Comprehensive Transport Planning for Belgaum Central Bus Stand Area

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***Abstract*-- Belgaum has developed very quickly in recent times, especially since 2000. As the city economy has grown, many new buildings and factories have been constructed, and working and living conditions for people in the city have gradually improved. However, the growth of Belgaum's population is now causing a number of serious problems, including traffic congestion, Accident rate. The study area which has been chosen is Central Bus stand Belgaum which acts as Central Business District (CBD) for Belgaum city that is totally congested due to various factors and traffic. There is no easy movement for buses and pedestrians. Because of the heavy congestion on roads approaching bus stand, the pedestrians are facing problems to cross the road. Also due to improper road conditions, are leading to accidents. This study focuses on reducing these problems and to continue the Improvements in Belgaum's living and working condition.**

Keywords*: *Central Business District (CBD), Pedestrian survey, Traffic surveys and Improvement strategies and suggestions.

I. INTRODUCTION

Present study towards the comprehensive transport planning for a central business district (CBD) area has been chosen in and around Belgaum KSRTC bus stand and City bus stand. It is observed from the visual observations, that there are problems associated with smooth traffic operation due to various reasons.

The pedestrian movement for crossing the road connecting Market circle to Khadebazarcircle and commute between KSRTC and City bus stand is concentrated at the main entrance of KSRTC bus stand. This pedestrian volume and higher vehicular volume has lead to conflict between pedestrian and vehicles which have resulted in terms of accidents. In view of this, it is necessary to remove the conflict and stream line the flow of traffic along the bus stand road and also ease out congestion and conflicts at KSRTC bus stand entrance location.

II. OBJECTIVES

- Identification of study area location in terms of network of roads and past study details
- Conducting necessary field studies such as Road inventory, Area inventory, and Traffic studies along the study area.
- Collection of relevant secondary data required for estimation and projection of traffic.
- Analysis of data to ascertain traffic characteristics and roadway details.
- Development of strategies to minimize the conflicts and reduce accidents.

III. LIMITATIONS

A detailed pedestrian surveys and vehicle surveys are carried out at the location only on the working day in the middle of the week. Most of the available footpaths are fully occupied by the small merchants and shop keepers. . In this survey the count is taken manually, during morning and evening peak hours especially when traffic moment is too high.

IV. SCOPE

To conduct comprehensive study for the surrounding area and to develop complete transport demand model for the area. This could be a major study that can be carried out by local government.

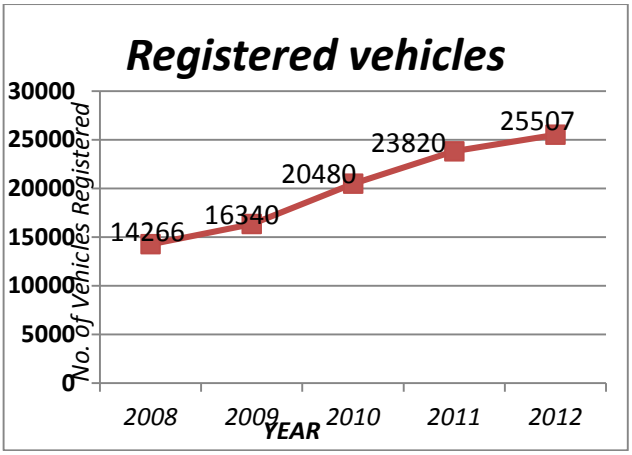
V. STUDY OF PRESENT CONDITIONS IN BELGAUM CITY

A General

Belgaum (also known as Belagavi) is the headquarters city of Belgaum district and is one of the oldest urban centers of Karnataka, lying at a distance of around 502 km from Bangalore and around 500 km from Mumbai. The city area is planned and regulated by the Belgaum Urban Development Authority (BUDA). The Belgaum Municipal Corporation (BMC) is the city administrator, which comprises 58 wards under its jurisdiction with an urban population of about 488,292 (Census 2011).

B Growth Rate of Vehicles

The study area lies within the Belgaum City and also central business district place for Belgaum which is greatly influenced by City traffic. Belgaum city has a large number of two wheelers among the fast moving vehicles and Bicycles account the major share of slow moving vehicles. The figure 1 below represents the growth rate for vehicles registration for Belgaum City in last 5 years (Fig.1).



C *Existing Condition of Location*

The pedestrian movement for crossing the road is concentrated at the main entrance of KSRTC bus stand. This pedestrian volume and higher vehicular volume has lead to conflict between pedestrian and vehicles which have resulted in terms of accidents. The figure 2 and 3indicates some following points:

- High traffic flow
- Considerable pedestrian delay
- Pedestrian facing problems to cross the road
- Formation of conflicts due to restricted access to roadway
- Due to improper road conditions, Entry and Exit of Buses have leading to accidents

Fig 2.High traffic flow at KSRTC Entrance

Fig 3.Pedestrian facing problems to cross road

VI. DATA COLLECTION:

For the purpose of preparing a comprehensive transport planning, detailed data collection are required to analyze the traffic characteristics at the study area, for this survey data has been collected by conducting various surveys like Inventory survey, Traffic surveys, Pedestrian surveys for 12 hours and Bus entry and exit surveys at KSRTC and City bus stands for 24 hours.

