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Focusing on Managing Methodologies reducing Traffic Congestion based on Analysis of Traffic Survey Data

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Abstract : Traffic congestion is a prominent, widespread, and urgent transportation issue affecting not just cities in India but many urban areas globally daily. It impacts all forms of transportation, particularly roadways, and every socioeconomic demographic. Some of the main contributors to congestion include rapid population growth, increasing urban development, insufficient or unplanned transportation infrastructure, inadequate public transit systems, and the growing number of private vehicles. This article examines the results of research and management strategies aimed at alleviating traffic congestion through the analysis of traffic survey information. For any road development or enhancement project and its management plan, gathering traffic data and forecasting traffic volumes are essential prerequisites. Traffic information plays a crucial role in the field of descriptive national economics, and understanding this data is vital for formulating effective transport policies for the movement of passengers and goods in both public and private sectors. The analysis of traffic data has been conducted to illustrate changes in Passenger Car Units over time, their composition, and to study traffic volumes, which ultimately aids in making informed decisions for effective and sustainable transportation planning policies. This analysis also facilitates further calculations of Average Annual Daily Traffic (AADT) and the volume of classified vehicle groups during peak hours, specifically the total PCUs per hour.

IndexTerms **- Traffic survey, data collection, PCU, traffic volume.**

I. INTRODUCTION

Traffic congestion has emerged as a significant concern. With an increase in urbanization and vehicle use at a constant rate, the issue of traffic congestion is worsening each day. In both urban and rural areas, traffic congestion results in loss of time and energy, exacerbates pollution and stress, reduces productivity, and consequently raises expenses for both society and the nation. The problem of traffic congestion is a challenge for cities of all sizes, including large, medium-sized, and small ones. Nevertheless, cities in Chhattisgarh, such as Raipur, Bilaspur, and Korba, illustrate the traffic conditions:
Raipur: Faces traffic jams and congestion, particularly during morning and evening rush hours.
Bilaspur: Deals with traffic issues takes place from growing urban development and infrastructure expansion.
Korba: Experiences traffic congestion at peak periods and due to construction activities.
Traffic Surveys are comprehensive approaches to gathering road traffic data, which encompasses vehicle counts, pedestrian counts, and other metrics over time for particular locations. There are various types of Traffic Surveys, categorized into manual counts and automatic counts. Manual Count refers to the process of counting traffic using a tally sheet, whereas automatic count includes methods that are electronic, mechanical, or electromechanical. Surveys are conducted to analyze various aspects and elements of traffic. The analysis offers crucial information about vehicle types and their classification in relation to time, enabling the identification of peak hour traffic volume demands, which can inform efforts toward enhancing transportation, infrastructure development, or improvement projects. Traffic analysis entails examining the movement of vehicles and pedestrians on roadways to gain insights into traffic patterns, pinpoint congestion areas, and improve traffic flow. A traffic survey was conducted in the city area of Tatibandh Chowk, Raipur, featuring a comprehensive analysis aimed at understanding traffic characteristics and vehicular data for the purpose of planning a more efficient traffic system in the city. The issues of traffic jams, vehicular accidents, and travel holdups on the roads of emerging urban areas have been a significant source of concern in recent times. The primary factors contributing to traffic congestion, delays, and accidents in cities include substandard road conditions, insufficient public transportation, a rise in the number of vehicles, poor coordination, hazardous intersections, reckless driving habits, and inadequate traffic management efforts.
The PCU recorded on specific segments of road during morning and evening peak hours provides insight into traffic patterns over time. This analysis aids in understanding road usage based on survey data, which is somewhat limited. The paper further details how to compute the total PCU per hour and its changes over time, along with the composition of PCUs. Additionally, the calculation of traffic volume can be examined to assess the Level of Service and to understand the usage patterns of the road.

II. LITERATURE AND REVIEW

India's swift urban growth has caused a significant increase in the number of vehicles on the roads. This rise in traffic volume has outstripped infrastructure development, leading to congestion in major urban areas throughout the nation. (Times of India Survey) Traffic congestion is now a common aspect of city life in India, with large cities struggling with overcrowded streets,

lengthy commute durations, and irate travelers. Developing effective strategies to tackle traffic congestion has become an urgent priority. (Business Today).

