

Application of Ergonomics Evaluation to Reduce Job Hazards of Building Workers

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Abstract: Ergonomics analysis is an analyzing the hazard in job and forestall before the hazards occur. The relation between the workers, task, tools and environment is called Ergonomics. By creating good and safety working construction environment to the workers may leads to increase productivity and reduce project delay. Ergonomic analysis are done by grouping of data from construction workers using prepared questionnaire and spot out the risk factors faced by workers. Questionnaire includes type of work, Health, Compensation, stress level (both physical and mental) etc., RII method is used to rank the risk factors. The findings prove that workers have satisfactory level of Ergonomics awareness but there is still lack of implementation. According to the risk factors level some recommendations and implementation ideas are given to overcome from hazards faced by workers.

Keywords: Ergonomics, Productivity, RII method, Risk factors.

1. Introduction

The Construction industry stands out from other industries as having the highest worker injury and fatality rates, which makes it the highest risk on Sprains and strains back, shoulder, knee and other musculoskeletal problems. Construction works typically require the adopting of awkward postures, lifting of heavy materials, manual handling of heavy and irregular-sized loads, frequent bending, bending and twisting of the body, working above the shoulder height, working below the knee level, staying in one position for a long period, climbing etc., to overcome this problems Ergonomics is only way to reduce these risk factors.

Ergonomics term is derived from the Greek words, 'ergon' and 'nomos' which refers to consideration of laws into the work. It is one of the strategies to make the job easier for the workers. In addition, ergonomics can also reduce the pain which is related to the job that can degrade the work performance and quality, working below the knee level, staying in one position for a long period, climbing etc.

2. Ergonomics Evaluation

An ergonomic evaluation is the process of performing a scientific investigation of an individual's work station and environment in order to provide recommendations for a healthier work environment based on the results of these findings. The purpose of an ergonomic evaluation is to

minimize or prevent injury to the individual and to promote workplace efficiency through the application of ergonomics. An ergonomic evaluation can be conducted as routine best practice to safeguard the health of employees or it may be required where an employee has incurred an injury and requires specialized support and pain management. The evaluation takes a holistic view of the physical capabilities of the individual, the physical demands of the job, the equipment used to perform the job, and the workplace environment. An ergonomic evaluation can help reduce the rate of injuries, increase individual productivity, and improve employee comfort.

3. Objective of the Study

The objective of this project is mainly focusing on ergonomics risk factors which faced by construction workers in construction site.

1. To spot out the ergonomic risk factors
2. To minimize the level of risk factors facing by workers and create good working environment to workers.
3. To adopt appropriate measures to reduce the risk factors after analyzing the rate of risk using RII (Relative Importance Index) method.

4. Scope of the Study

1. The ergonomic risk factors that present in building construction works are identified by questionnaire survey and personal interactions with workers
2. To find out the measures that want to be taken for reducing the risk factors and providing better working environment for each worker in building construction.
3. By analyzing and reducing the risk factors leads to improve productivity

5. Need for the Study

1. To find out the ergonomic risk factors that are faced by building construction workers and taking appropriate safety measures to reduce risk. To analyze the risk level, rank the identifying risk factors using RII method.
2. In order to minimize the risk, the productivity rate will

be increase with minimum cost and reduce project time in construction site.

6. Research Methodology

Questionnaire was prepared by absorption of construction site building workers and what are the problems they are faced in both physically as well mentally. By direct contact of workers like masons, helpers, painters etc., survey was conducted. Three sites elect primarily based on having G+5 floor in Chennai. Total numbers of thirty-one respondents were participated during this survey among these, 20 are helpers and eleven are masons. Questionnaire preparation are made based on three main factors; discomfort level in body, discomfort level in numerous body movement and discomfort level with work oriented factors. And additionally personal interview was conducted with the staff for knowing about the private information, nature and working type (type of work) and total time that the employee can remains in same position throughout operating.

7. Identified Risk factors

There are many risk factors that affect workers in Construction site. Among all the main factors are force, repetition and posture. Identifying and reducing these factors play an important role in this study. Here for this study 28 numbers of factors are considered as shown below,

A. Discomfort level in body

- Tiredness
- Redness
- Back pain
- Lower back pain
- Joint Pain
- Muscle Pain
- Swelling in any part of body
- Rise in temperature
- Loss of functions
- Repeated exposure of force
- Repeated vibrations
- Improper work positioning

B. Discomfort level in numerous body movements

- Bending
- Standing
- Squatting
- Stretching
- Suddenly Changing position
- Twisting
- Kneeling
- Stooping

C. Discomfort level in body postures and work type

- Methods of work

- Work load
- Repetitive work
- Lack of rest
- Climate/ environment
- Awkward posture
- Static posture
- Difficult task

8. Questionnaire Design and Collection of Data

Questionnaire preparation was based on the site absorption and for analysis Relative Important Index (RII). The main causes of musculoskeletal disorder, bone failure, over workload mental stresses and symptoms are included in the questionnaire. The discomfort level due to pains in body, temperature changes, swelling, redness, tiredness etc., discomfort due to body movements, such as bending, kneeling, squatting etc., and discomfort due to work related factors such as, climate, difficult task, lack of rest etc. are included in the survey. Questionnaire has three parts; one is the personal details, second is the survey and third is general interview questions to workers. In first part, the respondents were requested to give correct data related to their personal details such as, name, age, experience, qualification, nature of job and type of job. In second part, survey questions were included. Risk factors for the analysis of ergonomics are listed. The data collected based on Likert 5-point scale which consist Never, Mild, Moderate, Severe, Very severe.

