



## JOB DEMANDS ANALYSIS

**Company:** City of Burnaby

**Location:** Automotive Shop

**Job Title:** Tradesman –Automotive Mechanic

**Classification:** Regular Duty

### Purpose of Activities

The Automotive Mechanic is responsible for the repair and maintenance of the car and light truck fleet owned the City of Burnaby.

### Tools and Equipment

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

- Automotive shop bay (seven bays inside building, four bays under canopy), vehicle hoists located at all seven inside bays
- Hand tools (wrenches, screw drivers, sockets, chisels, punches, hammers, task light, cheaters, hammers, sledge hammer, etc.)
- Air tools (1/2 and 3/4 inch impact gun, pistol and in-line grip)
- Recycled oil/fluid drum with extension, funnels
- Parts washer, solvent
- Work bench with vise, step ladder, extension ladder
- Forklift, cherry picker lift, floor jacks, jack stands
- Parts room

### Usual Methods

1. Receive work order for vehicle.
2. Locate the vehicle. The Automotive Mechanic will search for the vehicle in the five acre Works Yard. \*\*
3. Drive the vehicle into the shop bay. \*\*
4. Get out of the vehicle. Determine how to work on the vehicle based on the work order. Does the vehicle need to be raised on the hoist, can it be jacked off the floor with floor jacks or left on the floor. Bend, stoop, crouch or crawl under the vehicle to set the hoist supports, floor jacks and/or jack stands in the proper location under the vehicle.
5. Raise the vehicle off the floor by raising the hoist or hand pumping the floor jack.
6. Gather tools and equipment to perform the required repair. \*\*
7. Dismantle the vehicle parts and components to gain access to the defective part. The Automotive Mechanic will use hand, power and air tools to dismantle the parts. Parts size and weight will range from light to extremely heavy. Some parts are handled easily by hand while other parts will require the use of a mechanical lifting device (forklift, portable cherry picker). Note: Due to space limitations, a mechanical lifting device can not always be used as it can not be positioned appropriately. In this instance, which



- happens regularly, one or more Automotive Mechanics will remove or install the part by hand.
8. Several times during step 7, the Automotive Mechanic will search the shop for shared specialty tools that he must use (1/2 or 3/4-inch impact gun, creeper, snipe or cheater, etc.). \*\*
  9. Walk to the Parts Room to order or pick up the required part.
  10. Walk back to the shop bay. At this time, if the part is not available, the Automotive Mechanic will start repairing another vehicle. Steps 1-9 are repeated on the new vehicle. \*\*
  11. Once the parts arrive, the first repair can be completed. Parts are cleaned in the parts washer and reinstalled with the new parts.
  12. The vehicle is reassembled.
  13. Several times during step 12, the Automotive Mechanic will search the shop for shared specialty tools that he must use (1/2 or 3/4-inch impact gun, creeper, snipe or cheater, etc.). \*\*
  14. Test or test-drive the vehicle to ensure the repair has been completed satisfactorily.
  15. Complete repair report.
  16. Repeat steps 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 Automotive Mechanic works an eight-hour day, Monday to Friday from 0700 to 1530 or 0830 to 1700. He receives a ten-minute rest period in the morning, a 30-minute lunch break and a ten-minute rest period in the afternoon. The Automotive Mechanic rarely works overtime. Current parts manuals are not always purchased and the Automotive Mechanic will often make the repair by trial and error. Some manuals and diagrams are difficult to read. There are seven bays for seven Automotive and Heavy Equipment Mechanics.

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 Automotive Mechanic. These safety issues centre on the lack of adequate workspace for each Automotive Mechanic. Several vehicles and heavy equipment pieces (Garbage Truck, Grader, Sweeper, etc.) fill the entire bay and 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 Automotive Mechanic(s) will remove or install the part by hand.

The Automotive/Heavy Equipment Shops air exchange system does not work well 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.

The lack of adequate workspace and adequate ventilation are factors that will negatively affect productivity. The shop bays are often out of service as the Automotive Mechanic waits for parts to arrive (hours, days). The lack of bays for each Automotive Mechanic significantly decreases productivity. Pushing tools boxes from one bay to another is time consuming and access to another bay may be blocked by vehicles or heavy equipment.



Working outside in the elements is also likely to negatively affect productivity, especially during the winter or when it is raining.

### 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 repair vehicles
- Reach below, at and above shoulder height to repair vehicles
- Insert hand(s) into confined areas to repair vehicles
- Hand, power and air tool use is required
- Climb, stand and balance on ladders or the vehicles to perform repair
- Work above shoulders in cervical extension from a stand, bend, stoop, crouch, kneel
- Work under vehicles 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 on the floor or on the hoist
- Some body postures can be selected by the Automotive Mechanic, but most body postures are the result of how the vehicle has been engineered

### Accommodative Considerations

1. People with injuries to the spine, in any region, may have difficulty with the static and dynamic movements required during the maintenance and repair of vehicles and equipment.
2. People with shoulder injuries such as rotator cuff tendinitis, bursitis and instability may have difficulty with dynamic and static loading and reaching activities required to access parts to make repairs.
3. 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.
4. People with nerve compression injuries in the upper extremities may have difficulty with the repeated and prolonged use of air tools (compression and vibration).
5. Post-whiplash and other neck problems may have difficulty with this position.
6. Individuals who do not cope in open low-autonomy work environments would have difficulty with this position.
7. Must hold a Tradesman Ticket (Automotive or Heavy Duty Mechanic) valid for the province of British Columbia.



