

Spot Speed Study In Chikkamagaluru, Karnataka, India.

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ABSTRACT: Speed is an important transportation consideration because it relates to safety, time, comfort, convenience, and economics. Spot speed studies are used to determine the speed distribution of a traffic stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed percentiles, which are useful in making many speed decisions. The intention of spot speed studies are to record speed characteristics under prevailing traffic conditions at a specific location along a roadway. Because traffic engineering involves the collection and analysis of large amount of data for performing all types of traffic studies, it follows that spot speed study is also an important element in traffic engineering. Managing traffic within our communities is a growing task for traffic engineers. As traffic volume increases and public financial resources decrease, targeting improvement projects to anticipate growth patterns is critical. This paper represents traffic condition on civil lines route NH 173 Chikkamagaluru.

INTRODUCTION

Speed is an essential measure to assess security of the street organize. Speed is likewise a critical transportation parameter in light of the fact that other than wellbeing, it identifies with time, safety, comfort, and financial aspects. SPEED is the ratio of travelled distance and time spent during a given period. Speed is also one of the macroscopic parameters for fundamental traffic stream parameters which used to characterise the traffic as a whole. Commonly, speed is used to describe the quality of journey and the performance of the road network in accommodating traffic demand as it is related to safety, comfort, time, economics and convenience. There are various factors will affect the speed such as characteristics of the driver, traffic composition and type of area. For example, increased speed limits at the areas with severe conditions of weathers are found to have a straightforward positive relationship with accident occurrence. Regarding the effects of weather, the impact of precipitation is considered persistent and generally leads to escalated accident frequency. Besides, maladjusted driving such as delayed reactions and aggressive driving is also one of the causes that affect the driver increases the speed and leads to the traffic accident. Strong emotions in the driver are the keys that influence such behavioural pattern of the driver Several types of speed such as running speed, time mean speed and space mean speed is essential for traffic engineering, spot speed certainly will be one of them as well. Spot speed studies are essential in the determination of speed distribution for a traffic stream at a particular location. It is also known as the instantaneous speed of a vehicle pass through a point on the roadway. One of the objectives to conduct spot speed study is to determine existing traffic operations and evaluate the devices for traffic control. Proper speed limits have to be evaluated and identified in order to avoid the occurrence of traffic accidents. Sudden changes in speed limit might lead to unfavourable traffic operational characteristics such as erratic decelerations, high speed and high-speed variances. Each of them is related to a higher probability of crash occurrence. Besides, spot speed study plays a crucial role in establishing roadway design elements. With the assist of significant data from spot speed study, geometric conditions consist of persistent operating speed with driver expectation and commensurate with the function of the roadway can be produced. For example, comfortable design for road alignments and stopping sight distance can be established with high accuracy data from spot speed study. Moreover, spot speed study helps in measuring the effectiveness of traffic programs or traffic control devices such as speed enforcement programs, traffic operational changes, signs and markings advisory speed limits that posted at critical locations determined by spot speed study.

OBJECTIVES OF THE STUDY:

The specific objectives of traffic speed include:

- To present detailed diagram of spot speed calculations.
- To calculate spot speeds and prepare tables for statistical analysis of spot speeds.
- To plot histograms, frequency curves and cumulative frequency curves of spot speeds.
- To determine weighted average speed, pace, modal speed, speed limit (85th percentile speed), design speed, etc. of spot speeds.

Types of speed:

- Spot speed : Spot speed studies are used to determine the speed distribution of a traffic. stream at a specific location. The data gathered in spot speed studies are used to determine vehicle speed. percentiles, which are useful in making many speed-related decision.
- Space-Mean speed: Space mean speed is defined as the harmonic mean of speeds passing a point during a period of time. It also equals the average speeds over a length of roadway.
- Time-Mean speed : The time-mean speed is the arithmetic average speed of all vehicles for a specified period of time.
- Free flow speed: The FFS is the average vehicle speed measured during low-volume periods (i.e., 500 pc/h/lane or less), with good weather and no work activity or incidents.
- Travel speed: Average travel speed means the average speed in miles per hour of a vehicle over a certain length of road.

