Highway Transport Policy Development Based on Ideal Flow Network

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1. INTRODUCTION

Effective transportation planning is essential for urban development, yet it often faces challenges due to the high costs and complexities involved in collecting accurate Origin-Destination (OD) data. Traditional methods require expensive surveys and intrusive data collection techniques, which are not feasible for many developing regions. Consequently, the lack of reliable data leads to suboptimal traffic management and policy formulation. This paper proposes the use of Ideal Flow Network (IFN) as an innovative solution for traffic assignment. The proposed Ideal Flow Network Transport (IFN-Transport) offers a novel approach to address these challenges by utilizing network structures and possible use of modern sensing technologies to manage traffic flow without relying heavily on costly OD data [1].

2. RELEVANT LITERATURE

The IFN approach is based on stochastic matrices and Markov Chain theory [2], allowing for the estimation of traffic flows using network structures alone or in conjunction with minimal supplementary data from sensors such as GPS or cameras. Teknomo [3] introduced the Ideal Flow Network, gaining attention for its application in traffic assignment without extensive OD data [4].

3. METHODOLOGY

For the case study, parts of road network data in Surabaya, Indonesia was sourced from Open Street Map and transformed into graph theory representations. The data was cleaned and organized into matrices representing link distances, capacities, and maximum speeds. The IFN model was enhanced to include road capacity adjustments. Algorithms were developed to calculate flow/capacity ratios, link speeds, and travel times using Greenshields and BPR cost functions. The model's theoretical foundation was strengthened by incorporating new mathematical formulations to improve its practical application.

An open-source software tool for Ideal Traffic Assignment was developed, featuring a user-friendly interface for transport planners. The tool enables the simulation of various traffic scenarios and the evaluation of different policy interventions. Prototypes of traffic flow and travel time predictions were created using the cleaned network data. The model's accuracy was validated through comparisons with real-world traffic data provided by the Surabaya municipality.

4. RESULTS AND DISCUSSIONS

The IFN model demonstrated significant potential in improving traffic assignment and management. The simulations showed accurate predictions of traffic flows and congestion points. Various traffic management policies, such as changes in road capacities and the implementation of

one-way streets, can be tested using the IFN tool. The results indicated that specific interventions could significantly reduce congestion and improve overall traffic flow.

4. CONCLUSIONS

The development and implementation of the Ideal Flow Network (IFN) for traffic assignment offers a cost-effective and practical solution to the challenges of traditional OD data collection methods. The enhanced IFN model and its accompanying software tool provide accurate traffic flow predictions and facilitate the evaluation of various traffic management policies. Training programs can be developed further for capacity building among local transport officers, enabling more informed and effective transportation planning and policy development. Further research and continuous improvements to the IFN model and tool are recommended to enhance their applicability and accuracy.

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