## Summary of Stresses

### Metabolic Stresses

The aerobic energy systems will provide the major source of energy for the Automotive Mechanic. This position requires a low to moderate level of aerobic activity to perform vehicle repair. The anaerobic energy system may be used in high intensity repair tasks, such as lifting tires to and from the wheel lugs, lifting parts to and from their proper location or using cheater to loosen or tighten nuts and bolts.

### 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 Automotive Mechanic. 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 Automotive Mechanic to use proper postural control and body positioning for most of the work they perform. 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**– vehicle maintenance and repair 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. 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 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 Automotive Mechanic 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 Automotive Mechanic 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 heavy 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 Automotive Mechanic 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 Automotive Mechanic to ask for assistance when handling heavy and/or oversized parts or pieces of equipment
5. Provide kneepads for the Automotive Mechanic for the times he will spend in a kneeling position when servicing a vehicle.
6. Purchase current vehicle manuals with easy to read fonts and diagrams.
7. Investigate a padded handle for the pistol grip air tools. Each Automotive 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.

PJDC-Automotive Mechanic

Referral: Lana Ho			Organization: City of Burnaby							Title: Mechanic - Automotive	
Dept.: Engineering			Division:							Contact:	
PHYSICAL DEMANDS			R E Q D D	S I D E	FREQUENCY*				Max. Weight (kg)	Usual Weight (kg)	Date: February 10, 1999
					Sel 1	Low 2	Mod 3	High 4			
S T R E N G T H	Lifting - Floor to Knuckle	X	D		X			20	<1-7	parts, tools, equipment	
	Lifting - Knuckle to Waist	X	D			X		50	<1-7	parts, tools, equipment	
	Lifting - Waist to Shoulder	X	D			X		20	<1-7	parts, tools, equipment	
	Lifting - Over Head	X	D			X		20	<1-7	parts, tools, equipment	
	Carrying - With Handles	X	D		X			10	<1-7	tools	
	Carrying - Without Handles	X	D				X	20	<1-7	parts, tools, equipment	
	Pushing - Upper Extremity	X	D			X		30	<1-7	wrenches, parts into position	
	Pushing - Hip/Leg Assist	X	D			X		50	<1-7	wrenches, parts into position, wheels	
	Pulling - Upper Extremity	X	D			X		30	<1-7	wrenches, parts into position	
	Pulling - Hip/Leg Assist	X	D			X		50	<1-7	wrenches, aprts into position, wheels	
	Reach - Shoulder or Above	X	D				X	20	<1-7	remove/install parts to vehciels	
	Reach - Sho. or Above extnd	X	D	X				20	<1-7	remove/install parts to vehicles	
	Reach - Below Shoulder	X	D				X	50	<1-7	remove/install parts to vehicles	
	Reach - Bel. Shoulder extnd	X	D	X				50	<1-7	remove/install parts to vehicles	
	Handling	X	D				X	50	<1-7	parts, tools, equipment	
	Gripping	X	D				X	40	<1-7	parts, tools, equipment	
	Fine Finger Movements	X	D				X	max.	low	remove/install parts to vehicles	
	E	Aerobic (percent)	X					90	repair vehicles		
N	Anaerobic (percent)	X			10			heavy lift, pulling wrenches, wrench extensions, etc.			
R	High Energy Expenditure	X			X			heavy lift, pulling wrenches, wrench extensions, etc.			
G	Low Energy Expenditure	X					X	repair vehicles			
P O S T U R E + M O B I L I T Y	Neck - Static Flexion	X					X	work below shoulders to repair 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 repair			
	Throwing										
	Sitting	X			X			to drive vehicle/equipment in/out of shop bay			
	Standing	X					X	on concrete floor, asphalt in works yard, on vehicle			
	Walking	X					X	in shop and works yard on concrete and asphalt			
	Running/Jumping			X				down from vehicles			
	Climbing - Arms and Legs	X			X			ladders, climb on/in vehicle			
	Climbing - Legs Only	X		X				ladders			
	Bending/Stooping	X					X	make repair, can't stand upright under hoist/vehicles			
	Crouching	X				X		make repair, can't stand upright under hoist/vehicles			
	Kneeling	X			X			to repair vehicle			
	Crawling	X		X				possibly to repair vehicle, under vehicle and on back			
Twisting	X	L/R				X	to access parts/components in vehicle for repair				
Y	Balancing	X		X				stand on ladders, vehicles, in engine compartments			
G E N I R R E G U L A R / E X T E N D E D H O U R S	Traveling										
	Work Alone	X					X	work independently, 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:	
PHYSICAL DEMANDS		R E Q D	S I D E	FREQUENCY*				COMMENTS	
				Sel. 1	Low 2	Mod. 3	High 4		
P E R C E P T I O N	Hearing - Conversations	X			X			co-workers, Foreman, vehicle operator	
	Hearing - Other Sounds	X				X		vehicles moving in shop area	
	Vision - Far	X					X	repair vehicles, clean parts	
	Vision - Near								
	Vision - Colour	X				X		oil, fluid quality	
	Vision - Depth	X					X	repair vehicle, move about in shop/shop area	
	Perception - Spatial	X					X	repair 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, repair vehicle	
	Reading	X			X			service reports	
W O R K E N V I R O N M E N T	Writing	X			X			service reports	
	Speech	X			X			co-workers, Foreman, vehicle operator	
W O R K E N V I R O N M E N T	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 repairing 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 repair 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								
	Medical Waste								
	Blood Products								
	T	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	

\* 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.

For detailed descriptions of each of the different categories, please refer to the reference guide or inquire with Human Effort at 1-888-4EFFORT