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Research Paper on Study of Platoon Dispersion Behavior at Urban Intersection

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Abstract

This study will analyse the effect the road traffic and travel situation is highly aggravated in metropolitan cities of developing country like India because of significant growth in traffic and addition of more and more numbers of vehicles year by year in to the stream with wide ranging static and dynamic characteristics. Signalisation is a traffic control strategy to ease the competition by providing right of way in a cyclic manner to conflicting traffic at intersections. Saturation flow is a major component in the design of signals, and is influenced by a variety of factors like vehicle composition, intersection geometry and driver's behaviour. Two-wheelers (2W) constitute a major proportion of urban traffic and therefore their effect on the saturation flow could be substantial. The highway capacity manual (HCM) has recommended a saturation flow model primarily for homogeneous conditions, with limited ability to address heterogeneity. But the traffic in India is highly heterogeneous and hence, defining a unified saturation flow concept is a challenging task. The variability in vehicle types necessitates the use of passenger car units (PCUs).Mixed traffic behaviour on saturation flow rate at the signalised intersections. Traffic data will be collected at signalised intersections located in urban area of different cities of Gujarat with different geometric configurations and approach width. Micro level discharge rate studies will be carried out by observing different traffic attributes. The passenger car units (PCUs) values will be derived for different types of vehicles in the traffic stream by different approaches. Mixed traffic discharge flow models will be developed using regression method by relating the various parameters. Also an effect of platoon dispersion on discharge rate will be carried out under this study.

Keywords: Heterogeneous Traffic; Passenger Car Unit; Saturation Flow, Platoon, Platoon Dispersion

I. INTRODUCTION

A. *Saturation Flow and PCU*

The term saturation flow is defined as the maximum rate of flow that can pass through a given road space (width), under prevailing roadway and traffic conditions, during the effective green time in a signal phase. Saturation flow is an important input parameter in the design of cycle time for traffic signals. India is a developing country and its cities are undergoing rapid urbanization and modernization as a result there is rapid growth in the road traffic. Traffic movement in India is very complex due to the heterogeneous traffic stream sharing the same carriageway. Signalized intersections play a critical role in the smooth operation of both arterial and urban streets, where traffic movement in different directions meets together.

The authors classified some patterns, which were different relative positions of motorcycle to passenger car, then used regression analysis to estimate how different among these patterns were in terms of headway and start-up lost time. However, that method is quite difficult from practical use.

The goal of this paper is to investigate the stochastic nature of queue discharge headways, which may provide better information, and, so, to develop a new saturation flow rate estimation method. To fulfil the objective, a literature review, data collection and data analysis, and model development were conducted.

B. What is Platoon

"Platoon of road traffic can be defined as a set of vehicles or pedestrians travelling together as a group, either voluntarily or involuntarily, because of signal control, road geometry or other factors". In the Highway Capacity Manual (HCM), a vehicle platoon is defined as a group of vehicles travelling together.

C. Objectives of Study

The specific objectives of this research were to,
1) To collect traffic data and study the traffic flow characteristics at selected signalized intersections.
2) To Estimate the passenger car equivalent unit values of different categories of vehicles at signalized intersections.
3) To study the effect of platoon dispersion at signalized intersections and to compare with Robertson's model.

D. Need of Study

1) To Estimate Passenger Car Unit (PCU)
2) To Study Platoon Dispersion Effect For Mixed Traffic Flow

E. Statement of Problem

Saturation flow is a major component in the design of signals, and is influenced by a variety of factors like vehicle composition, intersection geometry and driver's behaviour, so the analysis of saturation flow is must require in India.
Two-wheelers (2W) constitute a major proportion of urban traffic and therefore their effect on the saturation flow could be substantial.

II. LITERATURE REVIEW

Li and Prevedouros applied three methodologies to analyse the saturation headway based on the field data. It was revealed that when long queues are present, the typical field measurement of saturation flow rate based on the first 12 vehicles is an overestimate of saturation flow rate for through vehicles and an underestimate of saturation flow rate for protected left-turning vehicles. Lee et al. (2010) employed the flow rate method to estimate motorcycle PCU values, with the help of a recently developed agent-based simulation model, which was capable of representing the characteristic movement patterns of motorcyclists. Road traffic platoon dispersal pattern has been studied, using simulation technique, by several researchers (e.g., Seddon; Castle and Bonniville and Benekohal and Treiterer). The continued research attempts on simulating road traffic have helped to refine the simulation models to its present status of a universally accepted analytical tool for traffic flow modeling. Robertson (1969) developed an empirical platoon dispersion model using a discrete iterative technique. Because of the simplicity in applying the model, it gained popularity and became a virtual standard platoon dispersion model. Lighthill and Witham (1955) used the kinetic wave theory to study the dispersion. Pacey (1956) used the diffusion theory to characterize dispersion, where he assumed that if the stream speeds are normally distributed, the dispersion in the corresponding platoons can be described by the dispersion in speeds. SRobertson (1969) developed an empirical platoon dispersion model using a discrete iterative technique. Because of the simplicity in applying the model, it gained popularity and became a virtual standard platoon dispersion model.

