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A STUDY ON EFFECT OF METRO RAIL WORK ZONE ON TRAFFIC FLOW PARAMETERS IN URBAN AREA - A CASE STUDY OF CHANDKHEDA STRETCH IN AHMEDABAD CITY

Dhavalkumar D Chavda[1],Dr. N.G Raval[2]

[1]*M.E Student,Civil Engineering Department, Government Engineering College,Modasa*
[2]*Associate Professor, Civil Engineering Department, Government Engineering College, Modasa*

Abstract —*Metro rail project implementation includes way to the construction activities.In this process, long term construction work zones are inevitable. Long term work zones on urban roads lead to many problems such as reduction in space mean speed, reduction in traffic flow, increase in density, increase in delay etc. It becomes necessary to study and quantify the impact of Metro rail construction work zones on traffic flow parameters. The present research aims to study the impact of Metro rail construction work zones on traffic flow parameters and consequently quantify these impacts for present situation. Using videography techniques, space mean speed, flow and density are determined in work zone and non work zone conditions and compared. With such impacts, it becomes imperative to have traffic management techniques and systematic work zone scheduling so as to reduce the impacts of metro rail construction work zones. The present study will helpful for planning during implementation of Metro rail project or similar long term project to the urban authority.*

Keywords-*Work zone, Space mean speed, Flow,Density.*

I. INTRODUCTION

Due to the rapid growth of urban population and increasing vehicle count supplemented by increased use of private vehicles, congestion on urban roads has increased tremendously. In a developing country like India augmentation of road infrastructure and development of mass rapid rail systems are projected as the solution to address this problem. Implementation of these projects paves way to the construction activities and in this process long term construction work zones in urban areas are inevitable. Though these projects are aimed to decongest the roads but lack of proper planning and implementation norms for these long term urban work zones leads to many problems such as reduction in capacity, increase the travel time delays, queue length, fuel consumption, number of forced merges, and roadway accidents which lead to unaccounted economic losses. So as a first step it becomes necessary to study and quantify the impact of a mass rapid transit system construction work zones on traffic flow parameters.

Indian Roads Congress has suggested guidelines on safety in road construction work zone and Highway capacity manual (2010) provides capacity of short term and long term construction work zones, but the nature and construction activities related to a construction of a metro rail project differ much from a road project and consequently the effects of work zones due a metro rail construction project is different than highway projects and thus it becomes necessary to study and quantify the impact of mass rapid transit system construction work zones on traffic flow parameters which will further help in estimating the economic loss due to metro rail construction work zone.

II. OBJECTIVE OF THE STUDY

Followings are the objective of the present study:
1. To determine the traffic flow parameters at Metro rail work zone location.
2. To determine the traffic flow parameters for non work zone location.
3. To compare the traffic flow parameters at non work zone and work zone location.
4. To determine the effect of Metro rail work zone on traffic flow parameters.

2.1 Background

People are in constant moving in the metropolitan areas,it is difficult to implement long term construction work zone.Implementation of such type of project cause blockage or narrowing of lanes. Thus, this work zone have a significant impact on traffic flow as these often constitute bottlenecks, resulting in queues with delays as a result. Knowledge of the traffic flow parameters at work zone is crucial for traffic planners in planning the operation and maintenance activities. Although the problems are not tied to a specific road type the effect is usually greatest in the semi urban motorways, which in general carries the highest traffic volume.Long term construction projects like metro rail work are intended for future traffic reduction but during their implementation it impacts existing traffic flow adversely.Thus, an effect of work zone on traffic flow parameters need to be determined so that implementation of this projects can be properly planned and various alternatives for maintaining traffic flow can be determined.

III. METHODOLOGY

Following steps are executed for the study:
1. It includes problem identification, selection of siteand objectivesof the study area.
2. The data like collection of existing condition of surrounding roads, different types of traffic volume count study,space meanspeed measurement, density measurement iscollected.
3. Based on the data collection, data are analyzed. The comparative study for various traffic flow characteristics influence by with or without work zone are carried out.
4. The effect of work zone on speed, volume, density etc.are determined. .

