Multiobjective Optimization of Roadway Lighting Projects

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Roadway lighting systems play a major role in maintaining nighttime traffic safety as they reduce both the number and severity of nighttime traffic accidents. While the design of roadway lighting systems involves multiple objectives, past studies have focused on optimizing only one of the multiple objectives that should be considered. This paper presents a multiobjective optimization model for roadway lighting projects that simultaneously optimizes four design objectives. The incorporated objectives are (1) maximizing the average lighting level on the road surface; (2) maximizing the lighting uniformity along the roadway; (3) minimizing the glare to road users produced by the lighting system; and (4) minimizing the cost of operating the lighting system. The model is designed and developed as a multiobjective genetic algorithm to help decision-makers in their endeavor to provide efficient roadway lighting systems that strike a balance between the four conflicting objectives. The present model considers the following six design variables: type of lighting fixture, mounting height, spacing, fixture offset, fixture’s inclination, and fixture’s rotation angle. An application example is analyzed in this paper to clarify the use of the model and display its significant features in producing better lighting arrangements for roadways.

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