PLANNING AND DESIGN OF RING ROAD

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Abstract - *Provision on adequate infrastructure is a pre-requisite for sustained growth of economy and inherent to such growth is the need to ensure cost effective movement of People and goods. An efficient road infrastructure is therefore an essential requirement. The number of vehicles plying the road has increased dramatically. Hence, there is an urgent need to standardize the present inadequate road network in terms of its capacity. Kottarakkara , a town in Kollam district in Kerala is considered. Due to high acquisition price, impossibility in widening due to dense population and due to cross traffic , Construction of ring road was considered.*

 *Key Words***:** Ring road, Kottarakkara, Traffic Survey, Pavement Design, Proctor test, Bridge

1.INTRODUCTION

Kottarakara is a town in Kollam district in Kerala. NH744 (Kollam to Thirumangalam) meets the MC road (Thiruvanathapuram to Angamaly) at Kottarakara. There is heavy congestion on the Kottarakara town mainly in Pulamon Junction where the two roads intersects.

 The main purpose of a ring road is to relieve the town centres from cross traffic. It is meant both to divert traffic that has no business in the town centres and to redistribute traffic bound in and out of town centres. Likewise, heavy transport should be led away from the town centre, and the flow of car traffic should be distributed via different areas into the centre of town. The ring road should improve the vehicular access to a town centre, it should offer better car traffic flow through the town as a whole. One must keep in mind that at the time when ring roads first were planned and built, one was expecting an explosion in the growth of private car traffic. At that time, a ring road was regarded as a solution for the distribution of large numbers of cars. Furthermore, a ring road was believed to open up new opportunities for pedestrian streets in the town centre, areas almost free from heavy car traffic. A ring road is defined to be a main part of a town's road and street structure that encircles its central core. Most ring roads are planned and imposed upon an already existing town structure.

There have been heavy traffic congestions along arterial roads as a result of rapidly growing population and increased traffic volumes. Therefore, the construction of a ring around the Kottarakara town to mitigate the congestion and improve the logistics in the area is urgently needed. Also

by constructing a ring road at Kottarakara Town the travelling time will be reduced and all the places in the town will be easily accessible.

2. OBJECTIVES

- To improve connectivity and decongest the traffic flow to Kottarakara town.
- To facilitate smooth flow of traffic in the town and to reduce travelling time.
- Decongest town area and to meet future demand
- To interconnect every part of the town from the outskirts
- To adapt to the expanding needs of the city.

3. METHODOLOGY

It includes selection of study area, data collection and data analysis. A detailed literature review was done. Kottarakkara was selected as the study area. Different characteristics of Kottarakkara and Road inventory survey was done. Traffic survey including traffic volume count, turning movement survey and O-D survey was done. Traffic volume count was done at four locations(Karikkam, Plamoodu , Pallimukku, Mylom), turning movement survey at Pulamon Junction(four points for four days) and O-D survey at four locations. Hourly counting for different categories of vehicles was done. CBR test was done at 4 Points at 500m intervals. Pavement design was done using the CBR values obtained and using traffic volume count. Also a bridge and culvert was designed in Pallimukku – Karikkam stretch.

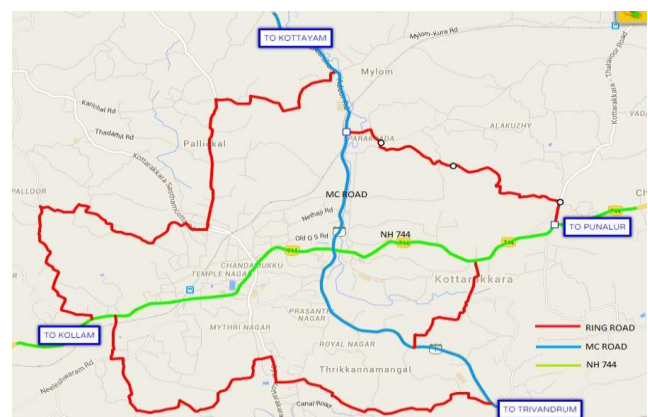## 4. ALIGNMENT OF PROPOSED RING ROAD

Fig 1: Final alignment of ring road

STRETCH 1

Proposed Alignment for Travelling through MC road from Thiruvananthapuram side to Kollam side(NH) and vice versa.

