Fixation of Toll charge for Six Lane Highway

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Abstract—Toll rates and traffic volumes (or demand) are the two major factors affecting revenue as well as investment strategies on toll roads. Although it has been experiencing dramatic growth in its highway systems during the past 10 years, there has been a lack of understanding in maintaining and operating its toll roads. Since most of the freeways in India are toll roads, it is necessary to establish a methodology for the toll road system based on the characteristics of India’s transportation systems and social economy. A methodology to determine the toll rates for India’s toll road systems is introduced. Factors affecting the toll rate are analysed, including gross domestic product, total number of vehicles, growth rates of passenger and freight transport, and roadway conditions.

Keywords:- Growth of traffic, Congestion, Vehicle characteristics, VOC.

I. INTRODUCTION

Toll tax is collected to recover the total capital outlay which includes the cost of construction, repairs, maintenance, expenses on toll operation and interest on the outlay. The new facility thus constructed should provide reduced travel time and increased level of service. In India most of the highway projects are given on PPP basis, i.e. Public Private Partnership. In this the private organization finances and constructs the facility and recovers the capital from the users in the form of toll tax. This tax is collected for a reasonable period of time after which the facility is surrendered to the public. Of late, toll tax is being levied on parking of vehicles in the urban centers in a move to decongest the streets and reduce the pollution levels. This concept is known as Congestion Pricing.

II. OBJECTIVES

Following are the objective of study area:
1) To forecast the toll travel demand for the study area
2) To study about the existing methods of fixation of toll charges.
3) To compare the various methods of fixation of toll charges.
4) To optimize the toll charges for the proposed study area.

III. STUDY AREA

The study corridor between Km.388.200 to 509.000, and being design a part of the National highway No.8, it passes through many urban settlements, industrial centers viz. Sabarkantha and Gandhinagar, etc. As the important link in the National Highway network of India, it probably carries the densest traffic in the country.

IV. TRAFFIC ASSESSMENT

Different types of survey were carried out on the study corridor from Km 388.200 To 509.000 of National Highway No.8, at different location and duration to appreciate the traffic and travel characteristics.
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Table 4: estimated cost of project
(Source: Feasibility for 6-laning of NH-8 from Udaipur Ahmedabad in the State of Rajasthan)

<table>
<thead>
<tr>
<th>Sr. no</th>
<th>Project Activities</th>
<th>Estimated Cost (Rs.)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Site clearance</td>
<td>15570107</td>
</tr>
<tr>
<td>2</td>
<td>Earthwork</td>
<td>728235560</td>
</tr>
<tr>
<td>3</td>
<td>Sub-base and base courses</td>
<td>926276470</td>
</tr>
<tr>
<td>4</td>
<td>Bituminous works</td>
<td>2517184915</td>
</tr>
<tr>
<td>5</td>
<td>Bridge, flyovers, underpasses, RoH, Pedestrian subway, footbridge, etc</td>
<td>2495561548</td>
</tr>
<tr>
<td>6</td>
<td>Drainage and Protection Work</td>
<td>714757586</td>
</tr>
<tr>
<td>7</td>
<td>Traffic sign, Markings and Road appurtenances</td>
<td>720576959</td>
</tr>
<tr>
<td>8</td>
<td>Maintenance, Repair and rehabilitation</td>
<td>842967485</td>
</tr>
<tr>
<td>9</td>
<td>Environmental Management</td>
<td>48293119</td>
</tr>
</tbody>
</table>

Escalation 25%; (Total project Cost) Rs. 1801884750

Total Project Cost 10811308458

Concession period in days 9855

Per day cost to be collected 1097037.899

Table 5: Vehicle Characteristics

<table>
<thead>
<tr>
<th>vehicle characteristics</th>
<th>Length in m</th>
<th>Width in m</th>
<th>Weight (self wt+ load capacity)</th>
</tr>
</thead>
<tbody>
<tr>
<td>car</td>
<td>3.66</td>
<td>1.5</td>
<td>1.4</td>
</tr>
<tr>
<td>Truck</td>
<td>9.2</td>
<td>2.4</td>
<td>9.7</td>
</tr>
<tr>
<td>bus</td>
<td>9.2</td>
<td>2.4</td>
<td>16</td>
</tr>
<tr>
<td>MAV</td>
<td>18.5</td>
<td>2.5</td>
<td>55</td>
</tr>
</tbody>
</table>

Table 6: weight age awarded vehicle characteristics

<table>
<thead>
<tr>
<th></th>
<th>Car (8.33%)</th>
<th>LCV (33.33%)</th>
<th>Truck/Bus (20.83%)</th>
<th>MAV (35.7%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Car</td>
<td>1/12 x 100</td>
<td>2.5/12 x 100</td>
<td>4/12 x 100</td>
<td>4.5/12 x 100</td>
</tr>
<tr>
<td>LCV</td>
<td>3.33%</td>
<td>33.33%</td>
<td>20.83%</td>
<td>35.7%</td>
</tr>
<tr>
<td>Truck/Bus</td>
<td>33.33%</td>
<td>33.33%</td>
<td>20.83%</td>
<td>35.7%</td>
</tr>
<tr>
<td>MAV</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
<td>100%</td>
</tr>
</tbody>
</table>

The toll fee per trip for each vehicle type may be assumed as:

Car = \( x_1 \)  
LCV = \( x_2 \)  
Truck or bus = \( x_3 \)  
MAV = \( x_4 \)

The total revenue collected per day must be equal to per day cost of project so that the total estimated cost of the project is recovered in the stipulated concession period.

2886X1 + 455X2 + 1009X3 + 706X4 = 563419.5634

Suppose \( X_1, X_2, X_3 \) and \( X_4 \) is \( X \)

\[
(8.33/100)*636.97 + (23.83/100)*636.97 + (35.7/100)*636.97 = 212.30 \text{ Rs}
\]

The car and multi axle truck vehicle are more than other category of the vehicle on the study area.

V. CONCLUSION

1. Economic evaluation of a proposed BOT facility is essential for the assessment of technical as well as economic feasibility of the project.
2. The estimation of vehicle operating cost and saving in travel time due to provision of a new facility must be undertaken carefully so that the toll fees for each vehicle type and toll collection period can be fixed accordingly.
3. With assumed parameters and computation methodology the Rounded off toll collection amount for car comes out to be Rs 53, for bus Rs 212, for truck Rs 132 and for multi-axle vehicle (MAV) as Rs 227.
4. The car and multi axle truck vehicle are more than other category of the vehicle on the study area.
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