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Preliminary Roadway Alignment Design: A Spatial-Data Optimization Approach

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Abstract : Roadway planning and design is a very complex process involving five key phases before a project is completed; planning, project development, final design, right-of-way, and construction. The planning phase for a new roadway transportation project is a very critical phase as it greatly affects all latter phases of the project. A location study is usually performed during the preliminary planning phase in a new roadway project. The objective of the location study is to develop alignment alternatives that are cost efficient considering land acquisition and construction costs. This paper describes a methodology to develop optimal preliminary roadway alignments utilizing spatial-data. Four optimization criteria are taken into consideration; roadway length, land cost, land slope, and environmental impacts. The basic concept of the methodology is to convert the proposed project area into a grid, which represents the search space for an optimal alignment. The aforementioned optimization criteria are represented in each of the grid's cells. A spatial-data optimization technique is utilized to find the optimal alignment in the search space based on the four optimization criteria. Two case studies for new roadway projects in Duval County in the State of Florida are presented to illustrate the methodology. The optimization output alignments are compared to the proposed Florida Department of Transportation (FDOT) alignments. The comparison is based on right-of-way costs for the alignments. For both case studies, the right-of-way costs for the developed optimal alignments were found to be significantly lower than the FDOT alignments.

Keywords : gemoetric design, optimization, planning, roadway planning, roadway design
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