Determination of Passenger Car Unit (PCU) On Bridge and Below Bridge

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Abstract: *Estimation of Passenger Car Unit (PCU) values is important for traffic capacity analysis, level of service measures, signal design and coordination, saturation flow rate determination and development of traffic flow models. Due to these wide applications, accuracy of PCU values is considered to have significant influence on traffic flow analysis. This project focus on estimation of PCU values on bridge and below bridge and comparing with IRC 106-1990. For this, site selected is at Sion-Panvel Expressway, Vashi flyover, Vashi Navi Mumbai. PCUs can be estimated from the various methods as given in the literature by using traffic flow data observed in the field. This study used Space occupancy methodology and for cross checking the values Modified methodology for estimation of PCU value of subject vehicles that includes the time headway as influencing parameter. The variations of PCU values with respect to traffic flow and facility type are also studied. . Developed countries devised several methods for calculating PCUs. These PCU values (devised in developed countries) are not suitable for Indian heterogeneous traffic conditions, where traffic is more diverse in nature, and driver do not follow lane discipline. . In mixed traffic situation the traffic movement is an extremely complex phenomenon.*

Keywords: *Passenger Car Unit; traffic; bridge; transportation*

1. Introduction

The term Passenger Car Unit (PCU) or Passenger Car Equivalency (PCE) was first introduced in HCM (1965) to account for the effect of trucks and buses in the traffic stream. Subsequently, PCU value of vehicle type and its estimation has been subject of interest over the world. The accuracy of measured traffic flow on a roadway is highly depends on correctness of PCUs used for converting traffic volume counts of observed vehicle category. With the extensive growth in roadway network, increase in numbers of vehicles plying on the Indian highways has been observed significantly. Substantial increase in traffic volume and speed levels on highways is warranted much safer and secured traffic flow operational system.

Traffic on Indian roads is of heterogeneous nature that incorporates wide variation in vehicles physical and operational characteristics. PCU of a vehicle type is used as a volume count adjustment factor to account for the non-uniformity in traffic flow stream. This problem of non-uniform traffic is resolved by converting volume count of different types of vehicle into a common unit i.e., PCU (passenger car unit) and thereby to express traffic volume in terms of PCU/hr. The appropriate measurement of traffic volume is the most vital inputs for the traffic system design and assessment of roadway capacity. Hence, the proper estimation of PCU values of different types of vehicle becomes essential for planning and design of traffic operational facilities. The most recent addition of the US HCM (2000) provides different sets of PCE values of trucks and recreational vehicles, for different types of terrain and highway facilities.

2. Literature study

Dr. Qauzi Sazzad, H.M. Iqbal Mahmud had the objective for this paper that is to determine the PCE that reflects the local traffic conditions in Dhaka Metropolitan City, Bangladesh. Emphasis was placed on the through movement of different types of vehicle. The main vehicle compositions observed during the study consist of passenger cars, auto-rickshaws, mini-buses and buses. The performance of the signalized intersections can be improved by using these PCE.

Table no. 1 Summary of PCE obtained by headway ratio method

Vehicle categories	PCE (this study)	PCE (MoC, 2001)
Passenger car	1.0	1.0
Auto-rickshaw	0.86	0.75
Mini-bus	1.42	3.00
Bus	2.16	3.00

This paper has discussed the procedure of deriving the passenger car equivalent (PCE) for through vehicles according to the traffic conditions of Dhaka Metropolitan City, Bangladesh. The PCE for four vehicle types were derived using the headway ratio method. The estimated PCE for cars, auto-rickshaws, mini-buses and buses are 1.00, 0.86, 1.42, and 2.16, respectively. The comparison between the estimated PCE and the PCE currently used in Bangladesh demonstrated in this paper. Presently, the PCE used in Bangladesh considerably differs from the PCE obtained from this study, which has a significant impact on the calculation of the saturation flow rate and thus influences the design of signalized intersections. They have suggested the values obtained in there study which can be used as a guideline in the design and analysis of signalized intersections in Dhaka Metropolitan City as well as in Bangladesh.

Charles Anum Adams, M. Abdul Muhsin Zambang has studied 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.

