

# Job Demands Analysis

**Worker's Occupation:** Labourer in Roads (LiR)

**Prepared for:** City of Richmond

**Date of Assessment:** June 13 & July 21, 2016

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## **OVERVIEW OF POSITION**

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This is a manual labour position, which involves the preparation, manipulation and maintenance of asphalt sidewalks, and roads. The manipulation of asphalt includes the melting, spreading and smoothing of asphalt by machine and by hand.

## **WORK HOURS/WORK SCHEDULE**

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- Fulltime Hours: 9.5 hours/day
- Shift: 5 days work, 4 days work and one day off (5-4-1)
- Breaks: one 60-minute lunch break
- Overtime: as required
- Frequency of overtime: varies depending on need

## **PERSONAL PROTECTIVE EQUIPMENT**

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- Hard hat
- Steel Toed Boots
- Gloves
- Overalls
- Safety Glasses
- Hearing Protection (Task-specific)

## **TOOLS AND EQUIPMENT**

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A LiR may use the following tools and equipment to perform their duties:

### Up to 20 lbs:

- Propane torch
- Sledgehammer
- Measuring tape
- Markers
- Chalk line
- Roller
- Shovel
- Brooms of varying sizes/types
- Asphalt rakes
- Buckets of varying sizes
- Tar hand brush
- Chisels

### 21-50 lbs:

- Propane tank
- Wheelbarrow

### 51-100 lbs:

- Portable generators
- Hand tamper
- Jackhammer

### Vehicles

- Asphalt pavers
- Compactor
- Steel wheel roller
- City trucks/trailers

## **WORK ORGANIZATION**

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Workers tend to operate in small crews and/or individually. An onsite leader/supervisor directs the work of each crew and their specific tasks for the day. A foreman supervises and organizes groups of crews.

## **REQUIRED EDUCATION & QUALIFICATIONS**

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- Completion of Grade 12
- Class 5 driver's license
- General orientation courses as required by the City of Richmond eg) flagging, traffic control

## **ESSENTIAL - PHYSICAL DEMANDS**

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The essential tasks of a Labourer in Roads (LiR) include the following:

1. Preparing and transporting materials from the City Works Yard to the work site
2. Preparing the work site
3. Loading the asphalt paver
4. Placing, and rough setting the asphalt
5. Leveling, temping/edging the asphalt
6. Compacting and paving the asphalt
7. Cleaning up the work site (sweeping, disposal of loose asphalt) and the work tools (diesel)

The following tasks from are physically repetitive:

4. Placing, and rough setting the asphalt
5. Leveling, temping/edging the asphalt

Over a period of 2-3 hours, a crew of LiR can typically pave a section of road up to 100 feet.

A detailed description of each essential task follows in this next section.

### 1 - Preparing and Transporting Materials from the City Works Yard

Labourer in Roads (LiR) staff meet at the City Works Yard on Lynas Lane at the start of each work shift and prepare for their duties for the day. Work tasks/schedules for the day are reviewed. Supplies and tools are loaded into City vehicles. LiRs drive to their designated work sites for the day.

### 2 - Preparing the Worksite

Labourer in Roads (LiR) staff prepares the worksite. This typically includes the following:

- Diverting traffic and setting up traffic cones.
- Transporting equipment from the City's work trucks to the work site.
- Identifying and marking the boundaries of the worksite with a chalk line or other.
- If required, liaising with other 3<sup>rd</sup> party providers to remove old asphalt road-top.
- Removing excess/protruding asphalt with a jackhammer, pick, shovel or broom.
- As required, drying edges or other areas with a propane torch (Figure 1).
- Spraying the asphalt paver with diesel to prevent asphalt from adhering to it (Figure 2).



Figure 1

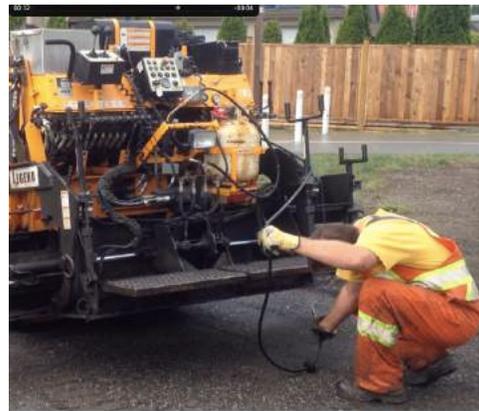


Figure 2

### 3 – Loading the asphalt paver

Working with a dump truck operator, a LiR will direct the dump truck operator with hand signals on the amount of fresh asphalt to deposit into the asphalt paver (Figure 3).