Vehicles can take deviation to left side from Karikkam Jn in M.C road and travelling through Thattom jn, Thrikkannamangalam jn, E.T.C jn, in front of E.T.C , block panchayath, I.H.R.D college of engineering, Kalluvathukkal, Neeleswaram Mukku, Jawahar Nagar, Mukkonimukku and ends through the existing under pass at Thamarasseri Jn in Kollam- Kottarakkara N.H road. The total length of road in this proposal is nearly 7.80 km, whereas the length of existing M.C road to thamarasseri jn through Pulamon Jn is about 7.50 km.

STRETCH 2

Proposed Alignment for Travelling through Kollam-Kottarakkara N.H road from Kollam side to Kottayam side and vice versa.

Vehicles can take deviation to the left side from the road starting in between Neduvathoor jn and Thamarasseri jn to Anakkottoor in Neduvathoor- Puthur road and Plying through Moorthikavu jn, Avanoor Jn , Muslim street, Pallikkal jn and finally ends at Mylom jn in M.C road. The total length of the proposed deviated road is about 8.70 whereas the road length through Pulamon jn is about 6.50 km.

STRETCH 3

Proposed Alignment for Travelling through Kottarakkara-Punalur N.H road from Punalur side to Kottayam side and vice versa.

Vehicles can be deviated to right side through existing road starting near from Kizhakketheruvu and plying to Palanirappu Jn, Bappuji Nagar, Descent Mukku, Parakkadavu and ends in M.C road nearly M.G.M school at Mylom jn. The total length of the proposal comes nearly 4.0 km, whereas the road length through Pulamon Junction comes to about 6.10 km.

STRETCH 4

Proposed Alignment for Travelling through M.C road from Thiruvananthapuram side to Punalur side and vice versa.

 The vehicle passing to Punalur side from M.C road can be take deviation to right side from St.George Shalem church road to Parayilmukku to St.Mary's High school junction and ends at Kizhakketheruvu junction in Kollam-Punalur road(NH road).The length of the road from St.George Shalem church road from M.C road to Kizhakketheruvu

junction in NH road is 2.0 km, whereas the length of road portion from M.C road to NH road through Pulamon junction is 7.20 km.

5. TRAFFIC SURVEY

LOCATION	2 WHEELER	3 WHEELER	4WHEELER	TRUCK	BUS
TVM	6472	826	8144	225	810
KOLLAM	6357	2347	6709	370	2173
KOTTAYAM	6414	1586	7426	297	1491
PUNALUR	5641	1104	4002	227	809
PCU COEFFICIENT	0.5	1	1	4.5	3
TOTAL PCU	12442	5863	26281	5035.5	15849