Considering the understandable advantages, use of technology and ease of operation,Video recording method is chosen.Mobile mounted over stand wasplaced at vantage point to cover the traffic flow over the entire approach. The data for traffic flow was recorded and later analyzed. To study the effect of work zone traffic flow parameters the traffic volume count survey are carried out with the help of Videography. The video graphic data also helps to calculate accurately volume count and space mean speed at instant time and from that density will be calculated using standard equation. The 50m lines are drawn across the road stretch and snapshots are taken. So that volume,space mean speed and density can be measured with and without work zone on Chandkheda stretch.

3.1 Selection of Study Area

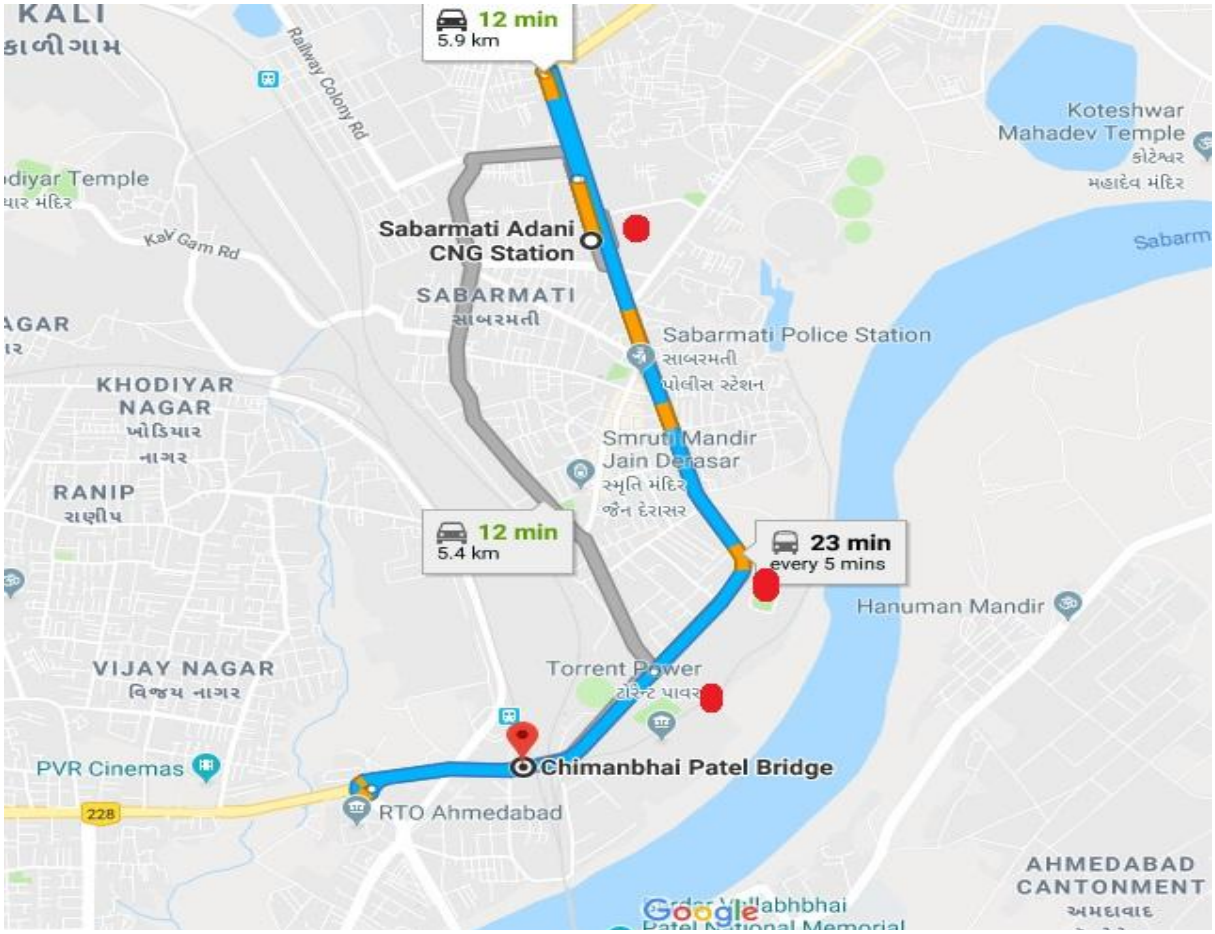

Figure 1 : Location map showing the stretch.

