Analysis of Traffic Problems in Muvattupuzha Town

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Abstract—This study investigate the traffic problems in Muvattupuzha town, which includes the current parking practices, existing road facilities with the help of parking accumulation survey, parking duration survey and traffic volume survey. The parking surveys gives the number of parking spaces available and its accumulation in both on-street and off-street parking. On the basis of these parking surveys, short-term solution is on-street parking and it’s cheap in terms of operation and maintenance but prices congestion. Considering the off-street requirements, parking area was designed in a vacant plot inside the town. Traffic volume survey conducted shows the impact of morning and evening peak hour congestions in the town. As a solution ring road was proposed by connecting State Highways and National Highway. Ring road connecting the main roads will reduce the congestion inside the town as well as these roads helps to connect the different places around the town. Pavement design and mix design of ring road was carried out in this study.

Index Terms—parking space, parking accumulation, traffic volume, ring road, mix design.

I. INTRODUCTION

The dramatic increase of the automobile in emerging towns leads to many traffic problems. The parking has become an integral part of the modern urban setting and an important land use. It is well known that Parking contributes to the appearance of city and affects traffic congestion and traffic operations; and is a vital component of the urban street and transit systems. In the view of explore the possibilities of managing the parking spaces by appropriately communicating the information to the users. The heavy traffic during peak hours shows the congestion inside the town, lack of effective road system affect the easier movement through town.

II. STUDY AREA

The study was conducted in Muvattupuzha town of Kerala state and town covers an area of 13.8 km². Muvattupuzha is considered as an important commercial centre and a prominent town since 1960. There is a plan to form a new Muvattupuzha district by joining eastern parts of Ernakulam and Idukki. This shows the importance of the town in Kerala.

III. METHODOLOGY

The following methodology was adopted in this study

A. Review of available reports and plans

Study of available reports, plans, survey data and statistics related to Muvattupuzha were identified and reviewed. The existing parking practices were studied. In addition, the relevant government departments were contacted for collection of secondary sources of information for parking as well as new bypass road.

B. Types of surveys conducted

Parking space survey, parking duration and parking accumulation survey, traffic volume survey were the traffic surveys were conducted.

C. Selection of parking lots

The study was conducted in the year of 2013-14. It was restricted to Muvattupuzha town areas i.e., where parking demand is expected to be high causing heavy congestion due to commercial activities. Around 11 parking lots were selected.

D. Conduct of surveys

The procedure adopted for various parking surveys is explained in the below paragraphs.

a) Parking space survey

Where individual spaces were not defined using road markings (i.e in uncontrolled areas), the number of spaces provided is based upon the assumption that each space is 2.5m*5m for four wheelers and 1.0*2.5m for two wheelers.
b) Parking accumulation survey

Parking accumulation survey was conducted by considering parking supply and occupancy in various parking lots for morning and evening. The registration plate method was used to collect the data for all the categories of vehicles on the typical working day for the period of ten hours from 9:00am to 7:00pm at one hour interval.

c) Traffic volume survey

Traffic volume survey was conducted by counting the number of vehicles passing through a lane at every 15 minutes of intervals. This survey was conducted between 7:00 am to 7:00 pm for a week. In this survey vehicles are classified into different classes.

E. Analysis of data

Data obtained from all the parking surveys was analyzed in terms of computation of various parking characteristics, especially parking accumulation, parking duration, need for off street parking and different parking management plans for on street parking. Traffic volume data obtained from surveys was tabulated, from table’s peak hour congestion and scope of new roads around the town considered. Inferences were drawn based on the analysis of the data.

F. Design and Suggestions

The data analysis and the inferences drawn helped in providing certain suggestions and designs to reduce the traffic problems in parking and congestion.

