Identification, analysis and recommendations regarding potentially high-risk lifting tasks in industry: a case study.

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IDENTIFICATION, ANALYSIS AND RECOMMENDATIONS REGARDING POTENTIALLY HIGH-RISK LIFTING TASKS IN INDUSTRY: A CASE STUDY

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ABSTRACT

In examining the work environment of a major South African manufacturing concern, this paper describes a practical project of identification, analysis and recommendations regarding potentially high-risk lifting tasks. Manual Materials Handling related injuries result in a significant cost to industry, and manual lifting, in particular, represents a major cause of injury to industrial workers. Ayoub (1992) states that backache is the second most common reason for absenteeism from work, and back injuries are a major source of lost time and compensation claims. An examination of clinic records at the plant in this case study confirmed that it is no exception to this trend. Consequently, an investigation was undertaken to identify potentially dangerous lifting tasks in the plant. In consultation with a co-responsible agent, 32 discrete positions in 18 tasks were identified for inclusion in the project. Data were collected and liftRISK analyses (Charteris and Scott, 1990) were conducted. Of the 18 tasks analysed, 8 had a very high situational risk, and a further 3 had an excessive situational risk. In addition to liftRISK analyses, attenuating work environment risk factors such as excessive carry, obstacles in the carry phase, rotation, and poor underfoot stability were noted. The most common negative contributory factor in task assessment was excessive stoop. Task modification recommendations were made on the basis of the findings.

INTRODUCTION

Manual Materials Handling (MMH) related injuries result in a devastating cost to industry, and manual *lifting*, in particular, represents a major cause of injury to industrial workers. In fact, in Britain more than a third of all over-three-day injuries arise from manual handling, i.e. the transporting or supporting of loads by hand or by bodily force (HSE, 1993).

Epidemiological studies indicate that low back pain affects up to eighty percent of the population (White, 1990), and that backache is the second most common reason for absenteeism from work (Ayoub, 1992). Back injury, particularly to the lower back, occurs with alarming frequency, and recent studies show that back injuries in industry are a major source of lost time and compensation claims, with low back pain incidence being responsible for 25.5% of all worker compensation claims in the USA (Ayoub, 1992).

Several factors interact to produce this situation. With increasing age, lumbar spinal degenerative disease or lumbar spondylosis becomes more important as a contributory factor (Fagan et al., 1995). Overexertion is probably the cause of the majority of injuries, and Plamondon et al. (1995) state that muscle strains and sprains constitute the largest single category of back injuries. Here it is assumed that workers who do not have adequate strength, or who are exposed to heavy manual tasks are at greater risk for low back injuries.

Operator characteristics are thus important, but a handling system consists of four components: a) worker, b) task, c) tools and equipment, and d) environment (Ayoub, 1992). This report is primarily concerned with task assessment (b) in terms of assumed default worker characteristics as exemplified by liftRISK (Charteris & Scott, 1990).

Given all of the above, the author was approached to assess lifting tasks at a major South African manufacturing concern. A Preliminary Ergonomics Report indicated that the company is no exception to the costly trend of lost time and compensation claims, with one production line alone registering 15 doctors visits for backache for a seven month period. For this

period the line lost 37 working days due to backaches requiring a doctor's visit. This figure does *not* include loss of productivity due to clinic visits, nor due to reduced efficiency on the job, and the total picture may thus be even more worrying. Also, manual lifting on this line is scarce compared to other sections of the plant, where the situation may be worse.

The high incidence rate is of some concern, both in terms of lost productivity and long-term health complications. As a result of this, the following assessment and follow-up courses of action were conducted:

A Identification of potentially problematic lifting tasks in the plant, data collection, and computer analysis of those tasks. Following this, identification of existing potential risk situations which could lead to down-time, injury, absenteeism or low productivity. From this, possible task modifications or interventions were proposed, where appropriate.

B Production of a brochure/information sheet on Back Care, injury prevention, risk factors, correct lifting techniques etc, for company employees.

C Presentation of a seminar for a specific management level, in order to equip them with the knowledge necessary to recognise problem areas, prevent potential problems, and implement appropriate interventions where necessary.

PROCEDURES

The computer-aided system that was used is called liftRISK, an expert system designed by Charteris and Scott (1990). The system identifies task-inherent risk, with the aim of reducing mismatch between task demands and worker capabilities in a wide range of stationary lift-related industrial operations. The system is simple and user-friendly, and can be used by loss-control officers and others interested in risk reduction in manual operations. Alternatively, it can be used to identify task characteristics and associated risks, thereby enabling Human Resources practitioners to effectively select workers with the physical attributes necessary for a particular task.

