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Speed Flow Density Study of Two Different Roadindian Road and Their Comparison

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Abstract

In this work speed -flow-density study of an Indian road has been conducted. Data has been collected using video camera and later decoded in computer. This data is very essential to estimate capacity of an Indian road. Since the collected data is of a narrow density domain, capacity prediction from this data is not promising. One of the data is collected in indore to mhow and another data is from mhow to pithampur .Both the data's were compared statistically. For both the data's R2 is calculated and it is compared with detection of traffic density flow precise to define whether both the data's are same or different.

Keywords: Fundamental diagrams, Heterogeneous traffic, Macroscopic parameters, Scatter diagrams.

I. OVERVIEW

The road transport mode in India has come to occupy a pivotal position in the overall transport system. Over the past five decades, the share of road transport in overall traffic flows has been continually increasing with a substantial shift from rail to road being observe.1 The road transport sector in India has expanded manifold in fifty years after independence, both in terms of spread and capacity. The growth in the importance of road transport within the transport sector is borne out by its growing share in GDP. The share of road transport in GDP is presently 3.69 per cent which accounts for a major share of all transport modes which contribute 5.5 per cent to GDP and handles more than 60 percent of the freight and more than 80 percent of the passenger traffic in India.2 Transport and communication is the basic infrastructure for economic development of a country.

Highways and roads are regarded as arteries and veins of a State which are essential for sustainable economic growth. However, overestimation of the requirement and planning beyond the necessity of road transport would be delayed in the process of economic development of a region The road network though extensive remains inadequate in terms of spread, suffers from a number of deficiencies and is unable to handle high traffic density at many places and has poor riding quality in some segments. The main reason for these shortcomings is the inadequacy of funds. Efforts are now underway to address these issues and improvement in the road network has been accorded a very high priority. This expansion of capacity will have to be accompanied by technological up-gradation in many critical areas. The need for new technology acquires greater urgency because the sector had been suffering from slow technological development for a long time.

The Indian road network is seemingly very large. However, only 47 per cent of the roads are paved. The high density corridors of road linking metro cities and ports are crowded and are carrying traffic more than capacity. About 14,000 kms of National Highway require four laning, while 10,000 kms require widening from single lane to two- lane to facilitate normal flow of existing road traffic.

The average productivity of a truck is 200 kms a day as against 350- 400 kms that would be possible through reduction of congestion. The demand for transport is affected by structural changes taking place in the economy. This growth in transport demand has to be met by expanding domestic supply as transport infrastructure is nontradable. Investment in transport must reflect the need to make up for existing capacity shortages and also to allow for growth in demand.

1. Motor Vehicle Population:

There has been a staggering 100 fold increase in the population of motorized vehicles; however, the expansion in the road network has not been commensurate with this increase. While the motor vehicle population has grown from 0.3 million in 1951 to over 30 million in 2004, the road network has expanded from 0.4 million km to 3.32 million km, only a 8 fold increase in terms of length during the same period. However, upgrading of roads by way of widening of carriage- ways, improved surface quality, strengthening/ reconstruction of old/ weak bridges and culverts, etc. has been carried out.

2. Speed flow density Heterogeneous traffic on Indian Roads Categories

Roadway capacity values and speed-&flow relationships used for planning, designing and operating roads, in most of the developed countries, pertain to fairly homogeneous traffic conditions comprising vehicles of more or less uniform static and dynamic characteristics. However, traffic scenario in developing countries like India differs significantly from conditions observed in developed countries. Road traffic in India is highly heterogeneous comprising vehicles of wide ranging physical dimensions, weight and dynamic characteristics. Different types of vehicles of heterogeneous traffic on Indian roads may be broadly grouped into the following categories:

1. Buses;
2. Trucks;
3. Light commercial vehicles comprising large vans and small trucks;
4. Cars including jeeps and small vans;
5. motorized three-wheelers, including three wheeled motorised vehicles to carry passengers and three wheeled motorized vehicles to carry small quantities of goods;
6. motorized two-wheelers, including motorcycles, scooters and mopeds;
7. Bicycles;
8. Tricycles to carry passengers or small quantities of goods;
9. Animal drawn vehicles.

