STUDY ON THE SITUATION OF OCCUPATIONAL ACCIDENTS ON CONSTRUCTION SITES IN ROMANIA

First A. Drd. Mădălina-Giulia BOBOCEA, *National University of Science and Technology POLITEHNICA Bucharest, Bucharest, ROMANIA*
Second B. drd. Elena-Cristina DEDIU, *National University of Science and Technology POLITEHNIC, Bucharest, ROMANIA*
First A. Drd. Andrei IACOB, *National University of Science and Technology POLITEHNICA Bucharest, Bucharest, ROMANIA*
Fourth D. Conf. dr. ing. Claudia BORDA, *National University of Science and Technology POLITEHNIC, Bucharest, ROMANIA*
Fiveth E. Sl. dr. ing. Constantin RADU, *National University of Science and Technology POLITEHNIC, Bucharest, ROMANIA*

ABSTRACT: This article examines the situation of occupational accidents in the construction site sector in Romania, an area characterized by increased risks for the health and safety of workers. Recent statistics indicate a high incidence of accidents, mainly presented by the lack of training of employees, non-compliance of equipment and insufficient resources allocated for effective controls. The study identifies the main causes of these accidents and highlights the need for a more rigorous approach in the implementation of occupational health and safety measures. In addition, the role of collaboration between authorities, employers and workers in promoting an organisational culture of safety is highlighted. These aspects are essential for increasing safety in industry and for the sustainable economic development of the construction sector.

KEYWORDS: industry, construction sites, work accident, risk, training

1. INTRODUCTION

The construction industry in Romania has registered a significant evolution in the last ten years, constituting a key sector for the country's economic development. The increase in investments, both public and private, together with access to European funds, has stimulated the development of infrastructure and real estate projects, contributing to the modernization of urban and rural space.
At the same time, this period was marked as a challenge related to global economic fluctuations, the shortage of specialized labor and the need to adapt to new regulations and sustainability standards. Through a detailed analysis of the trends and influence of the last decade, this article proposes factors to highlight the impact and long-term prospects of the construction industries in Romania, contributing to the understanding of the dynamics of this sector.
Occupational safety and health have become a topic of major importance, given the increased number of occupational accidents reported in the last decade. The construction industry stands out for an increased risk of work accidents, due to the specific unfortunate activities, precarious conditions and equipment used.
It has been found that in developing countries, the attention paid to health and safety issues at such workplaces is very low, most tasks are performed manually, occupational exposure to hazards is very high, and record-keeping is of poor quality when measured according to international standards
One of the main factors for this high percentage of accidents and injuries in the construction industry is the dynamic and ever-changing work environment,

where it is typical to have multiple teams working on different tasks in the same area and changing as the project progresses. Stress related to meeting deadlines and avoiding penalties is another major contributing factor. Common construction accidents and injuries include exposure to hazardous materials, electric shock, striking moving equipment, falling from heights, vehicle accidents, fractures, burns, heat stroke, amputation, hitting heavy construction equipment, bruising, fainting, coma, and death. It has also been established that the majority of these accidents and injuries occur due to lack of knowledge, lack of safety training, human error, unskilled workers, lack of adequate supervision, negligence, apathy and outright recklessness, as well as poor and inefficient management of construction sites.

Therefore, the objectives of this study were to identify and investigate the causes of occupational accidents and injuries in the Romanian construction industry and to propose effective measures to minimize the number of accidents and injuries.

2. CLASSIFICATION OF WORK ACCIDENTS

The correct definition of terms and the classification of accidents at work are two interconnected aspects, both of which are essential for an in-depth analysis of this phenomenon [1]. At European level, Eurostat defines a work-related accident as a short-term event that occurs during work and causes physical or mental injury. However, in order to fully understand the concept of work accident, it is necessary to consult Law no. 319/2006 occupational safety and health. A work accident is defined as a violent bodily injury or acute intoxication, survival during the professional work process or in the performance of work duties and which causes a temporary incapacity for work of at least 3 calendar days.

The classification of workplace accidents is an essential process for effectively understanding, preventing, and managing workplace hazards.

2.1. Identification of root causes

Pattern analysis: By classifying accidents according to cause (falls from heights, electric shock, improper use of machinery, etc.), trends and main causes of accidents can be identified.

Targeted prevention measures: Once the causes are known, specific prevention measures can be implemented to reduce the risk of those types of accidents happening again.

