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# Safety Improvements in Old Generation Pick and Carry Hydra Cranes With Reasonable Cost Control

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***Abstract:*** ***The project aims at reducing the accidents involved in construction project site where ever mechanical means of material handling is a major work. The Old Generation hydra cranes which are mostly used in construction sites has few high probable risk index which is a major threat for construction workers and Engineers. These high probable risks were assessed and necessary recommendations were taken to make these old generation hydra as a reliable tool machinery material shifting. At the same time necessary incorporation on old generation hydra were made at a reliable cost control as all construction activities were compared with cost vs production. After making necessary implications on the Old Generation hydra crane, the Risk probable value is capered with the earlier index value. All probable hazards associated with material handling are discussed and necessary effective actions were taken on the Old generation hydra. As the hazards were negotiated with effective means, the risk probable value is also brought down to a considerable value.***
***Simultaneously the accidents involved was also brought down and ensured a safer work environment.***

## I. INTRODUCTION

Even though various mobile cranes (HYDRA) were flooded in the market, construction industries largely depends upon the pick & carry cranes to execute the tasks in the stipulated time with normal preparations. Our company widely uses the old generation hydra cranes for various material handling activities, but the old generation hydra cranes were prone to accidents because of lapses in safety features. Due to non-availability of safety features in the hydra cranes, there are lot of accidents happens frequently. Even though advanced new generation hydra cranes are available in the markets, they are not readily available in the markets as per the demand and moreover it costs 150% than the old generation pick & carry hydra cranes. The challenge is to provide the necessary safety features to the old generation pick & carry hydra cranes with reduced cost, which meets all the necessary safety requirements with accountable cost saving along with increase in productivity

## II. OBJECTIVE

Improvising the old generation pick & carry hydra crane with all necessary safety requirements with less cost.
Increasing productivity

## III. SCOPE OF WORK

Improving the old generation pick & carry hydra crane will reduce the hazards related to the crane accidents, so the improvisation includes installation of fixed tyre guards, which protects from entanglement during movement, delay start mechanism, over hoist limit switch, boom limit switch, proximity sensors systems etc. These installations act as a “Third Eye” to the operator and help him to operate the hydra with safety.
The improvisation of safety features in pick & carry hydra crane boost the morale of the operator, which leads to the safe operation. The safe operation of pick & carry hydra crane will neglect the time delay, which in turn increase the productivity

## IV. STUDY METHODOLOGY

*A. Material shifting activity is mother of all major milestone activities in the construction industry, this activity involve*
*1)* Men
*2)* Material

3) Machinery
4) Safe location

B. *The material shifting activity includes*
1) Loading
2) Unloading
3) Transportation
4) Push
5) Pull
6) Hold
7) Carry & Lift

C. *Why Material Handling Plays Vital Role in Engineering Industry?*
1) 30 To 40% of Accidents due to M.H.
2) 45% of Production Time due to M.H.
3) 30% of Production Cost due to M.H.
4) 50 To 100 Times Handled before Shipping.

D. *Types of material handling*
1) Manual material handling
2) Mechanical handling
3) Automation

E. Factors influencing the material handling
1) Weight
2) Character
3) Size
4) shape
5) Distance
6) Purpose
7) Frequency
8) Cost
9) Route
10) Time
11) Quantity

F. *MANUAL MATERIAL HANDLING*

When human energy is put to use for lifting or carrying of material, it is called manual material handling.
Causes for accident in manual handling
1) Unsafe postures
2) Improper lifting
3) Heavy loads
4) Unsafe grip
5) Self-stability
6) Group incompatibility

Earlier material handling activity was carried out manually, which requires lot of efforts to complete the activity safely even for small materials.

G. *MECHANICAL MATERIAL HANDLING*

Whenever mechanical devices are involved in material handling, it is called as mechanical material handling.

Some of the appliances engaged in mechanical handling of materials are

*1)* Cranes
*a)* Overhead crane
*b)* EOT crane
*c)* Jib crane
*d)* Mobile crane
*e)* Tower crane
*f)* Gantry crane
*g)* Floating crane
*h)* Wharf crane

*2)* Derricks
*a)* Single boom
*b)* Jumbo
*3)* Conveyors
*4)* Forklift trucks
*5)* Pay loaders
*6)* Winch grab
*7)* Power trucks
*8)* Tractors – trackers
*9)* Motored pulley blocks

The movement of loads and materials is a major activity in an engineering industry. To achieve smooth movement, safety plays a very important role. To achieve this load movement lifting appliances are used.

*H. Crane Related Incidents*

One of the most productive and certainly most expensive pieces of equipment on any construction jobsite is the crane. A job's schedule can be completely dependent upon this one piece of equipment, and the crane operator can influence the attitudes of every trade on site. Since cranes affect a large segment of work at any construction site, proper crane management is essential to prevent a catastrophic accident. Statistics indicate that a significant number of construction injuries and fatalities are crane related accidents that also cost hundreds of thousands of dollars in equipment damage and other related costs.

