

## Ergonomic Analysis For Construction Workers on Bridge Site At Nashik

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### Abstract-

Ergonomics is a significant factor in reducing discomfort/pain of worker and is one of the procedures that eliminate the hazards and risk in construction industry. This study was conducted on Bridge site, Godavari River at Nasik. The aim of this study is to identify current applications about ergonomics practices. The method used in collecting the data is by choosing different sites and observing task of workers with the help of videos and Interviews. The task selected for the analysis was lifting and handling the reinforcement.

The majority of these injuries are due to overexertion in lifting and carrying heavy reinforcement materials. Also the questionnaire suggested that pain was common among all 20 workers of site and was being experienced frequently from 2 to 20 years. According to the survey from the 20 workers, 60% workers received medical treatment. 70% workers from 20 workers would like to change their job within 6 months due to discomfort. The survey shows that 90% workers perform the same task (repetitive work) more than one hour consecutively. There is no job rotation to them. Only 10 % Workers do not perform their job/ task more than 1 hour. 70 % workers handled reinforcement below Mid-thigh which forced the worker to bend their back and hence they feel pain/discomfort. Also, the 70 % workers twist their trunk during the reinforcement handling process. Survey shows that all the workers handled object/reinforcement above the shoulder. During the reinforcement handling process 90% workers reach behind or fully across the body with their shoulders. 80% workers never attended any ergonomic program. The Bridge workstation was facing problem of less efficiency of workers due to poor ergonomics. The injuries, strains and sprains occurs to the workers due to the continuous handling and lifting of reinforcement.

**Keywords-** Ergonomics, work related musculoskeletal disorder, construction ergonomics, and posture of workers

### I. INTRODUCTION

The Construction industry is an essential factor for the development in India. The construction industry contains dams, school, residential, recreational and commercial buildings and other construction works. There are many construction workers are busy in construction industry having different tasks from cleaning of site to finish the construction work. Every task in construction industry has serious injuries like strains, sprains and musculoskeletal disorders. This is happened due to carrying heavy loads, repetitive movement, awkward postures and contact stress vibration. Construction work is rapidly changing, as new developments in Construction technology come along which can make our jobs easier, but which also can present new problems for management, employees and workers. People are an essential part of every business process and critical to delivering quality products and services. Construction workers are exposed to a wide variety of health hazards at work. The exposure differs from job to job. It is especially costly when a worker becomes injured or ill given both these direct costs and the loss of the valuable services provided by the worker.

The main aim of the ergonomics is to best fit to the workers and their job environment. (2)Ergonomics achieves and maintain high levels of worker productivity and iteliminates the hazards and risk in construction industry. Ergonomics gives surety to workers to stay safe, comfortable, and productive.(3)

Ergonomics, as defined by the Board of Certification for Professional Ergonomists (BCPE), "is a body of knowledge about human abilities, human limitations and human characteristics that are relevant to design. Ergonomic design is the application of this body of knowledge to the design of tools, machines, systems, tasks, jobs, and environments for safe, comfortable and effective human use".(1)The science of ergonomics is a relatively recentphenomenon; the term ergonomics is derived from the Greek word ergos meaning "work" and nomos meaning "natural laws of" or "study of." Today, however, the word is used to describethe science of "designing the job to fit the worker, not forcing the worker to fit the job"(Kroemer and Grandjean 1997); thus the science of adapting work and working conditionsto suit the worker.The profession has two major branches with considerable overlap. One discipline sometimes referred to as "industrial ergonomics," or "occupational biomechanics," concentrates on the physical aspects of work and human capabilities such as force, posture, and repetition. A second branch, sometimes referred to as "human factors," is oriented to the psychological aspects of work such as mental loading and decision making.

## **II. METHOD**

The study was conducted at construction site of bridge which is located in Nashik city area during 13 Nov. 2014 to 30 November 2014. Nashik is one of the developing city of Maharashtra which is lies between N20.01,E73.77 and N19.99,E73.81. Construction workers working at bridge site of Godavari River, Nashik were selected in such a way that they perform the task of lifting, moving and placing of reinforcement. It is the complete a surveyon different discomfort of the body parts. The questionnaire included Medical Treatment Received by the workers, changes made in the job, Workers perform same task more than 1 Hr., Objects handled below Mid-Thigh by workers, Workers twist their trunk during handling process, Objects handled above shoulder by workers, Workers reach behind or fully across the body with their shoulders, Ergonomics program attended by workers. Body parts which feel discomfort while performing task areNeck, Left shoulder, Right shoulder, Left Elbow, Right Elbow, Left Wrist/ hand, Right Wrist/ Back, Right Knee, Legs. The questionnaire was distributed to 20 workers which perform the task of lifting, moving and placing the reinforcement on bridge site.