Using structured selection, the programme considers four task-related risks (mass, frequency, reach, and stretch), and four operator-related risks (age, arm strength, back strength, and aerobic capacity). The programme assesses each risk factor separately and then in relation to the others, and considers that certain pairs of factors, in combination, (e.g. heavy loads and high lift frequency) may exacerbate risk. By looping through structured selection, the programme produces a Task Inherent Risk, a Predisposing Operator Risk, and an overall Weighted Situational Risk. These are graphically depicted, alongside guidelines as to whether or not intervention should be considered. In addition, Intervention strategies for both Task and Operator are suggested. So, the interactive weighting of task demands and operator capabilities eventuates in a prioritised intervention strategy. The loss-control officer, seeking to reduce injury incidence, can now reduce job-related risk through task revision. Data can either be input for specific workers, or the programme can assume default capability to assess tasks for average, below average, or above average male or female workers of varying ages. In this study, following consultation with the Personnel Division, default characteristics for average South African workers aged 30-39 years were utilised for analysis.

Acting in concert with a co-responsible agent, eighteen potentially high-risk lifting tasks throughout the plant were identified. For these eighteen tasks, thirty-two discrete lift positions were isolated, and mass (kg), frequency (lifts min^{-1}), horizontal reach (cm) and vertical stretch or stoop (cm) were measured in the plant, as per the liftRISK guidelines (liftRISK User Manual, 1995). Additional risk factors such as rotation, poor underfoot stability, excessive distance carried, and obstacles during the carry phase were noted for each task. The various positions in each task were then subjected to liftRISK analyses on a 486 DX IBM Personal Computer, the results and intervention strategies being reported below.

ANALYSIS AND RECOMMENDATIONS

Table I : Classification of situational risk as per liftRisk analyses, for 32 discrete positions in 18 lifting tasks.

CLASSIFICATION	POSITIONS	%
Excessive	4	12.5
Very High	8	25
High	9	28.13
Moderate	7	21.88
Low	4	12.5
Nominal	0	-
	32	100

Table II: Categorisation of suggested intervention strategies for 32 discrete positions in 18 lifting tasks.

CLASSIFICATION	TOTAL	%
Reduce stoop	16	50
Reduce reach	22	68.75
Reduce mass	19	59.38

Table III : Identification and classification of additional risk factors for 18 lifting tasks.

CLASSIFICATION	TASKS	%
Rotation required	10	55.56
Excessive carry phase	8	44.44
Poor underfoot stability	3	16.67
Obstacles during carry phase	2	11.11

Sixty six percent of the 32 positions (18 tasks) analysed were classified as having high, very high or excessive situational risk. Thus only 34.37% of the positions placed workers at moderate or low risk (Table I). Additional risk factors were inherent in 16 of the 18 (88.89%) tasks observed. Table II presents the incidence of these factors.

- A common negative contributory factor in LiftRISK task assessment was excessive stoop. The prioritised intervention strategy suggested that stoop be reduced in 50% of the positions (Table II). This can be easily and cheaply remedied by stacking objects (initial and final position) on more than one pallet, as close to waist height as possible. (Stability of pallets, e.g. interlocking, should be checked).

- Reach was deemed excessive in many tasks. The prioritised intervention strategy suggested that reach be reduced in 68.75% of the positions (Table II). In most cases it is not practical to reduce reach, unless mechanical lifting is used.

- Mass was deemed excessive in some tasks. Where possible, mechanical lifting should be instituted. The prioritised intervention strategy suggested that mass be reduced in 59.38% of the positions (Table II). This is of course seldom possible, so where it is not practical or cost-effective, two workers rather than one should carry where mass is deemed heavy. The use of mechanical lifting aids will reduce the excessive reach factor prevalent in many tasks.

- Underfoot stability was poor at some sites (Table III). This must be remedied to prevent injury.

- Several tasks involved rotation (Table III). liftRISK does not take this negative contributory factor into account. It is an exacerbating factor as far as risk is concerned. Operators should turn rather than twist.

- Where a carry phase was required, there were often obstacles (Table III). As workers are often unsighted with regard to the locomotive surface during a carry phase, attention must be paid to maintaining clear pathways.

- It should be noted that the assessments were conducted using default values for average workers aged 30-39 years, and the conclusions reached consequently only strictly apply to those parameters. Workers with lower values than those appearing at the top of each assessment will be placed at additional risk.

SUMMARY AND CONCLUSIONS

This report examined and analysed thirty-two discrete positions in eighteen potentially high-risk lifting tasks at a major South African manufacturing concern. Of the 32 positions, 21 were deemed to carry high-, very high- or excessive-risk. Attenuating risk factors such as excessive carry, obstacles in the carry phase, rotation, and poor underfoot stability were noted at several of the sites. In addition to the liftRISK computer analysis, it must be remembered that any combination of lifting, bending, and twisting may be hazardous. In view of the high incidence of absenteeism at the plant due to backache, it was strongly recommended that the specific and general intervention strategies suggested in this report be followed. Almost all the intervention strategies are cheap and easy to implement, such as stacking of additional pallets to reduce the stoop component in a lift. In conjunction with an educative programme emphasising prevention, correct lifting techniques, and the initiatives already embarked on by the company Clinic, this could lead to an increase in productivity.

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