

ANALYSIS OF ACCIDENTS IN CONSTRUCTION IN 2015-2017

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A b s t r a c t

Worldwide, construction is a branch of the economy characterised by a high level of employee safety risks and a high accident rate. In Poland, over the last 20 years, the number of victims and the frequency of accidents in the construction industry have shown a decreasing tendency, but they are subject to large fluctuations. Current accident reporting methods focused on rigidly classified circumstances and root causes do not facilitate drawing general conclusions for the purpose of prediction. The paper presents an analysis of the number and characteristics of construction site accidents of the years 2015-2017 using data from reports of the National Labour Inspectorate. The preliminary analysis of available nationwide sources confirmed that every year nearly 50% of accidents that occur during construction works are falls from height. The analysis is intended as a starting point for further research on factors and causes of accidents at work in construction.

Keywords: construction, accidents at work, fall from a height, prevention of occupational accidents

1. INTRODUCTION

The construction sector has been one of the most accident-prone branches of the Polish economy [1]. Construction sites proved to be dangerous places for both the employees and unwary passers-by. The scale of the problem is clearly visible in the absolute numbers of accidents as well as accident rates.

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Accidents in construction typically result in severe injuries leading to disability or death. Health effects for accident victims are accompanied by measurable and significant material losses, an issue dealt with, among others, by Hoła et al. [2]. Accidents generate serious social costs to families of people directly affected by the accident, the society and the economy at large therefore effort taken to prevent accidents is considered a wise investment [3, 4].

The basic duties of the employer after an accident at work include determining, in a predefined way, the circumstances and causes of the accident, and to apply appropriate measures to prevent similar accidents in the future. This obligation results from art. 234 § 1 of the Polish Labour Code.

One of the most common classifications of accident causes used to report and analyse accidents at work in Poland is one that divides the causes into three categories: technical, organizational, and human. It is referred to as TOL [5]. It is directly used in accident reporting for the public statistics. It focuses on listing failures attributable to these categories. Organisational causes include the lack of supervision, admission to work without preparation, improper coordination of collective tasks, tolerating by supervisors the use of inappropriate technology, improper organisation of the workplace. Human causes result from people's psycho-physical condition and behaviour, e.g. disregard for or ignorance of danger, discarding protective equipment, including means of personal protection, passing through or staying in endangered and forbidden locations. Technical reasons are directly related to the technical condition of the work equipment and the protective measures used, improper care of the material factor. Judging by the accident statistics, the causes of accidents are dominated by organisational and human failures. Technical causes constitute the smallest percentage of all accidents at work.

The advantage of the method is the ease of use, but its relying on rigid checklists does not facilitate finding the accident's root causes nor analysing the development of the accident [5]. Nevertheless, due to the method's compulsory character and application in statistical reports, TOL-based reports are the basic source of secondary data that provide insight into the reasons of accidents.

The objective of this study is to identify the factors associated with construction accidents in Poland in the period 2015-2017 on the basis of the National Labour Inspectorate data [6, 7, 8] – to present the limited informative value of these reports and to provide grounds for further research into the methods of extracting and analysing information of the accidents' indirect causes and accompanying factors.

2. CAUSES OF ACCIDENTS: LITERATURE REVIEW

According to the statistics of the National Labour Inspectorate [6, 7, 8], nearly 50% of accidents occurring every year in the course of construction works are falls from height. The proportion of accidents of this kind has been stable for many years [9]. This problem is not specific only to Polish construction sites [10, 11, 12]. In general, the studies and publications worldwide point to a relatively fixed set of common causes of falls from heights:

- no protective barriers to prevent falls from a height,
- not using personal protective equipment,
- improper securing of openings in floors/decks,
- improper organisation of the workplace,
- lack of supervision.

The most frequent cases of falls from height are falls from scaffolding. In Poland, the problem of safe work on scaffolds was investigated into by, among others, Hoła et al. [13], Błazik-Borowa et al. [9], Dąbrowski [14], and Kaczyński [15]. For many years, findings of post-accident inspections by the National Labour Inspectorate point to a serious problem: in spite of strict regulations and a general understanding that “bad scaffolding is dangerous”, the scale of negligence in this respect is staggering. Even basing solely on data collected between 2015 and 2017 [6, 7, 8], one may conclude that the most common accident causes consist in ignoring the requirement for the scaffolding to be installed by qualified personnel (hence notorious non-compliance of the erected scaffolding with the manufacturer’s assembly instructions or with the individual design, and mistakes as trivial as missing sole boards, bracing, railing, improper layout of circulation paths etc.).

