

TRAFFIC CONGESTION MEASUREMENT AND MITIGATION ON URBAN ARTERIALS

by

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CERTIFICATE

This is to certify the thesis entitled “**Traffic Congestion Measurement and Mitigation on Urban Arterials**” being submitted by **Mr. A. Mohan Rao** to the Indian Institute of Technology, Delhi, India, for the award of the degree of **DOCTOR OF PHILOSOPHY**, is a record of original bonafide research work carried out by him. Mr. A. Mohan Rao has worked under my guidance and supervision. To the best of my knowledge, the thesis has reached the requisite standard. The material contained in this thesis has not been submitted, in part or in full to any other University or Institute for the award of any degree or diploma.

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ABSTRACT

Traffic congestion has been one of the major issues that most metropolises are facing in spite of measures being taken to mitigate and reduce it. In the recent past, traffic congestion has emerged as one of the main challenge for engineers, planners and policy makers in urban areas. Modern social and economic structures, shaped by car-oriented urban development and rapid growth in vehicle ownership, have established congestion as an inescapable reality of urban life. The growing impact of congestion is seen in terms of deteriorating urban air quality besides other adverse effects on quality of urban living.

The main focus of this study is aimed at understanding the recurring urban congestion, its measurement and mitigation. Literature review on this problem reveals some interesting insights. One of the important outcome was that there is no single, broadly accepted definition of traffic congestion. Traffic congestion can generally be defined as excess of demand for road travel. Many professionals and organizations have defined congestion in different ways based on variety of criteria. There have been attempts to develop congestion measurement indices for heavily motorised countries. In less motorised countries, there are not many documented studies on how to measure congestion and plan for its mitigation. Identification of traffic congestion threshold is an essential requirement for defining the congestion and suggesting appropriate mitigation measures.

As mentioned earlier, due to the lack of an unified definition for the measurement of congestion, several metrics are in use. These include speed, travel time, delay, volume and level of service etc. These metrics are evaluated in terms of their usefulness in identifying congestion to further to chose an appropriate remedial measure. Subsequently, data collection requirements and technologies for this metric becomes an important part of this study. Speed has emerged as the important traffic

measurement to identify congestion. Further, while exploring various technologies, GPS was found to be better due to its benefits vis-a-vis conventional data collection methods.

Ring road, one of the principal arterial in Delhi, the National Capital of India, was chosen for the case study. The choice of this arterial was based the fact that it has a well pronounced recurrent congestion on certain sections over the past several years. Extensive data collection was done at several locations on this corridor to measure all the traffic characteristics. Video data collection method was used to measure the space-mean speeds. Volume data and speed data were also collected.

In order to further refine the congestion measurement, extensive review of some of the indices was carried out. The index that comes close to the requirements of the current study is speed reduction index developed by National Cooperative Highway Research Program (NCHRP, 398). This index was further refined to reflect the deterioration in stream speed in comparison to the congestion and free flow speeds. The stream speed models and free flow models were developed by incorporating the prevailing traffic conditions of the chosen arterial road. This index was applied to measure the severity of congestion at various locations, Based on the results obtained, specific sections on the arterial where high congestion index values prevail, are chosen for further analysis.

Some of the congestion mitigation strategies were identified as: i) traffic management, ii) elevated road, iii) shifting of the bus stops and iv) dedicated bus lanes. These strategies were tested using a microscopic simulation tool, VISSIM. Each alternative is evaluated on the basis of the performance measures and congestion index developed. The traffic management option emerges as the better one in terms of increased travel speeds, reduction in travel times and delays at congested locations. However, the bus lane option emerges as one of the best alternatives as it moves more commuters for a given road space than any other alternative.

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