III. STUDY AREA AND METHODOLOGY

A. Study Area

1) Overview of Ahmedabad City
Ahmedabad, the largest city in the state of Gujarat located on the left bank of the river Sabarmati is named after Sultan Ahmed Shah who built the city in 1411 AD. Also known as Karnavati, it was the former capital and a prominent Centre of India's freedom struggle. With a vibrant past and an equally interesting present, Ahmedabad is one of those few cities which can boast about its well preserved ancient heritage along with being a highly industrialized Centre and it is also home to one of the best known management institutes of the world- Indian Institute of Management, Ahmedabad (IIM-A). The city has grown into a great textile and commercial Centre rightly called the 'Manchester of the East'. The city offers a lot to visitors in terms of aesthetic experience- there are many beautiful monuments of historical and archaeological importance, places of religious significance, picnic spots, excursion sites etc.
2) Site Description I.E. Shashtry Nagar, Ahmedabad
The study area identified was a 398 m section of an urban arterial in Gujarat, India, from the Shastry Nagar (Pallav Cross Road) to Akhabar Nagar intersection. Shastrynagar (Pallav Cross Road) intersection is a signal controlled T – intersection and the flow coming out from this intersection to the A.E.C is analyzed. Figure 3 below shows a schematic sketch of the study site and Figure 4 shows the Google maps image.In this study area, two intersections are consider i.e. Shashtrynagar and Pragatynagar, which is located nearby Pallav Cross Road. Shashtrynagar and Pragatynagar are located in Ahmedabad city having road width 9.18 m & 11.60 mand road length 398 m.

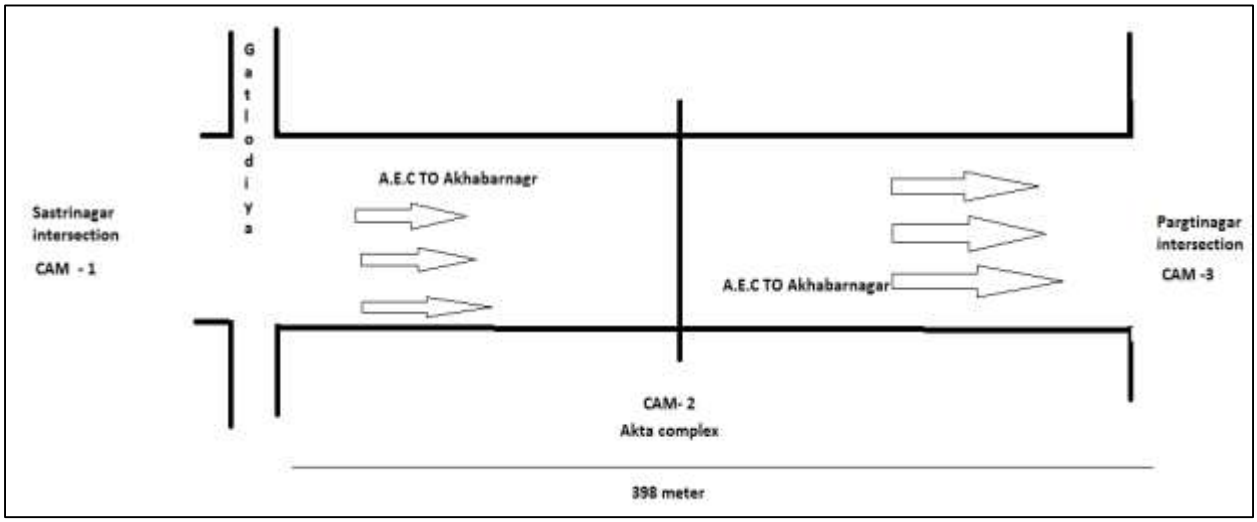

Fig. 1: Schematic sketch of Study Site

Fig. 2: Ahmedabad-Pallav Cross Road Intersection Google image

Fig. 3: Ahmedabad Pallav cross road cam-1 provided at Shivalik Yash Complex

Fig. 4: camera set up and video recording

B. Study Selection and Survey Details:

The signalized junction of Pallav Cross Road with A.E.C and Ghatlodiya, in the Shastry Nagar area of Gujarat City in India, was selected for the study. The straight-on stream of traffic on A.E.C to Akhabarnagar Field studies are carried out to study the prevailing traffic characteristics and operation at selected intersections. For the present study, it is extremely important to study different traffic movements in all possible directions at entry and exit points of approaches in intersections along with its traffic movement. The details about location of selected intersections and traffic survey schedule are given in Table 1 Study section and survey details.

