How to Cite:
Gupta, G., Anand, A., Raj, A., & Robert , B. (2022). Study of traffic volumes. *International Journal of Health Sciences*, *6*(S1), 9997–10012. https://doi.org/10.53730/ijhs.v6nS1.7363

Study of traffic volumes

Gunjit Gupta
Undergraduate Student, Department of Civil Engineering, Delhi Technological University (DTU), Delhi, India

Ayush Anand
Undergraduate Student, Department of Civil Engineering, Delhi Technological University (DTU), Delhi, India

Ayush Raj
Undergraduate Student, Department of Civil Engineering, Delhi Technological University (DTU), Delhi, India

Mr. B.R.G Robert
Assistant Professor, Department of Civil Engineering, Delhi Technological University (DTU), Delhi, India
Corresponding author email: brgrobert@dce.ac.in

***Abstract*---**"The area of transportation planning deals with transportation facilities (usually streets, roads, walkways, bike lanes, and public transit lines)." It is vital to assess the present state of traffic volume and anticipate the future state of traffic volume in this field traffic volume survey. The purpose of traffic volume studies is to determine the number, movement, and categories of highway vehicles in a given region. An attempt was made to grasp traffic patterns throughout various time periods using data collection. The characteristics of the traffic flow at that crossroads also have an impact on traffic control. As a consequence, the study's findings are valuable in controlling traffic at the intersection and giving some corrective measures to improve traffic safety in the region. Based on the findings, corrective actions such as road widening or enhanced public transit may be recommended.

***Keywords*---**Volume Survey, Average Daily Traffic, Green Shield Equation, Traffic Volume, Level of Service.

Introduction

A traffic volume study is often referred to as a traffic flow survey or just a traffic survey. It is described as the technique for determining the volume of traffic flowing on the roadways at a certain stretch at a specific time. It is quantified in

terms of vehicles per minute, hours, and days. The flow of the various vehicle classes must be translated into a common vehicle class known as the passenger car unit in order to show the traffic flow on a route per unit time. The volume of traffic fluctuates throughout the day. The volume of daily traffic varies depending on the day of the week, as well as the months and seasons of the year. Traffic surveys are a means of acquiring traffic statistics. This is a data gathering approach that may be utilised for a range of traffic engineering applications. Traffic surveys are used for a variety of purposes, including traffic monitoring, control and management, enforcement, forecasting, model calibration and validation, and so on [1].

When there is too much traffic on the road, vehicles go at a slower speed. This lengthens travel times and increases queuing. This is also referred to as a traffic gridlock. Congestion can occur as a result of a decrease in capacity, such as accidents on the road or road closures. Inadequate road design might also limit capacity. Congestion can also be produced by increased traffic, such as when a large number of automobiles exit a sports venue at the same time. Several methods are used to alleviate congestion in areas where it is common, such as commuting in large cities. Cars may be prohibited in certain areas or at certain times, or forced to carry passengers or pay a fee, or people may use public transportation, such as rapid transit, which travels independently of car traffic and is not affected by traffic jams [2,3].

Congestion is not the primary issue; rather, it is a solution to our underlying mobility problem, which is that too many people want to travel at the same times every day. Because the successful operation of the economic and educational institutions requires that people work, go to school, and even do errands during about the same hours so that they may connect with one another. That fundamental criterion cannot be changed without wreaking havoc on our economy and society [4]. Every major urban city in the globe has the same issue. Our project's goals include the following:

- Observe the various types of vehicle composition.
- Investigate the traffic flow and its characteristics.
- To calculate the average daily traffic at different periods of the day.
- To ascertain the traffic dispersion's directional distribution.
- Identifying and resolving traffic flow fluctuations

Objectives of traffic volume study

Planning Objectives:
Accurate information on the quantity of traffic on the roads is critical for the design of both road maintenance and enhancement programmes. Analysis of traffic volume networks aids in determining/planning the need for the improvement in terms of expansion of building missing links, by-passes, alternate roads, and so on [5].

Improvement Purpose:
To properly distribute a limited maintenance budget, it is required to evaluate the traffic volume carried by a given highway section in order to estimate the worth of the road and its relative priority. It is critical to understand traffic volume in order to optimise highway operating conditions.

