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A STUDY OF FLOW CHARACTERISTICS OF NATIONAL HIGHWAY

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ABSTRACT
Transport sector plays a very significant role in improving the economic development of any country. Road transportation is the major component of the transport sector in India. India has one of the largest road networks in the world hovering around 3.4 million km at present. As per present estimate, total road network carry nearly 65% of freight and 85% of passenger traffic. Traffic on roads is growing at a rate of 7 to 10% per annum while the vehicle population growth is of the order of 12% per annum. Traffic operation on a two-lane two-way highway is unique. Lane changing and overtaking are possible only in the face of on-coming traffic in the opposing lane. The overtaking demand increases rapidly as traffic volume increases, while passing opportunities in the opposing lane decline as volume increases. Therefore, flow in one direction influences flow in the other direction. The problem is more acute in case of mixed traffic flow when speed differential among different categories of vehicles is quite substantial. Important traffic conditions that affect capacity of a two-lane road are composition of traffic stream, directional split and presence of slow moving vehicles in the stream.

INTRODUCTION
Traffic analysts are required to be familiar with different traffic characteristics on multi-lane highways. These characteristics are important in the evaluation of traffic performance, examination of highway safety, setting appropriate traffic control devices and speed limits and development of simulation programs etc. In multi-lane highways, lane position is considered one of the most important factors affecting traffic performance and characteristics. The first beginnings for traffic flow descriptions on a highway are derived from observations by Green shields, firstly shown to the public exactly 75years ago (Proc. Of the 13thAnnual Meeting of the Highway Research Board, Dec. 1933). He carried out tests to measure traffic flow, traffic density and speed using photographic measurement methods for the first time.

OBJECTIVE
The aim of present project is to find out traffic condition for NH4 considered for highway flow and to suggest future development of traffic flow for NH4. This project work is explained with the help of following points:

1) To collect traffic data on two-way dual carriage way.
2) To analyse the traffic flow data collected on two lane road.
3) To study the effect of influencing parameter, gradient, lane width, shoulder width, etc.
4) To compute P.C.U. as various geometric road condition and to study its effect on flow characteristics.
5) To estimate the capacity of national highway.

RESEARCH DESIGN
LITERATURE STUDY
Preliminary literature review was carried out to gain a better understanding of the characteristics and study of flow parameters of National Highway.

DATA COLLECTION
This step and next step were the main practice activities of the research. The dataof hilly area and plain terrain for predetermined NH4 was mainly picked up from field survey at actual location.

OPEN INTERVIEWS

In order to derive in depth information of traffic analysis, several interviews were conducted with locals who were living in that area.

DATA ANALYSIS AND INTERPRETATION

The collected data and information were handled through analysis. This analysis was used to present the traffic analysis for predefined NH4 and to give suggestion for future development for NH4. A report has been prepared on the research findings. Finally, the research process, procedure and outcomes are recorded in detail.

FLOW CHARACTERISTICS OF NATIONAL HIGHWAY

TRAFFIC VOLUME

It is defined as the procedure to determine mainly volume of traffic moving on the roads at a particular section during a particular time.

SPEED

It is defined as the rate of motion in distance per unit of time. Mathematically speed or velocity v is given by,

$$v = \frac{d}{t}$$

Where, v is the speed of the vehicle in m/s, d is distance travelled in m in time t seconds.

DATA COLLECTION

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FLOW

The measurement is carried out by counting the number of vehicles n_t passing a particular point in one lane in a defined period t. Then the flow q expressed in vehicles/hour is given by,

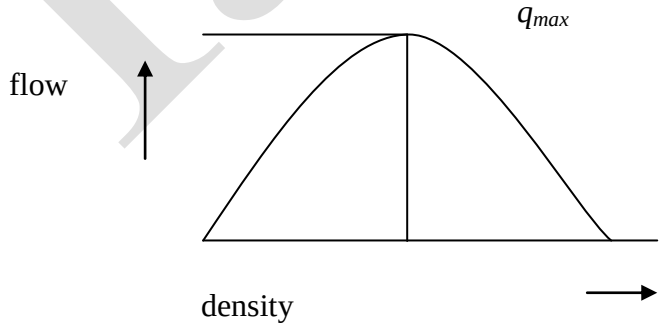
$$q = \frac{nt}{t}$$

Flow is expressed in planning and design field taking a day as the measurement of time.

