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SOIL PROFILES AND SEISMIC LOADING

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The contribution estimates different geotechnical profiles of site condition change and their influences on the computed seismic response spectra and time histories final values and forms applying on the seismic structures loading. The mentioned problems methodics attitude solution is based on the computed seismic motion parameters.

Key words: *geotechnical profiles, seismic response spectra, accelerogram*

Profili tla i seizmičko opterećenje. Rad daje doprinos procjenjivanju utjecaja promijenjenih uvjeta različitih geotehničkih profila na radilištu i njihov utjecaj na spektre izračunatih seizmičkih odgovora i povijesni utjecaj na konačne vrijednosti i oblike koji se primjenjuju na punjenje seizmičkih konstrukcija. Metodičko rješenje spomenutih problema se zasniva na izračunatim parametrima seizmičkog kretanja.

Ključne riječi: *geotehnički profili, spektri seizmičkih odgovora, akcelogram*

INTRODUCTION

During seismic event high buildings, big dams and social structures represent considerable social and environmental hazard and economic losses. The structures protection is applied by means of seismic loading computation. Geological and geo-technical site studies for loading computation parameters play essential role [1]. Large part of the territory of Slovakia is in direct seismogenic zones active influences. There are earthquake zones of Komarno, Pernek, Dobrá voda, Žilina and others [2, 3]. Insufficient knowledge of their accumulation and release of earthquake energy mechanism as well as prediction of methods ambiguity must be satisfactory motivation for seismic buildings load application. Seismic loading is the risk issue solution in engineering and building practice. Although big earthquake damages were not occurred in history of Slovakia this problem remained actual. New seismic records and seismologists and tectonophysicall stresses accumulation prediction affirm the earthquake possible occurrence [4, 5].

SEISMIC MOTION PARAMETERS COMPUTATION PROBLEMS IN DIFFERENT SITE CONDITIONS

The different soil profiles influences on the final seismic response spectra and time histories shape and values are analysed.

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The possible rock environments parameters changes on the seismic response spectra final form and size are described.

Presented applied methodics attitude to the mentioned problems solution, get along the seismic motion parameters computation. This solution attitude provides seismic motion parameters oncoming to research locality real geological and geotechnical conditions.

Seismic soil motion time history is sensitive in input data accuracy as structural place, seismic P and S waves' velocity, modulus and layered medium petrographic composition. Input parameters determination vagueness causes an influence on computed seismic response spectra final product. This inaccuracy causes shaped and numeric spectra changes.

The geotechnical profile petrographic composition changes as well as different medium layers thicknesses influence acceleration values and seismic response spectra form by noticeable way.

Clay and sand profile in comparison with solid rock profile behave in other way to the generated ondulation. The shear waves velocity, elastic modulus and density soil and rock value differences as well as medium damping play essential role in these changes. The clay and solid rock differences in seismic motion damping are expressive.

The seismic response spectra and seismic motion time histories computation in combined soil and solid rock media is more complicated. There are frequent environments event in Slovakia. These changes, which influence often part of seismic motion frequency spectra only make problems to engineers, because in digital form they are used as input parameters for the building trade software.

Layers thickness analysis of modelled geological medium and propagated seismic waves wavelenght are important for the computated seismic response spectra shapes. Thin

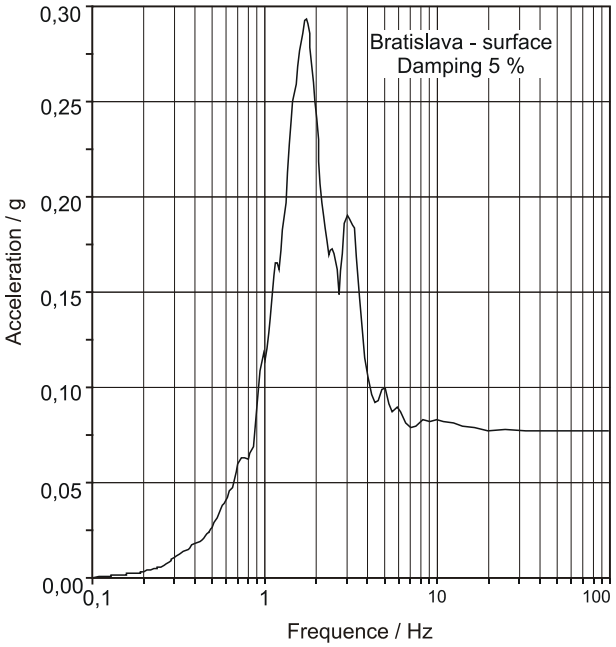

Figure 1. **Seismic response spectra**
Slika 1. **Seizmički spektri odgovora**

clay and sandy clay layers presence and low velocity and shear modulus existence is necessary take into consideration in media modeling and real models testing. Their presence can influence response spectra level and shapes and time histories values by essential way. On the other hand thin clay and sandy clay layers can modifier seismic response

