



## JOB DEMANDS ANALYSIS

**Company:** City of Burnaby

**Location:** Works Yard

**Job Title:** Labourer – Asphalt Crew

**Classification:** Regular Duty

### Purpose of Activities

The purpose of the Labourer is to perform the labouring duties required to patch City of Burnaby roads with hot or cold mix asphalt. The Asphalt Crew performs maintenance patching only.

### Tools and Equipment

The Labourer will use the following tools and equipment to perform his duties:

- Clothing – Steel Toe boots, safety vest, hard hat, leather gloves
- Traffic control – traffic cones, stop signs, men working signs
- Hand tools - square mouth shovels, push brooms, bitumus soaked corn broom and bucket, asphalt rake, hand tamper, etc.
- Jack hammer (42-kg),
- Wheel Barrow (23-kg) empty
- Propane torch for drying and heating area
- Hand roller (30-kg of force required to overcome inertia)
- Diesel bucket, scraper
- Three-ton crew cab truck and trailer (trailer has a power tail gate)

### Usual Methods

1. Load required tools onto three-ton crew cab truck and trailer.
2. Asphalt Crew drives to the work site.
3. The Labourer will set up traffic control signs and traffic cones as required to protect the Asphalt Crew from oncoming traffic.
4. The Labourer will begin to unload required tools and equipment from the truck and trailer. Set tools and equipment aside until required.
5. Prepare the area for asphalt. Sweep debris to pile, shovel debris to bucket, set aside. Heat area with propane torch to ensure that it is dry. Spread bitumus around the edges of the patch area.
6. A five –ton truck with a load of asphalt backs as close to the work area as possible.
7. The Labourer will open and close the tailgate chute by hand to deliver asphalt to the road or into a wheelbarrow if the truck can not get close to the patch area.
8. Using a square mouth shovel, the Labourer will spread the asphalt where the Rakerman indicates.
9. The Rakerman fills the patch area with asphalt and pushes it around with his rake.



10. Once the patch area has been filled, the Rollerman will roll the asphalt with a hand roller or a small riding roller.
11. The Labourer will proceed to clean up the work site. Excess asphalt is gathered and cleared off the road, tools and equipment are returned to the truck and trailer, the hand roller and small riding roller are returned to the trailer.
12. Take down traffic control signs and traffic cones. Return the signs and cones to the truck or trailer.
13. Drive to next work site.

**The presence of \*\* indicates non-value added tasks. These tasks do not contribute to the stated purpose of the work.**

#### Administrative Issues

The Labourer 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. There is no overtime or on-call requirement in this position. The Asphalt Crew usually consist of a Rakerman, Rollerman, Truck Driver and one or two Labourers. Hot asphalt mix is 320 degrees Celsius. Cold mix asphalt is rarely used. The Asphalt Crew will typically complete four to five patching jobs per day. The patching jobs may range from filling a small hole to approximately 25 square metres.

#### 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.

- Lift, carry, unload and load tools and equipment from the three-ton crew cab truck and trailer. Cut down dump box on the three-ton crew cab truck is 1.5 metres from the ground, the trailer is equipped with a power tailgate and some storage area.
- Clean and prepare patch area with brooms, shovels and bituminous asphalt
- Open and close tailgate chute on the five-ton truck to dump asphalt to the ground or wheel barrow
- Work with and on hot asphalt, 320 degrees Celsius
- Shovel asphalt to location as indicated by Rakerman
- Push/pull hand roller or wheelbarrow loaded with asphalt to required location
- Perform labouring duties in or near oncoming traffic
- Use jackhammer to break asphalt or concrete if required

#### 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.

- Lifting technique when lifting, carrying, placing or operating tools and equipment onto the three-ton crew cab truck box or trailer
- Choose body posture and shoveling technique when moving asphalt



### Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the labouring duties associated asphalt patching.
2. People with shoulder injuries such as rotator cuff tendonitis, bursitis and instability may have difficulty with dynamic and static loading and reaching when shoveling asphalt and maneuvering the loaded wheelbarrow.
3. People with forearm and elbow injuries such as tennis elbow may have difficulty with the static grip forces required to hold the shovel and the jarring and vibration encountered when using the jackhammer.
4. People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use of the jackhammer and static grip forces required to hold the shovel (compression and vibration).
5. People with lower extremity injuries may have difficulty with the dynamic movements and forces required to patch the asphalt.

