INTERNATIONAL JOURNAL FOR RESEARCH

IN APPLIED SCIENCE & ENGINEERING TECHNOLOGY

Study of Existing Highways and their Capacity Improvement

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Abstract: Road traffic in India is termed to be highly heterogeneous which comprises of different types of vehicles like bus, truck, auto-rickshaw, bike, scooter, cycle 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.

Area selected for the study is the National Highway no-72 (Ambala City (Baldev Nagar) to Naraingarh) which is an undivided 2-lane highway of 45Kms in length. Though the total length of the highway is nearly 200 kms as it passes through Ambala - Nahan - Paonta Sahib - Dehradun – Haridwar but the stretch selected for the study is Ambala City to Naraingarh. An exponential growth in the number of vehicles plying through this area and increase in number of accidents has subsequently raised the demand for widening of this highway.

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 carriageway width, sidewalks, service roads, verge, medians, and road reserve and traffic patterns related to different roads. Passenger car Unit (PCU) is 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.

Keywords: Highway Capacity, Passenger Car Units, Accident Analysis

I. INTRODUCTION

National Highways basically run through the length & breadth of the Country & are of national importance for strategic, administrative & other purposes.

They connect Capitals of states, ports, foreign highways, large towns and industrial centres including roads required for strategic movements for defence of India. They are deemed to be the primary road network of the country. Roads are considered to be one of the most cost effective and preferred modes of transportation. They are an essential infrastructure for the economic well-being of a country. Roads are critical for country's overall socio-economic development. Since the roads are an essential infrastructure, for the economy of a country, they are for public good. Hence it is necessary for the Government to invest on roads. An efficient and well-established road network is inevitable for promoting trade and commerce as well as meeting the needs of a sound transportation system in the country.

The rapid growth of population coupled with increased economic activities has favoured in tremendous growth of motor vehicles. This is one of the primary factors responsible for demand in widening of existing road. The intensity of traffic on Indian roads in general and in particularly on highways has increased into many folds thus rendering inadequate existing road capacity to contain the increased volume of traffic. To cope-up with this challenge, the Ministry of Roads Transport and Highways (MORT&H), Government of India has assigned National Highways Authority of India (NHAI) to take up the development of various National Highway Corridors where the traffic intensity has increased significantly there by necessitating capacity augmentation for safe and efficient movement of traffic.

Government of India is spending enormous amount of money on widening of NHs from two-lane to four-lane and six-lanes. Similar efforts are being made by the state governments also on widening and strengthening of the state and district roads. Upgradation of a road is justified only when capacity of the road is related to the projected requirement of traffic. The manuals for four-laning and six-laning of highways published by the Indian Roads Congress (IRC), New Delhi have indicated certain values of design service volume for two-lane undivided and four-lane divided roads to facilitate highway development projects in the country.

II. STUDY ABOUT ROAD STRETCH

The National Highway 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 72 (NH-72) is an Indian National Highway entirely within the state of Haryana, Himachal Pradesh, Uttar Pradesh. In Haryana it covers about 50 Km, in Himachal Pradesh 50 Km and in Uttar Pradesh 100 Km. The highway is maintained by National Highways Authority of India. NH-72 is a National Highway that links the Ambala to the town of Haridwar. It runs for a distance of 200 km (120 mi). 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. (-- Road length under study)