However, the faulty scaffolding erection process is not the only reason of falls from height: the same reports point to ignoring workplace hazards with the excuse of short deadlines or tight budget for the numerous instances of failing to provide the collective protection measures (other than scaffoldings). Thus missing (or insufficient) balustrades, unsecured walkways and passages, impromptu ladders in lieu of staircases, failing to secure openings in external walls and floors. The employees notoriously fail to use the personal protection equipment (even if provided by the employer) such as helmets and safety harness, or use it improperly (do not attach lanyards of their harness to anchorage points). Even the marking of dangerous zones is frequently neglected.

Interestingly, in spite of the employers’ taking care to fulfil the obligation to send the workers for regular medical checks, the verification of contraindications to work in certain positions (e.g. to work at heights) is not efficient: in many instances, the accident victims were found to be officially not fit to do the work they were doing.

Analysing accident data collected by the Statistics Poland [1] (collected according to a different methodology), Hoła et al. [13] came to similar conclusions and found that the critical circumstances related with scaffolding accidents were:

- inappropriate or simply missing collective and individual protection measures,
- poor design of scaffolding structure (static not adequately checked),
- inadequate supervision over the scaffolding assembly work as well as the works on scaffolding, and tolerating derogations from occupational health and safety rules,
- authorising the scaffoldings for use without proper inspection,
- the workers' ignoring the duty to use the personal protective equipment.

Alarming reports on scaffolding accidents are published year after year. No significant improvement in this respect is observed despite information campaigns and involvement of public institutions and leading contractors. This fact prompted the authors to investigate into further causes of accidents consisting in people falling from heights as well as people being hit by objects falling from heights.

The source of accident data are the reports of the National Labour Inspectorate covering severe, fatal and involving multiple victims occupational accidents reported between 2015 and 2017 [6, 7, 8].

3. RESULTS

3.1. Number of accidents in construction

In the analysed period, 1,662 accidents in construction were reported, affecting 1,969 people of which 574 suffered serious injuries and 245 were killed [6, 7, 8]. This means that, on average, at least one person was subject to a serious or fatal accident at work in construction every working day.

According to Article 234 § 2 of the Polish Labour Code "*the employer is obliged to immediately notify the competent regional labour inspector and prosecutor of an accident at work classified as fatal, serious or involving multiple victims and any other accident that caused the above-mentioned effects related to work, if it can be recognised as an accident at work*".

The fact that more and more workers in construction are self-employed leads to a misunderstanding of this obligation and loss of data.

The analysis of data contained in Table 1 does not give reasons to claim that a significant reduction in the number of accidents has been observed over the years. After a 7% drop in the number of accidents in 2016, in there was an increase by 4% compared in 2017. However, it can be observed that the number of fatal accidents decreased slightly (successively by 15% in 2016 compared to 2015 and by 11% in 2017 compared to 2016).

Table 1. Number of injured in accidents and of accidents at work in the years 2015-2017 in the construction sector. Source: National Labour Inspectorate data [6, 7, 8]

Year	Number of accidents		Number of victims in accidents		
			Total	of which:	
				fatal	severe
2017	total:	554	596	71	185
	of which: with multiple victims	27	69	6	7
2016	total:	533	576	80	195
	of which: with multiple victims	35	78	6	7
2015	total:	575	624	94	194
	of which: with multiple victims	45	94	4	23

Table 2. Number of victims in accidents at work in construction in the years 2015-2017 – according to events causing accidents [6, 7, 8]

Event causing accident (dominant)	Year	Number of victims in accidents		
		total	fatal	severe
The fall of a person from a height to a lower level	2015	247	41	78
	2016	187	18	64
	2017	209	33	58
Blow to the injured by an object falling from above	2015	70	14	16
	2016	50	9	21
	2017	61	3	18
Loss of control over means of transport or operated mobile equipment (mechanised or not)	2015	33	4	13
	2016	24	7	3
	2017	36	5	9
Slipping, falling, collapsing – (pulling the victim down)	2015	28	1	7
	2016	44	4	11
	2017	41	1	18