A six-lane divided high way is selected between Chandkheda to Chimanbhai bridge in Ahmedabad city for the study purpose.Three stretches have been selected for study purpose,which are given below:
1. Laxminagar to Acher Depot (Non Work Zone)
2. Rathi Apartment to Dharamnagar(Low Work Zone)
3. Powerhouse AMTS Stand to Chimanbhai Bridge(High Work Zone).

In the present study, service road lanes are closed due to metro rail construction are considered as low work zone. The service lanes are closed and width of roads decreased are considered as high work zone. The extended route, where traffic is not interrupted and construction of metro rail is not started is considered as non- work zone.

IV. DATA COLLECTION

Table 1 Road Inventory Data (From Chandkheda to Chimanbhai Bridge)

Sr No.	Stretch	Carriage way width	No. of lanes	Footpath type	Footpath width	Width of service road	Width of BRTS way	Road condition
1.	Non-Work Zone(Laxminagar to Acher Depot)	10.79 m	3	Concrete blocks	2.97 m	5.84 m	7.49	Good
2.	Low Work Zone(Rathi Apartment to Powerhouse Dharamnagar)	10.82 m	3	Concrete blocks	2.97 m	5.84 m	7.49	Good
3.	High Work Zone(Power House AMTS Stand to Chimanbhai Bridge)	10.82 m	3	Concrete blocks	2.97 m	0	7.49	Good

Table 2 Road Inventory Data (From Chimanbhai Bridge to Chandkheda)

Sr No.	Stretch	Carriage way width	No. of lanes	Footpath type	Footpath width	Width of service road	Width of BRTS way	Road condition
1.	Non Work Zone(Acher Depot to Laxminagar)	8.99 m	3	Concrete blocks	2.97 m	5.69 m	7.49	Good
2.	Low Work Zone(Chimanbhai bridge to Powerhouse AMTS Stand)	7.49 m	3	Concrete blocks	Not in use	Not in use	7.49	Good
3.	High Work Zone(Dharamnagarto Rathi Apartment)	5.30 m	3	Concrete blocks	Not in use	Not in use	7.49	Good

Different type of vehicles is observed on the selected stretches are classified as under:

1) Two wheelers
2) Three wheelers
3) Cars
4) Bus, Trucks
5) Bicycles

Data like speed and volume are collected using videography technique. The space mean speed, flow and density are determined by extracting the videography for interval of 5 minutes.

V. DATA ANALYSIS

The space mean speed, flow and density observed are tabulated. The relationship between traffic parameters are presented from Figure 2 to Figure 4. Figure 2 shows the relationship between various traffic parameters measured at Non Work Zone (towards Chandkheda).

