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Traffic Volume Count and Signal Optimisation at Mothi Circle Davanagere

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***Abstract*—Traffic analysis is basically the process of intercepting and examining the number of vehicles on the road and deducing the pattern of traffic movement. A traffic survey on Mothi circle intersection of Davangere city has been carried out which includes calculation of present traffic density and analysis of traffic volume by adopting the Manual method of counting. PCU estimations are made and appropriate design corrections are suggested for highway geometry. For the proposed design geometry the signal time is optimized.**

Keywords— Signal Optimisation, Traffic volume Count, PCU estimation and Geometric Design.

I. INTRODUCTION

Traffic Engineering is branch of engineering which deals with planning, geometric design and traffic operation of roads, highways, their networks, terminals, and also achieves efficient and convenient movement of person and goods.

Traffic is generally defined as the movement of people, goods or vehicles between spatially separated points, and thus includes pedestrians and all types of vehicles mechanized, motorized or non motorized. Today man and his transport vehicles occupy a large share of the urban space. Traffic congestions, air pollution and noise pollution and the resultant ill effects and frustration have become the order of the day. The demand for traffic survey and analysis is likely to increase for future development of Transport Network. Traffic analysis is fundamental to planning of roads and flyovers. It also provides the basis for determining the number of traffic lanes to be provided for different road sections having regards to volume, composition and other parameters of traffic [1].

Traffic analysis can therefore help further in the evaluation of investment needed for the future road constructions and improvements. Such traffic surveys are a valuable source of data for planning of highways, flyovers, roads etc. As such, these should be a regular feature in all the traffic departments. The ever increasing no of two wheelers, four wheelers along with public transport and pedestrians poses a serious a serious question mark for a smooth and congestion free movement of traffic.

Metro towns in India especially the old ones are facing acute Traffic and transportation problems and in spite of making efforts and investments, cities have not been able to cope up with this gigantic problem. The population in towns is regularly increasing but the road area especially in the existing part of the cities and in city cores, remains the same, making the situation grim by increasing the congestion in central and the other important part of cities. Mass transportation systems are generally neglected or do not provide regular, adequate, safe and reliable quality of services there by people relying on the private vehicles, which leads to extreme congestion, increase in pollution, accidents and add to general deterioration of quality of life in cities. In metro cities there are about 15% car users and as 75% of the transport budget is used for widening roads, which primarily benefits the car and two wheelers and not the mass transportation systems. Beside this increase of commercial and institutional activities in central built up areas ,temporary and permanent encroachment on roads ,unauthorized parking of tempos ,Rickshaws , use of same road lanes by slow moving vehicles, intermediate transport systems and fast speed vehicles , poor traffic management add to the problem. The problem can be addressed by preparation of a comprehensive traffic and transportation plan for the town along with appropriate placement/locating various land uses in the Master Plan [2].

A. Types of Traffic Survey

The following traffic surveys can be conducted for appreciating the existing traffic and travel demand characteristics and to prepare the transport infrastructure improvement plans.

- Road inventory survey
- Classified traffic volume count survey
- Origin and destination survey
- Household interview survey
- Speed and delay
- Parking survey
- Pedestrian survey
- Intermediate public transport operator survey
- Intermediate public transport user survey

B. Purpose And Scope Of The Traffic Studies

In order to facilitate the assessment of present and future traffic demands, for the development of need-based infrastructure accurate information and continuous monitoring of traffic by appropriate methods is necessary. Implementing authorities must therefore ensure that sufficient and appropriate data is available to undertake necessary planning, design, construction and maintenance of the country's road network, which is aimed at meeting

the prevailing traffic flow, future traffic growth and loading without considerable deterioration in the quality of service.
This guideline has therefore been prepared with the main aim being to provide basic information, concept and principles with respect to traffic data collection and analysis. There are various methods of data collection available and used by different organisations/institutions. This guideline therefore, is only intended to provide guidance in respect of data collection and analysis, and allows for variation in the methodologies adopted by different users, planners, developers, funding authorities, etc.
The beneficiaries of this guideline are Roads Department, other Ministries/Departments, local authorities, educational institutions, the private sector and individuals [3].

