SEISMIC SHAKE-TABLE TESTING OF BASE-ISOLATED STRUCTURES-IZIIS EXPERIENCE

Ljubomir TASHKOV¹, Lidija KRSTEVSKA²

The Institute of Earthquake Engineering and Engineering Seismology (IZIIS) has a five degree of freedom seismic shake-table, 5/5m at the base, with payload of 40 tons, MTS product. In the past 30 years many models in reduced scale 1/2-1/10 have been tested. Considering the base-isolated structures, four models with different base-isolation systems were tested: two churches and two liquid storage tanks in scale 1/3. This paper presents the testing methodology, obtained results and discussion about the efficiency of the tested systems.

CASE STUDY NO. 1: SHAKE-TABLE TEST OF 1/2.75 SCALED MODEL OF ST. NIKITA CHURCH BASE-ISOLATED BY LAMINATED RUBBER BEARINGS

St. Nikita church near Skopje

Model of the church with rubber bearings and steel stoppers

Response of the St. Nikita church model rubber bearings

Response of the St. Nikita church base-isolated by model fixed to the base.

¹ Professor PhD , Institute of Earthquake Engineering and Engineering Seismology, University” Ss. Cyril and Methodius, Skopje, e-mail : taskov@pluto.iziis.ukim.edu.mk
² Professor PhD , Institute of Earthquake Engineering and Engineering Seismology, University” Ss. Cyril and Methodius, Skopje, e-mail : lidija@pluto.iziis.ukim.edu.mk
CASE STUDY NO 2: SHAKE-TABLE TEST OF 1/3.5 SCALED MODEL OF ST. NICHOLAS CHURCH, BASE ISOLATED WITH FLOATING-SLIDING SYSTEM “ALSC”

Original St Nicholas church and its model to the scale of 1/3.5

Response of the St. Nicholas church model base-isolated by ALSC system.

Response of the St. Nicholas church model fixed to base

CASE STUDY NO 3 – BASE-ISOLATED RESERVOIR WITH ALSC SLIDING SYSTEM

Model of a reservoir base-isolated by ALSC system

Instrumentation set-up

Response of reservoir isolated by ALSC under harmonic excitation

Comparative presentation of reservoir system isolated by ALSC system and fixed to the base
CASE STUDY NO 4 – BASE-ISOLATED RESERVOIR WITH HIGH STRENGTH RUBBER BEARINGS

Fig. 5.1. Model of a reservoir base-isolated with high strength rubber bearings.

Comparison between hard rubber, soft rubber and ALSC base-isolation systems-earthquake excitation

CONCLUSIONS

The presented techniques of base isolation showed different effectiveness. Based on the performed experimental investigation, the following conclusions can be drawn:

The Study Case 1: Base isolation with laminated rubber isolators applied to the model of the St. Nikita church shows a limited level of effectiveness up to input acceleration of 0.5g.

The Study Case 2: ALSC floating-sliding base isolation system applied to the model of the St. Nicholas Church shows much better effectiveness than the laminated rubber isolators, preventing damage to the model up to input acceleration of 1.5 g.

The Study Case 3: Base isolation with high strength rubber isolators applied to the reservoir model shows that base isolators with hard rubber do not have any isolation effect, while soft rubber shows an effectiveness for excitation frequencies higher than 3.0 Hz.

The Study Case 4: Base isolation with ALSC system applied to the model of reservoir shows very effective reduction of the response during dynamic excitation, preventing the damage to the model and providing almost constant and effective base-isolation within a broad frequency and amplitude range of excitation.

REFERENCES
