



110 Years of engineering seismology and earthquake engineering in Croatia

Marijan Herak

*Full professor, University of Zagreb, Faculty of Science, Department of Geophysics, Zagreb, Croatia,
mherak@gfz.hr*

Abstract

The lecture will give a concise overview of development of the disciplines of engineering seismology (and to a lesser extent, also earthquake engineering) in Croatia from a perspective of a seismologist. A significant part of the talk is dedicated to the role that Andrija Mohorovičić played in establishing the framework of research related to the seismic safety of buildings, not just in Croatia – his analyses, ideas, and suggestions on the ways to deal with the threats earthquakes pose to our buildings, although over 110 years old, still sound modern and fresh, and were in several aspects truly visionary.

Key words: Engineering seismology, earthquake engineering, Andrija Mohorovičić, seismic hazard, Croatia

The lecture will give a concise overview of development of the disciplines of engineering seismology (and to a lesser extent, also earthquake engineering) in Croatia from a perspective of a seismologist. A significant part of the talk is dedicated to the role that Andrija Mohorovičić played in establishing the framework of research related to the seismic safety of buildings, not just in Croatia – his analyses, ideas, and suggestions on the ways to deal with the threats earthquakes pose to our buildings, although over 110 years old, still sound modern and fresh, and were in several aspects truly visionary (Fig. 1).

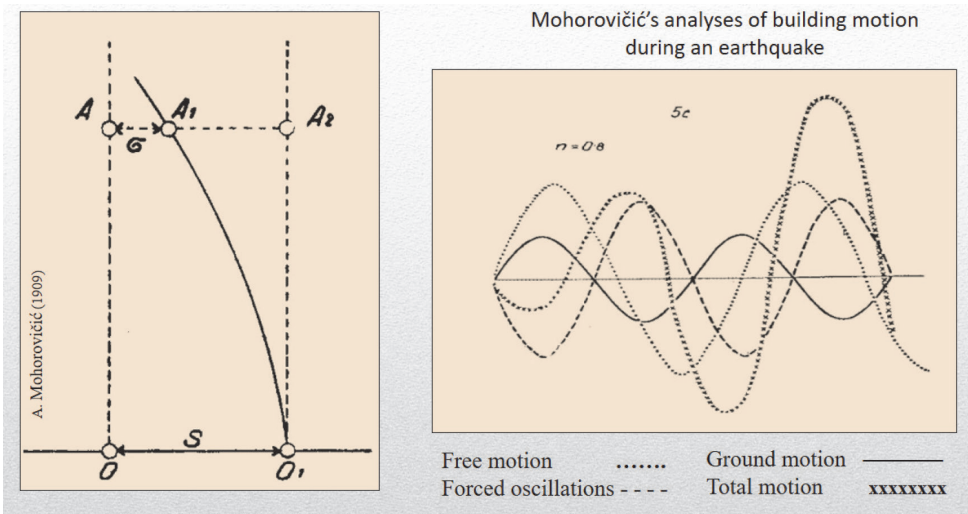


Figure 1. Mohorovičić's analyses of the building's motion during earthquake excitation [2]

Mohorovičić [1, 2] introduced into the Croatian practice the concepts of seismic hazard, response spectra, as well as a number of basic principles of aseismic building design. After a lull of several decades after Mohorovičić's retirement, the applied seismological investigations related to hazard estimation were revived in 1980-ies, and were further intensified in the beginning of the 21st century. Those included using microtremors for the estimation of soil amplification properties, derivation of local ground-motion prediction equations (for PGA), hazard estimation for the Croatian territory (both in terms of intensity and PGA), advanced methods for soil characterisation and microzonation studies (e.g. Fig. 2), assessment of building's dynamical parameters and of the potential of soil-structure resonance, etc.

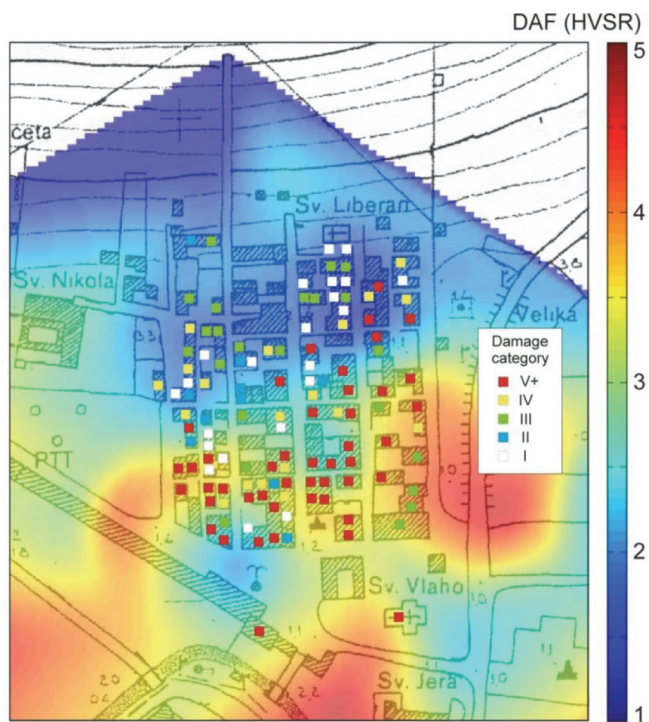


Figure 2. Comparison of observed damage to the building stock in Ston after the 1996 M6.0 earthquake, and computed local soil amplification of PGA, after [3]

The future presents many challenges – from further densification of the National strong-motion network, to compilation of the new earthquake hazard maps in accordance with the recent advances in the engineering seismology, improved knowledge of seismicity and the activity of seismogenic faults, and relevant changes in legislation.

References

- [1] Mohorovičić, A (1911a): Djelovanje potresa na zgrade. *Vijesti Hrvatskoga društva inženira i arhitekta*, 32, 17–18, 33–35, 51–53, 69–72, 85–86, 103–105, 112–116, 126–129, 139–142.
- [2] Mohorovičić, A. (1911b): Djelovanje potresa na zgrade – predavanje prof. dr. Andrije Mohorovičića u H. D. I. I. A. dne 1. ožujka 1909, preštampano iz »Vijesti Hrv. društva inženira i arhitekta«, Tiskara i litografija C. Albrechta, Zagreb, 79 pp. [available also in English translation: Mohorovičić, A. (2009): Effects of earthquakes on buildings (translation in English). *Geofizika*, 26, 1-65, http://geofizika-journal.gfz.hr/vol_26/No1/26_1_mohorovicic.pdf, accessed 4 March 2021].
- [3] Herak, M., Allegretti, I., Herak, D., Kuk, K., Vlado K., Marić, K., Markušić, S., Stipčević, J. (2010): HVSR of ambient noise in Ston (Croatia) – comparison with theoretical spectra and with the damage distribution after the 1996 Ston-Slano earthquake. *Bulletin of Earthquake Engineering*, 8 (3), 483–499.