Table – 1
Study section and survey details

Sr.no	*Location*	*GPS coordinate*	*Time of video-graphic survey*	*Duration*
1	*Pallav Cross Road (A.E.C), Ahmedabad*	*23°3'42"N*	*12.00 pm to 1.00 am*	*1 hour (morning) 26th Dec 2016*
2	*Pallav Cross Road (A.E.C), Ahmedabad*	*72°33'9"E*	*6.00pm to 7.00pm*	*1hour (evening) 7th Jan 2017*

C. Methodology Flow Chart

This video is based on peak hours taking in morning and evening at 12am to 1.00 pm and 6pm to 7pm.After collection of video here data extraction in excel sheet and measurements by area occupancy , time occupancy by using software avidemux 2.6 which is used to accurate data collection from any intersections.

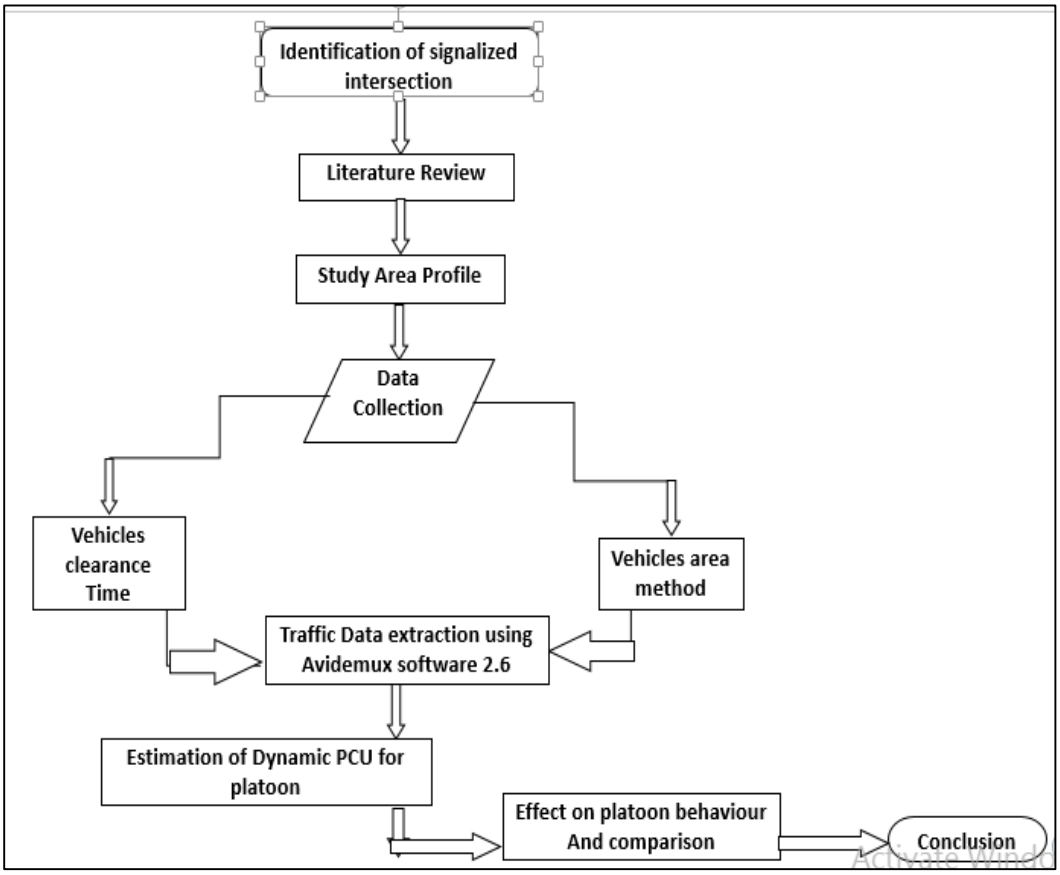

Fig. 5: Methodology of the Study

D. Data Extraction and Analysis

The data collected was processed in order to extract the required data on the vehicle passing time at each control point. The vehicles were classified into Eight classes – Two-wheelers (2W), Three-wheelers (3W), LCV (Tempo, Loading Rickshaw, Chhota hathi) ,Mini Bus , Bus , HCV (Truck etc.) and Bicycle. The extraction was carried out manually by recording a macro in Excel which gave the vehicle class along with the timestamp, as the vehicle passed the point. The timestamp had a least count of millisecond, thus giving more precision. The process was carried out for the 1 hour data from all the three control points. Since the data extraction was complex and turned out to be very tedious, it was decided to extract 1 hour data for the rest of the days. Vehicles, as they move from upstream to downstream, disperse to some extent mainly due to the difference in the desired speed of various drivers in the platoon. This dispersion was captured by analysing the same platoons at upstream and downstream points. The main aim of the study is to find the actual dispersion in the site, compare it with the dispersion given by Robertson's model and thus evaluate the model for heterogeneous conditions.

Fig. 6: Camera set up

Fig. 7: Video Collecting image from Abhushan complex

Fig. 8: road width and length measuring at study area

E. Data Analysis

The recorded traffic flow video was replayed on a computer and data related to entry capacity, and occupancy time was extracted manually and recorded for further analysis. The vehicles are classified into seven categories, namely, motorized two-wheeler, motorized three-wheeler, small car, big car, LCV, bus and truck. The data related to time occupied by each vehicle originated