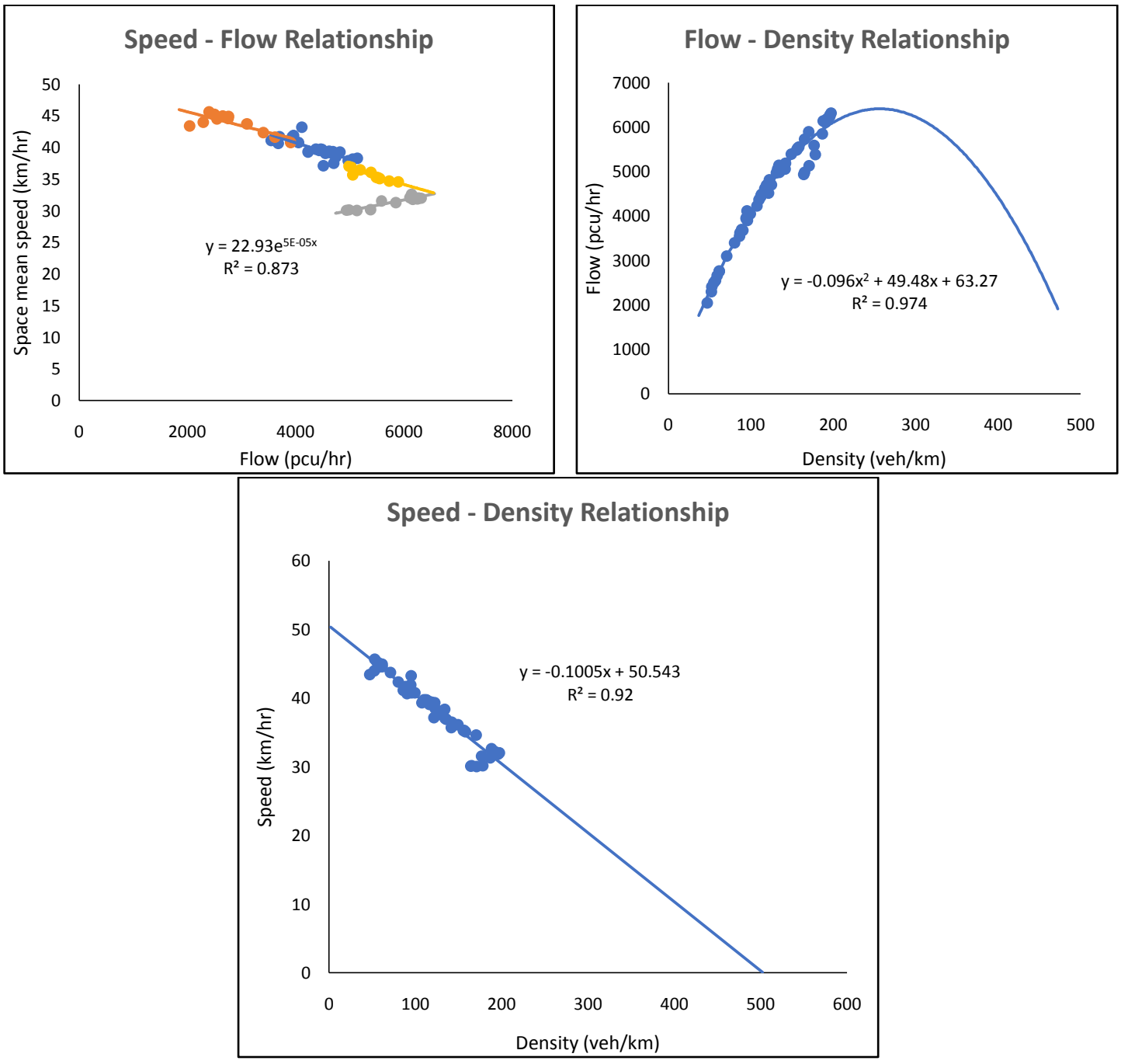

Figure 2 : Relationship between traffic parameters in Non Work Zone (Towards Chandkheda)

Speed–Flow relationship is presented in Figure 2. It is observed from Figure 2 that space mean speed is highest, when traffic flow is less. It is called Free flow condition. It reaches to maximum traffic flow and then after the traffic flow is decreasing. It is called forced flow condition. The traffic speed is more, when density of traffic is very less. The space mean speed is zero, when jam density is observed. Figure 3 and Figure 4 shows the relationship between various traffic parameters measured at High Work Zone and Low Work Zone towards Chandkheda.

