

Summary

Introduction and research aim

European standardization of safety measures in construction and handling sites has become of growing importance in the past two decades. This development makes business in Europe easier by removing trade barriers for industry and consumers. A very often used tool in construction and handling sites, the crane, can and has been the cause of major incidents in the past resulting in severe injuries or even loss of life. Years of experience have made the presence of existing hazards when using cranes quite clear. The availability of state of the art technology, the handling velocity and structure sizes, however, keep increasing giving rise to a change of the risks that are involved in operation.

The goal of this research is to evaluate if the safety measures that are presented in the current European standards respond sufficiently to the existing risks. This will be done by making a risk analysis based on statistics of crane accidents and then taking a look at the hazards that are identified and dealt with in the standards. The risk analysis uses data from the research of F. Taekema and shall consist of a hazard identification where the accidents that have happened in the past will be listed and of a risk estimation where the severance of the injury and the probability of occurrence are examined. This shall give a clear picture of the necessity of risk reduction.

Risk reducing measures in the European standards can be divided in engineering measures, protective measures and organizational measures. The engineering measures are the inherently safe design measures that remove hazards from the source and thus reduce the actual hazard, while the protective measures attempt to shield the human from getting near the hazard. The organizational measures are least preferred and inform the user of residual risk with warning signals, signs or with the instruction manuals.

Current rules and procedures

The basis of European standards is the machine directive 2006/42/EC of the European parliament and the council. In order to be sold in the European Economical Area, the crane needs to have a CE-mark that serves as a ticket to this European market, representing the conformity with the requirements of the Machine directive. The CE-mark procedure can be done by the manufacturer who, by following the procedure, affirms that his product meets the requirements. The manufacturer himself is responsible for the implementation of the directive on the whole crane and on its components. Only a limited list of hazardous products has to be certified by an independent institution, but cranes are not on this list. European standards suggest methods using state of the art techniques that the designer can use to meet the requirements of the machine directive, but following the standards is not mandatory.

In the operational phase, rules are dictated not only by the European union but also by the individual countries and the focus in this phase is more on providing a safe work environment to the worker and the employer's responsibility in this matter. The main obligation for the employer is to have the crane inspected, verifying the technical state of the crane with the intention to safely deploy it. Workers shall have the required certificates and receive the proper training which is again the responsibility of the employer. As a designer, not much can be done about these two factors but lack of worker training or inspection are major secondary causes of accidents and could therefore not be left unmentioned. What a designer can do to help the employer is to provide a good user manual that contains all necessary information in a clear and understandable language.

Discussion and conclusions

A discussion at the moment in the field of safety regulations is the EN13000 amendment for mobile cranes that calls for elimination of the override key on the rated capacity limiter taking responsibility out of the hands of the operator. The rated capacity limiter is an important tool for the operator that limits the load moment and thus prevents falling over of the crane.

Another issue concerns the current procedure for CE-marking a crane. Despite various inspections during the use of the crane, it is difficult to determine whether the manufacturer has used the right standards and applied them correctly. A possible solution is to include cranes in the appendix IV of the machine directive being a hazardous machine. This would mean an obligation for a certification of the crane design by an external institution or notified body.

As a third issue, the measures presented in the standards and the machine directive seemed not to be sufficient to prevent mobile cranes from touching overhead power lines. Extra measures might be necessary to reduce the large number of deaths caused by electrocutions due to power line contact of the crane. The last issue concerns stability of cranes because of adequate ground assessment. In the Netherlands, ground assessment is done based mainly on guidelines that companies provide. Standardized procedures would make ground assessment easier for the contractor.

In the end, however, the human remains the final responsible in the process. Once he understands the importance of a safe working procedure, a big step is already taken towards a safer working environment.