from each of the entry points, for straight movement and right turn movement was separately extracted and recorded for estimating PCU values for different vehicle categories.

Fig. 9: Snapshot of Movement Wise Time Occupancy Data

Table – 2
Slope Calculations (Sec) Data Sheet (Morning)

Platoon no.	*Platoon size*	*2W*	*3W*	*Car (4W)*	*LCV*	*Mini Bus*	*Bus*	*HCV*	*Bicycle*	*Slope (sec)*	*Head (sec)*	*Tail (sec)*
		Average travel time upstream to downstream(sec)										
1	*87*	*101.65*	*103.26*	*101.46*	*115.3*	*120*	*0*	*0*	*0*	*67.7*	*1.12*	*21.18*
2	*78*	*101.1*	*96.55*	*106.62*	*117.5*	*0*	*115*	*119*	*0*	*81.97*	*0.99*	*23.17*
3	*59*	*100.5*	*115.25*	*103.77*	*120*	*125*	*0*	*116*	*0*	*85.06*	*0.75*	*18.03*
4	*71*	*96.59*	*97.27*	*100.33*	*0*	*0*	*116*	*0*	*0*	*51.27*	*0.96*	*13.11*
5	*83*	*100.3*	*101.5*	*102.78*	*112*	*120*	*0*	*118*	*0*	*81.82*	*1.08*	*24.46*
6	*76*	*98.78*	*85.25*	*101.4*	*115.25*	*0*	*0*	*0*	*0*	*50.08*	*1.02*	*13.71*
7	*84*	*100.7*	*100.71*	*103.6*	*115*	*115*	*0*	*0*	*115*	*81.25*	*1.09*	*24.56*
8	*73*	*100.9*	*99.66*	*92.73*	*118*	*0*	*0*	*0*	*112*	*65.41*	*0.98*	*17.22*
9	*76*	*103.3*	*102.22*	*102.2*	*115.5*	*0*	*115*	*0*	*0*	*67.27*	*1.10*	*20.77*
10	*77*	*100.8*	*105*	*102*	*114.33*	*0*	*0*	*128*	*0*	*68.76*	*0.99*	*19.04*
11	*73*	*100.1*	*104.57*	*102.08*	*114.33*	*0*	*115*	*0*	*0*	*67.01*	*0.95*	*17.52*
12	*62*	*100.9*	*109.5*	*101.4*	*118*	*0*	*0*	*0*	*0*	*65.21*	*0.67*	*11.99*
13	*89*	*103.24*	*110.5*	*100.38*	*116*	*0*	*114*	*116*	*0*	*82.51*	*1.13*	*26.31*
14	*73*	*100.2*	*98.16*	*101.11*	*117*	*0*	*0*	*0*	*125*	*67.22*	*0.96*	*17.72*
15	*70*	*98.86*	*101*	*101.38*	*118*	*0*	*115*	*0*	*0*	*72.63*	*0.94*	*18.56*
16	*87*	*101.86*	*105.6*	*101.03*	*115*	*0*	*115*	*118*	*0*	*67.68*	*1.12*	*21.19*
17	*74*	*101.9*	*100.8*	*86.77*	*116*	*120*	*115*	*0*	*0*	*80.05*	*0.99*	*21.24*
18	*98*	*101.4*	*103.8*	*96.42*	*114.5*	*0*	*0*	*0*	*119*	*76.11*	*1.29*	*26.91*
19	*60*	*99*	*102.33*	*94.81*	*116.5*	*117.5*	*109.5*	*118*	*113.5*	*94.2*	*0.79*	*20.23*
20	*80*	*103*	*96.83*	*95.15*	*106*	*0*	*115*	*0*	*120*	*79.49*	*1.04*	*22.99*
21	*97*	*100*	*100.77*	*96.04*	*106.3*	*120*	*0*	*0*	*0*	*65.38*	*1.29*	*23.01*
22	*78*	*100.6*	*104.3*	*100.03*	*106*	*120*	*0*	*126*	*0*	*82.11*	*1.02*	*22.99*
23	*59*	*100.1*	*100.6*	*99.58*	*116*	*0*	*116*	*0*	*116*	*81.03*	*0.77*	*16.90*
24	*62*	*101.6*	*105.6*	*96.72*	*110*	*0*	*0*	*116*	*0*	*66.24*	*0.73*	*13.23*