3.2. Accident factors

According to standard [16], a dangerous factor, later referred to as accident-inducing factor, is a factor whose impact on the working person causes or can be a cause of injury. The presence of such factors in the working environment can lead to an accident. Among the physical factors at the building site, the following are regarded as accident-inducing [16]:

- moving machines and mechanisms,
- moving parts of technical devices,
- moving products, semi-finished products and materials,
- structural collapse,
- slide of masses and lumps, crumbling,
- surfaces on which it is possible to fall,

- blades and sharp edges, protruding elements, roughness and width of products and devices,
- surface temperature of equipment and materials to be handled,
- the position of the workplace in relation to the ground surface or floor.

The above accident factors translate into dangerous events that may cause accidents at work in construction (Table 2).

For instance, the position of the workplace in relation to the ground level or the floor in the room is associated with falls to a lower level. People are also hit by objects falling from height. In the analysed period of three years, the largest group of victim were people who had fallen from heights, a total of 643, almost 36% of all injured in accidents in construction. Among them, 200 suffered serious injuries, and 92 died as a result of the incident. Moreover, the number of fall fatalities fluctuates: after a drop in 2016 by almost 56% compared to 2015, in 2017 there was again an increase of 45% in relation to 2016.

3.3. Accidents and the type of works

Accidents figures are reported according to the type of works, i.e. the place of accident and the stage of the process during which the accident occurred. The data contained in National Labour Inspectorate source materials [6, 7, 8] shows that most accidents occurred at work during the construction of new buildings (Table 3).

Table 3. Number of injured in accidents at work in construction in the years 2015-2017 – according to the work process [6, 7, 8]

Work process (dominant)	Year	Number of victims in work accidents		
		in total:	fatal	severe
Construction of new buildings	2015	140	27	45
	2016	170	24	48
	2017	173	16	56
Reconstruction, repair, extension, maintenance of buildings and infrastructure	2015	136	17	37
	2016	116	10	40
	2017	125	15	41
Preparation, installation, assembly, dismantling, demolition, etc.	2015	70	11	20
	2016	49	8	15
	2017	39	6	9
Movement on the construction sites	2015	38	6	12
	2016	37	4	9
	2017	37	5	6

However, accidents occurred during reconstruction, repair, development or maintenance of buildings and infrastructure almost equally often. Though,

the most common place for the occurrence of an accident event was the construction site of new facilities (Table 4).

Table 4. The number of injured in accidents at work in construction in the years 2015-2017 – by the place of accident

Work process (dominant)	Year	Number of injured in accidents at work		
		in total:	of which: with fatal effect	of which: with severe injury
Construction site – object under construction	2015	294	49	91
	2016	281	38	93
	2017	275	29	84
Construction site – object dismantled, demolished, renovated	2015	167	29	45
	2016	118	13	38
	2017	143	21	47
Production site	2015	29	2	11
	2016	41	4	18
	2017	35	3	15

4. SUMMARY AND CONCLUSIONS

The analysis of construction process-related accidents reported in 2015-2017 confirms that falls from a height are the most common cause of accidents in construction. In spite of conducting accident investigations determining the circumstances and causes of the accident and aimed at eliminating such events in the future, in principle no significant reduction has been noticed.

However, the TOL approach to reporting accidents does not provide a full picture of the problem. The obligatory form of accident documentation focuses on dominant causes of accidents and limits the scope of information that potentially could be recorded and analysed. Therefore, “lessons learned” from the accident cases are superficial and, judging by the number of accidents, not fostering reflection useful in designing accident prevention measures. Therefore, other accident analysis methods are looked for – methods that depart from direct technical causality and putting blame on a particular person. These methods should consider systemic factors and the role of people and organizations in accidents.

Accident analysis understood as a process of finding the reasons for the accident occurrence is expected to provide enough input to re-engineer the construction organization system so that similar accidents do not occur any more. Its prerequisite is a thorough analysis of indirect accident causes – and the methods of extracting and analysing information of them are planned to be the scope of further studies by the authors.

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