Every year hundreds are killed and thousands are injured due to cranes being either the primary or secondary cause of an accident. The majority of the injury cases reported involved the following

*1)* Electrocution from contacting overhead power lines.
*2)* Caught-in, compressed or crushed in rotating or moving parts and/or the swinging superstructure of the crane.
*3)* Struck by an object, such as a falling, failing or swinging load.

These types of injuries and fatalities (electrocution, crushed, and being struck), which make up the majority of crane related accidents, are not occurring to the operators', but the ground workers or other individuals whose job places them near or around cranes.

These crane accident facts tell us that increase hazard awareness training for those whose job required them to work around cranes is essential. Operators', oilers' and others who work with the hazards associated with cranes are acutely aware of the dangers. However, for those who occasionally may be exposed are at a higher risk of being injured.

Important resources for ensuring the proper operation of mobile cranes are the consensus standards from the American Society of Mechanical Engineers (ASME). ASME/ANSI B30.5 – Mobile and Locomotive Cranes contains information on the characteristics and operations of cranes as well as the inspection, testing, and maintenance requirements. ASME/ANSI B30.9 – Slings contains valuable information pertaining to the construction, installation, operation, inspection, and maintenance of lifting devices, hooks and slings. These documents should be thoroughly understood by all those involved with cranes and hoisting and rigging operations.

Because of the complexity of most crane operations and because they can differ so much from one job to the next, no single set of guidelines can ever cover all the parameters involved, but a listing of these responsibilities (prepared by a large group of North American crane and legal experts) can be applied to most situations. It is crucial that all responsibilities be spelled out to everyone

involved in the operation before it begins.

Responsibilities should be spelled out for all parties involved, including but not limited to

4) Crane Owner
5) Crane Operator
6) Site Supervision

The crane owner (including all management and supervisory personnel employed by the owner) is responsible for the identification and assignment of specific responsibilities to the operating crews. The owner must be aware of the requirements of every job and provide equipment and personnel capable of completing the job in a safe and efficient manner and in accordance with all applicable regulations

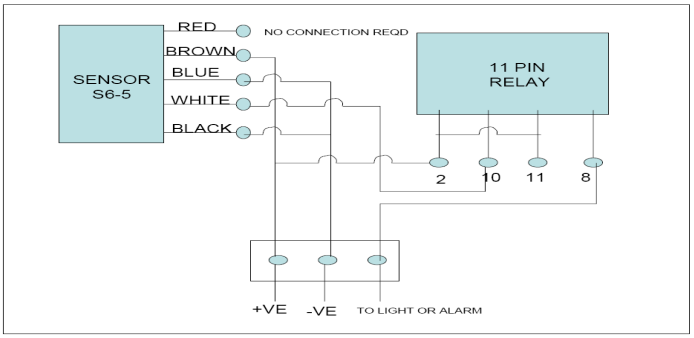
The operator is generally responsible for the safety of the crane operation as soon as the load is lifted clear of the ground. Because of this responsibility, whenever there is reasonable cause to believe that the lift might be dangerous or unsafe, the operator must refuse to lift until the concern has been reported to the supervisor, any hazards rectified and safe conditions assured. Site supervision has overall responsibility for the lift and therefore must plan all phases of the operation. This includes complete cooperation with the operator who has the final say regarding the safety of the operation.

## V. SAFETY IMPROVEMENTS IN HYDRA CRANE

### A. *Installation Of Sensor System*

Couple of Sensors is installed at the end of the bumper and they are connected to the electrical system of the hydra crane. Whenever there is object near to sensor within the proximity of 1meter it gives the signal to the operator.

Circuit diagram for sensor installation:




### B. Over hoist limit switch

*1) Features: Installed* in the Boom of the Crane: Connected to a Warning Device installed in the Operator Cabin and also to the Fuel injection system of the Engine of the Crane through a time delay and Solenoid switch.

*2) Working Principle :* During the hoisting operation, as soon as the Hook Block touches the Limit switch it activates the warning device at the operator cabin. If the operator does not react to the warning signal (By lowering the Hook Block) within the stipulated time which can be customized by the time delay (1 to 30secs), the limit switch activates a solenoid cuts off the fuel supply to the engine. Thus the engine is stopped preventing the hook block to travel further and hit the boom.

### C. Boom limit switch

*1) Features:* Installed near the center support of the boom (a pin connected with a spring) Connected to a Warning Device installed in the Operator Cabin and also to the fuel injection system of the Engine of the Crane through the same time delay used for OHLS and a solenoid switch.

*2) Working Principle:* During rigging operations the flange of the pin is compressed against the spring proportionate to the load being lifted.

As the flange touches the limit switch it gives the warning signal at operator's cabin and works in the same principle as the OHLS. Here the expected reaction from the operator is to lower the load.

### D. Wheel guards

Wheel guards are the mechanical fabricated arrangement around the hydra crane tyres, which prevents the materials, personnel entanglement with the tyres of hydra

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*E. Delay start mechanism*

Delay start mechanism is a device, which delays the ignition of the hydra engine by 30 seconds.

