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# GLOBAL SCENARIO ON ESTIMATION OF PASSENGER CAR UNIT: A REVIEW

**[1]Er Sumit Rana, [2]Er Mohit Bajaj**
[1]M.tech Scholar, GEC Panipat
[2]Assistant Professor Chandigarh University
Email: [1]sumitrana2568@gmail.com [2] mohitbajaj2222@gmail.com

***Abstract-Passenger Car Unit (PCU) is the metric used to convert heterogenic traffic in to homogenous traffic. In India traffic pattern is heterogeneous .it is necessary to convert heterogeneous traffic to homogenous traffic while designing any signalized intersection. PCU Value is dynamic in Nature. PCU value is depends upon current road traffic condition. In India PCU value is based on value given in IRC SP 41. Developed countries devised several methods for calculating PCUs. These PCU values (devised in developed countries) are not suitable for Indian heterogeneous traffic conditions this paper reviews the estimation carried out to find PCU value worldwide.***

## 1. INTRODUCTION:

The impacts on transportation sector are quite major due to rapid growth of urbanization, especially because of urban vehicular growth. Effects of urbanization are felt significantly in terms of traffic congestions, delays, road safety, pollution, and transport efficiency. As the population of country is increasing the demand for vehicles of all types is also increasing, e.g. car and motor cycles for personal use, heavy vehicles for goods transport and etc. Effectively addressing the congestion issue means not only adding new lanes (capacity) to the roadway system, it also means finding ways to make the existing roads work better. Traffic is a sign of mobility and of a dynamic economy. However, excessive congestion causes a range of undesirable consequences. It imposes costs on the community and businesses through:

- Longer, less predictable travel times.
- Lost productivity and additional running costs of vehicles.
- Increased pollution, noise, loss of amenity, driver stress.
- Reduced time, people spend with their families.

The study aims to plan and develop a quality transport network that supports the safe and efficient movement of traffic on major roads and protects lifestyle and safety in residential areas.

## 2. NEED FOR PCU VALUES

Different vehicle types occupy different spaces on the road, move at different speeds, and start at different accelerations. Furthermore, the behaviour of drivers of the different types of vehicles may also vary considerably.
This poses a problem for designing roads, intersections, and traffic signals. A uniform measure of vehicles is thus necessary to estimate traffic volume and capacity of roads under mixed traffic flow. This is rather difficult to achieve unless the different vehicle types are stated in terms of a common standard vehicle unit. For these reasons, the concept of Passenger Car Unit (PCU) or Passenger Car Equivalent (PCE) was developed and it became a common practice to convert the other vehicle types into PCUs. It is generally expressed as PCU per hour, PCU per lane per hour, or PCU per kilometer length of lane. The main objective of this paper is to review the estimation of passenger car units for motor cycle, three wheelers, trucks and buses at a signalized intersection.

## 3. FACTORS AFFECTING PCU VALUES

Passenger Car Unit (PCU) value has been defined by the TRRL as "On any particular section of road under prevailing traffic conditions, the addition of one vehicle of a particular type per hour will reduce the average speed of the remaining vehicles by the same amount as the addition of say, 'X' cars of average size per hour. One vehicle of this type is equivalent to 'X' PCU. In the case of a bottleneck, and particular in an intersection, if a particular type of vehicle under saturated conditions requires 'X' times as much time at the intersection as is required by an average car, then that type is equivalent to 'X' PCU". If the addition of one vehicle of a particular class in the traffic stream produces the same effect as that produced by the addition of one passenger car, then that vehicle class is considered equivalent to a passenger car. Hence, this value may be considered as a measure of relative space requirement of a vehicle class compared to that by a passenger car under a specified set of roadway, traffic and other conditions.

**PCU values depends on the following factors**

**1. Vehicle Characteristics:** Physical and mechanical, such as length, width, power, accelerations, deceleration and braking characteristics of the vehicles.

**2. Stream Characteristics:**
a) Mean stream speed.
b) Transverse gap or lateral clearance distribution of vehicles at different speeds of flow.
c) Longitudinal gap distribution of vehicles at different speeds of flow.
d) Speed characteristics of the stream such as speed distribution, dispersion and speed differences between different adjoining vehicles in longitudinal and transverse directions.
e) Stream composition, i.e. percentage composition of different classes of vehicles.
f) Traffic volume to capacity ratio.
g) Pedestrian volume.
h) Flow conditions.

