

# ANALYZING TRAFFIC FLOW AT VARIOUS CATEGORIES OF ROADS IN RURAL AREA OF DISTRICT GONDA (U.P.)

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**Abstract:** Traffic flow is one of the most common parameters in the research to thoroughly analyze the transport system of any geographical area. Traffic flow is depicted as total number of vehicles passing through a particular location per hour. In this paper, a study for traffic flow has been carried out in certain regions of Gonda district of Uttar Pradesh (UP). For this work, a geographical area has been majorly divided into three data collection points which are termed as State Highways, District Roads and Village Roads. To get the traffic data, a CCTV camera was mounted on such roads of district and its video was meticulously investigated for certain time periods. The data obtained from the video is initially analysed in tabular form. In order to utilize this analysis statistically, bar and pie diagrams have been used to further investigate our research work.

**Index Terms:** Traffic Flow, Traffic Volume, Period of Time, Categories of Roads, TFDCPs.

## I. INTRODUCTION

Traffic flow is known as the total number of motor vehicles or any means of conveyance passing a particular point during specified period of time and is normally expressed in the terms of vehicles per hour.

i.e. Traffic Flow = Total Number of vehicles / Period of Time

Or

If we denote traffic flow as “q”, number of vehicles passing through a particular point as “V” and specific period of time is one hour, then “q = V” (vehicle per hour).

If we consider “V” as a volume, we can say every traffic flow represents the Volume “V” and also shows its highest volume “V” in a particular period of time i.e. known as peak hour.

To understand the concepts related to this research, a lot of relevant literatures have been reviewed that enabled us to understand the topic very well. A lot of research works have been implemented in the field of transport analysis for analyzing traffic flow. Various theories, diagrams and models are also given in traffic flow analysis as time-space diagram, flow and density analysis, time mean speed and space mean speed analysis, microscopic and macroscopic models etc.<sup>1,2,3</sup> It is well known that every traffic flow has its specific volume “V” (i.e. vehicles per hour) and peak hour. The present research work is not only intended to statistical or mathematical analysis of traffic flow, but also tries to understand the nature of traffic flow at the various categories of roads in rural areas of the study region.

## II. OBJECTIVES:

The present research work is aimed to analyse the traffic flow at various types of roads in rural areas of district Gonda. The objectives of the research work are to analyse:

- Traffic flow variation
- Average traffic flow
- Type of conveyance

on various categories of roads according to change in specific period of time.

## III. WORKING HYPOTHESIS:

According to the topic of research and its objectives following hypothesis are considered to implement in our study of traffic flow:

- In the rural areas, local traffic flow varies according to category of roads.
- Traffic Flow will also vary during specific period of time in a single day at the same road locations of respective categories.

## IV. METHODOLOGY:

As methodology is an important factor for a research work, it is carefully designed to make this study application oriented and successful. This research work is based on primary and secondary data. Primary data is collected by the analysis of

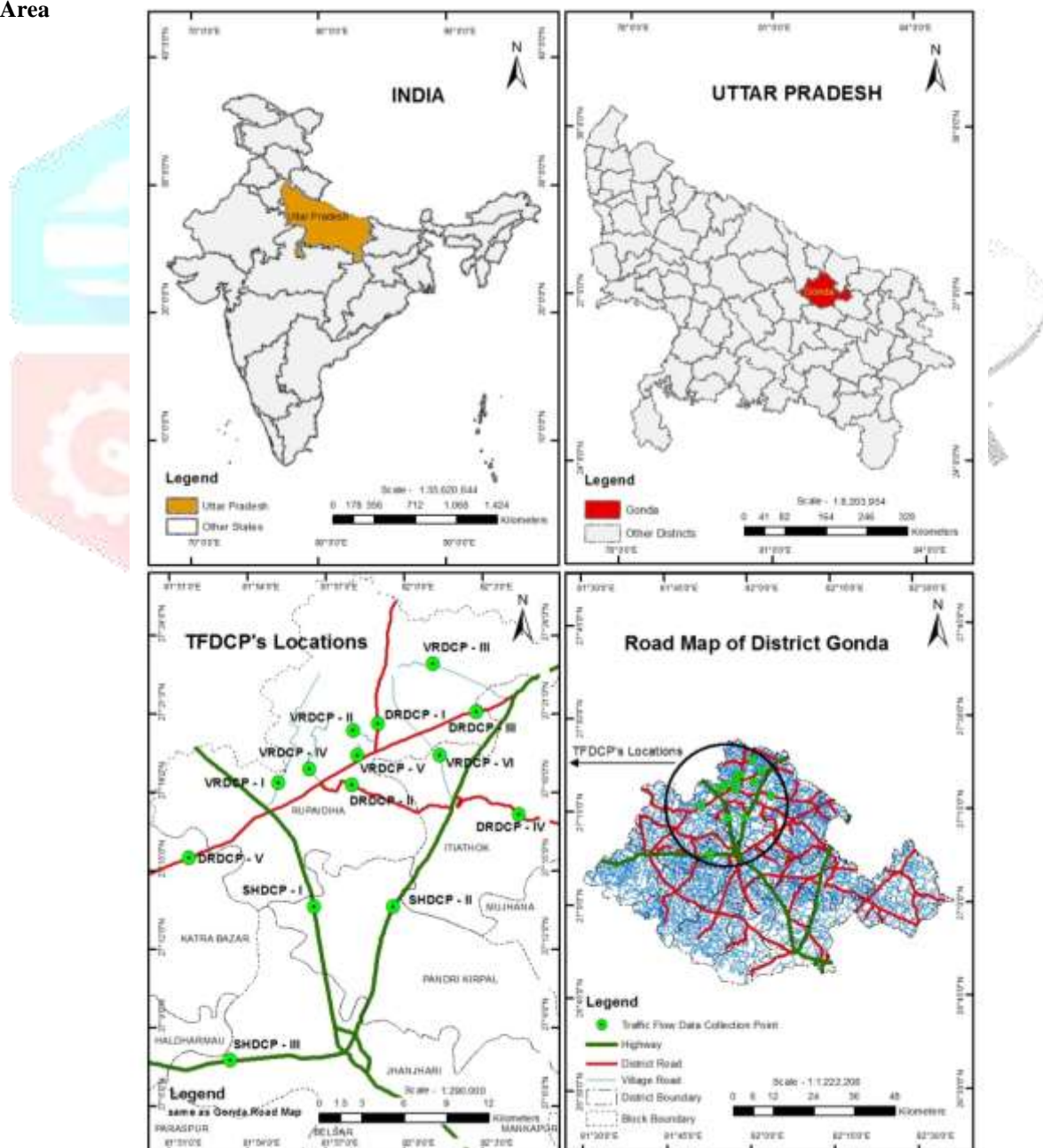
field survey and observations. Secondary data is collected at local district level government bodies like Public Works Department (PWD), Rural Engineering Services (RES), etc. According to the requirement, data and facts have been correlated and analysed. Maps and Graphs are also used to maintain the quality of this research work.