Figure 3

### 4 – Placing, and rough setting the asphalt

There are several steps in this process:

- i. Once the asphalt paver is loaded, one LiR will control the vehicle. The LiR controls the vehicle with various switches and levers (Figure 4). The LiR needs to be constantly monitoring the environment and amount of asphalt to unload, so the LiR needs to step on/off the vehicle routinely (Figure 5).

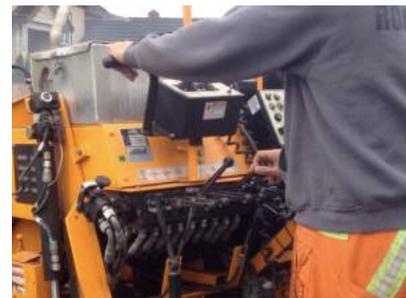


Figure 4

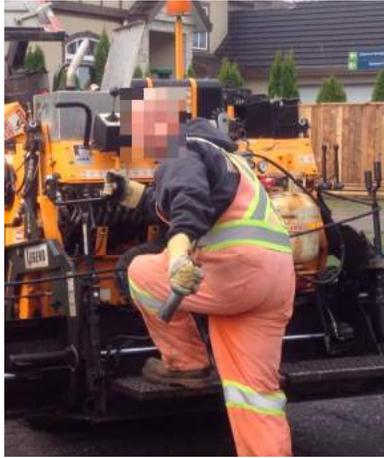


Figure 5

- ii. As the hot loose asphalt is released from the paver, the other LiRs will disperse the hot asphalt over the ground evenly with the use of a shovel and an asphalt rake (Figure 6).

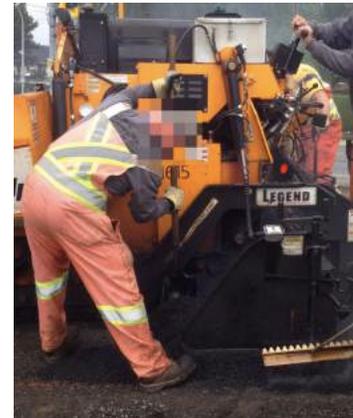


Figure 6

- iii. As the asphalt paver progresses forward, the LiR will continue to spread the loose asphalt over the ground with asphalt rakes. On average, a LiR will need to exert up to 35 lbs of pressure to push or pull the loose asphalt over the ground (Figure 7). To prevent the asphalt from adhering to their rakes, the LiRs will need to routinely brush diesel onto their rakes with a hand brush (Figure 8).



Figure 7



Figure 8

#### 5. Leveling, temping/edging the asphalt

LiRs continue to level the asphalt over the ground with an asphalt rake (Figure 9). The edges are shaped and compacted with either an asphalt rake or a hand tamper. A LiR will exert up to 80 lbs of pressure when using an asphalt rake or a hand tamper to shape these edges (Figure 10).



Figure 9



Figure 10

#### 6. Compacting and paving the asphalt

Upon levelling and hand tampering the asphalt, another LiR will operate a steel wheel roller and drive it over the asphalt to compact and smooth out the asphalt (Figure 11). If required, additional asphalt is added. A LiR, using a shovel, will remove excess loose asphalt from the dump truck. This action requires a LiR to exert up to 45 lbs of force (Figure 12). This asphalt is loaded into a wheelbarrow and deposited onto the appropriate location on the path/road (Figure 13). A loaded wheelbarrow can weigh up to 182.5 lbs. A LiR will level the asphalt (Figures 9 and 10) and a steel wheel roller is used to compact/smooth out the asphalt (Figure 11).



Figure 11



Figure 12



Figure 13

7. Cleaning up the work site (sweeping, disposal of loose asphalt) and the work tools (diesel)

Once the path/road is compacted, LiRs will clean up the surrounding environment by replacing their tools and sweeping up and discarding any debris (Figure 14).



