Critical Assessment of Road Capacities and Solutions for Traffic Problems – A Belagavi Case-Study

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Abstract – *Road capacity in general refers to the maximum traffic flow obtainable on a given roadway using all available lanes, usually expressed in vehicles per hour or vehicles per day. This depends upon several factors, mainly traffic conditions, road geometry characteristics, environmental factors etc. The present study is a critical assessment of road capacities of various roads at Kittur Rani Chennamma circle that is one of the major intersections in Belgaum city, Karanataka. It connects the major industrial and educational areas of the city. Field traffic surveys were carried out to capture the classified volume count for all the roads through video graphic techniques. Based on the collected data, the existing traffic volume per lane was ascertained during peak morning and evening hours. This has been compared with maximum Road capacity values specified as per IRC 106-1990 for urban roads to critically analyze the existing capacity potential of all the roads at Kittur Rani Chennamma Circle. Based on our study, it was observed that volume per lane for the roads are way beyond the capacity. However, interestingly, no major congestion issues were found in these roads. This study focuses on reducing travel time delays and for easy flow of vehicles through this intersection thereby leading for the Improvement in Belgaum's living and working condition.*

*Key Words***:** Road capacity, Traffic survey, traffic volume

1. INTRODUCTION

Now a day's transportation is one of the most burning issues in every territory of the world. Every country is approaching differently according to their needs and solving their transportation problems with their capabilities. For planning, designing and operation of transportation system the first and foremost requirement is volume. Volume is simply the number of vehicles passing a section of a roadway. Expressing traffic volume as number of vehicles passing a given section of road or traffic lane per unit time will be inappropriate when several types of vehicles with widely varying static and dynamic characteristics are comprised in the traffic. The problem of measuring volume of such heterogeneous traffic has been addressed by converting the different types of vehicles into equivalent

passenger cars and expressing the volume in terms of Passenger Car Unit (PCU) per hour. The interaction between moving vehicles under such heterogeneous traffic condition is highly complex. Again volume is not constant. It increases with time. So a continuous method of calculating volume is a matter of great importance for smooth functioning of transportation system. If volume data is not found on a continuous basis then the transportation system may fail and the economy of the country may face a great difficulty. The code specifies Design Service Volumes, i.e., the maximum hourly volume at which the vehicle can traverse through a point, or a certain distance under the prevailing conditions at a reasonable level of service. During design of roads, keeping in mind the need for easy vehicle movement, a design service volume pertaining to Level of Service (LOS) has been considered. Capacity values for different categories of urban roads (arterial, sub-arterial and collector roads) as prescribed by IRC 106:1990 has been specified below.

1.1 Objectives of the Analysis

The basic objectives of study include the following:

- To conduct Volume studies for all the roads at the intersection.
- To provide an appropriate data analysis and efficient control strategy for the existing traffic conditions.
- To compare the observed volumes with the capacity values given in IRC 106:1990 and evaluate the Level of Service.
- Exploring the possible causes and reasons to attribute the gap between observed volumes and standard capacities.
- Develop a transportation system that respects and enhances the natural and built environment.

1.2 Study of existing traffic condition

Traffic congestion is a condition on transport network that occurs as use increases, and is characterized by slower speeds, longer trip time, increased vehicular queuing. In present condition due to large number of vehicles results in the following problems:

- Heavy traffic and therefore causing congestion at the intersection travel time.
- More number of accidents at junctions.
- Inconvenience to pedestrians and cyclists to cross roads.
- Disturbance to traffic flow during rallies and protests.
- Delay for movement of ambulance.

2. Data Processing

For the study, 4 hour traffic counts were performed for several roads at morning and evening peak hours. For analysis purpose, the traffic volume was converted into equivalent passenger car units (PCU's) by using equivalency factors as specified by IRC 106:1990

1. Reasons for increased road capacity

This traffic volume is then expressed as PCU's per hour. IRC recommends conversion of different types of traffic into a common unit called Passenger Car Units (PCU) or Passenger Car Equivalents (PCE). Passenger car is considered as the base unit and every other mode is expressed in a multiple of a passenger car unit. PCU values reflect the level of interference the vehicle can cause to the traffic flow. This has been specified below.

1. Technology:

   There has been a change in the vehicle technology over the last decade. The engine, acceleration, speeds, brake, safety features, etc have manifested in a marked increase in mobility of vehicles. The new features such as satellite navigation, congestion / traffic indicators, FM radio traffic broadcasts are further helping in faster dispersal of traffic.

2. Better Roads

   Since 1990, the roads in India have undergone a sea of change. The quality of roads have increased manifold in the last two decades resulting in better ridership and faster vehicle speeds. Many junctions have been replaced by flyovers making the ride faster.

   As major traffic flow was observed between Ambedkar Road and College road, these two roads are selected for further study. The capacity, V/C ratios and the Level of service for these roads is as below

3. Familiarity of Roads

   Most of the ridership population comprises of work and education based traffic in the morning and home based return trips in the evening. Thus, familiarity of roads plays an important part in determining the capacity of roads as more familiar roads would mean higher speeds, lesser waiting time and better dispersion rate.

