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Factors influencing construction ergonomic performance in India

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Abstract

Many construction industry sectors have been experiencing chronic problems, such as poor management of workforce, improper working conditions, tools, and working methods. Many researchers have identified these problems as factors that affect construction productivity and overall ergonomic performance of the workers. Keeping in view the necessity of addressing problems as stated, a questionnaire-based survey was conducted to study the critical issues related to the workers involved in man-machine interaction at the construction sites. This research has identified the quantified RIIs, determined the influence ranks of 30 factors affecting construction ergonomic performance in India. These factors were classified under the following three primary classifications: (a) human/labor related factors; (b) tasks-related factors; and (c) equipment/tools-related factors based on various age groups and occupations of the construction workers. Industry practitioners and researchers can use the primary outcomes of this study in developing systems to enhance and improve health and safety of the construction workers for effective management of construction labor workforce and to achieve a competitive level of quality and a cost-effective project.

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1. Introduction

In many occupations particularly in construction, workers are often exposed to extreme environmental conditions. In a peripatetic construction worksystem, the workers usually work in an open environment under adverse environmental conditions, such as thermal and cold stress, insufficient illumination, loud noise, hand-arm vibration, etc. The large variations in the environment may cause various health injuries, thereby reducing the

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inherent productivity of the workers. Since the construction labors are the most dynamic element in the construction industry and their cost represents almost half of the overall construction cost [1, 2, 3], improving ergonomic performance of the workers has become a target for construction companies in India as it may also contribute to the development of cumulative trauma disorders (CTDs) hampering significantly the productivity of the workers as reported in many case studies. Therefore, in order to assess the effect of environment on the performance of worker, the extent of risk associated with the manual handling of tools/equipment, details of the tools and equipment and related issues while workers are engaged in construction jobs in this context, appropriate ergonomic principles are required to be applied to minimize the health hazards for ensuring safety and comfort of the workers [4].

2. Ergonomic issues in construction

As per the data available in 1999, out of the total population in India (936,546,000), approximately 315 million people are labourers and out of which 94 million people are construction workers as and when compared with USA which has nearly 10 million people engaged in construction [5]. In India, workers are facing a lot of health problems because of severe Manual Material Handling (MMH) activities at the workplace and the factory act, 1948, does not indicate any safe load limit for Indian population. Unlike developed countries, construction-related data on hazards and fatality are very few and are not available for Indian workers [6,7]. As there is dearth of literature in this sector [8] and research is very limited in this industry despite of high prevalence of MSDs [9, 10], there is a need for an in-depth study (laboratory study as well as field evaluation) of the construction sites [11].

Researchers pointed out that there is lack of studies in construction worksystem, presumably because of high task variability, irregular work periods, changing work environments, and the transient nature of construction occupations [1, 12]. Also, in highly physically demanding construction jobs, psychosocial and physical work-related factors are the most important factors associated with work ability. As construction work varies depending on site conditions, type of building, differences in worksystem, variation in work methods and other factors, these differences could either increase or decrease workers exposure to various occupational risk factors [13], such as slips and trips that depend on several contributing factors such as work conditions, working surfaces, environmental conditions, etc. [14].

The physically demanding nature of the construction trade have made it more risky for the workers affecting their health. This has been extensively studied by Holmström et al. and Zimmermann [15, 16]. Campbell has pointed out that construction industry have become more stressful in recent years [17]. The construction industry consists of many jobs each with its own specific demands for requirements. The need for recovery after work is a sign of occupationally-induced fatigue and a predictor of adverse health effects [18]. In order to address the serious issue of construction workers, five important research issues are considered in this study for identifying the factors influencing ergonomic performance of MMH tasks at the construction sites. The research issues are as follows: Issue-1: Characteristics of MMH Tasks, Issue-2: Features of the Working Environment, Issue-3: Types of MMH Activities and their Characteristics, Issue-4: Characteristics of the Jobs/Tasks, and Issue-5: Types of Tools and Equipment used. The information on several characteristics of construction-related MMH jobs/tasks are asked for as actual characteristics (methods as well as types of interfaces) of such jobs/tasks are dependent on a number of factors, such as job knowledge, experience, training, work conditions and risks.

3. Study methodology

Keeping in view the necessity of addressing problems as stated, a questionnaire-based survey was conducted and primary data for ergonomic design and analysis of the MMH tasks/jobs at construction sites were collected from a brown-field construction site at a steel plant in Eastern region of India that addresses a number of relevant five research issues related to the workers involved in man-machine interaction at the construction sites as mentioned. These research issues are considered to be essential for a comprehensive review of worksystem dimensions and components at the construction sites. Data were collected through the survey are required for identifying and properly assessing the risk factors associated with various MMH activities for which biomechanical, physiological and physical evaluations are necessary. Furthermore, based on the responses, the contribution of each of the factor

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