



Hazard Identification and Risk Assessment In EOT Crane Operations

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ABSTRACT: Hazard Identification and Risk Assessment or HIRA system can act as a risk assessment tool which will assist users in identifying hazard and estimating risk involved in each identified hazard. This risk assessment tool will identify possible hazard involved in each task in departments. Once the hazard has been identified, risks involved will be estimated and categorized. If the estimated risk falls in a category, which is higher than the low-risk category, then possible control measures will be recommended. At the same time, the user can add new work plan, task, and control measures in to the system to update existing information system.

KEY WORDS: Safety, Hazard, Identification, Risk, Control Measures

I. INTRODUCTION

Hazard Identification Risk Assessment(HIRA) is a process of defining and describing hazards by characterizing their probability, frequency and severity and evaluating adverse consequences, including potential losses and injuries. For any industry to be successful meet not only the production requirements but also maintain the highest safety standards for all concerned. The industry has to identify the hazards, assess the associated risks to tolerate level on a continuous basis, risk assessment as been performed using risk assessment guidelines and standards, such as Risk Assessment is a systematic method of identifying and analyzing the hazards associated with an activity and establishing a level of risk for each hazard. The hazards cannot be completely eliminated, and thus there is a need to define and estimate an accident risk level possible to be prevented. either in quantitative or qualitative way. Hazard identification and risk analysis involves identification of undesirable events that 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. In many industries there is legislative requirement for risk assessment to be undertaken for all hazardous equipment, machinery and operations taking into the account of the procedures used operation, maintenance, supervision and management.

Hazard identification is a vital part of the workplace safety process. This document is useful for those employers who don't have the time, expertise or knowledge to undertake the process. These simplify a thing that identify hazards, enter them in a Hazard Register, assesses the level of risk they pose and suggests ways of controlling them. Hazard identification is the process of identifying all hazards in the workplace.

II. LITERATURE REVIEW

Hazard Identification (HAZID) is the process of identifying hazards, which forms the essential first step of risk assessment . There are two possible purposes in identifying hazards of the literature review for aim. However, major incidents are rare and historical incidents are unlikely to represent the full range of potential incidents. Incident data should be used to supplement more systematic hazard identification techniques. Another useful source of information on the hazards associated with storage and handling of hazardous materials are MSDS [6]. It is also worth referring to the technical literature provided by material suppliers on their products. Workplace safety requires effective identification, assessment and control of significant workplace hazards. Identification of hazards present in any undertaking and evaluation and the extent of the risks involved, taking into account whatever precautions are being undertaken. Risk Assessment is the determination of quantitative or qualitative estimate of risk related to a well-defined



situation and a recognized hazard. The two types of risk assessment (qualitative and quantitative) are not mutually exclusive. Qualitative assessments are easier to make and are the ones required for legal purposes. When there are types of work, whose hazards and risks are similar in different workplaces or physical areas, a general risk assessment can be made.

The first step in the project is to gain a detailed knowledge about the process in which the project work is to be carried out. The detailed study includes individual activity carried out in the factory. Detailed study is made on the individual equipment or process that is studied. This study includes the working principle of the equipment, the working condition and the standards to be followed, the safety precautions taken, etc. The probability of occurrence is an estimate of how often a hazard event occurs. It is defined as the proportion of favorable outcomes to the total no. of possibilities if these are indifferent or the proportion observed in a sample. A review of historic events assists with this determination. Each hazard of concern is rated in accordance with the numerical ratings and definitions as below. In industrial safety, "severity" refers to the impact of an incident (fatalities, major injuries, or massive property damage). For EOT cranes, human factors are responsible for approximately 80% to 90% of all incidents, with a high correlation between specific human errors and "High-Severity" outcomes.

III. RESEARCH METHODOLOGY

Severity rate is the number of lost work days experienced per 15 workers. The injury severity rate shows the extent of safety anomalies by revealing how critical the injuries and illnesses. The employee who takes time to return to work after injury had a more severe problem than one who can return immediately.

- **Routine:** Done by Usual/Regular method of procedure.
- **NonRoutine:** Unusual/non-regular of procedure.
- **Normal Condition:** Risks converted to tolerable conditions by way of engineering control or by using PPE.
- **Abnormal Condition:** Deviation from normal condition, which requires immediate attention.
- **Emergency Condition:** Hazards and Risks, which are contained or mitigated by invoking emergency procedure.

<i>Rating</i>	<i>Description</i>	<i>Examples of Description</i>
5	Almost certain	Event occurs often and constant exposure to hazard. Very high probability of damage.
4	Likely	Event might probably occur and known history of occurrence. Frequent Exposure to hazard. High probability of damage.
3	Possible	Event could occur at some time and history of single occurrence. Regular or occasional exposure to hazard. Moderate probability of damage.
2	Unlikely	Event is not likely to occur and known occurrence. Infrequent exposure to hazard. Low probability of damage.
1	Rare	Event may occur occasionally and no reported occurrence. Rare exposure to hazard. Very low probability of damage.



IV. RESULTS AND DISCUSSION

Severity rate is the number of lost work days experienced per 15 workers. The injury severity rate shows the extent of safety anomalies by revealing how critical the injuries and illnesses. The employee who takes time to return to work after injury had a more severe problem than one who can return immediately.

Human Factor Category	Specific Error	Root Cause (Psychological)	Severity Rate	Potential Outcome
Skill-Based	Improper Slinging/ Rigging	Lapse: Forgetting a hitch or using a damaged sling.	Critical	Load slip, catastrophic drop, or struck by fatality.
Rule-Based	By passing Limit Switches	Violation: Intentionally overriding safety for speed.	Catastrophic	Two-blocking, rope snap, and total load loss.
Knowledge-Based	Misjudging Center of Gravity	Misperception: Lack of understanding of load dynamics.	High	Severe load sway, crane tipping, or structural stress.
Perceptual	Misjudging Distance/Clearance	Optical Illusion: Poor depth perception in high bays.	Moderate to High	Collision with building columns or other cranes.
Communication	Incorrect Hand Signals	Ambiguity: Non-standard signals between rigger/operator.	Critical	Ground personnel crushed between load and fixed object.
Physiological	Delayed Braking Reaction	Fatigue: Reduced alertness during night shifts.	High	Over-traveling the bridge into end-stops or personnel.
Psychological	Operating Under Pressure	Stress: Prioritizing production quotas over safety.	High	Taking "short swings" or moving loads over people.



V. CONCLUSION

EOT crane operation Systems have emerged as pivotal components in the defense against evolving cyber threats in 2025. By leveraging machine learning, deep learning, generative adversarial networks, reinforcement learning, and Explain able EOT, these systems demonstrate enhanced capabilities in detecting sophisticated attacks with higher accuracy and reduced false alarms.

The advancements in hybrid deep learning architectures and synthetic data augmentation have proven effective in Over coming limitations related to data scarcity and complex attack patterns. Frame works further strengthen the trust and usability of EOT Crane in operational environments.

Never the less, challenges including computational efficiency, real-time deployment, and adaptation to rapidly evolving threats remain. Addressing these issues is critical to translating research innovations into practical solutions.

In summary, EOT represent a transformative approach to, providing proactive, intelligent, and adaptable defense mechanisms. Continued research and development are essential to fully harness their potential in securing increasingly complex ecosystems.

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