The overall ranking of most important factors, causes, effects and procedures of change orders control on construction projects was determined by the evaluation of mean score and relative important index.The mean score for each factor was calculated by the following formula:

$$MS = \sum \frac{F \times X}{N}$$

Where, S=score given to each factor by the respondents, ranging from 1 to 5; F=frequency of responses to each rating 1to5 for each factor; and N is total number of respondents for that factor.

The relative important index was calculated using the following equation. This equation was used to calculate importance of variation factors according to survey responses.

$$RII = \frac{\text{Total point score}}{5 \times N}$$

Table 1 The level of importance and evaluation for Average Index Analysis

Physical discomfort scale	Rate of physical discomfort
1	No pain / Discomfort
2	Just noticeable Pain/ Discomfort
3	Average pain / Discomfort
4	Moderate pain / Discomfort
5	Intolerable pain / Discomfort

### III. ANALYSIS AND RESULT

The result will be further summarized to obtain the overall pain/ Discomfort to the body part in the task of handling the reinforcement. The respondent were requested to Severity of Discomfort of different body parts of the workers based on five-points scale starting with 1 for No pain / Discomfort, 2 for Just noticeable Pain/ Discomfort, 3 Average pain / Discomfort, 4 Moderate pain / Discomfort, 5 for Intolerable pain / Discomfort. The average analysis for each body parts is calculated.

The construction workers selected for the survey have the experience of 2 years to 20 years. Average experience is 10 years 6 months. Experience of the workers in construction field shown in the figure



Figure 1: Experience of Construction Workers in Year

The graph shows the severity of discomfort/ pain in percentage to the body parts Neck, Shoulders, Elbow, Wrist/Hand, Wrist Back, Knee, and Legs. The workers feel more than 50% discomfort/pain in each body parts. The shoulder, Knees and Legs has intolerable Discomfort/Pain. Discomfort survey was used to find out different areas of body parts. The result gives frequency of discomfort in the workers. i.e. The task of handling the reinforcement on the bridge site most of the workers feel discomfort to the body parts Shoulders, knee and legs.

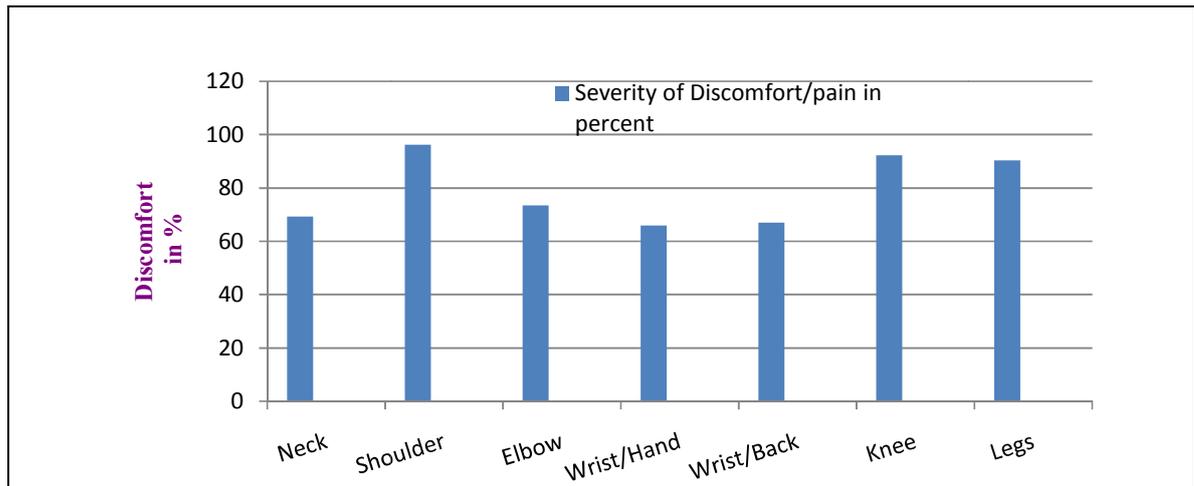


Figure 2: Severity of Discomfort to Different Body Parts

Discomfort intensity of severe to shoulder (96.16), Knee (92.22), Legs (90.29), Neck (69.25), Elbow (73.38), Wrist Back (67), Wrist Hand (65.83). The duration of observation was to be within 15 days among 20 workers.