**V. STUDY AREA:**

Gonda is one of the districts of Uttar Pradesh, India. It belongs to Devipatan division which is situated in north-east part of Uttar Pradesh. The district lies between 26° 47' to 27°20' north latitude and 81° 30' to 82° 46' east longitude. Total Area of Gonda district is 4,003 square kilometer (as per census 2011) and the elevation is about 100 meters above sea level. District Balrampur makes its boundary in the north and northeast, whereas some part of this district also touches the boundary of Siddharthnagar in northeast. In the west, the district is bounded by Bahraich as well as Sravasti in northwest. In the east, Basti district makes its boundary. River Ghaghara separates the Gonda from Faizabad district in south and from Barabanki in south-west. Its shape is very irregular and seems to be like a cup, which is widest in the north and narrowest in the south. It has got physical boundaries on two sides Kuwano River in the north and Ghaghara River in the south. Gonda district is situated in Tarai region of north plain and there is no mountain, plateau or desert in the district i.e. merely a plain area. The general slope of the district is from west to east, but it is north to south in the Western part <sup>4,5</sup>. The location map of study area is precisely given in Fig. 1.

**Fig. 1: Location Area**

**Map of Study**



## VI. IMPLEMENTATION:

Traffic flows data are collected from 14 places in the Gonda district. For collection of this data a CCTV camera was mounted in the month of November-December 2017 on the defined categories of roads. In this study, the places of mounting the camera are named as Traffic Flow Data Collection Points (TFDCPs). The video recordings of these TFDCPs are investigated to calculate the traffic flow. Out of these TFDCPs, 3 are concerned with the state highways; State Highway Data Collection Points (SHDCPs), 5 are concerned with district level roads; District Road Data Collection Points (DRDCPs) and other 6 are related to village roads; Village Road Data Collection Points (VRDCPs). These data collection points are shown in the map as TFDCP's Locations. All TFDCPs are randomly selected and related to rural areas i.e. no one lies within urban or market areas. To find much applicable average value of traffic flow, number of data collection points varies from one category to other. All traffic flow data are collected during November-December 2017 at 9 specific periods of time in a day as 7-8 A.M., 9-10 A.M., 12-1 P.M., 2-3 P.M., 4-5 P.M., 6-7 P.M., 8-9 P.M., 10-11 P.M. and 12-1 A.M. After collection of traffic flow data, an average value is calculated in their respected groups (SHDCPs, DRDCPs, VRDCPs) as shown in followings tables and diagrams.

S. No.	Category of Roads	Data Collection Points	Location
1	State Highway	SHDCP-I	Gonda-Bahraich Road (Part SH-30)
2		SHDCP-II	Gonda -Balrampur Road (Part SH-1A)
3		SHDCP-III	Gonda-Lucknow Road (Part SH-1A)
4	District Road	DRDCP-I	Khargupur-Gokarannath Shivala Road
5		DRDCP-II	Itiyathok-Gopalbagh Road
6		DRDCP-III	Maharajganj- Bhawaniyapur Road
7		DRDCP-IV	Itiyathok-Babaganj Road
8		DRDCP-V	Aryanagar-Colonelganj Road
9	Village Road	VRDCP-I	Aryanagar-Lonava Dargah Road
10		VRDCP-II	Babhanisarai - Gokarannath Shivala Road
11		VRDCP-III	Khargupur-Maharajganj Road
12		VRDCP-IV	Gopalbagh-Bhulaideeh-Barahema Road
13		VRDCP-V	Manoharapur-Gokarannath Shivala Road
14		VRDCP-VI	Bhawaniyapur-Itiyathok Road

Table-I: The locations of Traffic Flow Data Collection Points, type of data collection points (are as SHDCPs, DRDCPs, VRDCPs), with categories of roads and their respective road locations where the data are collected as shown in Fig.1.

Period of Time	Average of Vehicles at all SHDCPs					Total
	Cycles	Motorcycles	Light Vehicles (Car, Jeep, Taxi, etc.)	Heavy Vehicles (Bus, Truck, etc.)	Tractor and Tractor- Trolley (Both)	
7-8 A.M. (Morning)	73	68.67	53.33	82.33	14.67	292
9-10 A.M. (Morning)	272.33	471.67	151	51	26	972
12-1 P.M. (Noon)	363.33	659.67	173.67	81	23	1300.67
2-3 P.M. (Noon)	461.33	861.33	168.33	78.33	23.67	1592.99
4-5 P.M. (Evening)	389	755	197.67	77	23.67	1442.34
6-7 P.M. (Evening)	110.67	331.67	134	61.67	18	656.01
8-9 P.M. (Night)	21	59.67	50.67	42.67	7.67	181.68
10-11 P.M. (Night)	0.67	13.67	25	34.33	4.33	78
12-1 A.M. (Night)	0	6.33	17	26.67	3.33	53.33
Total	1691.33	3227.68	970.67	535	144.34	6569.02

Table-II: Average traffic flow values collected from all three SHDCPs, given under their types of conveyance (vehicles) and specified period of time in a day.