- To assess the current operational/service condition of a highway segment.
- To assess the need for traffic control equipment (warrant).
- Determining the type of improvement measure to be employed.
- To assess the efficacy of a traffic control measure.

The Goals of Dynamic Traffic Management:

- Up to current and continuous flow/congestion information is vital for optimising.
- Improving junction performance through traffic signal design
- By giving information to road users, network productivity may be increased [6,7]

Other Goals:

- To assess the worth of any route or road infrastructure.
- Determining the priority for road renovation and growth and allocating funding appropriately
- Developing and designing existing and new traffic operations facilities.
- Examine traffic patterns and trends along the route.
- To carry out structural pavement design and geometric road design based on a categorised traffic volume research.
- Volume distribution studies will be used to develop one-way streets and other regulatory measures.

Method for volume survey

Method of manual counting

A field crew is used in this approach to record traffic volume on the mandated record sheets. This approach can get data that mechanical counters cannot capture, such as vehicle categorization, turning motions, and counts when the loading condition or number of people are necessary.

However, having a manual count for all 24 hours of the day is impractical. As a result, in order to reduce the manual hours involved in talking complete counts, statically sampling techniques must be used. First, the fluctuation of traffic volume during the hours of day and the daily variations are observed.

The traffic volume analysis is then performed manually by picking a typical brief count period. The peak hourly traffic levels and average daily traffic volumes are then estimated using statistical analysis [8,9].

Simple Method:
Hand tally and manual counters/enumerators are used to count data.

10000

Benefits include the ability to collect traffic volume, vehicle categorization, and turning proportions using this approach. Data can be utilised immediately after it is obtained.
Disadvantages: For long duration counts and high flow rates, this method is unworkable. Error is common, especially when the volume is high. The count cannot be double-checked. In severe weather, the count cannot be completed [10].

Data Collection

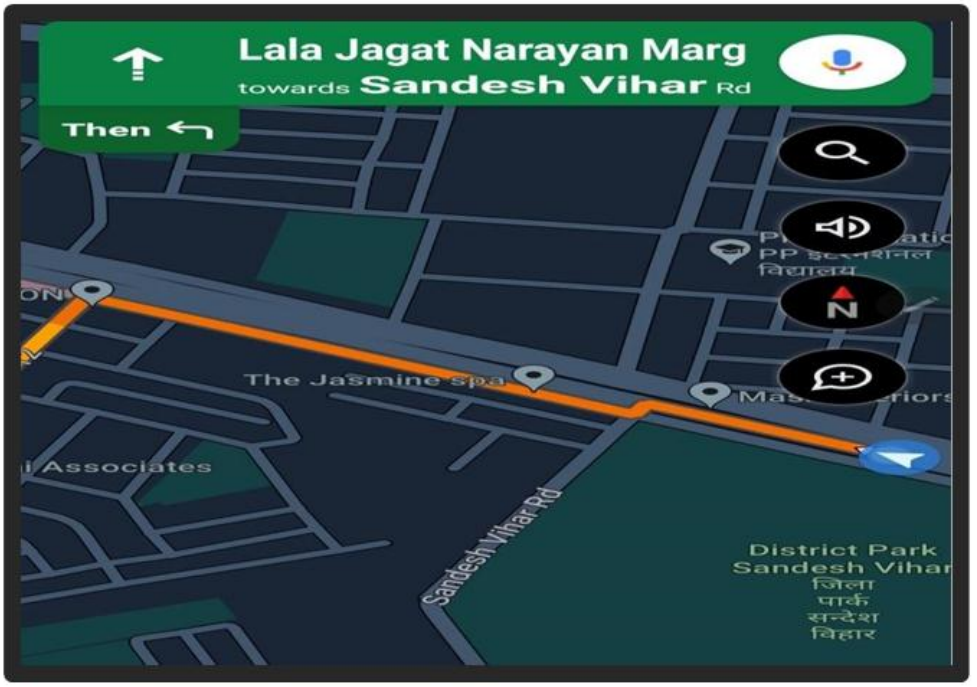

Fig: Lala Jagat Narayan Marg Road
(Google image of the road)

