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EFFECT OF TRAFFIC ENTRIES AND EXITS AT THE MAJOR ROAD ON ITS PERFORMANCE

Nimash Thilanka Suraweera[1], Niranga Amarasingha[2]
Faculty of Engineering, Sri Lanka Institute of Information Technology, New Kandy Road, Malabe, Sri Lanka.
[1]nimasht08@gmail.com, [2] niranga.a@sliit.lk

ABSTRACT- The transportation infrastructure is one of the crucial factors that affects economic growth and social development in the world. Roadside friction can be defined as the activities taking place by the sides of the road that restricts a smooth traffic flow on the road. Roadside frictions are increasing proportionally to the increase in population and urbanization. Roadside friction directly contributes to traffic congestion and road accidents. Entries to- and exits from- major roads can be identified as one of the major types of roadside friction in developing countries like Sri Lanka. As the approach methodology of the study, videography techniques were carried out to collect traffic data. The analysis was conducted using PTV VISSIM microsimulation software to determine the increment of the travel time due to roadside friction of traffic entries and exits from the major roads. Travel time comparisons were made with the presence and absence of roadside friction. The results indicated that travel time increments for the combined friction of entries and exits from the major road and on-street parking conditions vary from 25 to 90% when compared to the frictionless condition depending on traffic flow.

Keywords: Roadside friction; Travel time; Traffic congestion; Micro-simulation

1. INTRODUCTION

Land transportation can be considered as the main medium of transportation in the present world. Road transportation plays a major role as it accommodates to a highest portion of passengers as well as freight movements, in the developing countries like Sri Lanka. Population growth and urbanization are putting heavy pressure on the road transport [1]. In the major cities of developing countries like Sri Lanka, experience heterogeneous traffic conditions [2]. In heterogeneous traffic conditions contain more roadside friction activities than the homogeneous traffic systems [3]. Roadside friction impacts on the decrease of road capacity by reducing the width of the road, speed of vehicles, or increasing the travel time [4]. Sri Lanka is a multicultural country with differently demanded lifestyles; therefore, the roadside frictions are varying from one location to another depending on the density of such population variations. The significant roadside frictions are contributed from entries and exits of the major roads, on-street parking, pedestrian crossings, pedestrian walking along the carriageways, bus stops, roadside trading, etc [5]. Roadside friction activities negatively impact on traffic characteristics such as road capacity, speed, etc. Pedestrian moments including walking along and walking across the road both of them have a negative impact on the road performance [6]. An exception to the main types of roadside frictions, there are additional frictions that occur occasionally such as sports activities like marathon races, cycle races, jogging and cycling, construction activities [7], and social activities like protests, perahera, queues at fuel stations, etc. The road sections in Asian countries like Sri Lanka have lots of minor roads, shops, hospitals, commercial places, and social places besides the major road, so that the entries and exits from the major roads can be identified as one of the major roadside frictions. Several research studies were conducted on roadside frictions where the heterogenous traffic condition exists but those did not consider much about the roadside friction type of entries and exits from the major roads [5,6,7,8]. This study considers the roadside friction types of entries and exits from the major roads and on-street parking. The present study was aimed at identifying the impact of entries and exits from the major road and on-street parking on traffic characteristics on divided urban four-lane road in Sri Lanka. The main objectives of this research are to find out the delay travel time due to entries and exits from the major roads,

and on-street parking at the peak hours and off-peak hours. The results and the recommendations would ultimately help to minimize the traffic jams and accidents.

2. MATERIALS AND METHODS

The study is completed mainly in three phases, such as, selection of study area, field data collection and extraction, determine the influence of side friction on speed and travel time by analyzing the data. As the first step of this study, a 100m length section with a three-leg unsignalized intersection of Gampaha – Colombo (A33) road was selected as the study area as shown in Figure 1. This is an urban area with banks, shops, and other commercial places. The road geometry is flat in this selected area. Geometric data consisting of road width, section length, type of terrain, and number of lanes were collected. The traffic data was collected by video graphic method by using a video camera and drone camera. First conducted a traffic survey using a video camera from 07:00 am to 6:00 pm and identified the off-peak time as 8:30 am-10:30 am and mid-peak time as 13:00 pm-15:00 pm. Then traffic data was collected for selected mid-peak and off-peak times by using a drone camera on the same day. Surrounding schools are the most critical factor that impacts this selected mid-peak time in this location**.** Video records were taken to the laboratory and played on a large screen to extract the required data. All vehicles are divided into seven categories as Car, Van, SUV, Motorbike, Three-wheeler, HGV, and Bus. The data were extracted for every 15 minutes of period and the collected turning movement data are shown in Figure 2.

Figure 1. Bird view of the study road section

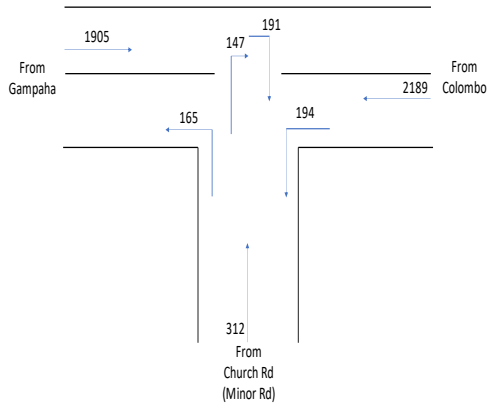

Figure 2. Peak time turning movement data

3. RESULTS AND DISCUSSION

The results were generated mainly in four conditions; frictionless condition, entries and exits from the major roads only, on-street parking only, and combined two types of friction conditions. The results have been tabulated in selected mid-peak time and off-peak time separately using PVT VISSIM Software. It has been found from the simulation that in the frictionless condition, average travel time for the selected 100m section is 7.21 seconds to the Gampaha direction and 7.44 seconds to the Colombo direction. During the off-peak time, the lowest travel time (and highest vehicle speed) is obtained in 3rd interval (09:00 am – 09:15 am). Also, the highest travel time (and lowest vehicle speed) is obtained in 8th interval (10:15 am – 10:30 am). In the friction condition, the lowest travel time (and highest vehicle speeds) is obtained in 8th interval (14:45 pm – 15:00 pm) in the peak period. The highest travel time (and lowest vehicle speeds) is obtained in 4th interval (13:45 pm – 14:00 pm). Similar results were obtained for entries and exits from the major road friction only,

on-street parking friction only, and combination of both frictions by VISSIM modeling. Accordingly, travel time increments percentages were estimated and tabulated in Table 1.

Table 1. Travel time increment percentages for different traffic conditions

	Gampaha - Colombo		Colombo - Gampaha	
Condition	Off-peak	Peak	Off-peak	Peak
1. Entries & exits	18.25%	45.09%	36.05%	68.24%
2. On-street parking	04.10%	07.11%	05.04%	07.67%
3. Combined entries & exits and On-street parking	25.31%	64.20%	47.38%	89.91%

4. CONCLUSION

The effects on travel time were obtained related to different friction conditions at mid-peak and selected off-peak time and the percentages of increment in travel time in different conditions were obtained. These results show that there is a significant impact from the road connectivity to the main road when it compared with other friction factors such as on-street parking activities. It is recommended to extend the studies to have more confirmative results covering a large extent of the study area; so that the results can be useful for policymakers and planners for traffic management and planning at the urban land use in Sri Lanka.

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