



## The impact of human behaviour on the (un)safety of the construction site

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### ABSTRACT

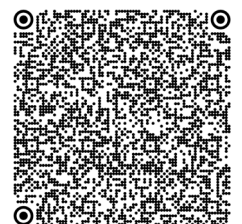
**Purpose:** A construction site is a space where construction workers use the right materials, tools and machinery. They are required to have the knowledge and skills to work safely, as their behaviour has a huge impact on the safety of the entire construction site.

**Findings:** All activities affecting the safety of the construction site should be preceded by a review of the legal conditions in the field of safety and health protection and, above all, by familiarisation with the design documentation of the facility. The document defines all the elements of the building object, construction equipment and works, land or plot development, function, form and construction of the building object, its energy and ecological characteristics, as well as the proposed necessary technical and material solutions showing the principles of connection with the surroundings and the conditions of use of the building object.

**Research limitations/implications:** Based on an analysis of the documentation, it is recommended to proceed with the development of a Health and Safety Plan or an IBWR manual. And to draw up an action plan for behaviour affecting construction safety. The work presents a network model and schedule for the execution of the works; schedules for employment, operation of machinery, and supply of materials; site development plans drawn up for the successive stages of construction; diagrams and descriptions of the organisation of the construction management and site management.

A typical technology and organisation design used should include: in the field of technology: technical characteristics of the construction project and the conditions of its implementation; a list of the elements of the object or processes that make up a specific project with an indication of the sequence of their execution and size; a description of the technology of the basic processes specifying the methods of their execution; the selection of machinery and auxiliary equipment and transport units; drawings of forming devices, scaffolding and other special constructions necessary for the adopted technology and the technology of execution of specific construction processes in atypical conditions.

**Practical implications:** The SDS and IBWR instructions being developed and the action scheme for behaviour affecting construction safety should find wide practical application.



**Originality/value:** Based on the analysis, an OHS plan and an IBWR instruction were developed. An action scheme for behaviour affecting construction safety was developed.

**Keywords:** Construction, Human behaviour, Safety and health protection

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## INDUSTRIAL MANAGEMENT AND ORGANISATION

### 1. Introduction

A construction site is a place where people (workers) make construction objects with the help of resources. They have tangible and intangible resources at their disposal. The primary tangible resources here are the materials, machinery, tools and other technical equipment necessary for the execution of a specific object. In contrast, intangible resources are the knowledge and skills of the workers of both management and labourers involved in the construction project. These resources, both tangible and intangible, influence their behaviour.

Typical *human behaviour* on a traditional site includes:

- the actions and attitudes of site workers (management and labourers),
- the learning process in the construction environment, which relates to the workers and management of the works subcontractors and site management,
- general knowledge of site safety [1-4].

At the same time, it is important to remember that *behaviour* and the associated *norms* and *values* should be analysed in the context of organisational culture. The basic components of organisational culture are shown in (Tab. 1).

Table 1.

Components of organisational culture (Authors' elaboration based on: [5,6])

No.	Name of the ingredient	Characteristics of the organisational culture component
1	Artefacts	<i>Physical artefacts</i> , which include, for example, the organisation of the premises, the adopted requirements for working or protective clothing, the order on-site or the segment of the allocated storage area for construction materials.
		<i>Behavioural artefacts</i> - refer to the rituals (standardised behaviours) on site.
		<i>Linguistic artefacts</i> - are associated with everyday communication routines that form what is known as building convention.
2	Behaviour (values)	<i>Values</i> are components related to perceptions and strong internal beliefs about what actions should be taken to ensure safety on the construction site, which at the same time will be implemented according to accepted, defined standards of safe behaviour. The stronger the values and the more site workers internalise them, e.g., by subcontractors (adopted as their own), the more influence they can have on on-site safety. Typical areas to which values may apply are, for example, the results expected, the competencies that workers use in their work, attitudes to safe operation, the safety of materials, tools and machines or teamwork, or concern for people based primarily on eliminating incidents and accident situations.
	Behaviour (norms)	<i>Norms</i> can exert a strong pressure to behave safely because of reactions - controlling others by how one reacts to their behaviour. Like values, norms can also be identified and examined at the level of declarations and/or adherence to them in everyday action. Some norms and values can be codified and described in a Health and Safety Plan (H&S plan) or a Building Safety Manual (BWRB manual).
3	Assumptions	<i>Assumptions</i> are the invisible and very poorly realised (mostly unconscious) components of organisational culture. Assumptions refer to beliefs about security in human nature, interpersonal relationships, and the nature of the building's relationship with the environment. What assumptions underlie the prevailing culture can partly be inferred by recognising the accepted norms and values of safe behaviour on site. Usually, however, they can only be guessed at based on observations of repeated patterns of behaviour and expectations of that behaviour.