III. PARKING SURVEYS AND TRAFFIC VOLUME SURVEY ANALYSIS

Table I. Parking Supply versus Accumulation

<table>
<thead>
<tr>
<th>Lot No.</th>
<th>Vehicle Type</th>
<th>Supply</th>
<th>Morning</th>
<th>Evening</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Occupied</td>
<td>Surplus or fall</td>
</tr>
<tr>
<td>1</td>
<td>2-W</td>
<td>12</td>
<td>17</td>
<td>+5</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>6</td>
<td>9</td>
<td>+3</td>
</tr>
<tr>
<td>2</td>
<td>2-W</td>
<td>20</td>
<td>13</td>
<td>-7</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>6</td>
<td>7</td>
<td>-1</td>
</tr>
<tr>
<td>3</td>
<td>2-W</td>
<td>60</td>
<td>88</td>
<td>-28</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>25</td>
<td>31</td>
<td>+6</td>
</tr>
<tr>
<td>4</td>
<td>2-W</td>
<td>18</td>
<td>23</td>
<td>+5</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>8</td>
<td>9</td>
<td>-3</td>
</tr>
<tr>
<td>5</td>
<td>2-W</td>
<td>4</td>
<td>3</td>
<td>-1</td>
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<td></td>
<td>4-W</td>
<td>4</td>
<td>3</td>
<td>-1</td>
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<td>6</td>
<td>2-W</td>
<td>5</td>
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<td>-2</td>
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<td></td>
<td>4-W</td>
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<td>+3</td>
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<td>7</td>
<td>2-W</td>
<td>24</td>
<td>19</td>
<td>-5</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>3</td>
<td>2</td>
<td>+2</td>
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<td></td>
<td>2-W</td>
<td>10</td>
<td>15</td>
<td>+9</td>
</tr>
<tr>
<td>8</td>
<td>4-W</td>
<td>10</td>
<td>18</td>
<td>+8</td>
</tr>
<tr>
<td>9</td>
<td>2-W</td>
<td>30</td>
<td>37</td>
<td>+7</td>
</tr>
<tr>
<td></td>
<td>4-W</td>
<td>15</td>
<td>18</td>
<td>+3</td>
</tr>
</tbody>
</table>

A. Parking space survey

The parking space obtained from survey is about 11 parking lots. The selection of parking lots was limited with in the town. The capacity of each parking lot is given in table 1.

B. Parking accumulation survey

The parking accumulation data collected from parking accumulation and duration surveys carried out for on-street and off-street parking areas within the influence area were compiled and analysed to work out the accumulation of parking. From the parking lots considered, only one is off-street parking lot, others are
on street parking. The parking lots are private ownership (i.e. parking for customers). The off street parking facility is free but only day time parking is permitted. The parking accumulation survey given in Table 1, which shows the accumulation of vehicles in various parking supply spaces. Majority of the parking lots shows surplus parking.

C. Parking duration analysis

Parking duration analysis was carried out to find the length of time spent in a parking space by the vehicle. The long term parked vehicles reduce the parking turnover of the parking spaces. The parking duration analysis shows 30% vehicles are parked for more than 2 hours. Owners and workers vehicles park their vehicles in front of shops for whole day time; it reduces 25% of parking spaces near streets. These long term parking’s trigger the crowded on street parking which reduce the carriage capacity of the roads. Parking accumulation survey and parking duration survey shows the current parking spaces are not enough for the parking demand of the town. During the surveys the number of vehicles parked in no parking areas, parking near intersections etc is very high; this shows the inadequate parking requirements of town.

D. Traffic volume survey

The presence of three state highways (SH 1, SH 8 and SH 41) and National Highway (NH 49) makes the traffic system a complex one. This survey shows the pcu per hour is more than two thousand. During morning and evening peaks the capacity of road exceeds its limits and congestion occurs. The official records shows that paved area is only 5.2% of total area, normally paved area lies between 10 to 12% of total town area. This shows that the town needs a road system which connects main roads.

IV. DESIGN AND MANAGEMENT PROPOSALS

On the parking aspects, suitable solution is identification of locations for surface parking. Design of parking yard at vacant plot and off-street parking management measures which were suggested are discussed in the following paragraph.

A. Proposal for off-street parking area

Surface parking facilities were proposed as an option for reducing the parking congestion and related problems in Muvattupuzha town. The limited surface parking area is not sufficient for the current traffic demand of town. The on street parking areas are limited for short term parking only otherwise the parking space turnover is less. If any long term parking is observed in streets, heavy fee will be charged. Proper sign boards should be placed for public awareness.

