APPROACHES TO DYNAMIC TRANSPORT PLANNING*

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Abstract

Dynamic transport planning refers to the analysis of the problem of choice of implementation date of the construction or improvement of transport facilities. This analysis may also include consideration of stage construction or progressive improvements in quality and/or capacity over time, beginning from some relatively low standard. A transport facility is defined as a vehicle (e.g., automobile, airplane) or a supporting facility (e.g., highway, port).

There appears at present to be a serious lack of any truly comprehensive evaluation of the essentials of the problem of choice of implementation date. It is the intent of the ensuing presentation to help to rectify that situation by introducing new concepts which structure the timing problem. The concepts are based on a suggested classification of future traffic and definitions of independent and indivisible facilities. In addition, volume of traffic and benefits of a transport facility are recognized to be dependent on calendar time and the facility's age.

Presently, no uniform theoretical framework exists for establishing the optimal time for constructing new facilities or improving existing ones. A framework based on the aforementioned concepts is introduced. It distinguishes between the phasing of projects through time in the absence of budget constraints and this phasing in the presence of such restrictions. The specific procedures suggested in this paper for the analysis of the problem of choice of implementation date apply to any individual transport facility and tend to unify the concepts involved in dynamic transport planning.

The article concludes with a survey of current approaches to dynamic transport planning and discusses these in the light of the above framework.

Introduction

NEED FOR ANALYSIS OF OPTIMAL TIMING

The transportation planning process may be viewed as one consisting of the following phases: statement of desirable objectives; preparation of forecasts of movements of people or commodities; generation of alternative (new or improved) transport facilities or plans; determination of costs.

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and benefits of these alternatives; evaluation of these alternatives; selection of the optimal facilities and determination of the optimal times of implementing the construction of these facilities; establishment of certain public actions. A transport facility is defined as a vehicle (e.g., an automobile or airplane) or a supporting facility (e.g., a highway, road, bridge, railway track, terminal, or port).

The present paper only considers approaches to dynamic transport planning or the analysis of the problem of choice of implementation date of the construction or improvement of transport facilities in order to determine the optimal times of implementation. There appears at present to be a serious lack of any truly comprehensive evaluation of the principles involved in dynamic transport planning; also both in the literature and in practice there appears to be considerable confusion about the subject. It is the intent of the ensuing presentation to help to rectify that situation by introducing new concepts which structure the timing problem.

The following example demonstrates the potential importance of treating the time of implementation as a variable in the evaluation and selection of transport facilities. Suppose two transport facilities A and B are evaluated and present budget constraints permit construction of only one now, the other being forced to wait five years. Table I shows the annual net benefits minus investment costs together with corresponding net present values (using a discount rate of 7%) of these facilities for the situations in which facility A is constructed now (Columns 2A and 3A) and B five years later (Columns 5B and 6B) and vice versa, i.e., B constructed now (Columns 2B and 3B) and A five years later (Columns 5A and 6A). The expected lives of facilities A and B are assumed to be ten years; hence, total net present values over this period of time are compared.

Employment of guidelines for project selection published by the U.S. government (U.S. Inter-Agency Committee on Water Resources, 1958; U.S. Department of Transportation, 1968) results in the selection of transport facility A. These guidelines consist of the establishment of priorities which are based on a ranking of potential projects in descending order of their total net present values for immediate construction. Table I indicates that these present values are $114,100 and $75,300 for transport facilities A and B, respectively; hence facility A is selected for construction now and facility B five years later. The above guidelines ignore the dynamic aspect of construction at some future point in time. Table II indicates that, if our goal is maximization of the overall net present value now from investment, future as well as present, facility B is selected for immediate construction and facility A for construction five years later. It is evident that our goal should be as described above, since this results in a