# STUDY OF EXISTING HIGHWAYS AND THEIR CAPACITY IMPROVEMENTS

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**Abstract -** *In India, condition of traffic due to various kind of vehicles maneuvering with different lane behavior and driver behavior resulting in supremely heterogeneous nature due to their static and dynamic features. Currently the traffic on the road rises rapidly and traffic volume overdoes normal limit. Study of several features of highway traffic is essentially required for preparation, design and maneuver of roadway facilities. For the improved vehicular road traffic it needs better roadway structure with greater capacity. An intension of this work is to analyze capacity for urban roads in heterogeneous condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. The problem of measuring flow may addressed by using Dynamic PCU values.*

*Road traffic in India is termed to be highly heterogeneous which comprises of different types of vehicles like buses, trucks, auto-rickshaws, bikes, scooters, cycles etc. comprising of wide range of static and dynamic characteristics. Due to the high variations in its dimensions at its physical levels and speeds, it is tedious to make these vehicles to follow traffic lanes and the vehicles generally occupy any convenient lateral position on the road depending on the road space that is available for a given instance of time. Hence, expressing traffic volume as number of vehicles for a specified section of road or traffic lanes per unit time those are available terms to be inappropriate for vehicles related to different types with its static and dynamic characteristics comprising in traffic, which generally varies for large extent.*

*Capacity of roads plays a vital role in assuming better network characteristics and in providing good performance of roads. Capacity values play an important role for further modifications of roads. Various geometric measures like carriage way width, sidewalks, service roads, verge, medians, and road reserve and traffic patterns related to different roads. Passenger car equivalent (PCE) and Passenger car Unit (PCU) are typically used for road capacity analysis with heterogeneous traffic conditions. Capacity analysis is fundamental to the planning, design and operation of roads, and provides, among other things, the basis for determining the carriageway width to be provided at any point on a road network with respect to the volume and composition of traffic. Due to this circumstance, will occur problem such as accident, traffic speed reduction etc. The population of Haryana is growing day by day. The intensity of the traffic and pedestrians crossing has increased significantly and there is no increase in the road width. For a variety of reasons such as increase population, industrial, commercial and auto*

*ownership growth, increasing traffic demand can exceed the carrying capacity of the road.*

**Key Words:** Road, National Highway, Highway Capacity, Passenger Car Unit (PCU), Road traffic, Traffic volume, Heterogeneous.

## 1. INTRODUCTION

Highway capacity is the maximum hourly rate at which persons or vehicles can be reasonably expected to traverse a point or a uniform segment of a lane or roadway during a given time period under prevailing roadway, traffic and control conditions. For the effective and quick vehicular traffic service it needs better highway infrastructure with greater capacity. Highway circumstances comprise of geometric parameters such as lane width of road, shoulder condition and width, pavement condition, horizontal and vertical geometric condition. For the capacity estimation it is relatively tough to estimate traffic volume on the road. Estimation of road capacity generally depends on other major factor corresponding to traffic volumes termed with Passenger Car Units (PCU), which directly effects the capacity estimations.

Two-lane roads represent the majority of the highway system in India. The analysis of traffic performance on two-lane roads is critical for their planning, design, maintenance, rehabilitation and operation. Performance evaluation is typically carried out with the capacity analysis for various highway facilities. The National Highway No. 72 passes through Ambala - Nahan - Paonta Sahib - Dehradun – Haridwarwhich is one of the most important National Highway of India. The present study is conducted on the selected stretch of NH-72 between Ambala City and Naraingarh which is an undivided 2-lane highway of 45Kms in length. At the location of 2 major bridges, the road has been widened to 4 lane divided carriageway but the rest of the highway is 2-Lane undivided road with paved shoulders and faces the problems like mixed traffic, traffic congestion, speed reduction, road condition and chances of accidents due to insufficient road widths & absence of traffic control devices/road safety & road side furniture at the desired locations.

For the study purpose, the road inventory data and traffic volume survey has been carried out. The maximum Passenger Car Unit/day of three days traffic volume survey is approximately 25000. As per IRC: 64-1990 "Guideline for

the Capacity of roads inRuralareas" the recommended design service volume for 2 lane roads is 15000 Passenger Car Unit/day. So the data was compared with IRC: 64- 1990, and the road widening has been proposed for NH-72.

## 2. LITERATURE REVIEW

This chapter deals with the literature review of the work that has been done around the world towards the study of existing highways & their capacity improvement & an extensive review of literature is undertaken for various existing studies on need for increasing highway capacityin order to relieve the traffic congestion. Below are some of the researches that highlight the work done in this regard:-

**Decorla-Souza and Cohen (1998)**[1] developed a methodology to estimate the induced travel demand due to metropolitan highway capacity expansion at the sketch planning level. The authors also described sources of induced travel and its estimation at facility, corridor and region wide levels. The developed methodology at the sketch planning level was demonstrated through a hypothetical corridor example for low, moderate and high levels of initial congestion. Induced travel was estimated for moderate (-0.5) and extreme (-1.0) travel demand elasticity scenarios and it was found out that initial level of congestion has a significant positive effect on induced travel. The authors concluded from the study results that capacity expansion releases the congestion efficiently even if there is significant induced travel impact.

**Robert B. Noland (1999)**[2]studied the Relationships between highway capacity and induced vehicle travel. The theory of induced travel demand asserts that increases in highway capacity will induce additional growth in traffic. This can occur through a variety of behavioral mechanisms including mode shifts, route shifts, redistribution of trips, generation of new trips, and long run land use changes that create new trips and longer trips. About 25% of VMT growth is estimated to be due to lane mile additions assuming historical rates of growth in road capacity. The results strongly support the hypothesis that added lane mileage can induce significant additional travel.