3. Need for vehicle volume and classification in Speed flow density:

One of the fundamental measures of traffic on a road system is the volume of traffic using the road in a given interval of time. The traffic using a road comprises a variety of vehicles ranging from the simple pedal cycles to the motorcars and the heavy commercial vehicles. Each type has its own impact on the performance of the road. A simple volume count, without classifying the vehicles into distinct types, is of limited use. It is, therefore, a normal practice, when the traffic comprises of a number of types of vehicles, to convert the flow into equivalent passenger car unit (P.C.U.) by using certain equivalency factors. The flow is then expressed as PCU per hour or PCU per day. A knowledge of the vehicular volume using a road network is important for understanding the efficiency at which the system works at present and the general quality of service offered to the road - users. The ultimate aim of all the traffic surveys and studies is to ensure safe and comfortable transport of men and goods.

II. OBJECTIVES OF THE STUDY

The following are the specific objectives of the study are as follows.

To study the importance of road development and its impact of infrastructure development in India, Indore to pithampur Madhya Pradesh and Maharashtra.

To know the status of roads in indore to pithampur Madhya Pradesh region.

- To take an overview of the road development programmes in pithampur.
- To make an assessment of the progress of the road net-works in the Indore, mhowpithampur region.
- Performance evaluation of regression analysis to prediction of traffic density with special reference to indore to pithampur region.
- To find out the various drawbacks and barriers in road development and comparison two different case region.
- To suggest some important measures for the improvement in the performance of flow rate.

III. PROPOSED METHODOLOGY

1. Role and Function:

Traffic Data Collection and projections thereof of traffic volumes are basic requirements for planning of road development and management schemes. Traffic Data forms an integral part in the science of descriptive national economics and such knowledge is essential in drawing up a rational transport policy for movement of passengers and goods by both government and the private sectors. This Guideline considers the fact that traffic flow data is important in planning of a particular section of the road

network and for its subsequent maintenance. Traffic flow pattern appears to be random in distribution, as itreflects people's motivation in terms of different composition of vehicles on different types of roads under varying environmental conditions.

It follows then that data being collected is a methodological statistics, because traffic flow pattern follows a random distribution. Despite such complexities, it does follow fairly and clearly defined patterns that are possible to classify and analyse. Thus, traffic data collection and analysis follows varying trends and plays an important role in the evaluation and management of road network schemes. While taking cognisance of the above, traffic flow data is needed for different purposes by different Ministries and/or Organisations in Indore to pithampur.

The major areas for which this data is required are:

1. Planning prioritisation and project initiation.
2. Project design.
3. Planning maintenance.
4. National Transport Statistics.
5. Road Safety Measures.
6. Traffic Control.

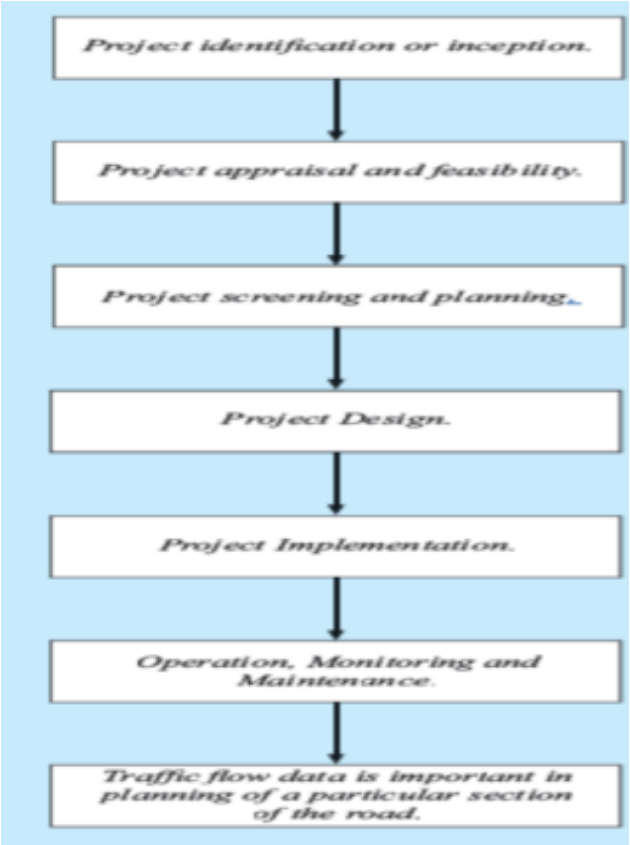

Figure 1 Proposed method block diagram.