9. Analysis of Data

To increase the Construction ergonomic performance analyzing the risk factors in construction sites want to be studied. There are different types of workers are there like painters, electricians, plumber, helpers etc., This study shows that masons and helpers are most affected persons than other workers in construction site. To find and analyzing ergonomics factors 31 respondent's data were collected. To rank and analyzing the data RII method are used.

A. RII Method

The relative importance of procrastination factors was quantified by the relative importance index (RII) method. prior to ranking. A multistage sampling technique was used in selecting the sample.

$$RII = \frac{\sum W}{A * N}$$

Where,

W is the weighting given to each factor by the respondents (ranging from 1 to 4),

A is the highest weight (i.e. 4 in this case), and

N is the total number of respondents.

Higher the value of RII, more important was the cause of delays.

10. Result and Discussion

Questionnaires are analyzed from five forms of workers such as, masons, helper and plasterers from three sites. 28 factors were elected from construction workers and 31 respondents were participated. From each type of workers, the factors are analyzed and rank was given to each factors. The result obtained by using relative important index. The results which obtained are given below.

Among the risk factors using RII method the ranks are allotted. The risk factors are identified based on both physically as well as mentally. By using the questionnaire reply we going to analyze the data.

A. Discomfort level in body

Factors	Mason		Helpers	
	RII	Rank	RII	Rank
Methods of work	0.528	7	0.49	6
Work load	0.410	11	0.47	10
Repetitive work	0.637	3	0.49	3
Lack of rest	0.255	22	0.26	21
Climate/ environment	0.510	8	0.55	3
Awkward posture	0.510	8	0.45	13
Static posture	0.290	21	0.32	17
Difficult task	0.219	24	0.27	21
Repeated exposure of force	0.310	20	0.39	16
Repeated vibrations	0.328	19	0.40	20
Improper work positioning	0.509	8	0.46	17

B. Discomfort level in numerous body movements

Factors	Mason		Helpers	
	RII	Rank	RII	Rank
Bending	0.7	4	0.55	6
Standing	0.382	15	0.56	6
Squatting	0.473	12	0.53	10
Stretching	0.346	18	0.49	13
Suddenly Changing position	0.364	17	0.5	24
Twisting	0.237	23	0.4	21
Kneeling	0.710	1	0.69	2
Stooping	0.673	2	0.73	3

C. Discomfort level in body postures and work type

Factors	Mason		Helpers	
	RII	Rank	RII	Rank
Methods of work	0.528	7	0.49	6
Work load	0.49	11	0.47	10
Repetitive work	0.637	3	0.49	3
Lack of rest	0.255	22	0.26	21
Climate/ environment	0.51	8	0.55	3
Awkward posture	0.510	8	0.44	13
Static posture	0.291	21	0.32	17
Difficult task	0.219	24	0.27	21

From the data these peoples are high at risk, that will be shown in below fig.

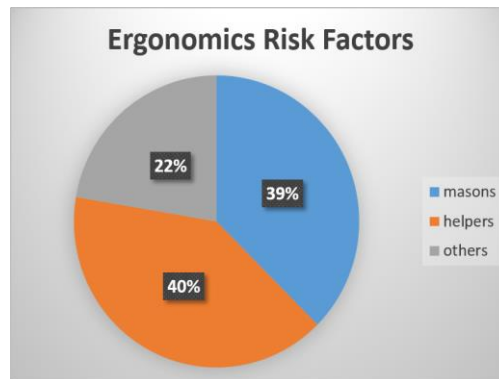


Fig. 1. Ergonomics risk factors in percentage

11. Conclusion

Based on this above study we spotted the risk factors which are mainly affected construction workers. By analyzing above result it proves that masons, helpers are high in risk. out of 95 respondents 56 respondents have different bone oriented disorder due to discomfort in the construction work. Due to this problem the productivity level of per persons are decreased. Some of them are already have musculoskeletal disorders symptoms that are identified and asked them to take preventing measures. For creating good working environment for these affected people and symptoms having peoples some recommendations are given. This helps to reduce Absenteeism of workers and leads to increase productivity. Ergonomics analyzing training will also help the workers to overcome from this risk factors. The top level management of every company like manager, director should take a step to these problems.

12. Recommendations

Based on the questionnaire survey and private interviews, the risk factors are identified successfully in construction site. The final recommendations given according to their problems and their requirements.

- Unnecessary bending in platforms should be avoided.
- Material should keep as near as possible.
- The body movements can reduced by using different tools
- Heavy material lifting should be done by equipment or done by two or more people.
- Use trolleys and wheel barrow for transporting materials.
- Correct posture should be maintained throughout the work.
- Appropriate intervals or break should be given to the people.
- The amount of repetitive works should be avoided.
- Inhale and exhale properly while working.
- workers should properly trained for the work safety.
- The correct interval of holidays should be given to the workers.
- According to the work the workers should properly allotted.
- Safety checklist should be maintained.

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