Prepared By: Jeffrey J. McGinn, Kinesiologist

May 18, 1999



## Summary of Stresses

### Metabolic Stresses

The aerobic energy system will provide the major source of energy for the Labourer position. This position requires a moderate level of aerobic function specifically when prepping the patch area, shoveling asphalt, moving asphalt in the wheelbarrow and cleaning the site once the patch has been completed. The anaerobic energy system may be required when using the jackhammer for extended periods or frequent lifting and maneuvering of the loaded wheelbarrow. This energy system will also take over as the primary energy source later in the day as an unfit Labourer becomes fatigued and the aerobic energy system can no longer supply the required energy.

### Structural Stresses

**Spine** –Prolonged forward flexed postures (lumbar/thoracic kyphosis) are encountered as the Labourer performs the labouring duties. These forward flexed postures will occur most likely while the Labourer is handling a load (shoveling asphalt, lifting/carrying tools and equipment, jackhammer use, maneuvering the wheelbarrow, etc.). This posture requires no activity from the torso musculature, but increase asymmetrical disc compression and passive stretch on the posterior spinal ligaments and disc fibres. This can contribute to disc integrity problems as well as decondition the torso support musculature. Lateral flexion and/or rotation with or without forward flexion (loaded or unloaded) will significantly increase the shear forces encountered by the discs, fibres and spinal ligaments.

**Shoulders and Upper Extremity**– The Labourer handles moderate static (grip forces on shovels, wheelbarrow, jackhammer, etc.) and dynamic (shovel asphalt, load and unload tools and equipment) loads to perform the tasks required in this position. Shoveling asphalt occurs from shoulder height (1.5 metres at the tailgate chute) to the ground. The static grip required during some tool use will also decrease the blood flow in the upper extremities.

Almost all of the Labourer's work is carried out in front of his body with some type of tool or implement. This position will weaken the shoulder girdle support structure and increase the risk of injury to this area. Rotator cuff and biceps tendon tendonitis injuries are likely as the muscle of the upper back and shoulder weaken through prolonged use. As this happens, thoracic spine kyphosis will increase and the cervical spine will be pulled forward out of its neutral position.

**Hips and Lower Extremities** – The Labourer is required to work at many levels as he performs the tasks required in this position. Walking, standing, bending and stooping are all required movements. The ground may be uneven and wet which will decrease the stability of the Labourer as he works in the above positions. It is likely that the Labourer will be handling a load (<1-50 kg) from these positions as well. Standing on concrete, asphalt and other hard surfaces will increase the compressive forces up through the ankle, knee, and hip and into the spine.

**Burns** – Contact with the hot asphalt (320 deg. C.) will burn the clothing and skin of the Labourer.



**Vehicle Traffic** – the greatest single danger to the Labourer is from vehicle traffic. Traffic volume will range from high to low depending on the street and time of day the repair is made. The Asphalt Crew will try and use the trucks and trailers for protection from the oncoming traffic, but it is not always possible and on occasion some motorist willfully disregard the traffic control measures set out (signs and cones).

## **INTERVENTIONS**

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

1. Encourage the Labourer to maintain an increased level of fitness away from work that will focus on cardiovascular endurance, muscular strength, muscular endurance and flexibility.
2. Provide regular education in effective use of the body and neutral joint positions for this type of work.
3. Use of a Flag Person will most likely reduce the risk of the Labourer being hit by a motor vehicle when performing his duties.

