

Impact of Work Zone on Traffic Accident Characteristics of Kochi

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Abstract: The rapid population growth and increasing economic activities have resulted in the tremendous growth of motor vehicles which is considered one of the primary factors responsible for increasing road accidents in many metropolitan cities of developing countries, including Kochi, India. The projects such as smart city, Infopark, Fashion city and Vallarpadam container terminal paved way to shoot up the travel demand. The existing transport infrastructure in city is not able to satisfy the fast escalating travel demands and this result in traffic congestion. A joint venture by central government and state government put forward a rapid transit system called Kochi Metro rail, a light metro rail system with the aim of reliving city from congestion. Long term work zones are inevitable for metro rail projects. Proper safety measures are essential to meet the problems occurred during long term work zones. Economic assessment accounts for the catastrophe of daily commuters with relation to accident at bi-level involving pre-construction and present development stages of Metro rail project. Study find out the economic loss to city's GDP due to accident occurrence and it is compared in a bi-level scenario. The study also suggests better alternatives of project management which have to be followed to minimize road accidents during the development stage of metro.

Keywords: Metro Rail, Accident, Infrastructure, GDP

I. INTRODUCTION

The rapid population growth and increasing economic activities have resulted in the tremendous growth of motor vehicles. This is one of the primary factors responsible for road accidents in many metropolitan cities, including Kochi, India. Kochi is the main city in Kerala having area about 94.88 km². A city is known as a good city when the transportation of the city is developed in an efficient manner. The main problem in Kochi city is the inefficient transportation system. Kochi needs to grow more and more to accommodate the changes in the transportation system. In this context the importance of Kochi metro arises. The Kochi metro is a better solution for the accommodation of the present and future transportation needs.

The increasing number of road accidents is imposing considerable social and economic burdens on the victims, and various direct and indirect costs. Road accidents are essentially caused by improper interactions between vehicles, between vehicles and other road users and/or roadway features. The situation that leads to improper interactions could be the result of the complex interplay of a number of factors such as pavement characteristics, geometric features, traffic characteristics, road users' behavior, vehicle design, drivers' characteristics and environmental aspects. Thus, the whole system of accident occurrence is a complex phenomenon. Many researchers have devoted their work in the area of road accidents and traffic safety aspects. Works have been undertaken on accident characteristics, accident forecasting and better roadway and vehicular design for the improvement of road safety in different traffic and roadway conditions.

A number of studies on road safety have also been carried out in India, in different cities such as Delhi, Mumbai, Chennai and Kolkata as well as on some highways. The notable studies include Kadiyali et al. (1983), Valli and Sarkar (1997), Chand (1999), Baviskar (1999), Saija et al. (2000), Sing and Misra (2001), and Chakraborty et al. (2001). However, no significant studies have appeared on the accident characteristics of passenger vehicles in Kochi. In this article an economic assesment of accident in a bi-level scenario i.e, during and before construction stage of metro rail system.

II. KOCHI TRAFFIC AND TRANSPORTATION SYSTEM

Population of Greater Cochin Development Authority (GCDA) area was 1.67 million in 1991 and 1.81 million as per 2001 Census. Population density is 2600 persons per sq. Km in GCDA area and 6300 persons per sq. Km in Cochin Corporation area. Population of Greater Cochin area has been growing at a rate of 1.4% per annum. The existing transport infrastructure is stress because of its inadequacy to meet the travel demand of this rapidly growing population. NH 17, NH 47 and NH 49; 3 National Waterways, an International Airport, Cochin Port located on strategic International Route and broad gauge lines linking Kochi to other States are the major intercity linkages. The existing street network in Kochi consists of arterial roads, sub arterial roads and local streets. The total length of highways, arterial and other major roads in Kochi urban agglomerate is about 613 km

The road-based passenger transport system of Kochi mainly consists of cars, buses, minibuses, auto rickshaws (three-wheeled motorized vehicles), motorcycles, taxis, bicycles and hand-pulled rickshaws. In a number of corridors tramcars also share the same right of way along with other vehicles. RITES have done a survey in (2001) and its result reveals the distribution of vehicular traffic and passenger traffic on mode base. The analysis result is shown in Figure 1 and 2

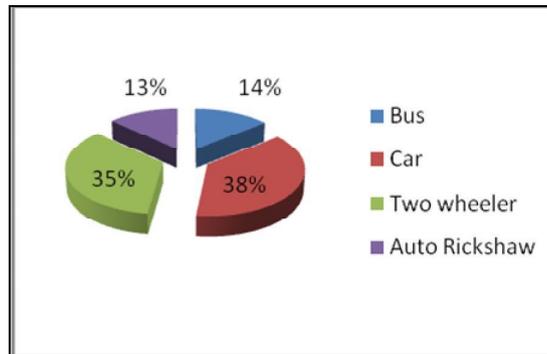


Figure 1. Distribution of Vehicular Traffic

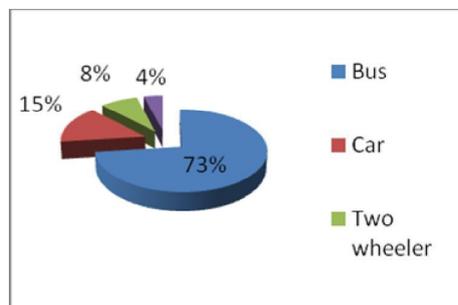


Figure 2 Distribution of Passenger Traffic

The survey reveals the fact that 73% of passenger traffic adopt buses to meet their travel demand and and 38% share of vehicular traffic in road network is car.