C. Need For The Study

The selected intersection which is having a much traffic flow due to the less width of the roads and the maximum people will travel in this intersection.
Such that due to this problem it will lead to accidents, traffic congestions and delay in travel time.
To solve these problems the study of the Present traffic volume and analysis should be made with regard to road geometry like increasing the road width and signal time. By addressing these two issues the traffic problem can be solved to little extent.

D. Objectives Of The Study

The extensive literature review paved the way for defining the following objectives for this study:

- To achieve smooth and easy flow of the traffic at intersection
- To develop methods for improvement in general and solving specific problem in particular.
- To have safe, convenient, rapid and economic transport of persons and goods.
- To improve the speed of vehicle.
- To provide a basis for future studies of road expansion.
- To reduce the delays in road journeys.
- To remove the traffic congestion.
- To reduce the chances of road accidents to a minimum.
- To increase the traffic carrying capacity of roads.

E. Study Area

Davangere is the "Heart of Karnataka". Davangere is surrounded from Chitradurga, Bellary, Shimoga, Chikmagalur and Haveri Districts. Davangere is at the centre of Karnataka, 14°28' N latitude, 75°59' longitude and 602.5 metres (1,977 ft) above sea level. Davanagere city covered total Area of 68.63square km. Davangere lies along on the National Highway 4, a part of the Golden Quadrilateral, at a distance of about 264 kilometres (164 mi) from the state capital, Bangalore.
As of the 2011 census, Davangere city had a population of 435,125. Males constitute 52% of the population, and females 48%.

Davangere is well-connected by road to Mumbai, Pune, Goa, Bangalore, Mangalore and Chennai through National Highway 4 (India) (previously Pune-Bangalore Highway and now Mumbai-Pune-Bangalore-Chennai Highway)
The study area is selected at Mothi circle intersection in Davanagere.

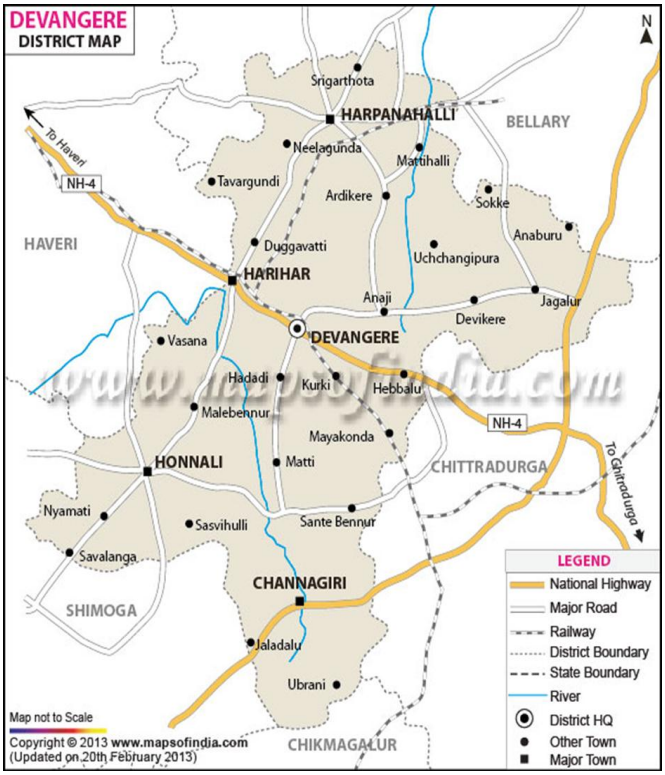

Fig. 1. Road Map of Davanagere City.

II. METHODOLOGY

In the present study traffic volume studies are studied at a intersection for a period of 4months for a period of 8 hours along the different movement at a intersection.
General observations were made for a period of two months for Davanagere city roads and Poona Bangalore road stretch is selected because of the more traffic flow in this road section
Intersection at Mothi Circle with traffic signal is identified located near the railway crossing in the city. Traffic volume count analysis methods were studied and formats for traffic volume count were prepared.
Traffic volume studies are conducted to determine the type of vehicles and movements at a given location.
These data can help identify critical flow time periods, determine the influence of large vehicles or pedestrians on vehicular traffic flow, or document traffic volume trends. The length of the sampling period depends on the type of count being taken and the intended use of the data recorded.
For example, an intersection count may be conducted during the peak flow period. If so, manual count with 15-minute intervals could be used to obtain the traffic volume data.
Manual counts are typically used to gather data for determination of vehicle classification, turning movements, direction of travel, pedestrian movements, or vehicle

occupancy. In the present study manual count method is adopted for studying the type and traffic volume composition at Mothi Circle Intersection.