<b>Table No. – III : Traffic Flow of District Roads (DRDCPs-I,II,III,IV,V)</b>						
Period of Time	Average of Vehicles at all DRDCPs					
	Cycles	Motorcycles	Light Vehicles (Car, Jeep, Taxi, etc.)	Heavy Vehicles (Bus, Truck, etc.)	Tractor and Tractor- Trolley (Both)	Total
7-8 A.M. (Morning)	23.6	33.6	5.8	7	2	72
9-10 A.M. (Morning)	104	166.2	18	7.6	4.8	300.6
12-1 P.M. (Noon)	111.6	202.6	23	11	6.8	355
2-3 P.M. (Noon)	144.4	237	25.6	7.4	5.2	419.6
4-5 P.M. (Evening)	128.6	211.4	25	8.4	5.6	379
6-7 P.M. (Evening)	38.8	106.6	18.6	6	4.4	174.4
8-9 P.M. (Night)	8.6	30.6	11.6	4.6	2.4	57.8
10-11 P.M. (Night)	0.6	9	7	3.8	1	21.4
12-1 A.M. (Night)	0	0.8	1.8	1.2	0.4	4.2
Total	560.2	997.8	136.4	57	32.6	1784

Table-III: Average traffic flow values collected from all five DRDCPs, given under their types of conveyance (vehicles) and specified period of time in a day.

<b>Table No. – IV : Traffic Flow of Village Roads (VRDCPs-I,II,III,IV,V,VI)</b>						
Period of Time	Average of Vehicles at all VRDCPs					
	Cycles	Motorcycles	Light Vehicles (Car, Jeep, Taxi, etc.)	Heavy Vehicles (Bus, Truck, etc.)	Tractor and Tractor- Trolley (Both)	Total
7-8 A.M. (Morning)	20.83	18.17	1.83	0.33	0.67	41.83
9-10 A.M. (Morning)	55.17	60.17	5.33	0.83	2.33	123.83
12-1 P.M. (Noon)	67.17	122	9.17	3.5	5.83	207.67
2-3 P.M. (Noon)	95.17	131.17	7.83	2.5	4.67	241.34
4-5 P.M. (Evening)	100.17	133	9.33	2.83	4.83	250.16
6-7 P.M. (Evening)	34.17	51.83	4.83	2	2.33	95.16
8-9 P.M. (Night)	8.67	13.5	1.67	0.5	1.17	25.51
10-11 P.M. (Night)	1.17	3.83	1	0.33	0.67	7
12-1 A.M. (Night)	0	0.17	0.67	0.5	0.33	1.67
Total	382.52	533.84	41.66	13.32	22.83	994.17

Table-IV: Average traffic flow values collected from all six VRDCPs, given under their types of conveyance (vehicles) and specified period of time in a day.

Table No. – V : Average Traffic Flow of State Highways, District and Village Roads						
Period of Time	Average of Vehicles at all DCPs (SHDCPs, DRDCPs and VRDCPs)					
	Cycles	Motorcycles	Light Vehicles (Car, Jeep, Taxi, etc.)	Heavy Vehicles (Bus, Truck, etc.)	Tractor and Tractor-Trolley (Both)	Total
7-8 A.M. (Morning)	39.14	40.15	20.32	29.89	5.78	135.28
9-10 A.M. (Morning)	143.83	232.68	58.11	19.81	11.04	465.47
12-1 P.M. (Noon)	180.7	328.09	68.61	31.8	11.88	621.08
2-3 P.M. (Noon)	233.63	409.83	67.25	29.41	11.18	751.3
4-5 P.M. (Evening)	205.92	366.47	77.33	29.41	11.37	690.5
6-7 P.M. (Evening)	61.21	163.37	52.48	23.22	8.24	308.52
8-9 P.M. (Night)	12.76	34.59	21.31	15.92	3.75	88.33
10-11 P.M. (Night)	0.81	8.83	11	12.82	2	35.46
12-1 A.M. (Night)	0	2.99	6.49	11.68	1.35	22.51
Total	878	1587	382.9	203.96	66.59	3118.45

Table-V: Average traffic flow values collected from all above 14 DCPs [3 SHDCPs (Table-I), 5 DRDCPs (Table-II) and 6 VRDCPs (Table-III)].

Fig. 2: Average Traffic Flow Bar Diagram of Table – II, III, IV & V

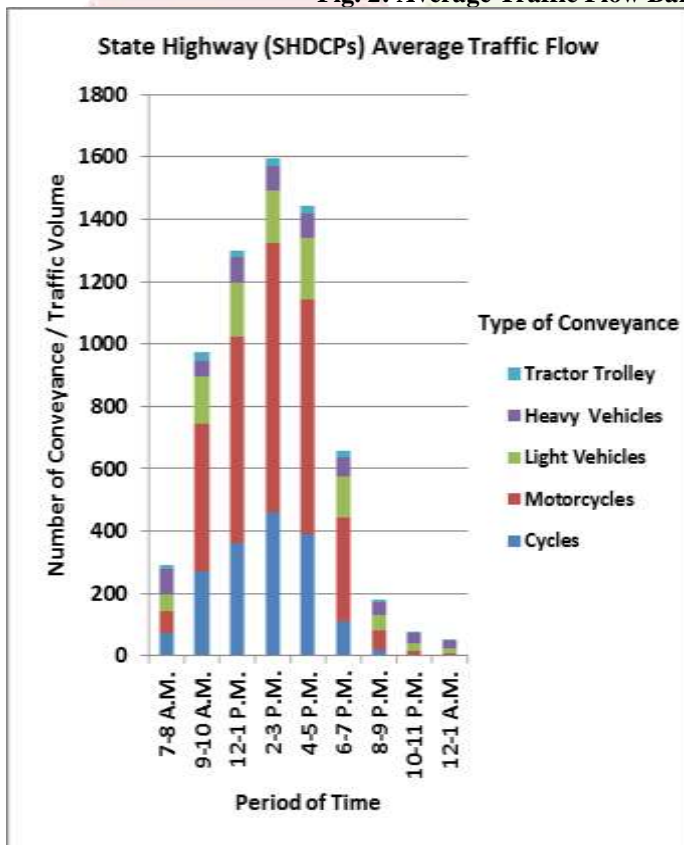


Fig. 2 (a)