Some of the key areas in which traffic flow data is needed for development and management of the road network include:

- Determination of a programme of road widening needs and general improvement or strengthening of existing road through a programme of reconstruction and construction of a new roads;
- To check the efficiency of the road network by comparing current traffic volume with the level of service or the calculated capacity;
- To establish the relationship between traffic volume, number of accidents and causes thereof, as well as determination of the probable occurrences;
- To plan prioritization of roads improvement schemes;
- To assess economic benefits arising from roads improvements;
- Investigation of various capacity and design problems for both roads and bridges and parking facilities.
- Design and improvement of new/existing junctions;
- Assistance in planning new developments such as roads in a new town, subdivisions, land use, which generally includes shopping centers, hotels, commercial and industrial complexes, service stations and other traffic generators activities;
- Determination of warrants or the need for implementation of traffic improvement and traffic control measures, such as synchronized/coordinated traffic signals, stop signs, one way roads, no entry, etc;
- To study future traffic trends and assisting in predicting traffic flows in the future for a given period;
- To classify roads on their functional basis. In addition to the above the following are typical specific needs:

1. Assessment of pavement performance through traffic surveys and Period monitoring of selected sections;
2. Ascertaining appropriate/optimal timings for maintenance interventions and rehabilitation needs of various roads countrywide;
3. Establish economic and social implications of design and feasibility studies of all development projects countrywide;
4. Establish the use of the road network by vehicles of different categories, traffic distribution, etc.
5. Video Camera.

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Video image processing system utilise machine vision technology to detect vehicles and capture details about individual vehicles when necessary. A video processing system usually monitors multiple lanes simultaneously, and therefore it requires high level of computing power. Typically, the operator can interactively set the desired traffic detection points anywhere within the system's view area.

Algorithms are used to extract data required for the detection of the raw data feeds. Due to the complexity of the images, it is not recommended that they should be processed outdoors as this can give poor results. The system is useful for traffic counting and give a +/- 3% tolerance, and is not appropriate for vehicular speed and their classification.

IV. RESULT AND ANALYSIS

1. Data Collection

For the intention of the present study Traffic Flow data and Average speed for all type of vehicles are collected through video graphic technique at every five minute interval on selected different urban road section (Indore to mhow and 150ft. pithampur to mhow) in Indore for the duration 8 hours covering morning periods (8:00a.m.-12:00noon) and evening periods (4:00p.m.-8:00p.m.).

2. Data Analysis

I. Capacity of Different Road Class

To develop a speed-flow model, traffic volume and speed are extracted from the traffic flow data. Volume is converted into PCU units by using equivalent factors and it is expressed in terms of hourly flow rate (PCU/Hr), subsequently density is calculated by using the fundamental formula:

K = q /v

Where,

k = density (PCU/Km),

q = hourly flow rate (PCU/Hr),

v = traffic stream speed (Km/Hr)

CASE -1 Analysis of Indore to Mhow road.

Data collection Report:

AVERAGE DAILY TRAFFIC SURVEY OF INDORE-MHOW ROAD

Date:

27/10/2017 to 2/10/2019

Section:

INDORE-MHOW

Direction:

Both way

Table 1 Indore to Mhow Data collection.