The following Table I represent the format adopted for traffic volume count for morning peak and evening peaks. Traffic counts during a Monday morning rush hour and a Friday evening rush hour may show exceptionally high volumes and are not normally used in analysis; therefore, counts are usually conducted on a Tuesday, Wednesday, or Thursday. Analysis of results will be made using plots and graphs. The results analysis made using bar chart and pie chart can be used to analyze the result. Appropriate geometric designs are made based on the volume of traffic.

TABLE I. MANUAL COUNT METHOD.

TIME	MOVEMENTS	TYPES OF VEHICLES			
		2 Wheelers	3 wheelers	4 wheelers	6 wheelers
8.00 to 8.15am					
8.15to 8.30am					
8.30 to 8.45am					
8.45 to 9.00am					
9.00 to 9.15am					
9.15 to 9.30am					

In the second phase of the work existing signal time was recorded for the Mothi Circle Intersection. Using trial cycle method the traffic signal time is optimised.

A. *Trial Cycle Method*

The 15 minute-traffic counts n_1 and n_2 on road 1 and 2 are noted during the design peak hour flow. Some suitable trial cycle C_1 second is assumed and the number of the assumed cycles in the 15 minutes or 15*60 seconds period is found to be $(16*16)/C_1$. Assuming average time headway 2.5 seconds, the green periods G_1 and G_2 of roads 1 and 2 are calculated to clear the traffic during the trial cycle.

$$G_1=2.5n_1C_1/900 \quad (1)$$

And $$G_2=2.5n_2C_2/900 \quad (2)$$

The amber periods A_1 and A2 are either calculated or assumed suitably (3 to 4 seconds) and the length C_1 is calculated equal to $(G_1+G_2+A_1+A_2)$ seconds. If the calculated cycle length is accepted as the design cycle. Otherwise the trails are repeated till the trial cycle length worked out and realtered the existing signal time.

III. RESULTS AND DISCUSSIONS

A. *Traffic Volume count Analysis*

The following observations were made at Mothi circle intersection with eight different movements of traffic is tabulated and the results are plotted.

- Direction of travel: Gmit to Ksrtc Road

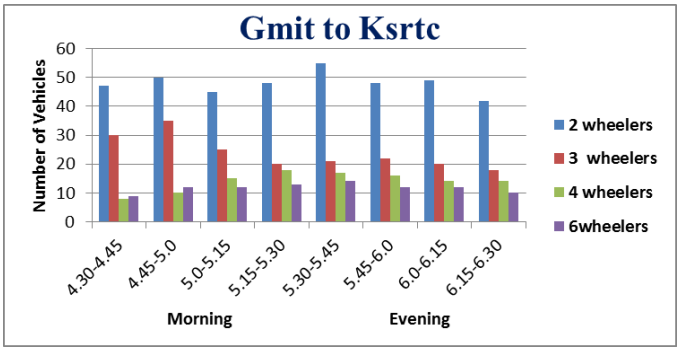

Fig. 2. Composition of Traffic Volume at Mothi circle travelling from Gmit to Ksrtc Road.

- Direction of travel: Ksrtc Road to Gmit

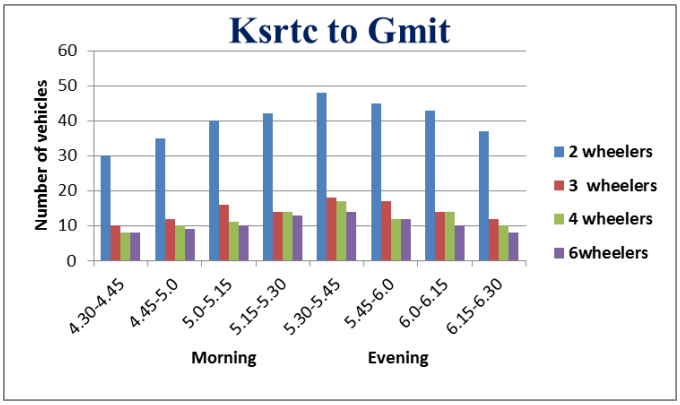

Fig. 3. Composition of Traffic Volume at Mothi circle travelling from Ksrtc Road to Gmit.