PJDC-Asphalt Labourer

|                                      |                             |   |                               |                  |            |          |          |  |                                    |  |                   |
|--------------------------------------|-----------------------------|---|-------------------------------|------------------|------------|----------|----------|--|------------------------------------|--|-------------------|
| Referral: Lana Ho                    |                             |   | Organization: City of Burnaby |                  |            |          |          |  |                                    | Title: Labourer - Asphalt Crew                     |                   |
| Dept.: Engineering                   |                             |   | Division: Roads               |                  |            |          |          |  |                                    | Contact: Lorne Graham                              |                   |
| PHYSICAL DEMANDS                     |                             |   | R<br>E<br>Q<br>D              | S<br>I<br>D<br>E | FREQUENCY* |          |          |  | Max.<br>Weight<br>(kg)             | Usual<br>Weight<br>(kg)                            | Date: May 5, 1999 |
|                                      |                             |   |                               |                  | Sel<br>1   | Low<br>2 | Mod<br>3 | High<br>4  |                                    |  |                   |
| S<br>T<br>R<br>E<br>N<br>G<br>T<br>H | Lifting - Floor to Knuckle  | X | B                             |                  |            | X        |          | 41   | <2-7                               | shovel asphalt, lift tools/equip., prep site       |                   |
|                                      | Lifting - Knuckle to Waist  | X | B                             |                  |            |          | X        | 41   | <2-7                               | shovel asphalt, lift tools/equip., wheel barrow    |                   |
|                                      | Lifting - Waist to Shoulder | X | B                             |                  | X          |          |          | 41   | <2-7                               | shovel asphalt from chute, lift tools/equipment    |                   |
|                                      | Lifting - Over Head         |   |                               |                  |            |          |          |  |                                    |  |                   |
|                                      | Carrying - With Handles     | X | E                             |                  | X          |          |          | 41   | <2-7                               | jackhammer, diesel can                             |                   |
|                                      | Carrying - Without Handles  | X | E                             |                  |            |          | X        | 25   | <2-7                               | shovels, broom, rake, signs                        |                   |
|                                      | Pushing - Upper Extremity   | X | B                             |                  |            | X        |          | 25   | <2-7                               | shovel asphalt, sweep, rake,                       |                   |
|                                      | Pushing - Hip/Leg Assist    | X | B                             |                  |            | X        |          | 50   | <2-7                               | shovel asphalt, push wheel barrow                  |                   |
|                                      | Pulling - Upper Extremity   | X | B                             |                  |            | X        |          | 25   | <2-7                               | shovel asphalt, sweep, rake                        |                   |
|                                      | Pulling - Hip/Leg Assist    | X | B                             |                  |            | X        |          | 50   | <2-7                               | shovel asphalt, pull wheel barrow                  |                   |
|                                      | Reach - Shoulder or Above   | X | B                             |                  | X          |          |          | 20   | <2-7                               | shovel asphalt from truck chute, load tools/equip. |                   |
|                                      | Reach - Sho. or Above extnd |   |                               |                  |            |          |          |  |                                    |  |                   |
|                                      | Reach - Below Shoulder      | X | B                             |                  |            |          | X        | 41   | <2-7                               | shovel asphalt, brush diesel, propane torch        |                   |
|                                      | Reach - Bel. Shoulder extnd | X | E                             |                  | X          |          |          | 41   | <2-7                               | lift, carry tools and equipment to/from truck      |                   |
|                                      | Handling                    | X | B                             |                  |            |          | X        | 41   | <2-7                               | shovels, jackhammer, equip., signs                 |                   |
| Gripping                             | X                           | B |                               |                  |            | X        | 50       | <2-7   | shovels, jackhammer, equip., signs |  |                   |
| Fine Finger Movements                |                             |   |                               |                  |            |          |          |  |                                    |  |                   |
| E                                    | Aerobic (percent)           | X |                               |                  |            |          | 95       | prep site, spread asphalt, load/unload tools/equipment from truck    |                                    |  |                   |
| N                                    | Anaerobic (percent)         | X |                               | neg.             |            |          |          | possibly during a heavy lift   |                                    |  |                   |
