

TASK ANALYSIS WORKSHEET

Company: The Corporation of Delta
Job Title: Paving

Department: Engineering Operations
Date: May 1, 2003

Job Summary:

The paving crew engages in asphalt paving and repair of potholes, road cuts, skin patching (excavation not required in this case), asphalt curb or sidewalk repairs, etc. The crew performs heavy manual work such as rolling, raking, shoveling and tamping asphalt and gravel in a variety of situations. Depending on the size of the hole, the entire paving job can take anywhere from 1 - > 8 hours to complete. The paving job also involves operating a backhoe, dump truck, pick up truck and a small vibratory roller. The crew performs the paving job in all types of weather conditions (except heavy rains). Personal protective equipment include: safety boots, hard hats and coveralls / safety vests. There are a total of 4 crew workers. The paving crew was observed on 3 different work sites.

The paving crew performs a variety of tasks including:

- Driving a work truck with trailer and roller;
- Preparing surfaces, potholes, road cuts, etc. prior to placing asphalt;
- Placing, leveling, shoveling, raking, rolling and tamping asphalt, using a variety of hand tools and safely operating power tools associated with the work; and
- Completes daily paperwork such as daily crew assignments, crew cards, internal work request, service request cards, codes material slips and apportionments materials to correct work orders.

The paving process is as follows:

- Saw-cut pavement down to base. This is done by contractor. (not assessed)
- Drive dump truck, pick-up truck (with vibratory roller) and backhoe to site. (not assessed)
 1. Excavate hole using backhoe.
 2. Sweep and clear area.
 3. Heat edges of hole using propane tank to get rid of moisture.
 4. Add adhesive (asphalt emulsion) to fill air voids between existing road and asphalt.
 5. FIRST LIFT: Dump asphalt (black top) into hole.
 6. Shovel and lute the asphalt.
 7. Use vibratory roller to compact the 1st lift asphalt.
 8. Once rolling is complete, clean off surface edges.
 9. Apply the adhesive (asphalt emulsion – a.k.a. tack) to the surface.
 10. SECOND LIFT: Pour asphalt to about 1/4" above existing road surface.
 11. Shovel, Lute and Compact the 2nd lift asphalt.

Other Notes:

- During the ergonomic assessment, the crew members informed the Ergonomist that all four crew members have experienced a back-related injury. Crew members also stated that they experienced some shoulder discomfort. All crew members perform stretches at the beginning of the shift (10 min.).
- N.B.: This assessment was based on a working population of males only.

Tasks & Description of Activities	
<p>1. Excavate hole using backhoe (Turbo 310SE).</p> <ul style="list-style-type: none"> ▪ Sometimes the crew members have to: i) physically pick-up pieces of pavement; ii) shovel out stones; and/or iii) lute excavated area. 	<div style="display: flex; justify-content: space-around; align-items: center;">   </div> <p style="text-align: center;">Excavated area</p> <p><i>(Note: Not a Corporation of Delta Backhoe, intended as pictorial sample only)</i></p>
<p>2. Sweep and clear area.</p> <ul style="list-style-type: none"> ▪ Sweep edges using a power broom. ▪ If necessary, the following tasks may be performed: i) cut off tree branches so that roller can roll over newly-paved site; ii) scrap off grass using shovel; and iii) tie bush with rope to avoid needles falling on newly-paved area. 	 <p style="text-align: center;">Power broom</p>
<p>3. Heat edges of hole using propane tank to get rid of moisture.</p>	 <p>Propane tank – tiger torch</p>

