

Measuring Traffic Congestion of Shillong: An Appraisal Study



Geography

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ABSTRACT

Traffic congestion has been one of major issues that most cities are facing. It is believed that identification of congestion is the first step for selecting appropriate mitigation measures. Congestion both in perception and in reality impacts the movement of people. Traffic congestion wastes time, energy and causes pollution. There are broadly two factors, which affect congestion; (a) micro-level factors (b) macro-level factors that relate to overall demand for road use. Congestion is 'triggered' at the 'micro' level (e.g. on the road), and 'driven' at the 'macro' level. The micro level factors are, for example, many people want to move at the same time, too many vehicles for limited road space. On the other side, macro level factors are e.g. land-use patterns, car ownership trends, regional economic dynamics, etc. Therefore, this paper gives an overview and presents the possible ways to identify and measure the metrics for urban arterial congestion.

Introduction

Though congestion is the fundamental concern in dealing with any transportation problem, the degree of congestion on urban arterial roadways is not always measured and treated uniformly, mainly because congestion is not a very well-defined phenomenon. Congestion can be defined as the roadway condition in which travel time or delay is in excess of that normally incurred under light or free-flow traffic conditions.

Traffic congestion has been one of major issues that most cities are facing and thus, many measures have been taken in order to mitigate congestion. It is believed that identification of congestion characteristics is the first step for such efforts since it is an essential guidance for selecting appropriate measures. Congestion - both in perception and in reality - impacts the movement of people and freight and is deeply tied to the history of high levels of accessibility and mobility. Traffic congestion wastes time and energy, causes pollution and stress, decreases productivity and imposes costs on society.

Traffic congestion is an unavoidable part of modern-day life. To understand the nature of congestion and to control its growth, a system for measuring the severity of traffic congestion is needed. Such a measure provides the foundation for traffic engineers and policy makers to identify problems and determines the effectiveness of mitigation strategies. In addition, a consistent and uniform measure will allow comparison of traffic conditions at different locations and also over time at the same location so that priorities for improvements can be developed, which helps the public to understand the traffic conditions objectively.

The Study Area:

Shillong the capital city of Meghalaya, which was planned by the British as a hill resort, has undergone substantial change - both in character and form. A tiny administrative unit has now become a vibrating city with commercial activity overshadowing the hill resort. Population of Shillong which in 1872 was 1368 persons now stands at around 2.50 lakhs. With the rapid growth of urbanization, Shillong now faces shortage of water, inadequacy of sanitation, traffic congestion and civic services that are strained to the limit. Shillong at present has the problem of a big city including long and unending queues of cars, and degraded urban environment.

Shillong like any other cities, experienced traffic congestion - a condition in roads that occurs as use increases, and is characterized by slower speeds, longer trip times, and increased vehicular queuing. The most common phenomenon in Shillong is the thick density of vehicles plying along the roads and then extreme traffic congestion sets in. Sometimes when vehicles are fully stopped for periods of time, this only lead to drivers becoming frustrated and engaging in road rage..

Objectives:

The main objective of this present study is to measure the degree of traffic condition in the study area

Data Base and Methodology:

The present paper proposes to measure the degree of congestion on arterial roadways of the study area. This measure combines two measures: average travel speed (ATS) and the proportion of time travelling at very low speed within the total travel time. Because the values measured in the real world are not always precise and also because travellers' perception of the ideal quality of flow is vague, a fuzzy inference method is introduced to aggregate the notions of travel speed and delay into a single index

The following table depicts the rules for measuring congestion index borrowed from Khaled Hamad and Shinya Kikuchi on Fuzzy Inference Approach in studying Traffic published in Transportation Research Record Journal of the Transportation Research Board.

Table:1-Rules for Congestion Index

		Travel Speed Rate					
		F	E	D	C	B	A
Very Low Speed Rate	High	Very High	Very High	High	High	Moderate	Moderate
	Moderate	Very High	High	High	Moderate	Moderate	Low
	Low	High	High	Moderate	Moderate	Low	Low

