International Research Journal of Engineering and Technology (IRJET) e-ISSN: 2395-0056
Volume: 07 Issue: 08 | Aug 2020 www.irjet.net p-ISSN: 2395-0072

Capacity Assessment of Two Lane Road:Case Study of State Highway

Gauri S.Biraje[1], Prf.A.S.Thorbole[2]

[1]M Tech, Dept. of Civil Engineering, RIT, Maharashtra, India
[2]Assistant Professor, Dept. of Civil Engineering, RIT, Maharashtra, India

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Abstract - *Two lane highways have major role in the highway system in India. The assessments of performance of two lane roads are necessary for the future traffic planning, design, operation and also maintenance. Indian roads have mixed traffic flow which leads to traffic congestion. It causes the slower speeds, vehicular queuing and various safety issues. The objective of this study is to find out the causes of traffic congestion of selected case study and also the capacity Assessment of the two lane road according to methodology given in the Indo Highway Capacity Manual. To achieve this objective the case study of two lane road from Patas to Baramti is considered for capacity assessment. Traffic study of this road is carried out. Traffic study reveals that Level of service for section I is C and for section II it is D.*

Key Words: *Passenger car unit (PCU), free flow speed, Level of service (LOS)*

1. INTRODUCTION

Indian roads are classified as per their width of carriageway like single lane, two lane or multilane roads. As per the report of MORTH, 52% of the national Highways (NH) and 36% of the state Highways (SH) in India are two lane roads [8] hence the analysis of performance of two lane roads are essential for the future decision making on public fund investment of highway projects [1]. Generally the performance evaluation of two lane roads is carried out by calculating the Capacity of road.

Road capacity is the maximum number of vehicles in a lane or a road that can pass a given point in unit time. Volume/capacity is one of the traditional method to find out the level of service of road. The capacity is expressed in the form of Level of service (LOS). There are six levels of services from A to F. Level of service A gives the free flow speed while level of service F gives the breakdown [5].

In India IRC 64:1990 and IRC 106: 1990 gives the methodology to find out the capacity of the Two lane roads (for urban and rural roads) but it gives very little information about the Level of service and the capacity of road, due to this developers in India use the Highway Capacity Manual of U.S (HCM) but the methodology given in this manual are not applicable to the Indian Heterogeneous traffic. Direct application of methodology given in HCM of U.S to find out the capacity of roads in India can cause wrong planning decisions and loss of huge amount of money [3]

The Indo Highway Capacity Manual is the first ever capacity manual published by the CSIR-Central Road Research Institute, New Delhi.

Here the case study of State Highway about 30.00 km which is two lane road are selected to calculate the capacity. The capacity calculated by using the Indo Highway Capacity Manual. For the two lane roads it is advisable to find Level of Service by using the Number of followers per capacity (NFPC)

2. Case Study and Data Collection

Selected case study area is in Maharashtra state. The project site starts at 0.00 Km and ends at 30.00 Km. It is two lane road. Fig 1 shows the total section of case study.

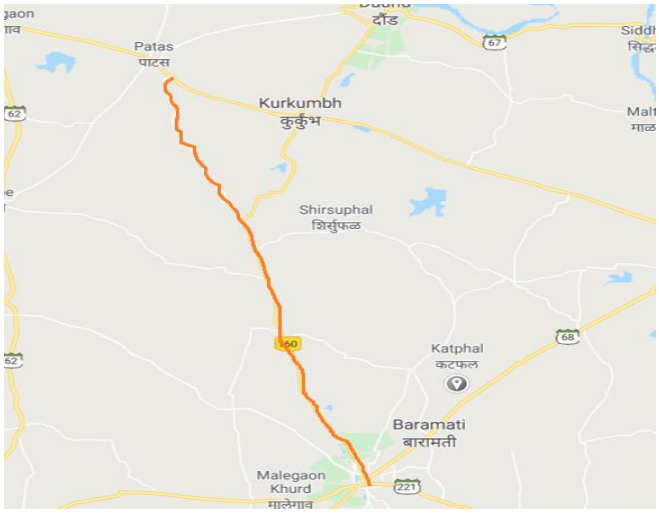

Fig -1: Route of case study

2.1 Description of the case study

Traffic survey-

Selected case study contain mixed traffic flow like LCV (light commercial vehicle) it contains the cargo, tempo, mini trucks, buses .LMV (light motor vehicles) it contains the car, jeep, taxies, delivery vans and also the multi axle vehicles. Volume count of selected case study carried out manually. Traffic count of mixed flow conducted in both directions for successive 15 minutes periods, 24 hours for 7 consecutive days.

