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Driver Duress in the Pit

JCB Health has a long history of providing occupational health services predominantly to the mining industry of NSW. JCB Health's "job analysis" is one such service that has been developed and conducted over many years to achieve various goals.

Background:

JCB Health was commissioned in November 1999 to undertake a job analysis of the Open Cut Examiner's (Open Cut Co-ordinator) job requirements at a particular Hunter Valley mine site. This project was prompted following a number of reports of aggravated back pain by the Open Cut Co-ordinator's at this particular mine site. Five out of six of the employees had reported back and neck symptoms over the previous few months. Lost time had not yet become a problem, however one employee had been on a restricted duties programme.

The aim of the project was to report and recommend improvements to the work environment of the Open Cut Co-ordinator's.

JCB Health undertook a job analysis of the functional, environmental and physical demands of the Open Cut Co-ordinator's role.

This paper will outline the assessment process and the factors identified as potentially contributing to the injury epidemic. Outlined are the recommendations made and the initiatives that have been undertaken thus far.

Two Occupational Therapists spent time onsite with each of the Open Cut Co-ordinator's. All three shifts were covered. Assessment was conducted via observation, individual interviews, and distance and force measurements. The employer has 6 full time open cut coordinators. Two Open Cut Co-ordinator's are on permanent night shift, while the remaining four rotate between afternoon and day shift. Currently there is a permanent Open Cut Co-ordinator position also assigned to Dispatch for each shift. Each shift is approximately 8 ½ hours duration with overtime dependent upon workload at the time. The Open Cut Co-ordinator's work 5 days per week.

Of the two Open Cut Co-ordinator's in each shift one is responsible for overburden and the other for coal production. While driving in light vehicles around the mine sites, coordinators cover a distance equivalent to driving from the east coast of Australia to the west coast every month. The exposure to prolonged sitting with associated jarring and vibration presents as one of the key critical issues. Vehicle seating and suspension, road maintenance, driving practices and physical demands of the job have also been addressed.

The Open Cut Co-ordinator Vehicle:

At the commencement of this project the Open Cut Co-ordinator's were driving a standard suspension Nissan Patrol that was replaced with a Nissan Turbo Patrol that had a 2 inch higher suspension system.

The Open Cut Co-ordinator's vehicles are serviced every 5000 kilometres. Maintenance is contracted out. The vehicles are replaced at approximately 75 000 kilometres and/or every 2 years.

The "overburden" vehicle travels on average further than the "coal" vehicle. (315km/day compared with 260km/day). This average was calculated from statistics calculated by the mine site over a 12 month period.

Seating:

McPhee (1993) has shown that there is an increased potential for sprains and strains of the back and neck of drivers who are subject to "rough rides" and vehicle vibrations of varying frequencies. Seat design has been identified as a contributing factor in such injuries. As the Open Cut Co-ordinator's are subject to continuous jarring and vehicle vibration whilst driving around the open cut it is essential that the design of their seats meet with specific design requirements (McPhee, B. 1993).

Figure 1 : Key Driver's Seat Dimensions

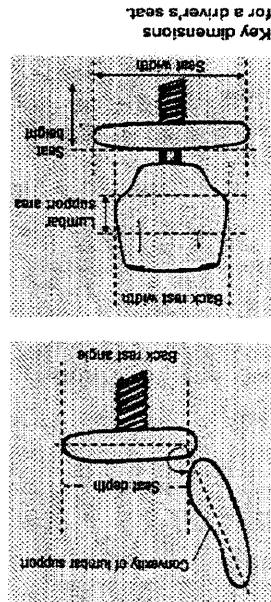


Table 2: Seat Measurement Comparison on Open Cut Co-ordinator Vehicle and Recommended Dimensions

SEAT DIMENSION	NISSAN TURBO (Current Open Cut Co-ordinator Vehicle)	RECOMMENDED DIMENSION {As per McPhee, B. (1993)}	COMMENTS
Seat Depth	530mm	380 – 480mm	Potential for increased pressure behind popliteal area for those Open Cut Co-ordinator's shorter in average height.
Seat Width	510mm	Minimum 450mm	Potentially makes it more difficult to exit the seat.

