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The reasons of buildings accidents at a stage of construction and acceptance in operation

Abstract. This work covers the consequences of accidents at buildings and structures during the construction and acceptance in operation. Information on accidents was collected using various sources of information: Internet resources, literary sources, scientific works, as well as reports from the world's journalistic services. The findings are presented more than the past ten years and cover construction incidents around the world. The most common causes of accidents are identified, which allow to obtain more detailed study of the problem and further provide for cases of such accidents at the construction site. In addition, the conclusions contain the main tasks in the solution of this problem and ways of their implementation.

Keywords: buildings and structures, building construction, failure, building accident, destruction of structures.

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Причини аварій будівель на стадії будівництва та прийняття в експлуатацію

Анотація. Ця робота охоплює наслідки аварій будівель та споруд під час будівництва та прийняття в експлуатацію. Інформація про аварії була зібрана з використанням різних джерел інформації: інтернет-ресурсів, літературних джерел, наукових робіт, а також звітів світових журналістських служб. Висновки представлені більш ніж за останні десять років і охоплюють інциденти, пов'язані з будівництвом по всьому світу. Виявлено найпоширеніші причини таких інцидентів, які дозволяють отримати більш детальний опис проблеми та надалі передбачати випадки таких нещасних випадків на будівельному майданчику. Крім того, висновки містять основні завдання у вирішенні цієї проблеми та способи їх реалізації.

Ключові слова: будівлі та споруди, будівництво, відмова, аварія, руйнування будівель.

The phenomenon of risk is a subject of investigation for many both practitioners and theorists. However, only a few of them take these problems and try to formulate the problem within the framework of a procedure. In many publications, the authors deal with the problem of identification of hazards areas and their classification in different groups, among others, due to the source of origin, the impact size, etc. [1]. The number of papers proposing a methodology of quantifying of the risk and elaboration of procedures for the adoption of appropriate actions (so called "an appropriate strategy on risk response") is relatively lower [2].

Rather often objects of accidents are those buildings which are being reconstructed, or are in a condition of incomplete construction. For example, on March 5, 2003 in Moscow, Russia, designs of multipurpose shopping center at dismantle of brick diaphragms (poles) which were around staircases have collapsed. Violations of technology of works at dismantle of designs became the main reason for a building collapse. The accompanying reasons were a deviation from design decisions at construction of the dismantled part of the building (insufficient jamming of a horizontal two-leg beam, fastening anchors diameter of a beam to an embedded

part of a basic pillow made 12 mm instead of 25 mm, a tail part of this beam hadn't been reliably connected by welding to the main part of the beam, at the same time the imitating (false) seam had been executed [3].

On February 23, 2015 in Cherniakhovsk, Russia, a wall of the unfinished building which construction had been stopped for considerable term collapsed. As a result of an incident the 11-year-old teenager had died, during a collapse the plate fell onto the boy. The unfinished building was in a private property, after inspection of the scene the decision on initiation of legal proceedings was made [4].

Accidents cause not only substantial economic losses but can also lead to loss of life. In India 71 people, 25 of them were children, in the result of a collapse of the house which was in process of construction died. According to the Indian TV channel NDTV, the tragedy happened near the city of Mumbai, on April 6, 2013. Construction of the seven-storeyed residential building was conducted illegally, in the absence of the necessary documentation confirming safety of works on an object. As law enforcement officers explain in spite of the fact that the building has been built illegally, and her construction isn't finished, four floors were already populated with residents. Poor quality of construction and construction materials became a probable cause of accident. The collapse of a part of the building has entailed destruction of all design. Witnesses tell that the seven-storeyed building fell down [5] in 3-4 seconds as a house of cards.

The specified tendency was confirmed in December, 2012 in the city of Vagkholy where in the result of a collapse of the unfinished house 13 people died, and earlier, in September, the building in the city of Pune, the State of Maharashtra collapsed therefore six people died [6]. On July 29, 2016 in the city of Pune, India, the part of the building that was at a construction stage collapsed. As a result of an incident nine workers have died.

Accidents of this kind arise around the world. For example, on March 29, 2013 in the city of Dar es Salaam, Tanzania, the 12-storeyed unfinished building fell down therefore 36 people have died. In relation to owners and construction contractors criminal proceedings are conducted during which nine people have already been arrested [5].

More developed countries, in particular, Russia aren't an exception there. So, on August 15, 2015 in the center of Moscow a new building collapsed. As a result of a collapse of overlappings between the first and second floors, two persons were injured [7].

In Surgut the new building collapsed on March 6, 2014. Overlapping between the fourth and fifth floors has collapsed. Under blockages rescuers have found three people, two of them were dead. Despite it, media haven't given any information on discovery of criminal consequence, or about the beginning of work of commission of inquiry at accident scene [8].

Considering emergence of accidents depending on the country where they have occurred (chart 1), it is possible to draw a conclusion that most of accidents of this kind have occurred in India and Egypt. Thirst of a profit of customers of construction and its performers, violation of safety standards and illegal construction became the main reasons of incidents. Therefore, dynamics of accidents in construction, and the main thing, economic and not economic consequences of such accidents, grow in proportion to economic instability of a country.

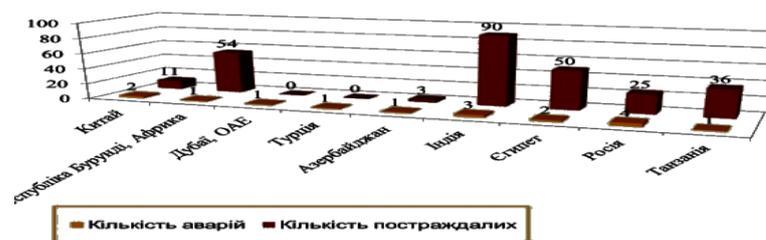


Figure 1 – Statistics of accidents at construction depending on the country where it has happened

On the basis of the shown material, it is possible to make certain conclusions concerning

types and reasons of accidents at construction and put buildings into operation. It is possible to consider that most of the accidents of this kind have a human factor as the reason, namely:

- saving of means which means involvement of unskilled labor, saving in quality of materials;
- Non-compliance with construction norms at construction;
- Negligence in construction of an object;
- Illegality of conducting construction;
- Discrepancy of the project documentation;
- Mistakes at design;
- Mistakes at construction of a building.

The listed above examples confirm that accidents of new buildings are an essential problem of the construction sphere. At the same time the reasons of these accidents are rather widespread, considering corruption of supervisory authorities and customers of construction.

It also should be noted that the level and quality of construction depend directly on the level of prosperity of the country in which it is conducted. The more economically unstable a country is the more often there are incidents of this kind where the major role is played not by the value of human life, but the financial benefit from the project.

The main task in the solution of this problem is to predict the possibility of accident in order to prevent it. Such result, in our opinion, can be achieved in several ways:

- high quality training of various levels and directions;
- improvement of the control system of conducting construction;
- introduction to calculation of designs not only by modelling of an emergency from the economic point of view, but also to consider the matter from noneconomic side.

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