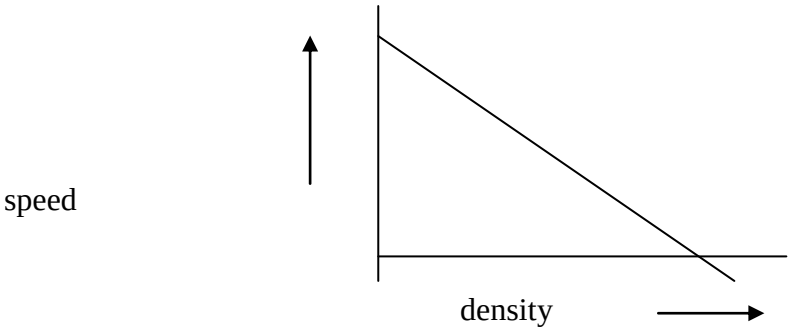
TRAFFIC DENSITY

Density is defined as the number of vehicles occupying a given length of highway or lane and is generally expressed as vehicles per km/mile.

FLOW-DENSITY CURVE



SPEED-DENSITY DIAGRAM



PASSENGER CAR UNIT (PCU)

Passenger Car Unit (PCU) is a metric used in Transportation Engineering, to assess traffic-flow rate on a highway. A Passenger Car Unit is a measure of the impact that a mode of transport has on traffic variables (such as headway, speed, density) compared to a single standard passenger.

CASE STUDY

Name Of Site : Tavandi Ghat
Length Of Ghat: 3 Km
Type Of Road: National Highway & Asian Hghway
Name Of Road: Nh-4 & Ah-47
No Of Lanes: 4

METHODOLOGY

Selection and prioritization of NH4 has been done step wise as detailed out. The best way to estimate P C U by vehicle and their direction of travel on highway surveys the steps are given as below,
Step I: First we visit on actual site and select one suitable section of road.
Step II: Next we divided selected section into three suitable point from which reading can be taken.
Step III: At each point like first, middle, and top we have taken manually readings for every half hour.
Step IV: At each station there are two types of reading taken one for volume of flow and another for speed of vehicle.
Step V: This procedure is repeated for three days.
Step VI: Next, feasibility for NH4 along these corridors were checked using road inventory data in terms of right of way future.
Step VII: Then further analysis was done by calculations and suggestion were found out.

Table Pcu For Different Types Of Vehicles At Different Gradient

Sr. No.	Gradient	PCU For							
		Car	TEMPO/ TRAVELER	SINGLE AXLE TRUCK	TANDUM AXEL TRUCK	MULTI AXEL TRUCK	BUS SINGLE AXEL	MULTI AXEL BUS	TRACTOR TROLLY
1)	4.38%	1	2.16	3.56	5.6	12.98	4	4.1	8.69
2)	-5.58%	1	2.07	3.21	3.89	7.96	3.61	3.47	9.36
3)	4.95%	1	3.16	5.08	6.92	18.89	5.39	5.16	6.8
4)	-5.33%	1	1.85	3.33	4.15	8.25	3.57	4.59	12.83
5)	6.70%	1	2.12	4.04	5.49	10.25	4.26	5.47	7.84
6)	-5.00%	1	2.01	3.52	4.17	8.99	4.09	4.1	8.48

