Gypsum dissolution risk analysis in the Prealpine part of the Vaud County (Western Switzerland)

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Subsidence or collapse due to bedrock dissolution is a relatively common phenomenon in Vaud County (Western Switzerland). Indeed, soluble rocks are present in the Jura and Prealpine parts. Solubility is significantly higher in evaporitic rocks (such as gypsum) than in Limestones, resulting in possibly important dissolution during a building's lifetime. In Limestone, subsidence results mainly from cover collapse over existing voids. This study aims at evaluating the cost of this phenomenon for the building portfolio of the region in which gypsum occurs. Currently, 2.5% of the portfolio value is located over gypsum-bearing formations and is therefore potentially affected.

Since this phenomenon is not covered by the public building insurance yet, no centralized event record exists. Therefore, a survey has been conducted with the affected communities to estimate the events frequency and damage severity. Some records from the archives of BERTAND LAURAUX SA have been added and allow to compare reparation costs with insured values. From these cases, a frequency and a buildings vulnerability distribution are established. The vulnerability distribution is considered to represent the reality, whereas the frequency is corrected to take into account the different amount of information gathered in the different municipalities and the incompleteness of the inventory, even in the communities with more information.

Assuming that the distribution of collapse events occurs with a constant average frequency and is time-independent, insurance financial years are modeled with a number of cases assigned randomly following a Poisson distribution. A Monte Carlo simulation is performed, where the affected buildings value is chosen among the potentially affected portfolio and its corresponding damage rate is assigned following the distribution previously established. The maximum damage for each building is limited to CHF 1,000,000 (EUR 827,000), to ignore unrealistic values. Thus, a cost distribution of potential financial years is obtained.

The risk for a given building is estimated by dividing the total risk by the number of concerned buildings and reaches EUR 75 per year and building, i.e. EUR 7,500 for a building built to last 100 years. Therefore, the risk is relatively small and only limited investigation and investments are to be considered for new buildings. However, more detailed hazard map might divide the total cost on a reduced number of buildings, which would allow focusing investments on more critical zones.

An estimation of the risk evolution in the future is made, based on the legalized building zones, which should cover the needs for the next 20 to 30 years. This data implies a relative increase of the affected portfolio. However, a recently accepted law limits the rate of secondary residences and is expected to freeze the development in most of the affected communities.