JOB DEMANDS ANALYSIS

Company: City of Burnaby **Location:** Automotive Shop

Job Title: Tradesman – Mechanic - Serviceman **Classification:** Regular Duty

Purpose of Activities

The Serviceman is responsible for safety inspections and regular service work on the City of Burnaby vehicle and heavy equipment fleet. Safety inspections and regular maintenance include: oil change, lube, general inspection of hoses and belts, brake inspection and adjustment on larger vehicles and equipment, top up fluid levels, exhaust and muffler inspection, change burnt out lights and complete minor repairs.

Tools and Equipment

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

- Automotive shop bay with vehicle hoist (light and heavy vehicles and equipment)
- Hand tools (wrenches, screw drivers, sockets, chisels, punches, hammers, oil filter wrenches, task light, etc.)
- Air tools (1/2 and 3/4 inch impact gun, pistol and in-line grip)
- Recycled oil drum with extension, funnels
- Parts washer, solvent
- Work bench with vise, step ladder, extension ladder
- Parts room

Usual Methods

1. Determine off master list which vehicles and equipment have been scheduled for service. Pull vehicle report from files.**
2. Locate vehicle or equipment. The Serviceman will search for the vehicles and equipment in the five acre Works Yard. **
3. Drive the vehicle or piece of equipment into the service bay. Some vehicles and pieces of equipment are too large for the service bay and will be serviced under the awning outside the service bay.
4. Get out of the vehicle or piece of equipment. Bend, stoop, crouch or crawl under the vehicle or equipment to set the hoist supports in the proper location under the vehicle. Some vehicles (Garbage, Recycle trucks) have cabs that tip forward by pumping a hand lever at shoulder height. The Serviceman uses a ladder to access the engine.
5. Walk to the hoist controls, depress the buttons and raise the hoist to the desired level. Some vehicles can not be raised high enough on the hoist to allow the Serviceman to stand erect under the vehicle, as the service bay ceiling is too low.
6. Gather tools and equipment to perform the required inspection and service.**

7. Perform vehicle inspection, service and make minor repairs. The Serviceman will also record any repair work required on the vehicle.
8. Brake adjustment will often require the Serviceman to remove the tires from the vehicle. He will use an impact gun to loosen the lug nuts, pull off the tire and then make the required adjustments. Tires on some of the vehicles can weigh 50 kg or more and they are handled by hand. There is no tire dolly in the shop. This task is performed with the vehicle raised slightly off the ground.
9. Lower the vehicle, add engine oil, check the remaining fluid levels, lube the doors and other hinges.
10. Complete the vehicle service report.
11. Back the vehicle out of the service bay and drive it back to works Yard parking area.
12. Repeat steps 2-11 with the next vehicle.

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

Administrative Issues

The Serviceman works an eight-hour day, Monday to Friday from 0830 to 1700 with a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. The Serviceman is not required to work overtime. Five vehicles are serviced every day, with every vehicle in the fleet receiving service at approximately ten-week intervals. There are approximately 300 vehicles and equipment in the fleet, which range from cars; trucks – S-10 Rangers, 1/2 ton, 1 ton, 5 ton, Flusher Truck, Sweeper, Garbage, Recycle, Bread vans; heavy equipment – Grader, Backhoe, Front End Loader. Garbage trucks are usually brought into the shop for servicing without having been properly cleaned. Rats, maggots and other bacteria have reportedly been found in or on these trucks.

There are several safety issues in the Automotive/Heavy Equipment Shop. These issues can increase the risk of injury and/or decrease the productivity of the Serviceman. These safety issues centre on the lack of adequate workspace for the Serviceman to work within. Several vehicles and heavy equipment fill the entire bay. Some are even too large to enter the bay. During normal daily work or in the event of an emergency, access and/or egress in, around or out of the shop is restricted. In addition, in some instances, where it would be prudent to use a mechanical lifting device, the mechanical lifting device can not get near the vehicle. When this happens, the Serviceman will remove or install the part by hand.

The air exchange system of the Automotive/Heavy Equipment Shop is weak as diesel, gasoline and other fumes hang in the air when the shop doors are open or closed. Lighting has been improved with the installation of overhead mercury vapor lights.

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.

- Walk, stand on concrete floor, asphalt works yard
- Bend, stoop, crouch, kneel and crawl to service vehicles and equipment
- Reach below, at and above shoulder height to service vehicles and equipment

- Insert hand(s) into confined areas to service vehicles and equipment
- Hand, power and air tool use is required
- Climb, stand and balance on ladders or the vehicles and equipment to perform service
- Work above shoulders in cervical extension from a stand, bend, stoop, crouch, kneel
- Work under vehicles and equipment while they are on the hoist or the shop floor

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.