Figure 14

**PHYSICAL DEMANDS OF WORK TASKS**

The following guide/descriptors have been used to identify the frequency, and the load of the specific steps as outlined in the preceding pages (3-7) of this document.

<b>Table ST1 - Physical Demand Characteristics Of Work</b> (Dictionary of Occupational Titles - Volume II, Fourth Edition, Revised 1991)			
<b>Physical Demand Level</b>	<b>OCCASIONAL</b>	<b>FREQUENT</b>	<b>CONSTANT</b>
	<b>0-33% of the workday</b>	<b>34-66% of the workday</b>	<b>67-100% of the workday</b>
Sedentary	1 - 10 lbs.	Negligible	Negligible
Light	11 - 20 lbs.	1 - 10 lbs.	Negligible
Medium	21 - 50 lbs.	11 - 25 lbs.	1 - 10 lbs.
Heavy	51 - 100 lbs.	26 - 50 lbs.	11 - 20 lbs.
Very Heavy	Over 100 lbs.	Over 50 lbs.	Over 20 lbs.

<b>Action</b>	<b>Weight / Force (Lb.)</b>	<b>Travel Distance</b>	<b>Frequency</b>	<b>Task Parameters (Essential/non-essential)</b>
<b>Lifting</b>				
Floor to Waist	11-20 lbs	0-36 Inches	Frequent	Essential – rakes, shovels, propane torch, brooms, etc. Steps 1-7. Figs 1, 2, 4, 6-10 & 14.
	21-50 lbs	0-36 Inches	Occasional	Essential – wheelbarrow and propane tank. Steps 1-7. Figs 1, & 13.
	51-100 lbs	0-36 Inches	Occasional	Essential – loaded wheelbarrow, and a hand tamper tool. Steps 1 & 6. Figs 13.
	100+ lbs	0-36 Inches	Occasional	Essential – loaded wheelbarrow. Step 6. Figs 13.

Waist to Shoulder	11-20 lbs	0-36 Inches	Frequent	Essential – obtaining supplies, prepping and operating machinery, Steps 1-7. Figs 2, & 4.
	21-50 lbs	0-36 Inches	Occasional	Essential – wheelbarrow and propane tank. Steps 1-7. Figs 1, & 13.
	51-100 lbs	0-36 Inches	Occasional	Essential – loaded wheelbarrow, and a hand tamper tool. Steps 1 & 6. Figs 13.
	100+ lbs	0-36 Inches	Occasional	Essential – loaded wheelbarrow. Step 6. Figs 13.
Shoulder to Overhead	11-20 lbs	0-36 Inches	Occasional	Essential – obtaining tools, hand positions while leveling with a rake, and operating levels on the asphalt paver. Steps 1-7. Figs 4, 6, & 9.

Action	Weight / Force (Lb.)	Travel Distance	Frequency	Task Parameters (Essential/non-essential)
<b>Carrying</b>				
Bilateral Carrying	11-20 lbs	0-36 Inches	Constant	Essential – rakes, shovels, propane torch, brooms, etc. Steps 1-7. Figs 1, 6, 7, 9-10, 12 & 14.
	21-50 lbs	0-36 Inches	Occasional	Essential – wheelbarrow and propane tank. Steps 1-7. Figs 1, & 13.
	51-100 lbs	0-36 Inches	Occasional	Essential – loaded wheelbarrow, and a hand tamper tool. Steps 1 & 6. Figs 13.
	100+ lbs	0-36 inches	Occasional	Essential – loaded wheelbarrow. Step 6. Figs 13.
Unilateral Carrying – Right / Left	11-20 lbs	0-36 Inches	Frequent	Essential – rakes, shovels, propane torch, brooms, etc. Steps 1-7. Figs 1, 6, 7, 9-10, 12 & 14.
	21-50 lbs	0-36 Inches	Occasional	Essential – propane tank. Steps 1-2. Figs 1.

