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Addressing travel time and pedestrian safety issues along a congested corridor using microsimulation tool: A case Study of Bangalore, India.

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1. Extended Abstract

With increasing population and a growing economic base, Bangalore, a metropolitan city in a developing country India, has witnessed a tremendous rise in vehicular growth. The resultant pressure on road spaces is very high, and deteriorating traffic conditions prompted the policymakers to formulate a traffic management plan for finding solutions, which are sustainable in nature and would improve mobility along the 2.5-Km corridor in the busy Koramangala region of the city. In order to ensure that the measures formulated to improve mobility will be effective, simulation using Traffic simulation software, VISSIM was carried out and their effectiveness was examined and compared to that of existing scenario.

1.1. Problem Statement

The population in Bangalore urban region and Municipalities has increased from 3 million to 10 million over past four decades. Bangalore is now, India's third most populous city and a well-known hub of India's Information Technology sector, ranked among the top 10 preferred entrepreneurial locations in the world. With increasing population and a growing economic base, Bangalore has witnessed a tremendous rise in vehicular growth. This

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rapidly growing number of private vehicles on roads entailed congestion and further increase in travel time along already-strained corridors. What adds to the traffic pressure here is very little scope for expansion of roads and the need to use existing roads for smooth movement of vehicles. Fig. 1 represents the population versus vehicular growth over the past four decades. Alongside the exponential growth rate for the year 2021 has also be projected.

Koramangala region is one such area within the rapidly-growing city of Bangalore, India, which is facing such issues. It is one of the newly-developing central business districts in Bangalore. The place is well connected by major arterial roads, Inner ring road and is in proximity to Outer ring road. Fill. The study bed is a two-km stretch located on Hosur road corridor in the Koramangala & Madivala region. The land use pattern encompassing this area is highly diverse in nature resulting in substantial amount of trip production and attraction. Inadequate geometric design of at-grade junctions along with heavy traffic movements at this location has led to congestion & frequent traffic delays.

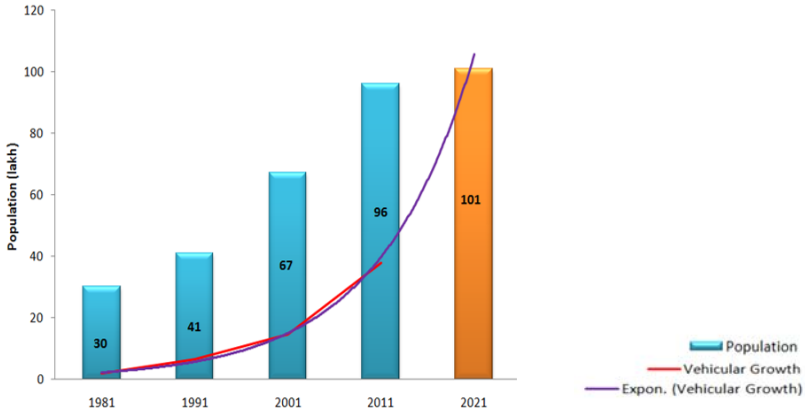

Fig 1: Growth rate- Bangalore, India

1.2. Research Objectives

With rapid urbanization cities face problems of congestion. Congestion occurs when demand for road space exceeds supply. Besides space being a limited resource, most of the time, the reason for congestion is the poor allocation of resources and lack of management. Hence, not only to save resources but also to use available means/resources prudently, it is necessary to assess the existing traffic management and suggest measures to improve the same. High pressure on road spaces and deteriorating traffic conditions prompted the policymakers to formulate a traffic management plan for finding solutions, both short and long term which would improve mobility along the corridor and also address pedestrian safety concerns. In order to achieve this, traffic management study was taken up for the section. In this case, objective of the study was identified as development of Traffic Management Plan which aims to improve mobility along the study corridor. Within the overarching goal of developing traffic management plan, key highlights of the study's objectives are listed below:

- Identifying the travel constraints along the corridor to improve the mobility and enhance the level of road safety for safe pedestrian movement.
- Formulate mitigation measures and check their effectiveness using microsimulation tool.