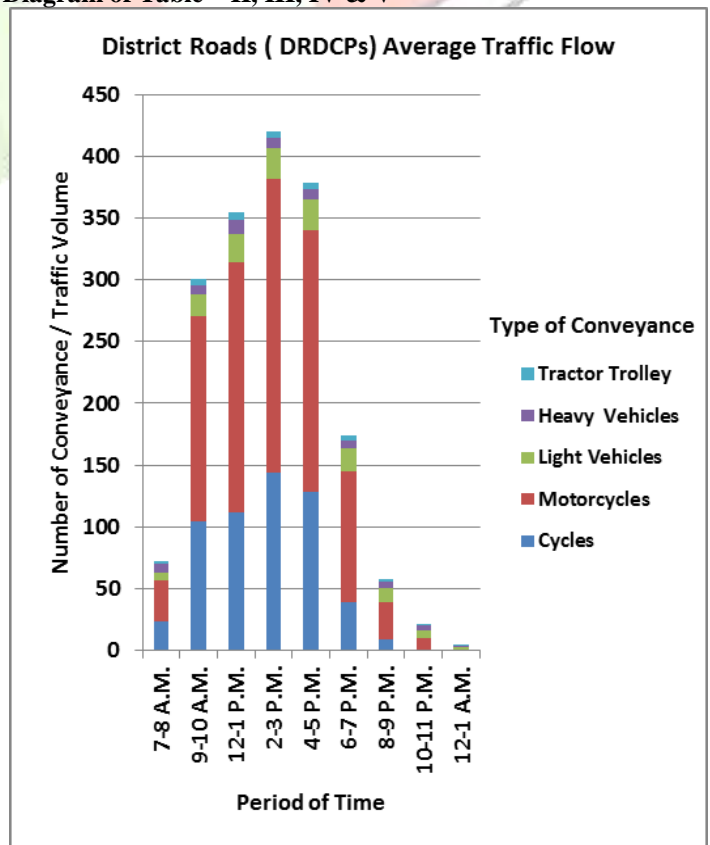


Fig 2 (b)

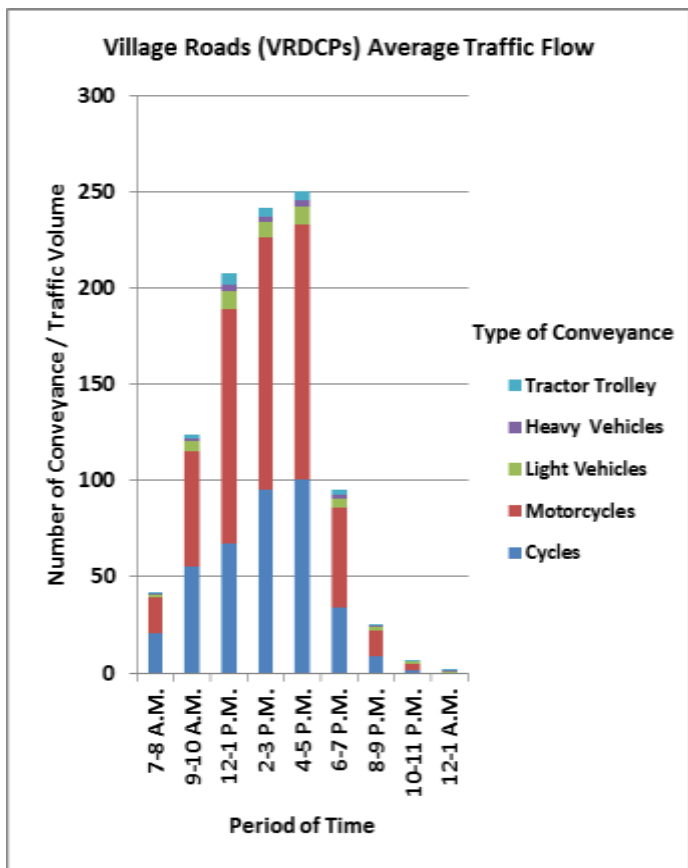


Fig. 2 (c)

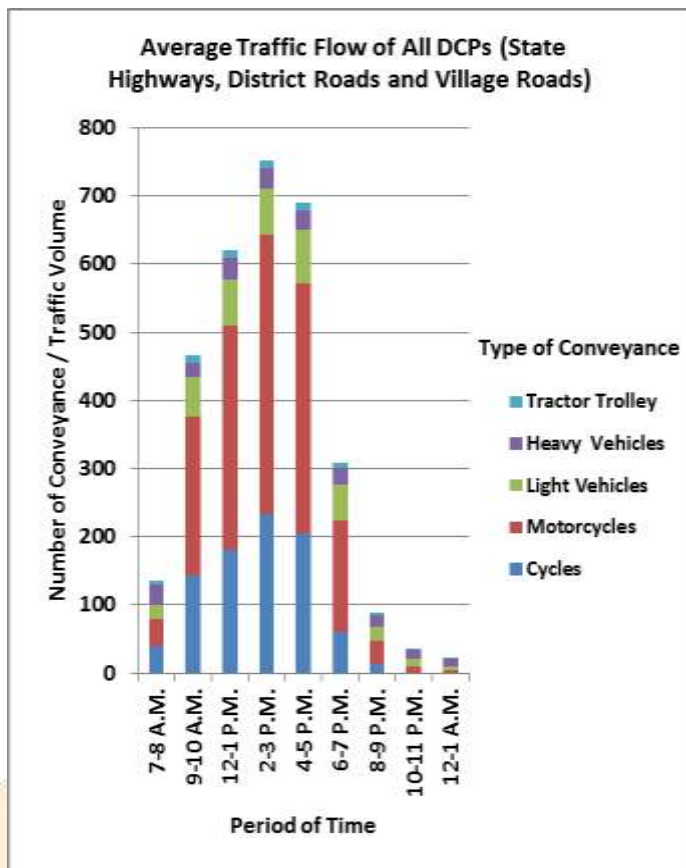


Fig. 2 (d)

Fig. 2 is a set of bar-diagrams related to Tables- II, III, IV and V respectively. Fig. 2 (a) represents the state highway average traffic flow. Fig. 2 (b) represents the district road average traffic flow. Fig. 2 (c) represents the village road average traffic flow. Fig. 2 (d) is concerned with Table- V and represents average traffic flow of all the above three values.

