Traffic Volume Count and Signal Optimisation at Railway Station Circle and Pooja 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 Railway Station circle and Pooja 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.

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 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.

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.

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
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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.

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.

C. 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 have safe, convenient, rapid and economic transport of persons and goods.
- To improve the speed of vehicle.
- 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.

D. 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' longitudeand 602.5 metres (1,977 ft) above sea level. Davanagere city covered total Area of 68.63square km. Davangere liesalong 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 Railway Station circle and Pooja circle intersection in Davanagere.

Fig. 1.Satellite view of Railway Station Circle

Fig. 2. Satellite view of Pooja Circle

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 road sand Poona Bangalore road stretch is selected because of the more traffic flow in this road section.

Intersection at Railway Station 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. 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 both Railway Station Circle and Pooja 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 COUNTMETHOD.

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

In the second phase of the work existing signal time was recorded for the Railway Station Circle and Pooja 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 ANDDISCUSSIONS

A. Traffic Volume count Analysis

The following observations were made at Railway Station Circle and Pooja Circle intersection with eight different movements of traffic is tabulated and the results are plotted.

Railway Station Circle

- Direction of travel: Gmit to Ksrtc Road

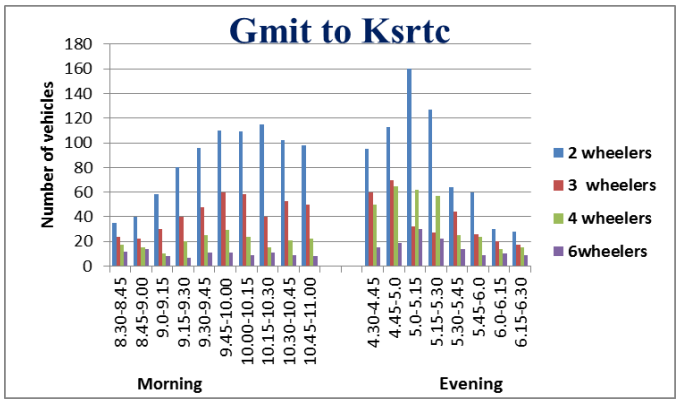

Fig. 3. Composition of Traffic Volume at Railway Station circle travelling from Gmit to Ksrtc Road

- Direction of travel: Ksrtc Road to Gmit

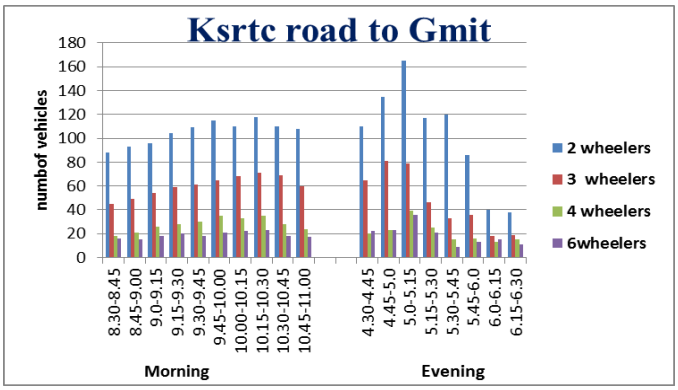

Fig. 4. Composition of Traffic Volume at Railway Station circle travelling from Ksrtc to Gmit.

- Direction of travel :Ratnamma Hostel road to Ksrtc

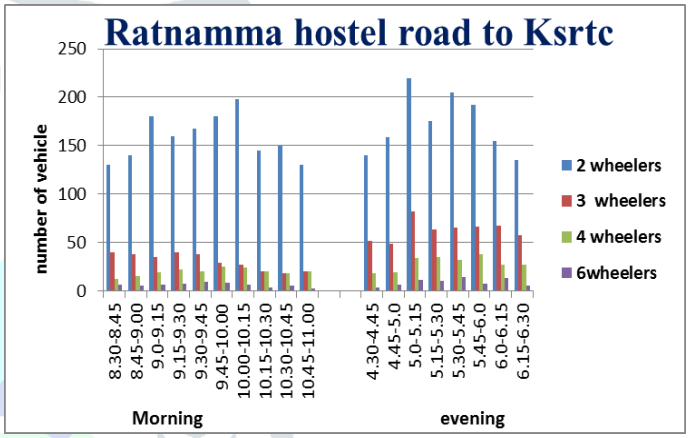

Fig. 5. Composition of Traffic Volume at Railway Station Circle travelling from Ratnamma Hostel Road to Ksrtc.