4. Urban traffic characteristics:

   Cars, Two wheelers and three wheelers contribute about 80% of traffic in urban roads. This makes a marked difference in vehicle movement as traffic dispersion would be faster as compared to roads with a higher percentage of heavy vehicles. In the past two decades, roads in India have witnessed a sea change in modal split characteristics. Bullock carts, animal drawn vehicles and hand carts completely out of the picture and instead fast moving two wheelers and cars have increased their share. Therefore, this increased percentage of light vehicles is an important criterion in increasing the road capacity in urban areas.

2. Way forward

As the required LOS was not achieved for the Existing Road the solutions can be adopted by Updating Urban Road capacities in order to bridge this gap between predicated capacities and observed volumes. The need of the hour is to revise the Road capacity values as in IRC 106:1990.

Also addition of extra Lanes, construction of overpass and underpass at the junction, Improvement of the intersection by diverting the major traffic flow through alternative routes. Encouraging people to use mass or public transport system, Introducing ring roads outside the city for heavy vehicles

3. Use of Overpass at the Junction:

Even though addition of extra lanes does not result in required LOS, therefore considering construction og Overpass for reducing congestion
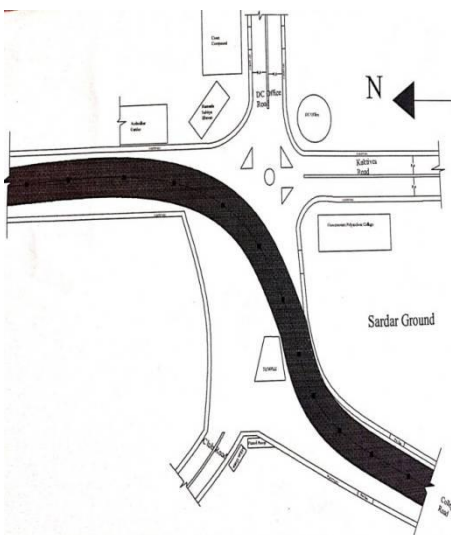

Fig. 3 Plan of intersection with Overpass

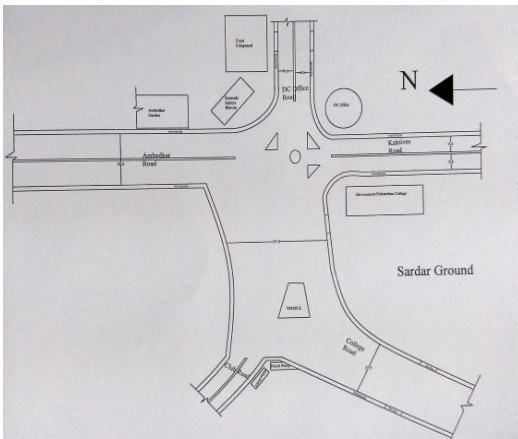## 4. Addition of Extra Lanes

Fig. 2 Plan of intersection with addition of extra lanes

5. Conclusions

A comparative study was performed for the maximum Road capacity values specified as per IRC 106-1990 to the practical capacity value on-site for urban roads to critically analyze the existing capacity potential of major roads. It was observed that volume per lane for several roads are way beyond the IRC prescribed capacities. However, interestingly, no major congestion issues were found in these roads notwithstanding the excessive volume. Some of the reasons – which could be attributed to this increased capacity, are: Technology, Better Roads, Familiarity of Roads, Urban traffic characteristics.

6. References

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Table-1 Design Service Volume (Source IRC 106:1990)

Sr No	Type of Carriageway	Arterial	Sub-Arterial	Collector
1	2-lane(One way)	2400	1900	1400
2	2-lane(Two way)	1500	1200	900
3	3-lane(One way)	3600	2900	2200
4	4-lane Undivided(Two way)	3000	2400	1800
5	4-lane divided(Two way)	3600	2900	-

6	6-lane Undivided(Two way)	4800	3800	-
7	6-lane divided(Two way)	5400	4300	-
8	8-lane divided(Two way)	7200	-	-

Table-2 Passenger Car Units (PCU)

Type of Vehicle	PCU Values
2-Wheeler	0.5
3-wheeler	1
Car	1
Light Truck	1.5
Heavy Truck	3
Bus	3
Others	6

Table-3 Peak hour volumes for selected roads

Ambedkar and College Road	6630
Ambedkar and DC Office	3074.5
Ambedkar and Kaktives Road	858
DC Office and College Road	2787.5
DC Office and Kaktives Road	330
DC Office and Ambedkar	3417
Kaktives and Ambedkar Road	857
Kaktives and College Road	860
Kaktives and DC Office Road	1421
College Road and Kaktives	1222.5
College Road and DC Office	6291
College and Ambedkar	6745

Table-4 V/C Ratios for existing Road (source:IRC 106-1990)

Direction	Volume (PCU/Hour)	Design service volume	V/C ratio	LOS
Ambedkar road to College road(2 lanes)	1805	1200	1.5	**F**
College road to Ambedkar road	2009	1200	1.6	**F**