SPOT SPEED

Spot speed is the instantaneous speed of a vehicle as it passes a specified point along a road. Spot speeds may be determined by manually measuring (with use of electronic or electromechanical devices like pneumatic tube detectors or radars) the time required for a vehicle to traverse a relatively short specified distance. Methods for spot speed data collection: There are several methods for collecting spot speed data. Some of them are:

- i. Manual method
- ii. Automatic method
- iii.

USES OF SPOT SPEED DATA

The result of spot speed studies are used for many different purposes by traffic engineers, including:

1. Establishing the effectiveness of new or existing speed limits or enforcement practices.
2. Determining appropriate speed limits for application.
3. Establishing speed trends at the local, state, and national level to assess the effectiveness of national policy on speed limits and enforcement.
4. Specific design application determining appropriate sight distances, relationships, between speed and highway alignment, and speed performance with respect to steepness and length of grades.
5. Specific control applications for the timing of “yellow” and “all red” intervals for traffic signals, proper placement of signs, and development of appropriate signal progressions.
6. Investigation of high-accident locations at which speed is suspected to be a contributing cause to the accident experience.

METHODOLOGY

Methods of Spot Speed Study

Methods of Conducting Spot Speed Studies are divided into two main categories:

1. Manual
 - I. Stop watch method
 - II. Radar meter method
 - III. Pneumatic road tube method
2. Automatic
 - I. Road Detectors
 - II. Doppler-Principle Meters
 - III. Electronic-Principle Detectors

Manual Method

The data is obtained manually by the assist of a mobile phone and analysed using several formulas. The apparatus and instruments needed for this study are mobile phones, notepad and pen. The detail of the location chosen is “Pavithra Vana” in the direction from Kadur to Chikkamagaluru stretch as this location fulfils the condition to conduct the study. After that, the exact location within this path is then selected based on the two conditions in which the path have to be 300 m long, and vehicle should be able to speed along that pathway. The time for this study to conduct is set at 6am to 6 pm. An interval of 300 m long is then measured and coordinated with the help of stopwatch and mobile phones. With measured distance on hand, two groups of people are required to stand on the beginning and final point of the path. The minimum requirement of people to form a group is two people. Then, two groups were synchronised to start recording the experiment at the same time for 300 vehicles passed along the path.

STOPWATCH METHOD

The stopwatch method can be used to successfully complete a spot speed study using a small sample size taken over a relatively short period of time. The stopwatch method is a quick and inexpensive method for collecting speed data.

Key Steps to a Stopwatch Spot Speed Study

A stopwatch spot speed study includes five key steps:

1. Obtain appropriate study length.
2. Select proper location and layout.
3. Record observations on stopwatch spot speed study data form.
4. Calculate vehicle speeds.
5. Generate frequency distribution table and determine speed percentiles.

DATA ANALYSIS AND CALCULATIONS: -

The results and analysis of the study are very important to ensure that the key objectives can be achieved. Expected result necessary to draw up at early stage before the project done, to be compared with the actual result. After the study is completed and the data have been tabulated the following steps may be considered as part of the typical data analysis. Specifically, the idea would be to identify key parameters associated with roadway speeds, which may include any or all of the following:

1. Mean Speed: The average speed; calculated as the sum of all speeds divided by the number of speed observations.

2. 85th Percentile Speed: The speed at or below which 85 percent of a sample of free flowing Vehicles is traveling; this is typically used as a base line for establishing the speed based on a spot speed study.
3. 95th Percentile Speed: The speed at or below which 95 percent of a sample of free flowing vehicles is traveling (based on a spot speed study).
4. Median (50th Percentile Speed): The speed that equally divides the distribution of spot speeds; 50 percent of observed speeds are higher than the median; 50 percent of observed speeds are lower than the median.
5. Mode: The number that occurs most frequently in a series of numbers.
6. Speed Variance: The difference in travel speeds for vehicles on the road. Mathematically, variance is the average of the squares of the difference to the mean for each observed speed.
7. Pace: A 10 mile-per-hour increment in speeds that encompasses the highest portion of observed speeds; often is the mean speed plus/minus five miles per hour.