**3. Roadway characteristics:**
a) Horizontal alignment.
b) Location: rural, urban, and semi-urban.
c) Stretch: mid-block, signalised intersection, police controlled intersection, uncontrolled intersections, and rotary.
d) Skid resistance of pavement surface.
e) Traffic flow regulations such as one-way, two-way, divided and undivided roads.
f) Number of lanes and pavement width
g) Sight distance.
h) Pavement surface unevenness, type and structural condition.

**4. Environmental characteristics:**
a) Surroundings and local factors.
b) Obstructions.
c) Roadway location - embankment, cut, underpass, overpass, tunnel.
d) Terrain conditions: plain, rolling, hilly, mountainous.

**5. Climatic conditions:**
a) Fog, mist.
b) Rainy, dry.

**6. Control conditions:**
a) Posted speed limit.
b) Segregation of slow and fast moving vehicles.
c) Free access, control of access.

## 4. BASIC PRINCIPLE TO ESTIMATE PCU VALUES

Two basic principles should be applied to the estimation of PCU Values for any of the roadway types identified in capacity analysis procedures. The first principle links the concept of PCU to the level of service (LOS) concept and the second emphasizes the consideration of all factors that contribute to the overall effect of all vehicles on the traffic stream performance. Level of service is quantitative measure of the effect of number of factors, which includes speed and travel time, traffic interruptions, freedom to manoeuvre safety, driving comfort and convenience to various categories of roads. Passenger car Unit (PCU) value of each class of vehicle has been found to be of prime importance in the study of mixed traffic particularly in studies concerning traffic flow parameter, capacity, signal design, parking lots etc.

## 5 SCOPE OF THIS STUDY

In this study, urban mid-block section has be considered to find the PCU values. With all the various factors influencing the PCU values as discussed above, the main factors which have been considered here are:
a) Average speed of each class under different set of prevailing conditions.
b) Average longitudinal gap.
c) Average Effective width.

## 6 LITERATURE SURVEY

**Ankit N Mahidadiya et al (2016)** reviewed the Global Scenario on Estimation of Passenger Car Unit. In India, traffic condition is mixed. It cannot be consider all vehicle type as same. As they have different interfere on road traffic. Passenger Car Equivalent (PCE) or Passenger car unit (PCU) is thus a metric used to assess traffic-flow rate on a highway. Passenger Car Unit (PCU) is the metric used to convert heterogenic traffic in to homogenous traffic. In India traffic pattern is heterogeneous, it is necessary to convert heterogeneous traffic to homogenous traffic while designing any signalized intersection. PCU Value is dynamic in Nature. PCU value is depends upon current road traffic condition. These PCU values (devised in developed countries) are not suitable for Indian heterogeneous traffic conditions this paper reviews the estimation carried out to find PCU value worldwide

 

**Ishant Sharma (2015)** studied on the automatic traffic signal system for Chandigarh. The increasing number of vehicles on our road intersections has given rise to the problems like road accidents, congestions, conflicts and bottlenecks. These problems can now only be solved by providing an efficient traffic control at intersections and that can be achieved by provision of automated volume based traffic signal system at intersections for continuous and efficient movement of vehicles through the intersection Chandigarh – the city beautiful – though a modern and well planned city is also facing the same traffic problems. Here, the present traffic signals are based on the static feed of time without considering the actual available traffic. This leads to a situation where vehicles wait unnecessarily in one of the lanes while the traffic flow is not up to the considerable amount in the other lane. This paper provides the feasibility of replacing existing traffic signals with a system to monitor the traffic flow automatically in traffic signals where sensors are fixed in which the time feed is made dynamic and automatic by processing the live detections. The paper deals with the feasibility of provision of inductive loop detection based traffic signals in place of existing pretimed traffic signals by comparing their performance, suitability and economics. In present study, firstly, Traffic field studies is used to have the traffic volume and speed data of the Transport Chowk Intersection which are used as input for the redesign of pretimed traffic signals [8] by Webster's and IRC method and also for the design of automatic traffic signals. And from the study, It can be concluded that the by replacing the pretimed traffic signals with the automatic traffic signals, capacity is being increased and LOS is also being improved.

