MECHANIZED BUILDING PROCESSES AND SAFETY AT WORK

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ABSTRACT

Building production undoubtedly belong to factors that negatively affect environment, work environment, safety at work and it is our obligation to treat issues with giving preference to new technologies, new methods and understanding, concurrently aiming at efficient implementation of a building project. Also the factor of health and safety at work (hereinafter only OSH – occupational safety and health) is becoming a significant factor in connection with all the production as well as non-production activities.

Key words: *mechanized building processes, health and safety at work, risk assessment*

1 INTRODUCTION

The elementary assumption of the effectivity in building construction is proper and early before/construct and construct preparation of buildings that creates proper conditions for effective realization of the building project. Treatment of issues in the systems of building production, due to their „specificity“ is only possible by thorough preparation, designing, individual approach to assessment of the internal structure of building processes in consideration of the environment as well as working conditions of people.

Due to this, the criterion of workforce protection should have a significant impact on the decision taken in selecting the optimal alternative of the mechanized building process. The decision-making procedure in connection with the mechanical design of the project can be supported by a risk management system. This includes risk assessment as well as proposal of measures for exclusion, or at least, minimization of the risk.

2 MECHANIZED BUILDING PROCESSES

The essential precondition for efficient building production is thorough and timely pre-production and production preparation of building projects. It establishes conditions for optimization of building projects implementation. Optimization and its tools, including designing, play key roles in finding acceptable solutions to actual tasks. The designing itself represent a set of theoretical and practical analyses of certain processes that in respect to some special applications have the highest possible general applicability.

The project is a complex of 3]:

- thing relationships (mechanization, devices),
- human relationships,
- time relationships (optimization of the work on project, optimization of the realization).

The final objective of designing is not just any technical solution with some economic effects, but rather an optimal overall solution providing for best technical results, favorable working conditions and the highest possible economic effect. In spite of the fact that the economic effect is becoming the dominant requirement, under certain conditions there may come to the forefront as priority ones also other aspects. Each aspect has its position within the system of efficiency assessment of a building process and at a certain point of time it can be the very decisive one.

By overall evaluation we need to define the ratio of achievement of our designated goals. They can have economical character. All the same time, in some special circumstances the main factor can be also a non-economical criterion. For example:

- society demands, market,
- problem solving of an unemployment rate in region (certain social walk of life),
- culture or work hygiene improvement, etc.

Important factor by the choice of an optimal variant is the possibility of the realization. If the chosen variant not technical or organizational viable, often is chosen (for the achievement of the proper solution) a combination of two or more variants. But when we don't want the partial evaluation of the project of mechanization, we need to take this adjudicated criteria complex and by technical proper variants we need to choose economical optimal variant [4]:.

For completeness we have to say that not always is optimal that variant, which reaches maximal economical effect and minimal per unit product costs.

In some proper circumstances they may be also another factors at the first place, we have to face the consequences of the project choice and we have to fit them by this choice. For example:

- specialized operations in a process of realization,
- the quality of the mechanized process final product,
- energy reduction,
- protection of the environment,
- health and safety at work.

3 HEALTH AND SAFETY AT WORK

Currently the factor of health and safety at work (hereinafter only OSH – occupational safety and health) is becoming a significant factor in connection with all the production as well as non-production activities, in many companies OSH has been even put to the NO 1st position, above all the other topical activities.

Regardless of the relation to OSH, the mechanized building processes belong to high-risk activities and therefore it is necessary to consider them minimally from the point of view of legislative obligations [2]. Each piece of equipment, individually but also as a constituent part of machinery, brings along also certain risks into the process of building. Due to this, the criterion of workforce protection should have a significant impact on the decision taken in selecting the optimal alternative of the mechanized building process. The decision-making procedure in connection with the mechanical design of the project can be supported by a risk management system. This includes risk assessment as well as proposal of measures for exclusion, or at least, minimization of the risk.

3.1 Risk Assessment

Risk assessment comprises two important steps, namely: identification of threat and risk assessment. By identification of the threat we specify all the sources that may endanger workers at work. We are able to characterize these threats from several points of view. In general we analyze threats posed by operation of each device individually, but also as a part of several serially running mechanisms or mechanisms working in parallel.

The biggest threats to workers stem from moving parts of machines or from their actual movement. Connecting these parts into machinery sets piles up the threat due to additional risks created by their mutual interaction.

Upon a thorough analysis of threats, as the next step it is necessary to assess the risk and consequently to assess whether the risk is still acceptable, i.e. to determine [1]:

- probability (p) of occurrence of damage to health and level of possible consequences (s) to health of workers,

- risk assessment on the basis of combination of probability and consequences as R = p x s (Risk = probability x severity).

The risk assessment, i.e. determination of the level of threat to workers represents the basis for a proposal of suitable measures as well as consideration of further steps in the process.