DATA COLLETION

Various methods of data collection for spot speed are:

- (1) stopwatch method,
- (2) radar meter method,
- (3) pneumatic road tube method.

The data gathered in spot speed studies are used to determine vehicle speed percentiles, which are useful in making many speed-related decisions.

Spot speed data have a number of applications which are as:

- i. Determining existing traffic operations and evaluation of traffic control devices.
- ii. Establishing roadway design elements.
- iii. Assessing roadway safety questions.
- iv. Monitoring traffic speed trends by systematic ongoing speed studies.
- v. Measuring effectiveness of traffic control devices or traffic programs, including signs.
- vi. Markings, traffic operational changes, and speed enforcement programs.

Data was collected manually on the study stretch for Vehicles using stopwatch method 300 m stretch was taken.

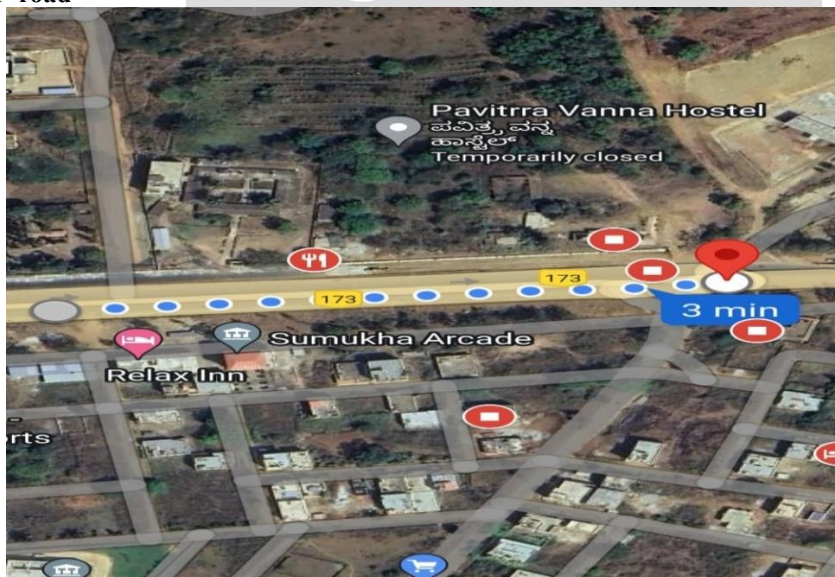
Calculation of spot speed by stopwatch method

The stopwatch method can be used to successfully complete a spot speed study using a small sample size taken over a relatively short period of time. The stopwatch method is a quick and inexpensive method for collecting speed data. A stopwatch spot speed study includes five key steps:

- a) Obtain appropriate study length.
- b) Select proper location and layout.
- c) Record observations on stopwatch spot speed study data form.
- d) Calculate vehicle speeds.
- e) Generate frequency distribution table and determine speed percentiles.

