

STRUCTURAL SAFETY SECRET OF “WALLED OBELISK” MONUMENT FROM THE TENTH CENTURY AND ITS SIMULATED MODEL FOR APPLICATIONS

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SUMMARY

"Örme Dikilitaş" – "Walled Obelisk" (Column of Constantine Porphyrogenetus) is a monument which is a 32.77 meter rough-cut limestone (with Horasan mortar between it) getting thinner to the four-sided hill with mean area of 2x2m. This monument is placed in one of the very sensitive seismic regions of the world-Istanbul -and from the construction date (approximately tenth century) until now it has been withstanding against all the strong earthquake actions. The system is modeled by the finite element method in nonlinear-contact studies under strong earthquake action in time and frequency domain respectively. The mathematical model of the monument has been obtained and investigated. It has been shown that in the obtained model support of the structure undertake a "Nonlinear Frictional Responsive Natural Seismic Isolator-NFRNSI" and show "similar" behavior to that of the current lead-core rubber bearings isolator (LRB-Lead Rubber Bearings). The total height of the NFRNSI is 3.44 m. Structure part which is act as NFRNSI consists of three step marble stone and massive marble stone (enablement) that form four sliding surfaces using Horasan mortar. Three-storey steps and massive marble stone that form four sliding surfaces using Horasan mortar appears as a "similar" function with LRB combined with layers of steel plates and hard rubber. Massive marble stone appears as a "similar" function with LRB lead cylinder core. NFRNSI shows fully frictional behavior different than the LRB and keeps upper part of the monument around the equilibrium (balance) state by the earthquake excitation which also varies around zero-equilibrium (balance) state. During the comparison of the mentioned isolators "similar" expression is used mainly in this meaning. For the comparison, the used fixed base model of the monument cannot reciprocate the recovered earthquake actions during its lifetime (1000 years). That has been shown comparatively. Discovered and presented model of the "Nonlinear Frictional Responsive Natural Seismic Isolator-NFRNSI" passed through historical experience (in this monument's example 1000 years), easy for construction, moreover not requiring any special maintenance, and can be usable also in today's structures in seismic regions.