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Pichugin Sergiy, *Ph.D., professor,*
ORCID: 0000-8505-2130, e-mail: pichugin.sf@gmail.com
Klochko Lina, *Post-graduate student,*
ORCID: 0000-0002-6064-2887, e-mail: lina.dmitrenko@gmail.com
National University "Yuri Kondratyuk Poltava Polytechnic"

ALGORITHM FOR MODELING POSSIBLE FAILURES AT THE CONSTRUCTION SITE

Abstract. *This work is devoted to the prerequisites, development stages and the results of creating an algorithm for modeling the accident possibility at a construction site. The main analysis results of statistical processing of the buildings and structures accidents database are considered. Based on the collected information a possible variant of the algorithm was developed with taking into account the most probable risks and failures at the construction site. Each level of algorithm implementation is presented depending on the building type, structure operation stage and the modelling accident type.*

Keywords: *statistics, modelling, accident, building, probability of an accident, destruction, consequences, systematization, algorithm.*

Пічугін Сергій*, д.т.н., професор*
ORCID: 0000-8505-2130, e-mail: pichugin.sf@gmail.com
Клочко Ліна, *аспірантка,*
ORCID: 0000-0002-6064-2887, e-mail: lina.dmitrenko@gmail.com
Національний університет «Полтавська політехніка імені Юрія Кондратюка»

АЛГОРИТМ МОДЕЛЮВАННЯ МОЖЛИВИХ ВІДМОВ НА БУДІВЕЛЬНОМУ ОБ'ЄКТІ

Анотація. *Дана робота присвячення передумовам, етапам розробки та результатам створення алгоритму моделювання можливості виникнення аварії на будівельному об'єкті. Розглянуті основні результати статистичної обробки бази даних аварій будівель та споруд. На основі проведеного аналізу та отриманої інформації було розроблено можливий варіант алгоритму, із врахуванням найбільш вірогідних ризиків та відмов на будівельному об'єкті залежно від типу будівлі, етапу роботи конструкції та виду аварії, що моделюється.*

Keywords: *статистика, моделювання, аварія, будівля, імовірність аварії, руйнування, наслідки, систематизація, алгоритм.*

At the present stage of building industry development, issues of further progressive destruction study have been raised with increased frequency up. Nowadays, this term is a topic for a lot of research and scientific works. Each developed country presents the results of such research at world-famous universities with the one main purpose of improving the construction site reliability.

Based on the tragic experience of accidents such as Seveso, Italy [1], directives, codes and laws on methods of conducting hazard and performance analysis, such as HAZOP [2], were developed and implemented. At present, such methods and algorithms need to be implemented in civil engineering as well. This is evidenced by the realities of construction projects, their uniqueness, scale and use of the latest architectural forms and materials, should ensure the structures reliability as much as possible.

Thus, in the case of scientific research, the issue of developing an algorithm that could give design engineers a clear methodology for modeling the possible accident occurrence at a construction site has been raised and resolved.

The algorithm is based on the statistical material systematization and processing of buildings and structures accidents in 2000-2022. Thus, it is possible to distinguish three main stages at which accidents occur: design and acceptance in operation, operation and a big age of the building. These stages presented in Fig.1 are the basis of the algorithm and have subclasses of the accidents' distribution by cause. For systematic modeling, all errors types have been marked R_1-R_5 for each type of building (Fig.1).

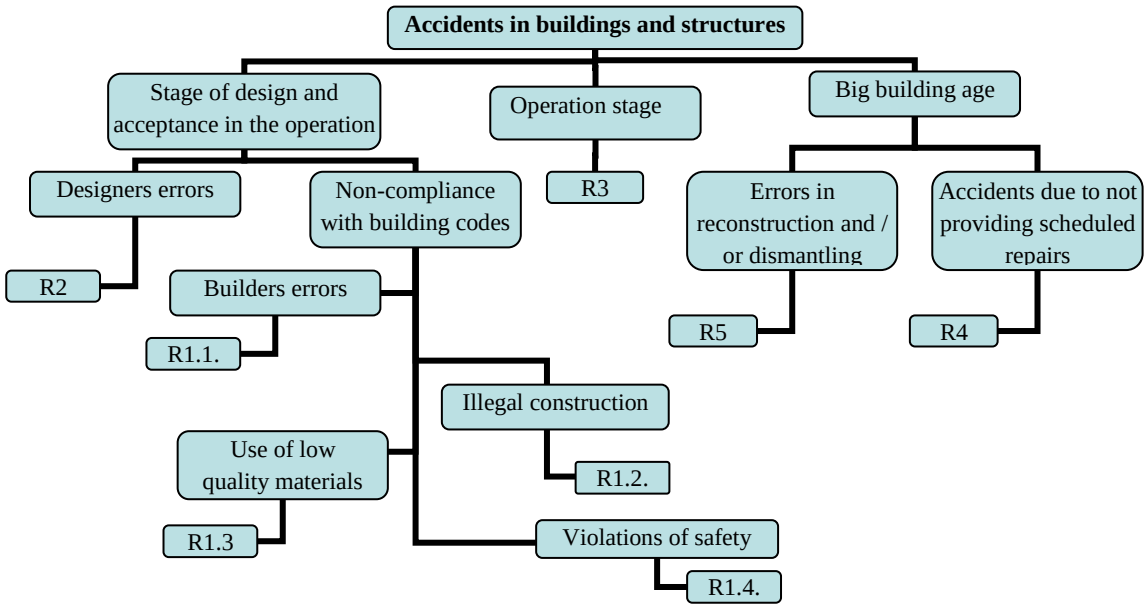

Figure 1 – Block diagram of buildings and structures accidents types to perform the algorithm for modeling the possible accident occurrence at a construction site

This algorithm should be used by design engineers at the stage of design documentation development for the construction site.

The buildings included in this algorithm can and must be supplemented based on the practice of modern construction in Ukraine (special design solutions, materials, construction systems, etc.).

The purpose of the algorithm is to study the progressive destruction possibility at the construction site, to identify the most vulnerable areas of the project and general verification, which avoids mechanical errors in the calculations. The result of the modelling is the conclusions of the engineer based on the visualization of the building structure accident.

To perform the algorithm, it is necessary to use three-dimensional visualization of the designed building using a software package that meets the project requirements.

Based on the analysis, you can make changes to the project if necessary. After that, the condition of re-checking for individual points of the algorithm is mandatory.

The created algorithm allows conducting a complete building analysis, but also takes into account the level of significance and complexity of the frame, thus highlighting the main priority stages. This system allows engineers to earn only the necessary models of destruction, without considering the minor failures of structures.

The algorithm is presented in the form of a sequence depending on the level (stage) of its implementation. This gradation allows design engineers to perform only the necessary modeling stages, without overloading the project with additional calculations. Each stage of modeling

depends on the type of building being designed and the construction complexity. Thus, the first modeling stage is the primary and basic for all structure's types. Execution of all subsequent modeling stages are based on the level of designed building complexity, the frame type and individual design features.

It should be noted that depending on the structure type, the first modeling stage is different. This approach is due to the results of statistical information processing. The distribution by levels (stages) from 1 to 3 is presented in decreasing order of this accident type probability.

Accident modeling types are presented based on many years of research and analysis of the buildings and structures accidents causes all around the world, different frames types and class of responsibility [3,4,5], which is the main factor in developing this methodology.

Conclusions. The obtained algorithm is quite practical for further use and aims to implement it in the project documentation. The implementation of such an algorithm will allow engineers to check the progressive destruction possibility on the construction site most effectively, as the algorithm focuses on the development of the most vulnerable areas of different building frames.

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