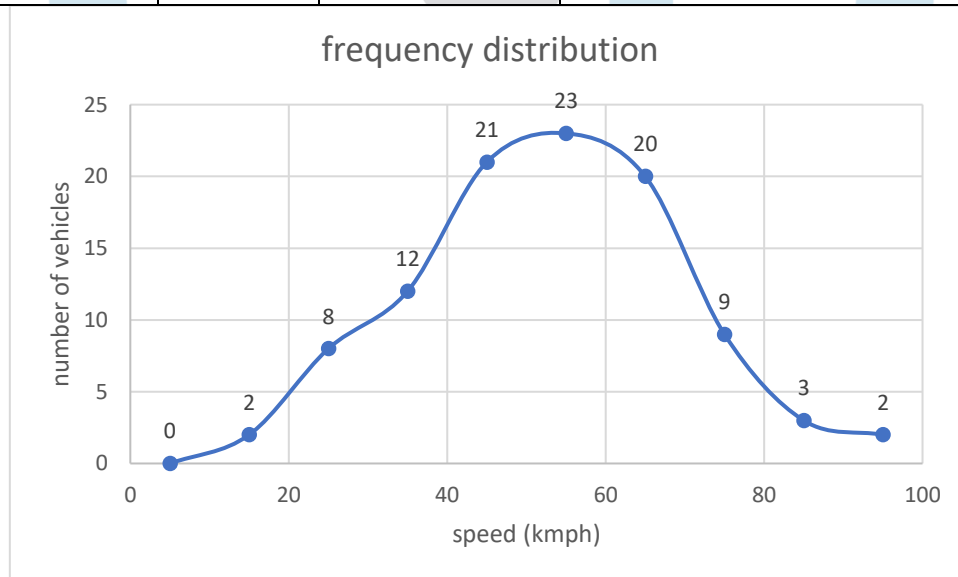
LOCATION

Kadur road

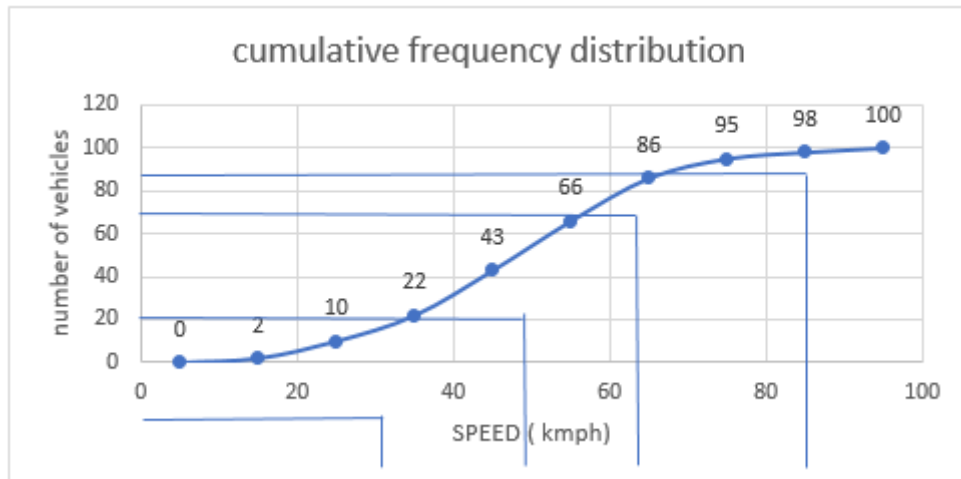


LOCATION: PAVITRAVANA	DATE: 20/04/2023
WEATHER: SUNNY DAY	TIME: 06A.M. TO 06P.M.
TYPE OF ROAD: NH 173	BASE LENGTH: 300m
MEASUREMENT TECHNIQUE: MANUALLY	VEHICLE: cars 100

speed range	mid speed (x)	frequency(f)	% of frequency(%f)	%cumulative frequency(%c.f)	fx
0-10	5	0	0	0	0
0-20	15	2	2	2	30
20-30	25	8	8	10	200
30-40	35	12	12	22	420
40-50	45	21	21	43	945
50-60	55	23	23	66	1265
60-70	65	20	20	86	1300
70-80	75	9	9	95	675
80-90	85	3	3	98	255
90-100	95	2	2	100	190
		$\Sigma f=100$			$\Sigma fx=5280$
				$\Sigma fx/\Sigma f= 53$	
				AVERAGE SPEED FOR CARS = 53kmph	



Modal speed 55kmph for this road and traffic condition.