Data of NSP to Pitampura Road

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL
3:30-4:30	72	1304	1068	0	2664
4:30-5:30	68	1160	992	172	2392
5:30-6:30	56	1068	728	144	1996
6:30-7:30	40	888	716	168	1812
TOTAL =	236	4420	3504	704	

Data of Pitampura to NSP Road

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL
3:30-4:30	60	1200	936	140	2336
4:30-5:30	64	1244	792	100	2200
5:30-6:30	36	1036	532	80	1684
6:30-7:30	24	840	600	144	1608
TOTAL=	176	4320	2860	664	

Vehicle composition of traffic stream from NSP to Pitampura Road

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTO-RICKSHAW
3:30 – 4:30	72	1304	1068	220
4:30 – 5:30	68	1160	992	172
5:30 – 6:30	56	1068	728	144
6:30 – 7:30	40	888	716	168
TOTAL	236	4420	3504	704
%AGE	2.66	49.86	39.53	7.94

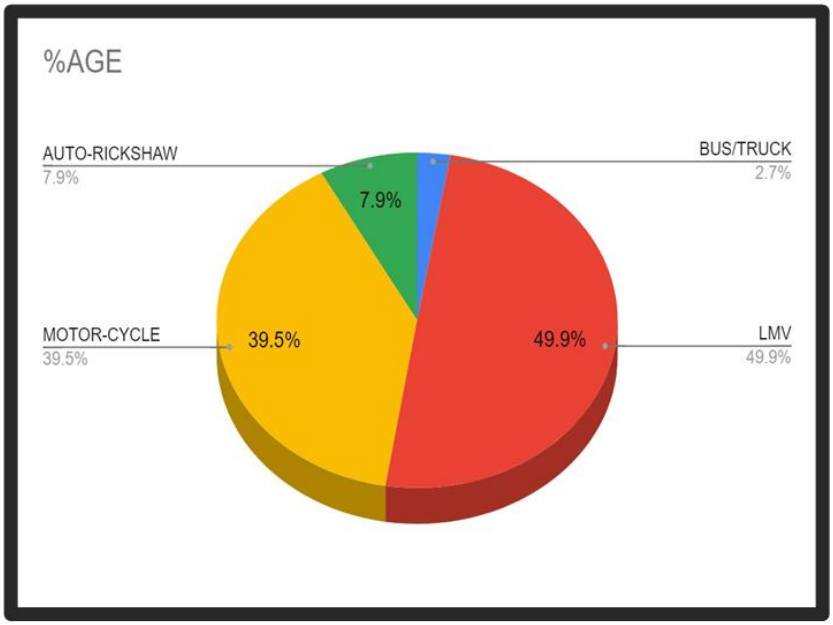

Fig. 4. Percentage vehicle composition of traffic stream from NSP to Pitampura Road

Vehicle composition of traffic stream from Pitampura to NSP Road

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTO-RICKSHAW
3:30-4:30	60	1200	936	140
4:30-5:30	64	1244	792	100
5:30-6:30	36	1036	532	80
6:30-7:30	24	840	600	144
TOTAL	176	4320	2860	664
%AGE	2.25	55.24	36.57	5.93