- Direction of travel : Ratnamma Hostel road to Gmit

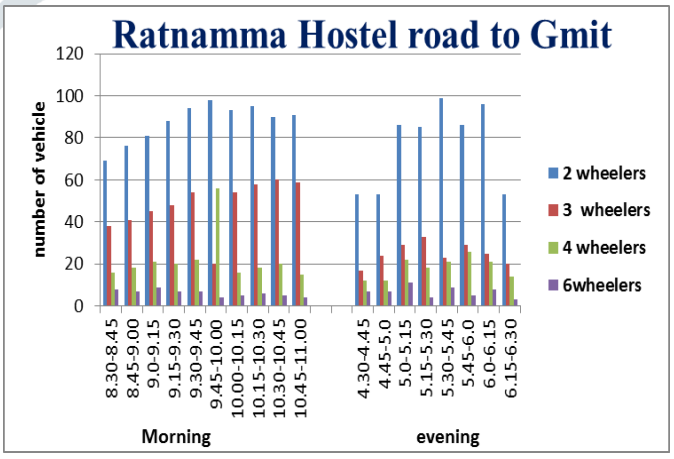

Fig. 6. Composition of Traffic Volume at Railway Station circle travelling from Ratnamma Hostel Road to Gmit

Pooja Circle

- Direction of travel: GMIT to KSRTC Road

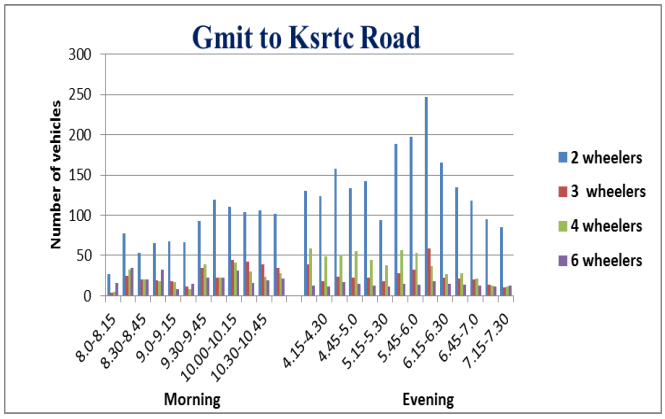

Fig. 7. Composition of Traffic Volume at Pooja Circle travelling from Gmit to Ksrtc

- Direction of travel: Ksrtc Road to GMIT

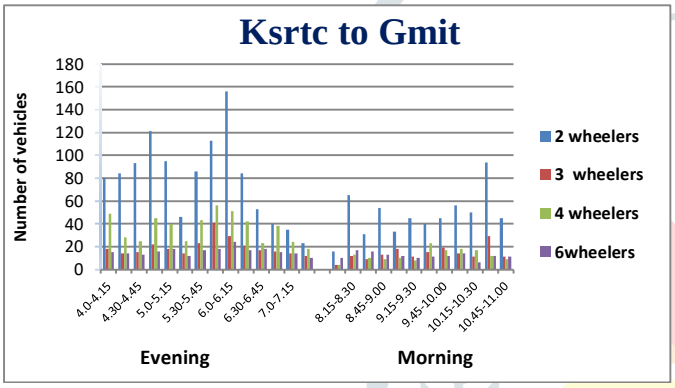

Fig. 8. Composition of Traffic Volume at Pooja Circle travelling from Ksrtc to Gmit Road

- Direction of travel :GMIT to Court Road

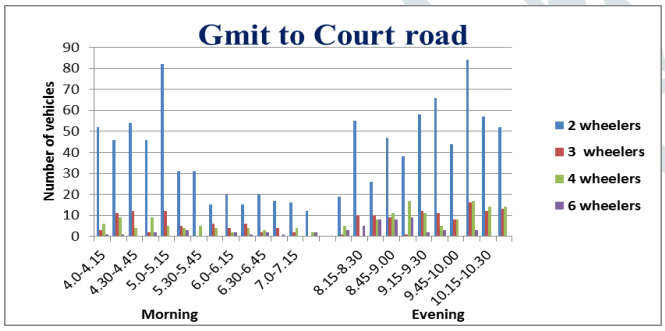

Fig. 9. Composition of Traffic Volume at Pooja Circle travelling from Gmit to Court Road

- Direction of travel : Court road to Gmit

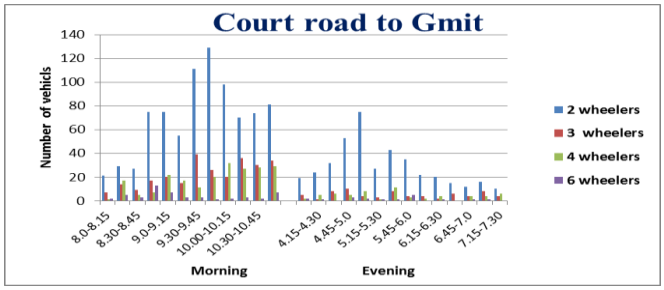

Fig. 10. Composition of Traffic Volume at Pooja Circle travelling from Court road to Gmit.

