CITY OF VICTORIA
PHYSICAL DEMANDS ANALYSIS

Effective Date: Aug. 15, 2007

Job Titles:	- Light Construction Equipment Operator - Asphalt Raker / Asphalt Maintenance Worker	**Date of Job Site Visit(s):**	August 15, 2007
Department:	Roads & Bridges	**On-Site Contact Person:**	Ric Bains (Manager)
Location:	Various Job Sites / Public Works Yard	**Classification:**	Regular Duty

POSITION FUNCTION

This Physical Demands Analysis report represents a combination of multiple positions that fall within the 'Roads & Bridges' section of the City of Victoria's Engineering Department. The primary functions of the 'target positions' being considered in this report are as follows:

1. **Light Construction Equipment Operator:** Employees in this position are responsible for performing labouring duties associated with the repair / maintenance (patching) of asphalt and concrete in roads within the City of Victoria.

2. **Asphalt Raker / Asphalt Maintenance Worker:** Employees in this position are responsible for performing a range of tasks to prepare road base and finish asphalt during the process of road paving.

TOOLS & EQUIPMENT

Employees working within the 'Roads' crews (i.e. Paving Crew, Road Construction Crew, Milling Crew, Crack-Sealing Crew) use the following tools / equipment in the performance of their essential duties:

- *Power Tools* – jackhammer, 'jumping jack'-style tamper, asphalt patching riding-roller, concrete saw, stand-up saw cart
- *Hand Tools* – shovel, pick, straight-bar, manhole lid-puller bar, wheelbarrow, asphalt rake, propane torch, hand-roller, hand-tamper, tar brush, push broom, bitumus-soaked corn broom, diesel bucket, scraper, sledgehammer
- *Traffic Control Items* – traffic cones, traffic signs ('lane closure', 'workers / equipment at work')
- *Safety Equipment* – leather gloves, long pants, hard hat, face shield / safety glasses, ear protection, dust mask, respirator, reflective vest, steel toe boots, first aid kit

USUAL METHODS

Employees working within the aforementioned 'target positions' utilize the following methods in the performance of their primary essential duties:

1. Gather tools, materials, and equipment for the workday and load them onto the truck / trailer.

2. Crew drives to the worksite and sets up traffic cones / signs.
3. Tools / equipment are carried from the truck / trailer to a convenient spot near where the asphalt or concrete will be removed / replaced.

4. Asphalt Removal
   a) Prior to excavation, worker will hand-locate and mark underground utility lines so that backhoe / bobcat operator is aware of cautionary zones.
   b) Backhoe / bobcat removes the asphalt road-top.
   c) Workers use straight-bar / pick / shovel / jackhammer (as needed) to remove protruding areas of asphalt, making the edges of the road-cut follow a clean line.
   d) Workers will use push brooms / flat shovels to keep the roadway clean of debris around the edges of the cut.

5. Asphalt Replacement
   a) As the truck backs up with a load of fresh asphalt, the workers will drive their shovels into the packed asphalt so that it becomes loosened in preparation for dumping.
   b) Truck dumps the asphalt adjacent to the road-cut, or directly into it. Alternatively, workers may shovel asphalt off the back of the truck.
   c) Asphalt dumped onto the road is shovelled into the road-cut area to desired depth (and shovels are used to roughly level the loose asphalt).
   d) Asphalt Raker uses a rake to carefully spread and level the asphalt.
   e) Roller Operator compacts the loose asphalt using an asphalt patching riding-roller (Note: hand-roller, and occasionally a hand-tamper, may be used to compact the loose asphalt in areas that are not accessible to larger equipment, such as next to a wall or fence-line).
   f) Once paving process is complete, workers clean up the site by gathering any remaining loose asphalt pieces off the road, and sweeping up or shovelling loose road debris / dirt / gravel as required.
   g) Tools and equipment are returned to truck / trailer, including return of hand-roller and/or asphalt patching riding-roller to trailer.
   h) Traffic control signs / cones are gathered and are returned to the truck.
   i) If another job is to be completed in same workday, the crew will drive to next work site, and repeats steps (a) - (h).

