

Spatial Analysis of the Protected Zone and Vulnerability of Urban Facilities in Mashhad to Useful Airstrikes, from a Passive Security Viewpoint

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1. Introduction

By raising the number of wars, especially during the last century, and by increasing the harm and loss of human lives and financial and psychological damage to people, efforts and movements were studied and considered in scientific terms under the passive defense. Today, the aim of targeting the cities with weapons and destroying urban infrastructures, primarily through aerial strikes, is to disrupt morale and cause harm to economic conditions and social systems, which can cause many disasters in case of destruction of such centers because of the high numbers of service users. Considering the importance of urban infrastructures during war, especially during air fights, proper attention to the principles of the passive defense approach has much higher priority in site selection and design. Mashhad is one of the most vulnerable cities of Iran in terms of war for having a high density of population and buildings, vast quantities of deteriorated texture. Since the aerial attack in this city has not been applied, we are trying to investigate the spatial safety of its urban infrastructures.

Many researches have been carried out in Iran on various topics related to passive defense. This research is modeling with the ANP-DEMATEL-GIS approach of boundary protection and vulnerability of urban infrastructures against airstrikes. The following are some of the most significant research activities in this field. Parisi, et al . (2014) used passive defense criteria in Saqqez to enhance urban safety and the need for it at the national and regional levels. Mohammadi Dehcheshmeh (2014) applied passive approach to civil defense on the Ahvaz, which led to the recognition of local standards for particular land use. Sajjadian, Alizadeh and Parvizian (2016), analyzed the risk associated with hospital location in Ahvaz from the perspective of passive defense. Iraqi (2011), Kamran and Hosseini Amini (2012), Zarehpour (2012), Hosseinzadeh (2013), Khmer (2015), and Alizadeh (2015), showed the importance of passive defense studies in urban development and safety of cities.

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2. Materials and Methods

To achieve the objectives of the research, infrastructure Indicators were extracted, including particular infrastructure, emergency services, public and management facilities, and 1560 infrastructure with desk studies and questionnaire planning. To measure the neighborhood pattern, fourteen significant layers in infrastructure vulnerability were identified and determined by distance operator for each layer against the Mashhad airstrikes and weighted using ANP-DEMATEL's combined methods. By adding these weights, standard distance maps were prepared by the ArcGIS spatial analyst and fuzzy overlay tools, and through the Geoda software regression tool, the trend pattern of four category infrastructure were calculated for urban infrastructure distribution against airstrikes.

3. Results and Discussion

The vulnerability can be considered an inherent flaw in the specific dimensions of the city's environment, which is prone to damage to the biological and physical properties of the city and modeling spatial vulnerability in terms of passive defense for the city's potential safe prospects. In the present study, after extraction of damage indices in the urban infrastructure of Mashhad in airstrike, using a hybrid model ANP-DEMATEL-GIS, the analytical level and spatial relationships, as well as the priorities of the vulnerability level from very high risk to very low risk were determined. The results of the vulnerability distribution of urban infrastructure in Mashhad is separable in two levels:

After analyzing the neighborhood trend using ANP-DEMATEL, in the field of effectiveness and influence, health and industrial are recognized as most effective indicators and warehouses and religious buildings classified as most affected indicator. The effectiveness and affectedness of indicators are of the most critical factors in such a way that the risk is recognized from the viewpoint of passive defense and partly on the safety of the effects. The final weight of the model also indicates that police centers, urban facilities and administrative centers respectively have the highest weights of 0.12, 0.118 and 0.117. Religious centers and health centers have the lowest weights of 0.008 and 0.009, respectively. The pattern trend in the evaluation of useful indicators classes in vulnerabilities shows that the highest coefficient between the influential factors of vulnerability is for particular infrastructures and management infrastructures with a coefficient of 1.55 and 1.18 and the lowest coefficient is related to the public infrastructure which is 0.002.

4. Conclusion

Spatial results clearly show that more than 60 percent of the infrastructures are in a vulnerable and insecure condition and that just 5 percent of all urban infrastructures are in a safe or low-risk condition.

Keywords: Spatial Modeling, Vulnerability, Urban Infrastructure, Passive Defense, Mashhad

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