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Building Information Modelling – 4D Modelling Technology on the Example of the Reconstruction Stairwell

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Abstract

Building Information Modelling (BIM) is a process that involves creating, generating, managing and using a digital representations of physical and functional characteristics of building. The use of the term 4D is intended to refer to the fourth dimension: time, i.e. 4D is 3D + schedule (time). The role of 4D BIM is to add a new dimension to 3D CAD or solid modelling—that is, 4D BIM adds a fourth dimension of Time to the 3D Space of CAD solid modelling on computer. In the paper show the project entirely made using 4D BIM

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Keywords: Building Information Modelling (BIM); 3D design; CAD; architectural engineering and construction (AEC) software

1. Introduction

The main goal of this paper is investigation of the BIM programs' abilities in regards to projects with various design options and with necessity to phase tasks.

The effect of this work is three-dimensional model of a staircase, with a few design options, "compatible" with BIM. On the base of this model, building documentation is created.

On the example of the staircase, the survey of Autodesk Revit 2015's effectiveness of creation of project with various design options will be undertaken. There will also be examined the possibility to exchange data with some other programs (e.g. Autodesk Navisworks). One section of this paper will also shortly introduce the idea of BIM – its foundations and terminology.

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2. Description of existing building and its documentation

2.1. Provided documentation

The provided documentation of the existing building consists of 2D architectural plans and one section of the staircase. All of them are created in traditional CAD 2D work system.

2.2. Description of existing building and its planned modernization

The effectiveness of the program will be examined on the example of a few decades old building. The access to each apartment is provided by only one staircase, which will be crucial in the planning of its extension.
The building consists of 7 floors – cellar, 5 residential storeys and attic. The cellar's height is 268cm. Other floors are about 335cm high. Fig. 1 demonstrates existing geometry of the stairwell.

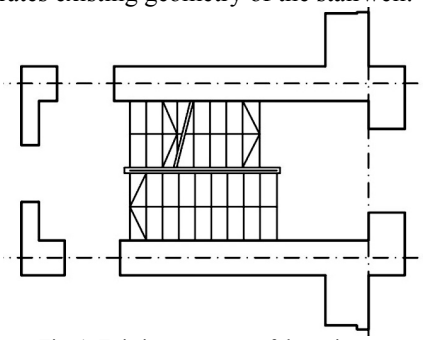

Fig. 1. Existing geometry of the staircase.

The aim of the modernisation is to add the elevator to the stairwell. There are 3 different conceptions of the upgrade:

- Building the elevator's shaft outside of the staircase, see Fig. 2.
- Building the shaft inside and moving the stairs out, see Fig. 3.
- Creating the lift at the place of one of the stairs' run and building additional stairs outside, see Fig. 4.

The first option will be the cheapest one, but the usefulness is limited because the elevator would have to stop at the mid-floors.
The second option provides better usefulness but the construction would be much more inconvenient. In order to provide the access to the flats there is necessity to phase the tasks very carefully.
The third option seems to be optimal. Its usefulness is slightly worse than the second one but its construction demands just the same inconvenience for the residents as the first option.

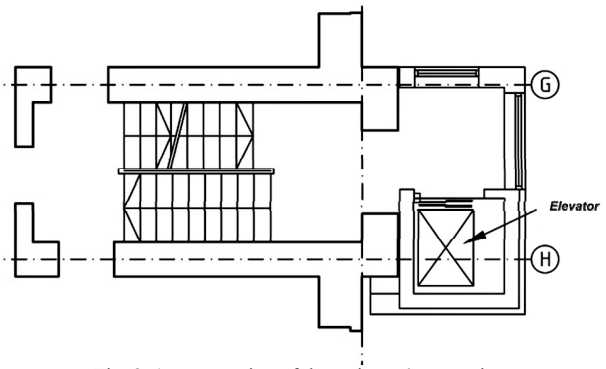

Fig. 2. 1st conception of the staircase's extension.

Important aspect of this work is to clearly present (with 3D visualisation), to all people concerned, the main features of all options without forcing anybody to read traditional documentation.