



e-ISSN: 2319-8753 | p-ISSN: 2347-6710

IJIRSET

International Journal of Innovative Research in
SCIENCE | ENGINEERING | TECHNOLOGY



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

Volume 11, Issue 6, June 2022

ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA

Impact Factor: 8.118



9940 572 462



6381 907 438



ijirset@gmail.com



www.ijirset.com

Spot Speed Survey of Maharashtra State Highway and National Highway

Prerna H. Salodkar, Rohit Bhosle, Gourav Melakar, Sharad Shambharkar, Sudhanshu Shende,

Pratik Meshram, Raman Sahare, Rushabh Badwaik, Dhananjay Mankawde

Department of Civil Engineering, Nagpur Institute of Technology, Mahurzari, Katol Road, Nagpur, India

ABSTRACT: The spot speed study concentrates on measuring the speed characteristics at predetermined areas under the natural conditions. The spot speed studies are coordinated to assess the movement of rates of vehicles in a surge of activity at a particular region on a roadway. Designing and construction of a road involves estimation of traffic volume and setting up ideal speed for the vehicles to travel in a comfortable way. Now days, due to rapid increase in volume of traffic the designed speed on high ways could not be maintained resulting a delay in reaching target point.

Our project also involves survey of spot speed of vehicles near a school zone. This helps us to recommend changes to the existing system. These recommendations may involve establishments of precautionary signs like school zone, speed limit etc.

Our project is to study the traffic volume and check the time to reach the target in off-peak timing on a highway Chandrapur-Ballarshah (SH264), Nagpur-Deolapar (NH44). The conclusion of the project is the solution to problems faced in chandrapur-ballarshah and Nagpur-deolapar Road journey by checking personally and taking feedback off public using the highway.

I.INTRODUCTION

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 characterize 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 behavioral pattern of the driver. Based on the past study, anger causes to fast acceleration and higher speeds even for 2 km after the emotion-eliciting event such as slow car or obstacle on the road. It showed that the emotion of a driver would primarily affect the driving behavior and increase the probability of traffic accident to occur.

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 unfavorable 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. A proper roadways design is desired to construct a roadway that having a harmonious relationship between actual operating speed, desired operating speed and posted speed limit. 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. In order to ensure the considerable margins of safety mainly utilized to design speed is still applicable, regular testing for spot speed is needed as well as carefully conduct since it related with lives.

Since the data collected from the spot speed study is vital, hence it is be collected, analyzed and presented excellently. During the process of data collection, the method procedures must be strictly followed to avoid any error which will decrease the accuracy of the data.

SCOPE:- Spot speed studies are coordinated to assess the movement of rates of vehicles in a surge of activity at a particular region on a roadway. The proposed look into work goes for breaking down the modular speed of vehicle, highway outline component, upper and lower speed restrain for regulation, planning and analysis traffic operation-control and direction.

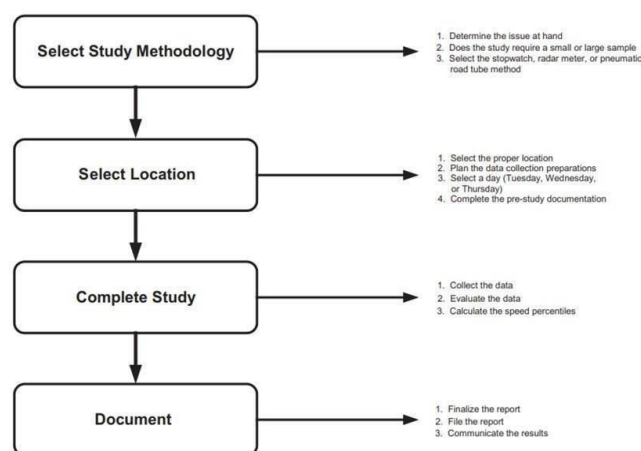
PROBLEM : In present scenario due to heavy traffic volume, he existing roads are insufficient to maintain the design speed. With the help of spot speed studies we can manage the traffic volume by diversion or by designing cycle time.

II. OBJECTIVES

The main aim of this study

- The main objective is to achieve efficient, free and rapid flow of traffic with safe drive.
- To calculate spot speed and prepare tables for statistical analysis of spot speed
- To plot histograms, frequency curves and cumulative frequency curves of spot speeds.
- To determine weighted average speed, modal speed, speed limit (85th percentile speed), design speed, etc. of spot speeds.
- To establish speed limit at school zone.
- To recommend zebra crossing or pedestrian signal if necessary.
- To present detailed diagram of spot speed calculations.
- It is useful in the geometric design of the road.
- Proper placements of signs and boards.

Spot Speed



III. METHODOLOGY

Speed is an important measure of the quality of travel and safety of road network. Speed by definition is the rate of movement of vehicle in distance per unit time. A typical unit of speed is kilometre per hour (KMPH) or miles per hour (mph).