Signalised intersections in Tamale metropolis selected for the study
Figure 1 Map of Tamale showing signalised intersections in the metropolis

Figure no.1 Map of tamale showing signalized intersections in the metropolis

Table no. 2 Passenger car unit values of vehicle groups

Intersection	Motorcycle	Tricycle	Car/taxi	Bus/truck
Barclays bank	0.30	0.75	1.00	1.52
Agric	0.38	0.67	1.00	1.68

The PCU values have been estimated for vehicles types in Tamale. The traffic mix derived from this study shows that there are as much motorcycles in the traffic stream as there are cars/taxis. The proportion of tricycles though smaller than those of motorcycles or cars/taxis were also equal to the proportion of buses/trucks. PCU values for motorcycles, tricycles and buses/trucks were 0.3, 0.75 and 1.52 respectively for the Barclays bank intersection and 0.38, 0.67 and 1.68 respectively for the Agric intersection. Most motorcyclists stop ahead of the intersection stop line because no proper demarcation has been made for them at all intersection sites studied.

Recommendations:

a) Provision for motorcycle queue storage at the stop line should be made due to the high percentage of motorcycles at the intersections to prevent them from stopping beyond the motor vehicle stop line at the intersections.

b) Passenger car unit values (PCU) have been derived for the mixed traffic conditions in the Tamale metropolis. This should be confirmed and adopted for design.

c) The Passenger car unit values (PCU) obtained were not the same at the various intersections, therefore it can be concluded that unified PCU values for different vehicles does not hold good for non-lane based traffic conditions.

S Srikhant, Arpan Mehar presents this paper estimation of PCUs from the dynamic methods by using traffic flow data observed in the field. Study describes a modified methodology for estimation of PCU value of subject vehicles that includes the time headway as influencing parameter. The approach used in this paper is inspired from the method of dynamic PCU estimation where a PCU is expressed as the ratio of speed ratio and area ratio of standard cars to the subject vehicle type. Unlike dynamic PCU method, this method includes time headway factor for PCU estimation. The method found more realistic and logical as it provides relatively higher values of PCUs than those obtained from dynamic PCU method.

After Comparison of modified PCUs with dynamic PCU values The PCU values as estimated on NH 202 and NH 16 highways sections based on proposed approach are further compared with PCUs determined by dynamic PCU method. The estimated mean PCU values estimated from both the methods are given in the Table below. It may be seen that the mean PCUs estimated from modified approach for all the vehicle types are relatively higher than the Dynamic PCU values. However, the difference is only found statistically significant in case of large size vehicle type such as HCV, MAV and BUS.

Table no. 3 PCU estimated using modified method and dynamic method for subject vehicle types

Vehicle Type	NH-202		NH-16	
	Modified method	Dynamic PCU method	Modified method	Dynamic PCU method
CB	1.28	1.25	1.45	1.44
LCV	1.54	1.49	1.57	1.52
HCV	4.06	3.87	4.15	4.04
MAV	8.85	7.53	7.67	7.45
TW	0.39	0.34	0.35	0.35
3W	1.18	1.05	1.15	1.12
B	6.90	5.97	5.32	5.26

Verification of PCUs through traffic flow simulation

The PCUs of vehicle types estimated from the proposed method are based on lower to medium traffic volume levels. The comparison of PCUs may also be better if it could have been performed with higher traffic volumes. To overcome such difficulties, microscopic traffic flow simulation model VISSIM was used to generate the congestion and to estimate PCU values of vehicle type at maximum flow level. The field data collected from the highway section NH 202 was used as input to the VISSIM and base link network was created.

The travel time of each vehicle type over the trap length obtained from the simulation was used to calculate the speed of each vehicle type. The average speed of each vehicle type obtained from field data and simulated data were compared. The percent error calculated between average speeds of each vehicle type and is reported in Table below. Fine tuning of VISSIM parameters was confirmed as speed values fall under acceptable limits of percentage error (5%). Hence VISSIM model may be used for further study.

Table no. 4 Estimated Percentage error between field and simulated average speed

Vehicle type	Simulation Average speed (kmph)	Field Average speed (kmph)	Percentage error
CS	61	64	4.62
CB	63	67	6.41
LCV	48	48	0.03
HV	41	42	3.47
MAV	39	39	0.67
TW	45	45	0.31
3W	39	41	3.53
B	47	45	2.94

After the study of the paper following conclusions and recommendations were made:

Conclusions:

a. Different methods given in the literature used to calculate PCU value of vehicle types are not found realistic under traffic flow conditions observed in field data. However, homogenization method and dynamic PCU method provides better results.

b. Modification to Dynamic method was done by adding the time headway factor is found realistic and logical under heterogeneous traffic flow conditions.

c. The modified approach used for PCU estimation in present study suggests relatively higher values than those obtained from dynamic PCU method.

d. Simulation of traffic flow was also performed through microscopic simulation model VISSIM for generating congestion and for comparing estimated PCU values at the level of maximum traffic volume. The capacity obtained by using by modified PCU method is 5230 pcu/hr which is higher than capacity obtained by dynamic PCU method is 4840 pcu/hr.

