

ABSTRACT

This article discusses many of the milestones in the development of the Passenger Car Unit (PCU). An attempt has been made to cover the critical and most recent research work in the development of PCU in both homogeneous and non-homogeneous traffic conditions, although the assessment is not exhaustive. Passenger car units or passenger car comparisons (PCUs) play a crucial role in the study of the traffic flow of different types of vehicles in the traffic flow and are used to transform traffic flows of different vehicle types into traffic flows consisting solely of passenger cars and which have been developed to analyse the effect of different types of vehicles on the road. The current article discusses and compiles various methods that have been followed to estimate the value of PCUs. Each method has its own factors such as density, headway time, speed, delay, etc. which are taken into account for the calculation of PCU.

KEYWORDS: Traffic Capacity, Passenger Car Unit, Urban Roads, Mixed traffic.

I. INTRODUCTION

The effects on the transport sector are quite large due to the rapid growth of urbanization, mainly due to urban vehicle growth. Effects of urbanization are felt considerably in terms of traffic congestion, delays, traffic safety, pollution and transport efficiency. As the population of the country increases, the demand for vehicles of all types also increases, e.g. motorcycles and motorcycles for personal use, heavy goods vehicles and so on. Effective tackling the congestion problem means not only adding new lanes (capacity) to the road system, but also finding ways to make the existing roads work better. Traffic is a sign of mobility and of a dynamic economy. Excessive congestion, however, causes a number 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 is aimed at the planning and development of a quality transport network that supports the safe and efficient traffic of traffic on main roads and protects lifestyle and safety in residential areas.

II. NEED FOR PCU VALUES

Different vehicle types occupy different spaces on the road, move at different speeds and start at different speeds. Moreover, the behaviour of drivers of the different types of vehicles can also vary considerably. This poses a problem when designing roads, intersections and traffic lights. A uniform measurement of vehicles is therefore necessary to estimate the traffic volume and the capacity of roads with mixed traffic. This is rather difficult to achieve unless the different vehicle types are expressed 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 usually expressed as PCU per hour, PCE per lane per hour or PCE per kilometre length lane. The main purpose of this document is to assess the estimation of passenger car units for motorcycles, tricycles, trucks and buses at a signalled crossing point.

III. FACTORS AFFECTING PCU VALUES

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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.

IV. BASIC PRINCIPLE TO ESTIMATE PCU VALUES

Two basic principles have to be applied to the estimation of PCU values for each of the lane types identified in capacity analysis procedures. The first principle connects the concept of PCU with the service level (LOS) and the second emphasizes the consideration of all factors that contribute to the overall effect of all vehicles on the performance of the traffic flow. The service level is a quantitative measure of the effect of a number of factors, including speed and travel time, traffic interruptions, freedom of movement, driving comfort and convenience for different types of roads. The value of the passenger car unit (PCU) of each vehicle class has proven to be of the utmost importance in mixed-traffic research, particularly in studies on traffic flow parameters, capacity, signalling, car parks etc.



V. LITERATURE REVIEW

Ankit N Mahidadiya et al. (2016) assessed the Global Scenario on Estimation of Passenger Car Unit. In India the traffic situation is mixed. It cannot be considered as all vehicle types the same. Because they interfere differently on road traffic. Passenger Car Equivalent (PCE) or Passenger Car Unit (PCU) is a measure with which the traffic flow on a motorway can be determined. Passenger Car Unit (PCU) is the metric used to convert heterogeneous traffic into homogeneous traffic. In India the traffic pattern is heterogeneous, it is necessary to convert heterogeneous traffic into homogeneous traffic when designing a signalled intersection. PCU value is dynamic in nature. PCU value depends on the current traffic situation. These PCU values (conceived in developed countries) are not suitable for heterogeneous traffic conditions in India. This document discusses the estimate that was made to find PCU value.

Sachin Jat et al (2015) designed the signal at intersection of vidisha to control traffic. In this article the traffic volume of intersections of the Vidisha city and traffic signals at each intersection was designed. One part of the dissertation is an overview of the traffic volume, which is done with the manual method, where the vehicles are counted manually without using a device or sensor with respective vehicle categories such as passenger, commercial and agriculture etc. And the other part design of traffic lights, which is done according to the IRC method of signal design by using the maximum PCU at the intersection in each direction. The design of traffic lights at these intersections in vidisha helps the traffic to move easily and safely and also helps to reduce the number of accidents at the intersections due to congestions and conflicts between vehicles.

Charles Anum Adams et al (2014) studied the values of the passenger unit for urban mixed traffic flows at signalled intersections on two lanes with double carriages in the Tamale Metropolis, Ghana. This study was aimed at evaluating the local equivalents values for passenger cars that can be used in the design of traffic intersections to improve the performance of signalled intersections in Tamale. Two identified 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 current conditions played on a laptop computer. The values of the passenger car units (PCU) were estimated using multiple regression analysis between saturation times and vehicle types. PCU values for motorcycles, tricycles, cars and buses / trucks have been evaluated. It was recommended to create a special area for the signalled intersection stop lines in the metropolis to accommodate the large quantities of motorcycles in traffic.

Parvathy R et al (2013) studied the development of new PCU values and the effect of the length of passenger cars on PCU. In this study an attempt was made to learn the characteristics of mixed traffic flows at identified intersections. This work provides the details of an empirical study performed to determine the PCU values for different vehicle types so that a comparison of results with PCU factors recommended by IRC code is possible. Moreover, an attempt was made to find the effect of the length of passenger cars on PCU. Data were collected from two identified intersections and the follow-up method and regression method were used to estimate the PCU of different vehicle types. The PCU values obtained in this study are compared with the previously determined values. It has been found that the estimated PCU values differ from those in India, and they are inversely proportional to the length of passenger cars. Studies show that PCU values have a major influence on the design of the signal, and emphasize the need for further research in this direction.

VI. CONCLUSION

This paper presented literature research into PCU values (Passenger Car Unit). Most articles in this context are aimed at calculating PCU on certain parts of the road and at intersection. It has been seen that the PCU value can change depending on the traffic situation. The PCU values of vehicles that consider all effects of factors such as incline, shoulder condition, roughness, vehicle percentage, percentage of slow moving vehicles are not universally calculated. A model that can incorporate all the effects of factors still has to be developed. It is also necessary to revise the PCU value in India. Because many cities in India undergo rapid urbanization, the result changes in traffic situations. This leads to applicability of the PCU value that was derived earlier

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