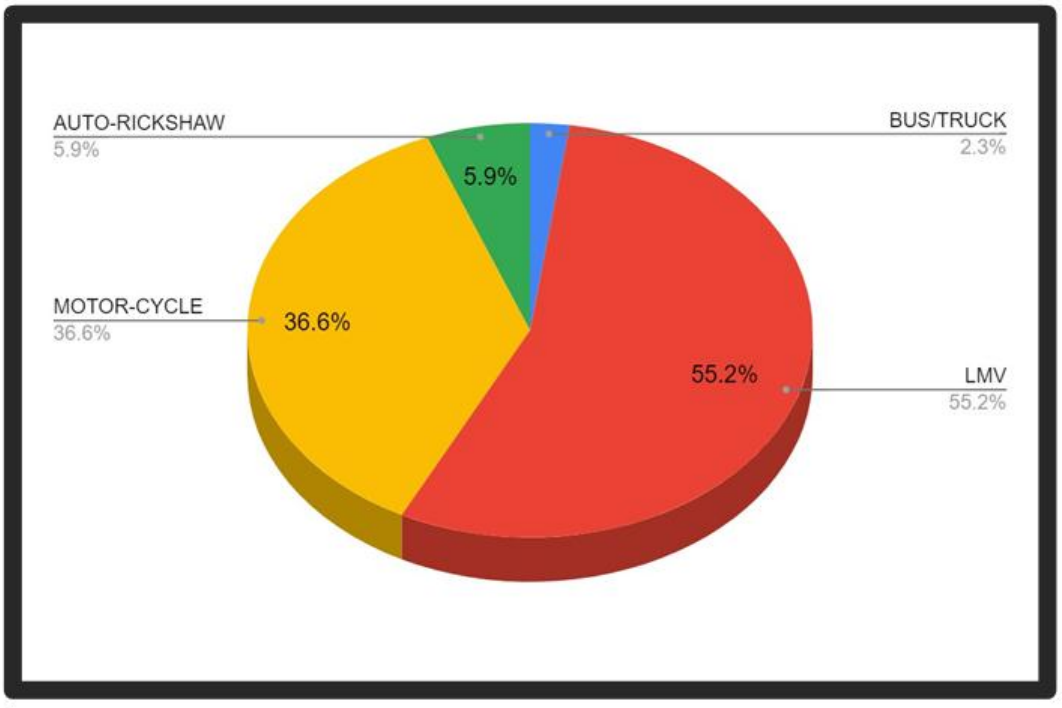

Fig. 5. Percentage vehicle composition of traffic stream from pitampura to nsp road

Table for passenger carrying unit

VEHICLE	VALUE OF PCU
BUS/TRUCK	2.2
CAR+VAN	1
MOTOR-CYCLE	0.5

AUTO-RICKSHAW	1.2

Conversion table of vehicles into PCE and flow rate calculation

NSP to Pitampura

TYPES OF VEHICLES	PCU	TIME SLOT 1	TIME SLOT 2	TIME SLOT 3	TIME SLOT 4
BUS/TRUCK	2.2	72	68	56	40
CAR +VAN	1	1304	1160	1068	888
MOTORCYCLE	0.5	1068	992	728	716
AUTO RICKSHAW	1.2	220	172	144	168
FLOWRATE	(PCU/hr)	2260.4	2012	1728	1536

Pitampura to NSP

TYPE OF VEHICLE	PCU	TIME SLOT 1	TIME SLOT 2	TIME SLOT 3	TIME SLOT 4
BUS/TRUCK	2.2	60	64	36	24
CAR + VAN	1	1200	1244	1036	840
MOTORCYCLE	0.5	936	792	532	600
AUTORICKSHAW	1.2	140	100	80	144
FLOW RATE	(PCU/hr)	1968	1900.8	1477.2	1348

- SERVICE FLOW-RATE IN NSP TO PITAMPURA – 2260.4PCU/hr.
- SERVICE FLOW-RATE IN PITAMPURA TO NSP – 1968.0 PCU/hr.

Percentage of directional distribution

DIRECTION	PCU/hr	TOTAL	DIRECTIONAL DISTRIBUTION
NSP TO	2260.4	4228.4	53.45%

PITAMPURA			
PITAMPURA TO NSP	1968.0	4228.4	46.542%

Time	NSP TO PITAMPURA Flow Rate (PCU/hr)	PITAMPURA TO NSP (PCU/hr)	NSP TO PITAM PURA ADT	PITAMPURA TO NSP ADT	NSP TO PITAMPURA (%ADT)	PITAMPURA TO NSP (%ADT)
3:30 PM-4:30 PM	2260.4	1968	28195	24972	8.01	7.88
4:30 PM – 5:30 PM	2012	1900.8			7.13	7.60
5:30 PM - 6:30 PM	1728	1477.2			6.128	5.91
6:30 PM – 7:30 PM	1535	1348			5.44	5.39

