MONITORING OF VERTICAL SHIFT OF HOLY-TRINITY CHURCH IN ŽILINA

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1 Introduction

In current times many spacious, deeply rooted and expensive buildings are being built by which the statics of the nearby buildings is being forgotten. The aim of this article is to describe the vertical shifts of the Holy Trinity Church in Žilina caused by digging a foundation base hole of big dimensions in its vicinity.

The building of a shopping centre in the vicinity of the church began in november 2008 by digging the foundation base hole. In the end of January the old splits and tears appeared as well as new splits and tears on the floor and the walls of the church (Picture 1). The splits and tears were probably created by the influence of the construction of a shopping centre which caused an unfavourable change on the subbase of the church. Therefore it was decided to make the geodetical measurements of the height changes of the church to find out the real size of the sinking. The bearing of the basic phase began 2 months after digging out the foundation base. By this time there were already visible tears and splits on the church building.

2 The measurement of the vertical traverses of the building

To measure we chose the method of exact nivelation using the gadget Leica 3003 with invar nivelation batten with coded scale. Totally 20 points were monitored, 11 of them on the church itself, 4 points on the balustrade and 5 points on the adjacent pavement. The stabilizing of the points on the church and on the adjacent pavement was done with nail signs and on the balustrade the screw bolts of the public lightning were used. The whole measurement was connected to the net of four agreed points. These points were chosen to be stable concerning the height and not to be influenced by the construction site.

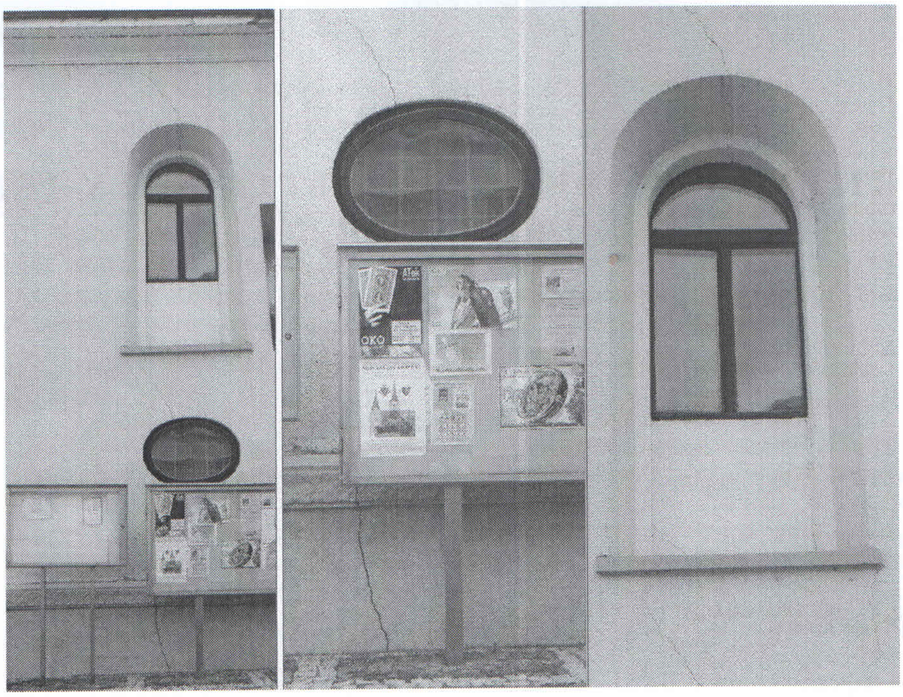

Figure 1: The splits and tears on the church

The basic height measurement was carried out on February 17th 2009, when there already were visible fractures on the walls of the church. The first phase was measured on 1st April 2009, the second on 18th August 2009, the third on 26th November 2009 and the fourth on 12th January 2010. The results were evaluated in relation to the basic phase.

The distribution of the observed points is to be seen at Picture 2. The pavement is on the level of the terrain sloping downwards from the edge of the houses surrounding the Marianske namestie (Marian square) and is represented by the points 300, 301, 302. 303, 304. The balustrade is the horizontal courtyard of the church and because of its height it is separated from the adjacent pavement and stabilized by the points 101, 102, 103, 104. The adjacent side of the church to the construction hole is represented by the points 201, 202, 203, 204, 205 and the outlying side of the church - 200, 199, 196 and its front side by the points 206, 196, 197. These points mark the ground plan of the church which base plate is on the same level as the balustrade.

Figure 2: The observation points

3 Interpretation of the vertical traverses of the object

The greatest vertical traverse was observed at the point 206 located closest to the base hole, approximately 15 metres while the depth of the hole is similar. The decline of the point also grew after constructing the underground garages up to the level of the terrain and to 12th January 2010 the result of a sinking of 8.27 milimetrs was noticed. – Picture 3.

An interesting process (course) was allocated of the height changes the following points have – 300, 301, 302, 303, 304, where the point 300 is located in the original build up area, approximately in the middle of the preserved object and the lower terrace of the balustrade. It shows an increase from the beginning of the measurements as if the zone of the sinking of the original slope in the neighbourhood of the construction site would cause the lift of the undisturbed and unlimited surface of the pavement, the building and the supportive wall of the balustrade.