2.2 Evaluation of the effectiveness of prevention measures

Monitoring improvements: Comparing accident data before and after the implementation of new safety measures can assess their effectiveness.

Identification of weaknesses: If the number of accidents does not decrease or if new types of accidents occur, it means that the existing prevention measures are not sufficient and need to be adjusted.

2.3 Resource allocation

Prioritization of investments: The classification of accidents allows resources to be allocated efficiently, focusing on the areas with the highest risk.

Optimizing budgets: By identifying the root causes of accidents, funds can be directed to training programs, protective equipment, and other measures that have a direct impact on risk reduction.

2.4. Compliance with legislation

Accurate reporting: The classification of accidents is necessary to prepare the annual reports on occupational safety and health, according to the legislation in force.

Conformity assessment: By analysing accident data, one can assess the extent to which a company complies with occupational safety and health regulations.

According to the legislation in force, work accidents can be classified according to the following criteria:
Number of people affected: **individual** (one or two people) or **collective** (three or more people).Place of occurrence: **at the workplace** (during working hours or in direct connection with the activity), **during travel** (road accidents) **or at other locations**. Severity of the consequences: **temporary incapacity for work** (ITM), **disability or death.**

3. CAUSES OF ACCIDENTS AT WORK

Results of the analysis done among the participants on the causes and injuries in the event of accidents are presented in Table 1.

Table 1. Frequent causes of work accidents in Romania in construction

CATEGORY OF CASES	Specific causes	Description
Human factors	Inattention, negligence	Fatigue, stress, non-compliance with safety rules
	Lack of qualification	Unskilled or insufficiently trained workers
	Stress and pressure	Deadlines, pressure for performance
Technical factors	Defective equipments	Unmaintained or defective machinery, tools, PPE
	Improper electrical installations	Damaged cables, faulty sockets
	Construction instability	Unsafe scaffolding, uncovered pits
Organizational factors	Lack of a safety culture	Prioritizing productivity over safety
	Insufficient risk assessments	Lack of a complete hazard analysis
	Lack of communication	Misunderstandings between teams, lack of information
Precarious working conditions	Narrow workspaces	Difficulty in handling materials
	Insufficient lighting	Increased risk of errors
	Excessive noise	Impaired concentration and communications

These results indicated that the main causes of construction accidents and injuries in Romania include:
• Human factors: inattention and negligence;
• Technical factors: malfunctions and errors of work equipment;
• Organizational factors: lack of training, lack of PPE (personal protective equipment);
• Lack of a safety and health supervisor and poor working conditions (unsafe working environment);
In the last 5 years, the construction sector in Romania has registered a significant number of work accidents, as follows:
In 2019:
- total accident: 3,839;
- fatal accidents: 102;
- accidents with temporary incapacity for work (ITM): 3,487.
In 2020:
- total accident: 4,040;
- fatal accidents: 84;
- accidents with temporary incapacity for work (ITM): 3700.
In 2021:
- total accident: 3,249;
- fatal accidents: 79;
- accidents with temporary incapacity for work (ITM): 3 170.
In 2022:
- total accident: 2,311;
- fatal accidents: 43;
- accidents with temporary incapacity for work (ITM): 2,268.
In 2023:
- total accidents: 1,980;
- fatal accidents: 38;
- accidents with temporary incapacity for work (ITM): 1,942.
These data highlight a downward trend in the total number of accidents and fatalities in the construction sector in Romania in the last five years. To visualize this evolution more clearly, we have created a graph (Figure 1) that illustrates the number of fatal accidents and accidents with temporary incapacity for work (ITM) in the period 2019-2023.
According to the graph, (Figure 1) there is a significant decrease in the total

number of work accidents in the construction sector in Romania between 2019 and 2023, both in terms of fatal accidents and those with temporary incapacity for work (ITM). This downward trend can be interpreted as a result of improved occupational health and safety measures, as well as increased controls and awareness of the risks associated with working in construction.
In the case of fatal accidents, the decrease from 102 cases in 2019 to 38 in 2023 indicates a considerable reduction in critical risks. However, it is important to note that although the trend is positive, the number of fatal accidents remains significant and highlights the need for additional measures to ensure the safety of workers.
On the other hand, accidents with temporary incapacity for work decreased from 3,487 in 2019 to 1,942 in 2023, suggesting that overall accident risks are decreasing but continue to be common. This reflects the fact that, although critical hazards are addressed more effectively, operational risks remain a major concern in the construction industry.