- Direction of travel : Gmit to Ashoka Road

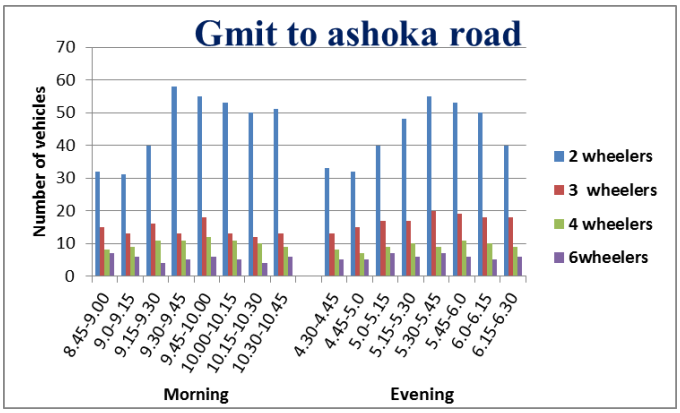

Fig. 4. Composition of Traffic Volume at Mothi circle travelling from Gmit to Ashoka Road.

- Direction of travel: Ashoka road to ksrtc

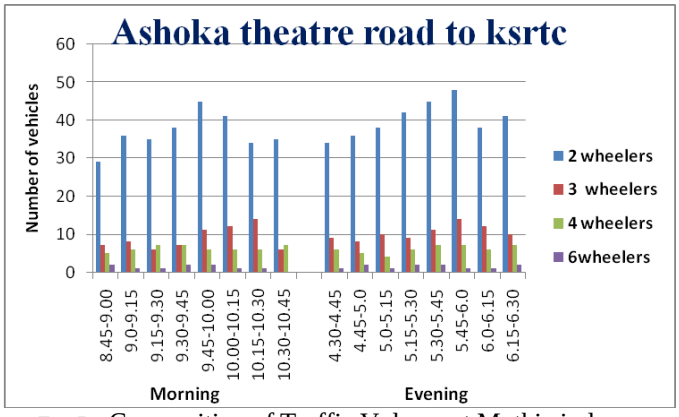

Fig. 5. Composition of Traffic Volume at Mothi circle travelling from Ashoka theatre road to ksrtc.

- Direction of travel: Ksrtc to ashoka road

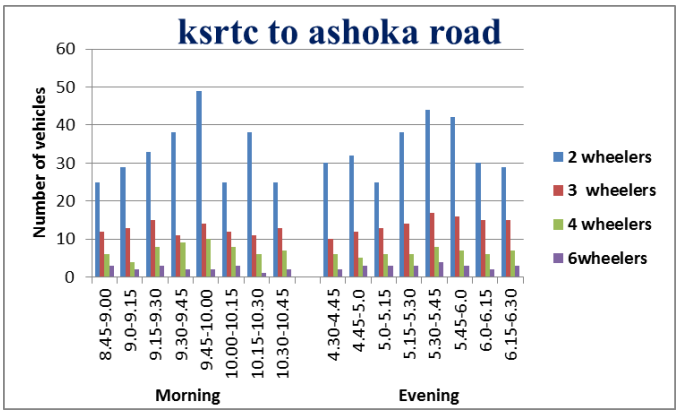

Fig. 6. Composition of Traffic Volume at Mothi circle travelling from Ksrtc to Ashoka Road.