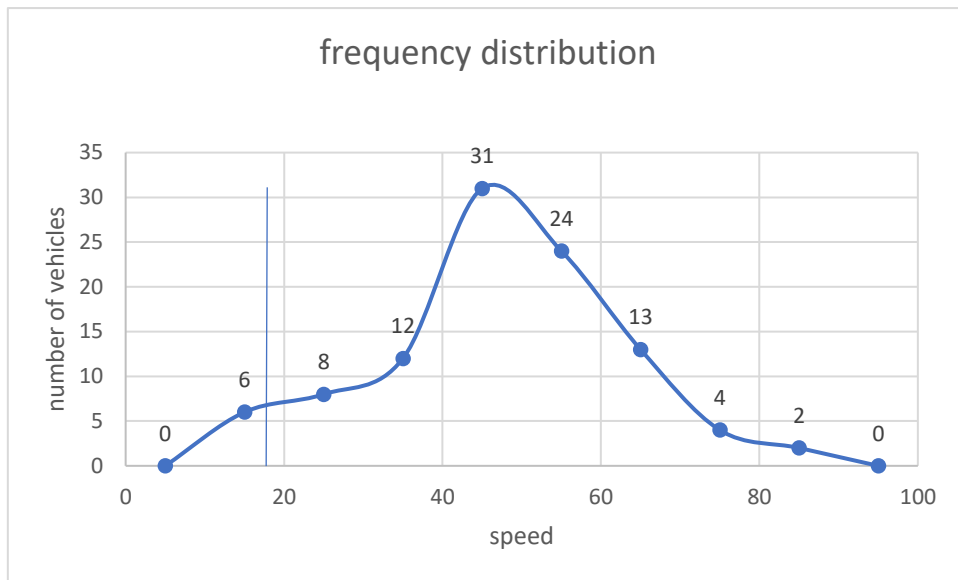


1. UPPER SPEED = 85th percentile speed = 63 kmph
2. LOWER SPEED = 15th percentile speed = 33 kmph
3. DESIGN SPEED = 98th percentile speed = 82 kmph
4. MEDIAN SPEED = 50th percentile speed = 50 kmph.

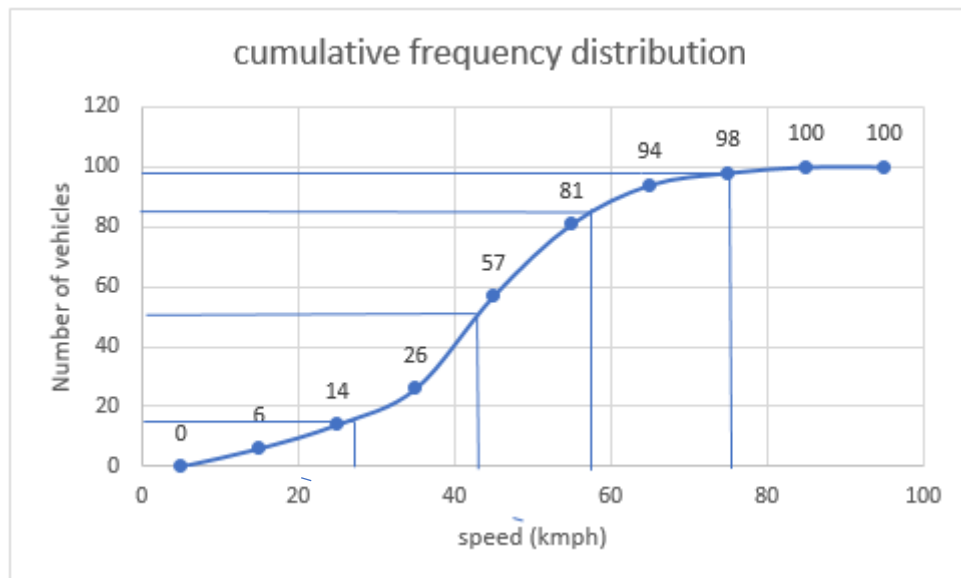
LOCATION: PAVITRAVANA	DATE: 04/05/2023
WEATHER: SUNNY DAY	TIME: 06A.M. TO 06P.M.
TYPE OF ROAD :NH 173	BASE LENGTH: 300m
MEASUREMENT TECHNIQUE: MANUALLY	VEHICLE: TWO WHEELER 100