Table – 3
Dynamic PCU Calculations (Morning)

Platoon No.	*PCU (2W)*	*PCU (3W)*	*PCU (4W)*	*PCU (LCV)*	*PCU (Mini Bus)*	*PCU (Bus)*	*PCU (HCV)*	*PCU (Bicycle)*
1	*0.21296*	*0.589995*	*1*	*1.372474*	*4.054429*	*0*	*0*	*0.001904561*
2	*0.20156*	*0.524958*	*1*	*1.330972*	*0*	*5.9400988*	*3.558622*	*0.003624774*
3	*0.20586*	*0.643843*	*1*	*0*	*4.129348*	*0*	*3.564181*	*0.005586491*
4	*0.215861*	*0.562029*	*1*	*1.408396*	*0*	*0*	*0*	*0.007704045*
5	*0.20743*	*0.572491*	*1*	*1.31607*	*0*	*0*	*3.660555*	*0.009400502*

6	*0.20707*	*0.48738*	*1*	*1.372691*	*0*	*0*	*0*	*0.011434125*
7	*0.20661*	*0.563539*	*1*	*1.340626*	*3.805234*	*0*	*0*	*0.013056535*
8	*0.23129*	*0.623034*	*1*	*1.53685*	*0*	*0*	*0*	*0.016670913*
9	*0.21485*	*0.579824*	*1*	*1.3649*	*0*	*6.1969993*	*0*	*0.017016932*
10	*0.21006*	*0.59676*	*1*	*1.353723*	*0*	*0*	*4.001137*	*0.018944776*
11	*0.20844*	*0.593851*	*1*	*1.352662*	*0*	*0*	*0*	*0.020822922*
12	*0.21151*	*0.626018*	*1*	*1.405445*	*0*	*0*	*0*	*0.02286825*
13	*0.21862*	*0.638155*	*1*	*1.395663*	*0*	*6.2544938*	*3.684549*	*0.025025675*
14	*0.21065*	*0.562796*	*1*	*1.397531*	*0*	*0*	*0*	*0.026756147*
15	*0.20728*	*0.496193*	*1*	*1.405722*	*0*	*6.247123*	*0*	*0.028590952*
16	*0.21431*	*0.605933*	*1*	*1.374729*	*0*	*0*	*3.723962*	*0.030602667*
17	*0.24962*	*0.673445*	*1*	*1.614574*	*4.740836*	*0*	*0*	*0.037858985*
18	*0.22354*	*0.624081*	*1*	*1.434194*	*0*	*0*	*0*	*0.03607406*
19	*0.22195*	*0.625691*	*1*	*1.484026*	*0*	*6.3605472*	*3.968272*	*0.038724793*
20	*0.2301*	*0.608261*	*1*	*1.345447*	*0*	*0*	*0*	*0.040617281*
21	*0.22132*	*0.608261*	*1*	*1.336752*	*4.283239*	*7.4546234*	*0*	*0.042252926*
22	*0.21377*	*0.604456*	*1*	*1.279809*	*0*	*0*	*4.016186*	*0.042499327*
23	*0.21367*	*0.585648*	*1*	*1.37898*	*0*	*6.4153503*	*0*	*0.044631898*
24	*0.22329*	*0.632934*	*1*	*1.448476*	*0*	*0*	*3.823977*	*0.047949557*