When the hydra was started, it gives loud hooter for 30 seconds to alert the nearby personnel who is standing nearby or sleeping nearby. After 30 seconds of loud sound, the engine starts.

## VI. CONCLUSION

After implementing the safety devices in the old generation hydra cranes, the number of incidents happens across the project sites gradually decreased.

Cost comparison between old generation crane and new crane is furnished below

| Sl. No | Description | Old Generation | New Generation |
|---|---|---|---|
| 1 | Capacity | 14 T | 14 T |
| 2 | Price (.Rs) | 1400000 | 2100000 |
| 3 | Safety Improvements Price (.Rs) | 22494 | Nil |
| 4 | Total | 1422494 | 2100000 |

With reference to the above table, Safe operation of hydra cranes can be ensured by “Safety Improvements In Old Generation Pick & Carry Hydra Cranes With Reasonable Cost” Without Compromising The Any Aspects Of Safety.

## VII. ACKNOWLEDGEMENT

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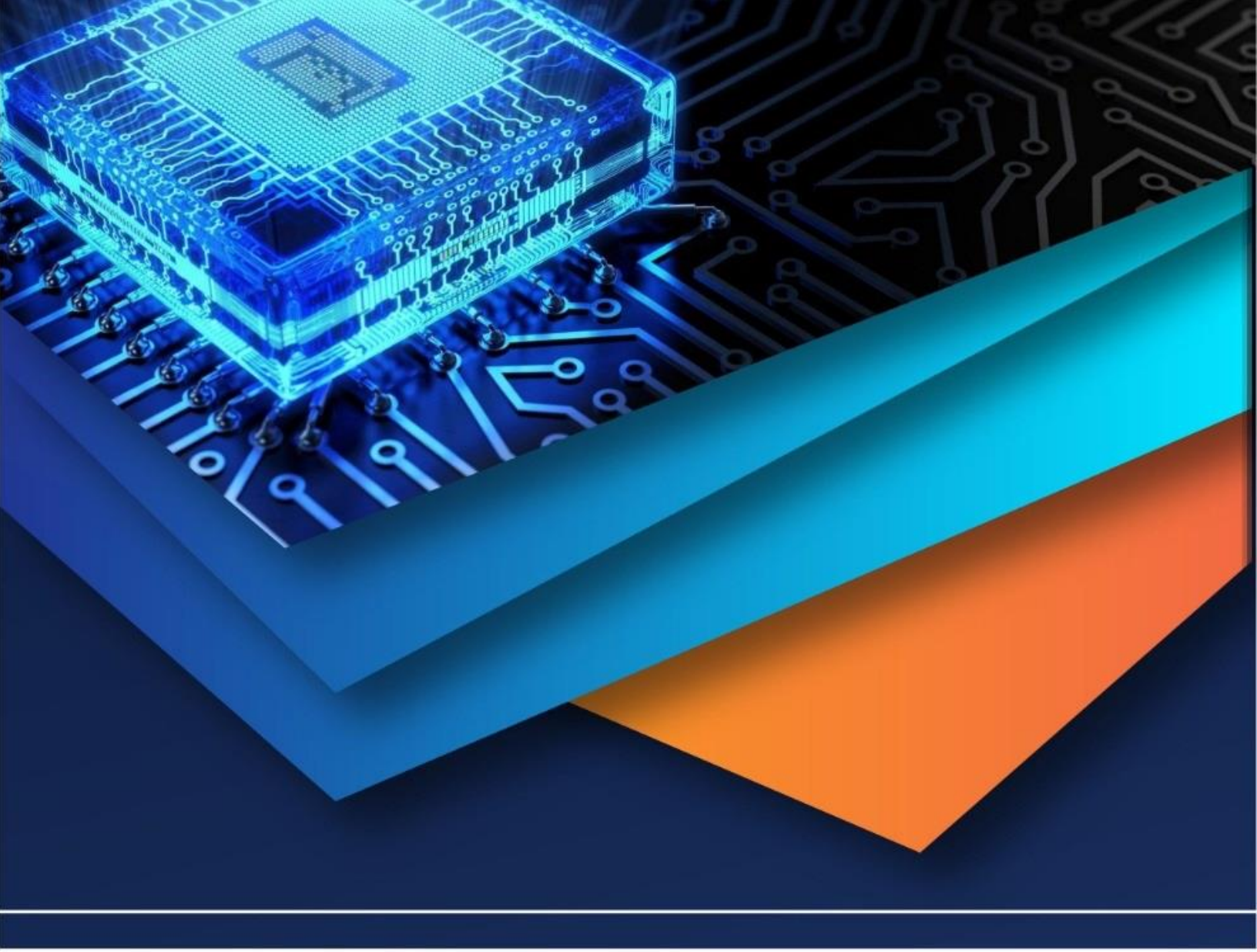

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