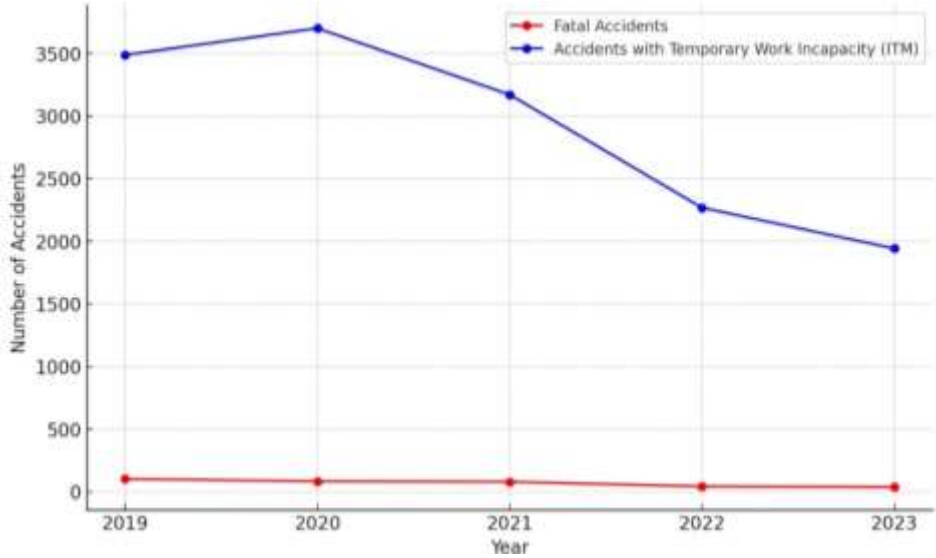


Figure 1. Trend od Fatal and ITM Accidents in the construction sector in Romania (2019-2023)

As can be seen, one of the specific causes of accidents at work and especially in the construction sector is the insufficiency of risk assessments.
- Risk assessment is a legal requirement in Romania, imposed by national and European legislation in the field of occupational safety and health. This involves the systematic identification of hazards in the workplace, the assessment of the risks associated with them and the implementation of prevention and protection measures. Organizations identify and assess risks in the design phase of the project, thus, the risk assessment method consists of several stages: - Identification of the main risk factors of the work system;
- Analysis of possible consequences;
- Establishing the probability of occurrence;
- Prioritization of risks according to the severity and likelihood of consequences;
- Developing and implementing prevention and protection measures.

The assessment of the risks of work accidents is done in several stages, these being:
Stage I - Systematic analysis of the activities identified at the workplaces according to the four elements of the work system: performer, work

environment, workload, means of production. [2]

Stage II - Identification of risk factors at the identified workplaces.

Stage III - Assessment of the risks of accident and occupational disease;

Stage IV - Prioritization of risks and establishment of prevention priorities;

Stage V - Elaboration of prevention and protection measures.

UNIT:		EVALUATION SHEET WORKPLACE	NUMBER OF PEOPLE EXPOSED:			
SECTION:			DURATION OF EXPOSURE:			
WORKPLACE: Unskilled worker			EVALUATION TEAM:			
WORKING SYSTEM COMPONENT	FACTORS OF RISK IDENTIFIED	CONCRETE FORM OF MANIFESTATION OF RISK FACTORS (description, parameters)	MAXIMUM FORECAST CONSEQUENCE	SEVERITY CLASS	CLASS OF PROBABILITY	LEVEL OF RISK
0	1	2	3	4	5	6
EXECUTOR	Wrong actions					
	Omissions					
	Socio-professional behavior					
WORKING ENVIRONMENT	Physical risk factors					
	Chemical risk factors					
WORKLOAD	Inappropriate content of the workload					
	Mental overload					
MEANS OF PRODUCTION	Mechanical risk factors					
	Thermal risk factors					
	Electrical risk factors					

Figure 2. Job evaluation sheet model

According to the model of the job evaluation sheet, the actual evaluation was carried out for the "unskilled worker" job at a civil construction site. During the assessment, 29 risk factors were identified, including:

- 6 mechanical risk factors;
- 4 electrical risk factors;
- 2 thermal risk factors;
- 4 physical risk factors;
- a chemical risk factor;
- a physical stress factor;
- 10 risk factors for wrong actions;
- a risk factor for omissions.

