CARPOOLING SYSTEM IN HYDERABAD CITY

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ABSTRACT

As is the trend worldwide, India is undergoing rapid urbanization. The increasing dependence on cars is resulting in expensive road building and maintenance, clogged and congested roads, high levels of energy consumption along with its economic and environmental costs, worsening air and noise pollution, traffic accidents and social inequities that arise when the poor find transportation services increasingly unaffordable. The most widely used mode of conveyance of public transport in Hyderabad is "buses". Thus, buses form a backbone of the transportation system in Hyderabad and serve about half of the travel demand while it constitutes less than 1 % of the total vehicle fleet of Hyderabad. It may be two-wheelers or four wheelers or even bicycles because of which the number of vehicles on the roads are increasing which is leading to further lowering of speed, congestion, increase in pollution level etc. Strategies to combat these problems would include reducing the emissions per vehicle kilometer traveled and the total number of kilometers traveled. Road congestion may be reduced using good public transport management, traffic management and car pools etc. In this paper, we have conducted a survey based on a structured questionnaire for carpooling and used the Green Shield model for the design and analysis.

Keywords: Carpooling, Congestion, Green Shield Model, Public Transport Management, Traffic Accidents, Urbanization.

I INTRODUCTION

Transportation contributes to the economic, industrial, social and cultural development of any country.

Road traffic has been growing at a very rapid rate in India. The investments on roads have not kept pace with the growth of traffic, leading to many problems like severe congestion, low speeds, high operation costs etc., One of the major problems associated with Indian traffic is its heterogeneous nature. The traffic on Indian roads, termed as mixed traffic consists of variety of modes, starting from human powered, bicycle to motorized multi-axle heavy commercial vehicles. These modes exhibit different physical and operational characteristics and the variety of situations that can result because of the interaction of these modes under the traffic stream analysis more complex.

1.1 Hyderabad Traffic Scenario

In Hyderabad, public transport such as buses, auto rickshaws and multi modal railways are the most frequently used transport by the residents. The composition of vehicles in Hyderabad are, 75% two-wheelers, 14% cars, 1% taxis, 4% goods vehicles, 2% buses (including 3,800 RTC buses) and 4% other vehicles (including 71,000

auto rickshaws). The city not only became an industrial center but also a major center for trade, commerce and culture. The municipal corporation of Hyderabad has major network of 295kms over which nearly 6 lakh vehicles per km with average speeds from 20 to 30 KMPH.To conserve fuel, decrease traffic congestion during rush hours and enhance the use of existing highways and parking facilities in Hyderabad, carpooling is required.

1.2 Car Pooling

Car Pooling (also known as ride-sharing and lift sharing), is the sharing of car journeys so that more than one person travels in a car. Pooling is also seen as a more environmentally friendly and sustainable way to travel as sharing journeys reduces carbon emissions, traffic congestion on the roads, and the need for parking spaces. Pooling aims at solving this problem by targeting the empty seats in the private cars. Employees of the same area or the students going to the same school can carpool. This can be done as the know each other and can communicate. But when going on an intercity trip you are not aware if some other person also intends to make the same journey. An overabundance of cars and two wheelers creates various problems which includes increased traffic, increase pollution, parking congestion.

1.3 Benefits of Car Pooling

1. Reduced travelling expenses and the need for second car.
2. Improved travel time through use of transit lanes.
3. Reductions in vehicle emissions.
4. Reduction in traffic volumes and congestion.
5. Provides an alternative, cost effective choice.

1.4 Green Shield Model

The macroscopic approach which develops algorithms that relate the flow to density and space mean speed. Green shield carried out one of the earliest recorded works in which he studied the relationship between speed and density. He hypothesized that a linear relationship exists between speed and density which he expressed as

$$\bar{U}s = Uf - \frac{Uf}{Kj} \times K$$

A linear regression line has an equation of the form Y= a + bx, where x is the explanatory variable and *Y* is the dependent variable.A scatter plot can be a helpful tool in determining the strength of the. Relationship between two variables.

