APPLIED SYSTEMS ANALYSIS IN LARGE-SCALE URBAN AND RURAL TRANSPORT PLANNING

by
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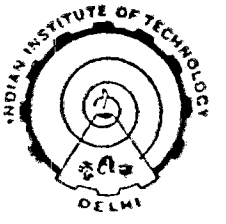
Thesis submitted in fulfilment of the requirements
for the award of the degree of
DOCTOR OF PHILOSOPHY



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CERTIFICATE

This is to certify that the thesis entitled "Applied Systems Analysis in Large-scale Urban and Rural Transport Planning" which is being submitted by Mr. Devashis Banerjee to the Indian Institute of Technology, Delhi, for the award of the degree of Doctor of Philosophy in Electrical Engineering, is a record of bonafide research work carried out by him. He has worked under my supervision and guidance and has fulfilled the requirements for the submission of this thesis. The thesis, in my opinion, has attained the standard required for a Ph.D. degree of this institute. The results contained in this thesis have not been submitted elsewhere in part or full for the award of any degree or diploma.

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ABSTRACT

The demand for transportation is derived due to spatial interactions in the activity system of a region. The attributes and specifications of the activity system have undergone a drastic change of emphasis in the past three decades due to innumerable external factors such as rising cost of energy resources, environmental and ecological awareness, and sustained economic, technological and social growth. Quantitative analysis of transportation system is therefore a challenging proposition now. It requires an in-depth study of the underlying complex interactions. The traditional multistage aggregate modelling constructs of transportation system analysis turn out to be inadequate and inconsistent for realizing the desired objectives.

In view of the above, a comprehensive discrete physical systems modelling construct for the land-use transport structure has been developed to simulate the flow-cost equilibrium. In this connection, a digital computer implementable algorithm for state-space modelling of large land-use transport structures based on the physical system theory framework is also reported.

To overcome the rather high data requirements of the physical system theory based modelling framework, a simplified alternate methodology proposed for equilibrium analysis of the land-use transport structures involves two stages: (i) estimation of O-D trip demands through an integrated land-use transport model such as the Lowry model or the Leontief-Strout model, and (ii) estimation of the trip volumes on the

transport links by an integrated model of modal-split and trip assignment based on the physical system theory framework. These models, empirically implemented in the context of the Delhi metropolitan region, also provide a methodology for assessing the feasibility and impact of a new mode, say rail transit, from the network theory considerations.

The study has further provided a successful empirical implementation of the Lowry model for quantification of the process of spatial codistribution of population and employment in the context of a rural region. In addition, a "Transport Priority Index (TPI)" model has been developed for deciding the intensity of need for road development for each village of the rural region under study. Recognizing that roads and road based transport play a crucial role in providing access to developmental facilities of the study region, a road network plan has been formulated to foster social equity and all-round development in the region. The TPI model is shown to be useful in building priority plans for the present as well as future rational integrated development scenarios of the region.

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