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**| RESEARCH ARTICLE**

# Factors Causing Accident Falls from Height in the Construction Sector: Literature Review

**Fakhrul Firdaus**[1] ✉ **and Dadan Erwandi**[2]
[12]*Occupational Health and Safety Department, Faculty of Public Health, Universitas Indonesia*
**Corresponding Author:** Fakhrul Firdaus, **E-mail**: Fakhrul.firdaus@ui.ac.id

**| ABSTRACT**

The construction sector has a large safety risk in the implementation process. In Indonesia, during the last five years, the number of work accidents has been increasing. BPJS TK, as an institution that serves occupational health insurance, noted that the accident rate increased by 5.65% from the previous year, and one of the jobs that contributed to the fatal accident rate in construction activities was working at heights. The research used literature review method by discussing the results of research related to the factors that cause accidents falling from heights in the construction sector. Library materials are taken from scientific search engines such as Google Scholar, Science Direct, and Pubmed. Based on the results of the search for scientific papers that are relevant to the factors causing accidents falling from heights, there are 9 scientific works that meet the criteria with 6 factors identified as factors causing accidents falling from heights, namely risky behavior, unsafe conditions, management and organization, human factors, work factors and external factors. This study focused on the factors that lead to fatal falls from altitude injuries. This is done so that it is easier for companies to prevent falls from a height by mitigating the factors that cause falls from a height.

**| KEYWORDS**

Construction, Factors Causing Falls from Height, Fall Accidents, Working at Height

**| ARTICLE INFORMATION**

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## 1. Introduction

The construction sector is a sector that is very important for the development of a country, data from "Oxford Economic" records growth in the global construction sector, reaching 3.9% per year until 2030. This is faster than the growth in the manufacturing sector globally (Robinson, 2021).

In Indonesia, the construction sector is currently the government's focus as an effort to support infrastructure progress to support other sectors such as fulfilling electricity and energy, food security, improving health and education facilities, road access and other supporting needs (Direktorat Statistik Industri, 2021).

The construction sector has a large safety risk in the implementation process. In Indonesia, during the last five years, the number of work accidents has been increasing. BPJS TK, as an institution that serves occupational health insurance, records that the number of accidents that occurred in 2021 reached 234,270 cases, an increase of 5.65% from the previous year (Mahdi, 2022).

One of the jobs that contribute to the number of fatal accidents in construction activities is working at heights. Working at heights is work performed by workers on the ground or waters that have different heights and has the potential to fall, resulting in workers being injured or dead or causing damage to company assets (Permenaker No 9, 2016).

In various countries, work at height in construction is a serious concern. This is due to the fact that fatal accidents caused by work at height in the construction sector account for quite a large number. (HSE UK, 2021) states that 50% of fatal accidents that occur

in the construction sector are caused by falls from heights. Meanwhile, other data regarding fatal accidents that occur from work at height in the USA are at a percentage of 36.4% (Brown et al., 2021)and in Australia, 32% (SWA, 2019).

Based on some data related to the incidence of falls from heights and also the high construction activity in Indonesia in the last 5 years, this scientific paper aims to describe the causes of accidents falling from heights in the construction sector.

## 2. Material and Method

This study uses the literature review method by discussing the results of research related to the factors that cause accidents falling from heights in the construction sector. Library materials are taken from scientific search engines such as Google Scholar, Science Direct, and Pubmed, with journal targets from 2020, 2021, 2022, and 2023.

The library materials identified on the scientific paper search engine were carried out using the keywords fall from heights, work accidents, and construction and found a total of 842 scientific papers. Then from the literature obtained, the researcher screened the scientific papers and obtained 63 scientific papers that were relevant to the research topic.

A collection of relevant scientific papers was further narrowed down through inclusion criteria, namely scientific papers discussing accidental falls from heights, scientific works discussing the causes of incidents of falls from heights, and scientific works discussing the prevention of falls from heights. So that from the inclusion criteria applied, 9 studies were found that fulfilled it.

## 3. Result

Based on the results of the search for scientific papers that are relevant to the causes of accidents falling from a height, there are 9 scientific works that meet the criteria. Some of the factors that cause accidents falling from a height are identified as follows:

**Table 1 Research Results**

| No | Author | Year | Title | Factors Causing Accidents to Fall from Height in the Construction Sector |
|---|---|---|---|---|
| 1 | Rafindadi et al. | 2022 | Analysis of the causes and preventive measures of fatal fall-related accidents in the construction industry | 1. Risky behavior (not using PPE properly, rushing to work)<br>2. Unsafe conditions (edges of buildings, holes in floors, unsuitable scaffolding, lack of lighting)<br>3. Management (training, unavailability of PPE at height, management commitment, lack of work procedures) |
| 2 | Halabi et al. | 2022 | Causal factors and risk assessment of fall accidents in the U.S. construction industry: A comprehensive data analysis (2000–2020) | 1. Age<br>2. Risky behavior (inappropriate use of PPE)<br>3. Unsafe condition (unsuitable scaffolding)<br>4. Organization (does not provide fall protection or protection) |
| 3 | Santiago Oliveira et al | 2023 | Fatal fall-from-height accidents: Statistical treatment using the Human Factors Analysis and Classification System – HFACS | 1. Age<br>2. Risky behavior (repeated violation, wrong decision making)<br>3. Unsafe conditions<br>4. Organization (Lack of Supervision, training, work procedures) |