4. Apply adhesive (asphalt emulsion) to fill air voids between existing road and asphalt.

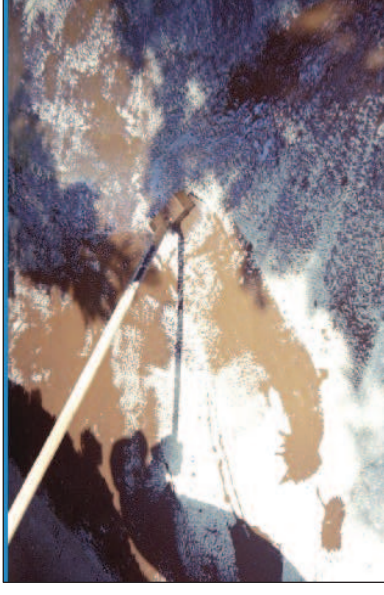
- Asphalt emulsion also seals the asphalt to the existing road.
- When dealing with an excavated hole, adhesive is applied only on the edges. If area is not excavated (e.g. leveling a driveway) then adhesive is applied over the entire area.



Asphalt emulsion bucket



Storage location of asphalt emulsion on truck



Applying asphalt emulsion over area

5. FIRST LIFT: Dump asphalt (a.k.a. black top) into hole.

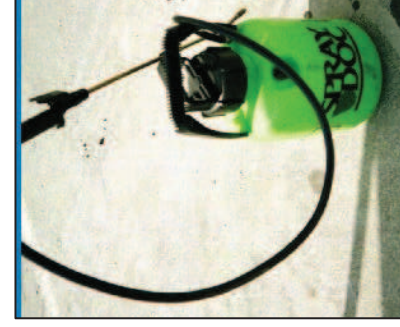
- Each dump truck holds 14 tonnes of asphalt.
- The crew members dump approximately 2 tonnes of asphalt at a time.
- The crew members stated that, on average, they use about 28 tonnes of asphalt per day.



Push down on pull-up door to release asphalt

6. Shovel and lute the asphalt.

- 2 crew members shovel the asphalt while the other 2 crew members lute the asphalt.
- Daily rotation of shovel and lute tasks.
- Based on 28-tonnes use of asphalt per day, each crew member shovels or lutes approximately 14 tonnes of asphalt per day.
- While shoveling, crew member may have to get “stuck asphalt” off the shovel or lute either by: i) scraping the asphalt off with a scraper; or ii) using Spray Doc (water).
- Occasionally, the crew members may have to pry out objects using a pry bar.
- If excess asphalt, then crew members may have to shovel asphalt back into dump truck. In this case, the dump truck is lowered to the lowest height.
- If paving task does not involve an excavated hole, then there is more luting then shoveling as more finessing is required.



Shovels and lute (oversized rake)

Shovel with asphalt

Spray Doc (water)

Pry bar

7. Use vibratory roller to compact the 1st lift asphalt.

- While asphalt is hot, compact the 1st lift asphalt using roller to achieve 5-7% air void.
- Areas which the roller cannot get over are tamped.



Vibratory roller
(Wacker 2047)