1.3. Methodological Approach

Traffic management study aimed at investigating the existing travel conditions, identifying the constraints/problems, diagnose the same with the help of primary & secondary data relevant to the study & suggest mitigation measures based on the analysis. Mitigation measures were suggested after comparing the impact on

'measures of effectiveness' for the proposed scenario to that of the existing one. Firstly, to address and also understand the intricacies of congestion issues, it was important to first examine the existing conditions in a qualitative manner. Reconnaissance was first conducted which involved observatory studies and identification of hotspots. It was intended to examine the general character of the area for deciding the mobility parameters for detailed studies. A survey team conducted detailed inspection of the study area to identify the problem areas. Traffic and pedestrian movement and travel pattern along the stretch was observed and mobility constraints were noted. It was observed that besides the traffic volume being high, absence of pedestrian-crossing provision; jaywalking, bad junction design and poor road geometry along the section are impediments to smooth traffic flow and thus adding up to the mobility woes and preventing smooth traffic flow along this corridor.

In order to further carry out the study, data requirement was appreciated for the data collection to be carried out so the existing conditions can be quantified. Traffic and pedestrian data collection studies along the corridor were conducted to collect data on flow characteristics. Classified traffic volume count was done at all five junctions along the corridor and pedestrian crossing volume count was done at junctions and mid-blocks. Intensive travel time data was collected using a Drive Recorder System (DRS) fitted on-board. Car fitted with DRS made multiple runs of the corridor, to and fro. DRS module has a camera and GPS unit. Camera on the dashboard video graphs the vehicle route and GPS records the coordinates at every ten-second interval. In addition, vehicle occupancy survey was also done to understand contribution of singly-occupied vehicles to the total car volume. From this comprehensive study of corridor, it was important to evoke measures, which are not ostensible in nature, and prove to be cost-efficient. In order to ensure that the measure formulated to improve the mobility will be effective, simulation using Traffic microsimulation software, VISSIM was carried out. Sustainable short-term or medium-term measures were prioritized over unsustainable measures like- provision of additional infrastructure. Applicable congestion mitigation strategies were looked upon and considering the facile nature of existing signal control along the corridor, signal optimization technique was identified as a short-term measure after examining its effectiveness. After examining various measures for their effectiveness, best fitting mitigation measures were proposed for the final traffic management plan.

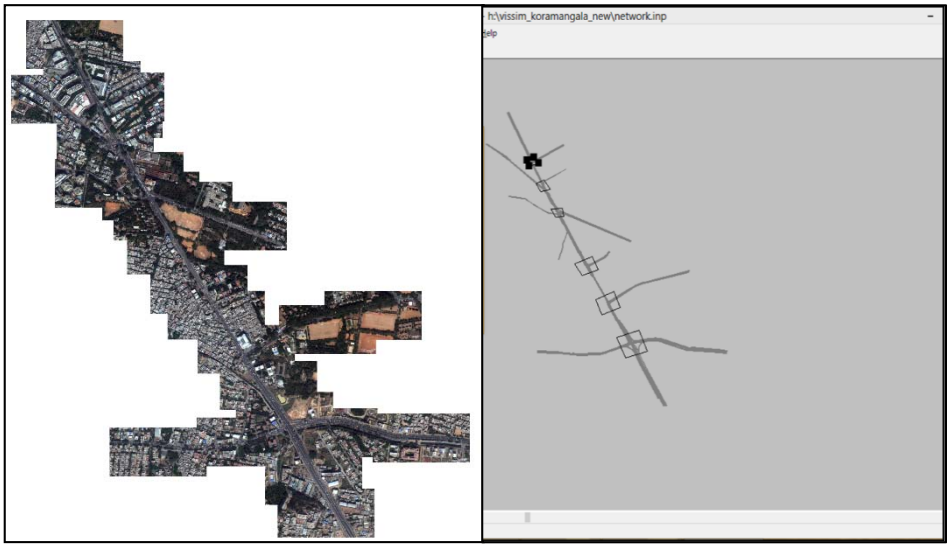

Fig 2: Network replicated on VISSIM

1.4. Results

Increased throughput at junctions, reduced queue length and delay were arrived upon by optimizing the signal phasing. The results showed as much as 23% increase in throughput and significant decrease in queue length and delay for three junctions, suggesting signal optimization as a prudent choice. Various other short-term traffic

management measures like change in junction design and traffic circulation pattern, minor roadway assignments coupled with pedestrian safety measures were suggested after examining their effectiveness using VISSIM, to ensure safe and smooth mobility within the corridor. Few of the suggested traffic operation measures were implemented and travel time within the corridor was slightly improved, if not significantly. Signal optimization results are shared in Table 1.

Table 1: Improvements by signal optimization

Junction	Scenario	Queue Length (m)	Delay (Sec/Veh)	Throughput (Veh/Hr)
Junction 1	Existing	110	68	2721
	Proposed	72	49	3184
Junction 2	Existing	190	60	4151
	Proposed	135	45	5106
Junction 3	Existing	165	65	3715
	Proposed	105	50	4680