Table – 4

Slope Calculations (Sec) Data Sheet Evening)

Platoon no.	*Platoon size*	*2W*	*3W*	*Car (4W)*	*LCV*	*Mini Bus*	*Bus*	*HCV*	*Bicycle*	*Slope (sec)*
		Average travel time upstream to downstream(sec)								
1	*114*	*105.50*	*108.50*	*101.05*	*112.00*	*104.00*	*113.00*	*0.00*	*111.00*	*94.34*
2	*109*	*101.60*	*109.27*	*104.80*	*112.00*	*0.00*	*0.00*	*0.00*	*115.60*	*67.90*
3	*103*	*99.53*	*104.50*	*103.87*	*122.00*	*112.00*	*0.00*	*114.00*	*120.00*	*96.98*
4	*122*	*99.29*	*108.00*	*103.87*	*123.00*	*0.00*	*109.20*	*102.00*	*125.00*	*96.29*
5	*107*	*103.50*	*106.50*	*104.63*	*112.00*	*112.00*	*117.75*	*0.00*	*117.00*	*96.67*
6	*135*	*100.10*	*104.50*	*104.14*	*110.00*	*112.00*	*112.00*	*0.00*	*117.00*	*94.96*
7	*140*	*102.70*	*106.25*	*101.43*	*105.00*	*0.00*	*108.00*	*106.00*	*115.40*	*93.09*
8	*79*	*104.00*	*104.66*	*109.17*	*115.00*	*0.00*	*101.00*	*0.00*	*113.00*	*80.85*
9	*136*	*104.60*	*108.33*	*106.76*	*105.50*	*0.00*	*112.00*	*109.00*	*112.80*	*94.87*
10	*120*	*101.40*	*108.25*	*104.57*	*107.33*	*0.00*	*115.00*	*0.00*	*118.00*	*81.82*
11	*123*	*107.20*	*107.83*	*105.37*	*0.00*	*0.00*	*109.00*	*0.00*	*118.00*	*68.43*
12	*145*	*106.30*	*107.27*	*104.96*	*112.00*	*0.00*	*114.00*	*114.00*	*114.00*	*96.57*
13	*114*	*105.10*	*106.50*	*108.83*	*112.50*	*0.00*	*110.66*	*0.00*	*116.50*	*82.51*
14	*141*	*94.13*	*108.12*	*100.50*	*0.00*	*0.00*	*111.83*	*0.00*	*125.00*	*67.45*
15	*72*	*83.36*	*103.00*	*105.57*	*115.00*	*0.00*	*115.00*	*0.00*	*115.50*	*79.68*
16	*85*	*87.31*	*104.50*	*103.88*	*0.00*	*0.00*	*114.00*	*0.00*	*119.00*	*66.09*
17	*179*	*92.98*	*103.78*	*110.05*	*100.00*	*0.00*	*0.00*	*0.00*	*118.00*	*65.60*
18	*139*	*96.00*	*105.22*	*109.00*	*120.00*	*0.00*	*101.00*	*0.00*	*104.00*	*79.40*
19	*121*	*93.06*	*104.75*	*106.81*	*0.00*	*0.00*	*112.50*	*101.00*	*114.66*	*79.10*
20	*129*	*90.76*	*107.16*	*100.65*	*113.00*	*0.00*	*113.50*	*113.00*	*0.00*	*79.76*
21	*156*	*95.69*	*100.66*	*96.55*	*110.00*	*0.00*	*106.33*	*0.00*	*111.60*	*77.60*
22	*158*	*91.55*	*107.42*	*101.00*	*112.00*	*0.00*	*116.00*	*0.00*	*114.66*	*80.33*
23	*144*	*95.83*	*106.76*	*100.25*	*105.00*	*0.00*	*107.00*	*0.00*	*115.66*	*78.81*
24	*159*	*93.95*	*103.90*	*100.89*	*108.50*	*106.00*	*113.50*	*0.00*	*117.28*	*93.00*
25	*147*	*93.93*	*100.66*	*105.09*	*113.50*	*0.00*	*113.50*	*112.00*	*116.11*	*94.35*
26	*139*	*93.92*	*107.42*	*104.73*	*112.00*	*115.00*	*102.00*	*0.00*	*118.00*	*94.13*
27	*210*	*94.85*	*106.76*	*106.27*	*115.00*	*105.00*	*105.00*	*0.00*	*119.00*	*93.99*
28	*202*	*94.66*	*103.90*	*102.47*	*113.00*	*0.00*	*110.00*	*0.00*	*109.00*	*79.13*