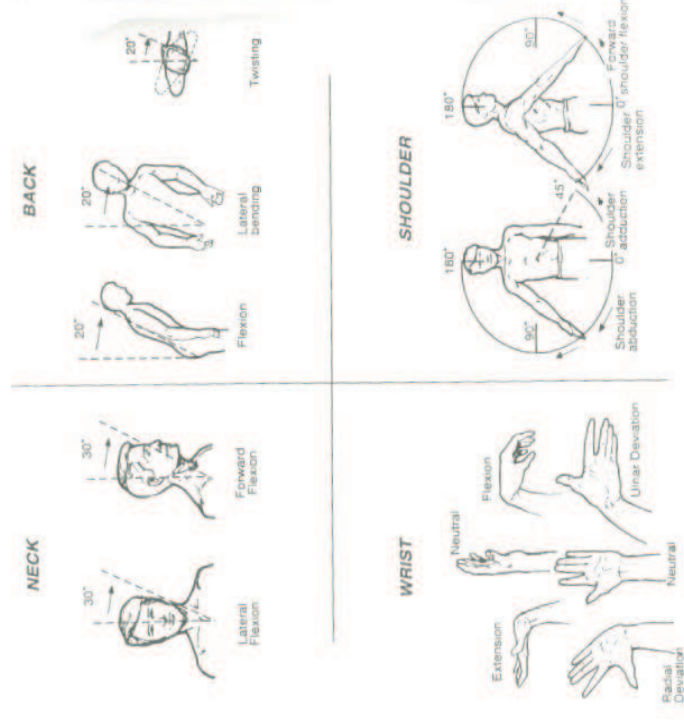


Hand
Tamper

<p>8. Once rolling is complete, clean off surface edges. (see #2 for description)</p>
<p>9. Apply the adhesive (asphalt emulsion) to the surface. (see #4 for description)</p>
<p>10. SECOND LIFT: Pour asphalt to about 1/4" above existing road surface. (see #6 for description)</p>
<p>11. Shovel, Lute and Compact the 2nd lift asphalt using vibratory roller. (see # 6, 7 for description)</p> <ul style="list-style-type: none">▪ Newly paved surface level should be same as existing road surface level.

Risk Factors considered:

- Joint posture: wrist, elbow, shoulder, neck, back, knees
- 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



Postures, WCB of BC

<p>Department/Work Area: Engineering Operations, Roads Maintenance Occupation: Paving Crew Specific Location: Delta (assorted) Contact Name: Assessed By: F. Ismail Assessment Date: May 1, 2003</p>

<p>Description of work area: Outdoor roadside urban and industrial park location. Hours of Work/Shift Schedule: 8:00 a.m. to 4:30 p.m. MSI signs / symptoms noted: back, shoulder</p>

Frequency percentages are based on NIOSH and Department of Labour guidelines.

Tasks for Ergonomics Risk Assessment (from Task Analysis worksheet):	Frequency / Duration of Task:
<ul style="list-style-type: none"> ▪ Drive dump truck, pick-up truck (with vibratory roller) and backhoe to site. (not assessed) 1. Discuss particulars with owner if site is close to privately-owned property. (not assessed – no physical demands). 2. Excavate hole using backhoe (if necessary). 3. Sweep and clear area. 4. Heat edges of hole using propane tank to get rid of moisture. 5. Add adhesive (asphalt emulsion) to fill air voids between existing road and asphalt. 6. FIRST LIFT: Dump asphalt (black top) into hole. 7. Shovel and lute the asphalt. 8. Use vibratory roller to compact the asphalt. 9. Once rolling is complete, clean off surface edges. 10. Apply the adhesive (asphalt emulsion – a.k.a. tack) to the surface. 11. SECOND LIFT: Pour asphalt to about 1/4" above existing road surface. 12. Shovel, lute and Compact the 2nd lift asphalt. 13. Once cooled, i) roll over again (with roller) to get rid of lines; ii) lay plastic over concrete; and iii) place barricades around area (not assessed – not done all the time). 14. Secure vibratory roller on pick-up truck (not assessed – trailer being replaced). 	<p>< 2 hours/day < 1 hour/day</p> <p>< 1 hour/day < 1 hour/day < 1 hour/day < 1 hour/day < 1 hour/day < 4 hours/day < 1 hour/day < 1 hour/day < 1 hour/day < 1 hour/day < 1 hour/day</p> <p>0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 34-66% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift 0-33% of shift</p>

The following tasks are described based on observations of the worker performing the tasks. Other workers may assume different body postures when performing the task.

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
<p>1. Excavate hole using 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 hour / 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>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>Identification</p>	<p>Grip Force:</p> <ul style="list-style-type: none"> ▪ Right hand power grip <p>Vibration:</p> <ul style="list-style-type: none"> ▪ Whole Body 	<p>< 1 hour / day</p>	<p>Power grip</p>	<p>The hand controls meet recommended guidelines for hand grip.</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>

Note: Risk factors associated with backhoe operation obtained from RA-Backhoe report (August 23, 2002).