 (All dimensions are in Km.)
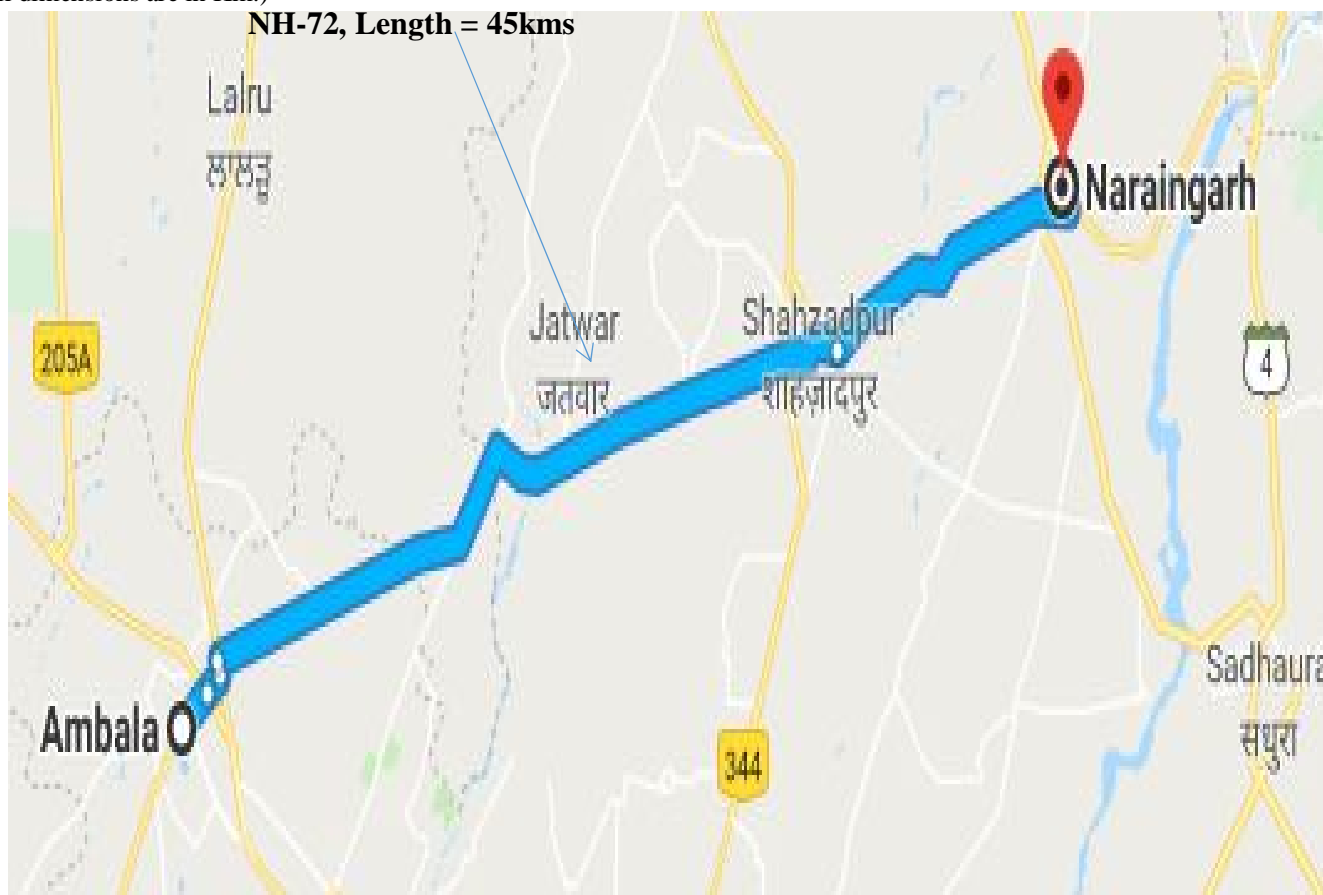
III.HIGHWAY CAPACITY