Table – 5

Dynamic PCU Calculations (Evening)

Platoon No.	*PCU (2W)*	*PCU (3W)*	*PCU (4W)*	*PCU (LCV)*	*PCU (Mini Bus)*	*PCU (Bus)*	*PCU (HCV)*	*PCU (Bicycle)*
1	*0.9092*	*0.32198*	*1*	*0.201161*	*0.191049*	*0.3265903*	*0*	*0.012237917*
2	*0.56958*	*0.254981*	*1*	*0.048436*	*0*	*0*	*0*	*0.016847142*
3	*0.41135*	*0.149646*	*1*	*0.03892*	*0.110471*	*0*	*0.102749*	*0.019259473*
4	*0.43693*	*0.064434*	*1*	*0.033559*	*0*	*0.7651545*	*0.088597*	*0.02619271*
5	*0.46455*	*0.300539*	*1*	*0.044518*	*0*	*0.8163734*	*0*	*0.038295029*
6	*0.94661*	*0.210901*	*1*	*0.109659*	*0.155628*	*0.2500222*	*0*	*0.071130079*
7	*0.55008*	*0.136276*	*1*	*0.035302*	*0*	*0.4852*	*0.093198*	*0.055687814*
8	*0.53701*	*0.182952*	*1*	*0.12705*	*0*	*0.2908192*	*0*	*0.064278325*
9	*0.73573*	*0.200716*	*1*	*0.092854*	*0*	*0.6365593*	*0.123401*	*0.090958705*

10	*0.69477*	*0.089083*	*1*	*0.139332*	*0*	*0.2109374*	*0*	*0.089172457*
11	*0.76177*	*0.145002*	*1*	*0*	*0*	*0.4601134*	*0*	*0.108949455*
12	*0.76224*	*0.14*	*1*	*0.083333*	*0*	*0.19*	*0*	*0.115942029*
13	*0.43888*	*0.186983*	*1*	*0.077732*	*0*	*0.532698*	*0*	*0.09238975*
14	*0.6234*	*0.309197*	*1*	*0*	*0*	*1.1024845*	*0*	*0.127129418*
15	*0.78967*	*0.289855*	*1*	*0.17271*	*0*	*0.3937794*	*0*	*0.149102404*
16	*0.70843*	*0.128916*	*1*	*0*	*0*	*0.6110495*	*0*	*0.145976744*
17	*0.79214*	*0.333553*	*1*	*0.073355*	*0*	*0*	*0*	*0.178146646*
18	*0.77165*	*0.193137*	*1*	*0.044777*	*0*	*0.2041822*	*0*	*0.179107151*
19	*0.63778*	*0.086008*	*1*	*0*	*0*	*0.4073042*	*0.118618*	*0.16456735*
20	*0.51021*	*0.03858*	*1*	*0.069*	*0*	*0.3146418*	*0*	*0.142452425*
21	*0.46284*	*0.03858*	*1*	*0.026792*	*0*	*0.3665135*	*0.070731*	*0.140657574*
22	*0.52603*	*0.202853*	*1*	*0.03005*	*0*	*0.1370286*	*0*	*0.167899199*
23	*0.59892*	*0.228394*	*1*	*0.036358*	*0*	*0.1657941*	*0*	*0.193911189*
24	*0.79885*	*0.179888*	*1*	*0.083429*	*0.094226*	*0.3804348*	*0*	*0.254258835*
25	*0.63768*	*0.07243*	*1*	*0.083429*	*0*	*0.5160672*	*0.099592*	*0.221907114*
26	*0.56269*	*0.170405*	*1*	*0.03555*	*1.182849*	*0.1621103*	*0*	*0.205402886*
27	*0.74624*	*0.134737*	*1*	*0.056023*	*0.080344*	*0.1290761*	*0.074728*	*0.254755435*
28	*0.70864*	*0.151968*	*1*	*0.057511*	*0*	*0.3946992*	*0.151829*	*0.260251468*