speed range	mid speed(x)	frequency(f)	% of frequency(%f)	% cumulative frequency(%cf)	fx
0-10	5	0	0	0	0
0-20	15	6	6	6	90
20-30	25	8	8	14	200
30-40	35	12	12	26	420
40-50	45	31	31	57	1395
50-60	55	24	24	81	1320
60-70	65	13	13	94	845
70-80	75	4	4	98	300
80-90	85	2	2	100	170
90-100	95	0	0	100	0
		$\sum f = 100$	100		$\sum fx = 4740$
				$\frac{\sum fx}{\sum f} = 47$ AVERAGE SPEED FOR CARS = 47	

Average speed of the stretch is = 47 kmph



Modal speed 45 kmph for this road and traffic condition.

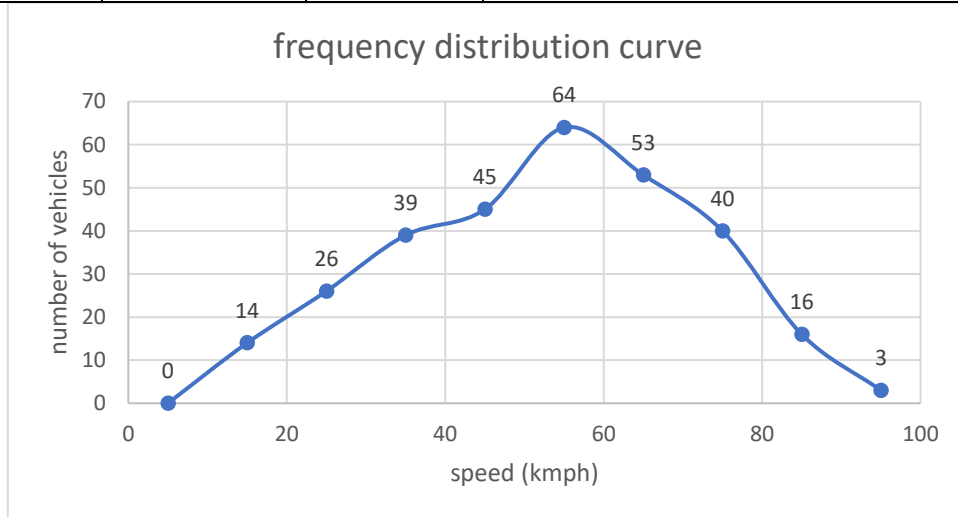


1. UPPER SPEED = 85th percentile speed= 58kmph
2. LOWER SPEED = 15th percentile speed= 28kmph
3. DESIGN SPEED = 98th percentile speed= 76kmph
4. MEDIAN SPEED = 50th percentile speed= 44kmph.