- Set up vehicle and equipment on the floor or on the hoist
- Some body postures can be selected by the Serviceman, but most body postures are the result of how the vehicles and equipment has been engineered

Accommodative Considerations

- People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the servicing of vehicles and equipment.
- People with shoulder injuries such as rotator cuff tendonitis, bursitis and instability may have difficulty with dynamic and static loading and reaching activities required to service the vehicle or piece of equipment.
- People with forearm and elbow injuries such as tennis elbow may have difficulty with the repeated jarring from air tool use as well as the static grip forces required during any power or hand tool use.
- People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use of air tools (compression and vibration).
- Post-whiplash and other neck problems may have difficulty with this position.
- Individuals who do not cope in open low-autonomy work environments would have difficulty with this position.
- Must hold a Tradesman Ticket (Automotive or Heavy Duty Mechanic) valid for the province of British Columbia.

Prepared By: Jeffrey J. McGinn, Kinesiologist February 15, 1999

Summary of Stresses

Metabolic Stresses

The aerobic energy systems will provide the major source of energy for the Serviceman. This position requires a low to moderate level of aerobic activity to perform vehicle and equipment service. The anaerobic energy system may be used in high intensity service tasks, such as lifting tires to and from the wheel lugs. This is not an everyday occurrence and the Serviceman can ask others for assistance

Structural Stresses

Spine –Significant loading of the spinal structures are likely in this position. Prolonged loaded and unloaded forward flexion, extension, lateral flexion and rotation of the spine are all movements required by the Serviceman. Forward flexed postures require 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 contributing to deconditioning of 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.

Due to the vehicle and equipment engineering and the space limitations found in the shop, it is almost impossible for the Serviceman to use proper postural control and body positioning for most of the work he performs. With this in mind, the goal should be to minimize the time spent in these undesirable, high-risk postures and make good postural and movement choices whenever the situation presents itself.

Neck, Shoulders and Upper Extremity– Servicing vehicle and equipment requires prolonged and repeated static and dynamic movements. The static and dynamic movements through the shoulder and upper extremity often require the rotator cuff muscle groups, upper trapezius and scalene muscles of the neck to maintain a significant load. Considerable work is performed above the shoulder which will increase the static loading of these same muscle groups. Hand, air and power tool use (predominately dominant hand) will increase the static and dynamic loading of the forearm flexors, extensors, supinator, pronator teres and the pronator quadratus. Power and air tool use will also increase the vibration, jarring and compressive forces from the grip to the elbow and shoulder that may lead to over use tendon or nerve compression injuries.

Hips and Lower Extremities – Standing and walking on concrete and asphalt for the entire shift increase the compressive forces through the ankles, knee, hips and spine. The awkward positions required to access some parts and components do not allow the Serviceman to perform the required work from a stable base of support. This in turn will increase the risk of injury for all of the other structures.

INTERVENTIONS

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

1. The present Automotive/Heavy Equipment Shop is inadequate for the type and volume of work that the Serviceman performs. A larger, more modern space is required. This space should be equipped with a proper ventilation system, an effective lighting system and be equipped with the proper number and type of tools and equipment required in a diverse mechanic shop. Floor and overhead hoists require adequate space around them to allow for access and egress. A pit to service vehicles and equipment will decrease the time required to hoist or jack up these pieces for servicing. A stakeholder needs assessment should be conducted to determine the actual requirements of the Automotive/Heavy Equipment Shop. Consult industry to determine space requirements based on the number of mechanics on staff and the footprint of various tools and equipment, etc.

2. Encourage the Serviceman to be active away from work focusing on cardiovascular endurance, muscular strength, muscular endurance and flexibility.

3. Provide regular education in effective use of the body and neutral joint positions for this type of work.

4. Encourage the Serviceman to ask for assistance when handling heavy and/or oversized parts or pieces of equipment

5. Provide kneepads for the Serviceman for the times he will spend in a kneeling position when servicing a vehicle. Replace the knee pads as they become worn.

6. Purchase current vehicle and equipment manuals with easy to read fonts and diagrams.

7. Investigate a padded handle for the pistol grip air tools. Each Mechanic may require their own impact gun or changeable grip so that the pistol grip can be matched to the user's handgrip. Investigate the use of a variable speed impact gun to reduce the jarring force at the end of the cycle.