Recommendation, limitations and future scope:

a. Higher estimation of capacity is better than underestimation for planning, operation and analysis of highway. So, use the modified dynamic method for estimation of PCU values of different vehicles types under heterogeneous traffic conditions.

b. Study was conducted under relatively lower to medium traffic flow level and no evidence is presented about PCUs under higher to maximum traffic flow level field conditions.

The methodology adopted in this study will be extended for development of comprehensive PCU model by including more numbers of influencing factors under varying traffic and roadway conditions.

Pooja Raj, Shabana A. had aimed to estimate PCU values using effective area approach by considering the influence of neighboring vehicles on divided and undivided urban midblock sections under mixed traffic. Data were collected on a four-lane divided road section and two-lane undivided road section located in two Indian cities for six hours using video-graphic technique. For each vehicle type, PCUs were calculated using effective area and mean speed for six different cases considering neighboring vehicles. A single PCU value was obtained by calculating the weighted average of PCUs for each type of vehicle for all these cases. The variation of PCU values with respect to traffic flow and facility types were studied for both the study sections. Estimated PCU values of different vehicle types were validated with existing methods for mixed traffic conditions and capacities for both divided and undivided road were calculated using estimated PCU values. Based on the analysis, some key conclusions arising out of this study are as follows:

a. For all types of vehicles in both the study sections, case 6 has the largest effective area, respectively. This is because when the subject vehicle is surrounded by more neighboring vehicles, the entire effective area has to be considered which may be large;

b. For both locations, HCV (3.19-4.57) has the highest PCU value followed by LCV (1.71-1.88). Two wheelers (0.22-0.31) have the lowest PCU value;

c. PCU values for all types of vehicles were higher for two-lane undivided road compared to four-lane divided road due to the influence of opposing vehicles;

d. The speed ratio decreases and the area ratio increases with increase in traffic flow. Hence, the PCU values decreases as the traffic flow increases;

e. PCU values obtained by adopted methodology had a minimum percentage error of 4% in comparison with existing methods indicating that adopted method is better;

f. Capacity of four lane divided road and two lane undivided road was found to be 3588 PCU/hr and 4198 PCU/hr., respectively and were found to be higher than the values given in IRC: 106-1990.

In this study, only one two-lane undivided road and one 4-lane divided road were considered. However, different road sections have different traffic composition, traffic volume; geometric features like road width, etc. and thus, PCU values and traffic flow characteristics depend on these factors. This study has focused only on influence of speed of subject vehicle on its PCU values. A subject vehicle will not be fully influenced by surrounding vehicles if they are far apart. Hence, the future scope of this study is to consider speeds of neighboring vehicles and time headway between subject and surrounding vehicles for estimation of PCU values. Furthermore, using the effective area approach, influence of road width, side frictions and pedestrian movements on PCU values can also be studied. The same methodology can be also adopted for estimating MCU values.

Table no. 5 Six Cases and Corresponding Equations for Estimation of Effective Area 277 of Subject Vehicle

Sl.	Cases	Equation	Representation of each term in the equation
1	Only subject vehicle	$A_k = l_k \times w_k$	A_k = Effective area of subject vehicle type k (m^2) l_k = Length of the subject vehicle (m) w_k = Width of the subject vehicle (m)
2	Subject vehicle - one adjacent vehicle	$A_k = l_k \times W_k$	A_k = Effective area of subject vehicle type k (m^2) l_k = Length of the subject vehicle (m) W_k = Effective lateral distance of subject vehicle (m)
3	Subject vehicle - two adjacent vehicles		
4	Subject vehicle - leader vehicle	$A_k = L_k \times w_k$	A_k = Effective area of subject vehicle type k (m^2) L_k = Effective longitudinal distance of subject vehicle (m) w_k = Width of the subject vehicle (m)
5	Subject vehicle - leader - one adjacent vehicle	$A_k = L_k \times W_k$	A_k = Effective area of subject vehicle type k (m^2) L_k = Effective longitudinal distance of subject vehicle (m) W_k = Effective lateral distance of subject vehicle (m)
6	Subject vehicle - leader - two adjacent vehicles		

3. Concept of PCU values

The PCU value of a particular vehicle class may not remain a constant value as generally assumed. The PCU value of a vehicle class is found to vary depending on several factors such as the proportion of different vehicle classes in the stream, roadway geometrics, stream speed, etc. the PCU value of the vehicle class is found to be different on mid-block stretches, signalized intersections and other types of intersections. Therefore the PCU of a particular vehicle class is a dynamic variable value and seldom remains constant value.