DATE	Motorised Traffic											Non-Motorised Traffic					Grand Total
	Passenger Vehicles					Goods Vehicles				Agricultural		Passenger		Goods Vehicles			
							Ord. Trucks							Animal Drawn			
	Two Wheeler	Three Wheeler	Car/Jeep	Mini Bus	Bus	Tempo / LCV	2 Axle	3 Axle	M Axle	Tractor with Trailor	Tractor	Cycle	Cycle Rickshaw	Animal Drawn	Horse Drawn	Hand Cart	Vehicle (No.)
PCU Factor	0.5	1.0	1.0	1.5	3.0	1.5	3.0	4.5	4.5	4.5	1.5	0.5	2.0	8.0	4.0	3.0	
27/10/17 UP	2145	21	796	126	151	78	81	73	45	22	12	28	0	0	4	1	3583
27/10/17 DN	1942	19	655	142	148	85	82	76	53	35	25	26	0	0	3	4	3295
28/10/17 UP	2184	73	737	185	153	105	92	84	46	28	8	34	0	0	1	4	3806
28/10/17 DN	2069	52	744	215	148	45	111	97	58	28	8	32	0	2	2	2	3897
29/10/17 UP	2445	26	805	168	144	92	51	90	78	25	9	24	0	2	4	6	3961
29/10/17 DN	2580	25	825	151	148	80	59	65	61	12	11	15	0	7	4	6	4049
30/10/17 UP	2661	89	801	132	160	82	68	87	56	13	8	29	0	0	2	6	4194
30/10/17 DN	2801	78	746	244	160	105	66	93	79	27	8	31	0	1	2	8	4449
31/10/17 UP	2895	79	786	153	166	95	40	97	78	21	10	15	0	0	4	5	4394
31/10/17 DN	2608	55	673	175	151	85	63	78	78	26	11	20	0	2	0	8	4032
1/11/17 UP	2474	33	704	266	160	113	61	92	64	9	7	11	0	1	2	7	4004
1/11/17 DN	2439	38	715	205	161	91	58	79	53	19	11	22	0	0	3	9	3903
2/11/17 UP	2685	41	752	194	164	90	62	95	38	13	20	21	0	1	2	6	4184
2/11/17 DN	2176	19	931	307	159	127	71	89	52	22	14	15	0	3	6	4	3995
Total Weekly Traffic	34404	648	10620	2663	2173	1353	966	1195	823	283	162	323	0	19	39	76	55746
Total PCU	17202	648	10620	3995	6519	2030	2895	5378	3704	1274	243	162	0	152	156	228	55203
Average Daily Traffic	4915	93	1517	380	310	193	138	171	118	40	23	46	0	3	6	11	7964
PCU ADT	2457	93	1517	571	931	290	414	768	529	182	35	23	0	22	22	33	7886

Table 2 Regression analysis Outcomes.

SUMMARY OUTPUT	
Regression Statistics	
Multiple R	0.904256148
R Square	0.817679182
Adjusted R Square	0.804656266
Standard Error	3818.287145
Observations	16

These table shows various parameters like R square, Error Observation point analytical values. These are provide 81.76% precise values and lower error generation in flow rate.

CASE -II Analysis of Mhow to pithampur road

Data collection Report:

AVERAGE DAILY TRAFFIC SURVEY OF MHOW TO PITHAMPUR ROAD

Date:

27/10/2017 to 2/10/2019

Section:

MHOW TO PITHAMPUR

Direction:

Both way

Table 3. Regression analysis Outcomes Mhow to pithampur Road.

Regression Statistics	
Multiple R	0.915271
R Square	0.837721
Adjusted R Square	0.825238
Standard Error	4328.802
Observations	15

These table shows various parameters like R square, Error Observation point analytical values. These are provide 83.77% precise values and lower error generation in flow rate.

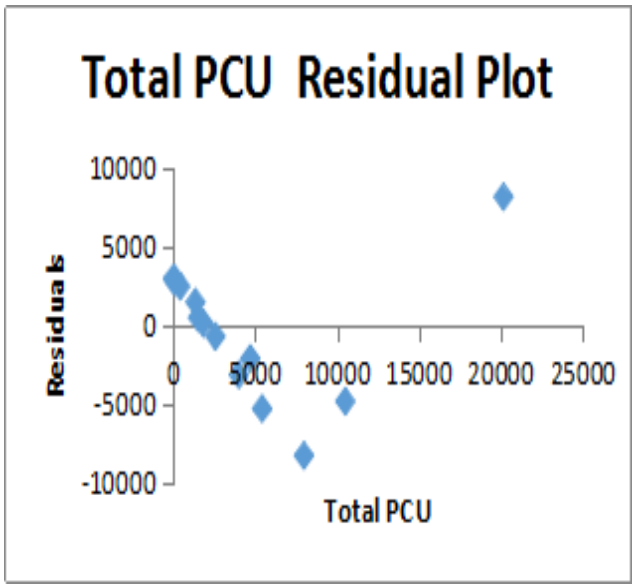

Figure 4.1: CASE-II Total PCU Residual Plot.