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>2. Sweep and clear area.</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ Unsupported back flexion ▪ Neck rotation ▪ Shoulder flexion 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Static (>30 sec.)</p> <ul style="list-style-type: none"> ▪ Shoulder abduction ▪ Shoulder flexion 45° <p>Dynamic:</p> <ul style="list-style-type: none"> ▪ Neck rotation ▪ Back flexion up to 90° ▪ Shoulder flexion up to 180° 		<ul style="list-style-type: none"> ▪ Back flexion 30- 90° + static right shoulder abduction + left shoulder flexion 45° (+ some vibration) while using power broom to sweep edges (155 – 200 sweeps per area). ▪ Neck rotation to view brooming task. ▪ When sawing off branches, back flexion (20°) + left shoulder flexion 90-180° to hold branches + right shoulder flexion 90-145° to saw off branches. Stands on asphalt emulsion bucket while sawing branches. <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
	<p>Force:</p> <ul style="list-style-type: none"> ▪ Power broom ▪ Saw 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Weight of saw – 0.5 kg</p> <p>Weight of power broom – 9 kg</p> <p>Force to push on power broom – 13.6 kg</p>	<p>Weight of saw – 0.5 kg</p> <ul style="list-style-type: none"> ▪ Weight of power broom – 9 kg ▪ Force to push on power broom – 13.6 kg (note: forces could not be measured accurately due to reaction force from broom). <p>The gripping of the tools (saw) with one hand is acceptable (WCB Worksheet B). Lifting and carrying broom from truck to area is also acceptable (WCB Worksheet B). Based on 13.6 kg force exertion, force to push on power broom is unacceptable [Humanscale Tab 4: Strength – weak male data – right arm adduction 5.5 kg + left arm abduction 4.4 kg = 9.9 kg * ½ (sustained force without discomfort) = 5 kg].</p>	<ul style="list-style-type: none"> ▪ Weight of saw – 0.5 kg ▪ Weight of power broom – 9 kg ▪ Force to push on power broom – 13.6 kg (note: forces could not be measured accurately due to reaction force from broom). <p>The gripping of the tools (saw) with one hand is acceptable (WCB Worksheet B). Lifting and carrying broom from truck to area is also acceptable (WCB Worksheet B). Based on 13.6 kg force exertion, force to push on power broom is unacceptable [Humanscale Tab 4: Strength – weak male data – right arm adduction 5.5 kg + left arm abduction 4.4 kg = 9.9 kg * ½ (sustained force without discomfort) = 5 kg].</p>
	<p>Repetition:</p> <ul style="list-style-type: none"> ▪ Performs a variety of movements 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>			<p>Not considered repetitive work.</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>3. Heat edges of hole using propane tank to get rid of moisture.</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ Shoulder flexion ▪ Elbow extended 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Dynamic</p> <ul style="list-style-type: none"> ▪ Shoulder flexion ▪ Elbow extension 		<ul style="list-style-type: none"> ▪ Shoulder flexion and elbow extended when heating edges of hole. <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
	<p>Force:</p> <ul style="list-style-type: none"> ▪ Lift propane tank – tiger torch 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Weight of propane tank (tiger torch) – 19.5 kg</p>		<ul style="list-style-type: none"> ▪ Weight of propane tank (tiger torch) – 19.5 kg ▪ To lift propane tank off truck – vertical height origin 147 cm → to knuckle height; 41 cm horizontal reach; shoulder abducted due to edge of truck <p>Lifting propane tank off truck exceeds ergonomic guidelines (WCB Worksheet B) due to horizontal reach and original height (above shoulder).</p>
	<p>Repetition:</p> <ul style="list-style-type: none"> ▪ Performs a variety of movements 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>			<p>Not considered repetitive work (once / day).</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>4. Add adhesive (asphalt emulsion) to fill air voids between road and asphalt.</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ Shoulder abduction ▪ Shoulder flexion ▪ Elbow extended ▪ Shoulder – arm behind body 	<p>2 - 20 min duration (varies depending on surface area)</p> <p>0-33% of shift</p>	<p>Dynamic:</p> <ul style="list-style-type: none"> ▪ Shoulder abduction >90° ▪ Shoulder flexion ▪ Elbow extended ▪ Shoulder – arm behind body 		<ul style="list-style-type: none"> ▪ Shoulder abduction >90° to lift bucket off truck. ▪ Dynamic shoulder flexion, shoulder arm behind body and elbow extended when applying adhesive. <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
	<p>Force:</p> <ul style="list-style-type: none"> ▪ Lift asphalt emulsion bucket 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Weight of asphalt emulsion bucket – 19.5 kg</p>		<ul style="list-style-type: none"> ▪ Weight of asphalt emulsion bucket – 19.5 kg ▪ To lift asphalt emulsion bucket off truck – vertical height origin 155 cm → height to overcome edge of truck 180 cm → to knuckle height; 2 handed lift; 41 cm horizontal reach; shoulder abducted due to edge of truck; fair grip – wire handle <p>Lifting asphalt emulsion bucket off truck exceeds ergonomic guidelines (WCB Worksheet B) due to horizontal reach and original height (above shoulder).</p>
	<p>Repetition:</p> <ul style="list-style-type: none"> ▪ Performs a variety of movements 	<p>varies (depending on surface area)</p> <p>0-33% of shift</p>			<p>Not considered repetitive work.</p> <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
<p>5. FIRST LIFT: Dump asphalt (black top) into hole.</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ Unsupported back flexion ▪ Shoulder flexion ▪ Elbow extended 	<p>duration varies (depending on amount of asphalt needed)</p> <p>0-33% of shift</p>	<p>Static (>30 sec.)</p> <ul style="list-style-type: none"> ▪ Back flexion 60° ▪ Shoulder flexion ▪ Elbow extended 	<ul style="list-style-type: none"> ▪ Static back flexion 60° + shoulder flexion + elbow extended while releasing asphalt from dump truck. <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
	<p>Force:</p> <ul style="list-style-type: none"> ▪ Push down force on pull-up door to release asphalt 	<p>duration varies (depending on amount of asphalt needed)</p> <p>0-33% of shift</p>	<p>Push down force - > 45 kg</p>	<ul style="list-style-type: none"> ▪ Push down force (>45 kg) with one hand on pull-up door to release asphalt. (> 5 push-down exertions per paving job) <p>Push down forces on pull-up door exceeds ergonomic guidelines (Kodak).</p>

