Analysis of Trends in Traffic Flows in Kandy Municipal Area

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Abstract: Study on traffic behaviours of major approaches in a commercially active city like Kandy is an essential requirement for the transportation planners and developers to identify the potential issues and to make strategies to overcome them. In this study, the author compares the traffic flow characteristic of the selected major roads in Kandy namely, Northern approach, Western approach and Eastern approach. Both inbound and outbound flows have been studied. In this study, data collected from surveys done in the above approaches in 1998, 1999, 2010, 2015 and 2016 have been used. From this study, it is possible to investigate the growth patterns in the traffic flow of each vehicle classes during these eighteen years of time at different approaches. This information will be useful for the road planners to identify the traffic-related issues in the road network.

Keywords: Traffic trends, traffic composition, traffic behaviour.

1. INTRODUCTION

Kandy is a historically important city which is commercially active next to Colombo in Sri Lanka. It is situated at 400-650 meters above mean sea level. Having Evolved as a city for the last 600 years, Kandy is a major cultural, commercial, administrative and transport center. It can be said as one of the most reserved cities in the world. It was declared as a world heritage city in 1988. On the other hand, as it is an economically active city with a population in 2012 around 160,000.

The main road network that gives access to Kandy Municipal Area consist of the Kandy-Colombo (A01) road, Kandy-Kurunegala (A10) road, Kandy-Jaffna (A09) road, Kandy-Mahiyangana-Padiyatalawa (A26) road, Raja mawatha (B413) and Peradeniya-Badulla-Chenkalady (A05) road. Three of the roads, A01 (together with the parallel William gopallawa mawatha), A09 and A26 give direct connection to the Kandy Municipal Area. Due to the geographical constraints imposed by the Mahaweli River and the Hantane mountain range, there are no circular or orbital road links between the radial roads that are of adequate capacity and speed to serve as suitable bypasses to the CBD.

Traffic behaviors of major roads in a commercially active city like Kandy are necessary for many of the planning and design functions. And an accurate estimation of those rates is needed for pavement design, overall planning activities, and other highway infrastructure needs. As socio-economic characteristic of Kandy city have been changed rapidly during last few years, the traffic flow rate also have been changed. Hence, this study is to understand the changes in traffic flow rates and to estimate the traffic flow growth rates. The most important contributing factors for traffic flow rate changes are roadway characteristics, such as the number or lanes, functional classification, and area types, socio-economic variables including nearby population, dwelling units, automobile ownership, employment statistics and per capita income. (Xia & Al 1999)

The sources of data are listed below.

- 1998 and 1999 - Department of Civil Engineering, University of Peradeniya,(unpublished data)
- 2010 – Kandy City Transport Study Report
- 2015 – Strategic Cities Development Project – Kandy

Figure 1 shows the map of the Kandy city.
2. TRENDS IN TRAFFIC FLOW

Figure 2 illustrates the approach wise traffic composition into Kandy city.

In that map, N.A., E.A. and W.A. stand for Northern approach, Eastern approach and Western approach respectively.

Figure 1 Map of Kandy City

Figure 2 Approach-wise Traffic Composition
Only a slight variation in approach-wise composition has been observed in between 1998 and 2010 while a significant increase in traffic from western approach and a significant decrease in traffic from other approaches have been observed in between 2010 and 2016.

Figure 3 shows the variation of two way 24 hour average daily traffic (ADT) with time.

![Figure 3 Variation of ADT](image)

A uniform growth rate has been observed in eastern and northern approaches while a rapid increase in growth rate after 2010 has been observed in western approach

Figure 4 is showing the vehicle traffic composition.

![Figure 4 Vehicle Traffic Composition into Kandy City](image)
Composition of car traffic and bus traffic has been reduced while that of motor cycles and three wheelers have been increased. This pattern may be due to the socio-economic developments which were took place in these areas between 1999 and 2016.

Table 1 shows the average annual growth rate percentage of vehicular traffic in each approach during the period of 1998 to 2016.

<table>
<thead>
<tr>
<th>Table 1 Average annual vehicular traffic growth rate (Percentage)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Direction</strong></td>
</tr>
<tr>
<td>----------------</td>
</tr>
<tr>
<td>Western Approach</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Northern Approach</td>
</tr>
<tr>
<td></td>
</tr>
<tr>
<td>Eastern Approach</td>
</tr>
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<td></td>
</tr>
</tbody>
</table>

According to the values presented in table 1, three wheelers showing a higher amount of average annual traffic flow growth irrespective of approach and direction. Followed by three wheelers, motor cycles showing the second higher amount of average annual traffic flow growth. Then cars show a considerable amount of growth rate. Goods vehicles are also showing a significant amount of growth rate. On the other hand, busses showing a significant amount of decrease in all roads except northern approach. Even though busses showing a small amount of growth in northern approach, it is fairly negligible when comparing with that of other modes such as three wheelers, motor cycles and cars in that approach.