Table – 6

Dispersion in head and tail for different platoons using actual dispersion (Morning)

platoon no	*platoon size*	*2w*	*3w*	*car (4w)*	*LCV*	*MINI BUS*	*BUS*	*HCV*	*BICYCLE*	*Head(sec)*	*Tail(sec)*
1	*87*	*59.77*	*17.24*	*17.24*	*4.6*	*1.15*	*0*	*0*	*0*	*1.12*	*21.18*
2	*78*	*42.31*	*11.54*	*37.18*	*2.56*	*0*	*3.85*	*2.56*	*0*	*0.99*	*23.17*
3	*59*	*57.63*	*6.78*	*30.51*	*1.69*	*1.69*	*0*	*1.69*	*0*	*0.75*	*18.03*
4	*71*	*61.97*	*15.49*	*21.13*	*0*	*0*	*1.41*	*0*	*0*	*0.96*	*13.11*
5	*83*	*62.65*	*7.23*	*22.89*	*3.61*	*0*	*2.41*	*1.2*	*0*	*1.08*	*24.46*
6	*76*	*53.95*	*10.53*	*30.26*	*5.26*	*0*	*0*	*0*	*0*	*1.02*	*13.71*
7	*84*	*69.05*	*8.33*	*19.05*	*1.19*	*1.19*	*0*	*0*	*1.19*	*1.09*	*24.56*
8	*73*	*58.9*	*12.33*	*26.03*	*1.37*	*0*	*0*	*0*	*1.37*	*0.98*	*17.22*
9	*76*	*48.68*	*11.84*	*32.89*	*5.26*	*0*	*1.32*	*0*	*0*	*1.10*	*20.77*
10	*77*	*66.23*	*11.69*	*16.88*	*3.9*	*0*	*0*	*1.3*	*0*	*0.99*	*19.04*
11	*73*	*68.49*	*9.59*	*16.44*	*4.11*	*0*	*1.37*	*0*	*0*	*0.95*	*17.52*
12	*62*	*58.06*	*6.45*	*35.48*	*0*	*0*	*0*	*0*	*0*	*0.67*	*11.99*
13	*89*	*64.04*	*6.74*	*23.6*	*1.12*	*0*	*3.37*	*1.12*	*0*	*1.13*	*26.31*
14	*73*	*65.75*	*8.22*	*23.29*	*1.37*	*0*	*0*	*0*	*1.37*	*0.96*	*17.72*
15	*70*	*61.43*	*7.14*	*30*	*0*	*0*	*1.43*	*0*	*0*	*0.94*	*18.56*
16	*87*	*51.72*	*11.49*	*33.33*	*1.15*	*0*	*1.15*	*1.15*	*0*	*1.12*	*21.19*
17	*74*	*59.46*	*8.11*	*24.32*	*4.05*	*1.35*	*2.7*	*0*	*0*	*0.99*	*21.24*
18	*98*	*62.24*	*6.12*	*26.53*	*4.08*	*0*	*0*	*0*	*1.02*	*1.29*	*26.91*
19	*60*	*45*	*15*	*26.67*	*3.33*	*3.33*	*0*	*3.33*	*3.33*	*0.79*	*20.23*
20	*80*	*60*	*7.5*	*23.75*	*2.5*	*0*	*2.5*	*0*	*3.75*	*1.04*	*22.99*
21	*97*	*63.92*	*9.28*	*22.68*	*3.09*	*1.03*	*0*	*0*	*0*	*1.29*	*23.01*
22	*78*	*56.41*	*7.69*	*33.33*	*1.28*	*0*	*0*	*1.28*	*0*	*1.02*	*22.99*
23	*59*	*61.02*	*13.56*	*20.34*	*1.69*	*0*	*1.69*	*0*	*1.69*	*0.77*	*16.90*
24	*62*	*64.29*	*8.93*	*19.64*	*5.36*	*0*	*0*	*1.79*	*0*	*0.73*	*13.23*

IV. SUMMARY AND CONCLUSION

- The platoon characteristics for various platoons, namely their size, vehicle compositions within the platoon and the dispersions in head and tail values. Slope gives the average time interval taken by a platoon to move from upstream to downstream. '*a*' and '*b*' denotes the dispersion in head and tail for each platoons.
- Platoon number 1 which comprise of 87 vehicles with 2W 59.77% being 3W 17.24%, 4W 17.24%, LCV 4.60%, HCV 0%. At upstream, the platoon starts with a bunch of 2W but as they reach downstream, they are overtaken by the LCVs which arrive first. This is mainly due to the difference in the desired speed of the various drivers, especially LCVs which accelerate at a much higher rate than the other vehicles within the platoon. Platoon 1(Morning) has a head dispersion of 1.12s and a tail dispersion of 21.18s. The high dispersion in tail is mainly due to the presence of some 2W which move at a speed less than the average speed of the platoon. High speeding LCVs increase the average speed of platoon, thus causing more dispersion.

A. DP -2 Work

Comparison of Dispersion in head and tail for different platoons using actual dispersion and Robertson's model.

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