Evaluation and Zoning of the Dangers of Abandoned Qanats in Sabzevar city

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Extended Abstract

Introduction
Sabzevar city has hot summers with dry and cool climate. Not so long ago, in this city water supply sources for agriculture and drinking were Qanats. Qanats have been one of the oldest and the most economical ways of extraction of ground water in Iran. In Sabzevar city, there are 12 Qanats that extending from north to south; they called Afzal abad, Haj abbas, Fath abad, Haj mulla, Jafar abad, Naghabashk, Saleh abad, Sanjar abad, Aghasi, Kolah farangi, Amid abad and Ghasabeh. Eight of these Qanats are located in central and historical texture. Over the past few decades, the expansion of the city and the city, the deep excavations for drinking water and the continuation of droughts over time have left most of these Qanats dry.

In 1370s with city physical development and creation new places added to residential texture. In this time Water & Sewage Company by making network of sewage system blocked some of these Qanats and some of the habitants used Qanats channels instead of sewage network system. At the present time, due to the depth of Qanats and gender of land, some areas of the city are impenetrable. So water is accumulated in underling layers and has led to rising water level of 18 meters in 1350s to 4 meters now. This situation is caused urban development and urban planning to be difficult due to population growth and need for modern construction. This issue especially in deep digs and high densities has added the burden of abandoned Qanats beneath the city and subsequently land subsidence and destruction of structures have caused financial and, in some cases, criminal losses.

Discussion and Results
The study of comprehensive plan map of Sabzevar city and its correspondence with the map of Qanats routes and also drop down and raise the water, show that central parts and worn texture of Sabzevar city includes 186 hectares of the total area of the city had the most subsided, in other words 85 percent of these collapses happened in these textures. The study of GIS layers show the uses of Sabzevar city from total urban usage are at the risk of subsidence & landslide of the Qanats. 54/7 percent is related to residential uses in low, medium and high densities that are located in the direct danger of the subsidence of the Qanats, also the urban transport network, which has a large part of the city's surface after residential use, is located in the direct danger of falling and collapsed earth. Studies show that 25 percent of the communication network is constructed along or adjacent to the longitudinal route of the city's Qanats. The daily commuting of vehicles, especially during daytime, on loose and unstable sediments, exacerbates the risk of collapse.

Given the fact that the use of these applications is approximately 24 hours, this problem adds up to the severity of the risk.

Conclusions
In general, it should be concluded that in the zoning of the risk of land subsidence, there are other factors such as type of building materials, construction principles, building strength, building height, building density, residential land cover, Water stagnation is effective in reducing the risk of land subsidence. In this regard, it is necessary to establish technical and legal regulations to encourage the owners of buildings constructed on Qanats to identify and control the danger and

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also determination and assignment of the various stages of construction of new buildings and facilities (authorized) in zones with the probability of the existence of Qanats. Also, identifying the blocked routes of the Qanats and trying to reopen the natural drainage route is one of the most important tasks of Sabzevar municipality managers.

**Keywords:** Sabzevar, Qanat (aqueduct), subsidence and collapse of Qanats, abandoned.
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