III. TRAFFIC ACCIDENT SCENARIO OF KOCHI

In Kochi traffic accidents occur for various reasons. The major problems identified in road sector are Majority of traffic problems are concentrated along two east-west corridors of the city, The city is divided into two parts by the Railway line, Improper traffic junctions, Chronic parking problems in core areas, lack of parking space results in road side parking causing bottle necks and creating traffic block, The pedestrian crossing across major corridors in city centre is a serious problem etc.

IV. ACCIDENT STATISTICS

An accurate and comprehensive system of collecting and recording accident data is required for studying the traffic accident characteristics in a city. Such data serve to identify the basic causes of accidents and to suggest means for overcoming the deficiencies that lead to such accidents. For the present accident characteristics study in

Kochi, the past accident data for the years 2005 to 2014 were collected from published reports of the Transport Department of Government of Kerala and Kerala Traffic Police.



Figure 3 Total Reported accidents
Source: Kerala Police

V. ECONOMIC COST OF ROAD ACCIDENTS

The value presented in the table below reveals the economic cost of different types of accidents according to IRC: SP: 30-2009 (Table3.1).

Table 3.1: Economic cost of different types of accidents

Sl No	Accident severity	Economic cost
1	Fatal	864350
2	Major	172650
3	Minor	30450

Source IRC: SP: 30-2009

It is found that after the metro construction started the percentage of contribution in accidents by the motor cycles increased to 38.3% whereas during the previous years it were 36.31% (2012) and 35.89 % (2011) respectively. The pedestrians involvement in accidents is also increased to 17.89% than previous years (15.94% (2012) and 15.92 % (2011)). The reason is attributed that the lack of pedestrians facility such as shoulder deficiency, deficiency in pavement marking at junctions etc. Table 4.5 shows the important places in Aluva-Pettah Corridor and number of accidents happened there after construction started. Kaloor is a major intersection in this region of the city, intersecting the two major arteries of downtown Kochi namely, the Banergy road and the K K road. The number of accidents occurred at Kaloor during construction period is more when compared to any other section.

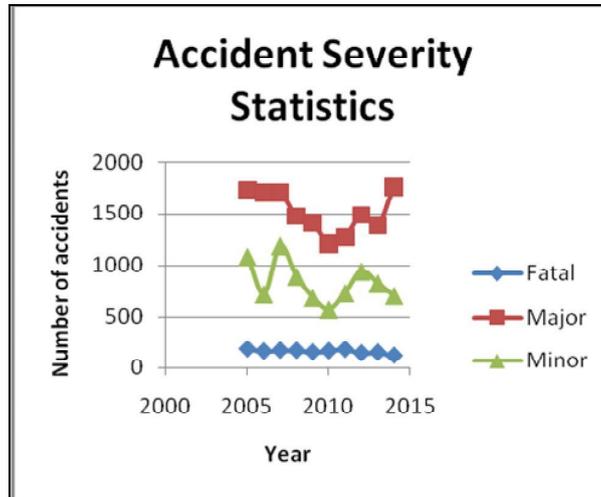


Figure 4: Accident severity statistics

Figure 4 reveals the number of accidents in accordance with their severity.

VI. ECONOMIC LOSS DUE TO ACCIDENT WITHIN KOCHI CITY LIMIT

As per table 3.1 the economic value assigned for a fatal accident is Rs 864350 , for a major accident Rs 172650 and for a minor one 30450. The economic analysis of accident is shown in the table below.

Table 4.6 Economic evaluation of accident losses

Year	Fatal	Major injury	Minor injury	Economic Loss(In crores)
2005	185	1738	1081	49288690
2006	163	1711	721	458247650
2007	172	1713	1186	480531350
2008	170	1481	892	429795550
2009	154	1418	689	398907650
2010	166	1211	572	369978650
2011	182	1277	731	400044700
2012	144	1490	941	410368350
2013	151	1394	826	396342650
2014	119	1770	705	429915400

The increase in economic cost after 2013 is due to the impact of work zone. It can be clearly stated with the facts and statistics discussed in the above section. The data 2014 is up to the month of November, so that the actual

economic loss is more than the calculated. This loss will be compensated when savings of accident due to metro rail come across.

6.1 SAFETY STRATEGY

The major safety issues identified in Kaloor, Edapally, and Palarivattom are inefficient street light and speed reducing measures, presence of severe pot holes, insufficient warning signs, visibility problem, concrete projections in to the road surface, presence of electric posts on the road side, red rope in workability over the barricades, parking of vehicle in the non parking area, presence of unwanted sand deposits on the road, shoulder deficiency, unexpected side road entry and improper pavement markings. The speed of vehicles is insisted to follow 30 km/hr in the work zone by the KMRL. But it is observed that none of the vehicles are following that speed limit. So the proper enforcement and the installation of speed bump at the junctions are the solution for reducing the accidents. The lane marking, installation of high mast street lighting, pedestrian markings at junctions etc are the urgent safety measures to be provided in the black spots for enhancing the safety. The presences of several pot holes in the road surfaces were identified. The proper maintenance of road is the only solution for this. The other remedies should be provided on the black spots for reducing the accidents are to make the visibility of road by cutting the branches of trees, cutting of the concrete projections, removing of unwanted sand deposits near the road and provide enough shoulder width.

VII. CONCLUSIONS

The study reveals the economic loss due to accident in Kochi city in past ten years. The exact reason for occurrence of accident is not entirely impact of work zone. The accident economic cost is comparatively more for last two years. Inefficient work zone management and lack of safety is a reason for this economic loss. Better alternatives of safety measures suggested in study can minimize the accidents resulted by metro development.

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