I. Now, ADT in NSP TO PITAMPURA direction: 28195 PCU
AADT in NSP TO PITAMPURA direction: 33440 PCU

II. ADT in PITAMPURA TO NSP direction: 24972 PCU
PCU AADT in PITAMPURA TO NSP direction 29617 PCU

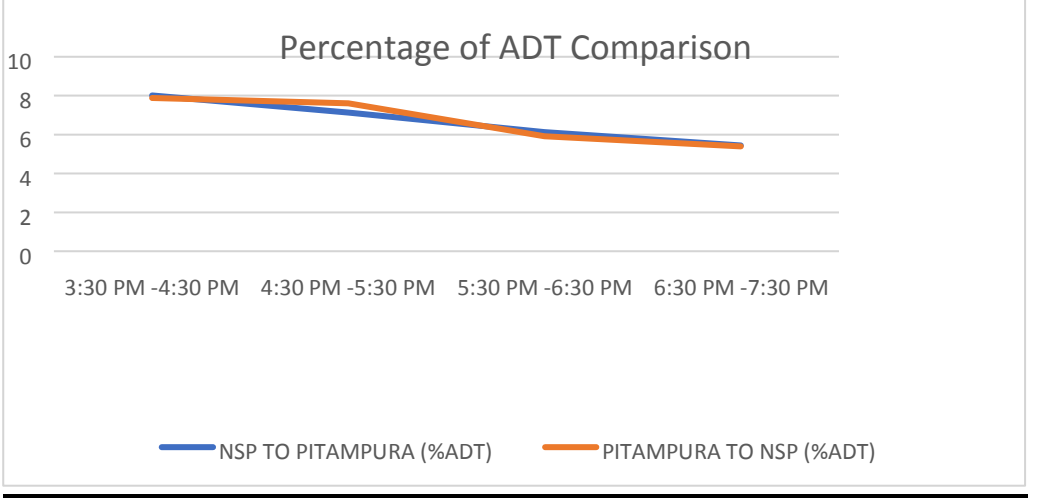

Fig. 6. Comparison between percentage ADT for both road

Theory of green shield equation:

❑ The concept of fluid mechanics inspired traffic flow analysis.

$q = k X v$ .....[1] Where:

v - average vehicle speed(km/hr) k - traffic density(veh/km) q - traffic flow rate(veh/hr)

✈ Fundamental relationship is given by Greenshields model:

$v = v_f (1 - {}_k{}^k j)$ .....[2]

Where:

- maximum speed at zero density.

k_j - Jam traffic density/condition of zero vehicle speed.

✈ substituting the values FROM EQUATION 1 AND 2 and converting it into traffic density quadratic equation; ❑ we get:

$$\boldsymbol{q = -\_\_\_kvjf\ (k - k2j) + vfk\_\_4j\ ....[3]}$$

from the above equation we get two fundamental traffic Flow characteristics [11,12].

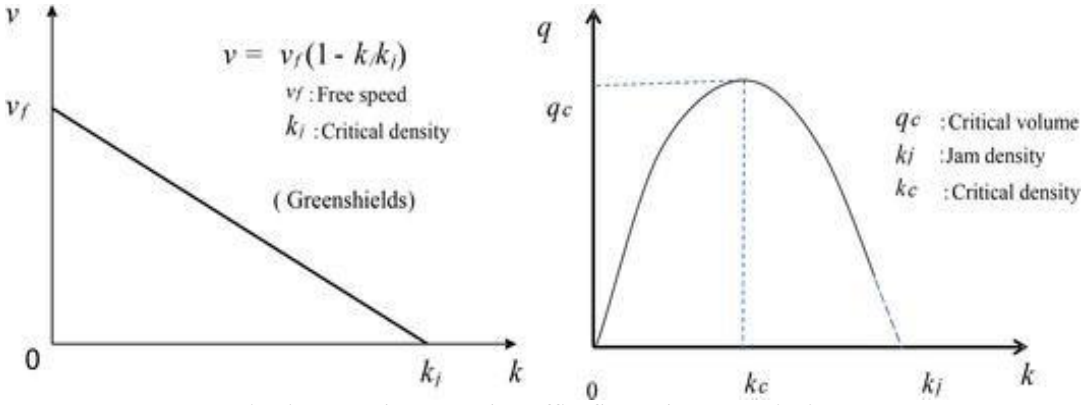

Fig. 7. Fundamental traffic flow characteristics

10006

Data collection and calculation using greenshield equation

DAY 3: OF DATA COLLECTION (18TH FEB 2022)

