

Distance and Coverage: An Assessment of Location-Allocation Models for Fire Stations in Kuwait City, Kuwait

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Abstract : The major concern of planners when placing fire stations is finding their optimal locations such that the fire companies can reach fire locations within reasonable response time or distance. Planners are also concerned with the numbers of fire stations that are needed to cover all service areas and the fires, as demands, with standard response time or distance. One of the tools for such analysis is location-allocation models. Location-allocation models enable planners to determine the optimal locations of facilities in an area in order to serve regional demands in the most efficient way. The purpose of this study is to examine the geographic distribution of the existing fire stations in Kuwait City. This study utilized location-allocation models within the Geographic Information System (GIS) environment and a number of statistical functions to assess the current locations of fire stations in Kuwait City. Further, this study investigated how well all service areas are covered and how many and where additional fire stations are needed. Four different location-allocation models were compared to find which models cover more demands than the others, given the same number of fire stations. This study tests many ways to combine variables instead of using one variable at a time when applying these models in order to create a new measurement that influences the optimal locations for locating fire stations. This study also tests how location-allocation models are sensitive to different levels of spatial dependency. The results indicate that there are some districts in Kuwait City that are not covered by the existing fire stations. These uncovered districts are clustered together. This study also identifies where to locate the new fire stations. This study provides users of these models a new variable that can assist them to select the best locations for fire stations. The results include information about how the location-allocation models behave in response to different levels of spatial dependency of demands. The results show that these models perform better with clustered demands. From the additional analysis carried out in this study, it can be concluded that these models applied differently at different spatial patterns.

Keywords : geographic information science, GIS, location-allocation models, geography

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