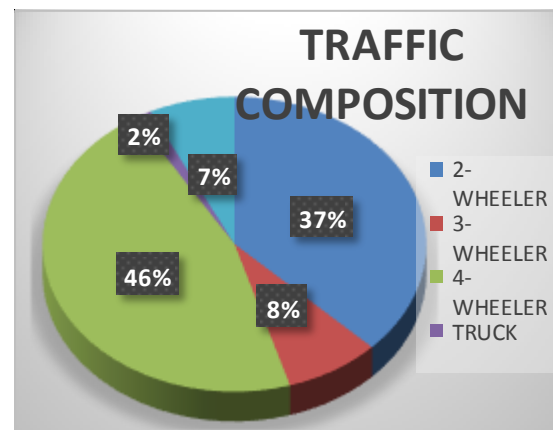TABLE 1: Traffic volume count

Fig1: Traffic Composition
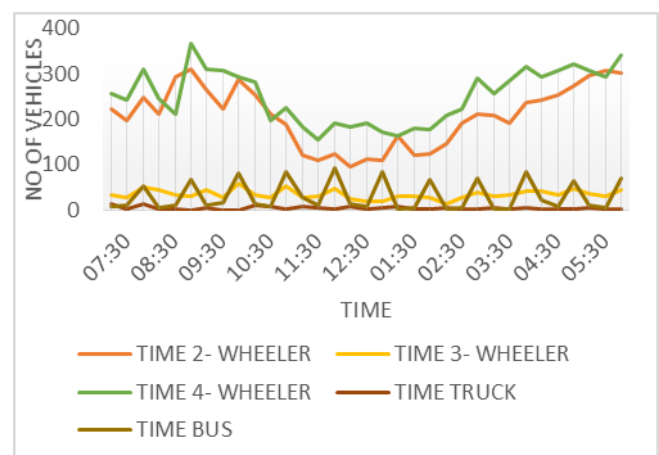
Fig2: Hourly Variation of traffic

6. GEOTECHNICHAL INVESTIGATIONS
6.1 PROCTOR COMPACTION TEST

Descrpition	1	2	3	4	5	6
1. Wt. of mould (g)	4389.5	4389.5	4389.5	4389.5	4389.5	4389.5
2. Wt. of mould and compacted soil (g)	6028.5	6254.6	6367.7	6405.3	6348.8	6254.6
3. Wt. of compacted soil (g)	1639.0	1865.1	1978.2	2015.8	1959.3	1865.1
4. Density(g) = Wt. of soil/vol. of mould (g/cc)	1.74	1.98	2.1	2.14	2.08	1.98
5. Water content (%)	8	10	12	14	16	18
6. Dry density (g_d) = g/(1+w) (g/cc)	1.611	1.8	1.875	1.89	1.79	1.677

Table 2- Standard Proctor test
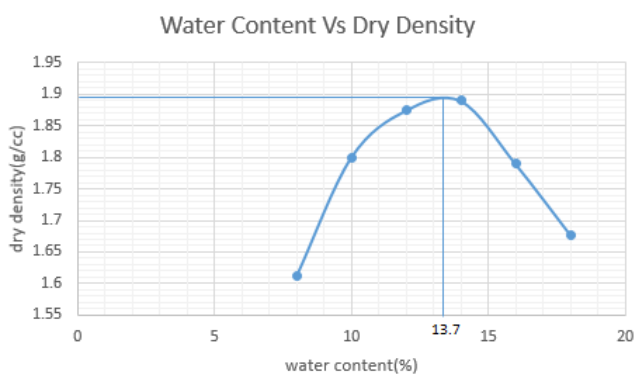
O.M.C obtained from graph = 13.7%

6.2 CALIFORNIA BEARING RATIO TEST

PENETRATION	NO OF DIVISION	LOAD
0	0	0
0.5	54	902.88
1	126	2106.72
1.5	192	3210.24
2	254	4246.88
2.5	297	4965.84
4	387	6470.64
5	422	7055.84
7.5	467	7808.24
10	481	8042.32
12.5	491	8209.52

Table 3- CBR test
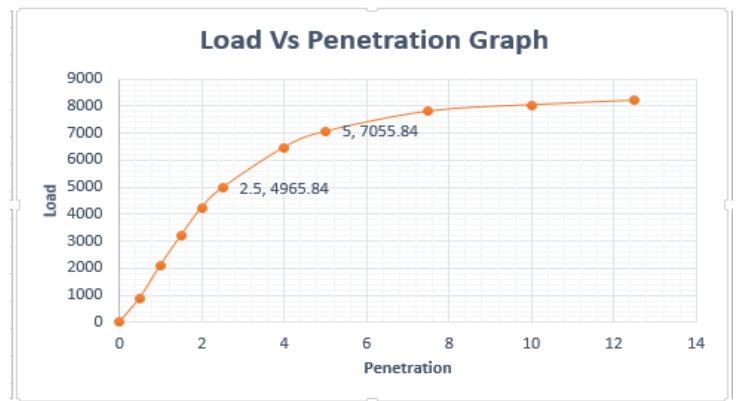
CALCULATIONS:
CBR value for 2.5 mm penetration = 4965.84*100/13700 = 36.25%
CBR value for 5 mm penetration = 7055.84*100/20550 = 34.33%

