



Transportation Science

Publication details, including instructions for authors and subscription information:
<http://pubsonline.informs.org>

Book of Interest

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To cite this article:

Sang Nguyen, (1975) Book of Interest. Transportation Science 9(3):283-284. <https://doi.org/10.1287/trsc.9.3.283>

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Books of Interest

Optimization of Transport Networks, Peter A. Steenbrink, John Wiley & Sons, Somerset, New Jersey, 1974, 325 pages, \$22.00.

This book focuses on the problem of determining the optimal road network infrastructure by choice of the dimensions (capacities) of road links for a given spatial distribution of population and employment. The problem is stated mathematically as the minimization of a nonlinear function of traffic flows and link dimensions. The travel demand is considered fixed. The minimization is subject to flow conservation and upper and lower bound constraints on link dimensions, which are considered to be continuous variables; no explicit budget constraint is imposed.

The book consists of two parts: the first part (chapters one to seven) introduces a new solution technique for the optimization of large networks, and the second part (chapters eight to eleven) describes the application of this technique to the optimization of the Dutch interurban road network.

The first three chapters introduce the terminology and notation used, and cover the theoretical aspects of the optimization of transport networks. Basic notions of cost, benefit, social surplus, and equilibrium in a transport network are briefly discussed. The distinction between descriptive and normative assignments is illustrated through the Braess paradox. The section on existing traffic assignment procedures appears to be out of date, and probabilistic assignment techniques have not been mentioned. In chapter four, general mathematical formulations of optimization problems are stated, followed by a comprehensive survey of existing mathematical formulations of the optimization problem and associated solution techniques.

Chapter five constitutes the main chapter of the book. The author proposes a new approach to the optimization problem. The procedure consists of decomposing the original problem into a set of subproblems and a master problem. Each subproblem provides a relation between the optimal dimension of a link and the link flow. The master problem takes the form of an assignment problem. The innovation of the procedure lies more in the process of decomposition than in the proposed "stepwise assignment according to the least marginal objective function." Indeed, this assignment procedure is closely related to the now familiar incremental loading traffic assignment procedure. The results of intensive testing and a sensitivity analysis of the assignment procedure are presented. In the analysis the author fails, however, to stress the sensitivity of the proposed technique to the order in which

origin-destination pairs are processed. The chapter appears primarily to give a description of the art of using an incremental loading assignment technique.

Theoretical extensions of the optimization problem to the dynamic case and the multiple travel mode case are discussed in chapter six. Chapter seven is an excellent overview of shortest paths algorithms and algorithms that recompute shortest paths after a small change in the network.

The four remaining chapters are devoted to a case study: the optimization of the Dutch interurban road network using the method proposed in chapter five. The design of the objective function is discussed in detail. Much valuable practical information concerning travel time costs, vehicle-operating costs, costs of accidents, costs of investments and maintenance, etc., is communicated to the reader.

Although the book provides a valuable account of the application of a mathematical solution procedure to the planning of the Dutch road network, it does not seem to be intended for classroom use; rather it appears to be aimed at the practitioner who needs to know how to carry out a similar study. However, it may also be a useful introduction for researchers to the application of mathematical techniques to a real life transportation planning problem.

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