The maximum speed limit on major haul roads is 80km/hr. The roads are designed for the heavy vehicle traffic typical of the mine sites. The large dump trucks develop corrugations in the road surface that are atypical conditions for 4WD light vehicles. These conditions expose the vehicle driver to constant vibration. Further, while haul roads are graded regularly, "potholes" can quickly develop, exposing the vehicle driver to sudden jarring.

Road Conditions:

In summary the seat installed in the Nissan Turbo Patrol does not meet most of the recommended seat dimensions as outlined in McPhee (1993). The lack of height adjustment and seat suspension together with the inadequate lumbar support are potential factors contributing to the incidents of back strain and pain experienced by some of the Open Cut Co-ordinator's.

SEAT DIMENSION	NISSAN TURBO (Current Open Cut Co-ordinator Vehicle)	RECOMMENDED DIMENSION (As per McPhee, B. (1993))	COMMENTS
Height Adjustment	Non-Adjustable	Easily adjustable to allow for individual anthropometric measurements.	Lack of overall seat height adjustment may be a contributing factor to incorrect posture for some Open Cut Co-ordinator's.
Seat Fore / Aft Range	250mm	300mm of travel	Restricted travel range may lead to increased pressure on the underside of driver's thighs especially for "shorter" Open Cut Co-ordinator's.
Back Rest Width	480mm	360mm - 400mm	Potentially makes it more difficult to exit the seat.
Lumbar Support Area	220mm	250mm radius (Lumbar area)	Lumbar support reported to be "inadequate" for Open Cut Co-ordinator individual needs. Ideally adjustable lumbar support would be advantageous.
Seat Suspension	Standard	Sufficient to prevent major jolts and jars	Providing seat suspension will reduce the effect of vibration and major jolts experienced by the driver

as to avoid "knocking your elbow."
identified by one of the Open Cut Co-ordinator's the GIOC was placed in this position so
seat level. This requires an even greater degree of neck flexion to view the screen. As
in the Nissan Turbo Patrol the GIOC has been repositioned in the centre console area at
screen.
assume a slightly flexed neck position with left lateral rotation to be able to view the
side of the driver at approximately "elbow" height. The Open Cut Co-ordinator must
in the Nissan Patrol the GIOC is positioned in the centre console area to the left hand
periods eg. in excess of 5 - 10 minutes.
by the Open Cut Co-ordinator at various times, however it is not viewed for lengthy
production and transfer necessary computerised information. The GIOC may be viewed
situated in the light vehicle. It is utilised by the Open Cut Co-ordinator's to monitor
The Global tracking system (GIOC) is an electronic screen approximately 20cm x 15cm

- Full range of neck movement is required by the Open Cut Co-ordinator to enable him to look out the windows, view the side mirrors and the GIOC screen.
- A full body range of movement is required when transferring from sitting to standing position to access and egress vehicle. A subjective measure of the frequency of the Open Cut Co-ordinator's exiting the vehicles was calculated to be approximately 6 times per hour. This increased activity may place added strain on the back and contribute to spinal twisting. (Refer recommendations)
- The Open Cut Co-ordinator is required to maintain a sitting posture for the majority of the shift with frequent exiting of the vehicle in the initial stages of the shift. In discussion with Open Cut Co-ordinator's it was reported that they sit for a maximum of 10 - 15 minutes during this stage (this was supported by observation). Whilst driving light vehicles around the pit the Open Cut Co-ordinator is exposed to various vibrations (Refer Road Conditions).
- The Open Cut Co-ordinator is required to walk across rough, sloping, treacherous or uneven ground, often in the poor visibility conditions of night shift or the muddy conditions that result from wet weather.