Highway capacity is defined by the Highway Capacity Manual as 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. The figure below itself explains of highway capacity concept.
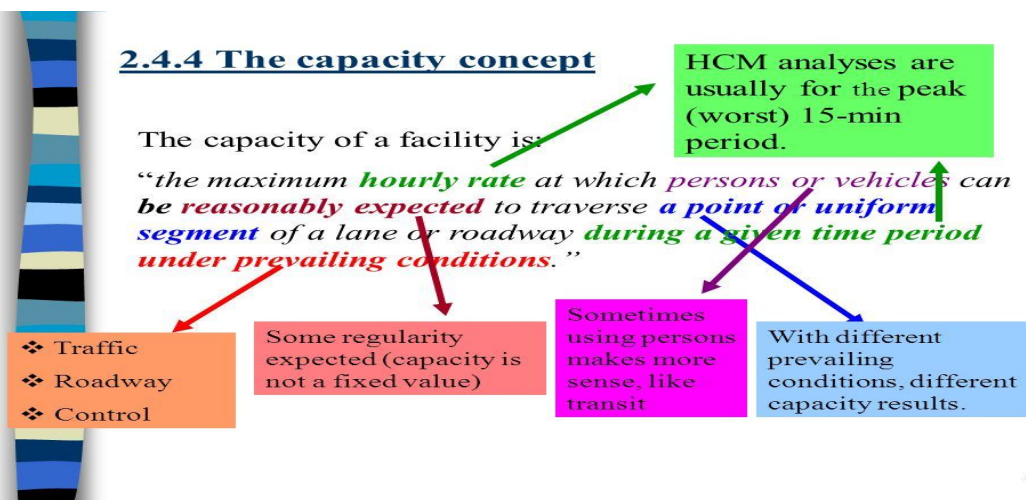
IV. METHODOLOGY AND DATA COLLECTION

The study aims at "Capacity Improvement of Existing Highways" and the stretch selected for the study is National Highway-72 between Ambala City (Baldev Nagar) & Naraingarh. NH-72 between Ambala city & Naraingarh is an undivided 2-lane highway which carries two-way traffic that is highly mixed in nature with vide variations in the static & dynamic characteristics of vehicle. Traffic volume & accident data for NH-72 are collected from different sources to study the need of capacity improvement.

A. Data Collected from Field study

The data for the roadway condition, traffic sign, traffic signal and man-made features are collected from PWD office, Ambala and field studies as below:

1) Length of the stretch: 45.0 km.
2) Type of Pavement: Bituminous.
3) Width of carriageway: Varies from 5.0m to 7.0 m.
4) No. of lanes: 2 lanes.
5) Divided/Undivided: Undivided.
6) Type of Shoulder: Earthern Shoulder.
7) Surrounding Environment: Rural & Urban
8) Type of traffic: Mixed traffic.
9) Road Condition: Poor.
10) Maintenance Required at most of the places.
11) Bridge Condition: Average.
12) Traffic Signals: Non-Working.

B. Accidental Data Collected from Police Stations

The only information available for accident studies is the FIR (first Information Report) lodged in five Police stations. i.e. PS Panjokhra, PS Baldev Nagar, PS Shahzadpur, PS Patvi & PS Naraingarh under which the stretch of Ambala Naraingarh highway falls which is shown below in Table-1 and Figure1.