- Direction of travel: Ksrtc to Ashoka Theatre road

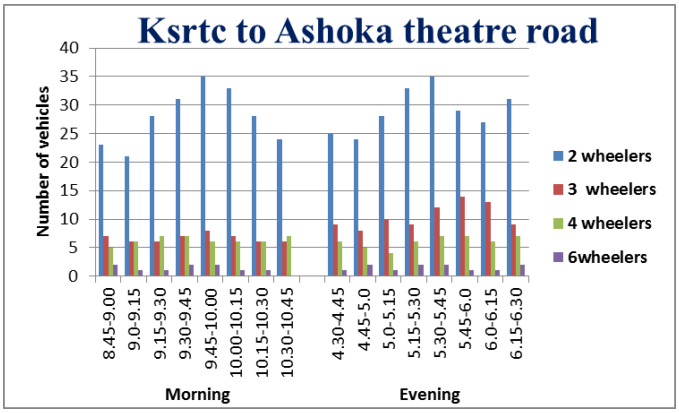

Fig. 7. Composition of Traffic Volume at Mothi circle travelling from Ksrtc to Ashoka theatre Road.

- Direction of travel: Ashoka Theatre road to Gmit

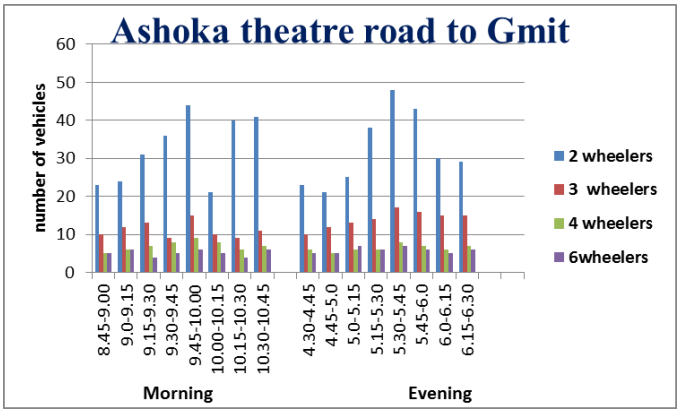

Fig. 8. Composition of Traffic Volume at Mothi circle travelling from Ashoka theatre Road to Gmit.

- Direction of travel: Gmit to Ashoka Theatre road

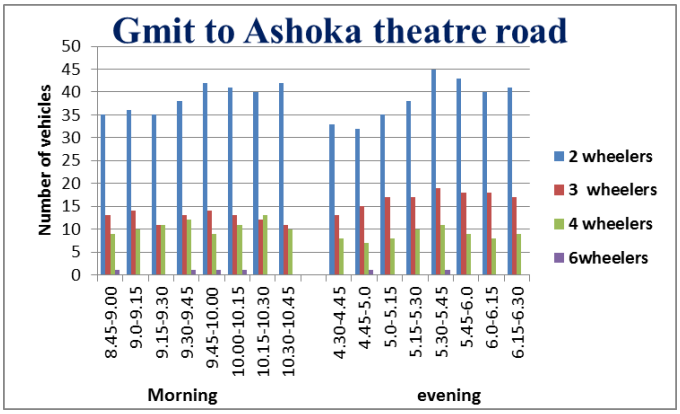

Fig. 9. Composition of Traffic Volume at Mothi circle travelling from Gmit to Ashoka theatre Road.

The Table II represents standard PCU values for urban roads for different class of vehicles according to IRC recommendations.

TABLE II. PCU VALUE TABLE.

Sl.No	Vehicles class	PCU values for Urban roads
1	2 wheelers	0.4
2	3 wheelers	0.5
3	4 wheelers	1.0
4	6 wheelers	2.2

The Table III represents PCU capacity per day for different types of roads according to IRC recommendations.

TABLE III. CAPACITY OF DIFFERENT TYPES OF ROADS

Types of roads	Capacity PCU per day (both direction)
Single lane with 3.75m wide carriage way and normal earthen shoulders	1000
Single lane roads with 3.75m wide carriage way and1.0m wide hard shoulders	2500
Roads with intermediate lanes of width 5.5m and normal earthen shoulders	5000
Two lane roads with 7.0m wide carriage way and earthen shoulders	10000
Four lane divided highway(depending on traffic access control)	20000 to 30000

B. PCU calculations

PCU capacity
Per day $= (P*X_1) + (Q*X_2) + (R*X_3) + (S*X_4)$ (3)

Where, P is Number of two wheelers,
Q is Number of three wheelers
R is Number of four wheelers and
S Number of five wheelers and above
X_1, X_2, X_3 and X_4 are respective PCU coefficient values

