

Structural and Physical Aspects of Construction Engineering

Masonry Building - Influence of Change of Load on Its DefectsOlga Ivankova^{a,*}, Lenka Konecna^a

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Abstract

This paper deals with the investigation of defects of three-story masonry building due to improper design and infringement of the technological procedures during the construction of building. Various cracks in load-bearing masonry walls and also the cracks in masonry partition walls are significant defects. The main reason is usually improper design of load-bearing elements of the structure (dimensions of masonry walls and partition walls, reinforcement or thickness of RC ceilings, bracing of the whole structure, straining beams) and a non-uniform settlement of building. Therefore, a plate of typical floor and non-uniform settlement of selected building were assessed in this paper. Description of the structure, applied loads, considered soil-structure interaction in the computing model, and examples from the similar structures are mentioned. Obtained results are analyzed and recommendations in similar cases for planning engineers and site managers are mentioned.

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Keywords: masonry building; defects; design; partition wall; assessment of the structure; RC plate; settlement of a structure

1. Introduction

Large masonry structures are very sensitive to some kinds of loads, e.g. temperature, non-uniform settlement, tension and in the case of partition walls also large pressure. Therefore, it is very important to pay attention to adequate design [1-4] and observance of technological procedures suggested by producer of bricks. Effects of loads applied on the structure can be reduced by using the dilatations in load-bearing structures and foundations. Masonry buildings are also sensitive to large seismic loads (Slovakia belongs to low risk area), therefore, this was not discussed in this paper.

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More information can be found in [5,6]. In detailed assessment of masonry structures, suitable modeling of connections between the bricks has to be used [7-11].

Nomenclature

l_{eff}	effective distance [m]
ϕ	diameter of reinforcement [m]
c	cover of reinforcement [m]
h_d	thickness of plate [m]
h_0	equivalent height of the cross-section [m]
RH	relative humidity [%]
t_0	age of the concrete in time of beginning of the loading [days]
$\varphi(\infty, t_0)$	coefficient of creep [-]
β	coefficient of the long-term effect of applied quasi-permanent load [-]
ξ	distribution coefficient [-]
h_{eq}	equivalent height of the plate [m]
k_t	empirical distribution coefficient depending on the time of action of the load on the structure [-]
k_1	coefficient of influence of surface of reinforcement [-]
k_2	coefficient of distribution of stresses in reinforcement [-]
μ_i	roof shape coefficient [-]
C_e	exposition coefficient [-]
C_t	temperature coefficient [-]
k	modulus of subgrade reaction [kN/m ³]
ν	Poisson ratio [-]
E_{def}	modulus of soil deformation [kPa]
γ_F	partial coefficient of the load [-]
ψ_2	coefficient of long-term component of variable load for quasi-permanent loads [-]

2. Description of the structure

Three-story masonry building (used as a sanatorium) consisting of two dilatation blocks with dimensions of (60×20) m and (15×21) m, Fig. 1a, was considered. Ground plan of the building had the shape of asymmetric letter “T”. Originally, another building was built at this place. It was torn down and only old strip foundation was left (in this case, this was not a good decision, because it caused a non-uniform settlement of structure).

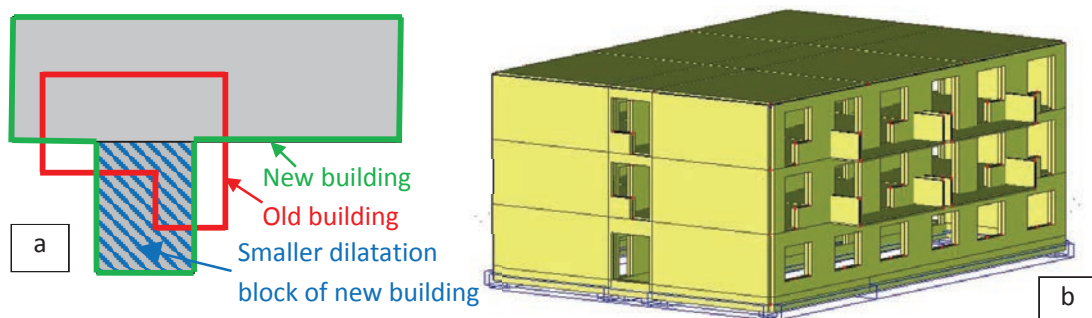


Fig. 1. (a) ground plan of new building; (b) 3D model of dilatation block.

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