Due to deviation in traffic flow whole case study divided into two sections such as section I and section II. According to Traffic survey the peak hour traffic for both the sections find out.

Peak hour for section I is 9.00-10.00 AM. Following table gives the peak hour data for section I.

Table1. Peak Hour traffic for SECTION I

Vehicle Category	Peak Hour Traffic
2 Wheeler	175
LMV	140
LCV (Light Commercial Vehicles)	110
2 Axle and 3 Axle Vehicles	85
4 to 6 Axles vehicles and , HCM	15

For section II peak hour is 5.00-6.00 PM. Following table gives the peak hour data for section II.

Table 2. Peak Hour traffic for SECTION II

Vehicle Category	Peak Hour Traffic
2 Wheeler	510
3 Wheeler	8
LMV	225
LCV (Light Commercial Vehicles)	120
2 Axle and 3 Axle Vehicles	120
4 to 6 Axles vehicles and , HCM	25

3. Reasons of Traffic Congestion

According to detailed site study and traffic pattern of selected case study reasons of traffic congestion find out. They are as follow-

- Selected case study is M.I.D.C area, lots of industries are present in the selected case study so this road contain heavy traffic flow during the peak hours.
- Also it is Sugarcane Belt Area. So during the sugarcane crushing season there is heavy traffic on the road
- It is major chemical and Pharmaceutical hub Centre
- For the two lane road 7m carriageway width is required but for the above road it is reduced from 7m to 6.6 m at chainage 13+500 to 14+200.

4. Research Methodology

Indo Highway Capacity Manual gives the theoretical methodology to find out the capacity of different type of roads. For calculating the capacity of two lane roads following procedure given in the Indo Highway Capacity Manual.

1. Estimation of peak hour traffic in Passenger car unit (PCU)

Here stream equivalency factor is used to convert the heterogeneous traffic into homogeneous. Following are the equation

$$Se = 1+0.150P_{BC}-0.702P_{2W}+0.204P_{AUTO}+1.770P_{LCV}$$
$$+5.075P_{BUS}+3.550P_{TAT}+4.598P_{TT}+5.414P_{MAT}-1.239*1/N$$

Where,

P_{BC} = Big cars Proportion in traffic flow

P_{2W} = Two Wheelers Proportion in the traffic flow

P_{AUTO} = Auto Rickshaws Proportion in the traffic flow

P_{LCV} = LCV (Light commercial vehicles) Proportion in traffic flow

P_{TAT} = Two/Three Axle Trucks Proportion in traffic flow

P_{BUS} = Bus Proportion in traffic flow

P_{TT}= Tractor Proportion in traffic flow

P_{MAT}=Multi axle vehicles Proportion in traffic flow

N=Total flow in vehicles per hour

Se = stream equivalency factor for Two lane roads in PCU/hr.

2. Calculation of Base Capacity

Base Capacity (PCU/hr.) = $394+34V_{os}$

Where, V_{os}- Operating speed of standard car

3. Calculation of number of followers

Number of followers (NF) = $1.1742Q^{0.9306}$

Where, Q = Traffic Flow PCU/hr.

4. Determine Number of followers per capacity (NFPC)

NFPC is number of vehicles in following state on section of two lanes roads, divided by its base capacity.it is used to calculate the level of service of two lane road.

This Manual gives the Number of followers and their respective Level of service. They are as follow-

Table3. NFPC and respective LOS

LOS	NFPC
A	≤ 0.15
B	0.15-0.25
C	0.26-0.40
D	0.41-0.55
E	0.56-0.70
F	>0.71

5. RESULT

According to methodology given in Indo Highway Capacity manual, for selected case study -

1. Section I- level of service is C

2. Section II- level of service is D

6. CONCLUSION

Here the Capacity of selected Case study is reduced. It affects the comfort and convenience of drivers. Also it shows there is problem of traffic congestion during the peak hours. So it is necessary to increase the capacity of selected case study.

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