Physical Demands of the Open Cut Co-ordinator role:

Other access tracks within the pit are not graded or maintained. These tracks often require steep ramp access and may traverse rocky or uneven ground.

While driving, the Open Cut Co-ordinator must respond to radio and telephone requests, be taking note of the equipment and manning and be planning the upcoming movement of such. These activities reduce the concentration of the Open Cut Co-ordinator to the driving task.

Each shift, an Open Cut Co-ordinator will cover conditions that include vibrations from corrugations, jarring from unseen potholes and rough access tracks while distracted by the demands of their busy role in vehicles that are recreational vehicles.

Lighting Plants: The task of moving and setting up lighting plants is generally completed by the afternoon shift Open Cut Co-ordinator. In general the lighting plant is towed around the pit by the Open Cut Co-ordinator light vehicle.

The Open Cut Co-ordinator's are required to perform various manual-handling tasks. These tasks can be performed in varying environmental conditions. It was noted that manual handling demands varied between shifts i.e. Lighting plants are positioned on afternoon shift. There are also individual differences in work practices, eg. One Open Cut Co-ordinator reported he often assists the pump crew drag around lay flat whilst another advised he rarely did this. Manual handling is an area of the Open Cut Co-ordinator role that is not an essential requirement for most activities. It is possible the Open Cut Co-ordinator could enlist assistance to complete most of these tasks.

Manual Handling:

a) Main hydraulic drop down stair incline access
 b) Alternate access is via a fixed vertical ladder with first rung at an approximate height of 900mm (NB. This height varies depending on ground surface around pad).
 Utilising the alternate access to the dragline raises the risk of injury. There is potential for strain and sprain to the lower back and lower limb musculature due to overstretching. Risk of slips, trips and falls especially in wet weather and potential for ankle injury and jarring as result of "jumping off" onto the uneven ground surface (Refer Recommendations).

two access points onto the dragline:
 The overburden Open Cut Co-ordinator's are required to monitor the dragline activity, which may involve accessing the dragline to communicate with the operators. There are

- Upper limb reach is required by the Open Cut Co-ordinator to access the two-way radio, vehicle controls and the GIOC system.
- On occasion the Open Cut Co-ordinator may be required to assume various postures (squatting, kneeling, low postures) to perform various inspections.
- The Open Cut Co-ordinator is also required to demonstrate lower limb range of movement and flexibility to access various pieces of equipment in the pit .

Physical Demands of the Open Cut Co-ordinator role continued:

The demands of the job may require the Open Cut Co-ordinator to view the screen whilst driving. The neck flexion in conjunction with the vibration experienced while driving compounds the potential for a serious neck injury.
 To be able to relay information through the Goic the Open Cut Co-ordinator needs to touch the screen. To do this he needs to twist into an asymmetrical posture. This may contribute to lower back strain and increased muscle loading if performed repetitively.

The Open Cut Co-ordinator assumes a standing position in front of the steel attachment to the lighting plant. A resistance force is required to manually handle the steel attachment as it moves from a vertical to a horizontal position at approx. 450mm from ground level (ie height of light vehicle tow bar). A number of the Open Cut Co-ordinator's were observed to utilise incorrect body mechanics ie forward flexed posture when moving the attachment from a vertical to a horizontal position. There is potential for sprain/strain injury to the trunk and upper body. This task is a manual handling risk that should be investigated regards possible engineering modifications eg. A spring loaded system at base of attachment that takes the weight of the attachment as it drops to the horizontal position.