The overall level of risk resulting:

$$Nr = \frac{\sum_{i=1}^{n} r_i * R_i}{\sum_{i}^{n} r_i} = \frac{6(4*4)+22(3*3)+1*(2*2)}{6*4+22*3+1*2} = \frac{298}{92} = 3{,}24, \quad (1)$$

resulting that the value obtained falls within the limits of the "very low" risk level for the gravity-probability couple. [3]

SHEET OF PROPOSED MEASURES					
No. crt.	WORKPLACE/ RISK FACTOR	RISK LEVEL	PROPOSED MEASURE		
			Nomination of the measure	Competencies/responsibilities	Deadlines
0	1	2	3	4	5

Figure 3. Proposed measures sheet model

The measures proposed to eliminate the risks of accidents were:

- **organizational measures:** training of the staff on how to handle electrically operated hand tools; use of tools only with the devices mounted; training of workers to comply with their own instructions for work safety; strict delimitation of the work area with the necessary work safety measures; wearing E.I.P.; following the verification schedule of the means of protection provided (both work equipment and personal protective equipment); obtaining the opinion on the worker's suitability for working at height; presentation of the consequences of non-compliance with its own OSH instructions;

- **technical measures:** installation of nets for retaining materials accidentally fallen from the upper heights; insulation of the connection terminals and other current paths in the component of the electrical work equipment; checking and repairing the power conductors; use of power cables and extension cords only if they have insulation suitable for the work in the workshop; visual verification of the integrity of the earthing of the enclosures of the electrical equipment and metal supports in the work area; [4].

4. RECOMMENDATIONS

Recommended procedures for minimizing the causes of accidents and injuries may consist of several administrative and safety measures that must be applied effectively. First, all employers must respect the basic rights of all their employees, including their safety at work. The employer is responsible for providing the necessary personal protective equipment and maintaining its validity for use, as well as for training workers on its correct use. The employer is obliged to enroll qualified and certified safety and health supervisors at its workplaces and to ensure that the staff is aware of their responsibilities and duties for maintaining the safety of the construction site and also how to improve it to be healthier and safer for everyone. [5] The employer is also ultimately responsible for providing intact equipment and machinery at the workplace. Equipment and machines must also be replaced in a timely manner with new ones. All workers must be properly qualified and trained practically for each task they must perform. In addition, continuous on-the-job training on occupational safety and hazards at work must also be part of every worker's arsenal. Workers who are at risk of falling from height must always wear a seat belt and other necessary PPE "safety harnesses".

5. CONCLUSIONS

For the period 2021-2027, the European Commission's policy direction in this area is detailed in the "EU Strategic Framework on Safety and Health at Work 2021-2027". This document sets out the EU's objective to maintain its leadership in upholding high standards of working conditions both inside and outside the EU. It identified three key challenges: anticipating and managing changes in the working environment due to the green, digital and demographic transitions; improving the prevention of occupational accidents and diseases; and increasing preparedness for any potential future health crises [6]. In Romania, the construction sector ranks first in the statistics on fatal work accidents. Unlike other sectors of the economy, construction is characterised by particularities such as the size and volume of materials, equipment and labour, the mobility of workers on site, the diversity of job categories and vulnerability to minor and major occupational accidents. [7] Reducing risk and value is about taking the right steps at every stage of the construction process. To do this, it is necessary to identify the risk factors associated with each phase of the project, so as to establish prevention and protection measures associated with the risks analyzed.

6. REFERENCES

[1] Butnaru, B.I., Analysis of risk factors in the construction industry, "Gheorghe Asachi" Technical University of Iași, Iași, 2018 ;
[2] Gogelescu1 C., Tudose E., Bulboacă C., Chivu O., Analysis of workplace safety measures in working conditions at height in temporary and mobile construction sites, Journal of Research

and Innovation for a Sustainable Society, Bucharest, 2021;
[3]https://ro.scribd.com/document/453973448/Anexa-5-Scala-incadrare-nivel-de-risc-pdf
[4]https://www.inspectiamuncii.ro
[5]https://monitorsocial.ro
[6]https://inpm.ro
[7]https://statistici.insse.