## 2. Construction safety

Security problems in the broadest sense have preoccupied humankind since the beginning of its existence. People have always faced various threats, and security issues have been his natural need. As civilisation developed and the world changed, the need for security did not diminish; on the contrary, it grew and became more complicated. Contemporary people are no longer satisfied with the mere guarantee of survival; they want something more: stability, predictability, and the development of prosperity [7].

In contemporary broader terms, safety is a state of certainty, peace of mind, and absence of danger; it is the ability to avoid harm due to risk, danger or threat. In narrower terms, e.g., in relation to work, called occupational safety is an activity aimed at protecting the worker from an accident or possible danger at work. It is implemented

through various technical measures, the safe organisation of work and the formation of safe human behaviour at work, considering the type and severity of potential accident hazards [4,8,9].

An analysis of the causes of occupational accidents according to the TOL classification shows that the safe behaviour of workers on site is influenced by the following:

- *organisational factors*, and among these, the inadequate general organisation of work, including lack of instruction in using the material factor, ranks first;
- *human factors*, including the employee's abnormal and inappropriate self-injurious behaviour [10].

It is important to remember that these factors occur at a specific time and place on the construction site. They are external and internal factors relating to workers, materials, machinery and technical equipment involved in the construction project (Tables 2, 3).

Table 2.

External factors affecting construction safety

No.	Name of the factor	Factor characteristics
1	rapid execution of works	Contracts are almost always awarded as a result of the hearing of the tender. The winning bidder is the one who has proposed the lowest price. The contract must be realised within a specific, usually very tight timeframe. For non-deadlines are met with penalties for the contractor. The contractor shall strive to get the job done quickly, at minimum cost
2	unreliable subcontractors	Except for the smallest investments, there is an element of sub-performance stemming from the need to have the necessary skills to execute the work. Subcontractors are also selected through a tender issued by the main contractor. Some subcontractors attempt to do their job by taking so-called shortcuts in order to save time and money, not caring that it causes problems for others. On-site conflicts can therefore arise, creating management and coordination problems
3	atmospheric conditions	Much construction work is carried out in the open air. In this respect, the following have a fundamental impact on on-site safety. atmospheric conditions
4	updating of the occupational risk assessment carried out	No two are similar to construction sites themselves. While some aspects of occupational safety and health on construction sites remain unchanged; however, the overall occupational risk assessment must be carried out again for each new construction. It is imperative to make sure, that the conclusions drawn from an occupational risk assessment on another site are still relevant and complete

Table 3.

Internal factors affecting construction safety (Authors' elaboration based on [11])

No.	Name of the factor	Factor characteristics
1	low level of health and safety knowledge	among employees and employers
2	minimising construction costs	by saving on expenses that could ensure a higher level of safety and the involvement of low-skilled workers
3	failure to carry out or inadequate risk assessment	failure to carry out or adequately assess and communicate occupational risks employees

### 3. Values to foster safe behaviour on construction sites

The literature analysis shows that human behaviour, including employee behaviour, is decisively influenced by organisational culture [12]. According to B. Mikula [13], the issue of behaviour formation can be divided into four groups:

- *Group I* is based on the assumption that people are guided by the good in all their actions and that in life, they seek happiness and strive to achieve it;
- *Group II* concerns the assumptions that should characterise employees at all levels of management concerns the attitude with which they approach the implementation of the actions undertaken;
- *Group III* includes the developmental shaping of employee behaviour and is mainly concerned with the appropriate, positive and creative energy required to perform tasks;
- *Group IV* refers to the characteristics that influence the organisational culture, which fosters the development of the organisation through appropriate development-oriented employee behaviour; these characteristics are related to the good and positive emotions felt by those employed by the company.

In the construction industry, each organisation, including construction, has its own individual safety culture, which determines how people relate to risk and safety and formulates the rules of conduct and values recognised by the members of a particular group [14].