The relevant secondary data like accident data, growth rate of Belgaum city are collected. Summary of Present traffic volume at intersections, Mid block, Pedestrian volume, KSRTC bus entry in 15 min and in one hour and for 24 hour. The table 1 gives details of survey conducted.

TABLE I. LIST OF TRAFFIC SURVEYS

Sl. No	Survey	No. Of Locations	Location details
1	Classified traffic volume counts at mid blocks	1 (12 Hours)	1.Bus Stand Road
2	Classified turning movement counts at junctions	2 (12 Hours)	1. Market Circle 2. Khadebazar Circle
3	Pedestrian counts	3 (12 Hours)	1. Main Gate of KSRTC Bus stand 2. Back Gate of KSRTC Bus stand 3. alternate ways

A *Mid Block Count Details*

The average daily traffic volumes observed on the Bus stand road is 12,379 PCU (13744 vehicles). Details are presented in Table 2.

TABLE II.DETAILS OF MID BLOCK COUNT SURVEY

Category	Vehicle type	Vehicle count
Passenger Vehicles	KSRTC Bus	1208
	CITY Bus	965
	Mini Bus	60
	Pvt. Bus	13
	Car/ Jeep/ Van	503
	Two Wheelers	7704
	Auto Rickshaws	2037
	Auto Rickshaws (goods)	162
Commercial Vehicles	LCV (4-Tyres)	21
	Tractors	1
	Two Axle Truck	0
	Three Axle Truck	0
Slow moving Vehicles	Cycles	1051
	Carts	19
Total Vehicles		13,744
Total PCU's		12,379

B *Traffic Composition*

Composition of daily traffic is presented in Figure 4. Out of the total traffic, 97% of traffic consists of passenger

vehicles. Share of two wheelers is the highest followed byauto rickshaws and cars.

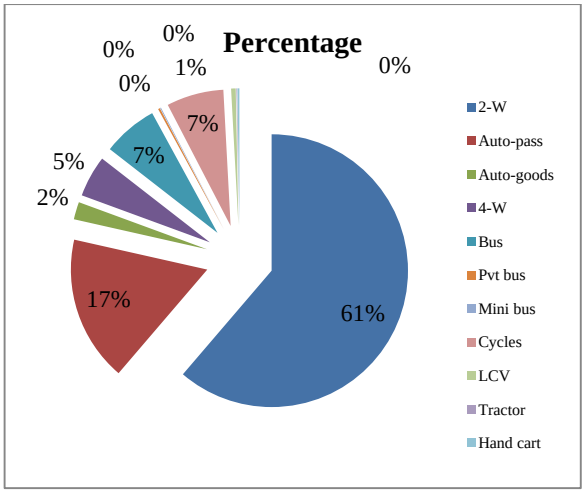


Fig 4. Traffic Composition – Bus Stand Road

C *Pedestrian Count Details*

There are three entries where the pedestrians are entering in to the KSRTC Bus stand. Pedestrian counts were carried out at all three locations to access the requirement of pedestrian facilities near KSRTC Bus stand. Peak Hour Summary is presented in Table 3.

TABLE III.SUMMARY OF PEAK HOUR PEDESTRIAN CROSSING

Sl. No	Location name	Peak hour	No. Of pedestrians movement
1	KSRTC Entrance	11.00–12.00	970
2	KSRTC Back Gate	1.00-2.00	775
3	Alternate way	1.00-2.00	670

D *Traffic Projection*

Based on the growth rates, the anticipated future traffic at the Intersection is estimated for next 15 years with the compound growth rate of 7.08% for Belgaum city traffic and given below in Table-4.

TABLE IV.PROJECTED PEAK HOUR TRAFFIC IN PCU FOR KSRTC BUS STAND INTERSECTION

Sl. No	Traffic movement	Year/PCU			
		2014 (Present)	2019	2024	2029
1	Market circle to Khadebazar circle	1162	1635	2301	3239
2	Khadebazar circle to Market circle	1278	1799	2532	3564
3	KSRTC Entry from Market circle	305	429	603	848
4	KSRTC Entry from Khadebazar circle	80	112	157	221
5	KSRTC Exit to Market circle				
		246	346	487	685
6	KSRTC Exit to Khadebazar circle	50	70	98	138
Total		3124	4398	6191	8715

VII. DATA ANALYSIS STUDIES:

The preliminary analysis of all the data collected has been further analyzed to ascertain the characteristics and to arrive at the decision regarding existence of the traffic operations at the location. The analysis has been carried out considering the variables such as vehicle arrival pattern, headways, gaps, speed, delay and volume. These data have been analysed using statistical techniques to check the goodness of fit.