RESULT:
CBR value of sample = 36.25%

7. PAVEMENT DESIGN

COMPUTATION OF DESIGN TRAFFIC VOLUME

The design traffic is considered in terms of the cumulative no.of standard axles to be carried during the design life of the load. This can be computed using the following equations:

$$N = \frac{365((1+r)^n - 1)A \times D \times F}{r}$$

Where
N=Cumulative no.of standard axles in the design in million standard axles
A=Initial traffic in the year of completion of construction in terms of the no.of commercial vehicles per day
D=Lane distribution factor(as per IRC 37-2012)
F=Vehicles damage factor (as per IRC 37-2012)
N=Design life in years
r=Annual growth rate of commercial vehicles (for 7.50% annually)
CALCULATIONS:
CBR value for 2.5 mm penetration = 4129.84*100/13700 = 30.14%
CBR value for 5 mm penetration = 5551.04*100/20550 = 27.01%
The maximum CBR value to taken for design as per IRC 37-2012 is 10%.
Therefore CBR value is 10%.

Cumulative number of standard axles,N
$=365((1+r)^n-1)A \times D \times F/ r$
Initial traffic,A　　　　　　　　　$=P(1+r)^x$
Where,
Number of commercial vehicle as per last count,P = 663

No of years between the last count and the Year of completion of construction,x =3 years

Annual growth rate of commercial vehicles,r =7.5%

Therefore, A

$= 663(1+0.075)^3$

=824

Annual growth rate of commercial vehicles,r =7.5 %

Design life in years,n =15

Initial traffic,A =824

Lane distribution factor ,D = 0.75(As per IRC 37-2012,Pg13)

Vehicle damage factor,F =3.5(As per IRC 37-2012,Pg 12)

N $= (365((1+0.075)^{15} - 1)824 \times 0.75 \times 3.5)/.075$

$= 20.62 \times 10^6$

CSA =20.62 msa

From the above design catalogue pavement composition corresponding to CBR value 10% and cumulative traffic 20.62 msa is 566 mm.(from table)

CUMULATIVE TRAFFIC (msa)	TOTAL PAVEMENT THICKNESS (mm)	PAVEMENT COMPOSITION		GRANULAR BASE AND SUB BASE (mm)
		BITUMINOUS SURFACING		
		BC (mm)	DBM (mm)	
10	540	40	50	
20	565	40	75	
30	580	40	90	BASE=250 SUB BASE=200
50	600	40	110	
100	630	50	130	
150	650	50	150	

Therefore from calculation, the thickness of each layer are:

Granular sub-base =200 mm

Wet mix macadam =250 mm

Dense bituminous macadam =76mm

Bituminous concrete =40mm

Total thickness =566mm
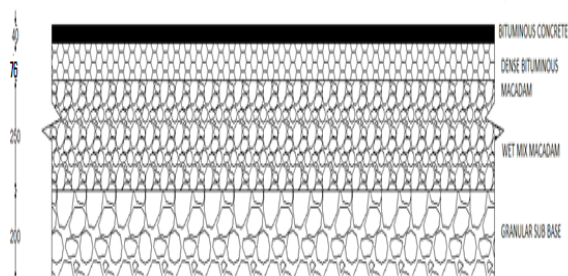
9.. CONCLUSION

- As there is cross traffic in Kottarakkara town ,bypass cannot fullfill the requirement, so a ring road was selected.
- The traffic volume study showed that the existing road is inadequate for the present volume of traffic and also there is no chance for widening the road.
- From the results of traffic volume study, it was found that peak hour traffic was from 8.00am- 10.00 am and evening 4.00pm-6.00pm.
- Geotechnichal investigations including Standard proctor test and CBR test was done in Pallimukku – Karikkam stretch.
- Based on traffic volume studies and CBR value the pavement was designed.

10. ACKNOWLEDGEMENT

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