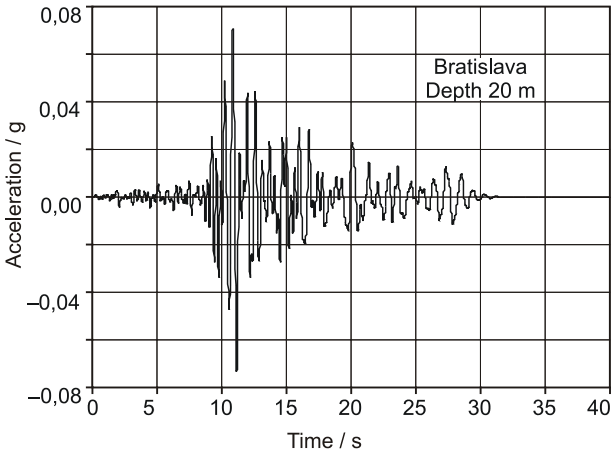

Figure 2. **Accelerogram**
Slika 2. **Akcelerogram**

spectra shape, which is very important parameter for engineers. That's why the seismic motion computed parameters are necessary for correct seismic loading, applied in these profiles. Complicated shapes spectra are filtrated by special methods and all computed seismic response spectra real specifications are simultaneously take into consideration for prospecting locality. So real geological media modelling and testing in relation with the time histories and seismic response spectra computation is the most important stage in seismic load computations.

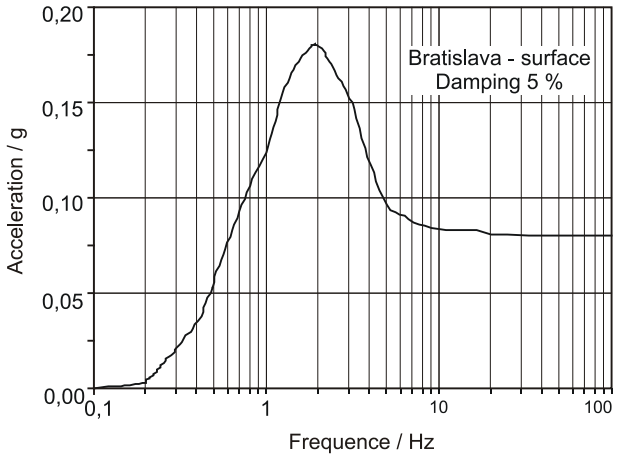

Figure 3. **Design seismic response spectra**
Slika 3. **Programirani spektri seizmičkog odgovora**

After seismic shock, building function and integrity maintenance demand the real geologic properties modeling application for his seismic loading computation. The seismic loading input parameters are the geological, geo-

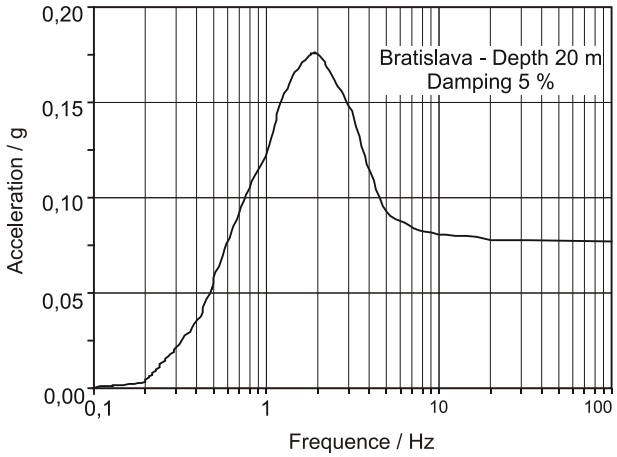

Figure 4. **Design seismic response spectra**
Slika 4. **Programirani spektri seizmičkog odgovora**

technical, geophysical, engineering geological and drilling exploration analysis products. Exact synthesis of these results can guarantee the exact input parameters, output values high precision and authenticity and good quality digital output data for engineer's software.

Figures represents computed and designed seismic response spectra and time histories. Computed surface

seismic response spectra and seismic motion time history, as real medium modelling rock environment seismic response results (Figures 1., 2.), are exact seismic loading computation input parameters.

The spectra are necessary to smooth out for seismic loading application (Figures 3., 4.). Smoothed spectra are directly applied in designer's software. Seismic model-

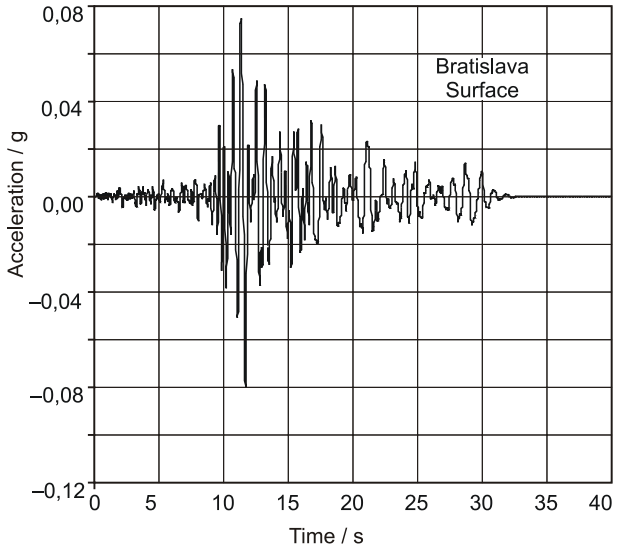

Figure 5. **Accelerogram**
Slika 5. **Akcelerogram**

ling outputs digital form, simplify architect's work and permit obtained results reproducing and filtering under the architect dispositions.