**Fig. 3: Distribution of Average Traffic Flow According to Period of Time**

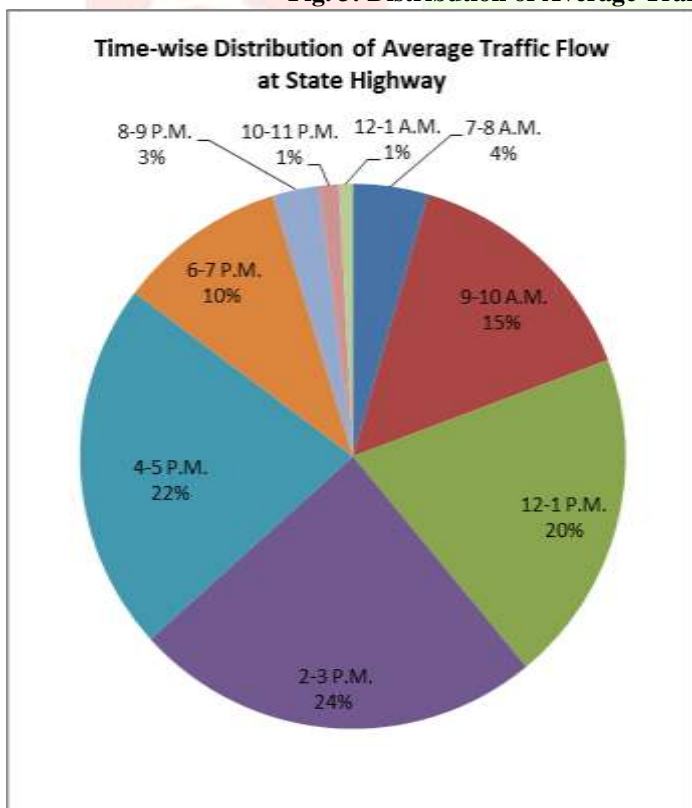


Fig. 3 (a)

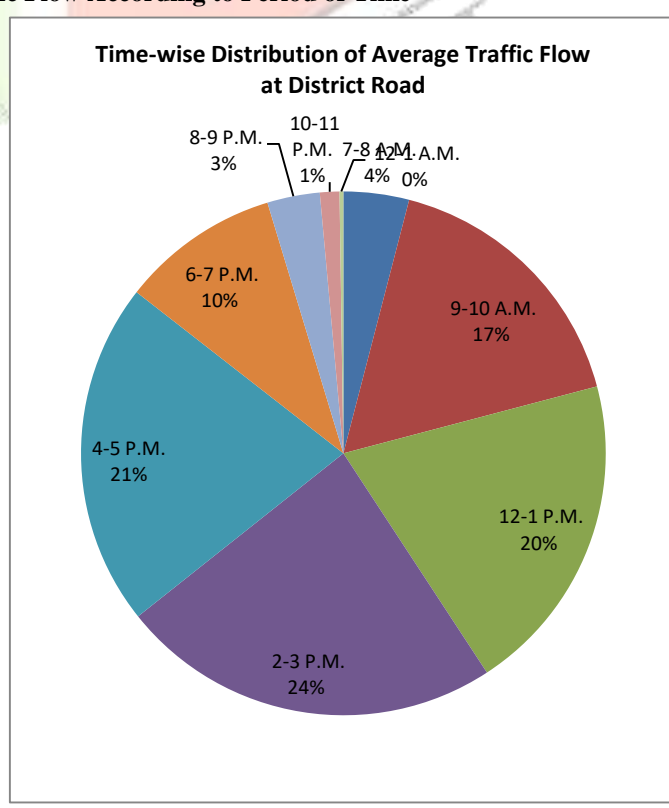


Fig. 3 (b)

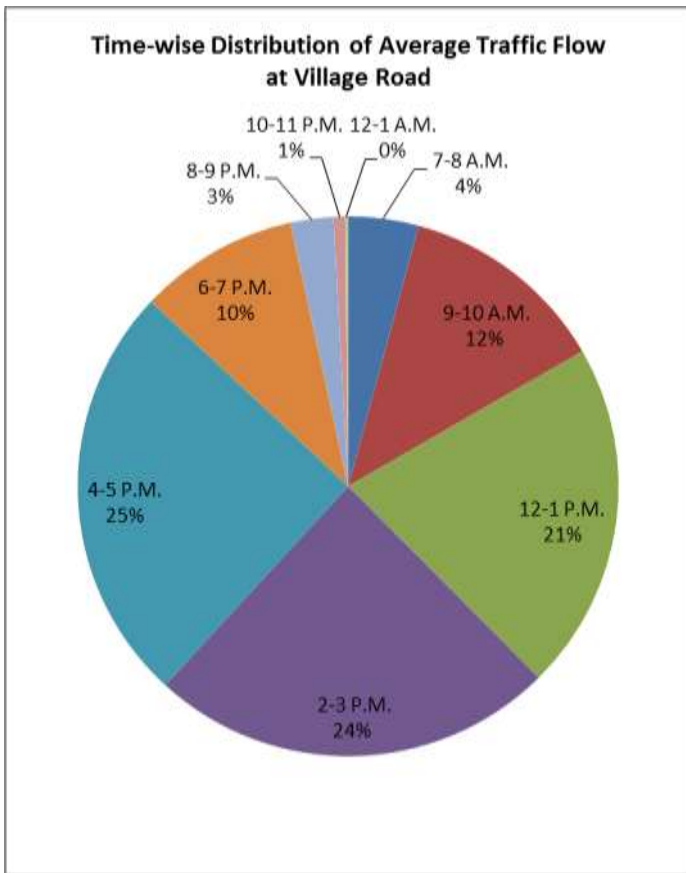


Fig. 3 (c)