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
<p style="text-align: center;">Identification</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ back flexion ▪ Shoulder abduction ▪ Shoulder flexion ▪ Shoulder – arm behind body ▪ Elbow extended ▪ Forearm rotation ▪ Radial deviation 	<p>duration varies (depending on surface area)</p> <p>34-66% of shift</p>	<p>Static (>30 sec.)</p> <ul style="list-style-type: none"> ▪ Back flexion 45-90° <p>Dynamic:</p> <ul style="list-style-type: none"> ▪ Shoulder arm behind body ▪ Shoulder abduct 90-120° ▪ Shoulder flexion 40-90° ▪ Elbow extended ▪ Forearm rotation ▪ Radial deviation 	<p>Assessment</p>
<ul style="list-style-type: none"> ▪ Static back 90° (~30 sec) to scrap asphalt off shovel or lute using scraper. ▪ To spread asphalt across the hole, assumes following dynamic postures: shoulder – arm behind body, abduction 90°, shoulder flexion 40-90° ▪ Static back flexion (45-60°) + dynamic arm behind body + shoulder abduction 90-120° + extended elbows + forearm rotation (supination) + rt. radial deviation when shoveling. ▪ Dynamic shoulder flexion 90°, elbow extended and back flexion 45° when luting. ▪ Shovel asphalt - uses scraping motion (push and pull of gravel) to smooth area. ▪ To shovel access asphalt back into dump truck, lift shovel from floor level to 185 cm high. At the time of the assessment, the crew member shoveled asphalt 20 times into the dump truck → lifting behind the body. <p>Repetitive awkward postures (shoulder and back) may lead to overall physical fatigue. If increased shoveling / luting occurs and in combination with awkward postures may exceed ergonomic guidelines.</p>				

