

**COMMUTERS' PERCEPTION AND TRANSPORTATION ALTERNATIVES  
ANALYSIS FOR MITIGATING MORNING PEAK HOUR TRAFFIC CONGESTION  
A CASE STUDY FROM KOTTAWA TOWARDS THE CAPITAL COLOMBO WITHIN  
20 KM DISTANCE**

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## **INTRODUCTION**

Morning peak hour traffic congestion is now an escalating social, economic and political problem, as delays on roads and costs associated with these delays are steadily increasing. Thus an efficient and high quality public transport system capable of retaining existing customers as well as attracting private vehicle users has become an urgent need. The focus of this study was therefore to highlight some major causes responsible for morning peak hour traffic congestion and how commuters make travel decisions with respect to different public transport service quality attributes and related factors.

## **METHODOLOGY**

### **Data Collection**

This study was conducted as a case study on the 138 bus route, along the High-level road, towards the direction of Colombo city starting from Kottawa. This narrows the very broad field of investigation into a researchable topic. As the initial part of the study a 'supply survey' which included a number of traffic and transportation surveys along with secondary data collection was conducted. This enabled a better understanding about the vehicle and passenger movement patterns, travel characteristics and available infrastructure within the study area. The data collection activities in the 'supply survey' included 'Travel speed survey (locating high accessible nodes along 138 bus route)', 'road inventory survey (assessing physical characteristics and condition on the road)' and 'traffic counting survey (identifying the vehicle composition at Kottawa junction)' and each was carried out over a period of 3 months from May, 2012 to July 2012. In addition, significant data from secondary sources pertaining to the current traffic volume within the country was also collected as a part of the data collection process.

The second phase of the study (questionnaire survey) was conducted to examine prevailing passenger transport demand, drawbacks and viable improvements required for the existing public bus transport system with special reference to the 138 bus route. Locations for recruitment were chosen based on convenience and respondents were selected through non-probability quota sampling taking a predetermined quota on primary transport mode of choice to commute into account. 500 questionnaires were filled out and 472 were accepted as the study sample.

### **Data Analysis**

Data analysis was performed using SPSS 16 and R version 2.13.2 (2011-09-30). The analysis was conducted in four steps. In the initial stage, descriptive analysis was performed for the data obtained from both observational studies and questionnaire survey to obtain a general summary. Principle Component Factor Analysis (PCFA) with varimax rotation was then performed with the aim of grouping the five point Likert-scale variables into a small number of interpretable factors. To make sure that the correlation matrix was appropriate to produce a factor structure not found by chance, a visual examination of the correlation matrix followed

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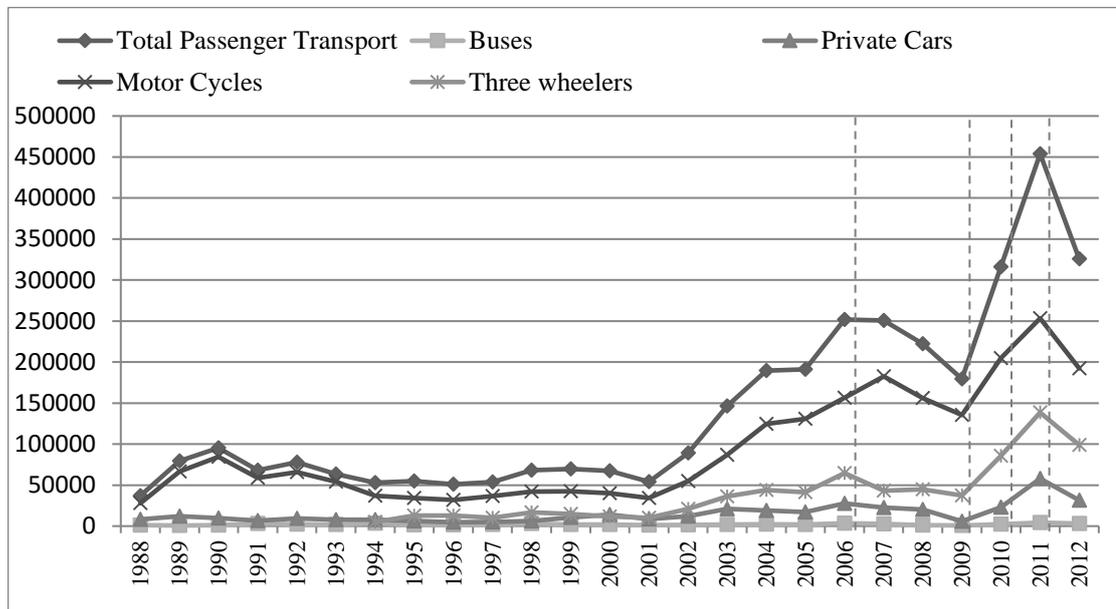
by a Bartlett's test of sphericity and Kaiser-Meyer-Olkin (KMO) tests were carried out. Factor extraction involved the Kaiser's criterion, the scree test, and parallel analysis (Hayton et al. 2004) in determining the number of factors to be retained for interpretation. Following the guidance of Lattin et al. (2007), assuming that the data in the sample are representative of the underlying population, bootstrap validation method was then used to assess the validity of the results from the PCFA.