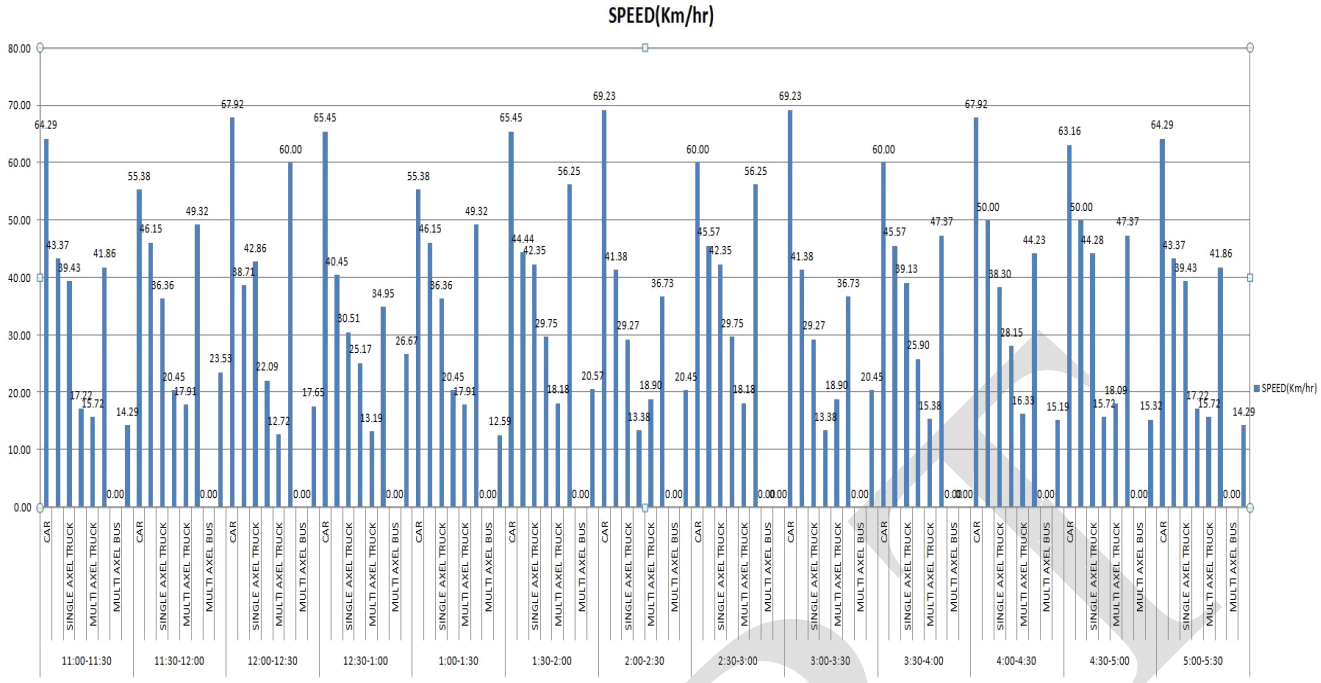


Fig: Time v/s Speed (Up Gradient)