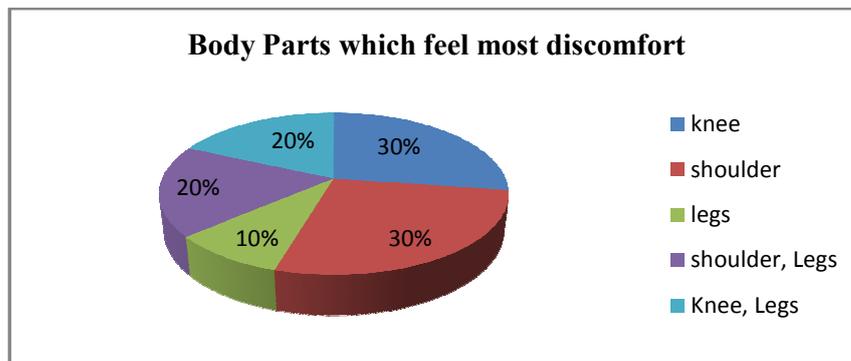
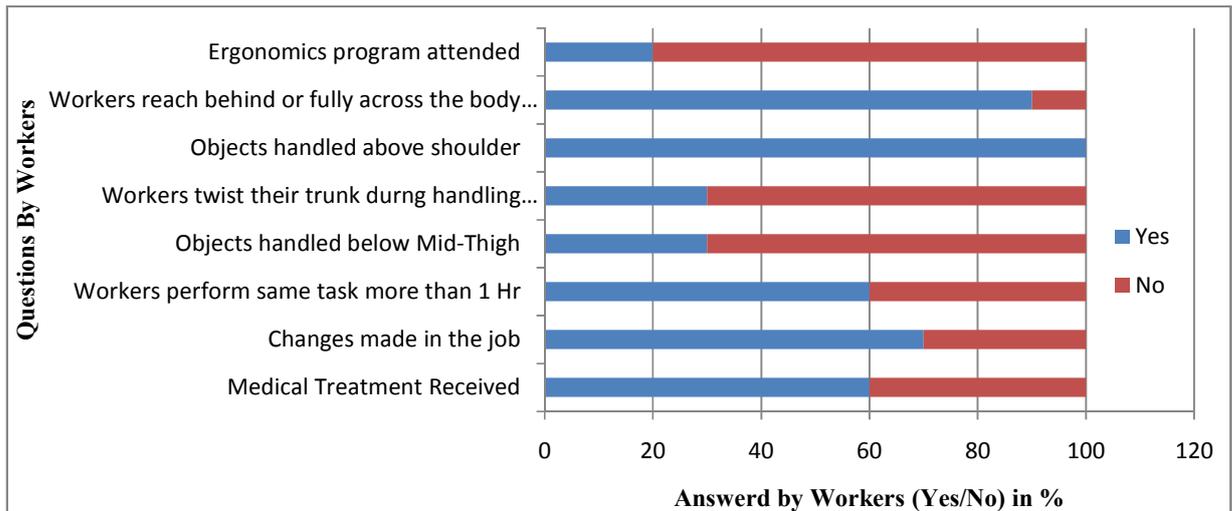


Figure 3: Body Parts which feel most discomfort

According to the survey, shoulders, knees and Legs are the most discomfort part of the body. Figure shows discomfort of knee, shoulders and legs has 30%, 30% and 10% respectively. And the discomfort for both shoulders–legs and knee–legs has 20%, 20% respectively.

Also the questionnaire suggested that pain was common among the workers of site and was being experienced frequently from 2 to 20 years. According to the survey from the 20 workers, 60% workers received medical treatment (like physiotherapy, family doctor, etc. or other for this specific body part.). 70% workers from 20 workers would like to change their job within 6 months due to discomfort. The survey shows that 90% workers perform the same task (repetitive work) more than one hour consecutively. There is no job rotation to them. Only 10 % Workers do not perform their job/ task more than 1 hour. 70 % workers handled reinforcement below Mid-thigh which forced the worker to bend their back and hence they feel pain/discomfort. Also, the 70 % workers twist their trunk during the reinforcement handling process. Survey shows that all the workers handled object/reinforcement above the shoulder. During the reinforcement handling process 90% workers reach behind or fully across the body with their shoulders. As per the survey 80% never attended any ergonomic program. From the words Aching, Numbness (asleep), Stiffness, Burning, Pain, Tenderness, Cramping, Redness, Tingling, Loss of Colour, Swelling, Weakness about discomfort, Pain and weakness-discomfort are only the common injury factors. This result indicates the problem of MSDs is serious on bridge site at Nashik.



*Figure 4: Answer Given by Workers (Yes/No) in %*

#### IV. CONCLUSION

The Bridge workstation was facing problem of less efficiency of workers due to poor ergonomics. The majority of these injuries are due to overexertion in lifting and carrying heavy materials. The injuries, strains and sprains occur to the workers due to the continuous handling and lifting of reinforcement. Knee, shoulder and legs are the part of the body mainly affected due to poor working posture in the task of lifting, moving and placing of reinforcement.

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