Third, bi-variate test of association (Kruskal Wallis Test and Bootstrapped One-Way ANOVA) was conducted to explore the relationship between the study variables and the derived factors.

Finally, the factors derived from the PCFA were further analyzed using multidimensional scaling analysis. This was done in order to create a map of the locations of the factors in reference to each other, based on their similarities and dissimilarities.

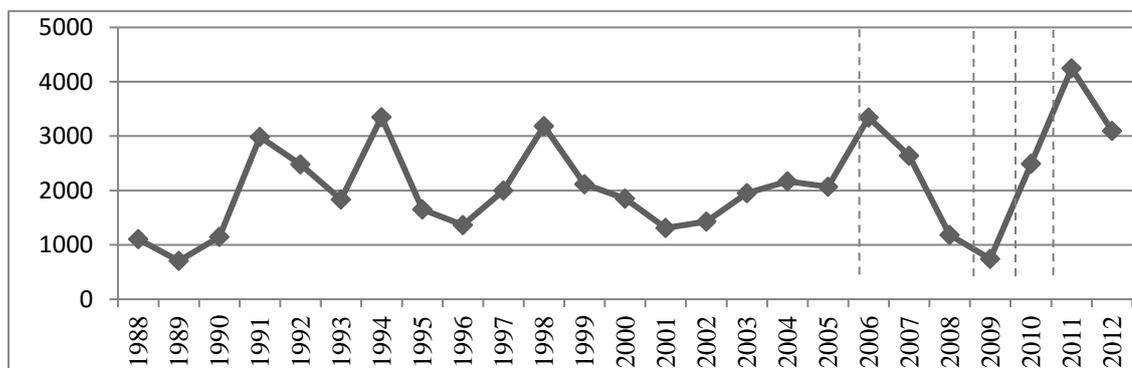
## RESULTS AND DISCUSSION

Figure 1: New Registration of Passenger Transport Vehicles in Sri Lanka 1988 - 2012



Source: Department of Motor Traffic

Figure 2: New Registration of Buses in Sri Lanka 1988 - 2012



Note: 2006 - 2009: Critical war period

2009 - 2010: Post war

2010 - 2011: Government cut import taxes on vehicles and also gave reduced-tax permits to state sector employees in June 2010.

*2011 – 2012: Government increased the import duty of vehicles to discourage imports (However there has been no change in the tax imposed on commercial vehicles such as tractors, buses and Lorries)*

Figure1 depicts a disaggregated analysis of new registrations of ‘passenger transport vehicles’ in Sri Lanka. It clearly illustrates that the increase of total passenger transport vehicles is mostly created by private vehicles (three-wheelers, motor cycles and private cars) compared to public vehicles. Figure 2, depicts an attempt to analyze the new registration of ‘Buses’ in Sri Lanka. Since there has been no change in the tax imposed on commercial vehicles such as tractors, buses and lorries special attention should focus on identifying the causes behind the sudden drop of new registration of buses in 2012.

Results through ‘travel speed survey’ and ‘road inventory survey’ highlighted that the number of schools, traffic lights, incoming access road to main road from both the left side and the right side have a significant impact on morning peak hour traffic congestion on working days. ‘Traffic Counting Survey’ carried out at Kottawa junction, highlighted that the public transport share at Kottawa junction toward the direction of the city of Colombo along the high-level road during the peak period is only around 6 percent, though it serves almost two thirds of the total travel demand. In contrast, over 90 percent of the road space is used by private and hired vehicles while serving only 35 percent of the total travel demand.