| R                                    | High Energy Expenditure     |   |                               |                  |            |          |          |  |                                    |  |                   |
| G                                    | Low Energy Expenditure      | X |                               |                  |            |          | X        | prep site, spread asphalt, load/unload tools/equipment from truck    |                                    |  |                   |
| P<br>O<br>S<br>T                     | Neck - Static Flexion       | X |                               |                  |            |          | X        | shovel asphalt, sweep area, lift, carry tools and equipment          |                                    |  |                   |
|                                      | Neck - Static Neutral       | X |                               |                  |            |          | X        | stand, walk at work site   |                                    |  |                   |
|                                      | Neck - Static Extension     | X |                               |                  |            |          | X        | work from bend, stoop  |                                    |  |                   |
|                                      | Neck - Rotation             | X | E                             |                  |            |          | X        | prep site, shovel asphalt, clear site                                |                                    |  |                   |
| T                                    | Throwing                    |   |                               |                  |            |          |          |  |                                    |  |                   |
| U                                    | Sitting                     | X |                               |                  | X          |          |          | drive to next work site in truck                                     |                                    |  |                   |
| R                                    | Standing                    | X |                               |                  |            |          | X        | at work site on concrete and/or asphalt street                       |                                    |  |                   |
| E                                    | Walking                     | X |                               |                  |            |          | X        | at work site between trucks and asphalt location <25 metres          |                                    |  |                   |
| +                                    | Running/Jumping             |   |                               |                  |            |          |          |  |                                    |  |                   |
| M                                    | Climbing - Arms and Legs    | X |                               |                  | X          |          |          | into back of crew truck, in box of 5-ton truck                       |                                    |  |                   |
| O                                    | Climbing - Legs Only        | X |                               | X                |            |          |          | on hills, trials, sidewalks  |                                    |  |                   |
| B                                    | Bending/Stooping            | X |                               |                  |            |          | X        | shovel asphalt, set out traffic cones, sweep, prep area              |                                    |  |                   |
| I                                    | Crouching                   |   |                               |                  |            |          |          |  |                                    |  |                   |
| L                                    | Kneeling                    |   |                               |                  |            |          |          |  |                                    |  |                   |
| I                                    | Crawling                    |   |                               |                  |            |          |          |  |                                    |  |                   |
| T                                    | Twisting                    | X | E                             |                  |            |          | X        | shovel asphalt, prep area, lift and carry tools and equip from truck |                                    |  |                   |
| Y                                    | Balancing                   | X |                               | X                |            |          |          | on truck or at work site   |                                    |  |                   |
| G<br>E<br>N                          | Traveling                   | X |                               |                  | X          |          |          | in City of Burnaby   |                                    |  |                   |
|                                      | Work Alone                  |   |                               |                  |            |          |          | in a crew with rakerman, rollerman, truck driver, labourer           |                                    |  |                   |
|                                      | Interact with Public        | X |                               |                  | X          |          |          | possibly at work site, ntraffic                                      |                                    |  |                   |
|                                      | Operate Equip/Machinery     | X |                               |                  | X          |          |          | propane torch, power tailgate on trailer                             |                                    |  |                   |
|                                      | Irregular/Extended Hours    |   |                               |                  |            |          |          | 0700-1530, Monday - Friday, no 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.

