ABSTRACT

Seismic vulnerability assessment of the waste water system of Grevena

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The aim of the present thesis is the estimation of seismic vulnerability due to ground shaking of the waste water system of Grevena for the cases of 3 different earthquake scenarios (the ones with a mean return period of 100, 500 and 1000 years).

Chapter 1 the importance of lifelines for the community, their special characteristics and their social and economic consequences are highlighted. Furthermore, the major concepts of lifeline seismic engineering are defined and the methodology for the application is described.

In chapter 2, a description of the wastewater system of Grevena, which is totally digitalized in G.I.S. format, takes place and the correspondent inventory G.I.S. databases for the elements exposed to seismic risk (Pipelines, Manholes, Waste Water Treatment Plant) of the wastewater system are presented. In addition, the classification of lifelines elements occurs in diagrams and maps according to their specific typology and their distinctive geometric, structural and functional features.

In chapter 3, empirical and analytical fragility -vulnerability curves and relationships are presented for each element at risk of a waste water system for both ground shaking and permanent ground deformation.

In chapter 4, the study of site-specific earthquake response analyses of soil deposits for the Grevena case is performed for 3 different earthquake scenarios (the ones with a mean return period of 100, 500 and 1000 years) in terms of peak ground acceleration and peak ground velocity. The above study is based on the existing seismic hazard study of the region, the geological and geotechnical information ,the results of in situ geophysical tests and the 1D soil profiles. The results of this study (average acceleration and velocity response spectrum, average spectral amplification ratio, variation of amplification ratio with frequency, variation of peak ground acceleration and maximum shear strain with depth, peak ground acceleration, velocity and displacement at the ground surface and the pipelines' depth) are presented in terms of tables, diagrams and maps in GIS format that describe the spatial distribution of the strong ground motion.

In chapter 5, the expected damage state due to ground shaking is estimated for each element at risk of the waste water system using appropriate fragility - vulnerability curves and relationships for 3 seismic scenarios (the ones with a mean return period of 100, 500 and 1000 years). The vulnerability assessment of the components of the waste water system of Grevena is based on the site-specific earthquake response analyses results (peak ground acceleration and peak ground velocity) that estimated in chapter 4.