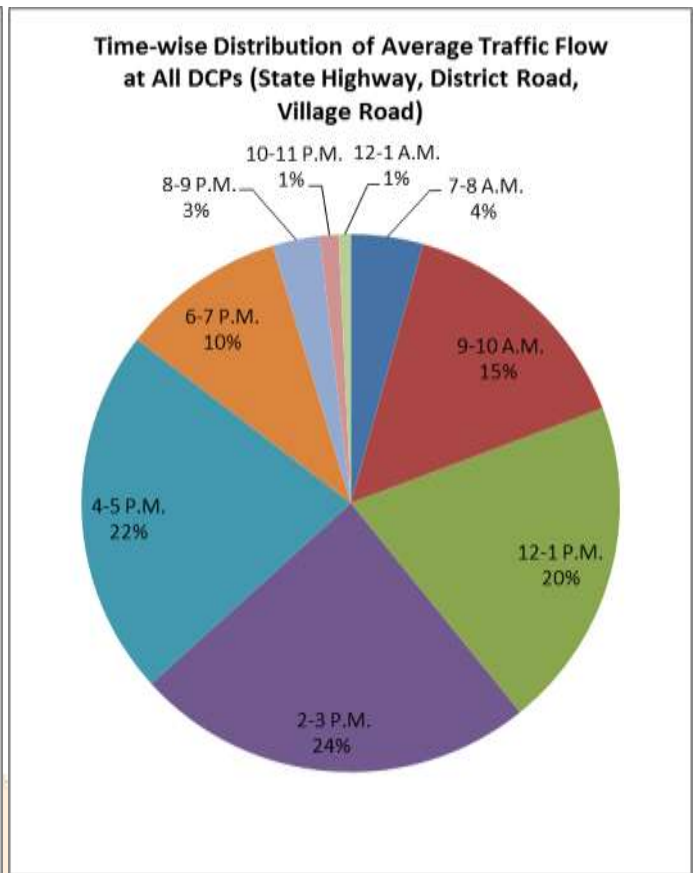


Fig. 3 (d)

Fig. 3 represents the time-wise average traffic flow distribution (in percentage) and related to Tables – II,III,IV and V respectively. Fig. 3 (a) shows the time-wise average traffic flow distribution at state highways. Fig.3 (b) shows the time-wise average traffic flow distribution at district roads. Fig. 3 (c) shows the time-wise average traffic flow distribution at village roads and Fig. 3 (d) shows the average value of all the above three and is related to table-V.

Fig. 4: Distribution of Average Traffic Flow According to Type of Conveyance

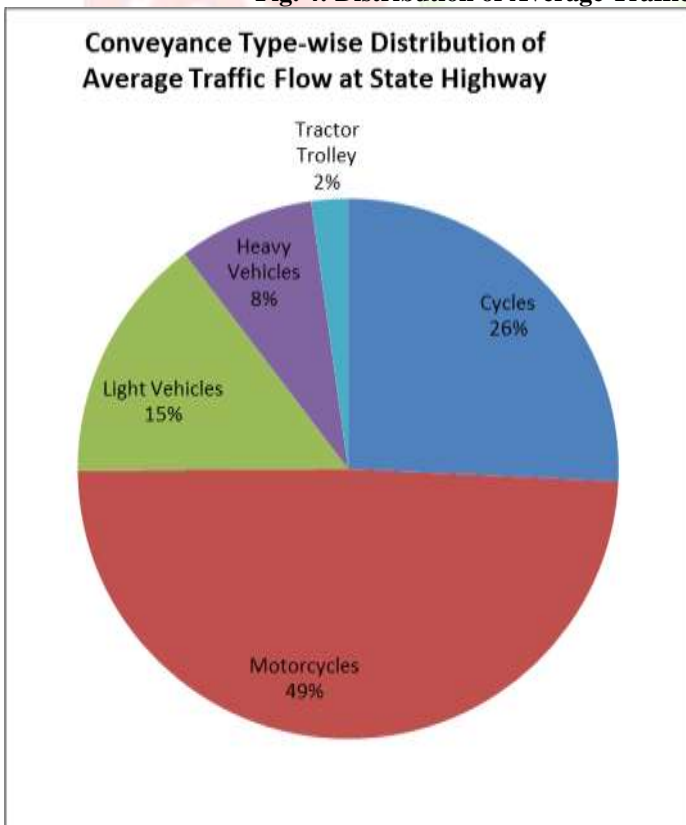


Fig. 4 (a)

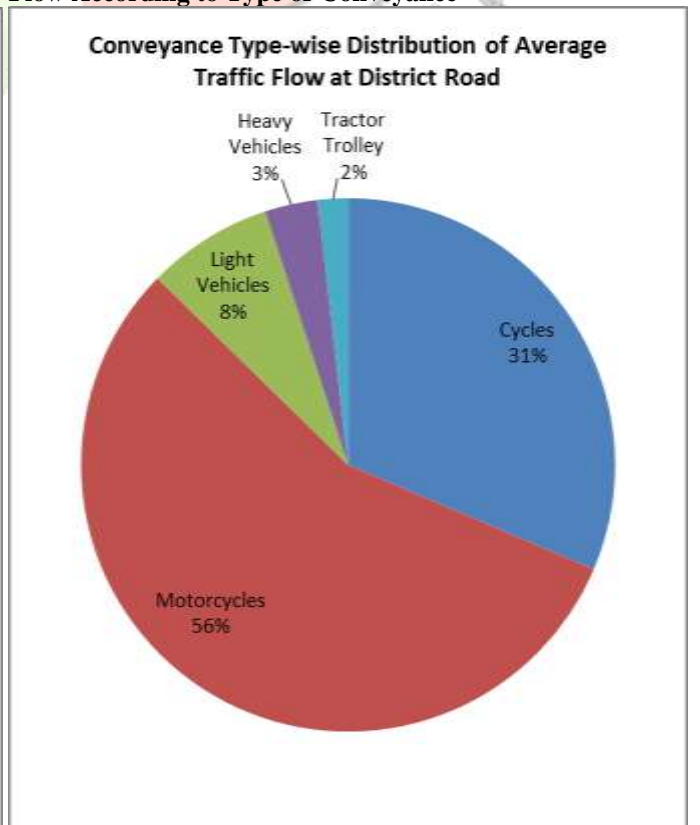


Fig. 4 (b)

