Identification & Assessment

4. Material Handling	Awkward Postures as per the Loader Assessment	Varies	As per the Loader Assessment	Assessment
Identification	Force: Manual Lifting e.g. fork installation	Varies	May exceed 23 kg.	<ul style="list-style-type: none"> ▪ Static neck and back flexion observed while operating the loader primarily due to the visual requirements of the tasks. ▪ Dynamic neck and back twisting were observed while moving backwards and while picking up and depositing loads. <p>NIOSH lifting guidelines indicate floor to waist lifting with good hand grasp, low frequency and no back twisting should not exceed 23 kg.</p> <p>Using the backhoe loader end for transporting heavy equipment reduces the amount of manual handling required by the employees.</p> <p>Unable to determine the weight of the forks, however, employees identified them as a possible risk factor.</p>

Examples of Backhoe Driving:



Fig. 1 Loader



Fig. 2 Backhoe



Fig. 3 Material Handling (forks)

(Note: not a picture of the Corporation of Delta Backhoe, intended as pictorial sample only)

SUMMARY

In general the risk factors for the Backhoe Driver are related to static and dynamic awkward postures (back, neck and shoulder) and static seated work. The jarring movements and whole body vibration from a moving vehicle over uneven ground may contribute to the risk factors.

CONTROLS

Recommendations for control of identified risk factors will focus on methods to minimize risk. The Backhoe Driver works in varying climates and conditions.

**Control Priority Note: 1 = recommended for implementation to reduce risk factors; 2 = optional, for consideration as a means of reducing risk factors; 3 = not for immediate action but for future consideration as appropriate.*

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
Endurance for physically demanding work	Maintain an increased level of fitness focusing on cardiovascular and muscular endurance and muscular flexibility.	2	Employee	
Preparation for all physically demanding work	Develop a physical warm up program and train drivers (through the use of certified fitness instructors) specific to the demands of the job. Workers should perform this warm up prior to the start of the day and before resuming work following >30 min. breaks. The duration of the warm up is less than 10 min. Micro stretches should also be performed following static, awkward postures e.g. neck bending during backhoe use.	2	Superintendent / Safety Dept.	
Awkward and Static Postures	Ensure drivers slide the seat as close a comfortably possible toward the hand controls or steering wheel to minimize extended reaches. Encourage drivers to stand and walk about the worksite when the backhoe is not in use. It was noted at all 3 worksites that the drivers remained in the vehicle during breaks and when they were waiting to resume work (15 minute pauses). Ensure any new backhoe's being purchased provide adjustable seating (forward seat pan tilt, height and seat pan depth.)	1	Employee	

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
Vibration	<p>Ensure that regular compactor maintenance is done to reduce vibration and shock from jolting. The seat compression function is an important design that may require ongoing maintenance.</p> <p>Evaluate any new backhoe's being purchases as to seat design and vibration reduction. All manufacturers are required to perform vibration testing and provide an assessment to meet WCB and ISO standards.</p>	2 3	Superintendent	
Overall risk factors	Provide education related to identified risk factors and methods of working to reduce risk e.g. neutral joint positions, leg position, reduction of twisting etc.	1	Superintendent	

References:

- GVRD Job Demand Analysis for Equipment Operator – Backhoe (City of Burnaby), 1999
- Humanscale (1990) Body Measurement, Hand Grip, Human Strength and Seating Guide
- Eastman Kodak (1986), Ergonomic Design for People at Work, Volume 1 and 2
- Steven Pheasant, Bodyspace (1996), Anthropometry, Ergonomics and the Design of Work,
- WCB of BC, Worksheet A, Risk Identification and Worksheet B, Risk Assessment.
- NIOSH Lifting Guidelines (1991)

Prepared by: Brenda De Jong, August 23, 2002