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
Shovel and lute the asphalt ... continued	<p>Force:</p> <ul style="list-style-type: none"> ▪ Pry bar ▪ Shovel ▪ Lute ▪ Spray Doc (water) 	<p>duration varies (depending on surface area)</p> <p>34-66% of shift</p>	<p>Weight of tools 1.8 – 11.8 kg</p> <p>wt. of Spray Doc – 5.5 kg</p> <p>Force to push shovel 18 – 45 kg</p> <p>Force to push lute – up to 34 kg</p>	<ul style="list-style-type: none"> ▪ Weight of lute – 1.8 kg ▪ Weight of empty shovel (152 cm long) – 2.3 kg. Weight of shovel with asphalt – 11.8 kg. ▪ Weight of pry bar – 11.8 kg (183 cm). ▪ Weight of Spray Doc – 5.5 kg – one-handed lift. ▪ Force to push on shovel – 18 – 45 kg (force could not be measured accurately) ▪ Force to push on lute – up to 34 kg (forces measured at an angle) <p>Weight of shovel is within ergonomic guidelines (CCOHS). Weight of shovel with asphalt exceeds ergonomic guidelines (CCOHS). One-handed lifting of Spray Doc is within ergonomic guidelines (Mital). Based on the forces obtained, one-handed pushing of shovel and lute exceeds ergonomic guidelines for repetitive one-handed pushing (Mital). May experience local muscle fatigue, including postural fatigue from forward bending. The risk decreases when the height the shovel is raised is minimal. Recovery time of 5 to 10 min., and the short duration time the task is performed will minimize the risk (Eastman Kodak).</p>
	<p>Repetition:</p> <ul style="list-style-type: none"> ▪ Performs a variety of movements 	<p>duration varies (depending on surface area)</p> <p>34-66% of shift</p>		<ul style="list-style-type: none"> ▪ Based on a 28-tonne-use of asphalt per day, the crew members shovel or lute 14 tonnes of asphalt. When shoveling, 9.5 kg of asphalt are lifted. This equals to about 1474 shovels (assuming all asphalt is lift) per day. <p>Repetitive awkward postures (shoulder and back) may lead to overall physical fatigue. If increased shoveling / luting occurs and in combination with awkward postures may exceed ergonomic guidelines (Kilbom, 1994, ANSI Z-365 Checklist).</p>

Note: Some risk factors associated with shoveling obtained from RA-Construction report (July 18, 2002).

Task	Risk Factors	Freq/Dur	Mag/Range	Assessment	Assessment/Observations/Comments
<p>7. Use vibratory roller to compact the 1st lift asphalt.</p>	<p>Awkward Posture:</p> <ul style="list-style-type: none"> ▪ Lateral back flexion ▪ Forward back flexion ▪ Shoulder abduction ▪ Shoulder flexion ▪ Neck rotation ▪ Neck flexion ▪ Squatting ▪ Elbow extended 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<p>Static (>30 sec.)</p> <ul style="list-style-type: none"> ▪ Lateral back flexion 45° ▪ Forward back flexion ▪ Shoulder abduction 45° <p>Dynamic:</p> <ul style="list-style-type: none"> ▪ Shoulder flexion 30-90° ▪ Neck rotation ▪ Neck flexion ▪ Squatting ▪ Elbow extended 	<p style="text-align: center;">Assessment</p>	<ul style="list-style-type: none"> ▪ While operating roller, static (10-60 sec) lateral back flexion 45° towards left or right + forward back flexion + shoulder abduction 45° + dynamic neck rotation / flexion to view compacted area. ▪ Standing / squatting + Shoulder flexion 30-90° + elbows extended when tamping. <p>The dynamic nature and frequency and duration of the tasks do not exceed ergonomic guidelines for awkward postures (WCB Worksheet B).</p>
	<p>Force:</p> <ul style="list-style-type: none"> ▪ Jarring ▪ Tamping 	<p>duration varies (depending on surface area)</p> <p>0-33% of shift</p>	<ul style="list-style-type: none"> ▪ Jarring ▪ Tamping areas which the roller cannot get over ▪ Hand tamper – 11.4 kg 		<ul style="list-style-type: none"> ▪ If paving over an excavated hole, when compacting the 1st lift asphalt , roller climbs and descends over edge of hole - 4" in height (up to 100 times per paving job depending on surface area). There is no shock absorption on the roller. ▪ Areas which the roller cannot get over are tamped (40 – 174 tamps depending on size of area). Forces could not be measured as force applied and # of tamps depend on crew member performing the tamping task. ▪ Hand tamper – weight 11.4 kg, length 124 cm <p>Any form of jarring or jolting should be avoided.</p>