6. Asphalt Small Repair Patching
   a) Once small area of old asphalt is removed, workers shovel broken-out road debris into bobcat bucket or box of truck.
   b) Propane torch is used to heat area to ensure it is fully dry.
   c) Broom is used to spread bitumus around edges of area to be patched.
   d) Truck hauling the asphalt-load will back as close as possible to patch area, and workers manually open truck tailgate to empty required amount of asphalt onto road (or into a wheelbarrow, if the truck is not able to back right up to the patch area).
   e) Square mouth shovel is used to spread the asphalt over the area designated by the Asphalt Raker.
   f) Asphalt Raker fills the patch area with asphalt, using a rake to carefully spread and level the asphalt.
   g) Once the patch area is filled, the Roller Operator compacts the loose asphalt using an asphalt patching riding-roller (Note: hand-roller, and occasionally a hand-tamper, may be used to compact the loose asphalt for very small patching jobs, or for areas that are not accessible to larger equipment, such as next to a wall or fence-line).
   h) Once patching process is complete, workers clean up the site by gathering any remaining loose asphalt pieces off the road, and sweeping up or shovelling loose road debris / dirt / gravel as required.

i) Tools and equipment are returned to truck / trailer, including return of hand-roller and/or asphalt patching riding-roller to trailer.
j) Traffic control signs / cones are gathered and are returned to the truck.
k) Crew drives to next work site in need of road repair, and repeats steps (a) - (j), as this crew typically competes 4 - 5 asphalt patching jobs per day.

7. Concrete Removal / Casting Replacement

a) Jackhammer / straight-bar / pick are used to break out old concrete / castings in need of replacement.
b) Broken-out pieces of concrete are loaded by hand into bobcat bucket or onto a truck flatbed.
c) Casting lid is removed using a pick, and then lid / base are rolled off to side.
d) Concrete is dumped around casting from back of truck, or from cement mixer.
e) Freshly poured concrete is carefully levelled using rake and broom.
f) Once process of laying new concrete is complete, workers clean up the site by gathering any remaining broken-out pieces of concrete, and sweeping up or shovelling loose debris / dirt / gravel as required.
g) Traffic control signs / cones (if utilized) are gathered and are returned to the truck.
h) Crew drives to next work site, and repeats steps (a) - (g).

ADMINISTRATIVE ISSUES

Each 'Roads' crew consists of multiple workers with designated roles. For example, the Paving Crew consists of the following positions: Asphalt Raker, Roller Operator, Truck Driver, and one or two Labourers. The typical shift for 'Roads' workers extends from 07:00 am to 15:30 pm. Shifts are scheduled Monday to Friday, and the workers receive two 15-minute rest periods, and one 30-minute lunch break during each shift. There is occasional overtime, although there is no on-call requirement. Any repairs or mechanical maintenance that vehicles or power equipment require is completed within the Public Works mechanical shop.

WORK ENVIRONMENT (refers to all 'Roads' crews)

Physical Effort:
Lift and move moderate to heavy materials (occasional to frequent basis)

Mental Effort:
Within normal limits

Visual / Auditory Effort:
Within normal limits

Work Environment:

- *Work outside (continuous, aside from riding in truck to worksites)
- Work in close proximity to moving traffic (frequent)
- Exposure to equipment noise (occasional to frequent, e.g. jackhammers, saws, backhoes, tampers, asphalt patching riding-rollers, etc.)
- Exposure to equipment vibration (occasional to frequent, e.g. saws, jackhammers, tampers, asphalt patching riding-rollers, etc.)
- Exposure to asphalt fumes, chemical fumes, exhaust fumes, and airborne particulates – airborne dirt / dust or saw-cutting particulates (occasional)

*Note: the environmental conditions can considerably alter the degree of challenge of this job. It is possible to be exposed to widely varying conditions, including:

- extremely hot conditions (i.e. with implications for dehydration, sunburn, and heat stroke)
- extremely wet conditions (i.e. with implications for less reliable footing when climbing on / off vehicles, increased heaviness when shovelling wet dirt / mud / clay / gravel, and a need for higher grip forces due to slipperiness of tools / equipment handles)
- extremely cold conditions (i.e. with implications for less reliable footing as noted above due to snow / ice, increased heaviness of shovelling as noted above, and a need for higher grip forces due to slipperiness of tools / equipment handles due to ice / wetness)

KEY SKILLS AND ABILITIES (refers to all 'Roads' crews)

- Understand and discuss job-related matters.
- Operate a variety of light to heavy industrial equipment and vehicles.
- Operate hand tools and light power equipment.
- Establish and maintain effective working relationships.
- Deal with the public in a courteous and tactful manner.
- Work safely on widely varying job sites (i.e. on various streets throughout residential and commercial neighbourhoods).