Figure 5 shows the two way 24 hour ADT of vehicle types.

![Figure 5 Growth of Vehicular Traffic](image)

It can be observed that motor cycles and three wheelers show an increasing trend. Busses show a fairly decreasing trend. For cars it was decreased initially and suddenly starts to increase in 2010 and the rate of increase in increased further in 2015.

Table 2 shows the peak hour and its share (the peak hour traffic as a percentage of whole day traffic).
Table 2  Peak hour traffic

<table>
<thead>
<tr>
<th></th>
<th>1998*</th>
<th>2010</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>Northern Approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak hour</td>
<td>7.30-8.30 am</td>
<td>7.00-8.00 am</td>
<td>7.00-8.00 am</td>
</tr>
<tr>
<td>Share</td>
<td>9.65%</td>
<td>9.15%</td>
<td>8.24%</td>
</tr>
<tr>
<td>Eastern Approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak hour</td>
<td>7.00-8.00 am</td>
<td>6.45-7.45 am</td>
<td>7.15-8.15 am</td>
</tr>
<tr>
<td>Share</td>
<td>11.35%</td>
<td>10.75%</td>
<td>13.01%</td>
</tr>
<tr>
<td>Western Approach</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak hour</td>
<td>7.00-8.00 am</td>
<td>6.30-7.30 am</td>
<td>6.45-7.45 am</td>
</tr>
<tr>
<td>Share</td>
<td>9.27%</td>
<td>11.19%</td>
<td>8.15%</td>
</tr>
</tbody>
</table>

* 7.30 in 1998 is equivalent to 7.00 in 2010 and 2016

Figure 6 shows the approach wise two way 24 hour ADT of vehicle types.

In all approaches it can be observed that private vehicles such as cars, three wheelers and motor cycles are in increasing trend while bus is in slightly decreasing trend.

Figure 7 and 8 are showing the trend in two-way 24 hour average daily vehicle traffic flow and daily passenger traffic respectively.
Figure 7 Trend in Vehicle Traffic

Private vehicles are in exponentially increasing trend while public vehicles and goods vehicles are not showing any notable variation between the considered time periods.

Figure 8 Trend in Passenger Traffic
As occupancy rate is higher for public vehicles, the passengers travelled in public vehicles are higher than that of private vehicles. But, the rate of increase is high for private vehicles than public vehicles. By comparing figure 7 & 8, it can be noted that the number of passengers traveled in private vehicles is increased about 150% while the number of private vehicles increased by about 250%. This indicates that the occupancy rate in private vehicles is decreasing.

Figure 9 shows the proportion of public transit and private vehicles in 1998 and 2016.

![Figure 9 Public Transit vs. Private Vehicles](image)

As per figure 9, irrespective of approaches majority of the traffic share is occupied by private vehicles than public transits.

The main key factor for these patterns of results might be the socio-economic improvements in the Kandy area. As per-capita income increases, peoples tend to buy more vehicles. Thus private vehicle ownership is getting increased. Because of that, usage of three wheelers and motor cycles are rapidly increased, usage of cars and vans gradually increased and usage of busses are gradually decreased.

At the same time, growth in population of Kandy area might be the key factor for the increasing trend of goods vehicles traffic flow. But, in general, the total traffic flow rates are showing growth in all of the approaches. Among the approaches, traffic flow in eastern approach is showing a higher amount of growth rate. Followed by eastern approach, western approach is showing second higher amount of growth rate. Northern approach is holding the third position. This may be due to the variation of socio-economic improvement among these areas.

### 3. CONCLUSIONS

Personal vehicles such as three wheelers, motor cycles and cars are showing an increasing trend in traffic flow rate while public transit such as busses are showing a decreasing trend in Kandy roads. Socio-economic improvements took place in Kandy area such as per-capita income is the key factor for these trends. Based on this study it can be concluded that the Kandy city is not sustainable in the view point of transportation. If these trends are continuing like this for a long time, it will become more critical. The government should take some actions to increase the public transit usage.
4. ACKNOWLEDGEMENTS

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5. REFERENCES


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