➤ *Pumps:* This task is similar in nature to lighting plants regards moving the pumps around the pit. There is a designated pump crew who are responsible for moving the crew regards the positioning of the pumps. Depending on the Open Cut Co-

ordinator they may be involved in manual handling related to the layflat/pumps. ➤ *Tow Rope/Sling:* In the event of trucks becoming "bogged" the Open Cut Co-

ordinator is responsible for retrieving the disabled vehicle by utilising the towrope. The towrope is situated in the pit. It is approx. 10m in length and consists of a flexible high-tension wire. When required the Open Cut Co-ordinator may be involved in dragging and lifting one end of the towrope. This task can be performed in various terrains and wet conditions and is always carried out with the assistance of others. An estimated force gauge weight of approx. 56kg was taken to ascertain the weight involved in handling the sling. ➤ *Other Manual Handling Tasks:* The Open Cut Co-ordinator is also responsible for marking out various areas of the pit. This requires handling wickets hats, safety ribbon and hammering stakes into the ground. The maximum weight involved with these tasks would be the weight of the hammer at approx. 3 ½ kg.

Office Area

In the mustering area the Open Cut Co-ordinator's utilise a large white board to communicate manning details. They also have a communal office in this area as a base. All Open Cut Co-ordinator's commented that this office area was utilised for short periods of time usually at the commencement and completion of shift. Tasks performed in this area included PC data work, general writing tasks and phone liaison. It was noted that the seating provided in this office area did not meet ergonomic requirements and was generally in very poor condition.

Problems identified:

- Frayed and worn upholstery and cushions
- Non adjustable lumbar supports
- Height adjustments broken or inaccessible from seated position
- Back seat on one particular chair was unstable and unsafe

Recommendations

LIGHT VEHICLE SEATING:

Explore and trial one of the integrated seating systems currently on the market (including air-ride system)

ROAD / VEHICLE MAINTENANCE:

- Ensure road maintenance programmes are treated as a priority.
- Encourage Open Cut Co-ordinator's to be vigilant about driving to road conditions and speed limits.

GOIC:

- Investigate alternative positions for the GOIC to reduce the potential injury risks eg neck strain.
- Alternatively if the GOIC remains in its present position it should only be used while the vehicle is stationary to avoid neck jarring.
- When viewing the GOIC the Open Cut Co-ordinator should perform a counter stretch to the right hand side to reduce muscle strain.

EDUCATION / TRAINING:

JCB Health currently conducts training programmes with various employers dealing with specific issues onsite.
Provide the Open Cut Co-ordinator's with further education / training packages regards:

- Posture, body mechanics- related to accessing their vehicles and specific seating instructions.
- Manual Handling – task specific education in correct manual handling techniques and their application to high-risk tasks eg. Moving lighting plant.
- Fitness for work – individual assessments made available to all Open Cut Co-ordinator's for strengthening and stretching programs.
- Development of "The 5 Minute Open Cut Co-ordinator Stretching Guide" to be placed in all Open Cut Co-ordinator vehicles.

DRAGLINE ACCESS

As discussed in the body of the report the alternate access poses as a potential risk. It's recommended that Open Cut Co-ordinator's use the main access on the dragline at all times.

OFFICE SEATS

Replacement of office chairs, as existing seating is unsatisfactory.

IMPLEMENTATION

Since the project was completed the following is an outline of the initiatives the employer has implemented:

- Ongoing 4WD driver education is conducted in the mine site.
- As a result of the assessment, vibration studies have commenced with a baseline check on new vehicles with a follow up review at 60 000km. Results of these will be considered prior to addressing driver seating.
- Provision of new office chairs and workstations in the dispatch area.
- Individual onsite Physiotherapy assessments of employees.

FUTURE DIRECTIONS

- *Rehabilitation tool*: improved awareness regards the inherent physical requirements of the job will be useful for rehabilitation. In the event of an injury, the suitable duties can be identified and critical demands of the job matched to employee capabilities.
- *Pre-employment functional assessment*: development of a specific pre employment functional assessment for open cut co-ordinators.
- *Exercise/screening programs*: implement routine screening of employees regards back injury risk factors ie body fat and obesity, flexibility, strength and fitness, postural checks. Provision of stretching and exercise programming to target specific employees with similar job demands.

REFERENCES:

McPhee, Barbara (1993) "Ergonomics in Mining with The Control of Sprains and Strains", National Occupational Health and Safety Commission, 1993.