CONSTRUCTION OF A REAL-WORLD BILEVEL LINEAR PROGRAMMING MODEL OF THE HIGHWAY NETWORK DESIGN PROBLEM

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Abstract

The formulation of the highway network design problem (NDP) as a bilevel linear program (BLP) allows more realistic solutions taking into account the reaction of users to improvements made by the system. In this paper, a conceptual framework for the optimization of investments in inter-regional highway networks in developing countries is proposed. The model is applied to the Tunisian network using actual data. Considerable effort was expended to make the implementation as realistic as possible, taking into consideration travel times, operating costs, accident costs, improvement costs, conservation laws, and effects of intra-regional flows. A new formulation allowing the incorporation of any improvement cost functions, including non-convex and non-concave functions, is introduced.

1. Introduction

This paper is concerned with the construction of a bilevel linear program (BLP) for optimizing the investment in the inter-regional highway network of a developing country. The notion of development is related, in this study, only to rural highway transportation. A country or region is considered to be developing if most or all of its inter-city traffic is carried on two-lane highways or on lower quality roads.

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Fig. 1. Tunisian inter-regional highway network (shaded links are those improved in solution to BLP).