**Satish Chandra and Upendra Kumar (2003) [3]** suggested the effect of lane width on capacity under mixed traffic conditions in India. A new concept to estimate the passenger car unit (PCU) of different types of vehicles under mixed traffic conditions is presented. It utilizes the area, as opposed to only the length, and speed of a vehicle. Data were collected at ten sections of two-lane roads in different parts of India. The width of carriageway (this term is commonly used in India for the total width of the paved surface of a road excluding its shoulders) ranged from 5.5 to 8.8 m. All vehicles were divided into nine different categories and their PCU's were estimated at each road section. It was found that the PCU for a vehicle type increases linearly with the width of carriageway.

**Zhao et al., (2004)**[4]developed a multistage stochastic model and solution algorithm based on Monte Carlo simulation and least squares regression for optimal decision making in highway development, expansion, operation and rehabilitation. Real options based approach had been incorporated in the model that accounts for three uncertainties i.e. traffic demand, land price and highway deterioration as well as their interdependence. The developed model and solution algorithm were demonstrated through numerical examples.

**Fields et al., (2009) [5]** analyzed the problem of severe congestion through capacity expansion using Atlanta State case study. Authors modeled additional lane-miles needed for Atlanta from 2005 to 2030 to relief congestion using Atlanta regional commission (ARC) data. Authors identified and analyzed four innovative capacity expansion project types which include: (1) express toll net-work (2) north-south tunnel (3) Lakewood tunnel and freeway extension and (4) toll truck way system from Atlanta. It was concluded from the analysis that capacity expansion with express toll net-work provided better congestion relief with maximum revenue generation.

**Sinha et al., (2011)**[6] carried out a theoretical study that investigated highway upgradation decision making for three different alternatives (do nothing, addition of lanes to existing highway and construction of new expressway) on the basis of benchmark traffic volume. Using historical traffic volume data from state of Indiana (USA) it was revealed that, an average benchmark traffic volume for 4-lanes major arterials to be widened to 6-lanes or upgraded to expressway have a range between 18,000 to 20,000 vehicles/day.

**Asia Pulse (2011)**[7] states that road widening will be able to manage increased capacity of vehicles. It controls the traffic of new vehicles in the road and it makes transportation process easy. The extension of the road once completed will additionally ease the current traffic condition. It reduces according to time and increases the driving comfort.

## 3. OBJECTIVES

– To study the existing traffic situation for the selected road stretch

– To carry out traffic volume survey of stretch

– To study on need of road widening and justify

## 4. STUDY AREA AND METHODOLOGY

The National Highway-72 No. 72 passes through: Ambala - Nahan - Paonta Sahib - Dehradun –Haridwar and is one of the most important National Highway of India. Due to the ease of connectivity, there has been an exponential growth in the number of vehicles plying through this area which has subsequently raised the demand for widening of this

highway. National Highway No.72 (NH-72) is entirely within the state of Haryana, Himachal Pradesh, Uttar Pradesh. In Haryana it covers 50 Km, in Himachal Pradesh 50 Km and in Uttar Pradesh 100 Km. The highway is maintained by National Highways Authority of India. The present study is conducted on the selected stretch of NH-72 between Ambala City and Naraingarh which is an undivided 2-lane highway of 45Kms in length. At the location of 2 major bridges, the road has been widened to 4 lane divided carriageway but the rest of the highway is 2-Lane undivided & also in deteriorated condition due to very heavy traffic.



**Figg. – 1, Study Area of NH-72**

In this study, both the primary and secondary data is used to arrive at certain conclusions. As per recent practice, any improvement to an existing stretch is being done based on the traffic growth rate as per past trends, which is purely based on the growth of vehicles. To calculate the capacity improvement of two lane National Highway, we have selected Ambala City - Naraingarh road stretch (NH 72). The highway is of undivided type. **Primary Data** is collected from site which involves:

1. A detailed site investigation: in which include road inventory data, traffic flow condition and identify the traffic circulation pattern in and around the study area.

2. Traffic survey and analysis: The collected data was analyzed to identify the Roadway Segments capacity, based on the Indian road congress guideline for capacity of rural road in plain area IRC: 64-1990.

3) Preparation of conceptual design: The next step is to propose section specific interventions to the identified issue and prepare their of implementation plan. Based on the need of urgency.

The number of vehicles at study stretch of National Highway can be counted either manually or by machine depending upon the duration of study, accuracy required, location of study area etc. But as we don't have any equipment, Manual Counting method will be adopted.

Manual Counting Method

i) Direct Method

ii) Indirect Method

Direct Method :-In its simplest form an observer counts the numbers of vehicles along with its type, passing through the section for a definite time interval. For light volumes, tally marks on a form are adequate. We can obtain the traffic volume as well as vehicle classification. We will be using this method during off peak hours.

Indirect Method :- In this method the traffic volume data is collected with the help of Videographic technique. The traffic data is collected on typical weekdays during daytime since traffic volume is observed to be drastically low during night time and also, all types of vehicles are not found. Video is captured & after that it is played on a computer toextract the traffic data. At morning and evening time, we will be using this method because of high traffic flowin each direction for recording the entry and exit of vehicles. After calculating the traffic volume data of the selected National Highway stretch, the data will be used to reduce the congestion on highways along with implementation of various safety measures. Moreover various means to enable the smooth movement of vehicles and pedestrians on the road could be suggested to avoid the delay in travel time. Thus, limiting the possible conflicts within the traffic.

**Secondary data** refers to the information or facts already collected and published. It is the data collected and reported by some source is accessed and used for the study. The secondary data is already published data, which is available in:

1) Books, magazines, newspapers, periodicals.

2) Public records and statistics.

3) Journals.

4) Various publications of the Central and State Government.

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