Action	Weight / Force (Lb.)	Travel Distance	Frequency	Task Parameters (Essential/non-essential)
<b>Push / Pull</b>				
Static / Dynamic Pushing & Pulling	11-20 lbs	0-36 Inches	Constant	Essential – preparing tools and materials, gears/levers, push/pulling asphalt and tools. Steps 1, 2, 4-7. Figs 4, 6-10, & 12-14.
	21-50 lbs	0-36 Inches	Constant	Essential – preparing tools and materials, dynamic push/pulling asphalt at 35 lbs, unloading asphalt from a dump trunk at 45 lbs, and tools. Steps 1, 2, 4-7. Figs 4, 6-10, & 12-14.
	51-100 lbs	0-36 Inches	Frequent	Essential – static pull or push of 80 lbs of force with an asphalt rake to level asphalt and create edges or move/unload a wheelbarrow. Steps 4-6. Figs 6-10 & 12-14.
	100+ lbs	0-36 Inches	Occasional	Essential – static pushing/pulling of 182.5 lbs of force with wheelbarrow. Step 6. Fig 13.

Action	Force Required	Frequency	Task Parameters (Essential/non-essential)
<b>Gripping</b>			
Right & Left Hand	11-20 lbs	Constant	Essential – all hand tools (shovels, rakes, bucket, broom, brush, levers). Steps 1-7. Figs 1, 2 & 4-14.

Action	Force Required	Frequency	Task Parameters (Essential/non-essential)
<b>Fine Finger Movement</b>			
Right & Left Hand	11-20 lbs	Frequent	Essential – manipulating all hand tool, diesel knob/wheel, equipment toggles and switches. Steps 1-7. Figs 2, 4-5 & 11.

The table in the subsequent page highlights the frequency of the most common movement patterns performed by the City of Richmond's Labourers in Roads (LiR).

The numeral in the "Task #" column refers to these tasks:

1. Preparing and transporting materials from the City Works Yard to the work site
2. Preparing the work site
3. Loading the asphalt paver
4. Placing, and rough setting the asphalt
5. Leveling, temping/edging the asphalt
6. Compacting and paving the asphalt
7. Cleaning up the work site (sweeping, disposal of loose asphalt) and the work tools (diesel)

The "Frequency" column is described as follows:

N = Not required, R = Rarely (<2%), O = Occasional (3-33%), F = Frequent (34-66%), C = Constant (67-100%)

PHYSICAL DEMAND	TASK #	FREQUENCY					DESCRIBE ACTIVITY Note distances, durations and surfaces
		N	R	O	F	C	
<b>MOBILITY</b>							
Walking	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Walking ~ 90% of time - Over paved/uneven/graded terrain - Operating hand tools and wheelbarrow Standing ~ 90% of time - Obtaining/operating tools/machinery and talking with peers Sitting ~ 5% of time - Operating city trucks and machinery Driving ~ 5% of time - Operating city trucks, asphalt pavers, steel wheel roller
Standing	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Sitting	3,6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Crawl	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Driving (Forklift/Vehicle/Other)	3,6	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>POSTURE – Back</b>							
Bending Forward	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Forwards ~ 66% of time - Shoveling/temping/raking/leveling and torching asphalt Twisting ~ 33% of time - Obtaining supplies - Analyzing/assessing work conditions/terrain - Preparing materials ie) applying diesel
Bending Backwards	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Twisting	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>POSTURE – Reaching</b>							
Note forward and/or side reach distances							
Above Shoulder Level	1,3,6,7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Both Above ~ 33% - Unloading asphalt from a dump truck Chest to shoulder ~ 66% - Obtaining/loading tools - Shoveling/temping/loading asphalt Below chest ~ 75% - Shoveling/temping/loading asphalt - Preparing/cleaning materials
Chest to Shoulder Level	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
Below Chest Level	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	
Behind Body	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>POSTURE – Elbow/Forearm/Wrist</b>							
Elbow Flexion/Extension	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Both Elbow ~ 75% - Shoveling/temping/loading asphalt - Tool use (brush, shovel, rakes, buckets) Wrists ~ 50% - Applying diesel to tools/machines - Operating toggles/levers on machines
Wrist Flexion/Extension	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Wrist Rotation	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>POSTURE – Neck</b>							
Forward Bending/Flexion	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	Forwards/Twisting/Turning ~ 66% - Monitoring environment while operating vehicles - While shoveling/temping, applying diesel, clean up, torching - Reviewing work
Backward Bending/Ext.	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Twisting/Turning/Tilting	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
<b>POSTURE – Hip/Knee/Ankle/Foot</b>							
Crouching/Squatting	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Crouch / Squat ~ 33% - Carrying supplies and materials to the worksite - Lifting a wheelbarrow/tools - Applying diesel to machines/tools Climbing ~ 33% - Climbing in/out of City vehicles and machines Foot pedal ~ 25% - Operating City vehicles and machines
Kneeling	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Climbing (Stairs/Other)	1-7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Jumping	-	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
Foot Pedal/Action	1,7	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
		<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	
N = Not required, R = Rarely (<2%), O = Occasional (3-33%), F = Frequent (34-66%), C = Constant (67-100%)							