(1) NSP TO PITAMPURA

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL(X4)
3:30PM - 4:30PM	60	1364	1032	276	2732
4:30 PM -5:30PM	80	1308	1120	164	2672
5:30PM – 6:30PM	64	1008	628	140	1840
6:30PM-7:30PM	60	732	724	168	1684

(2) PITAMPURA TO NSP

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTO-RICKSHAW	TOTAL(X4)
3:30 PM – 4:30 PM	64	1256	1004	168	2528
4:30PM – 5:30PM	72	1312	868	108	2360
5:30PM-6:30 PM	32	1104	500	100	1736
6:30 PM -7:30 PM	28	932	656	128	1744
TOTAL=	196	4604	3028	504	

DAY 3: OF DATA COLLECTION (18TH FEB 2022)

(1) NSP TO PITAMPURA

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL(X4)
3:30PM - 4:30PM	60	1364	1032	276	2732
4:30 PM -5:30PM	80	1308	1120	164	2672
5:30PM – 6:30PM	64	1008	628	140	1840
6:30PM-7:30PM	60	732	724	168	1684

(2) PITAMPURA TO NSP

TOTAL =	264	4412	3504	748	

10008

DAY 4: OF DATA COLLECTION (19TH FEB 2022)

(1) NSP TO PITAMPURA

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL(X4)
3:30PM - 4:30PM	92	1400	1204	128	2824
4:30 PM -5:30PM	44	1332	828	180	2384
5:30PM – 6:30PM	80	1068	516	100	1764

(2) PITAMPURA TO NSP

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTO-RICKSHAW	TOTAL(X4)
3:30 PM – 4:30 PM	56	1420	948	152	2576
4:30PM – 5:30PM	64	1148	684	88	1960
5:30PM-6:30 PM	36	1168	596	128	1928
6:30 PM -7:30 PM	20	1024	760	100	1904
TOTAL=	176	4760	2988	468	
6:30PM-7:30PM	68	644	604	152	1468
TOTAL =	284	4444	3152	560	

DAY 5: OF DATA COLLECTION (20TH FEB 2022)

(1) NSP TO PITAMPURA

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTORICKSHAW	TOTAL(X4)
3:30PM - 4:30PM	104	1084	1392	84	2664
4:30 PM -5:30PM	68	1236	956	168	2428

(2) PITAMPURA TO NSP

TIME	BUS/TRUCK	CAR + VAN	MOTORCYCLE	AUTO-RICKSHAW	TOTAL(X4)
3:30 PM – 4:30 PM	68	1244	768	124	2204
4:30PM – 5:30PM	52	932	732	92	1808
5:30PM-6:30 PM	40	900	660	136	1736
6:30 PM -7:30 PM	28	1060	632	116	1836
TOTAL=	148	4136	2792	468	
5:30PM – 6:30PM	60	936	584	108	1688
6:30PM-7:30PM	40	688	504	124	1356
TOTAL =	272	3984	3436	484	

10010

AVERAGE VELOCITY:

5.2.1 Average velocity from NSP to Pitampura side:

9.

$$= \frac{85 + 9.24 + 9.04 + 7.77 + 6.97}{5}$$

=8.574 m/hr.

5.2.2 Average velocity from Pitampura to NSP side:

8.

$$= \frac{51 + 9.40 + 10.48 + 9.34 + 8.51}{5}$$

= 9.248 km/hr.

Conclusion and Recommendations

This report summarises the analysis's findings and their significance. This report included all feasible analyses based on field survey data.
Discussion on Vehicle Composition (BASED ON DATA OF DAY1):

- Lights vehicle (car, jeep, etc.) occupied about 49.9% of total vehicle.
- Percentage of bus/truck is very low which is about 2.7%.
- Percentage of utility auto-rickshaw is in between 7.9%.