3.1 Estimation of PCU on Midblock Sections:

Several methods were used for estimating PCU values on midblock sections in both homogeneous and mixed traffic conditions. Midblock sections can be classified into urban midblock (divided and undivided arterials, sub arterials, etc.) and nonurban midblock (divided and undivided highways, freeways, expressways, etc.). The various methods used for the estimation of PCUs for these facility types under homogeneous and mixed traffic conditions are discussed in this section.

3.1.1 Speed Modeling

In mixed traffic conditions, Chandra presented the new concept using speed as a primary variable to determine the PCU of vehicles on urban midblock

$$PCU = (Vc/Vi)/\ (Ac/Ai) \tag{1}$$

Where,

Vc and Vi = mean speeds of car and vehicle type i, respectively; and

Ac and Ai = their respective projected rectangular areas on the road.

3.1.2 Headway Method

Patil and Adavi (2015) estimated PCUs for urban midblock in Pune, India, using the following equation:

$$Ft = tc/tv \tag{2}$$

Where,

Ft = PCU factor for time headway of vehicle class v; and

tc and tv = mean lower time headway of cars and vehicle class v, respectively.

3.1.3 Space Occupancy Method

Paul and Sarkar (2013) have done a case study on urban arterial roads of Delhi City, India, where PCU was estimated considering speed and influence area as parameters. They modified Chandra's speed–projected area ratio method as shown in the following equation for estimating PCUs. The adopted formula for determining PCU is given by

$$PCUk = (Vcar\ /Vk)\ /\ (Acar/\ Ak) \tag{3}$$

Where,

PCUk = PCU of vehicle type k;

Vcar and Vk = mean speeds of passenger car (small car) and vehicle type k, respectively (m=s); and

Acar and Ak = effective area of passenger car and vehicle type k, respectively (m^2)

3.1.4 Multiple Linear Regression

Method Regression analysis method is used in many studies to derive PCUs. Minh and Sano (2003) obtained the following equation for estimating PCE:

$$S= FFS + a1PC +a2BUS+a3MC +a4HV \tag{4}$$

Where,

S = average traffic stream speed;

FFS = free flow speed;

PC = number of passenger cars in traffic stream;

BUS = number of buses in traffic stream;

MC = number of motorcycles in the traffic stream;

HV = number of heavy vehicles in the traffic stream; and

a1, a2, a3, a4 = marginal effect of respective mode on average traffic stream speed

Based on the estimation of the above coefficients from Eq. (4), Adnan (2014) derived PCE factors for different types of vehicles on urban arterials by taking the ratio of coefficients obtained for each vehicle type (air) with the coefficient obtained for reference vehicle, i.e., passenger car (a1) using the following equation:

PCE = air/a1 (5)

An attempt was made by Basu et al. (2006) to model stream speed as a function of dynamic control variables like traffic volume and its composition for estimating PCU values. The speed model was used to study the variation of PCE with base volume and composition. The effect of traffic volume and its composition on PCU of different vehicle types in a mixed traffic stream was investigated taking an urban divided midblock section as the case study. Patel et al. (2016) determined dynamic PCU values by expressing the speed-flow relationship in the form of multiple regression equation taking the speed of cars as the dependent variable and volume of different vehicle categories as the independent variables. The ratio of the regression coefficients of different vehicle categories to the regression coefficient of the car gives an estimate of PCU factors. The speed of car was regressed against the volumes of different vehicle types as follows:

V1 = A0 + A1Q1 + A2Q2 + A3Q3 + ⋯ + AnQn (6)

Where,

V1 = speed of cars;

Q1 = flow of cars; Q2; Q3; …

Qn = flow of vehicle type 2; 3... n;

A1; A2… An = regression coefficients; and A0 = constant.