3.2 Proposal of Measures in Risk Management

When drafting the measures we derive from a hierarchy prescribed by safety regulations. The most effective way of elimination or at least minimization of the risk is the use of suitable technical, organizational and methodological measures. In case of mechanized building processes the correct organization of work represents the most significant safety measure.

We shall validate the success rate of the proposed measures during practical operation of construction machines. This stage of risk management also includes continuous monitoring of design works and outputs of the risk analysis.

3.3 Principles of the Design of Mechanized Building Processes

When designing the mechanized building processes it is also necessary to respect certain principles deriving from OSH requirements. In the decision-making process these principles may significantly affect the choice of an optimal alternative. Proper understanding of basic principles of OHS represents a precondition for a good quality of the design. These principles derive from safety requirements that concurrently help to identify the threats. The resulting risk, as a level of threat to workers, will depend on the conditions of the relevant project. Some of the safety requirements are further listed including related foreseeable risks [1] :

- machinery can be operated only in accordance with the operating rules and operation manual, (risk of machinery selection which in terms of OHS may not suit conditions of construction, risk of unsuitable deployment and improper organization of works),
- and it is prohibited:
- to work with the machinery under reduced visibility and at night, in case the working area of the machinery and the work site are not sufficiently illuminated (risk of machinery selection which does not meet OHS during reduced visibility),
- to work with the machinery within dangerous vicinity of another machine or vehicle except for those that work in mutual interaction with the machinery (risk of selection of machines which may pose threat to each other in interaction),
- to move the machinery or its part above heads of persons and above an occupied car cabin of a driver of a vehicle (risk of a design of works organization of a machinery which will pose danger to other persons)),
- to work with the machinery at a site not providing good visibility from the operator’s position and where persons carrying out building works including machinery operator may be endangered (risk of negligence of the principle of good visibility on the side of the machinery operators),
- to move the machinery or working tool of the machinery within the protection zone of a live power line (risk of a design of machinery whose reach of the working tool interferes with the protection zone of the power lines),
- an earth-moving machinery can move or work, depending on soil load capacity, within such a distance from the edge of a slope or trench as to avoid collapsing of the machinery

(risk of a design of machinery which will not comply with the load capacity and composition of the soil),

- machinery can move or work below the wall or slope within such a distance as to avoid occurrence of danger of the wall's or slope's collapsing (risk of improper organization of works),
- in case a scraper is moving, within its close working area in the driving direction it is prohibited to remove rocks, roots as well as to carry out other works (risk of improper organization of works at the time of concurrently implemented other works),
- and it is required that:
- during driving and operation of the machinery on the slope there is applied such a method of driving as to avoid any dangerous shift of the center of gravity and loss of stability of the machinery (risk of incorrect works procedure),
- under parallel operation of several machines at one site the distance kept between them is such as to avoid any risk of their operation (risk of machines posing mutual risk to each other under their parallel operation),
- during transportation of fresh concrete by a stable pump or a pump installed at a vehicle's chassis it is provided for a safe vehicle entry excluding complex and repeated reversing (risk of work threat due to spatial limitation),
- the pump for delivery of fresh concrete on a chassis (auto-pump) is positioned in such a way as to eliminate any obstacles in the area of jib and pipes handling, which could impede this handling, endanger occupational health and safety, and as to ensure observance of protection zones of air power lines (risk of incorrect works organization as well as improper positioning of the machinery),
- the person operating the pump has a good view of the work site (risk of improper spatial positioning of the machinery) etc.

3.4 Heath Risks

Occupational health and safety is affected not only by safety but also health risks. They constitute a part of the group of risks that are also connected with the mechanized building processes. Besides dust, noise and vibrations, health of workers can be endangered, according to the authors [5] also by emissions which concurrently represent environmental aspects of the mechanized building processes. The most dangerous emissions include emissions of:

- greenhouse gases,
- noise,
- black smoke,
- dust,
- lead,
- electricity directly related to greenhouse gases.

Results of the study demonstrate that the highest degree of danger is posed by greenhouse gases, black smoke and energy consumption which are not, though, monitored or calculated at construction sites and therefore represent a challenge for building industry to increase the level of control of air polluting emissions.

4 CONCLUSION

The analysis and application of currently used ways of designing the mechanized building processes and their integration in the system of construction technology designing, necessitates a more comprehensive and more objective definition of impacts affecting the assessment of mechanized building processes.

The given article contributes to treatment of the given topic and in the conclusion it is possible to state that the optimal way of implementation of the mechanized building processes is not always the one achieving the maximum economical effect – minimal costs per production unit. Under certain conditions there may come to the forefront also other aspects that have to be considered and the overall perspective regarding the designing of mechanized processes acquires a different dimension. decreasing of energy intensity.

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