PCU capacity per day at Mothi circle is calculated as follows

= (900*0.4+450*0.5+170*1+85*2.2)*24 =22608.4

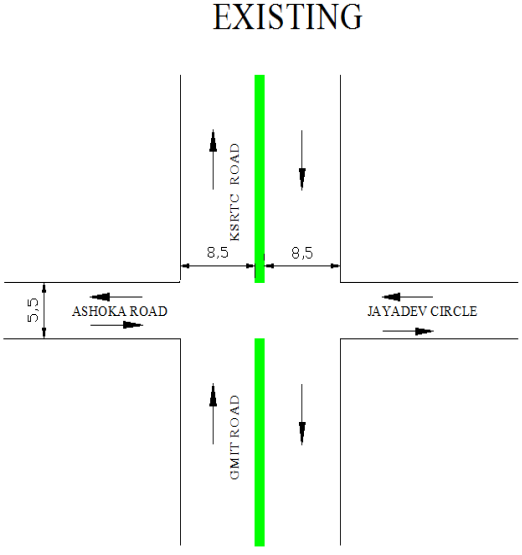

Fig. 10. Existing Plan of Mothi circle intersection.

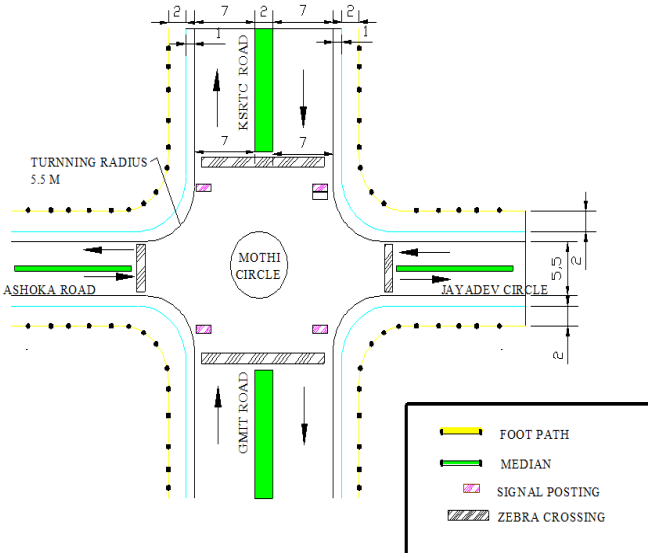

Fig. 11. Proposed Plan of Mothi circle intersection.

C. Signal Time Optimisation

Number of vehicles flow from GMIT to KSRTC Bustand from 5.15 to 5.30pm=222 (Peak hour time interval and respective volume is taken)
Number of vehicles flow from ksrtc to gmit from 4.30 to 4.45pm=212 (Peak hour time interval and respective volume is taken)
Assume trail cycle c_1=50seconds
Number of cycle 15mins =900/50=18
Green time for road allowing on average headway of 2.5sec per vehicle

G_1=212*2.5/18=29.44

Green time for second lane G_2=212*2.5/18=38.83
Amber time A_1 and A_2 are 3 and 2seconds
Therefore total cycle length = 29.44 + 38.83 +2 +3
= 65.27 seconds.
Therefore obtain value greater than the assumed value hence provide a signal timings of 66 seconds on each lane.

IV. CONCLUSIONS

The present study concludes that the proposal suggested at Mothi circle can be adopted for the smooth and easy flow of traffic without causing delays. The proposal is made with the design corrections in highway geometry like widening the roads at intersection, providing adequate drainage facilities, signal optimization, pedestrian crossings, increasing in turning radius for smooth and easy travel of road users. The width of the intersection is increased from 18m to 22m with appropriate design aspects. The signal time is optimized to 66 seconds for each lane according to the proposed design geometry. It can also be concluded that due to the adequate provision of pedestrian crossing the rate of pedestrian accidents may be minimized.

ACKNOWLEDGMENT

This Research was carried out due to growing concerns of the traffic problems and congestions in the Davanagere City. The study is carried out by G.M Institute of Technology Davanagere.Grateful acknowledgement is made to Regional Transport Office Davanagere and GMIT Davanagere for their helpful comments and resources for carrying out this study.

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