1.5 Calibration of Green Shield's Model

To use this model for any traffic stream, one should get the boundary values, especially free flow speed (v_f) and jam density (k_j). This must be obtained by field survey and this is called calibration process. The dependent variable is considered as speed and independent variable is considered as density. Although it is difficult to determine exact free flow speed and jam density directly from the field, approximate values can be obtained from several speed and density observations and then fitting a linear equation between them. Let the linear

equation be y = a + bx such that x is density k and y denotes the speed v. Using linear regression method, coefficients a and b can be solved as,

a =$\bar{y}$-b$\bar{x}$

$$b = \frac{n\sum_{i=1}^{n} x_i y_i - \sum_{i=1}^{n} x_i . \sum_{i=1}^{n} y_i}{n.\sum_{i=1}^{n} x_i^2 - (\sum_{i=1}^{n} x_i)^2}$$

II STUDY AREA

2.1 Study Area Description

The present study is aimed mainly at the effect of pooling system on traffic flow and density. To obtain the volume and speed of individual modes under mixed traffic conditions with due considerations to the composition of traffic and geometries. As the work is focused on study of pooling techniques on both cars and two wheelers, the mid blocks selected where the composition of two wheelers is more and due to the heterogeneity of traffic different modes of traffic is also available. Hence the selection of survey locations should have a mixed traffic stream with a possibility of getting data for different compositions.

2.2 Location Details of Selected Mid Blocks

	
Fig:2.1.Shamshabad-Aramghar:In this section the road width is 7.50m. This mid-block is commercial area, it is under no parking zone and it is on national highway 44.	**Fig:2.2. Aramghar-OWAISI Hospital Cross Roads: In this section, the road width is 7.50m This mid-block is connecting Aramghar to LB Nagar cross roads, this is commercial**

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Fig:2.3. OWAISI Hospital X Road-SagarRing Road: This section is connecting Aramghar to LB Nagar cross roads the selected section road width is 7.50m. It is a commercial area and it is under no parking zone.

Fig:2.4. SagarRing Road-LB Nagar: This section is connecting kharmanghat with LB Nagar. The selected section road width is 7.50m It is a commercial area, it is under no parking zone.

Fig:2.5.LB Nagar X road: In this section the road width 7.50m It is commercial area.

III DATA COLLECTION

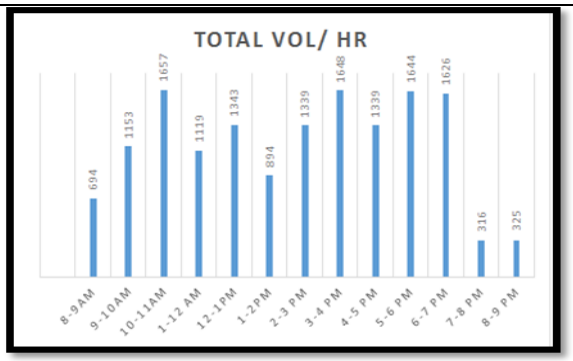

Table:3.1. Traffic flow at Shamshabad-Aramghar Midblock without pooling technique. From the above data, the peak hour occurs between 10-11am with 1657 total vehicles per hour, but maximum number of cars travel between 6-7 pm and two wheelers between 10-11am

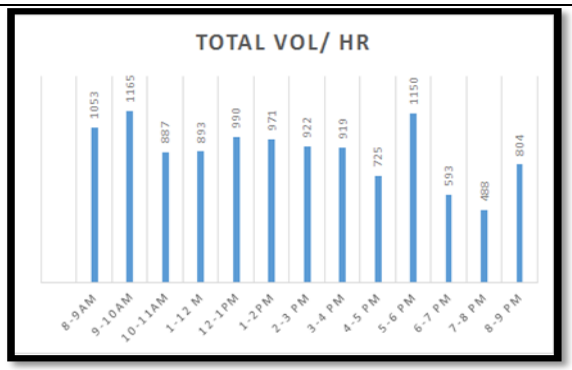

Table:3.2. Traffic flow at Aramghar-Owaisi Hospital crosses roads Midblock without pooling technique. From the above data, the peak hour occurs between 9-10am with 1165 total vehicles per hour and maximum number of cars travel between 9-10am and maximum number of two wheelers between 5-6 pm.