## **ESSENTIAL – NON-PHYSICAL DEMANDS**

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Labourers in Roads (LiRs) are required to account for environmental variables. These variables (wind, warm or cool temperatures, and weather) can significantly impact the quality, look and usefulness of the finished product. LiRs need to know how asphalt responds in these conditions. They need to work efficiently, anticipate problems, and take preventative measures to prevent any problems.

LiRs are also required to demonstrate their understanding of the following:

- Knowledge of the occupational hazards
- Knowledge of the safety precautions
- Knowledge of chemical composition of asphalt and how it reacts to the environment
- Converse, instruct, follow and direct work as required through various mediums such as face to face direct contact, phone calls, email, and memos

These demands (environment, hazards, safety, administrative) require the following range of cognitive and sensory skills.

### Attention/concentration

- Sustained - attending to the environment, traffic, the task of laying asphalt and machinery
- Divided - conversing with crew, minding/directing traffic, machinery and preparing asphalt.
- Alternating - conversing with crew or 3<sup>rd</sup> party operators, directing traffic, and other tasks

### Memory

- Procedural - knowledge of methods, materials, tools, equipment and use of same
- Immediate and delayed visual - written directions/diagrams and location of materials/tools
- Immediate and delayed auditory - verbal directions and discussions with crew/leader
- Prospective - project timelines, daily/weekly schedules, meeting times

### Executive Functioning

- Initiation - beginning task/project
- Working memory - short term directions/changes, one off instructions
- Sequencing - identifying and/or following an order of activities/actions
- Problem solving - identifying and/or addressing unexpected issues
- Termination - completing a task/project

### Sensory

- Vision - observation of the immediate environment and task at hand
- Hearing - attending to sounds within the environment
- Touch - to hold and manipulate tools/equipment

The table in the subsequent page summarizes the key environmental conditions that may influence and impact a LiRs ability to do their job.

**ENVIRONMENTAL/PSYCHOSOCIAL FACTORS:**

ENVIRONMENTAL & OTHER CONDITIONS	YES	NO	TASK DESCRIPTION
Inside Work Location		X	
Outside Work Location	X		
Electronic		X	
Mechanical	X		Various hand tools ranging in size. See page 7 – figures 11, 12, and 13 for examples.
Fumes, Gases or Odours	X		Inorganics (diesel, fumes/odours from asphalt, fumes/odours from machinery, traffic fumes).
Dust	X		Dust from loose asphalt, soil, and ground
Toxic Conditions	X		Asphalt and diesel substances
Explosives	X		Propane tank for torching asphalt
Wet/Humid	X		Weather conditions ie) rain
Noise	X		Traffic, immediate environment, and various tools
Vibration	X		Compressor, asphalt paver, steel roller
Exposure to Changes in Temperature	X		Sun, rain, and wind
Confined and/or Awkward Spaces		X	
Talking	X		Interacting with co-workers, public, managers.
Hearing	X		Interacting with co-workers, public, managers
Near Vision	X		Reading schedules/timelines and phones. Operating switches/toggles on machinery.
Far Vision	X		Directing traffic. Driving City vehicles.
Depth Perception	X		Preparing, setting, and finishing asphalt.
Decision Making	X		Limited to the onsite/crew supervisor
Reading	X		Signage, materials handling, written directions/memos, or emails.
Writing	X		Limited to the onsite/crew supervisor
Driving	X		City vehicles to and from worksites.
Operating Hand/Foot Controls	X		Driving City vehicles to and from worksites.
Travel	X		Driving City vehicles to and from worksites.
Deadline Pressures	X		At the direction of the supervisor/foreman.
Work Alone	X		Specific tasks/steps while laying asphalt.
Work in Group	X		Within crews to complete the tasks.