Table-1 Annual Variation of Accidents

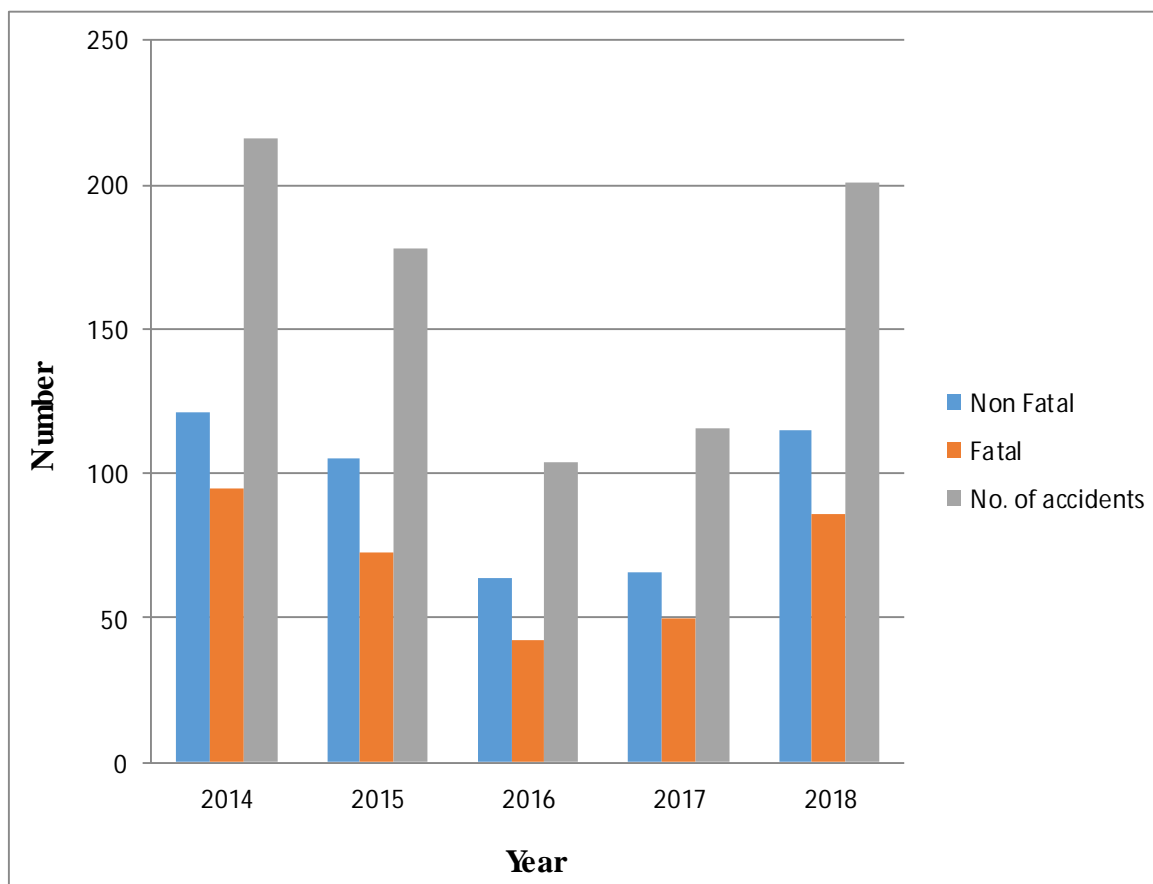| Year	No. of accidents	Fatal	Non Fatal
2014	216	95	121
2015	178	73	105
2016	104	42	64
2017	116	50	66
2018	201	86	115

Fig 1 Annual Variation of Accidents

C. Traffic Volume Data Collected from PWD Office

In addition to the above, traffic volume data were also obtained from PWD Ambala Division records. A total figure of PCU's calculated in year 2009 on the basis of traffic volume survey were obtained from PWD and NHAI office.

V. ROAD WIDENING BASED ON ROAD ACCIDENT ANALYSIS AND TRAFFIC ANALYSIS

Road widening can improve traffic safety and capacity. Road widening is normally carried out when the road is inadequate for the traffic using it, or when there is a need for extra lanes.

The widening of roads is one of the useful methods to deal with the current long- standing traffic problems. Roads are required to be widened & developed for facilitating vehicles rather than for pedestrians & non-motorized vehicle. The widening is proposed for the selected stretch on the basis of road accident analysis and traffic analysis. Widening the lanes on a bend can reduce the risk of head-on crashes by giving drivers more room to get around the bend without crossing into the opposing lane. Similarly, widening on turning lanes can improve safety, especially for larger vehicles

A. Annual and Month Wise Variation of Accidents in Study Area

For study purpose, the stretch of National Highway-72 between Ambala City (Baldev Nagar) & Naraingarh is selected where the traffic flow and accidental rate has gone high. Peak accident occurs in winter season i.e. in the month of December, January and February. This is due to distraction related to environment. Problem in these months are Fog, Mist and severe cold. Also it is seen from the analysis that the involvement of light motor vehicles and two-wheelers is more in accidents happening on the selected stretch. Accident data for NH-72 is collected from 5 major Police Stations and summarized in table 2 which shows the annual variation in accidents of the selected stretch of NH-72 during the year 2014-2018.