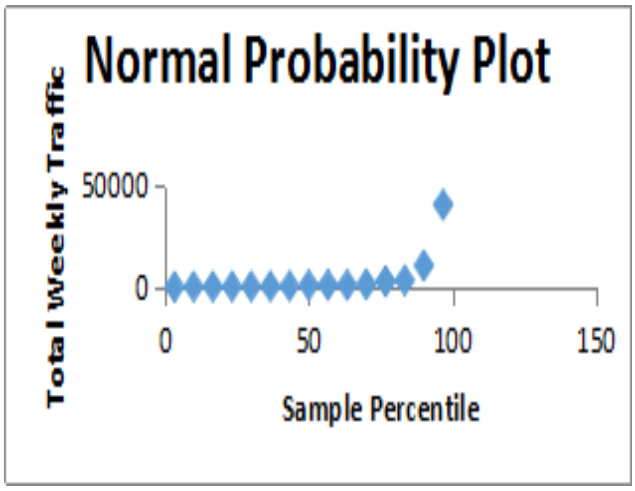

Figure 2 CASE-II Fitted flow-density diagram for the collected data

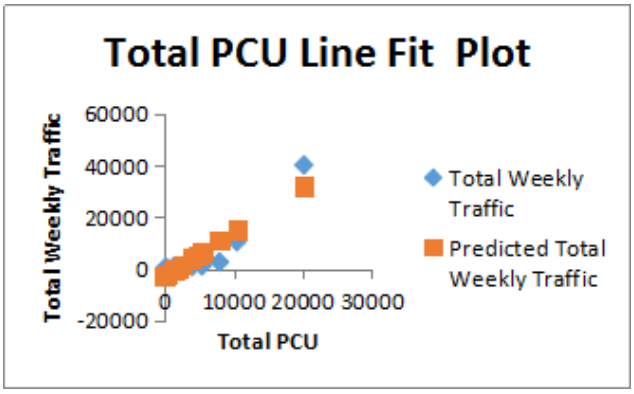

Figure.3 CASE-II Total PCU and best fit Mhow to pithampur.

V. CONCLUSION

1. The actual capacity analysis is fundamental to plan and improve the existing traffic facilities.
2. Capacity is increase with increase in width of carriageway for selected different road section and Level of service is increase with the decrease in the width of carriageway.
3. The observed capacity value by the static PCU method is 2% higher than the suggested value by IRC.
4. By using the Artificial Neural Network is give the exact R value in the training data set and in validation check the data set is fail minimum time.
5. The collected data is from a limited domain of density, so unable to predict capacity properly. Both the density and flow data follow normal distribution, i.e., as per the natural phenomena of density and flow. If the data is up to the mark then there is a possibility of predicting the relation in between traffic parameters as shown in fundamental diagrams. Both the data's are compared to one another and it was found that they are different to each other.

VI. SCOPE FOR FUTURE WORK

The protocol CSP-14XN developed for extracting data from different databases needs to be improved and restructured to accommodate large amount of data streams which could be coming from different network operators. The load on CSP-14XN or its advanced versions could be minimized by having a buffer to combine active and idle MSs within the network operators" systems as the requirement is to get the total count of number of MSs at a particular time at a particular point. To improve the data

collection on vehicular traffic density along highways, deployment of standalone BSC with inbuilt VLR will help in reducing network congestion and help in speedy data transfer. For successful implementation of this proposal, it will be more effective if highway BTS sites are clubbed together to form individual clusters. Another area which could be considered is that of having all highway sites manned by one single cellular operator region-wise for effective data collection and coordination.

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