Fire Station Site Selection in Rural Areas: A Case Study of Dickinson County, Kansas

Abstract

This study examines a methodology for rural fire station site selection with a case study of Dickinson County, Kansas. The primary research question centers on finding the optimal site to place a new fire station within the study area to address unmet need. The question is a planar form of the Maximal Covering Location Problem where potential sites are represented by address points and potential building sites by a continuous plane. Current fire services are accounted for by evaluating the effective service areas of existing stations. The evaluation uses network analysis based on the county’s “all-weather” road network and response standard established by the National Fire Protection Association and Insurance Services Offices, Inc. guidelines. Unmet need is identified as the address points that lie outside those service areas. Local concerns such as adhering to building site restrictions from the county’s Comprehensive Plan are taken into consideration as well. Simple enumeration of total demand points covered by potential building sites is used to calculate the optimal solution. Application of the methodology resulted in a small contiguous region of appropriate building sites that would address the maximum amount of unmet need.

This study also evaluated the impedance of fire district boundaries on the effectiveness of existing fire stations. The potential service area of each station was
compared to its actual response area. The effective range of every fire station in the study area was shown to be limited by district boundaries.