- Direction of travel: Court road to Ksrtc road

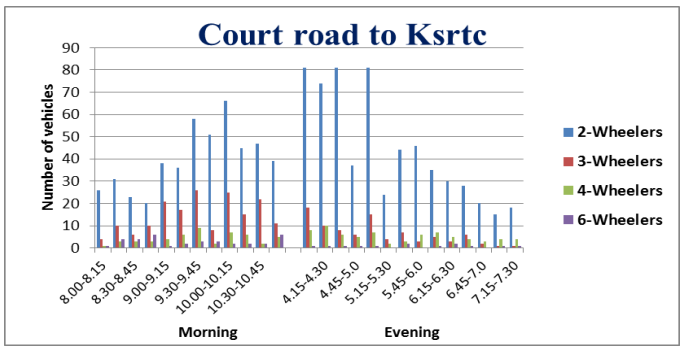

Fig. 11. Composition of Traffic Volume at Pooja Circle travelling from Court road to Ksrtc

- Direction of travel: Ksrtc to Court road

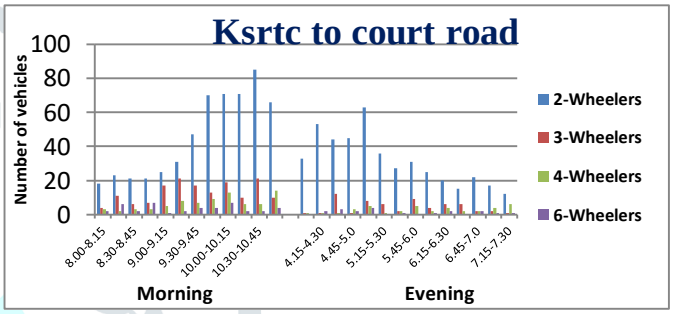

Fig. 12. Composition of Traffic Volume at Pooja Circle travelling from Ksrtc to Court Road.

The Table II represents standard PCU values for urban roads for different class of vehicles according to IRC 064-1976 Code Book.

TABLE II. PCU VALUETABLE.

Sl.No	Vehicles class	PCU values for Urban roads
1	2 wheelers	0.75
2	3 wheelers	2
3	4 wheelers	2
4	6 wheelers	3.7

*Source: Incorporated from IRC 064-1976 Code Book

The Table III represents PCU capacity per day for different types of roads according to IRC 064-1976 Code Book.

TABLE III. CAPACITY OF DIFFERENT TYPES OFROADS

Types of roads	Capacity PCU per day (both direction)
Single lane with 3.75m wide carriage way and normal earthen shoulders	1500
Single lane roads with 3.75m wide carriage way and1.0m wide hard shoulders	2400
Roads with intermediate lanes of width 5.5m and normal earthen shoulders	3000
Two lane roads with 7.0m wide carriage way and earthen shoulders	3600
Four lane divided highway(depending on traffic access control)	5400

*Source: Incorporated from IRC 064-1976 Code Book

B. PCUcalculations

PCU capacity Perday

$= (P*X_1) + (Q*X_2) + (R*X_3) + (S*X_4)$ (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 Railway Station Circle is calculated as follows

= (635 X .75 + 230 X 2 + 170 X 2 + 96 X 3.7) X 24
= 39154.8

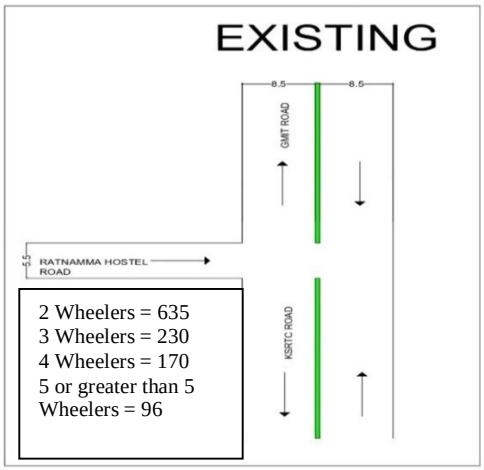

Fig. 13. Existing Plan of Railway Station Circle intersection.

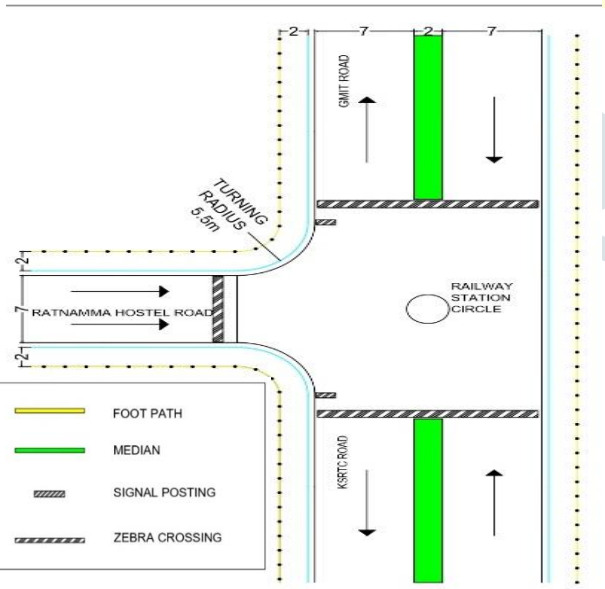

Fig. 14. Proposed Plan of Railway Station Circle intersection.