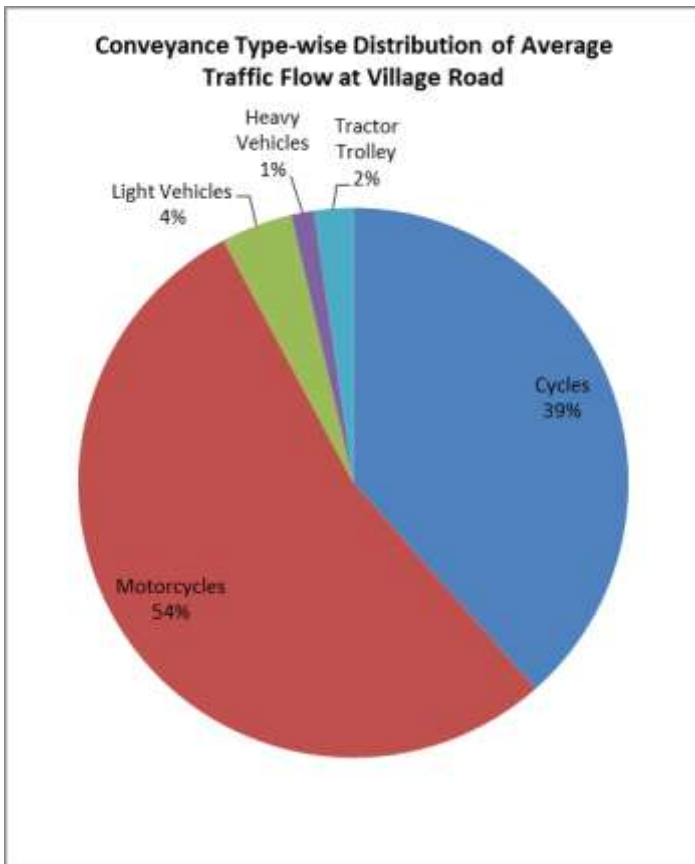


Fig. 4 (c)

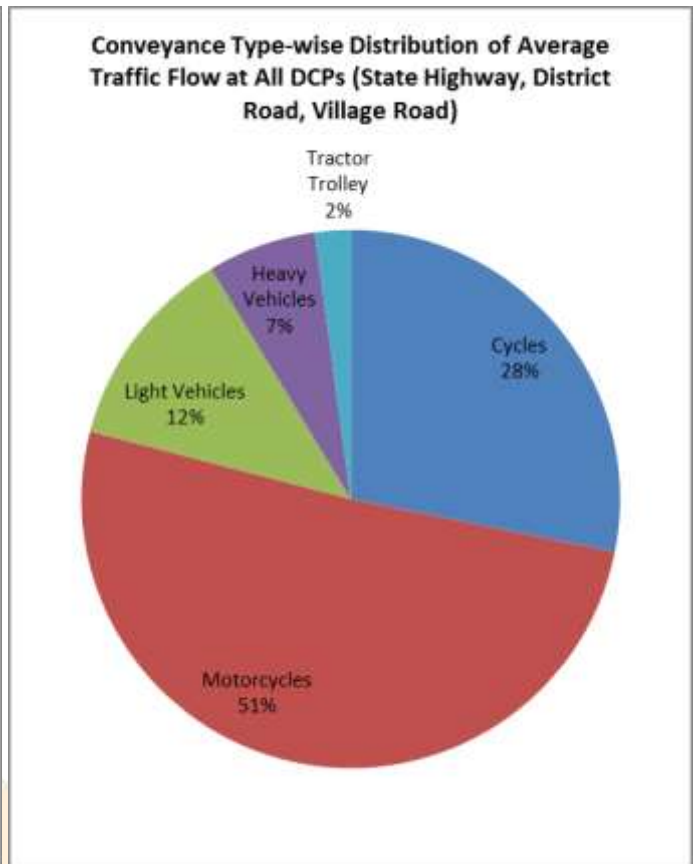


Fig. 4 (d)

Fig. 4 represents the distribution of average traffic flow for certain types of conveyances at various categories of roads and is related to Tables – II, III, IV and V respectively.

**Fig. 5 : Road Categories-wise Total Average of Traffic Flow and Pucca Road Length in Study Area**

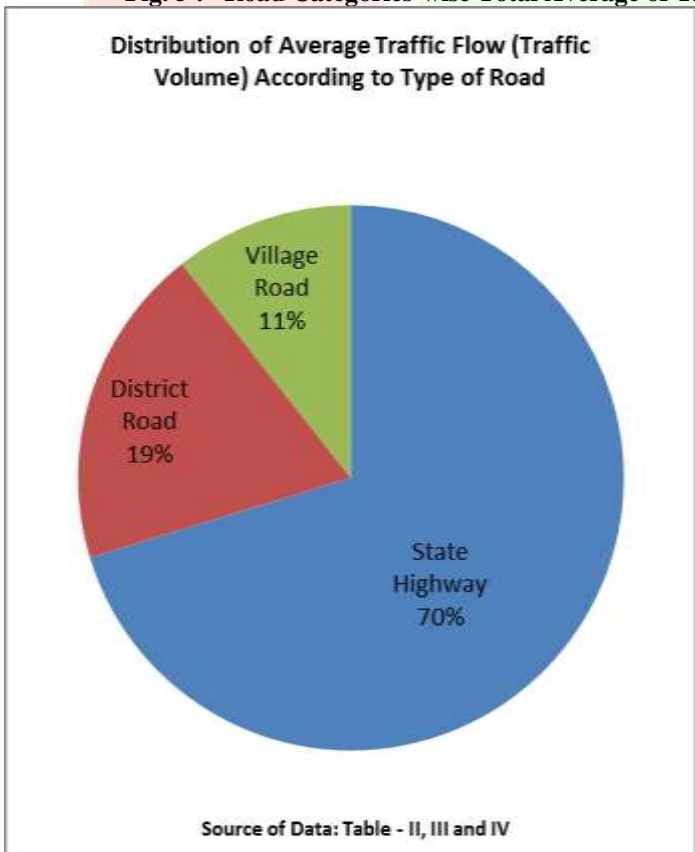


Fig. 5 (a)