INDEPENDENCE (refers to all 'Roads' crews)

- Workers within these positions are under direct supervision at all times.
- Work is assigned according to a daily schedule (set by assistant supervisor).
- Work quality is reviewed by leadhand / assistant supervisor on a regular basis.
- Problems (e.g., an inability to complete certain tasks for various reasons, malfunctioning tools / power equipment, etc.) or complaints from the general public are referred assistant supervisor / manager.

QUALIFICATIONS (refers to all 'Roads' crews)

Formal Education, Training and Occupational Certification:

- Grade 10 education minimum, and
- Current and valid Class 5 B.C. Driver's Licence.

Experience:

- 1 year of related experience … or …
- an equivalent combination of education and experience.

ROADS CREWS SUMMARY TABLE

<table>
<tr><th>JOB TASK</th><th colspan="2">TASK DETAILS</th></tr>
<tr><td rowspan="2">Lifting

Floor to Waist</td><td colspan="2">Max = 94 lbs (rare, when lifting hand-roller onto trailer)

Avg = 20 - 50 lbs (occasional to frequent)</td></tr>
<tr><td>e.g. Lifting of various items, including (but not limited to) the following:
hand-roller lifted onto trailer (94 lbs),
bag of cement mix (88 lbs),
5-gallon bucket ¾ full of ‘colas’ (40 - 50 lbs),</td><td>chunks of broken-out asphalt (varies, range of 20 - 50 lbs),
bucket of dust used to tack-down fresh oil on road (36 lbs),
5-gallon bucket ¼ - ½ full of diesel fuel (15 - 25 lbs).</td></tr>
<tr><td>Lifting

Waist to Chest / Shoulder</td><td colspan="2">Max = 80 lbs (rare, lifting an 80 lb jackhammer into storage compartment on air compressor unit, such that workers’ gripping hands travel between waist and chest level)

Note: no other job demands require significant lifting between waist and chest / shoulder level.</td></tr>
<tr><td rowspan="2">Lifting

Floor to Shoulder / Head</td><td colspan="2">Max = 50 lbs (rare, when lifting heavier broken-out chunks of asphalt into box of asphalt truck.)

Note: asphalt pieces exceeding this weight would be lifted by two workers, or by mechanical equipment.

Avg = 15 - 35 lbs (occasional)</td></tr>
<tr><td>e.g. Lifting of various items, including (but not limited to) the following:
chunks of broken-out asphalt (20 - 50 lbs) lifted into box of asphalt truck,
5-gallon bucket ¾ full of ‘colas’ (40 - 50 lbs) lifted into box of asphalt truck,</td><td>bucket of dust used to tack-down fresh oil on road (36 lbs) lifted into box of asphalt truck,
5-gallon bucket ¼ - ½ full of diesel fuel (15 - 25 lbs) lifted into box of asphalt truck,
Hand / power tools (5 - 10 lbs) lifted into box of asphalt truck.</td></tr>
</table>

<table>
<tr><td>Carrying

Two-Handed</td><td colspan="2">Max = 88 lbs (occasional, when carrying bag of cement mix over a distance of 30 - 50 feet)

Avg = 20 - 50 lbs (occasional to frequent)</td></tr>
<tr><td></td><td colspan="2">e.g. Bilateral Carrying of various items, including (but not limited to) the following:
bag of cement mix (88 lbs) carried over a distance of 30 - 50 feet,
chunks of broken-out asphalt (20 - 50 lbs) carried over a distance of 50 - 100 feet.</td></tr>
<tr><td>Carrying

One-Handed</td><td colspan="2">Max = 50 lbs (occasional, when carrying 5-gallon bucket ¾ full of ‘colas’ emulsified asphalt over a distance of 50 - 100 feet)