Referral: Lana Ho		Organization: City of Burnaby							Title: Mechanic Serviceman
Dept.: Engineering		Division:							Contact: Darryl Robertson
				FREQUENCY*					Date: February 10, 1999
	PHYSICAL DEMANDS	REQD	SIDE	Sel 1	Low 2	Mod 3	High 4	Max. Weight (kg)	Usual Weight (kg)	COMMENTS
STRENGTH	Lifting - Floor to Knuckle	X	D		X			20	<1-7	parts, tools, to service vehicle
	Lifting - Knuckle to Waist	X	D			X		50	<1-7	parts, tools to service vehicle, tires
	Lifting - Waist to Shoulder	X	D			X		20	<1-7	parts, tools to service vehicle
	Lifting - Over Head	X	D			X		20	<1-7	parts, tools to service vehicle
	Carrying - With Handles	X	D		X			10	<1-7	small tool box
	Carrying - Without Handles	X	D				X	20	<1-7	parts, tools, rag
	Pushing - Upper Extremity	X	D			X		30	<1-7	wrenches, parts
	Pushing - Hip/Leg Assist	X	D			X		50	<1-7	wrenches, hoist arms, oil drum, tires
	Pulling - Upper Extremity	X	D			X		30	<1-7	wrenches, parts
	Pulling - Hip/Leg Assist	X	D			X		50	<1-7	wrenches, hoist arms, oil drum, tires
	Reach - Shoulder or Above	X	D				X	20	<1-7	access part to service vehicle on hoist
	Reach - Sho. or Above extnd	X	D	X				20	<1-7	access parts to service vehicle
	Reach - Below Shoulder	X	D				X	50	<1-7	service vehicle,
	Reach - Bel. Shoulder extnd	X	D	X				50	<1-7	access parts to service vehicle
	Handling	X	D				X	50	<1-7	parts, tools to service vehicle
	Gripping	X	D				X	40	<1-7	parts, tools, steering wheel
	Fine Finger Movements	X	D				X	max.	low	remove/place parts to service vehicle
ENRG	Aerobic (percent)	X					100	service vehicles and equipment		
	Anaerobic (percent)									
	High Energy Expenditure									
	Low Energy Expenditure	X					X	service vehicles and equipment		
POSTURE+MOBILITY	Neck - Static Flexion	X					X	work below shoulders to service vehicles/equipment		
	Neck - Static Neutral	X					X	stand, walk, sit		
	Neck - Static Extension	X					X	access parts/components above shoulders		
	Neck - Rotation	X	L/R				X	to access parts/components in vehicles for service		
	Throwing									
	Sitting	X			X			to drive vehicle/equipment in/out of shop bay		
	Standing	X					X	on concrete floor, asphalt in works yard		
	Walking	X					X	in shop and works yard on concrete and asphalt		
	Running/Jumping			X				down from vehicles or equipment		
	Climbing - Arms and Legs	X			X			ladders, climb on/in vehicle		
	Climbing - Legs Only	X		X				ladders		
	Bending/Stooping	X					X	service vehicle, can't stand upright under hoist/vehicles		
	Crouching	X				X		service vehicle, can't stand upright under hoist/vehicles		
	Kneeling	X			X			to service vehicle		
	Crawling	X		X				possibly to service vehicle		
	Twisting	X	L/R				X	to access parts/components in vehicle for service		
	Balancing	X		X				stand on ladders, vehicles, in engine compartments		
GENERAL	Traveling									
	Work Alone	X					X	service vehicle alone, in shop with others		
	Interact with Public									
	Operate Equip/Machinery	X					X	hoist, power and air tools, vehicles, equipment		
	Irregular/Extended Hours							8 hour day, Monday-Friday, 8:30am-5:00pm, 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:
				FREQUENCY*				Date:
	PHYSICAL DEMANDS	REQD	SIDE	Sel. 1	Low 2	Mod. 3	High 4	COMMENTS
PERCEPTION	Hearing - Conversations	X			X			co-workers, Foreman, vehicle operator
	Hearing - Other Sounds	X				X		vehicles moving in shop area
	Vision - Far	X					X	service vehicles, clean parts
	Vision - Near							
	Vision - Colour	X				X		oil, fluid quality
	Vision - Depth	X					X	service/maintain vehicle, move about in shop/shop area
	Perception - Spatial	X					X	service/maintain vehicle, move about in shop/shop area
	Perception - Form	X					X	vehicle parts/components, tools
	Feeling (Tactile)	X					X	force application to loosen/tighten parts, service vehicle
	Reading	X			X			service reports
	Writing	X			X			service reports
	Speech	X			X			co-workers, Foreman, vehicle operator
WORK ENVIRONMENT	Inside Work	X					X	in shop
	Outside Work	X			X			walk in works yard to find vehicle
	Hot Conditions >25 deg. C	X		X				spring, summer, fall, shop doors open
	Cold Conditions <10 deg.C	X		X				fall, winter spring, shop doors open
	Humid	X		X				wet weather conditions
	Dust	X			X			possibly when servicing vehicle
	Vapor Fumes	X					X	diesel, gasoline, solvent in parts washer
	Hazardous Machines	X					X	hoists, floor jacks, hand/power/air tools
	Proximity to Moving Object	X				X		hoists,floor jacks,hand/power/air tools,vehicles in shop
	Noise	X					X	power/air tools, running vehicles in shop
	Electrical Hazard							
	Sharp Tools	X				X		hand/power/air tools to service vehicle
	Radiant/Thermal Energy	X			X			hot motor or parts on vehicle, hot oil, fluid
	Slippery Conditions	X					X	oil, fluid, water on shop floor
	Vibration and Related	X				X		power and air tool use
	Chemical Irritants	X				X		oil, transmission fluid,windshield washer fluid,antifreeze
	Organic Substances	X		X				when servicing garbage trucks
	Medical Waste							
	Blood Products							
	Congested Worksite	X					X	in shop and in service bay area
	Lighting - Direct	X					X	overhead fluorescent and mercury vapor lights
	Lighting - Indirect	X					X	daylight from open shop doors
	Lighting - Adjustable	X					X	trouble lights
	Lighting - Fluorescent	X					X	overhead fluorescent lights
	Lighting - Incandescent							
	Lighting - Shadows etc.	X					X	under vehicle, working under the hood of vehicle

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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