| | | | | |
|---|---|---|---|---|
| 4 | Arifuddin et al. | 2020 | An investigation of fall accident in a high-rise building project | 1. Human factors (use of inappropriate PPE, lack of experience, lack of knowledge, fatigue)<br>2. Unsafe conditions (unsuitable scaffolding, lack of lighting)<br>3. Type of work (preparation of materials, structure, manufacture of scaffolding, completion work)<br>4. Organization (Lack of Supervision, training, work procedures, lack of fall prevention work programs from heights) |
| 5 | Tonetto & Saurin | 2021 | Choosing fall protection systems in construction sites: Coping with complex rather than complicated systems | 1. Age<br>2. Risky behavior (violation of work standards at height)<br>3. Organization (does not provide fall protection or protection) |
| 6 | Manzoor et al. | 2021 | Evaluating the critical safety factors causing accidents in high-rise building projects | 1. Risky behavior (use of inappropriate PPE, work without skills)<br>2. Unsafe conditions (unsuitable scaffolding, no pit and edge protection)<br>3. Organization (does not provide fall protection or protection) |
| 7 | Zermane et al. | 2023 | Investigating Patterns of workplace fatal fall injuries: Case Study of Malaysia | 1. Human factors (lack of experience, lack of knowledge, fatigue)<br>2. Unsafe conditions (poor housekeeping, no pit and edge protection)<br>3. Type of work (preparation of materials, structure, manufacture of scaffolding, completion work)<br>4. Equipment (use of damaged scaffolding or non-standard installation) |
| 8 | Salleh et al. | 2022 | The Causes and Mitigation Measures of Fall from Height Accidents in Malaysia | 1. Risky behavior (using inappropriate PPE, using damaged tools, risky postures, ignoring safety aspects at height)<br>2. Management commitment (not providing fall protection and training)<br>3. Work environment (poor housekeeping, lack of safety signs, rainy weather)<br>4. Communication |
| 9 | Nowobilski & Hoła | 2023 | Methodology based on causes of accidents for forecasting the effects of falls from scaffoldings using the construction industry in Poland as an example | 1. Technical factors (use of damaged scaffolding or non-standard installation)<br>2. Organization (no supervision, training, no fall protection and protection)<br>3. Human (use of inappropriate PPE, lack of experience, lack of knowledge, fatigue) |

Based on the literature review conducted, there are 9 factors that cause accidents falling from a height, with a summary in Table 2.

**Table 2 Factors that cause accidents fall from a height**

| No | Factors that cause accidents fall from a height |
|---|---|
| 1 | Risky Behavior |
| | Not using PPE properly.<br>Rush to work<br>Mistakes in making decisions |
| 2 | Unsafe Condition |
| | Open edge of the building<br>Hole in the floor<br>Unsuitable scaffold<br>Lack of lighting<br>Poor housekeeping |
| 3 | Management & Organization |
| | Training<br>Management commitment related to the work program<br>Lack of work procedures<br>Lack of supervision<br>Does not provide protection and fall prevention<br>Communication |
| 4 | Human Factor |
| | Age<br>Lack of experience<br>Lack of knowledge<br>Fatigue |
| 5 | Job Factor |
| | Material preparation work<br>Structural work<br>Scaffolding manufacture<br>Completion work |
| 6 | External Factor |
| | Weather |

**4. Discussion**

Based on the results of a literature review conducted, there are 6 factors identified as factors causing accidents falling from a height, namely risky behavior, unsafe conditions, management and organization, human factors, work factors and external factors.

Research conducted by (Rafindadi et al., 2022)states that fatal accidents at work at height occur mainly due to contributing factors to risky behavior carried out by workers. Meanwhile, financial constraints, the complexity of work at height, dangerous work procedures, unprotected edges of holes, and rush to finish work are sub-factors that contribute to fatal accidents related to falls from heights (Rafindadi et al., 2022).

Other studies added that the factors contributing to 621 fatal accidents due to work at height had been identified from individual factors, including age, gender, experience, and use of personal protective equipment (PPE). Improper use of PPE is one of the causes of falling from a height such as the edge of a building or other tall steel structure. In this case, the personal protective equipment used in work at height is a body belt (full body harness) which is inappropriate (Chi et al., 2005).

The Occupational Safety Health Administration (OSHA) mentions that in using the right seat belt, workers must carry out the 100% tie-off principle as a fall protection mechanism. 100% tie-off is a mechanism to always tie the safety belt at the anchor point, even if workers have to move or change their working position. Failure to comply with the 100% off principle may result in the fall protection system not functioning. This happened in one of the steam power plant construction projects in Kupang, NTT, where one of the foremen fell and died because he did not fasten the body belt (full body harness) at the anchor point (Mauludin, 2022). In research conducted by (Arifuddin et al., 2020), the main factors that cause falls from a height are mostly related to the human factor. Intensive safety outreach programs should be a priority for organizations to raise awareness of workers, and training

programs to improve their knowledge and skills are needed for workers. Besides that, supervision is needed at each work location, and management also needs to prepare safety protection programs, rewards and sanctions for workers who carry out / do not carry out the program (Arifuddin et al., 2020).

## 5. Conclusion

Falling from heights is still a big concern for any company doing any kind of work at heights. This research aims to describe the causes of accidents falling from heights in the construction sector and focuses on the factors that cause fatal falls from height injuries. 6 factors were identified as factors causing accidents falling from a height, namely risky behavior, unsafe conditions, management and organization, human factors, work factors and external factors. This is a study to provide a background for companies in preventing falls from a height by mitigating the factors that cause falls from a height and reducing the number of falls from height accidents in the construction sector. This study is only a literature review and needs more comprehensive research on the root causes of falls from height accidents for future research.

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