Travel Time and Congestion Analysis of Heterogeneous Traffic Condition, a Case Study on Kothapet Signal to Nalgonda X-Road Signal Road

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Abstract: The vehicular population in Hyderabad is around 50,00,000 (as of 2018), so it is very essential to manage its movement and ill effects like noise pollution, traffic congestion, waiting time at signals. In this project we have considered one of the busiest routes i.e., Chaderghat circle- LB nagar circle, these areas have heavy traffic due to college buses, city buses, two-wheeler, four wheelers and also heavy trucks (transport loaded vehicles). For addressing the traffic congestion, volume count survey (by video graphic method), travel time and delay survey (by moving observer method), origin-destination survey (by license plate matching method) of 7 days i.e. throughout the week and for speed-flow-density relationship spot speed study at Nalagonda X road, Moosarambagh Signal, and Kothapet is to be performed and analyzed. From the calculated data, graph of flow v/s density, speed v/s density, speed v/s flow relationship is to be developed. From all analyzed data, alternative remedial measures are explored. Based on the alternative remedial measures best alternative is chosen.

Keywords: Traffic study, Travel time, Traffic congestion, Spot speed study

I. Introduction

Over the last two decades there is a rapid growth in the concept of urbanization in India [1]. Due to the urbanization, the demand in transportation facilities which are the basic need of the country's population has increased tremendously [1]. The urban traffic population has increased much more due to rapid growth in employment for daily wages as there is a boost in urbanization.

So, it is prime objective of transportation fraternity to provide new and impactful solution to the existing situation for better management [2]. There are situations where metro rail is active but the traffic congestion [3] is still the same, for example, kothapet signal – moosarambagh signal – Nalgonda X road signal, where the average waiting time of a vehicle is considerably more than that of other metro rail regions.

II. Objectives

Controlling the traffic jams on roads due to increase in the number of vehicles
• Saving the time of the people at the intersection.

• To control traffic data like; traffic volume; Speed; Capacity.
• To regulate the capacity and level of service for a given stretch of the road.
• To analyze the Level of Service of the on kothapet signal to Nalgonda X road signal in Hyderabad.
•To find the hourly traffic speed volume variation on kothapet signal to Nalgonda x road signal in Hyderabad.
•To identify the causes of traffic congestion on kothapet signal to Nalgonda x road signal in Hyderabad.
•To suggest the solutions for the best quality of traffic on kothapet signal to Nalgonda x road signal in Hyderabad.

III. Traffic Study & Analysis

1. Study Area

Hyderabad is integrated into the National Highway Network of India through NH 44, NH 65, NH 163, NH 765, NH 765D, while four State Highways SH1, SH4, SH 6, SH 19 originate/terminate in Hyderabad. Hyderabad has a vehicle population of nearly 48 lakhs and is the highest after Delhi, Bengaluru, Chennai and Mumbai.

Kothapet signal to Nalgonda X Road signal is one of the busiest roads in Hyderabad; it has very increased variations of the traffic at different time. It has a very high traffic congestion during morning and evening due to which the travel time increases, on of 5 the reason for the traffic congestion is given below and the other is covered in the other sections

Road from Kothapet signal to Nalgonda X Road signal. This road is also one of the oldest and popular roads of the city area. Length of the study area=4.6km No. of lanes=4 and 3 lanes

2. Travel Time Study

The objective of Travel Time and Delay Study is to calculate the quality of traffic movement along a route and to fix the locations, types, and extent of traffic delays by moving test vehicle method [4].

From the data analysis it is revealed that on Sunday the Average journey time, average running time and delay is lowest compared to working day. While the average journey time and delay time from Nalgonda X road signal to Kothapet signal at morning hours (Peak hours (8:00Am – 10:30Am)) and from Nalgonda X road signal to Kothapet signal at evening hours (Peak hours (4:00Pm – 6:00Pm)) is more compared to the Sunday and afternoon hours of the weekdays.