Avg = 10 - 35 lbs (occasional)</td></tr>
<tr><td></td><td>e.g. Unilateral Carrying of various items, including (but not limited to) the following:
5-gallon bucket ¾ full of ‘colas’ (40 - 50 lbs) carried a distance of 50 - 100 feet,
bucket of dust used to tack-down fresh oil on road (36 lbs) carried over a distance of 50 - 100 feet,</td><td>5-gallon bucket ¼ - ½ full of diesel fuel (15 - 25 lbs) carried over a distance of 50 - 100 feet,
hand-tamper (16 lbs) carried over a distance of 50 - 100 feet,
small broken-out asphalt chunks (5 - 10 lbs) carried over a distance of 50 - 100 feet.</td></tr>
<tr><td>Pushing</td><td colspan="2">Max = 30 lbs of pushing <u>force</u> (rare, when pushing hand-roller on uncompacted asphalt, on an uphill grade, over a distance of 50 - 150 feet)

Avg = 10 - 15 lbs of pushing <u>force</u> (occasional)</td></tr>
<tr><td></td><td>e.g. Pushing associated with varied tasks, including (but not limited to) the following:
pushing hand-roller over uncompacted asphalt, on an uphill grade (20 - 30 lbs <u>force</u>), over a distance of 50 - 150 feet,
pushing hand-roller over compacted asphalt, on a flat grade (10 - 15 lbs <u>force</u>), over a distance of 50 - 150 feet,</td><td>wheelbarrow usage (carrying asphalt load over a 50 foot distance during asphalt repair / ‘patching’),
wheelbarrow usage (carrying load of gravel over a 50 - 100 foot distance during concrete repair),
jackhammer usage (varied force).</td></tr>
<tr><td>Pulling</td><td colspan="2">Max = 115 lbs of pulling <u>force</u> (rare, when using manhole lid-puller bar to break the ‘seal’ of dirt / road debris when removing manhole casting lid, and to subsequently pull / drag the manhole lid over a 3-foot distance)

Avg = 20 - 60 lbs of pulling <u>force</u> (occasional)</td></tr>
</table>

	e.g. Pulling associated with varied tasks, including (but not limited to) the following: • using manhole lid-puller bar to remove manhole casting lid (115 lbs force), • pulling / dragging of jackhammer (62 lbs force) over a distance of 10 - 25 feet,	• pulling hand-roller over uncompacted asphalt, on an uphill grade (20 - 30 lbs force), over a distance of 50 - 150 feet • pulling hand-roller over compacted asphalt, on a flat grade (10 - 15 lbs force), over a distance of 50 - 150 feet.
Reaching Above Shoulder	**Max Duration** = 5 seconds (rare, when placing tools onto elevated truck bed)	
	e.g. Overhead reaching during a few tasks, including (but not limited to) the following: • placing tools onto truck bed of 5-ton truck, • shovelling asphalt off of bed of open-box 5-ton truck.	
Reaching Below Shoulder	**Frequency** = Frequent to Constant	
	e.g. Reaching: to low levels during the vast majority of job tasks.	
Neck Motion - Flexion (look down) - Extension (look up) - Rotation (side turn)	Flexion: Max Duration = 1 - 5 minutes (looking down at asphalt / concrete) Extension: Not a significant job demand Rotation Max: Duration = 5 sec (turning head to side)	
Sitting	**Max Portion of Shift** = combined total of 10 - 15% of shift (predominately while riding in trucks, such as when travelling between asphalt patching job sites, for 5 - 20 minutes per trip). *Note: exception to the above comment is the need for some workers to operate heavy equipment (if adequately trained) in a seated posture, as outlined below.*	
	e.g. Sitting in the following scenarios: • driving between work sites within city, • operating 'bobcat' machine,	• operating asphalt patching riding-roller, • operating milling machine.
Standing / Walking	**Max Portion of Shift** = combined total of 85 - 90% of shift **Max Sustained Duration** = 2.5 hours (i.e. remaining on one's feet until break periods, when sitting is an option if preferred) *Note: exception to the above commentary is that some workers may operate heavy equipment (if adequately trained) in a seated posture as outlined above, which would decrease standing / walking times proportionally.*	