**Sachin Jat et al (2015)** designed the signal at intersection of vidisha to control the traffic. In this paper the traffic volume of intersections of the Vidisha city and traffic signals were designed at each intersection. The one part of the thesis is survey of traffic volume, which is done by manual method, wherein the vehicles are counted manually without using any device or sensor with respective vehicle categories like passenger, commercial and agricultural etc. and the other part is design of traffic signals, which is done according to the IRC method of signal design by adopting maximum PCU on the intersection in each direction. The design of traffic signals at these intersections in vidisha will help the growing traffic to move with ease and safety and also helps in reducing the accident rate at the intersections due to congestions and confliction between vehicles.

**Chris Lee at al. (2015)** has estimated PCE value for heavy vehicles at three four-leg roundabouts in Vermont, Ontario, Canada and Wisconsin using vehicle movement data collected from video cameras. The PCEs were determined such that the coefficient of variation in 1- min entry capacities is minimized. The study also applied the PCEs to the prediction of the entry capacity using the HCM 2010 roundabout capacity model. For the model inputs, the critical headway and the follow-up headway were adjusted based on the difference in driver's gap acceptance behavior between cars and heavy vehicles.

**Suhas Vijay Patil et al (2015)** studied the development of passenger car units (PCU). In this study an attempt is made to find out Passenger Car Unit (PCU) value for Nal Stop. Passenger Car Unit (PCU) value of each class of vehicle is very important for any mixed traffic flow studies. These may be concerning traffic flow parameters, capacity, signal design, parking lots etc. The work took into account the effect of mixing of traffic, speed and headway. A set of PCU values was then derived. The analysis is based on the field studies conducted at Nal Stop in Pune city considering almost all classes of vehicles commonly found in Pune city, India. The PCU value of each vehicle is not a constant but varies with several factors such as proportion of other classes, level of service, volume to capacity. The speeds of individual vehicles in the queue need not to be precisely equal, but may vary slightly from vehicle to vehicle and similarly the time headway of individual vehicles in the queue. In this study, the average value of speed and time headway is taken.

**Charles Anum Adams et al (2014)** studied the Passenger Car Unit Values for Urban Mixed Traffic Flow at Signalized Intersections on Two Lane Dual Carriageways in the Tamale Metropolis, Ghana. This study aimed to evaluate the local passenger car equivalent unit values which may be used in the design of traffic intersections in order to improve the performance of signalized intersections in Tamale. Two signalized intersections with fixed time control along one of the busiest corridors were studied. Manual counts were used to collect data from three hour video recordings of each intersection under saturation flow conditions played on a laptop computer. The passenger car unit values (PCU) were estimated using multiple regression analysis between the saturation times and vehicle types. PCU values for Motorcycles, Tricycles, Cars and Buses/trucks have been evaluated. It was recommended that a special area should be prepared in front of the signalized intersection stop lines in the metropolis to accommodate the high volumes of motorcycles in the traffic.

**Parvathy R et al (2013)** studied the development of new PCU values and effect of length of passenger cars on PCU. In this study, an attempt has been made to learn the characteristics of mixed traffic flow at signalized intersections. This work provides the details of an empirical study carried out to determine the PCU values for various types of vehicles, so that a comparison of results with PCU factors recommended by IRC code is possible. Moreover an attempt has been made to find the effect of length of passenger cars on PCU. Data were collected from two signalized intersections and the headway ratio method and regression method were used to estimate the PCU of different types of vehicle. The PCU values obtained in this study are compared with the values established earlier. It is found that the estimated PCU values are different from those being used in India, and they are inversely related to the length of passenger car. Studies reveal that PCU values have a great impact on signal design, emphasizing the need for further studies in this direction.