From the Author's practical experience, Group II factors have the greatest impact on safe behaviour on site (Tab. 4).

When shaping a culture of safety at work [15-18], special attention should be paid to three elements:

- Physical working environment: tools, machinery, organisation of workstations;
- Employee behaviour (compliance with health and safety regulations, communication of information and cooperation, demonstrating a concern for safety beyond the call of duty);
- Internal characteristics of employees: knowledge, skills, motivation [19,20].

Among these elements, human behaviour is strongly influenced by:

- Open and frank communication related to informing workers about hazards and risks [21,22];
- Involving site (works) management, expressing personal interest and concern for worker safety, complying with health and safety regulations, and treating safety issues as equal to production [22];
- Worker participation, e.g., involvement of workers in the development of internal health and safety standards and documents, in activities and decisions made during the construction project [23];
- Health and safety education, i.e., occupational safety training tailored to the specific job and to the needs of workers in a particular construction phase [11];
- Analyse accidents, report and analyse accident and near-accident incidents that have occurred on similar construction sites, identify causes and take preventive action at their workplaces [10];
- Motivating and reinforcing safe behaviour, expressing approval and appreciation to workers who act safely and are committed to improving safety on site [18];

Table 4.  
Traits with the greatest impact on safe behaviour on site

No.	Feature	Feature characteristics
1	openness	An attitude towards new tasks, new colleagues, and changes in the organisation and its environment. Only employees who are willing to be open to change or to be challenged can exhibit pro-developmental behaviour leading to the development not only of themselves personally but also of the organisation
2	proactivity	A proactive person takes the initiative and takes responsibility for their actions. They must also be guided by their professed values rather than by external circumstances prompting them in particular behaviours
3	adaptability	It is a trait that shows a willingness to adapt to certain conditions, changes, and new circumstances. Employees who do not have a problem with it show the ability to develop and find themselves in different conditions, which often arise quite unexpectedly and require rapid adaptation to continue performing tasks, expand their responsibilities, or even expand the organisation's activities. It is an important trait in terms of employee behaviour affecting their development and, consequently, the organisation as a whole
4	creativity	Employees who demonstrate creativity are much more able to take on tasks that are the challenge requires a creative approach, combining facts and creating new value from them, both for themselves and the organisation as a whole, contributing to its development

- Cooperation between employees (contractors, subcontractors) and an atmosphere of understanding and trust between management and employees and between employees from different departments and organisational levels of the companies employing them [14,21,22,24,25].