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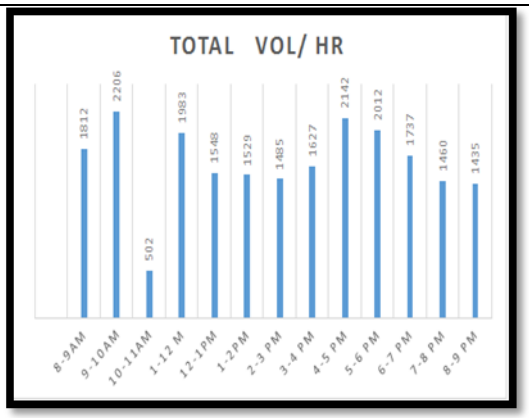

Table:3.3. Traffic flow at Owaisi Hospital cross roads-Sagar ring road Midblock without Carpooling technique. From the above data, the peak hour occurs between 9-10am with 2206 total vehicles per hour and maximum number of cars travel between 9-10am and maximum number of two wheelers between 4-5 pm.

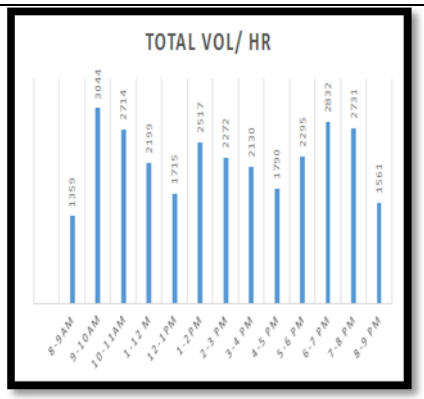

Table:3.4. Traffic flow at Sagar ring road-LB Nagar Midblock without Carpooling technique. From the above data, the peak hour occurs between 9-10am with 3044 total vehicles per hour and maximum number of cars travel between 9-10 am and maximum number of two wheelers between 9-10am.

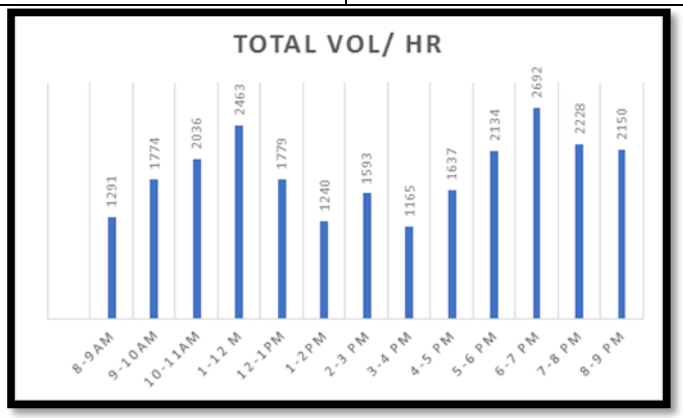

Table:3.5. Traffic flow at LB Nagar X Roads Midblock without Carpooling technique. From the above data, the peak hour occurs between 6-7 pm with 2692 total vehicles per hour and maximum number of cars travel between 6-7pm and maximum number of two wheelers between 11-12Pm

3.6 Speed Data

From the above table, it can be analyzed that maximum speed is during afternoon times and in morning times. During peak hours as the density increases the speed is reduced. Here the speed is measured in KMPH.