Climbing Ladders	**Max** = 3 ladder rungs (rare, when climbing on / off heavy equipment) **Avg** = 2 - 3 ladder rungs (occasional) *Note: climbing of <u>stairs</u> is not a component of this job.*
	e.g. Ladder Climbing is required in the following scenarios: • climbing on / off 'Milling Machine' (3 ladder rungs), • climbing on / off 'Asphalt Loader' machine (3 ladder rungs), • climbing on / off 'Asphalt Truck' (2 ladder rungs), • climbing on / off 'Asphalt Patching Riding Roller' (2 ladder rungs).
Sledge Hammering	**Max Sustained Duration** = less than 1 minute Rare to occasional, when dirt / road debris have firmly 'sealed' manhole covers, which prevents their removal solely using a manhole lid-puller bar. (i.e. sledgehammer is used to loosen road debris and break the 'seal', allowing for manual removal of covers using normal manhole lid-puller bar procedure). Sledgehammers may also be used to break-up asphalt chunks, pound stakes into the ground, etc.
Bending / Stooping	**Max Portion of Shift** = 1 hour of shift (occasional, when working on 'Road Construction Crew' hooking up lateral tie-ins to storm sewers / catch basins, or when repairing / resetting castings) **Max Sustained Duration** = 2 minutes sustained (i.e. period of bending, followed by brief period of straightening up, then a return to bending posture) **Bending Depth** = bending to a depth 1 foot above ground-level (Note: workers can bend knees if preferred) *Note: squatting / kneeling are acceptable postural substitutions for bending in most of these job task scenarios.*
Ground Level Postures (i.e. Kneeling and/or Squatting)	**Max Portion of Shift** = 1 hour of shift (occasional, when working on 'Road Construction Crew' hooking up lateral tie-ins to storm sewers / catch basins, or when repairing / resetting castings) **Max Sustained Duration** = 2 minutes sustained (i.e. period of squatting / kneeling, followed by brief period of standing or walking, then a return to squatting / kneeling posture) *Note: bending is an acceptable postural substitution for kneeling / squatting in most of these job task scenarios.*

<table>
<tr><td rowspan="2">Sweeping</td><td>Max Portion of Shift = 2 - 3 hours of shift (occasional, using push-broom behind milling machine)

Max Sustained Duration = 5 - 10 minutes of sustained sweeping (occasional to frequent, depending on job task)</td></tr>
<tr><td>e.g. Sweeping is associated with varied tasks, including (but not limited to) the following:
keeping roadway clear of asphalt millings following use of Milling Machine (sweeping for 2 - 3 hours/shift),
using tar brush to spread colas along edges and surface of asphalt repair ‘patches’ (sweeping for 1 - 2 hours/shift),
keeping roadway clear of debris around edges of the initial asphalt cut,
clearing dirt or debris from road / sidewalk upon completion of asphalt / concrete replacement, or asphalt repair ‘patching’.</td></tr>
<tr><td rowspan="2">Raking</td><td>Max Portion of Shift = 4 - 5 hours of shift (occasional to frequent, when Asphalt Raker on ‘Paving Crew’ uses a rake to carefully spread and level the asphalt during road patching procedure)

Max Sustained Duration = 5 - 10 minutes of sustained raking (frequent for worker in role of Asphalt Raker, rare for all other workers)</td></tr>
<tr><td>e.g. Raking is associated with varied tasks, including (but not limited to) the following:
rake is used by Asphalt Raker to carefully spread and level newly poured asphalt,
raking gravel in preparation of road for asphalt paving / patching.</td></tr>
<tr><td rowspan="2">Shovelling</td><td>Max Portion of Shift = 4 - 5 hours of shift (frequent, when working on ‘Paving Crew’ / ‘Milling Crew’)

Max Sustained Duration = 5 - 10 minutes of sustained shovelling (occasional to frequent, when working on ‘Paving Crew’ / ‘Milling Crew’)</td></tr>
<tr><td>e.g. Shovelling of the following substances:
hot asphalt (10 - 20 lbs per scoop),
mixed concrete (10 - 20 lbs per scoop),
asphalt millings (10 - 15 lbs per scoop),
broken-out asphalt pieces (5 - 10 lbs per scoop),
gravel (5 - 10 lbs per scoop),
snow from bus stops / shelters (5 - 10 lbs per scoop if snow is wet / slushy).</td></tr>
</table>