The main purpose of this study is to determine traffic parameter, especially speed. Spot Speed measurements are most often taken at a point (or a short section) of road way under conditions of free flow.

The intent is to determine the speeds that drivers select, unaffected by the existence of congestion. This information is used to determine general speed trends, to help determine reasonable speed limits, and to assess safety.

Basically, there are two types of speed: the time-mean speed and the space-mean speed.

Space Mean Speed: It is the length of a road section divided by the average travel time of several vehicles over this specific section.

Time Mean Speed or Spot Speed: It is the average spot speed of several vehicles measured at a given spot.

For geometric design of roads, it is necessary to have a realistic estimate of the speeds at which vehicles travel. Based on the speed studies, the design speed can be selected, and other geometric elements of design such as horizontal curvature, vertical profile, sight distances and super-elevation can be determined.

Spot Speed studies are conducted to estimate the distribution of speeds of vehicles in a stream of traffic at a particular location on a highway.

This is carried out by recording the speeds of a sample of vehicles at a specified location. When we measure the traffic parameter over a short distance, we generally measure the spot speed. A spot speed is made by measuring the individual speeds of a sample of the vehicle passing a given spot on a street or highway. 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 decisions. Spot speed data have a number of safety applications, including the following

- Speed trends,
- Traffic control planning.
- Accidental analysis,
- Geometric design.
- Research studies.

METHODS OF SPOT SPEED MEASUREMENT :

Methods of conducting spot speed Studies are divided into two main categories: Manual and Automatic. Spot speeds may be estimated by manually measuring the time it takes a vehicle to travel between two defined points on the roadway a known distance apart (short distance), usually less than 90m. Distance between two points is generally depending upon the average speed of traffic stream. Following tables gives recommended study length (in meters) for various average stream speed ranges (in KMPH).

Following are the methods measure spot speed of vehicles in a traffic stream, in which first two are manual methods and other are automatic:

1. Stop watch method
2. Pneumatic tube method
3. Doppler principle method (Radar)
4. Electronic principle detector (Photography)

Among these available methods, we adopted stop watch method considering the advantages and adaptability of the method. The detailed experimental procedure followed will be discussed in the following section:

STOPWATECH METHOD

Stretch Selection Criteria

The following are the basic features that a selected stretch should satisfy to obtain accurate results:

- Any location may be used for solution of a specific traffic engineering problem.
- The geometry of road should be plain, without any adulation or slope.
- For accurate results, selection a section where is road condition is good and where drivers drive comfortably.
- Intersections joining or diverting traffic should not interrupt the traffic flow or speed of the vehicles passing the stretch.
- The stretch should be free from speed breakers, precaution signs etc... and the drivers should be able to travel with their natural style.
- Experimentation should be done in the time of free traffic flow.



- Mainly the drivers should not be aware of the experiment going on, he may be distracted.

EXPERIMENTATION :

The equipment required to carry out stop watch method is:

- Stopwatch
- Measuring tape
- Flag

We require at least three observers to carry out the experiment. After choosing a section that satisfies the above criteria, 30 meters stretch is measured using a measuring tape. Two observers, one carrying stopwatch and other carrying data sheet stand at starting point of the stretch. The third observer stands at the ending point of the stretch.

Once the observers are set in position, test samples may be selected randomly and the observer at first point starts the stopwatch immediately when the car passes the section, and the third observer waves the flag when the test sample crosses the last point of the section. The stopwatch should be stopped immediately when the flag is waved and the time taken by that test sample to cross the section is noted by this observer standing at the first point of the section. For convenience, for the observer may assist to inform the details of the chosen test sample to the third observer.

IV. RESULT AND DISCUSSION

Date: **5 JANUARY 2022**; Sample type: Four wheelers Table 5.
Spot speed observation for Bajaj Vidya Bhawan, Chandrapur

Vehicle number	Speed (kmph)	Vehicle number	Speed (kmph)
1.	55	16.	82.87
2.	80.15	17.	61.25
3.	40.1	18.	50.25
4.	70	19.	84.97

5.	11.15	20.	52.77
6.	85	21.	88
7.	35.12	22.	65.27
8.	85.87	23.	90
9.	22.5	24.	50.12
10.	80.28	25.	84.98

11.	15	26.	95.41
12.	70	27.	20.25
13.	85.22	28.	88.12
14.	46	29.	25
15.	21.25	30.	83.12

Date: 6 JANUARY 2022 ; Sample type: Four wheelers

Spot speed observation for NAGPUR-DEOLAPAR(NH-44) (SPOT B)