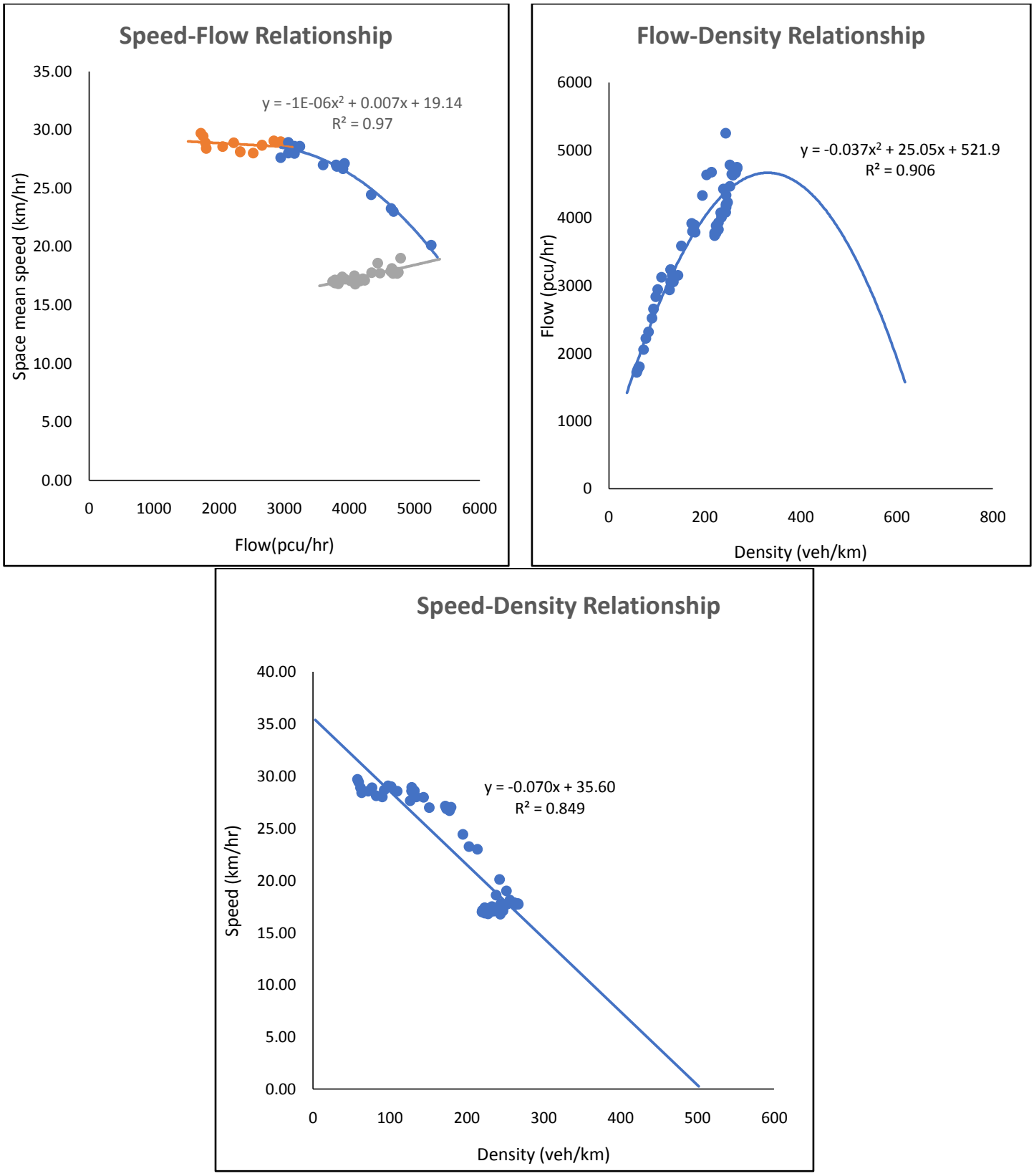

Figure 3 : Relationship between traffic parameters in High Work Zone (Towards Chandkheda)