(1) IF (Travel Speed Rate is F) and (Very Low Speed Rate is High) then (Congestion Index is V. High)
 (2) IF (Travel Speed Rate is F) and (Very Low Speed Rate is Moderate) then (Congestion Index is V. High)
 (3) IF (Travel Speed Rate is F) and (Very Low Speed Rate is Low) then (Congestion Index is High)
 (4) IF (Travel Speed Rate is E) and (Very Low Speed Rate is High) then (Congestion Index is V. High)
 (5) IF (Travel Speed Rate is E) and (Very Low Speed Rate is Moderate) then (Congestion Index is High)
 (6) IF (Travel Speed Rate is E) and (Very Low Speed Rate is Low) then (Congestion Index is High)
 (7) IF (Travel Speed Rate is D) and (Very Low Speed Rate is High) then (Congestion Index is High)
 (8) IF (Travel Speed Rate is D) and (Very Low Speed Rate is Moderate) then (Congestion Index is High)
 (9) IF (Travel Speed Rate is D) and (Very Low Speed Rate is Low) then (Congestion Index is Moderate)
 (10) IF (Travel Speed Rate is C) and (Very Low Speed Rate is High) then (Congestion Index is High)
 (11) IF (Travel Speed Rate is C) and (Very Low Speed Rate is Moderate) then (Congestion Index is Moderate)
 (12) IF (Travel Speed Rate is C) and (Very Low Speed Rate is Low) then (Congestion Index is Moderate)
 (13) IF (Travel Speed Rate is B) and (Very Low Speed Rate is High) then (Congestion Index is Moderate)
 (14) IF (Travel Speed Rate is B) and (Very Low Speed Rate is Moderate) then (Congestion Index is Moderate)
 (15) IF (Travel Speed Rate is B) and (Very Low Speed Rate is Low) then (Congestion Index is Low)
 (16) IF (Travel Speed Rate is A) and (Very Low Speed Rate is High) then (Congestion Index is Moderate)
 (17) IF (Travel Speed Rate is A) and (Very Low Speed Rate is Moderate) then (Congestion Index is Low)
 (18) IF (Travel Speed Rate is A) and (Very Low Speed Rate is Low) then (Congestion Index is Low)

The severity of congestion, which is the output of the process, is categorized into four classes: "low," "moderate," "high," and "very high." Their membership functions in which the x-axis is a scale between 0 and 1, where 0 is very good, and 1 is very bad. The four classes of congestion condition are defined on the basis of this scale. The boundaries of the classes are rather vague, and hence each class is designated with a natural language term, which is useful in expressing the prevailing situation.

The task of combining the two measures (i.e., travel speed rate and very-low-speed rate) and deriving a natural-language-based congestion measure is performed using a fuzzy rule base of the following type:

Rule: IF (travel speed rate is X) AND (the very-low-speed rate is Y), THEN (Congestion is Z)

where X, Y, and Z each represent the degree of congestion. The part of the rule following IF is called the antecedent, and the

part following THEN is called the consequent. The two rules corresponding to the extreme conditions are as follows:

IF travel speed rate is "high"AND the very-low-speed rate is "high," THEN congestion is very high."

IF travel speed rate is "low"AND the very-low-speed rate is "low,"THEN congestion is "low."

Results and Discussion

The common observed phenomenon in Shillong is the School traffic congestion, Sometimes school congestion creates speeding in the larger vicinity, as frustrated parents and commuters try to make up for lost time associated with the congestion, Reckless driving, speeding, and traffic violations associated with high school students' driving themselves to and from school., Street racing, and Loud car stereos .

By applying the rules of the fuzzy approach in the Study area, it is found that areas in the heart of the city experienced high congestion particularly in peak hours either in morning or evening. However, the study area displays Congestion Index from Very High to High particularly at the heart of the city since commercial activities is still concentrated at the city centre. The other most obvious cause of traffic congestion of Very High to High Concentration Index is around schools where the biggest source of those vehicles is parents' dropping off and picking up their children from school.

Fig:3- Congestion Index Map of Shillong

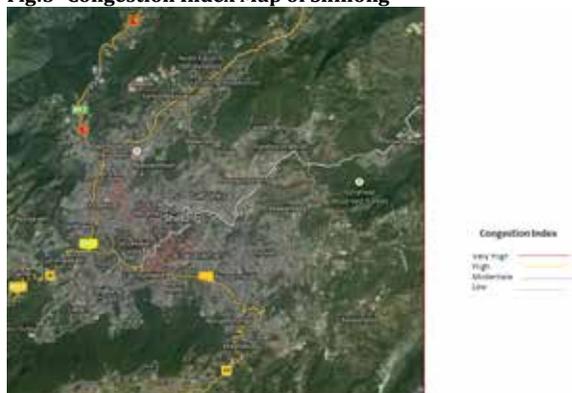


Fig:4(a) & (b)- Different Localities where traffic is highest due to school location

However, it is observed that the suburbs of the study area experienced moderate to low concentration index. it may be observed that using either high speed or low speed rates alone cannot capture the real status of the conditions in the suburbs of the study area.. For example, comparing the case during the a.m.or p.m peak hour, the travel speed rates are almost equal, but the very-low-speed rate is much higher along GS road to Mawlai. perhaps because of the many traffic signals and speed breakers along the segment. In this case, the this represent the situation in which the traveler's overall speed may be high but the large proportion of very-low-speed travel causes frustration.

CONCLUSION

Thus the above discussion indicate a unique characteristic of traffic flow quality. The proposed approach considers the average travel speed and the variation of travel speed and produces a composite measure. The fuzzy inference approach is appropriate because possible errors in measurement cause the individual values to be imprecise and the implication of the values with respect to the severity of congestion is also ambiguous. Furthermore, it can represent the traffic conditions over roadway segments, corridors, specific geographic areas, or a highway network. The resulting congestion index can further be used for time-series comparison as well as spatial comparison of traffic conditions. Future research, however, is needed to determine how the model can be expanded to include other measures, such as traffic volume and roadway capacity information.



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