

A study of the historical construction technology of bell towers in Cyprus

Margarita L. Petrou* and Dimos C. Charmpis†

* Department of Civil and Environmental Engineering
University of Cyprus
75 Kallipoleos Str., P.O. Box 20537, 1678 Nicosia, Cyprus
Email: mpetro03@ucy.ac.cy

† Department of Civil and Environmental Engineering
University of Cyprus
75 Kallipoleos Str., P.O. Box 20537, 1678 Nicosia, Cyprus
Email: charmpis@ucy.ac.cy

ABSTRACT

Bells are idiophones instruments used since antiquity for various purposes. The wide use of bells led to the development of a slender structure – the bell tower. Christian ecclesiastical architecture incorporated bell towers about one thousand years ago and until today they are considered an integral part of a church. In Cyprus, the construction of bell towers only began at the mid-19th century, after the lift of the bell-rigging ban, imposed during the Ottoman rule. Thereafter, a vast number of bell towers were erected in pre-existing churches of various architectural styles. Also, new churches – built from then on – were designed with one or two bell towers attached to the main body.

Until 1930s, when the use of reinforced concrete was introduced in the construction industry, the bell towers were built mainly with stone masonry. A typical bell tower of that period would have four levels and consist by the following parts: a solid base, a shaft, a belfry, and a roof of a decorative canopy. Most of those bell towers demonstrate a heavy carved decoration following the patterns of the Cypriot neo-gothic style – the prevailing architectural style from the mid-19th century until the beginning of the 20th century.

Unreinforced masonry structures are vulnerable to seismic actions due to their limited capacity to sustain tensile stresses. Slender unreinforced masonry structures are even more vulnerable due to the great displacement caused during an earthquake. The installation of iron ties is a technique often applied to improve the overall behavior of the structure and help resist seismic actions. In Cyprus, which is a highly seismic area, the use of iron ties is encountered in almost every bell tower. Four iron ties – two in vertical and two in traverse direction – are installed to stabilize the shaft and the belfry.

The current study aims to explore and record the historical background of the traditional construction practice of the bell towers through literature review. Furthermore, the case study of such a bell tower in a village of Cyprus, which was stroke by an earthquake in 2016 and partially collapsed, led to conclusions regarding the effectiveness of the iron ties installed on bell towers.

REFERENCES

- [1] M. Kiessel and A. Tozan, “Orthodox Church Architecture in the Northern Districts of Cyprus from the mid-19th Century to 1974”, *Prostor.*, pp. 160–173, (2014).
- [2] M. Petrou and D. Charmpis, “Iron Ties Originally Anchored into Masonry as a Historical Construction Technology – Case Study: A Church in Cyprus,” in *Structural Analysis of Historical Constructions*, vol. 18, pp. 153–161, (2019).