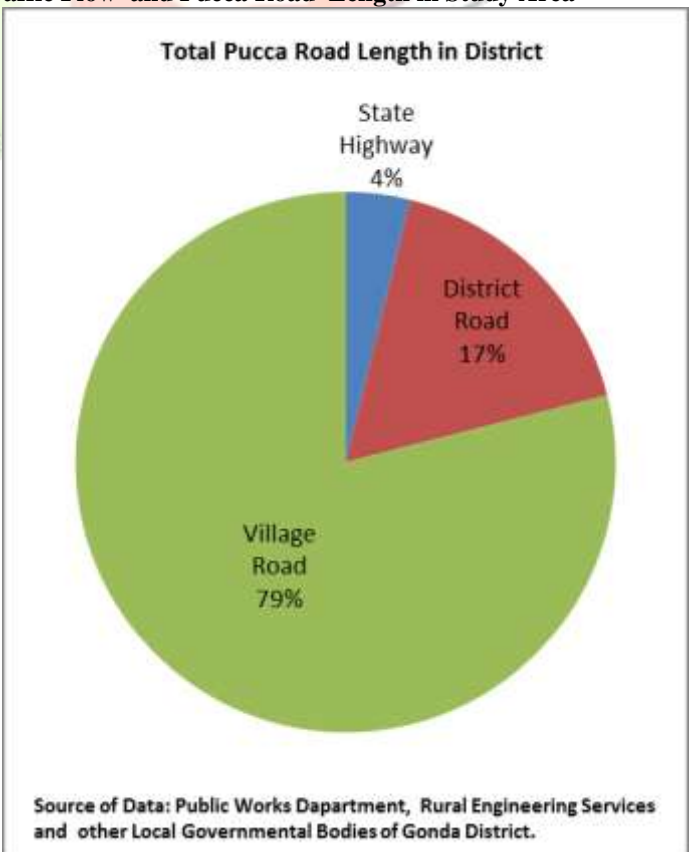


Fig. 5 (b)



Fig. 5 (a) shows the distribution of total average traffic flow at various categories of roads related to Tables- II, III and IV. Fig. 5 (b) shows the distribution of total pucca road length in the district as categorized under state highways, district roads and village roads. This diagram is basically derived from secondary data (outsourced from Public Works Department, Rural Engineering Services, Zila Panchayat and other local government bodies of Gonda district).

## VII. RESULTS AND DISCUSSIONS:

It is already notified that the traffic flow data are collected from 14 road locations and 9 specific period of time in a day. After data collection an average value is calculated in their respected groups (SHDCPs, DRDCPs, VRDCPs) i.e. given in Tables and analysed through various diagrams.

Most of the Categories of roads, their tables (II,III,IV,V) and Diagrams (Fig. 2 and Fig. 3) are showing that there are three very peak periods of times with high traffic flow volumes “V” are as 12-1 P.M., 2-3 P.M. and 4-5 P.M. According to change in period of time most of the tables and diagrams are showing their traffic flow volume “V” from high to low in the sequence 2-3 P.M.> 4-5 P.M.>12-1 P.M. > 9-10 A.M. > 6-7 P.M. > 7-8 A.M. > 8-9 P.M. > 10-11 P.M. > 12-1 A.M.

All the conveyances have been counted in five categories such as cycles, motorcycles, light vehicles (Car, Taxi etc.), heavy vehicles (Bus, Truck etc.) and Tractor- Trolley. According to the Tables – II, III, IV, V and Figs. 2 and 4 in all tables and diagrams, it can be seen that motorcycles have highest traffic volume i.e. approximately 50 % of total type of conveyances, showing a little variation in between changes according to road categories. After that cycles contribute second highest traffic volume around 30 %, also show minor variations in their road categories. Light vehicles have third highest traffic volume, showing variation between 2-15 % according to the categories of roads. Tractor-Trolley is showing lowest traffic flow volume in most of the respective Tables and their diagrams except in Table – IV (VRDCPs), Fig. 2 (c) and 4 (c), in which heavy vehicles have lowest traffic volumes represent village road. Here, Tractor-Trolley has 2% of total traffic volumes and heavy vehicles have a variation of 1-8 %, in their road categories.

In the Tables-II, III, IV and Fig. 2, high variation can be observed in traffic volume according to various categories of roads. These tables and diagrams also show a lot of variation in types of conveyances (on various categories of roads) during certain period of time.

Fig. 5 (a) shows that state highway has highest traffic volume which is 70 % of the total traffic flow. District roads have about to 20 % while village roads carry around 10 % of the total average traffic flow. According to Fig.5 (b), contribution of pucca road in State Highway is less than 5 %, district road is about 15 % and village road is about 80 %. These all conditions are providing a clear perception of traffic flow in the study area.

The Present Study Shows the traffic flow volumes in various specific period of time in a day in the rural areas of the study area district Gonda. It has been demonstrated above that there are two type of variations in traffic flow, first is based on categories of road and second is according to change in period of time. From these findings average traffic flow has been calculated on all locations. Further, types of conveyances are also analyzed on all road categories in aforesaid periods of time.

There is potential for minute errors in data collection and its analysis. Data has been collected in specific duration (November-December 2017). There may be variation in traffic flow in other seasons or due to social-political reasons. However, these all data will helpful to understand the nature of traffic flow in the study region, its future analysis and related forecasting.

## REFERENCES

- [1] Kadiyali, L.R. (2017) Traffic Engineering and Transport Planning, Khanna Publishers, New Delhi.
- [2] Fundamentals of Transportation / Traffic Flow. Retrieved from: <[https://en.wikibooks.org/wiki/Fundamentals\\_of\\_Transportation/Traffic\\_Flow](https://en.wikibooks.org/wiki/Fundamentals_of_Transportation/Traffic_Flow)>. (24 April 2018)
- [3] Traffic Flow Theory/Theory and Concepts. Retrieved from: <[http://www.webpages.uidaho.edu/niatt\\_labmanual/Chapters/TrafficFlowTheory/TheoryAndConcepts/index.htm](http://www.webpages.uidaho.edu/niatt_labmanual/Chapters/TrafficFlowTheory/TheoryAndConcepts/index.htm)>. (27 April 2018)
- [4] Geographical and other general information of district Gonda. Retrieved from: <<http://devipatanmandal.nic.in/>>. (14 April 2018) and <<http://gonda.nic.in/>>. (14 April 2018)
- [5] Census 2011 data of district Gonda. Retrieved from: <<http://www.census2011.co.in/census/district/554-gonda.html>>. (14 April 2018) and <<http://gonda.nic.in/>>. (14 April 2018)