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HAZARD IDENTIFICATION AND THEIR CONTROL IN LIFTING MACHINERY

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ABSTRACT

Cranes are a central components in engineering industries and are associated with large number of hazards with its operations in shop floors and also there are different types of lifting machinery available depending upon design, technology and nature of work, so it is also make difficulties to operates such type of lifting machinery in shop floors There are different types of lifting machinery available in industries in one shop like overhead cranes, semi gantry cranes, forklifts, pick and carry cranes (hydra) which is erected by different manufacturer increases risk associated with it, depending upon the design and technology which make changes in safety devices, motions, braking systems, remote controls, in lifting machinery day to day which became danger to operate by same operator's As the operators were shifted from one crane to another, there was a high chance of making mistakes during moving the controls, which might have resulted in severe accidents, due to lack of training, experience and education of operator's especially during periods of high workload. This paper reviews the hazards associated with lifting machinery in their operations in heavy engineering industry in which 64 different types of lifting machinery available, capacities ranging from 200 kg to 450 ton with the help of safety inspection and questionnaire study, and also their low cost solutions have been recommended which may not became unnecessary burden on the top management of maintenance costs with rarely available spare parts. All these had a toll on the factory's economy and growth.

Index Terms—Crane safety, Safety inspection, Lifting machinery, Hazard identification.

I. INTRODUCTION

The lifting machineries are the most widely used for lift, shift and placement of large and heavy loads in work shop in engineering industries by which raising, lowering and movement of heavy loads from one place to another place is performed at many times in the whole working day by operator's. to perform such types of operations in shop floor electric overhead travelling cranes, semi gantry cranes, forklifts and pick and carry cranes are used depending upon the nature of operations to be performed. EOT and semi gantry cranes includes main three motion LT longitudinal travelling, CT cross travelling and UP-DOWN hoist motion but they can transfer heavy loads only the exiting rail track which is depending upon the floor area other than it forklifts and pick and carry cranes are used to shift loads from one shop floor to another because they can travel on rubber tire. each and every working day some common types of unsafe act is occurs, because there are different types of cranes are available in one shop floor each floor contains 5 to 6 lifting machinery at different locations and only one or two operator's are available to operates all these machinery so it creates high chance of making mistakes during moving the controls, which might have resulted in severe accidents, due to lack of training, experience and education of operator's and also the machinery operates with the help of remote control or pendent, each machinery has different types of control buttons at different locations whenever operator's is shifted from one to another they face difficulties to operates the machinery. Thus it becomes more dangerous situation. This risk is not limited only to those directly involved in lifting operations, as evidence by several recent crane accidents in which pedestrians were killed. Lifting machinery has some common hazards in each and every working day but the action required to minimize them is neglected by the management to achieved production on time it is resulting in injuries or fatality. To keep pace with rapid industrialization several design modifications in lifting machinery have been made, but most attention has been given to the capacity of handling more loads of deferent shapes and sizes. The crane designs give very little importance on the ergonomics of operation of these cranes. Each and every lifting machinery have their own advantages and also some hazards associated with them in order to eliminate the hazards

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associated with them hazard identification is carried out in a engineering industry but there are many techniques are available to identify the hazards in lifting machinery the use of safety inspection and questionnaire study is recommended.

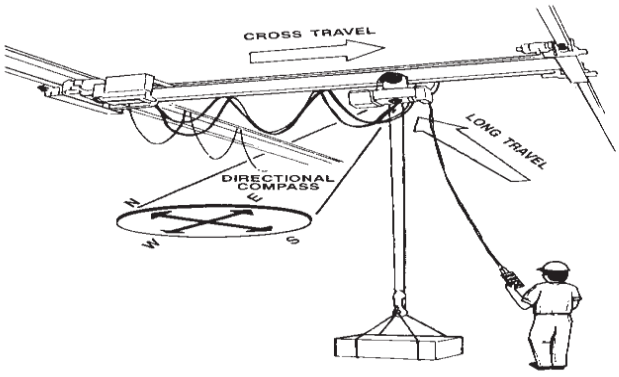
II. LITERATURE SUREVEY

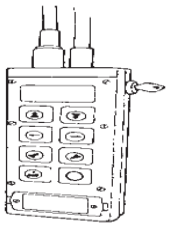
One of the first ideas for the ergonomic consideration of crane cabin design came from the original & 'common sense' recommendations made by Bramley (1953). He observed that in most cranes, controls varied widely in design, function and manipulation, leading to a large number of hazardous problems. Das & Sen (1999) conduct Ergonomics studies, on the machine control and the resultant movements of the cabins and the hooks in 51 electric overhead travelling cranes in a heavy engineering factory, showed that control-movement compatibility is absent in most of the cranes and also a number of low-cost ergonomics solutions have been recommended to minimize these problems. Richard (2001) He gives a review of crane safety in construction industry in this paper reviews available information on crane-related injuries, currently safety devices, and commonly used crane safety procedures. Recommendations for improved crane injury prevention and future crane safety research are given.

III. PROBLEM

By using checklist of lifting machinery and A multiple choice-type questionnaire was constructed, to find out hazards lifting machinery.

1. Lake of knowledge and training of operator's regarding particular machinery which they operators.
2. Different types of cranes from different manufactures are installed in factory have their design differ from each other that creates the difficulty to operates the machinery to operator's.
3. Cranes have their different types of remote some manufactures provide long travel (LT) at the top and Cross travel (CT) at middle and UP AND DOWN motion at bottom, in some cranes are pendent operated and some is remote operated. This complicated and differ design of pendent/ remote creates disturbance to operators.