**Subhash Chand et al. (2009)** dealt with the determination of PCU factor. The study clearly emphasize the need for estimation of PCU values based on actual field studies at the signalized intersections for their analysis and performance as these are found to vary considerably as compared to IRC PCU values. Estimated PCU values are observed to give

higher but consistent value of saturation flow for different approach widths as compared to IRC-PCU values. Estimated PCU values give consistent value of saturation flow per meter width of approach for all the approaches. But estimated values of PCU fail to explain the variation of saturated flow during different saturated green phases of same approach which may be attributed its sensitivity to composition and the varying composition of traffic during different green phases of signal. It affirms that PCU values at signalized intersections are highly dynamic and further emphasizes the need of estimation of PCU values based on different comprehensive approach.

## CONCLUSION

This paper presented literature review on PCU (Passenger car Unit) values. Most papers in this context are focused on calculating PCU at particular sections of the road as well as at Intersection. It been seen that PCU value may change according to traffic condition. The PCU values of vehicles considering all effects of factors such as grade, shoulder condition, roughness, percentage of vehicle, percentage of slow moving vehicles has not been calculated universally.
A model which can incorporate all effects of factors is yet to be developed. It is also needs to revised PCU value in India. Because many cities of India undergoes rapid urbanization its result change in traffic condition its leads to applicability of PCU value which is derived before.

## REFERENCES


1. A. A. Obiri-Yeboah,"Passenger Car Equivalents for Vehicles at Signalized Intersections within the Kumasi Metropolis in Ghana.", IOSR Journal of Engineering (IOSRJEN), April 2014.
2. A. Mehar; S. Chandra; and S. Velmurugan,"Passenger Car Units at Different Levels of Service for Capacity Analysis of Multilane Interurban Highways in India", American Society of Civil Engineers. (ASCE), 2014.
3. Chris Lee"Developing Passenger-Car Equivalents for Heavy Vehicles in Entry Flow at Roundabouts", ASCE, 2015.
4. J. R. Juremalani , T. L. Popat, D. T. Shete, A Critical Appraisal of Traffic Signal Design for at- Grade Intersections under Mix Traffic Conditions. - A Global Scenario"
5. M. Mardani Na, S. Chandra and I. Ghosh, "Passenger Car Unit of Vehicles on Undivided Intercity Roads in India", The 4th International Workshop on Agent-based Mobility, Traffic and Transportation Models, Methodologies and Applications (Science Direct), 2015.
6. Patel Mira (2014), Solution for reduction of traffic congestion- A case study of Thaltej rotary intersection, *International Journal of Applied Engineering and Technology*, 4(1), pp 37-4
7. Ar Jaiswal Anuj and Dr Sharma Ashutosh (July 2012): Optimization of Public Transport demand- A case study of Bhopal, *International Journal of Scientific and Research Publications*, 2 , pp 1,6,
8. Rokade S, Jain M, Goyal P, Sharma V (July, 2014), Analysis and Design of intersections on Approach road of Birla Mandir, Bhopal, *International Journal of Innovative Engineering Research (IJIER)*, 1(1), pp 1
9. Analysis and Solutions to improve traffic flow at intersections of Bhopal: Major Project Report (2015) [University Institute of Technology, RGPV, Bhopal
10. Khanna S. K. and Justo C.E.G (2011), Highway Engineering, 9th Edition, (Nem Chand and Bros, Roorkee)
11. ALTERA Corporation. Traffic Management in Stratix GX Devices. White Paper. San Jose, C.A.
12. IRC: 106: 1990 – Guidelines for Capacity of urban roads in plain areas.
13. IRC-86-1983 "Geometric Design Standards for Urban Road in Plains.
14. Kadiyali L.R., Traffic Engineering and Transportation Planning, Khanna Publishers, Sixth Edition.
15. Khanna S. K. & Justo C. E. G. 2001. Highway Engineering, Nem Chand &Bros, Eight Edition.
16. S. Anand, S.V.C. Sekhar, Mohamed Rehan Karim. September 1999. Development of Passenger Car Unit (PCU) values for Malaysia. Journal of the Eastern Asia Society for Transportation Studies, Vol.3, No.3.
17. YahyaSarraj, IsraaJadili. 2012. Estimating passenger car unit factors for buses and animal driven carts in Gaza city, Palestine. The 4thInternational Engineering Conference –Towards engineering of 21st century.


 