Fig 1 shows the graph representation of travel time survey on a particular day.

This travel time and delay time may increase in the future with the increase in vehicular number [5], certain measures should be taken to overcome this issue, remedial measures are covered at the conclusion.

3. Spot Speed Study & Volume Count Survey

Speed is defined as distance per time of travel, and it depends on every trip. It may change according to the volume of traffic.

The stopwatch method is used for spot speed study analysis using a small sample size taken over a relatively shorter period of time. The stopwatch method is a quick and economical method for collection of speed data.

The analysis is primary to achieve the objective. Collected data is compiled in a tabulation after the collection of data in the below mentioned way for analyzing the data. Analysis is done to know the key parameters such as Mean Speed of the vehicle, 85th Percentile Speed, 98th Percentile Speed, 50th Percentile, Mode, Median and Speed variance.50th percentile speed signifies the average speed of the traffic [10]. The 85th percentile speed signifies the speed at which 85% of the observed vehicles are travelling at or below the particular speed, this percentile speed used in recommended for posted speed limits based on the assumption that 85% of the drivers are travelling at a speed they recognize to be safe. The 98th percentile speed is the speed at which 98% of observed vehicles are travelling at or below that particular speed. The 98th percentile is considered as the design speed.

i. At moosarambagh towards Nalgonda X road signal, for vehicle type:2-wheeler on Monday:

Maximum Speed = 85th Percentile Speed= 33.71 Kmph
Minimum Speed = 15th Percentile Speed= 20.28 Kmph
Design Speed = 98th Percentile Speed= 36.96Kmph
Median Speed = 50th Percentile Speed= 27.44 Kmph

ii. At moosarambagh towards Nalgonda X road signal for vehicle type: 4-wheeler on Monday:

Maximum Speed = 85th Percentile Speed= 35.69 Kmph
Minimum Speed = 15th Percentile Speed= 15.61 Kmph
Design Speed = 98th Percentile Speed= 41.02 Kmph
Median Speed = 50th Percentile Speed= 27.62 Kmph

iii. At moosarambagh towards Nalgonda X road signal for vehicle type: 2-wheeler on Sunday:

Maximum Speed = 85th Percentile Speed= 41.61 Kmph
Minimum Speed = 15th Percentile Speed= 25.19 Kmph
Design Speed = 98th Percentile Speed= 49.29 Kmph
Median Speed = 50th Percentile Speed= 39.69 Kmph

iv. At moosarambagh towards Nalgonda X Road signal for vehicle type: 4-wheeler on Sunday:

Maximum Speed = 85th Percentile Speed= 35.56 Kmph
Minimum Speed = 15th Percentile Speed= 20.31 Kmph
Design Speed = 98th Percentile Speed= 48.83 Kmph
Median Speed = 50th Percentile Speed= 27 Kmph

Table 1 Shows the data with respect to the spot speed study.

The design speed should be adopted based on the isolated speed limit of the road. The vehicles found in the lower 15 percent are considered to be travelling arbitrarily direct and those saw over the 85th percentile is thought to outstrip a secured and reasonable speed. 85th percentile could be a deciding factor for fixing the speed limit because it is protected and reasonable under favorable conditions.

Traffic Volume Count is usually expressed in terms of Passenger Car Unit (PCU). The main objective of the ordered traffic volume count is to know the traffic the traffic patterns based on the data collected, and also to provide feasible solution for nullifying the problem identified [6], [11].

The Traffic Volume survey was conducted on 17-02- 2020 (Monday), 21-02-2020 (Friday), 23-02-2020 (Sunday), in the Morning and Evening peak hours. The volume of vehicles is obtained from video recording, then forecasted for the future to take the remedial measure for the future, the ultimate goal of the project is to forecast the flow for the future and take necessary measures for the future [7].