Vehicle number	Speed (kmph)	Vehicle number	Speed (kmph)
1.	20.816	16.	51.226
2.	43.088	17.	92.881
3.	104.226	18.	87.108
4.	50.112	19.	43.226
5.	46.226	20.	94.116
6.	90.110	21.	82.196
7.	99.194	22.	98.281
8.	91.122	23.	88.102
9.	61.26	24.	49.202

10.	87.194	25.	84.198
11.	108.228	26.	70.226
12.	47.884	27.	108.224
13.	93.216	28.	21.226
14.	92.016	29.	42.336
15.	86.108	30.	85.110

CALCULATIONS (SPOT A)

One of the greatest advantages of spot speed study is that the average spot speed of the test vehicles can be calculated by both analytically and statistically. For better understanding, we performed both the operations and they are mentioned below-

Analytical Calculations (Spot A)

Equation for calculating speed percentile

$$PD = P_{min}$$

$$SD = \frac{P_{max} - P_{min}}{S_{max} - S_{min}} \times (S_{max} - S_{min}) + S_{min}$$

$$P_{max} - P_{min}$$

Where,

SD = Speed at PD

PD = Percentile desired

Pmin = Higher cumulative percent Pmax =

Lower cumulative percent Smin = Higher speed

Smax = Lower speed

1.85 PERCENTILE SPEED (MAXIMUM SAFE SPEED) :

$$SD = 85 - 48.3585 - 48.35 \times (85 - 75) + 75$$

$$= 84 \text{ kmph}$$

2. 15 PERCENTILE SPEED (LOWEWR SAFE SPEED)

$$SD = 15 - 13.3315 - 13.33 \times (35 - 25) + 25$$

$$= 35 \text{ kmph}$$

Statistical Calculation (Spot A) This calculation is for cross checking the values obtained in analytical analysis.

FREQUENCY DISTRIBUTION TABLE (SPOT A)

Table 6.1.1: Frequency distribution table (Spot A)

Speed (kmph)	Avg. speed (kmph)	Frequency (f)	Frequency (%)	Cumulative Frequency
0-10	5	-	0	0
10-20	15	2	3.33	3.33
20-30	25	6	10	13.33
30-40	35	1	1.67	15
40-50	45	2	3.34	18.34

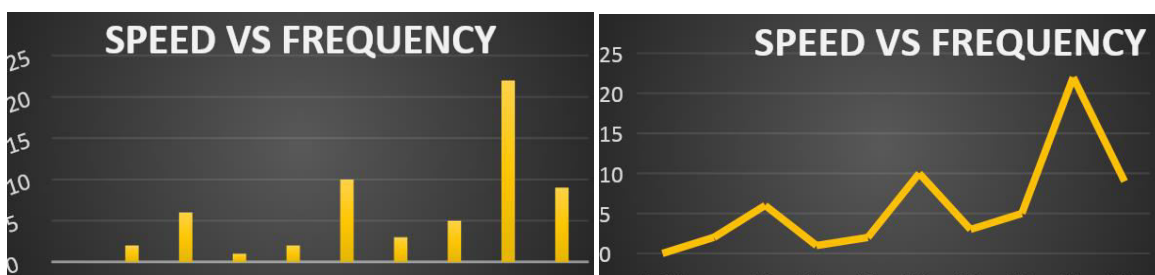
50-60	55	10	16.67	35.01
60-70	65	3	5	40.01
70-80	75	5	8.34	48.35
80-90	85	22	36.67	85.02
90-100	95	9	15	100
		60	100	

**NORTH BOUND FREQUENCY CURVE (SPOT A)
DISTRIBUTION CURVE (SPOT A)**

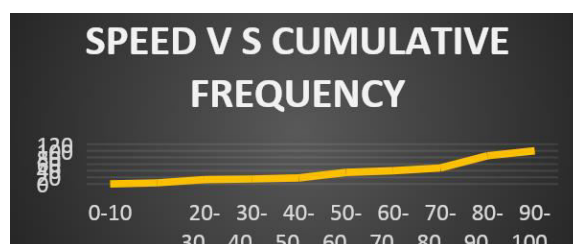
Graph: North bound frequency curve (Spot A)
(Spot A)

FREQUENCY

Graph: Frequency distribution curve



CUMULATIVE FREQUENCY CURVE (SPOT A)



Graph : Cumulative frequency curve (spot A)

Speed (kmph)	Avg. speed (kmph)	Frequency (f)	Frequency (%)	Cumulative Frequency
0-10	5	0	0	0
10-20	15	0	0	0
20-30	25	1	1.67	1.67
30-40	35	2	3.34	5.01

CALCULATION (SPOT B)

Analytical Calculations (Spot B)

- 85 percentiles (Maximum safe speed)
 $SD = 85 - 56.7390.07 - 56.73 \times (95 - 85) + 85$
 $= 93 \text{ kmph}$
- 15 percentiles (Lower safe speed)
 $SD = 15 - 21.6821.68 - 5.01 \times (45 - 35) + 35$
 $= 39$