|   |                            |                  |                  |            |          |           |   |  |  |
|---|----------------------------|------------------|------------------|------------|----------|-----------|---|--|--|
| Referral:   |                            | Organization:    |                  |            |          |           |   | Title: see 1st page header                                       |  |
| Dept.:  |                            | Division:        |                  |            |          |           |   | Contact:   |  |
| PHYSICAL DEMANDS  |                            | R<br>E<br>Q<br>D | S<br>I<br>D<br>E | FREQUENCY* |          |           |   | COMMENTS   |  |
|   |                            |                  |                  | Sel.<br>1  | Low<br>2 | Mod.<br>3 | High<br>4   |  |  |
| P<br>E<br>R<br>C<br>E<br>P<br>T<br>I<br>O<br>N                          | Hearing - Conversations    | X                |                  |            |          |           | X   | rakeman. Rollerman, truck driver, foreman, public                |  |
|   | Hearing - Other Sounds     | X                |                  |            |          |           | X   | trucks, vehicle traffic, roller                                  |  |
|   | Vision - Far               | X                |                  |            |          |           | X   | perform labouring tasks on asphalt crew                          |  |
|   | Vision - Near              |                  |                  |            |          |           |   |  |  |
|   | Vision - Colour            |                  |                  |            |          |           |   |  |  |
|   | Vision - Depth             | X                |                  |            |          |           | X   | spread asphalt as required, move around work site, near traffic  |  |
|   | Perception - Spatial       | X                |                  |            |          |           | X   | spread asphalt as required, move around work site, near traffic  |  |
|   | Perception - Form          |                  |                  |            |          |           |   |  |  |
|   | Feeling (Tactile)          | X                |                  |            |          | X         |   | spread asphalt to required location, sweep                       |  |
|   | Reading                    |                  |                  |            |          |           |   |  |  |
| W<br>O<br>R<br>K<br>E<br>N<br>V<br>I<br>R<br>O<br>N<br>M<br>E<br>N<br>T | Writing                    |                  |                  |            |          |           |   |  |  |
|   | Speech                     | X                |                  |            |          |           | X   | rakeman, rollerman, truck driver, foreman, public                |  |
|   | Inside Work                | X                |                  |            | X        |           |   | in cab of truck driving between job sites                        |  |
|   | Outside Work               | X                |                  |            |          |           | X   | labouring on the asphalt crew, assigned other duties during rain |  |
|   | Hot Conditions >25 deg. C  | X                |                  | X          |          |           |   | on asphalt 320 deg. C.   |  |
|   | Cold Conditions <10 deg. C | X                |                  | X          |          |           |   | assigned to other duties during wet weather                      |  |
|   | Humid                      | X                |                  | X          |          |           |   | assigned to other duties during wet weather                      |  |
|   | Dust                       | X                |                  |            | X        |           |   | from sweeping debris at work site prior to asphalt               |  |
|   | Vapor Fumes                |                  |                  |            |          |           | X   | asphalt fumes, diesel from truck and can                         |  |
|   | Hazardous Machines         | X                |                  |            | X        |           |   | propane torch, power tailgate                                    |  |
|   | Proximity to Moving Object | X                |                  |            |          |           | X   | near roller, trucks, in traffic                                  |  |
|   | Noise                      | X                |                  |            |          |           | X   | from truck and traffic, roller                                   |  |
|   | Electrical Hazard          |                  |                  |            |          |           |   |  |  |
|   | Sharp Tools                | X                |                  |            |          |           | X   | shovels, scrapers  |  |
|   | Radiant/Thermal Energy     | X                |                  |            |          |           | X   | asphalt 320 deg. C.  |  |
|   | Slippery Conditions        | X                |                  | X          |          |           |   | in wet weather   |  |
|   | Vibration and Related      | X                |                  | X          |          |           |   | Shovel asphalt, jackhammer use                                   |  |
|   | Chemical Irritants         | X                |                  |            |          |           | X   | diesel, bitumus asphalt  |  |
|   | Organic Substances         |                  |                  |            |          |           |   |  |  |
|   | Medical Waste              |                  |                  |            |          |           |   |  |  |
| Blood Products  |                            |                  |                  |            |          |           |   |  |  |
| Congested Worksite  | X                          |                  |                  |            |          | X         | in traffic on major roadways, residential streets |  |  |
| T   | Lighting - Direct          | X                |                  |            |          |           | X   | day light, sun light   |  |
|   | Lighting - Indirect        | X                |                  |            |          |           | X   | day light  |  |
|   | Lighting - Adjustable      |                  |                  |            |          |           |   |  |  |
|   | Lighting - Fluorescent     |                  |                  |            |          |           |   |  |  |
|   | Lighting - Incandescent    |                  |                  |            |          |           |   |  |  |
|   | Lighting - Shadows etc.    | X                |                  | X          |          |           |   | depends on time of day and location                              |  |

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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