Dynamic PCU of vehicle type n is given by

DPCU = An/A1 (7)

3.1.5 Modified approach of estimation of passenger car unit (PCU)

PCU of a vehicle type depends on vehicular characteristics, stream characteristics, roadway characteristics, environmental factors, climate conditions and control conditions (Anand et al.1999). The factors considered in present study are mean speed, mean time headway and mean rectangular projected area of vehicle types. Present study estimates the PCU value of subject vehicle types by taking the product of speed factor, headway factor and area factor. The factors calculation and development of PCU equation is discussed in detail in the following paragraphs.

a. Speed factor (Fv)

Time spent by the vehicle in the traffic stream will decrease by increase in mean speed of vehicle. When other factors remain constant, PCU is inversely proportional to mean speed of vehicle. Speed factor is ratio of mean speed of standard car (Vc) to mean speed of subject vehicle type (Vi).

$$Fv = Vc \div Vi$$

Where,

Fv = speed factor of subject vehicle type,
Vc = mean speed of standard car,
Vi = mean speed of subject vehicle type.

b. Headway factor (Ft)

Moving space available for vehicle in traffic stream is increases with the increase in the meantime headway maintained by the vehicle. Hence, PCU is directly proportional to mean time headway. Headway factor based on the mean time headway of different vehicle type is calculated by dividing the mean lower time headway of subject vehicle type (Ti) by the mean lower time headway of standard car (Tc).

$$Ft = Ti \div Tc$$

Where,

Ft = Headway factor of subject vehicle type,
Tc = mean lower time headway of standard car,
Ti = mean lower time headway of subject vehicle type.

c. Area factor (Fa)

PCU of a vehicle type depends on vehicular dimensions. PCU is inversely proportional to area of vehicle. Area factor is the ratio of rectangular projected area of standard car (Ac) to the area of subject vehicle type (Ai).

$$Fa = Ai \div Ac$$

Where,

Fa = Headway factor of subject vehicle type
Ac = rectangular projected area of standard car
Ai = rectangular projected area of subject vehicle type

d. PCU of subject vehicle type

PCU value of subject vehicle is calculated by product of speed factor, headway factor and area Factor of corresponding subject vehicle.

$$PCUi = Fv.\ Ft.\ Fa \qquad (8)$$

Where,

PCUi = PCU value of subject vehicle type,
Fv = Speed factor of subject vehicle type,
Ft = Headway factor of subject vehicle type,
Fa = Area factor of subject vehicle type.

3.2 Objective

1. To estimate the passenger car unit (PCU) value of bridge under study.
2. To compare the PCU value with IRC 106-1990.

3. To study the influence of traffic volume, traffic composition & road width on PCU values.

4. Methodology

Table no. 6 Study flow diagram

5. Outcome and Results

To estimate the passenger car unit (PCU) value, the technique included various tools, such as the performance of various traffic studies such as site selection, preliminary survey, traffic volume study, spot speed study and data analysis, measurements and recommendations.

1. **Site selection:**
   Site selected for study purpose is at Sion-Panvel Expressway, Vashi flyover, Vashi Navi Mumbai. Various site has been studied and by considering the different parameters required for the study site is been selected.

Figure no. 2 Sion Panvel Expressway, Vashi Flyover, Vashi Navi Mumbai

2. **Traffic Volume Study:**
   Traffic volume studies are conducted to determine the number, movements, and classifications of roadway vehicles at a given location. Traffic volume is been determine by manual counting from data collected i.e. video recording at different hours (Peak hour, Moderate hour, Non peak hour) on 28th September,2019

Table no. 7 Traffic Volume below and on bridge

Type Of Vehicles	Below Bridge			On Bridge		
	Peak Hour	Moderate Hour	Non Peak Hour	Peak Hour	Moderate Hour	Non Peak Hour
Two Wheeler	443	314	510	582	467	564
Three Wheeler	121	192	235	153	154	162

Small Car	727	696	936	1468	1177	1254
Big Car	212	154	198	316	310	443
Tempo	26	24	30	272	220	445
Bus	128	56	106	54	35	28
Truck	38	13	20	84	163	250
Heavy Vehicles	0	0	0	16	0	52

3. Projected Area Determination:

For calculation of PCU standard dimensions of classified vehicles are required i.e. projected area and length of vehicle. After taking areas and width of various available models of specific vehicle average values are given in the table below.