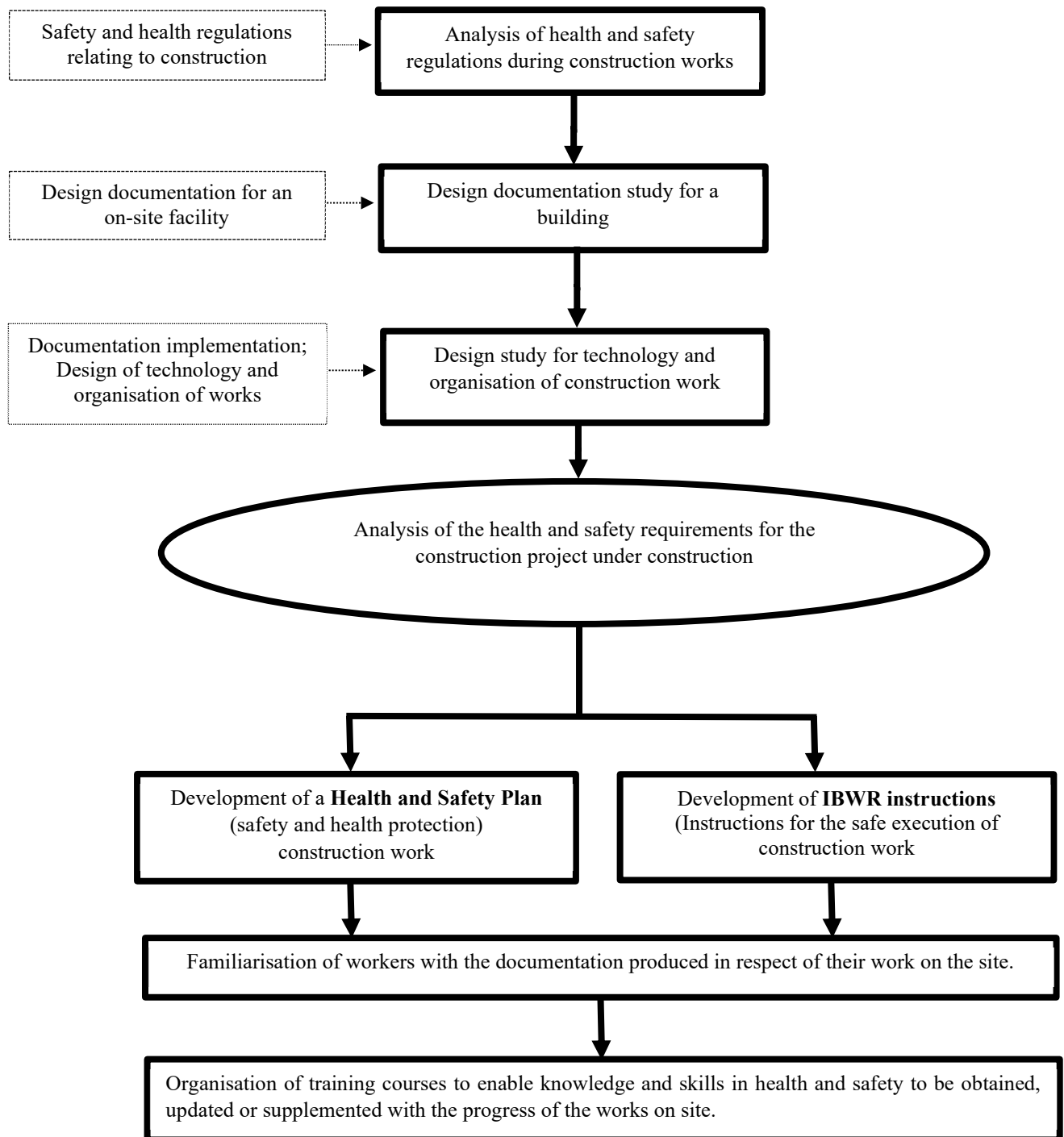


Fig. 1. Diagram of examples of behavioural measures affecting construction safety

#### 4. Proposal for behavioural measures affecting construction safety

Commencement of behavioural activities affecting the safety of construction should be preceded by a review of the legal conditions in the field of safety and health protection and, first of all, acquaintance with the design documentation of the facility. The document defines all the elements of the building object, construction equipment and works, land or plot development, function, form and construction of the building object, its energy and ecological characteristics, as well as the proposed necessary technical and material solutions showing the principles of connection with the environment and the conditions of use of the building object.

Depending on the type, size and complexity of the building facility, the project documentation should be analysed, which should include:

- in the event that a building permit is required: construction design, detailed designs, works take-off, BIOZ information [19,20,23,26];
- if a building permit is not required: plans, drawings or other documents making it possible to determine the type and scope of the basic construction works and the conditions and location of their execution, the works take-off, designs, permits, justifications and opinions required under separate regulations [27,28].

Based on the design documentation, the problems associated with the execution of construction works on the site are analysed, investigated and resolved. A works estimate is prepared, and a cost estimate is calculated. Using the works estimate and cost estimate, based on an analysis of the work fronts and available resources as required, the technology and organisation of the works are designed.

A typical technology and organisation design should include the following:

- in terms of *technology*: technical characteristics of the construction project and the conditions for its implementation; a list of the elements of the facility or processes that make up a specific project with an indication of the order in which they are to be carried out and their size; a description of the technology of the basic processes specifying the methods of their implementation, selection of machinery and auxiliary equipment and transport units, drawings of forming devices, scaffolding and other special structures necessary for the adopted technology and the technology of implementation of specific construction processes in atypical conditions, e.g. in winter;
- in terms of *organisation*: description of the organisation adopted for the execution of the works; network model

and timetable for the execution of the works; schedules for employment, operation of machinery, supply of materials; site development plans drawn up for successive stages of construction; diagrams and descriptions of the organisation of the site management and construction management.

Once the documentation has been analysed, developing the SHE plan or the IBWR instructions can begin. An example of an action scheme for behaviour affecting construction safety is shown in Figure 1.

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