VIII. IMPROVEMENT STRATEGIES:

A *Junction Improvements*

With reference to figure 5 and 6 the improvements suggested are:

- Providing road dividers along Market road and KSRTC bus stand road
- Providing a central island with properly designed geometric elements
- Providing zebra crossings with appropriate markings

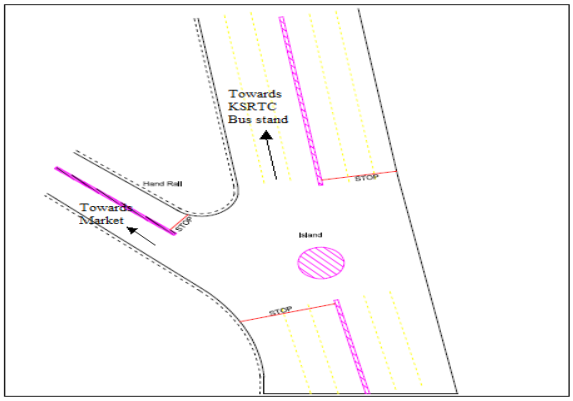


Fig 5. Market Junction with proper control devices

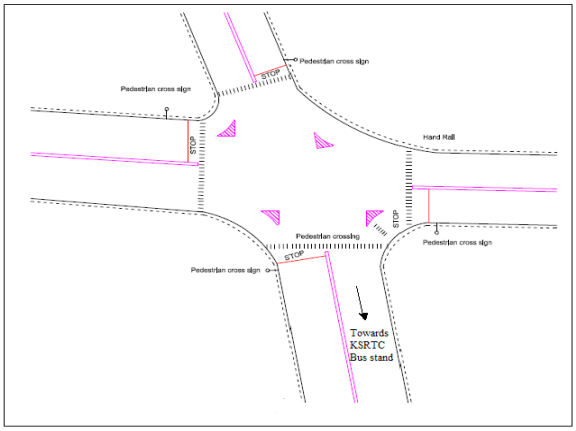


Fig 6.Khadebazar Junction with proper control devices

B Pedestrian Facilities[6]

With reference to the figure7, the pedestrian subway is proposed to achieve the pedestrian safety across the road linking between KSRTC and City Bus stands with consideration of IRC guidelines for controlled crossing.

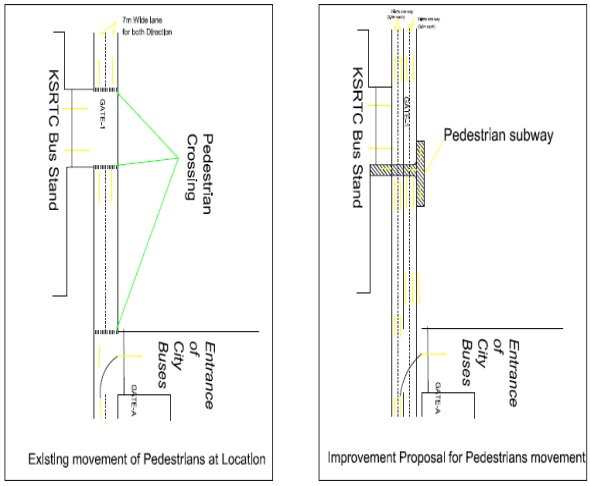


Fig 7. Proposal of pedestrian crossing at Intersection

C Level of Service

Referring to the Table 5 and Table 6, addition of lane to existing road the level of service has been improvised.

TABLE V.V/C RATIO FOR EXISTING ROAD

Direction	Volume (PCU/hr)	Design service volume	Volume/ capacity	LOS
Towards KSRTC bus stand	1162	1200	0.97	E
Towards City bus stand	1358	1200	1.13	F

TABLE VI.PROJECTED PEAK HOUR ADDING ONE LANE EACH SIDE OF BOTH KSRTC AND CITY BUS STAND [7]

Year	Direction	Towards KSRTC bus stand	Towards City bus stand
2014 (Addition of lanes)	Design service volume	2900	2900
	Volume	1162	1358
	V/C	0.4	0.46
	LOS	B	B
2019	Design service volume	2900	2900
	Volume	1635	1911
	V/C	0.56	0.65
	LOS	C	D
2024	Design service volume	2900	2900
	Volume	2301	2690
	V/C	0.79	0.9
	LOS	D	E
2029	Design service volume	2900	2900
	Volume	3239	3786
	V/C	1.1	1.3
	LOS	F	F

Adding lane on each side of KSRTC and City bus stand gives the average V/C value of 0.43 which reduces the traffic by 62% with Level of Service B.

IX. CONCLUSIONS:

- The prevailing chaos around KSRTC and City bus stand area Belgaum has been scientifically investigated for proper local area management for decongestion and proper movements of pedestrian
- The improvements suggested are junction improvement, proper pedestrian crossing, exit ramp at KSRTC bus stand and providing additional lanes though length of road.

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