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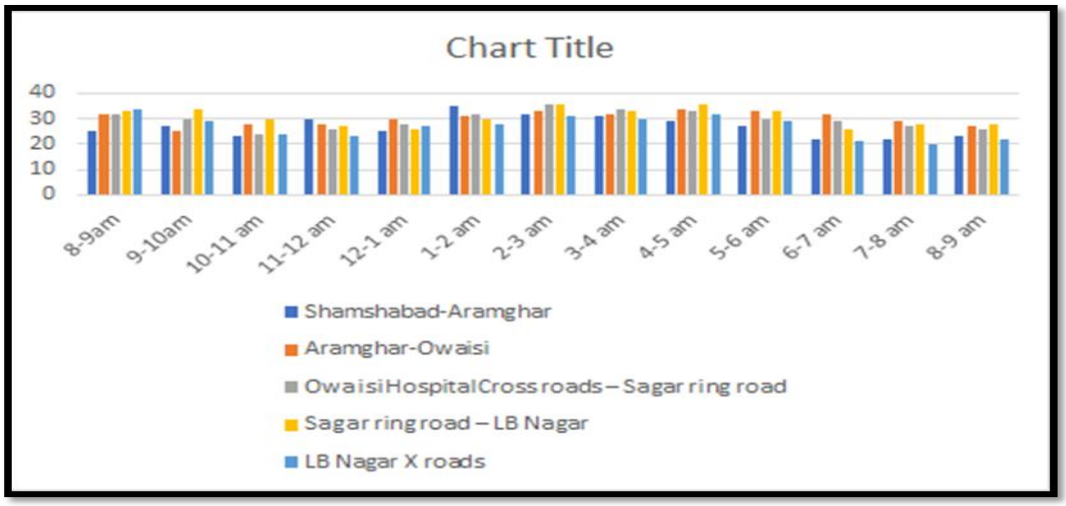
Table: 3.6. Speed Data at Various Mid Blocks at Different Times



IV ANALYSIS OF DATA

By standardising the number of cars i.e., to ride comfortably in a car normally four passengers can be seated. So, dividing the total number of cars by four, for the same number of passenger's optimum number of cars on road can be obtained. By standardising the number of bikes i.e., to ride comfortably on bike normally two passengers can be seated. So, dividing the total number of bikes by two, for the same number of passenger's optimum number of motorised two wheelers on road can be obtained.

Analyzing using Green Shield Equation is shown with an example:

$$\bar{U}s = Uf - \frac{Uf}{Kj} \times K$$

a = Uf = free flow speed

$$b = \frac{-Uf}{Kj}$$

$\bar{U}$S=space mean speed

$\bar{U}$S=a+bk$\bar{y}$=a+b$\bar{x}$

a=$\bar{y}$-b$\bar{x}$= 27 – 42 b

$$b = \frac{N\sum_{I=1}^{N} X_I Y_I - \sum_{I=1}^{N} X_I . \sum_{I=1}^{N} Y_I}{N.\sum_{I=1}^{N} X_I^2 - (\sum_{I=1}^{N} X_I)^2}$$

$$= \frac{13(14920)-(557)(351)}{13(28407)-(557)^2}$$

b = -0.02

a=$\bar{y}$-b$\bar{x}$= 27+0.02(42)

a =27.84

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a= uf = 27.84, $b = \frac{U_f}{K_j} = -0.02 = -\frac{27.84}{K_j}$

Kj= 1392veh/km

$$q_{max} = \frac{U_f \times K_j}{4} = 9688.32 veh/hr$$

$$\bar{U}s = Uf - \frac{Uf}{Kj} \times K$$

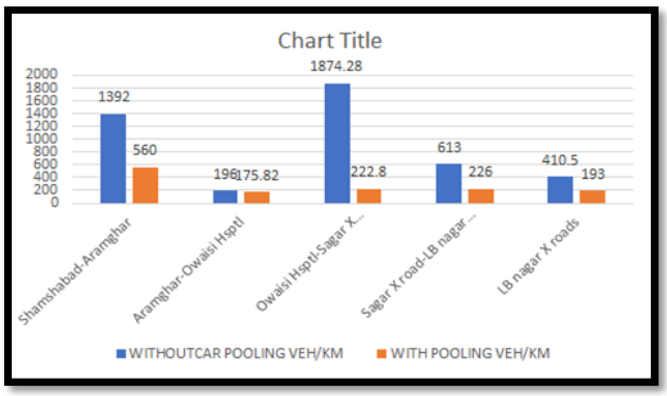
a= uf = free mean speed

Us=space mean speed

4.1 Density

The density had a rapid change when pooling has done. From the above chart, it clearly shows the variation that the density reduced to almost half after carpooling.