- PCU capacity per day at Pooja Circle is calculated as follows

= (843 X 0.75 + 167 X 2 + 158 X 2 + 93 X 3.7) X 24
= 39032.4

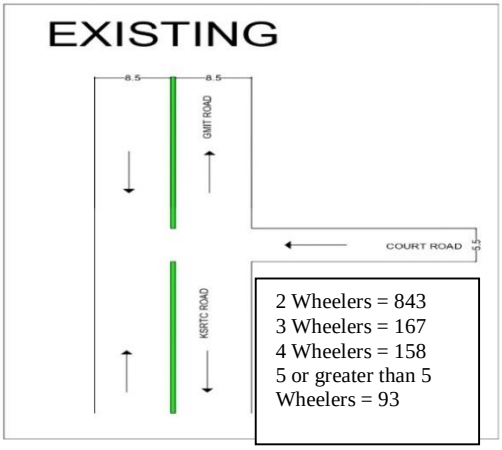

Fig. 15. Existing Plan of Pooja Circle intersection.

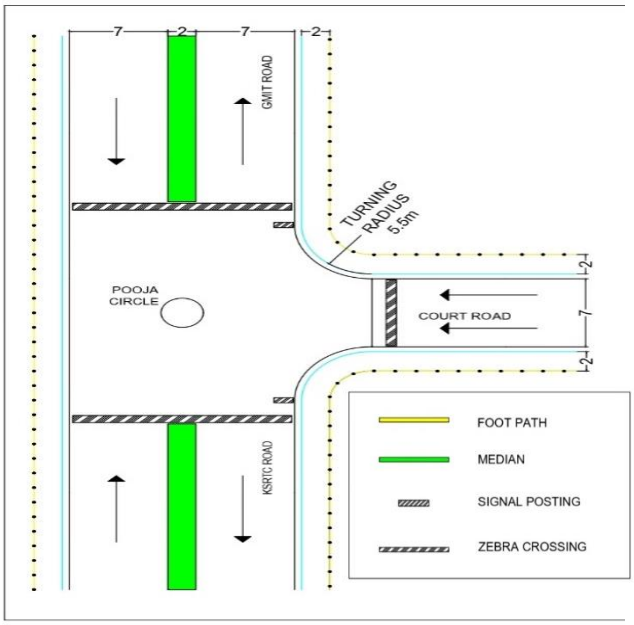

Fig. 16. Proposed Plan of Pooja Circle intersection.

A. Signal Time Optimisation

For Railway Station Circle

Number of vehicles flow from GMIT to KSRTC Bus-stand from 5.15 to 5.30pm = 355
(Peak hour time interval and respective volume is taken)

Number of vehicles flow from ksrtc to gmit from 4.30 to 4.45pm = 337
(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

G1 = 355*2.5/18 = 49.30

Green time for second lane G2 = 337*2.5/18 = 46.80

Amber time A_1 and A_2 are 3 and 2seconds

Therefore
Total cycle length = 49.30+46.80+2+3 = 101.1 seconds.

Therefore obtain value greater than the assumed value hence provide a signal timings of 101.1 seconds on each lane.

For Pooja Circle

Number of vehicles flow from GMIT to KSRTC Bus stand from 5.15 to 5.30pm = 226
(Peak hour time interval and respective volume is taken)

Number of vehicles flow from ksrtc to gmit from 4.30 to 4.45pm = 260
(Peak hour time interval and respective volume is taken).

Assume trail cycle c1 = 50seconds
Number of cycle 15mins = 900/50 = 18

Green time for road allowing on average headway of 2.5sec per vehicle

G1 = 226*2.5/18 = 31.38

Green time for second lane

G2 = 260*2.5/18 = 36.11

Amber time A1 and A2 are 3 and 2seconds.

Therefore total cycle length = 31.38+36.11+2+3 = 72.5 seconds.

Therefore obtain value greater than the assumed value hence provide a signal timings of 72.5 seconds on each lane.

TABLE IV – Cycle Time

Name of Intersection	Existing Cycle Time	Proposed Cycle Time
Railway Station Circle	60	101.5
Pooja Circle	60	72.5

CONCLUSION

The present study concludes that the proposal suggested at Railway Station circle and Pooja 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 101.5 and 72.5 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.

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