	Task	Risk Factors	Freq/Dur	Mag/Range	Assessment/Observations/Comments
Identification	8. Once rolling is complete, clean off surface edges.	Refer to #2 for risk factors and assessment.			
	9. Apply the adhesive (asphalt emulsion) to the surface.	Refer to #4 for risk factors and assessment.			
	10. SECOND LIFT: Pour asphalt to about 1/4" above existing road surface.	Refer to #5 for risk factors and assessment.			
	11. Shovel, Lute and Compact the 2 nd lift asphalt.	Refer to #6 and 7 for risk factors and assessment.			
Assessment					

SUMMARY

The risk identification and assessment for Paving tasks have identified some risk factors that exceed recommended guidelines. While the job tasks have been assessed individually, cumulative effects of combined tasks may increase the level of risk.

In general the risk factors for the Paving crew are related to static and dynamic awkward postures (back, shoulder), forces related to shoveling, luting and lifting heavy objects off truck. The jarring movements and whole body vibration from a moving vehicle (roller, backhoe) over uneven ground may contribute to the risk factors. The concerns raised by the crew (relating to back and shoulder discomfort) are comparable to the risk factors identified.

New crew members who have not acclimatized to the physical demands of work may be at an increased risk of injury. All crew members are at a higher risk of injury in the morning hours when they may not be physically prepared or warmed up prior to performing physically demanding work. This was demonstrated in the Corporation of Delta's musculoskeletal injury (MSI) analyses (2001) report where 55% of MSI WCB claims occurred in the AM.


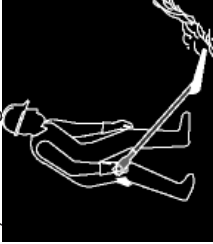
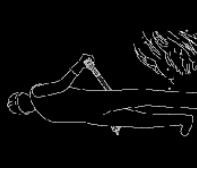
Additionally, while not exceeding guidelines for the individual tasks, cumulative effects of awkward postures of the neck, back, shoulder and arm/wrist may increase the risk of injury (> 66% of shift when all activities or tasks are combined).

CONTROLS

Recommendations for control of identified risk factors will focus on methods to minimize risk.

**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. This is especially important for new workers who may not be acclimatized to the demands of work.	2	Employee	
Preparation for all physically demanding work	Develop a physical warm up program and train workers 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 and back bending.	2	Superintendent / Safety Dept.	
Awkward and Static Postures (Backhoe) – <i>obtained from RA-Backhoe report (August 23, 2003)</i>	Ensure drivers slide the seat as close a comfortably possible toward the hand controls or steering wheel to minimize extended reaches. Ensure any new backhoe's being purchased provide adjustable seating (forward seat pan tilt, height and seat pan depth.)	1	Employee	
Awkward and Static Postures (Roller)	To avoid static back (lateral flexion) and shoulder (abduction) postures while operating roller to view compacted area, it is recommended that another crew member (other than the one operating the roller) view the compacted area so that the crew member operating the roller can assume a neutral posture while driving, i.e. face forward.	1	Employee	