Table 2 Detail of Annualy, Month Wise Variation of Accidents

Year	Jan	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
2014	26	12	22	20	10	12	8	16	10	20	36	24	216
2015	30	20	12	12	8	9	7	5	16	18	21	20	178
2016	15	12	8	5	10	2	8	3	9	5	13	14	104
2017	18	16	15	5	2	10	0	8	6	8	12	16	116
2018	25	34	14	17	10	9	12	21	8	16	19	16	201
Total	114	94	81	59	40	46	31	43	49	67	101	90	815

B. Traffic Flow from Census Collected from PWD Records

PWD (Public Works Department) records are the main source of details of road. In addition to the above, traffic volume data were also obtained from PWD records. A total figure of PCU's calculated in the year 2009 on the basis of traffic volume survey were obtained from PWD and NHAI office. Taking the value traffic projection has been done as per IRC:108-1996, adopting the uniform growth rate of 5% (Compounded) for all vehicles. The projection of all the tollable traffic has been done for 10 years concession period i.e. upto 2019.

It is observed that percentage accidents are increasing relatively in most of the year. In the year 2014, accident rate was high and low in the year from 2016-2017. In the year 2018 the accident rate again increased rapidly. It may be due to increase in no. of vehicles, bad traffic environment and increase in population, less carriageway width, poor pavement condition & uncontrolled junctions. Over speed on the less available width is a major factor for road accidents.

VI. CONCLUSIONS

From the study conducted, it is found that maximum accidents occurs on the selected stretch (NH-72, Ambala City (Baldev Nagar) to Naraingarh) and other problems faced by the users is mainly due to the less width, lack of shoulder width, poor road condition, undeveloped junctions etc. of the road. The below suggested possibilities will help in reducing the accidents and conduction of smooth flow of the future traffic.

A. Development of 4 lane divided carriageway with paved shoulders will lead to the improvement of geometric deficiencies through curve improvements and the improvement of various intersections.
B. The repair/rehabilitation of existing Cross-Drainage (CD) structures on the selected stretch and provision of new CD structures at appropriate locations.
C. Proper drainage, grade-separators, road furniture, utilities and amenities wherever required shall also be provided.
D. The minimum average daily PCU to qualify for four-laning is 40,000 PCUs per day. Hence as per IRC:108-1996, an average projection of PCU during the year 2018 has already crossed the figure of 40,000 which qualifies the need of upgradation of NH-72 i.e. 4 lane divided carriageway with paved shoulders should be developed.
E. As many village roads directly connect this highway, Animal drawn vehicles and light vehicles are more in number which slows down the speed of heavy vehicles.
F. The accident rate can be reduced by providing signalized junction, junction improvement, shoulder clearance, installation of humps, shifting of poles, removal of trees near the edge of pavement etc.

Overall, the widening to 4 / 6 lanes shall improve connectivity, prevent traffic congestion, reduce travel time and travel cost, reduce accidents besides upgrading and improving the socio- economic condition of the region. Thus to enable that the project road is able to withstand the pressure of the traffic growth, it has been found that the proposed widening of the existing road to 4 / 6 lanes standards is needed.

VII. SCOPE FOR FURTHER STUDY

Further study can be done to upgrade the highway capacity using some other methods of capacity analysis. As the population is increasing day by day we need to improve our roads for better efficiency in transportation. And the highways are to be constructed by keeping in mind the future aspects. All the environmental aspects, vehicular characteristics and human characteristics should be taken into account. This will help the concerned department and the traffic engineer, in evolving a better traffic system in this area as well as in other areas.

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