For the long term parking in town, an extra parking yard is essential. This facility can be utilised by office staffs, shop owners, workers etc. For the parking yard design a vacant plot was selected near to KSRTC bus stand. A portion of the land is already used for parking but the parking is mixed one. The space utilization and appearance of parking area is poor. The parking area of 2100 m$^2$ is available in this plot. The standard parking space is given as for a car (2.5x5.0m) and for a bike (1.0x2.5m). The layout of parking is given below fig 1. Capacity of yard is 100 cars and 30 bikes.

![Figure 1: Parking yard layout](image1.png)

![Figure 2: Ring road](image2.png)
Along with this parking yard another parking lane is provided opposite to the KSRTC bus stand and about 100 bikes can be parked in this lane. The better implementation of traffic rules will reduce the long term parking in on-streets. If the crowded on-street parking is reduced, the capacity of road may increase by 5%. This plot is located between KSRTC bus stand and taluk hospital and entrance of the parking yard is from MC road as well as from pocket road of 6m wide. The traffic volume analysis and details about existing pavements leads to design solutions explained above.

B. Proposal of ring road at Muvattupuzha

The ring road at Muvattupuzha is formed by constructing two bypasses and existing one bypass road. The existing portion is a bypass road which connects the NH 49 and Thodupuzha road. This bypass starts from one way junction in NH and meets near Muvattupuzha private bus stand. The ring road construction has two phases. Phase I is MC road bypass and phase II is NH bypass. The ring road through the outer periphery of town has a huge impact on the transportation facility inside the town. This ring road helps to reduce the travel time, cost of travel and congestion inside the town.

C. Phase I design of ring road

Phase I of ring road is MC bypass which starts from 130 junction and meets Kadathy in NH 49. The alignment of the road was prepared using total station. The proposed road is of length 2.3 km and pavement design was carried out using CBR value and Standard cumulative axles.

The sub grade soil was collected from 3 different locations; proctor's compaction test and CBR test were carried out. The average CBR value of samples is 12.1 %. From traffic volume study CVPD was found and cumulative standard axles calculated as 13.6 msa.

As per IRC 37:2001, the pavement thickness obtained as 550 mm. The details of pavement thickness are 40 mm thick bituminous concrete, 60 mm thick dense bituminous macadam, 250 mm thick granular base and 200 mm thick granular sub base.

D. Phase II details of ring road

Phase II bypass known as NH bypass. This road starts from kadathy (NH 49) and it meets Kakkanad, Perumbavoor road at vazhapilly and road joints to NH 49 at Karakkunnam. This by-pass road helps to reduce travel time and congestion inside the town. This phase gives a ring road system around the town.

E. Mix design of bitumen

The mix design determines the optimum bitumen content. Marshall method of mix design was adopted in this study. The grain size analysis of available aggregates (20 mm, 12 mm, 6 mm, M sand) is carried out to find the suitable aggregate mix. The mix obtained was 15:25:15:45, which lies within the limits of MORTH specification.

The experiment starts with 4.5% bitumen and increase content by 0.5% successively. The various mixes were prepared according to different % of bitumen. Testing of specimen consist of finding Marshall’s stability, flow value directly. The weight of specimen in air and in water is found for calculations. From the observations 5 graphs were plotted. The graphs were (1) Binder content versus corrected Marshall Stability, (2) Binder content versus Marshall flow value (3) Binder content versus percentage of void (Vv) in the total mix, (4) Binder content versus voids filled with bitumen (VFB), (5) Binder content versus unit weight or bulk.
specific gravity ($G_m$). The Marshall stability curve and flow value curve was given in the figure 3 and figure 4 respectively. The optimum bitumen content was obtained as 5.1% (average of max values for flow, stability and $V_v$ for 4%).

V. CONCLUSION

The town suffers serious parking and traffic problems. The parking accumulation and duration surveys gave an idea about the parking demand inside the town. As a solution, an off-street parking yard is designed and it can accommodate 90 cars and 30 bikes. For on-street parking, proper parking management measures were suggested. Traffic volume survey at Aramana junction in main central road gives high traffic volume values and which leads to proposal of a ring road around the town. Phase I flexible pavement design was carried out and thickness obtained as 550 mm in which Granular Sub Base (200 mm), Granular Base (250 mm), Dense Bituminous Macadam (60 mm), and Bituminous Concrete (40 mm) provided. The optimum bitumen content was obtained as 5.1%.

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REFERENCES