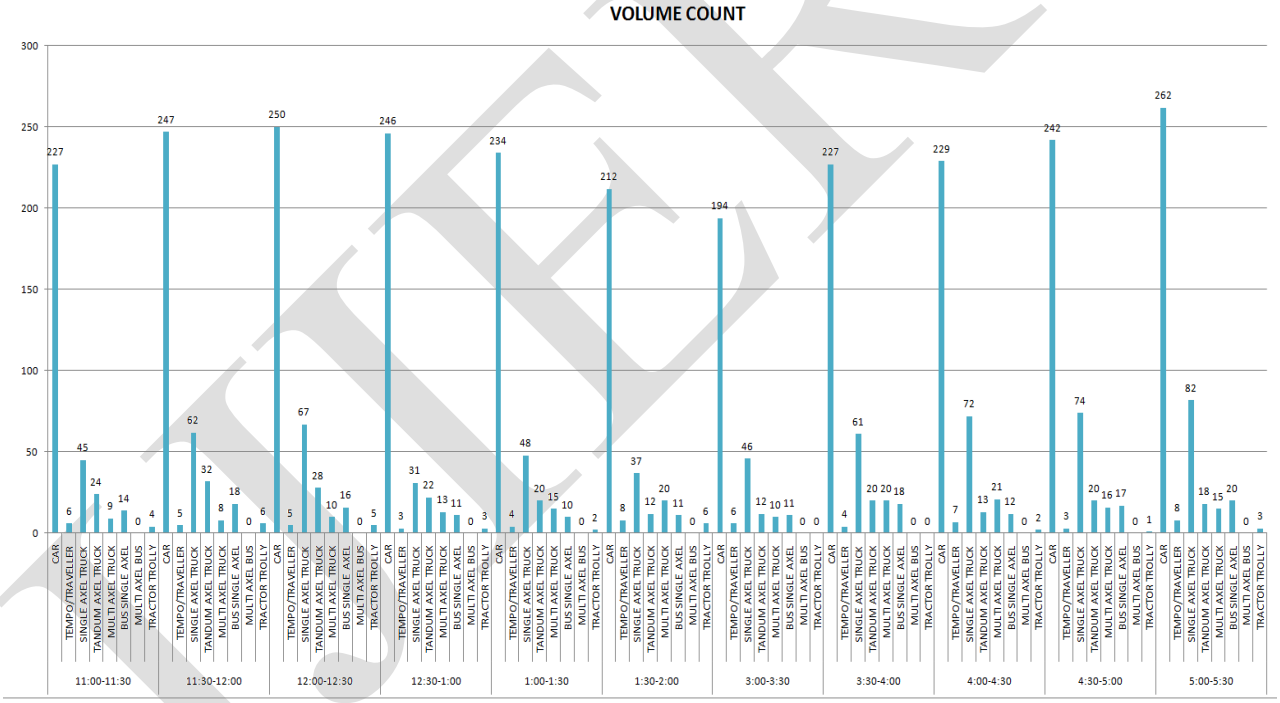


Fig: Time v/s Volume (UP Gradient)

Table-Avg. Speed/Day At Hotel Amar To Bangalore Ch.568.5 -568.4 (UP GRADIENT)

VEHICLE TYPE	26/12/15	27/12/15	28/12/15
CAR	63.56	60.41	55.04
TEMPO/TRAVELLER	44.42	48.85	44.98
SINGLE AXEL TRUCK	38.14	55.98	42.41
TANDEM AXEL TRUCK	21.06	44.69	39.84
MULTI AXEL TRUCK	16.31	43.45	32.34
BUS SINGLE AXEL	45.93	56.1	46.32
BUS MULTI AXEL	0	0	28.57
TRACTOR TROLLY	16.24	13.66	17.18

Table Avg. Volume/day At Hotel Amar To Bangalore Ch.568.5 -568.4 (UP GRADIENT)

VEHICLE TYPE	26/12/15	27/12/15	28/12/15
CAR	236	230.08	161.92
TEMPO/TRAVELLER	5.58	6.17	5.08
SINGLE AXEL TRUCK	58.92	47.25	30.5
TANDEM AXEL TRUCK	19.92	18.25	12.17
MULTI AXEL TRUCK	14.33	19.67	14.08
BUS SINGLE AXEL	14.83	12.17	10.17
BUS MULTI AXEL	0	1	1
TRACTOR TROLLY	3.5	1.67	1.75

Table Avg. PCU At Hotel Amar To Bangalore Ch.568.5 -568.4 (UP GRADIENT)

VEHICLE TYPE	AVG PCU VALUES
CAR	1
TEMPO/TRAVELLER	2.16
SINGLE AXEL TRUCK	3.56
TANDEM AXEL TRUCK	5.6
MULTI AXEL TRUCK	12.98
BUS SINGLE AXEL	4
BUS MULTI AXEL	4.1
TRACTOR TROLLY	8.69

*Similar data was collected for down gradient

LANE DISTRIBUTION

Simultaneously with Classified Count, Lane Distribution was observed using manual count method.

Data on lanes from Kolhapur to Banglore

	car	tempo	Single axel truck	Tandem truck	Multiaxel truck	bus	tractor
Inner lane	410	55	236	174	103	58	3
Middle lane	412	52	140	109	104	43	3
Outer lane	223	34	47	26	17	16	10

CONCLUSION AND RECOMMENDATIONS

1. As from survey and analysis we concluded that the P.C.U. for upgrade section is going to be increase with increase in gradient.
2. The speed of the heavy vehicles get reduced due to steep upgrade and due to congestion of traffic occurs. The speed of the other vehicles get reduced and it affects on the PCU value, because the speed is inversely proportional to PCU value.
3. The standard values of P.C.U. suggested by IRC-64-1990 to design road does not matches with the actual P.C.U. values calculated for the road.
4. The pattern of lane distribution observed on upgrade side is due to congestion of most heavy vehicles in inner and middle lane and other outer lane has no congestion.
5. The pattern of lane distribution observed on downgrade side is due to congestion of most heavy vehicles in middle lane and inner and outer lane has no congestion.

RECOMMENDATIONS

- PCU values recommended by IRC-64-1990 are applicable for flat roads only. For hilly areas with gradient and curvature the actual PCU values are worked out and those values can be useful for designing purpose.
- From lane distribution study we have recommended that for upgrade gradient the inner and middle lane should kept for the heavy commercial vehicles and the outer lane should kept for cars so the congestion of traffic will not occur and efficient flow will takes place.
- From lane distribution study we have recommended that for downgrade gradient the middle lane should kept for the heavy commercial vehicles and the outer lane should kept for cars, so that congestion of traffic will not occur.

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