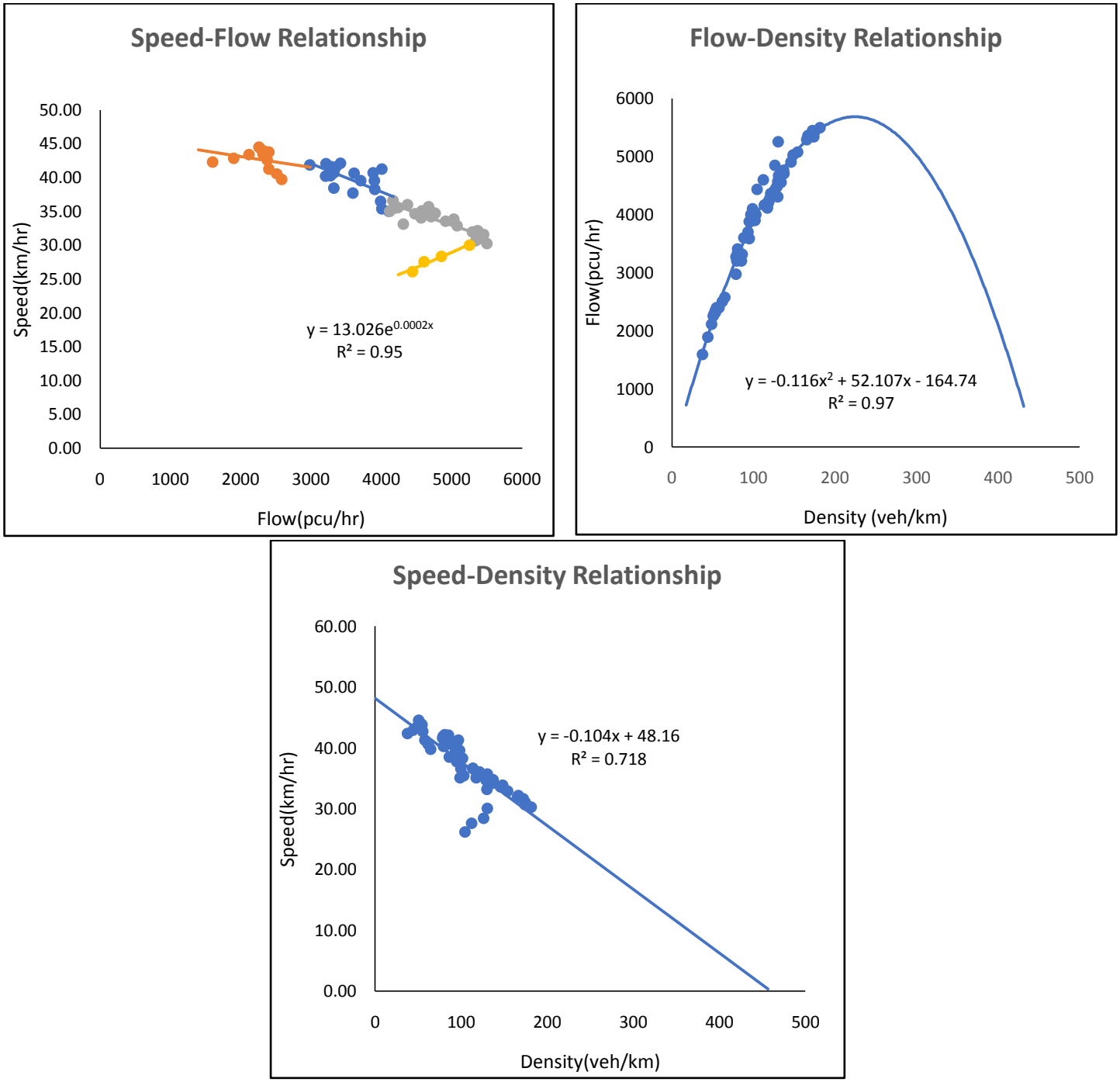

Figure 4 : Relationship between various traffic parameters measured at Low Work Zone (towards Chandkheda)

Table 3Observed Traffic Flow Parameters towards Chandkheda

Parameters	Non Work Zone(Laxminagar to Acher Depot)	High Work Zone (Rathi Apartment to Dharamnagar)	Low Work Zone (Power House AMTS Stand to Chimanbhai Bridge)
Space Mean Speed (km/h)	34	18	30
Highest Flow (pcu/h)	6500	5200	5500
Density (veh/km)	191	289	183

VI. SUMMARY AND CONCLUSION

In developing country like India, rapid growth of urban population and growth of vehicles are increased. To overcome the congestion and delay, Metro rail systems are projected as the solution but which in turn creating a long-term work zone.These work zones leading to congestion on urban road.The present study has focused to study the influence of these work zones on traffic flow parameters for which chandkheda to chimanbhai stretch has been selected in Ahmedabad city.It is observed from the study that space mean speed is decreased by 47% and 11% at high work zone and low work zone respectively compared to Non-work zone. It is observed from the study that flow is decreased by 20% and 15% at high work zone and low work zone respectively compared to Non-work zone. The density of traffic is increased by 51% and decreased by 4% for high work zone and low work zone respectively.

VII. REFERENCES

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