Impact of metro rail construction work zone on traffic environment

Ravi Bhutani*, Dr. Sewa Ram, Dr. Kayitha Ravinder

*School of Planning and Architecture, New Delhi, 110002, India
1CSIR-Central Road Research Institute, New Delhi, 110020, India

Abstract

Implementation of metro rail projects paves way to the construction activities and in this process long term construction work zones are inevitable. Long term work zones on urban roads lead to many problems such as reduction in capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents which lead to unaccounted economic losses. So it becomes necessary to study and quantify the impact of mass rapid transit system construction work zones on traffic environment which will further help in estimating the economic loss due to metro rail construction work zone. This research aimed to study the impact of metro rail construction work zones on traffic environment and consequently quantify these impacts for present situation. Using VisSim 6.0 software, effect of intersection in a work zone was studied. Queue lengths were calculated in work zone and non-work zone conditions. Total economic losses is calculated to be around 20 crore/km/year for elevated metro construction in the given site. With such huge economic loss it becomes imperative to have systematic work zone scheduling and traffic management techniques so as to reduce the impacts of metro rail construction work zones.

Keywords: Work zones; capacity loss; speed reduction; travel time delays; fuel consumption; economic losses

* Corresponding author. Tel.: +91-9769705773
Email address: bhutani.ravi@gmail.com
1. Introduction

Work Zone is defined as an area of a highway in which maintenance and construction operations are taking place that impinge on the number of lanes available to traffic or affect the operational characteristics of traffic flowing through the area.

Due to the rapid growth of urban population and increasing vehicle count supplemented by increased use of private vehicles, congestion on urban roads has increased tremendously. In a developing country like India augmentation of road infrastructure and development of mass rapid rail systems are projected as the solution to address this problem. Implementation of these projects paves way to the construction activities and in this process long term construction work zones in urban areas are inevitable. Though these projects are aimed to decongest the roads but lack of proper planning and implementation norms for these long term urban work zones leads to many problems such as reduction in capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents which lead to unaccounted economic losses. So as a first step it becomes necessary to study and quantify the impact of a mass rapid transit system construction work zones on traffic environment.

Indian Roads Congress has suggested guidelines on safety in road construction work zone [1] and Highway capacity manual (2000) provides capacity of short term and long term construction work zones, but the nature and construction activities related to a construction of a metro rail project differ much from a road project and consequently the effects of work zones due a metro rail construction project is different than highway projects and thus it becomes necessary to study and quantify the impact of mass rapid transit system construction work zones on traffic environment which will further help in estimating the economic loss due to metro rail construction work zone.

1.1 Objectives of the present study:

- To study, identify and assess the different characteristics of an elevated metro construction work zone in the study area
- To study the traffic flow characteristics at work zone location and compare it with non work conditions
- To study fuel consumption characteristics in a work zone.
- To estimate economic loss due to the increased fuel consumption and loss of travel time in a work zone.
- To simulate various scenario using VisSim software and study the impact of changing work zone conditions on traffic flow characteristics.

<table>
<thead>
<tr>
<th>Nomenclature</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>Km</td>
<td>Kilometer (equal to 0.621 miles)</td>
</tr>
<tr>
<td>h</td>
<td>Hour</td>
</tr>
<tr>
<td>ln</td>
<td>Lane</td>
</tr>
<tr>
<td>Rs</td>
<td>Rupees</td>
</tr>
<tr>
<td>PCU</td>
<td>Passenger car unit</td>
</tr>
</tbody>
</table>

2. Literature Review

Many researchers in different countries have worked and reported impacts of work zone on rural roads but there is a dearth of literature on the impacts of metro construction work zones on urban traffic environment since very less research has been carried out in this field. So most of the literature referred was related to work zone on rural roads to get a fair amount of idea to proceed in the present research. Vidya R, Santhakumar Moses, Mathew Samson(2000) [2] analysed the variation of speeds in different construction work zones during different construction stages in