The International Journal of Computer Applications published an empirical study focused on traffic simulation models, aimed at improving road network management in Raipur City. According to a report from the Department of Urban Administration and Development, public transportation in the city has largely collapsed. D. Ravishankar, the Additional Transport Commissioner of Chhattisgarh, informed Down To Earth (DTE) that poor management was the cause of the public transportation issues. He recognized that the system is poorly managed and that the quantity of buses diminished during the pandemic. He emphasized that Raipur has lacked comfort, cleanliness, and safety, which are essential for the ongoing operation of public transportation systems. Consequently, the study's analysis, based on various methodologies, offers diverse classifications of vehicles and variations in PCU composition over time, ultimately assisting in the assessment of Level of Service (LOS) and road usage patterns.

III. Material and Methods

The procedures to achieve an outcome regarding traffic conditions have been implemented through traffic survey techniques that involve mathematical evaluation of the data gathered during the survey.

DATA COLLECTION

A traffic survey was conducted at ten key junctions of the road, categorized by time sessions, specifically during morning and evening peak hours. The comprehensive data from the traffic survey, showcasing various types of vehicles according to the time of day, has been presented. For the traffic survey, video recording and data sheet methods were utilized, as they are easy to set up with minimal manpower and facilitate a straightforward survey process. The video photography setup consists of a high-quality digital camera, a tripod, and a sufficient power supply lasting at least thirty minutes. The camera is positioned at the roadside, and the video recording begins. After capturing the footage for the specified duration, the video is then transferred to a laptop. On the laptop, the video is analyzed to gather traffic data. Different categories of vehicles are counted from the footage and recorded in the data sheet at predetermined time intervals. Subsequently, the completed data sheet is utilized to analyze the information for the desired outcome. The survey was conducted in two sessions: the first from 9 AM to 11 AM and the second from 4 PM to 6 PM, over a continuous period of three days at the same location to ensure data consistency. The specific times were chosen due to the high volume of traffic associated with school, office, and market hours. The data collected regarding various classes of vehicles over time can be found in Table 1, while the fluctuation of PCUs in relation to time is illustrated in Fig. 1.

DATA ANALYSIS

The collected data from the traffic survey supports the analysis based on manual assessments performed for various vehicle categories. Following this, the PCU per hour was calculated for both the morning and evening peak periods. The fluctuation of PCU throughout the day for the chosen date during the morning peak is depicted in Figure 1. Figure 2 shows the breakdown of PCU. A study of traffic volume has been conducted to determine the total PCU per hour for each segment of the road intersection during the morning and evening peak hour sessions.

Data Collection

The data collection approach outlines various techniques required to carry out the research. The analysis of the collected traffic survey data, as presented in Table 1, includes several methodologies that can deliver the analytical framework for the gathered data and the essential results needed for the research. The comprehensive data analysis encompasses the findings of the traffic volume study illustrated in Table 2.

IV. Data Analysis

Electro-manually, traffic data has been documented at all significant intersections of roads. Data was gathered at each location during two sessions: the morning peak hour and the evening peak hour.

TRAFFIC VOLUME STUDY

The volume of traffic was assessed using information obtained from a survey carried out at the city's five busiest roads, concentrating on the morning and evening rush hours, represented as total vehicles per hour and passenger car units per hour, as outlined in Tables 1 and 2. 2.

Abbreviations used:

PCU (Passenger Car Unit)

Table.1. Traffic Survey Data

Time	2-Wheeler	3-Wheeler	Car	Jeep/Van	Mini Bus	Bus	LCV	Truck	Tractor	Bicycle	Tricycle	Total	PCU
09:00-09:15	191	29	43	4	0	2	3	27	0	8	0	307	263.6
09:15-09:30	193	33	58	2	0	2	7	30	0	7	0	332	296.40
09:30-09:45	219	29	52	3	0	5	10	28	0	9	0	355	306.8
09:45-10:00	245	36	46	4	0	9	17	23	2	11	1	397	335.7
10:00-10:15	230	30	42	3	3	8	19	22	0	9	1	369	314.3
10:15-10:30	245	24	37	4	5	7	20	18	0	11	1	371	297.7
10:30-10:45	313	27	70	7	4	8	15	27	2	7	0	478	391.4
10:45-11:00	331	29	102	10	2	5	31	44	0	2	0	568	518.90
Total	1967	237	450	37	28	46	122	219	4	64	3	3177	
PCU	983.5	237	450	37	42	115	183	657	6	12.8	1.5		2724.8