A typical pendant control

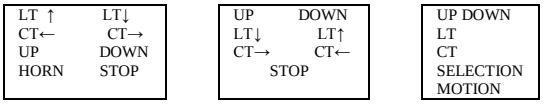


Fig. 1 Crane motions, Remote control and Typical Arrangement of push buttons.

4. Lake of direction marking on cranes and their pendent operators don't knows how to operates a single direction LT, CT or up and Down have to use all push one by one buttons to check the right button by which he wants to move the crane there is a hazard armed, when crane carries load major accident may occurs.
5. Fork lift and Mobiles cranes are lifting the load under the load chart which shows the actual SWL at different configurations which display in SLI safe load indicator, but in hydra and fork lift SLI is nit provided by some manufactures.
6. In each motion of crane having safety limit switches to stop the motion under the limit, Anti two blocking, CT, LT, Anti-collision, Hooters, Warning Lights etc which are electrical devices. ANSI recommends that the use of this device should be considered a damage prevention measure only. These devices are not failing safe secondary devices to be designed and installed
7. The National Safety Council has attributed 90% of mobile crane accidents to "operator

error" There is no universally accepted certification or licensing of crane operators. There is no daily checklist record or inspection procedure to inspect all check points of cranes before use. Heavy loads were carried by cranes in very busy workshops, where most workers did not use safety helmets, nor were there effective warning bells to alert workers to the movement of the crane. Moreover, due to the un ergonomic design of the crane cabins, the crane operators had very poor visibility of the loads, the lifting device and the shop floor. As a result, any mistake during manoeuvering the controls could lead to severe accidents.

8. Another problem was arrived in plant 64 different types (installed by 6 different manufactures) of lifting machinery available, as compare to it only 12 operator's are available to operates the crane so that over workload is given to operator's to achieve production they face difficulties to operates different pendent
9. Use of reversing motion to stop the cranes. While brake is loose is may became one of the hazardous condition when two or three cranes operates in same track.

IV. RECOMMENDATIONS:

On the basis of the results and discussions, a number of very low-cost, easily implementable, Ergonomics solutions of the existing problems were recommended to the factory management for implementation to improve the working conditions, work methods, efficiency, productivity, occupational safety and health of the crane operators. It was also pointed out that all the recommendations should be implemented starting immediately, step by step, on a priority basis. In this factory, it was not possible to replace the old cranes with new ones due to the extreme "nancial constraints. Modernization of the existing cranes, to some extent, could be done by incorporating ergonomic modifications according to the following recommendations:

1. The nature of movements of the controls in all the EOT cranes should conform to the same normal motion stereotypes, so that the operators are less likely to make wrong movements of the controls when given duty in another type of crane. This could easily be done by simply changing or reversing the electrical connections of the controls to bring the movements to the normal motion stereotypes. Care, however, should be taken that in reversing the control polarity in the existing cranes no negative transfer brings any disastrous consequences.
2. All operators should be given proper training in operating the cranes, which is completely lacking in the existing situations of the factory. There is no universally accepted certification or licensing of crane operators. A proper card is provided to valid operators so that only authorized operator's crane operates the crane.
1. Proper direction marking to be maintained by permanent marking or painting on pendent or remote once in a week by which difficulty is reduced.
2. Daily checklist to be filled by operator's which helps to other shift operator's to assist the crane problem if any. Preventive maintenance to be carried out once in 15 days interval in which limit switches and brakes are must be operationally checked.
3. In future, when new cranes are made by the factory or purchased, standardized ergonomic control arrangements should be incorporated.
4. As per discussion the proper arrangement of push buttons in pendent/remote is set depending upon the nature of use in a day 9 out 12 operator's says they mostly use 65% of UP DOWN, 20 % CT and 15 % LT motion per day, it is easily possible for electrical maintenance to change the position of push buttons an arranged it depending upon the nature of use in pendent at once which reduce the hazards wrong motion

LT↑	LT ↓
UP	DOWN
CT→	CT←
SIREN	E STOP

Fig. 2 Simple arrangement of control push buttons

5. In Mobile cranes and Hydra SLI must be installed to know about the capacity at different radius.
6. The position of the wire of pendent also adjusts it usually front at the chest of the operator's.
7. Other means of safety devices which are not electrical are recommended likes buffer and stoppers at the end of the Cross Travel and Long Travel motion and wheel guards for anti two blocking marking to be done by some means by which the last position of

hoist is marked so that the operator's knows about the limitations.

8. Load testing must be carried out once in a year of lifting machinery, fork of the fork lift must be checked by NDT methods.
9. Change the position of operator's from one crane to another must be avoided, simplify control buttons of remotes related to another by which the machinery is easily operate To overcome this, it was recommended that the crane operators should be placed into Three different groups (A, B, C) must always be operated by the associated group of operators and they must not be interchanged.

V. CONCLUSION

It is the only way to eliminate the accidents is Identify the Hazards to assess the associated controls with the Lifting Machinery and to bring the hazard to tolerable level. Lifting activity because of the very nature of the operation, complexity of the systems, procedures and methods always involves some amount of hazards. Hazard identification is carried for identification of undesirable events that can leads to a hazard, the analysis of hazard mechanism by which this undesirable event could occur and usually the estimation of extent, magnitude and likelihood of harmful effects. It is widely accepted within industry in general that the various techniques of Hazard Identification contribute greatly toward improvements in the safety of complex operations and Lifting Equipment.

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