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Estimation of Average Daily Traffic (ADT) Using Short-Duration Volume Counts

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1. Introduction

Average Daily Traffic (ADT) is utilised as important basic data in the transportation and road sector to determine the geometry of new roads and to predict the future service levels of existing roads based on planned traffic volume. As the installation of traffic counters to obtain long duration volumes like ADT is expensive, carrying out a short-duration survey and extrapolating the volumes to ADT would be more economical. The use of the 'Expansion Factor Method' to extrapolate short duration volumes to ADT has been discussed in this research.

2. Methodology

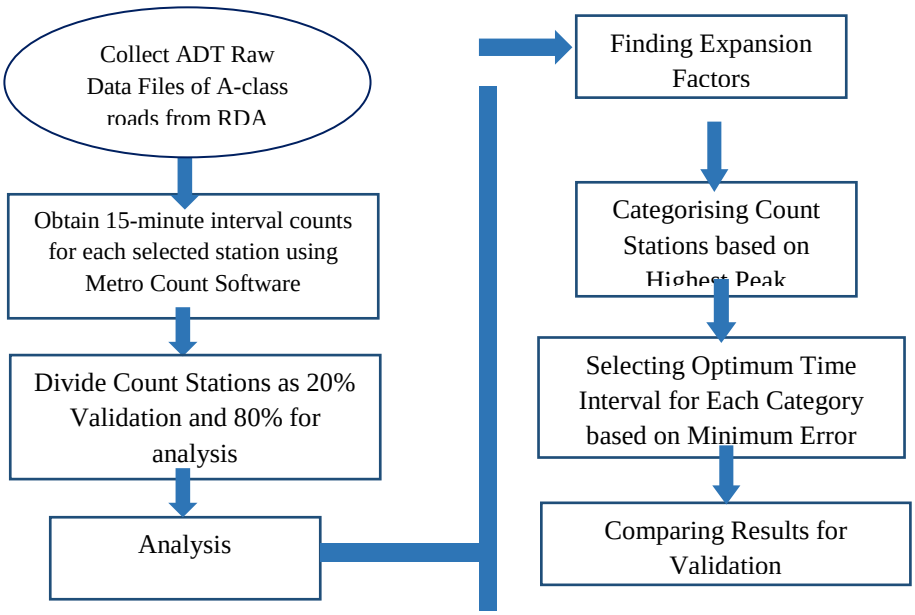

Figure 1: Flow Chart

Among the methods of estimating ADT/AADT from short-duration counts, what has been used in this study is the 'Expansion Factor Method'. This is because of data availability and the decision as to what the final output should be, as determined according to research objectives.

Expansion factors are calculated considering the time durations 1h, 2h, 3h, 4h, 5h and 6h. Also, the time interval changes within the day. As an example, for 1h time duration, the intervals would be 00.00 – 01.00, 00.15 – 01.15, 00.30 – 01.30 etc. and for 2 hour intervals; 00.00 – 02.00, 00.15 – 02.15, 00.30 – 02.30 etc. The expansion factor is expressed as a percentage of the volume of a particular time interval to the total volume during 24 hours.

$$\text{Expansion Factor} = \frac{\text{Volume of a particular interval}}{\text{Total volume over 24 hours}} * 100$$

The flow profile within a day changes according to the location of the count station. Count stations are categorised according to flow variation. For flow variation to be taken into account quantitatively, the count stations having the highest one-hour flow in the 00.00 - 10.00 time interval were selected to category 1, count stations having highest one-hour flow in 10.00-15.00 time interval were selected to category 2 and those having the highest one-hour flow in the 15.00-24.00 time interval were selected to category 3. These time intervals were selected by observing the time intervals where the morning, mid-day and evening peaks lie in the flow profiles.

The time interval within the day where each time duration should lie to get minimum errors in expansion factors should be selected as the optimum time interval. For this, expansion factors of the same category under the same time duration were used to find the standard deviation within each time interval. Using the standard deviation values found and by finding the mean of those expansion factor values, the error was found according to the equation below. The time interval giving the minimum error was selected as the optimum time interval.

$$\text{Error} = \frac{\text{Standard deviation of expansion factors}}{\text{Average of expansion factors}} * 100$$