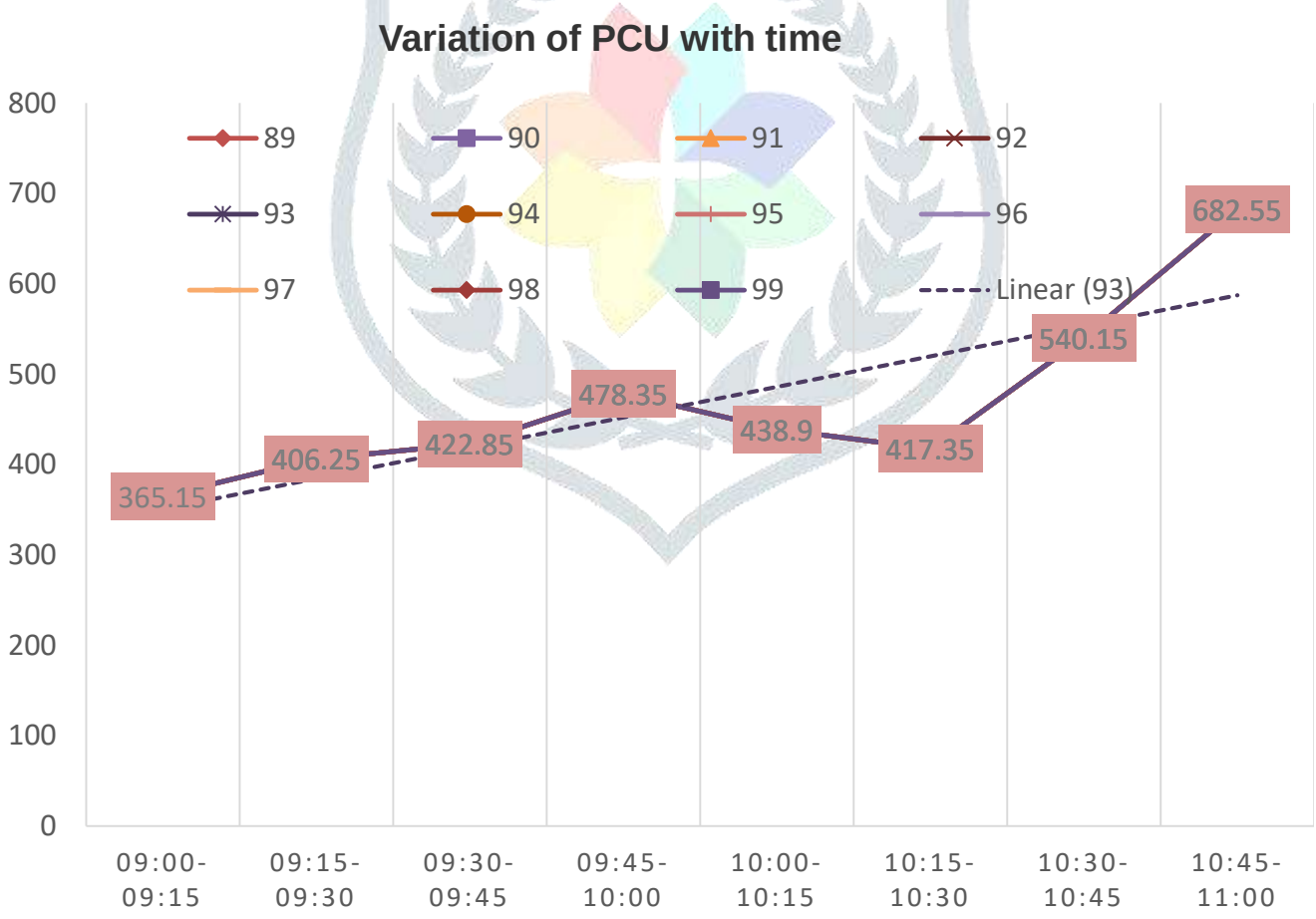

Figure1: Variation of PCU with Time

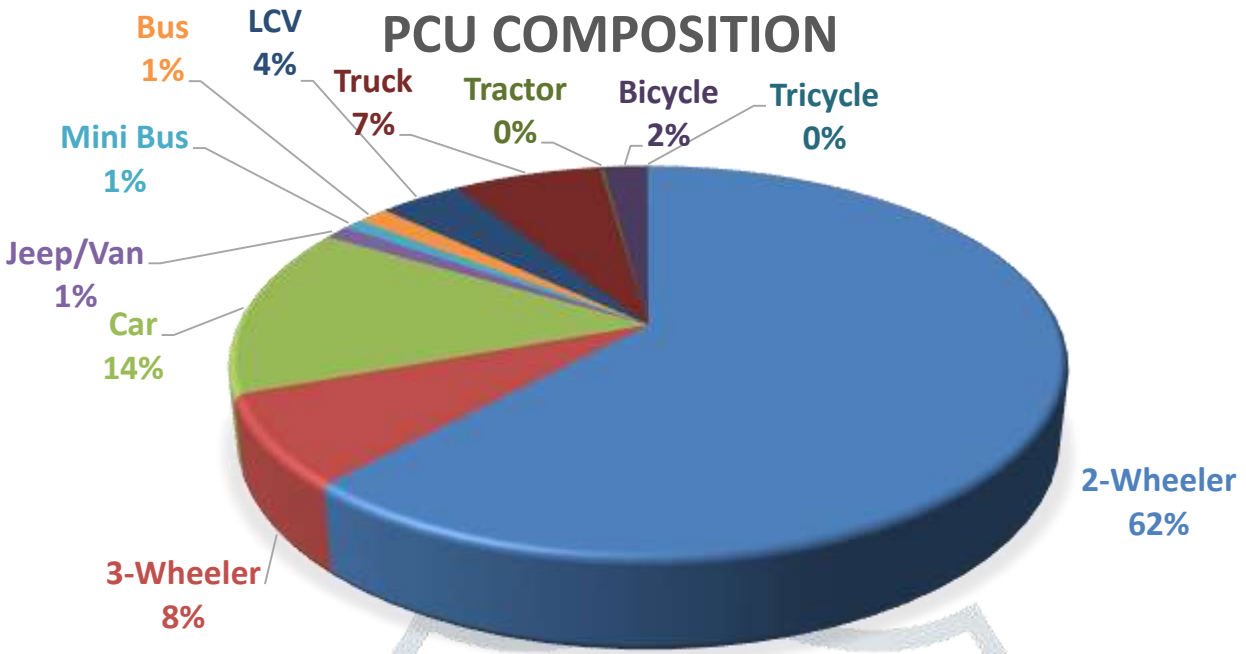

Figure: 2 PCU Compositions

The analyzed traffic survey data has been assessed using various methodologies for traffic volume studies, which aids in establishing the level of service for each road intersection, understanding road usage patterns, and converting traffic counts. This approach has been validated based on the following criteria:

TRAFFIC VOLUME STUDY

The volume of traffic is a crucial factor in evaluating data from traffic surveys. The traffic survey conducted on five main roads in the city focused on the results from two hours of morning peak traffic and two hours of evening peak traffic, represented in total vehicles per hour and passenger car units per hour, as illustrated in Table 2.

V. RESULT

The various methods of analysing traffic survey data indicate the different techniques employed for data evaluation. A Traffic Volume Study has been conducted, revealing the traffic volume associated with a specific road section during peak hours of two hours in the morning and two hours in the evening, measured by the total number of vehicles passing through and the passenger car unit. Figure 1 illustrates the fluctuation of traffic volume over time, while Figure 2 displays the percentage of specific vehicle types traveling along a certain road section. This analysis facilitates further research focused on traffic surveys geared towards intelligent transportation systems for effective planning and optimal road usage.

VI. SUMMARY AND CONCLUSIONS

Considering the analysis provided in this paper, it has been determined that traffic surveys are essential for the planning of traffic and transportation projects. Traffic volume assessments have been conducted during peak hours to evaluate the requirements for road development or planning that can support the existing traffic levels. The information gathered from traffic counts during the survey assists traffic authorities in developing an efficient transportation system that is economical, dependable, and sustainable

As a transportation engineer, the primary goal should be to ensure a safe and dependable journey for the public. Therefore, this analysis outlines the potential for enhancing a specific location or site by implementing a new system that improves data collection through an Intelligent Transportation Management System (ITMS) based on collected algorithms (such as real-time traffic data collection, like Automatic Traffic Signals). This will involve developing a detection system for effective management and operation in transportation aimed at reducing traffic congestion, minimizing traffic accidents, and enhancing accessibility for diverse groups of road users. Additionally, it will aid in the proper maintenance of roadways by establishing various policies and regulations to prevent violations.

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