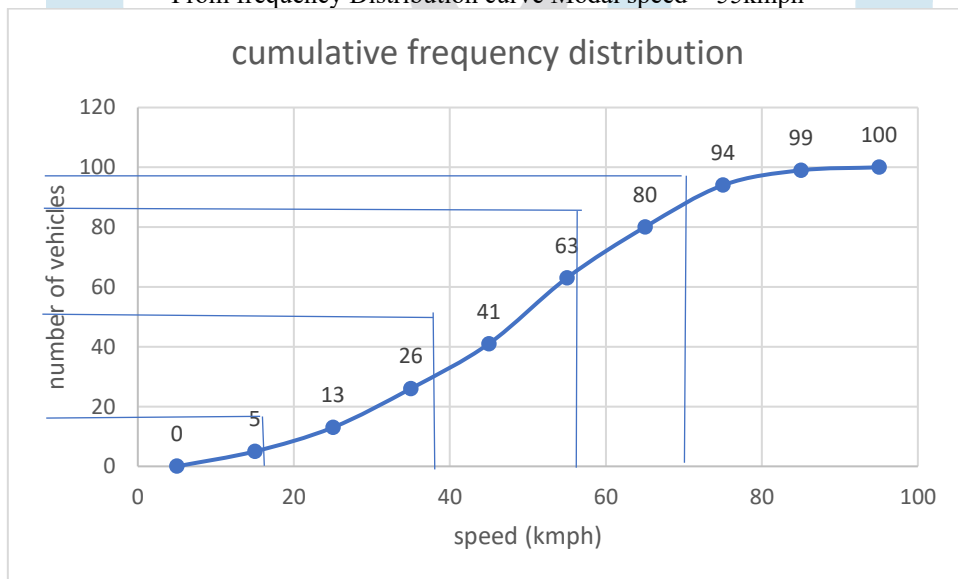
LOCATION: PAVITHRA VANA	DATE: 15/05/2023
WEATHER: SUNNY DAY	TIME: 06A.M. TO 06P.M.
TYPE OF ROAD :NH	BASE LENGTH: 300
MEASUREMENT TECHNIQUE: MANUALLY	VEHICLE:300

speed range	mid speed (x)	frequency(f)	% of frequency(%f)	%cumulative frequency(%cf)	fx
0-10	5	0	0	0	0
0-20	15	14	5	5	210
20-30	25	26	9	13	650
30-40	35	39	13	26	1365
40-50	45	45	15	41	2025
50-60	55	64	21	63	3520
60-70	65	53	18	80	3445

70-80	75	40	13	94	3000
80-90	85	16	5	99	1360
90-100	95	3	1	100	285
		$\sum x = 300$	100		$\sum fx = 15860$
					$\sum fx / \sum f = 53$
AVERAGE SPEED FOR CARS = 53					



From frequency Distribution curve Modal speed = 55kmph



- (a) Upper speed limit for regulation = 85th percentile speed = 70kmph
- (b) Lower speed limit for regulation = 15th percentile speed = 30 kmph
- (c) Speed to check geometric design element = 98th percentile speed = 82 kmph
- (d) Median speed limit = 50th percentil speed = 50 kmph

CONCLUSION AND RECOMMENDATION

Conclusions Based on the findings of this study, the following conclusions were made:

(a) The average speed of vehicular traffic on highways in Chikkamagaluru town ranged between 50 – 53 km/h except for the kador road which recorded an average spot speed of 55 km/h approximately. This discrepancy was attributed to its homogenous traffic composition with higher percentage composition of heavy vehicles and very fast moving vehicles.

(b) The modal speed of vehicular traffic on kadur to Chikkamagaluru highways falls within the range of 46 – 50 km/h except the kadur road which recorded a modal speed ranging between 56 – 60 km/h due to its peculiar characteristics.

(c) The 85th percentile vehicular speed on highways in Chikkamagaluru town is 55kmph. A general speed limit within the range of 50 - 55 km/h is reasonable and guarantees safety of motorist and pedestrians travelling on highways in Chikkamagaluru town.

- Average Speed of the stream, = 53kmph,
- Design Speed (98th Percentile) = 82kmph,
- Maximum Speed (85th Percentile) =70kmph,
- Minimum Speed (15th Percentile) = 30kmph,
- Modal Speed = 55kmph,
- Median speed =50kmph,

RECOMMENDATIONS

The following recommendations were made;

- Road rehabilitation by installing roadway facilities such as hard shoulders, pavement markings, standard minimum lane width, etc so as to improve highway capacity to accommodate increased traffic volume and satisfy design speed are essential strategies for improved traffic flow and guarantee safety of road users.
- The erection of speed limit warning signs in line with findings of this study along each highway at selected spots in Chikkamagaluru town shall guarantee vehicular travel safety to a reasonable extent.
- The findings of this study should be employed by local council and state government authorities for planning and development of transportation facilities in Chikkamagaluru town to improve liveability and guarantee safe, efficient and sustainable transportation system in the town.

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