Further, from the central tendency findings it is reported that the existing public bus transport system is not satisfactory from both private vehicle users and existing customers’ perspective. A majority of the commuters, those who use private vehicles as their primary transport mode of choice to commute, have pointed out that inconvenience, lack of seating facilities and delays are the major reasons which discouraged them from using public bus transport. Another important point to emphasis is that, the majority of present public transport users utilize public transport service not because they consider it as a good alternative for private vehicles, but due to unavailability of own vehicle and less cost involved.

Principal component Factor analysis which was used to reduce the number of specific attributes in to smaller dimensions, pointed out any action taken to encourage a mode shift to public bus transport should address six broad areas.

The first factor was clearly the most important one since it accounted for the highest portion of the total variance and consisted of eight items. All items in this factor referred to the importance attached by the commuters towards time related attributes and the service offered by crew members, conductors and bus drivers and was therefore named as ‘punctuality and service reliability’. Further, investigations also revealed that irrespective of the level of individual characteristics, a majority of the respondents attached high importance to this factor.

The second factor consisted of three items, which was summarized as the expenses and economic related attributes and was therefore named as ‘Price conscious’. More disaggregated analysis revealed that high expenses involve in using their own vehicles encourage them to commute by bus. Further, test of associations revealed that monthly household income and marital status had a significant impact on this factor.

The third factor: ‘Easy accessibility’ consisted of four items. In this factor, the first two items were about easiness of reaching the bus service whereas the remaining two were about easiness of reaching the work place. A significant association was found between the age of the respondent and the level of importance they attached to this factor. As was expected elders who were 55 or above were more concerned about this matter. It further revealed that ‘easy accessibility’ is one of the most expected attributes from a better service by private vehicle users.

The fourth factor which was composed of four items reflected the commuters' perceptions towards the comfort in the bus, cleanliness, seat availability and sense of independence while travelling and was therefore labeled as 'On board comfort'. A significant difference was found with respect to monthly house-hold income where high income earners were more concerned about on-board comfort than others. Not surprisingly, a difference was also found with respect to primary transport mode of choice. Both private vehicle users and office provided staff bus users have attached high importance toward this factor than public vehicle users.

The fifth factor: 'Safety and security' summarized three items referring to parking place security and personal security. The two attributes with high positive loadings indicated that introducing safe and secure parking lots encourage commuters to shift to bus services, placing their own vehicle at a parking lot. Further investigation also revealed a significant difference in relation to this factor with respect to type of work place. Workers from private, semi government and banking sectors were more concerned about these safety issues than others

The last factor 'Special services and features' consisted of only two attributes related to the importance attached by the commuters toward 'special bus services only for ladies' and 'extra comfort features like A/C, TV facilities and daily newspapers'. A significant difference was found with respect to gender, where female commuters place more importance on this factor than male commuters.

The second PCFA was carried out to guide the research in relation to the objective: "To propose possible alternative solutions to reduce the morning peak hour traffic congestion, from commuters' point of view". This resulted five factor solution named 'Control Access', 'Law and driver education' 'Infrastructure development and maintenance', 'Parking management' and 'Improving bulk carrier public transport systems.

Further analysis revealed that compared to the other three aspects, 'Parking management' and 'Improving bulk carrier public transport systems' have lower priority among the commuters. These findings highlight the necessity of well organized public awareness programs to improve public understanding on how these actions could assist their protection. Multi dimensional scaling analysis further simplified these resulted factors in to broader areas for planning and actions.

To conclude, the outcomes of the study highlight some perceptions and expectations of the commuters and different aspects of the public transportation system affecting the performance of the system as a whole. Therefore, the findings and recommendations of this study will be very useful in planning both the road system and the public bus transport system. This will help in reducing the congestion problems one step ahead before the situation gets worse. Further it is hoped that this study will stimulate further research into this important phenomenon.

## **RECOMMENDATIONS**

It is also important to draw attention to some limitations associated with the study. First, this study was conducted as a case study since it narrows the very broad field of investigation into a researchable topic. However as is the nature of a case study, the research questions are difficult to answer completely as it will not be generalizable due to the narrow focus. It will thus generate indications that could be used for predictions or as a hypothesis for future investigations. Future studies should therefore recruit a higher number of respondents in a wider area in Sri Lanka. Further, due to lack of resources and technology, manual counting was used to collect traffic data. However the use of this traditional method for collecting data is necessary but not sufficient due to their limited coverage. Automated counting can be used parallel to the manual traffic counting process.

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