Table no. 8 Projected Area and Average width

Type Of Vehicle	Projected Area (Sq. Mt)	Average Width (Mt)
Two Wheeler	2.09	1.43
Three Wheeler	4.16	2.195
Small Car	6.12	1.648
Big Car	7.99	1.774
LCV	6.48	1.60
HCV	15.41	2.6775
Bus	13.266	1.80

4. Speed Determination:

For calculating the speed of various specified vehicle manual method was adopted. For which two points A & B were selected at a distance of 40M such that vehicles coming from on bridge and below bridge are visible clearly.

Table no. 9 Average Speed and time taken by vehicles

Type Of Vehicle	Speed (Mph)			Time Taken (Sec)		
	Peak Hours	Moderate Hours	Non-Peak Hours	Peak Hours	Moderate Hours	Non-Peak Hours
Two Wheeler	14.21	14.84	18.39	1.46	1.39	1.12

Three Wheeler	15.29	13.19	19.72	1.4	1.62	1.07
Small Car	12.84	13.23	14.65	1.59	1.57	1.41
Big Car	14.99	14.03	18.04	1.4	1.54	1.41
LCV	8.16	13.14	10.23	2.49	2.27	1.99
HCV	11.07	8.0	10.54	1.93	2.5	1.9
Bus	7.56	8.21	9.28	2.69	2.47	2.21

5. **Result:**

PCU Estimated

By using the collected data of traffic engineering i.e. the speed and volume of various specified vehicles we have calculated PCU values by using two methods namely modified factor method and space occupancy method

Table no. 10 PCU values by Space Occupancy Method and Modified Factor Method

PCU Factors				
Type Of Vehicle	**Below Bridge**		**On Bridge**	
	Space Occupancy Method	**Modified Factor Method**	**Space Occupancy Method**	**Modified Factor Method**
Two Wheeler	0.20	0.13	0.171	0.13
Three Wheeler	0.58	0.524	0.56	0.47
Small Car	1.0	1.0	1.0	1.0
Big Car	1.13	1.003	1.14	1.02
LCV	1.62	2.46	1.06	0.77
HCV	1.97	4.96	3.03	3.6
Bus	3.55	5.76	2.55	2.94

6. Comparative Analysis

The above values obtained needs to be compared with some standard values given by standard agency. For which IRC 106:1990 can be used.

Table no. 11 PCU Values Recommend by the IRCC 106:1990

Sr No	Type Of Vehicle	PCU Factors	
		Percentage Composition Of Vehicle Type In Traffic Stream	
	Vehicle	**5%**	**10% And Above**
1	Motor Cycle And Scooter	0.5	0.75
2	Passenger Car, Pick-Up Van	1.0	1.0
3	Auto-Rickshaw	1.2	2.0
4	Light Commercial Vehicle	1.4	2.0
5	Truck Or Bus	2.2	3.7
6	Agricultural Tractor-Trailer	4.0	5.0

The values obtained were compared with the values given in **IRC 106:1990** but difference were found in the values when compared to determined values also the vehicular classification of the code was not precise. So we compared our values with actual calculated PCU factors of year 2017 which was calculated by an agency and article published by **ARCHIVES OF TRANSPORT.** We used this paper because IRC haven't published any recent PCU values. After comparing we found that PCU factors changes with time due to changes in vehicular, roadway and traffic characteristics

7. Conclusion

PCU value may differ due to change in roadway, vehicular and traffic conditions. In India, the urban roads faces wide variety of mixed traffic and disparity in their sizes, speed and technology. Due to this the use of static PCU values is difficult. Followings are the conclusion made after study:

1) PCU values obtained by space occupancy method are more realistic as compared to modified factor method.
2) For LCV and HCV there is a large difference in the values over the bridge and below the bridge, approximately gets device by 35percent.
3) PCU values changes w.r.t time and traffic capacity as well as vehicular characteristics.
4) PCU values over bridge are less than the values below bridge. The difference is approximately 20 to 40 percent.

Hence it becomes necessary to revise these PCU factors with time because of change in vehicular, roadway and traffic characteristics. Because these are the important factors which affects the PCU factors.

8. Scope

- Fundamental diagram of traffic can be plotted which can help to predict the capacities of bridge road on and below respectively and its behavior when applying inflow regulation or speed limits.
- Comparison study can be carried out with other bridges around in order to overcome the defects, faults by repair works or improve the condition of road accordingly by redesigning for the same.
- VISSIM model can be used as a tool to stimulate transportation condition by comparative study of existing and proposed condition.
- Also driver characteristic should be taken into consideration for estimation of PCU in future.

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