3. Results

Table 1: Results of Categorization

Category	Results
1	67 count stations were found Can be identified as locations 20km distance away from highly urban cities like Colombo, Gampaha, and Kandy. Also, the cities Kalutara, Matara and Anuradhapura were included in this list.
2	64 count stations were found Can be identified as locations 15km distance away from the towns which were not mentioned in category 1
3	17 count stations were found Locations in rural areas which do not fall into either category 1 or category 2

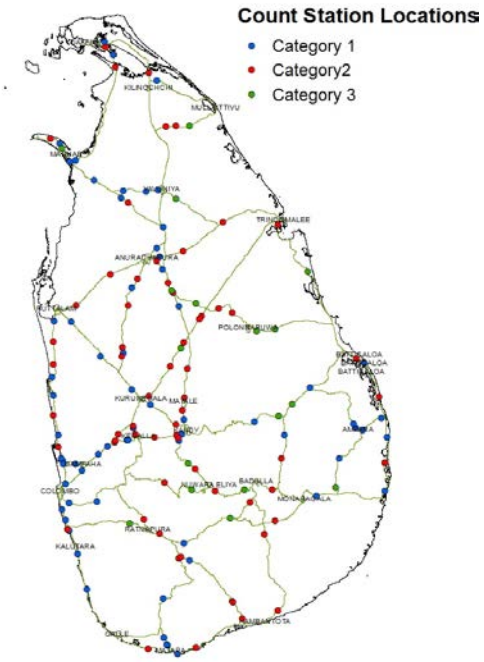

Figure 2: Categorisation of Count Stations

Table 2: Average expansion factors for optimum time intervals

Category	Expansion factors					
	1h	2h	3h	4h	5h	6h
1	6.031558	11.89209	20.3263	25.38375	30.59136	33.53736
2	5.938514	11.94999	17.91123	22.75272	26.34571	32.3291
3	6.747337	12.99297	19.52706	25.90544	32.65278	38.49414

Table 3: Optimum time intervals

Category	Optimum Time Interval					
	1h	**2h**	**3h**	**4h**	**5h**	**6h**
1	11.00 - 12.00	10.30 - 12.30	06.30- 09.30	06.00 - 10.00	05.45 - 10.45	05.00 - 11.00
2	09.45 - 10.45	09.15 - 11.15	08.30 - 11.30	06.15 - 10.15	05.30 - 10.30	05.30 - 11.30
3	13.15 - 14.15	15.00 - 17.00	14.30 - 17.30	14.15 - 18.15	13.15 - 18.15	12.45 - 18.45

The error percentages obtained from the validation of each time duration in all three categories were averaged and plotted in Figure 3.

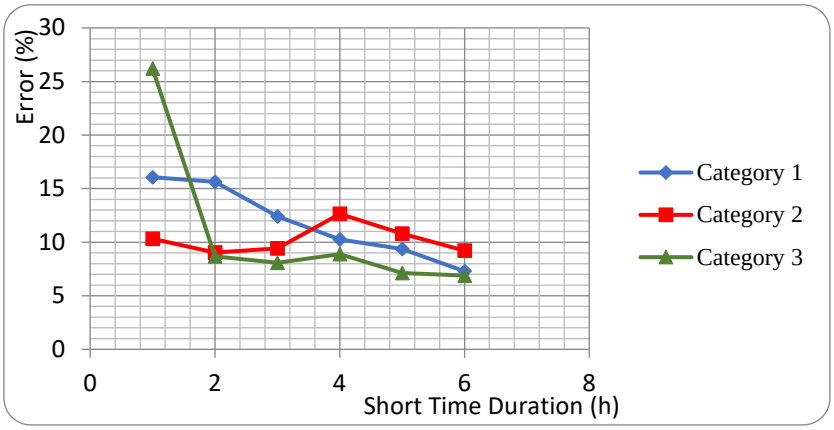

Figure 3: Variation of the error percentage with short time duration

4. Conclusion/Recommendation

When considering the extent of decrease of the error percentage when the short time duration is increased by 1 hour, it can be seen from Figure 2 that, for the 1st category, three or four-hour durations are the optimum and that for the 2nd and 3rd categories two-hour duration is the optimum.

Although the categorisation of locations was based on the highest peak which was the most suitable option, there also seem to be some issues with it as some locations categorised as urban have rural land use characteristics and vice versa.

Therefore, a recommendation can be made to fine-tune the categorisation procedure by collecting more land use data near the count stations and formulating a list of parameters for identifying similarities between categories.

5. References

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***Keywords**: average daily traffic, short duration counts, expansion factors, traffic estimation, transportation*