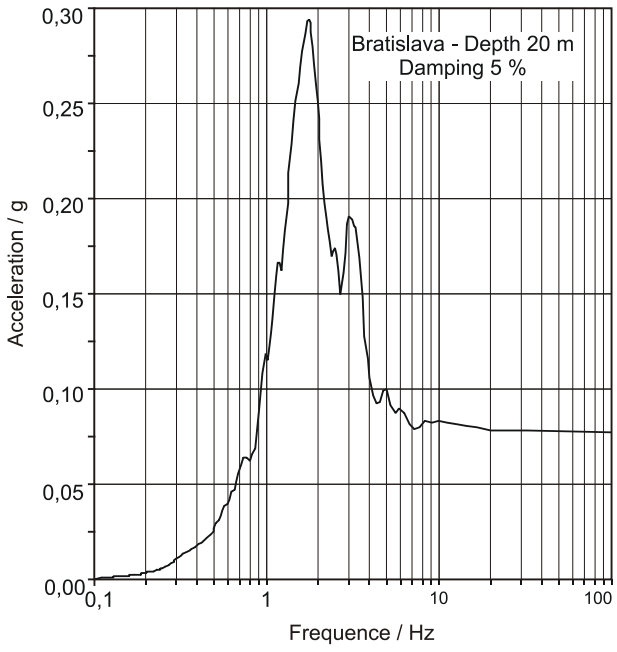

Figure 6. **Seismic response spectra**
Slika 6. **Seizmički spektri odgovora**

On the Figures 1., 3. and 6., 4., the same locality computed and designed surface and depth seismic response spectra are presented.

On Figures 5. and 6. the surface and depth time histories are presented and represent seismic motion, which would be occurred during seismic event.

Our computation and modelation methodises way based on the professional software, bought in NISEE, University of California, Berkeley in USA, permit to compute acceleration values and seismic response spectra, velocity spectra and displacement curves on surface as well as in different depth level. Software allows us to make these computations at 2D and 3D modification in interaction with touched structures.

CONCLUSION

The local subsoil properties includes seismic waves velocities, soil and rock densities, elastic modulus, shear and longitudinal waves quality parameters and damping, have a principal influence on computed acceleration values form and seismic response spectra level.

These site conditions are changed from place to place. Therefore, time histories and seismic response spectra computation modelation is necessary to realise for each locality and every structure.

For obtaining credible modelation results is necessary to know input site parameters as well as each geological structure exact evaluation and specification. For obtaining credible design seismic response spectra is necessary to have models testing experiences and seismic parameters motion precise estimation.

The soil profile parameters, themselves, obtained with high accuracy from different prospecting methods, don't guarantee correct real geotechnical model construction and testing. Seismicity and macroseismic parameters knowledge can increase mentioned procedures precision.

Following the earthquake the legislature must realize the seismic hazards mapping act to assist local authorities in minimizing future osses due to liquefaction, earthquake-induced landslides, strong ground shaking and other seismic hazards.

For architecture use it is necessary to designate seismic hazard zones in regulating the new construction seismic safety. Prior to certain projects kinds development within seismic hazard zones local governments must require site-specific seismic hazards evaluations to validate the hazard level at the site and make appropriate recommendations for mitigation. The information contained in seismic hazard zone maps must also be incorporated into future code revisions.

Serious earthquake damages numerous cases demonstrate that investor´s money economizing and seismic loading lay solution can cause catastrophic consequences in few seconds.

REFERENCES

[1] Z. Kalab, J. Knejzlik: Seismicity monitoring of eastern part of the bohemian massif using solitary stations of Institue of geonics Transactions of the VSB - Technical university of Ostrava, Civil engineering series Czech Republic (2003), 119 - 129.

[2] V. Janotka, J. Viskup: An appraisal of seismicity of the area of the G/N Project. Counter - Memorial of the Slovak republic. Part I. Annexes. Scientific evaluation of the Gabčikovo - Nagymaros Barrage system and variant C. International Court of Justice. Haag, Netherlands (1994), 183 - 197.

[3] V. Janotka, J. Viskup: Seismic hazard in the area of the G/N project with special regard to the postulated Györ-Becske seismogenic zone Counter-Memorial of the Slovak republic. Part II. Annexes. Scientific evaluation of the Gabčikovo-Nagymaros Barrage system and variant C. International Court of Justice. Haag, Netherlands, (1995), 198 - 211.

[4] J.Viskup, V. Janotka: Application of the map of the engineering geological zoning in the seismic microzoning. 7th International Congres in Portugal, International association of Engineering Geology. Balkema, Rotterdam, 2 (1994), 2233 - 2238.

[5] J. Viskup, V. Janotka: Engineering geological senzoning and seismic microzoning. Proceedings of the 2nd International Conference on Seismology and Earthquake Engineering. (SEE-2), IIEES Tehran, I. R. Iran, 1 (1995).