Statistical Calculation (Spot B)

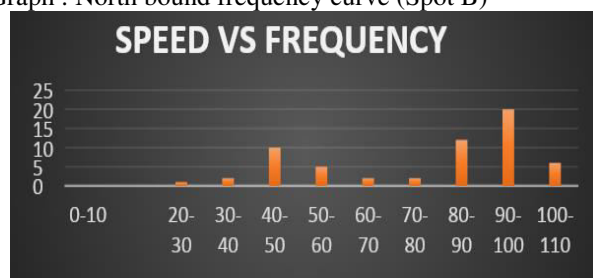
FREQUENCY DISTRIBUTION TABLE (SPOT B)

Table : Frequency distribution table (Spot B)

40-50	45	10	16.67	21.68
50-60	55	5	8.34	30.05
60-70	65	2	3.34	33.39
70-80	75	2	3.34	36.73
80-90	85	12	20	56.73
90-100	95	20	33.34	90.07
100-110	105	6	10	100
		60	100	

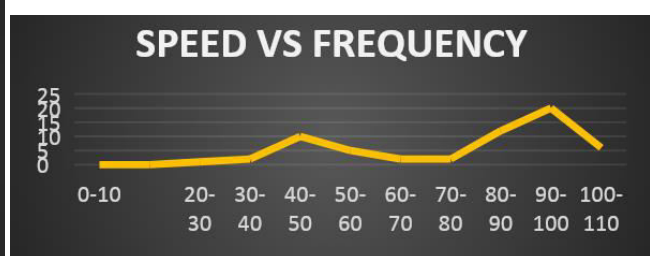
NORTH BOUND FREQUENCY CURVE (SPOT B) DISTRIBUTION CURVE (SPOT B)

Graph : North bound frequency curve (Spot B)



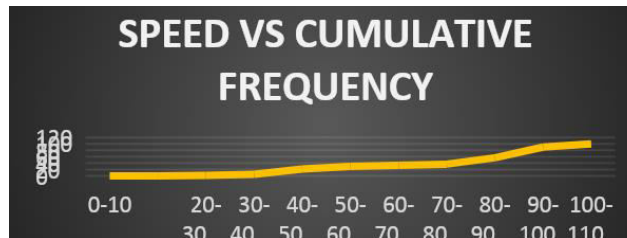
FREQUENCY

Graph : Frequency distribution curve (Spot B)



CUMULATIVE FREQUENCY CURVE (SPOT B)

Cumulative frequency curve (spot B)



V. CONCLUSION

SPOT (A)

- Precaution sign stating "School Zone" should be established.
- Speed limit board of 35 KMPH should be established along with school timings.
- Zebra crossing for the school students should be provided.
- School zone board should be established before 50

SPOT (B)

- We would recommend to place radar meter so that it will show actual speed of vehicle.

REFERENCES

1. Fitzpatrick K, Carlson, P., Brewer, M.A., Wooldridge, M.D., and Miaou, S.P. Design Speed, Operating Speed, and Posted Speed Practices, NCHRP, Department of Transportation Engineering; 2003. Report No. 504.
2. Robertson, Douglas H... Et. Al., Spot Speed Studies. CH.3 of Manual of Transportation Engineering Studies, Institute of Transportation Engineers, 1994, pp 33-51.
3. SK Khanna (2010). Traffic Engineering. Highway Engineering. Nem Chand & Bros.
4. Currin, T.R.2001. Spot Speed Study. In Introduction to Traffic Engineering: A Mannual for Data Collection and Analysis, ed. B. Stenquist. Stamford, conn.: Wadsworth Group, pp. 4-12.
5. Garber, N. J. and Gardiraju R. 1989. Factors affecting Speed Variance and its Influence on accidents. In transportation research record 1213 (pp 64-71). Washington DC.: transportation research Board, National Research Council.
6. Garber, Nicholas J. and Hoel L. A. 2009. Traffic and Highway Engineering. 4th edition. University of Virginia: Cengage Learning.
7. Solomon, D. accidents on Main Rural Highways Related to Speed, Driver, and Vehicle. Publication by U.S. Department of Commerce, Bureau of public Roads, 1964.
8. Donald, (1994). "the relative effectiveness of a variety of sign types." Road safety proceedings conference of the Australian road research Board, Vol.17, No.5, pp.31-48.



INNO  SPACE
SJIF Scientific Journal Impact Factor
Impact Factor: 8.118



ISSN INTERNATIONAL
STANDARD
SERIAL
NUMBER
INDIA



INTERNATIONAL JOURNAL OF INNOVATIVE RESEARCH

IN SCIENCE | ENGINEERING | TECHNOLOGY

 9940 572 462  6381 907 438  ijirset@gmail.com



www.ijirset.com

Scan to save the contact details