Discussion on Directional Distribution
Approximately 46.542 percent of traffic flow was towards NSP. It was evening rush hour.

Discussion on level of service:

- According to the value of average velocity determined from Greenshields model(9.248 and 8.574 km/hr); our urban street falls under the category "F" of LOS.
- This leaves us to a conclusion that:
- There is breakdown in flow.
- Every car follows the vehicle in front of it in lockstep.
- Travel time cannot be predicted.
- Road is in a constant traffic jam [13,14]

Recommendation
Based on our study findings, we have issued the following recommendations:
There should be more public transportation instead of private automobiles to meet the needs of those who live in residential areas near the road.

- Non-motorized transportation (rickshaws and bikes) should be avoided in this regions this will enhance the level of service (loss) on the road and thus aid to increase travel speed.

- Data should be gathered for an hour instead of 15 minutes for more meaningful data (in this case).
- There should be no more delays in the development of parking spaces near the studied area so that the parking space may be accommodated by neighbouring cars.

References

1. Faruk AN, Liu W, Lee SI, Naik B, Chen DH, Walubita LF. Traffic volume and load data measurement using a portable weigh in motion system: A case study. International Journal of Pavement Research and Technology. 2016 May 1;9(3):202-13.
2. Lingras P, Sharma SC, Osborne P, Kalyar I. Traffic volume time-series analysis according to the type of road use. Computer-Aided Civil and Infrastructure Engineering. 2000 Sep;15(5):365-73.
3. Khoda Bakhshi A, Ahmed MM. Real-time crash prediction for a long low-traffic volume corridor using corrected-impurity importance and semi-parametric generalized additive model. Journal of transportation safety & security. 2021 Mar 4:1-35.
4. Arasan VT, Arkatkar SS. Microsimulation study of effect of volume and road width on PCU of vehicles under heterogeneous traffic. Journal of Transportation Engineering. 2010 Dec;136(12):1110-9.
5. Hoque MS. Traffic volume study. Lectures Notes on CE. 2011;351.
6. Kurzhanskiy AA, Varaiya P. Traffic management: An outlook. Economics of transportation. 2015 Sep 1;4(3):135-46.
7. Besada JA, Carramiñana D, Bergesio L, Campaña I, Bernardos AM. Modelling and simulation of collaborative surveillance for unmanned traffic management. Sensors. 2022 Feb 15;22(4):1498.
8. Sabry M, Abd-El-Latif H, Yousef S, Badra N. Determination of AADT from Short Period Traffic Volume Survey. Journal of Applied Sciences Research. 2007;3(7):607-12.
9. Limantara, A.D., Subiyanto, T.T.S.B., Muhammad, F.N.S.W.M. and Nawir, I.S., 2021, August. Smart Survey Model of Average Daily Traffic (ADT) for Pavement Planning and Monitoring. In *2nd Borobudur International Symposium on Science and Technology (BIS-STE 2020)* (pp. 1-5). Atlantis Press.
10. Apronti D, Ksaibati K, Gerow K, Hepner JJ. Estimating traffic volume on Wyoming low volume roads using linear and logistic regression methods. Journal of traffic and transportation engineering (English edition). 2016 Dec 1;3(6):493-506.
11. Dhapudkar RS. Analysis and development of traffic stream parameters of heterogeneous traffic at signalized intersection. Int J Eng And Sci (IJES). 2014;3(1):339.
12. Rakha H, Crowther B. Comparison of Greenshields, Pipes, and Van Aerde carfollowing and traffic stream models. Transportation Research Record. 2002;1802(1):248-62.
13. Singh B, Goyal T. Study of traffic volume and level of service of Panjab University, Chandigarh. International Journal of Engineering Research and Applications. 2015 Jul;5(7):9-14.

14. Landis BW, Vattikuti VR, Ottenberg RM, McLeod DS, Guttenplan M. Modeling the roadside walking environment: pedestrian level of service. Transportation research record. 2001;1773(1):82-8.