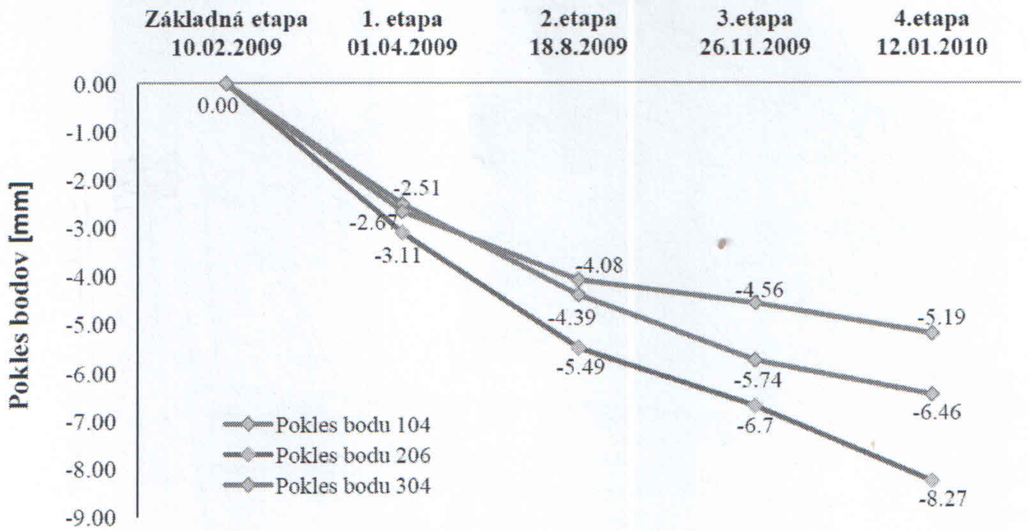

Figure 3: Shifts to the points

The uneven development of the height changes is recorded also at points 201, 202, 203, 204, 205, 206. This process of sinking is dependant on the distance of the point to the construction site. The point 201 has the longest distance therefore it shows the smallest sinking. The gradual approximation of the points to the base stone (basement) of the building manifests the greatest sinking.

4 Conclusion

The presented results of measurement account for significant traverses on the observed points. During the course of 11 months the point 206 recorded as much as 8.27 mm. On the contrary the point 300 which is a part of the pavement showed lift. The traverses were also manifestated after constructing underground garages up to the level of the ground, but also when constructing above ground garages. The measurement was finished in the middle of January 2010 before the inspection of the building.

The results of the geodetic measurements were the background to solve geodetic problems of the construction site and were used to evaluate the stability of the church itself.

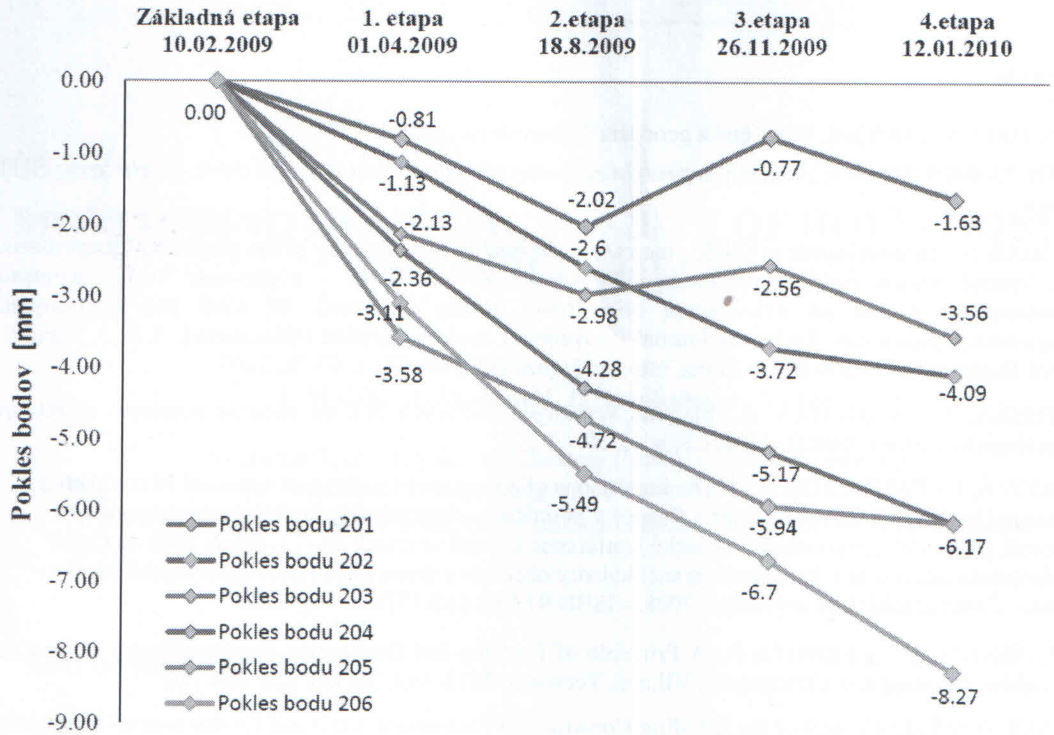

Figure 5: Shifts of points located on the Church

The geodetic methods of measuring the traverses and re-shaping the construction objects should be an indespensable part of monitoring construction objects. There is a possibility of applying in addition to the mentioned methods, the use of 3D laser scanning and ground photogrametry. Based on the results of geodetic measurings it is possible to strike on time, adapt the measures which prevent negative influences or damages and increased costs for the construction.

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