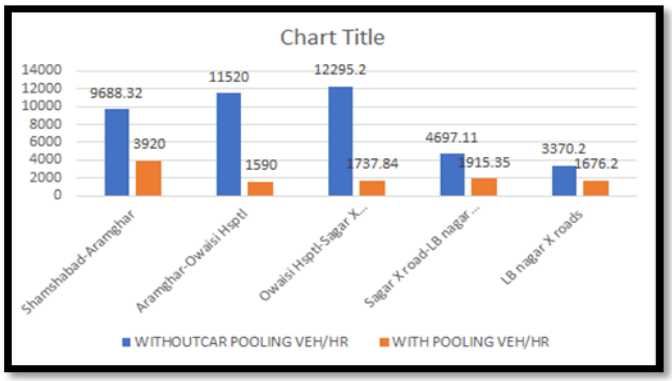
Table:4.1. chart shows the density of vehicles before carpooling and after carpooling



4.2 Flow

After carpooling the flow has reduced, this means the traffic jam in the mid blocks is reduced and this creates a more space for the vehicles for their smooth move. The speed of the vehicle also increased

Table:4.2. chart shows the density of vehicles before carpooling and after carpooling



V CONCLUSIONS

From the study, it is revealed that there is definite influence of pooling technique on traffic flow and density.

1. In Shamshabad – Aramghar midblock before and after pooling the maximum flow varies from9688.32 veh/hr to 3920veh/hr and jam density varies from 1392 veh/km to 560veh/km.
2. In Aramghar–Owaisi hospital midblock before and after pooling the maximum flow varies from 1152.48veh/hr to 1590.29veh/hr and jam density varies from -196 veh/km to 175 veh/km
3. In Owaisi hospital – Sagar ring road midblock before and after pooling the maximum flow varies from 12295.2 Veh/hr to 1737.84veh/hr and jam density varies from -1874.28veh/km to 222.8veh/km.
4. In Sagar ring road – LB Nagar midblock before and after pooling the maximum flow varies from 4697.11 veh/hr to 1915.35veh/hr and jam density varies from 613 veh/km to 226veh/km.
5. In LB Nagar X roads midblock before and after pooling the maximum flow varies from 3370.20 veh/hr to 1676.20veh/hr and jam density varies from 410.5 veh/km to 193veh/km.
6. Carpooling saves money and reduces congestion on our roads and highways. It also gives you the opportunity to develop new friendships with co-workers or other commuters. There are several benefits when two or more people share a ride in one vehicle.
7. Carpooling can save you and it reduces the costs involved in repetitive or long-distance driving.
8. It reduces the stress of your commute and allows you to read, relax, or even work while commuting.
9. Carpooling enables some families to cut back to one car or to do without a car at all.
10. If you don't have a car or don't drive, carpooling allows you to consider jobs throughout the area.
11. Carpooling can provide you with new friendships and company for your commute.
12. Carpooling reduces air pollution and traffic congestion, something that benefits all of us!
13. Carpooling helps to combat rising traffic congestion, by filling the extra seats in your car, there are fewer drivers, and therefore fewer cars crowding the roads.

Apart from all the benefits related to the traffic, the users have many economic advantages thanks to the sharing of costs which allows the individuals to retrench expenses. Carpooling will also generate revenue for all the intermediary actors and the tools described here will help finding the best business model that will leverage the revenue sharing depending on the considered context, such as the type and density of the regional area considered, the amount of traffic at peak hours, etc.

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