4. Origin - Destination Survey:

An origin-destination study is used to determine travel patterns of traffic on an installation during a typical day. They are useful in assisting long-range traffic planning [9]. From the road side interviews, it clearly indicates that most of **them use this route for work** and schools/college, which indicates that in future time there will be heavy increase in the vehicles due to the road being the intermediate for the work purpose and schools/college.

5. Level of Service

Level-of-Service (LOS) is introduced by HCM to denote the level of quality one can derive from a local under different operation characteristics and traffic volume [8], [13]. Level of service is nearer to C during the non-peak hours and may go upto D, and level of service is nearer to D and may go upto E during peak hours, the level of service is E, at moosarambagh signal towards Nalgonda X road signal during morning and evening at Nalgonda X road signal towards Moosarambagh signal. Level of service will be beyond F in the future traffic conditions.

IV. HELPFUL HINTS
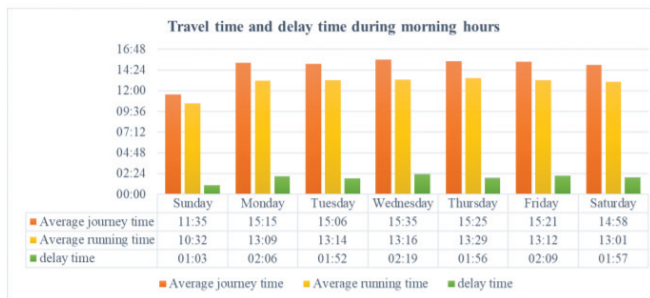
A. FIGURES AND TABLES

Fig1: Travel time and delay time during morning hours throughout the week from Kothapet signal to Nalgonda X road signal (8:30am -10:30am)

TABLE I.
SPOT SPEED STUDY ON MONDAY FOR 2-WHEELERS

Location: Moosarambagh towards Nalgonda X road signal

Weather: Good

Base length: 30m, measurement technique: manually

Date:10-02-2020

Time:4:00-6:00pm

Vehicle: 2-wheeler

Speed class limits(km/hr)	Mid point speed (km/hr)	No. of vehicles	Frequency %	Cummulative frequency %	f_x
15-19	17	3	5.45	5.45	51
20-24	22	8	14.54	19.99	176
25-29	27	15	27.27	47.26	405
30-34	32	17	30.91	78.17	374
35-39	37	11	20	98.17	407
40-44	42	0	0	98.17	0
45-49	47	1	1.81	100	47
50-54	52	0	0	100	0
		$\sum f=55$			$\sum f_x=1460$

Average speed of the 2-wheelers= 1460/55=26.55km/hr

V. CONCLUSIONS

As the number of vehicles has increased much rapidly resulting in congestion. If the count of vehicles increases by next 8-10 years, then there will be serious in congestion on the roadways and commuters will face very much difficulty. It is a clear message that regulatory bodies will have to take a big leap, especially in terms of traffic management in cities like Hyderabad. So, we need to step up and bring a change on road capacity and maintain proper level of service or reduce it to minimum. If more and more public transport is utilized, then there are more chances of reducing the LOS to minimum level. From our study we had observed a LOS C, D, E and F, which is increasing the travel time of commuters and at times it causes headache to the drivers and commuters as well.

Need of bus facility as major transport mode with the frequency of 1 bus/minute. Parking facilities like Multilevel parking should be provided with user charges. Parking facilities need to be improved, which also acts as commuters more travel time and due to this congestion comes into picture. Real-Time Traffic Feedback: The real-time traffic feedback, not just for where exactly the streetcar is at all times but also the traffic around the downtown area, that shows available parking spaces, etc. will affect the use of public transit. Real-time traffic feedback also makes concepts like "congestion pricing" a little easier to sell to consumers who're used to using roads for free [12]. Autonomous Vehicle Technology: Autonomous vehicles are likely to reduce congestion with fewer accidents and driver-caused traffic. It would eliminate human error that causes issues like "phantom traffic," which is caused by the ripple effect of a driver braking in the middle of a freeway. As a long-term solution, Skybus technology can be implemented rather than that of metro train.

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