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
<p>Awkward and repetitive postures (Shoveling)</p>	<p>CCOHS recommends the following shoveling rates + recovery times:</p> <ul style="list-style-type: none"> ▪ Recommended rate for continuous shoveling tasks is usually considered to be around 15 scoops per minute. ▪ Tasks involving continuous shoveling at this rate should not be carried on longer than fifteen minutes at a time. ▪ Since most shoveling is done outdoors, consideration for the prevailing conditions is very important. In the more extreme conditions such as very hot and humid, or very cold and windy, 15 minutes of shoveling should be followed by 15 minutes of not shoveling. <p>(CCOHS)</p> <p>When shoveling, CCOHS recommends the following:</p> <p>a)  Keep feet wide apart. Place front foot close to shovel.</p> <p>b)  Put weight on front foot. Use leg to push shovel.</p> <p>c)  Turn feet in direction of throw.</p>	<p>1</p> <p>1</p>	<p>Superintendent Employee</p> <p>Employee</p>	

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
Force	<p>Ensure all tools and equipment are in good shape and repair. Static forces will increase if tools and equipment require more work or repetition of work due to poor maintenance including cleaning.</p> <p>Evaluate tools and equipment when being replaced to ensure the weight and design (e.g. grip) will reduce the workload (e.g. wrenches, valve key etc.).</p> <p>Investigate alternative techniques of using power broom to reduce forces required when pushing e.g. i) applying horizontal forces instead of lateral forces; or ii) reducing rotation speed of brush to reduce reaction force exerted by brush.</p> <p>Lifting the propane tank and asphalt emulsion bucket from the back of the truck exceeds ergonomic guidelines. Consider installing a fold-down door on the side of the truck to promote for a straight lift without maneuvering (i.e. reduce horizontal distance + avoid having to lift above the truck wall).</p> <p>Investigate ways to reduce force required to push down on pull-up door (when releasing asphalt). Possible solutions include: i) increasing the length of the lever thereby reducing the force + promoting a 2-handed push down application; ii) regular maintenance of pull-up door fixtures; and iii) alternative doors that do not involve a lever, e.g. fold down door.</p> <p>Trial shovels with “D-handles” to determine feasibility when paving.</p> <p>When shoveling, employees should not overload the shovel. As per CCOHS, for a high rate of shoveling (i.e. 15 scoops per min.), the load should not exceed 5 – 7 kg. For a lower rate, the load can be increased to a maximum of 11 kg.</p> <p>When shoveling over a height of 1.3 m (as in the case of dumping excess asphalt back in the dump truck), reduce the load in the shovel (CCOHS).</p>	<p>1</p> <p>3</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p> <p>1</p>	<p>Superintendent Employee</p> <p>Superintendent Employee</p> <p>Superintendent Employee</p> <p>Superintendent</p> <p>Superintendent</p> <p>Superintendent</p> <p>Superintendent</p> <p>Employee</p> <p>Employee</p>	

Risk Factor	Recommended Controls	Control Priority*	Responsible Person	Status
Vibration (Roller, Backhoe)	<p>Ensure that regular 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 backhoes and rollers 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>	<p>2</p> <p>3</p>	<p>Superintendent</p> <p>Superintendent</p>	
Overall risk factors	<p>Consider job rotation between crew members to provide a distribution of workload and decrease the cumulative effects of the combined tasks.</p> <p>Provide education related to identified risk factors and methods of working to reduce risk e.g. neutral joint positions, reduction of twisting, etc.</p>	<p>1</p> <p>1</p>	<p>Superintendent</p> <p>Superintendent</p>	

References:

- Humanscale (1981) – Tab 4: Human Strength
- Eastman Kodak (1986), Ergonomic Design for People at Work, Volume 1
- WCB of BC, Worksheet A, Risk Identification and Worksheet B, Risk Assessment.
- ANSI Z-365 Checklist in Advanced Ergonomics Manual, 1994
- Kilbom, A. (1994) – Repetitive work of the upper extremity: Part 1 – Guidelines for the practitioner.
- Canadian Centre for Occupational Health and Safety (CCOHS) – Shoveling.
- Mital, Nicholson & Ayoub (1993), A Guide to Manual Material Handling.

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