

MEASUREMENT AND MONITORING OF ROAD TRAFFIC CONGESTION AT SILIGURI AIR VIEW MORE TRAFFIC INTERSECTION POINT: A GEO-PLANNING PERSPECTIVE

Santanu Chanda¹ & Dr.Indrajit Roy Chowdhury²

¹Former Post graduate student, Department of Geography, PrabhuJagatbandhu college, Andul, Mouri, Howrah.

²Assistant professor, Department of Geography and Applied Geography, North Bengal University, District: Darjeeling.

Received: December 06, 2018

Accepted: January 22, 2019

ABSTRACT: *Air View More Intersection Point is the connector of five road approaching xing, so traffic congestion is very high as well as vehicular emission. The research paper has been based on topoint out the major causes of traffic congestion at this location, identify various problems that passengers are facing daily, the various measures that would have been implied to solve this problem by planning perspective. Transport has become very pertinent in promoting the economic development on one hand and infrastructural development on the other. Transport and development have a reciprocal relationship which implies that transport is the base of any development. Air View More at Siliguri is facing tremendous level of congestion which is effect on human health as well as environment.*

In Air View More we find the various congestion problems which have been based on the degree of measurement and monitoring on the traffic signalling system, illegal car parking, and the population of this area is gradually increasing day by day. As a result daily passengers and commuters cannot reach in their work place or their destinations for the traffic congestions. Local people faced many problems while walking. Siliguri is city taking vital role in booming of economy of West Bengal. But now due to traffic jam, vehicular emission this city is causing the major loss in the economy of North Eastern India. By reducing traffic jam, decreasing vehicular emission this city can play a very important role for the state and at the same it can be also being relief and peace for the citizen by ensuring healthy environment free from noise and pollution.

Key Words: *Intersection Point, Traffic Jam, Infrastructure, Measurement, Economic Booming.*

I. Introduction

Urban transport has become very pertinent in promoting the economic development on one hand and infrastructural development on the other. The increased travel demand has resulted in rapid growth in the number of motor vehicles in the cities. Siliguri Metropolitan has registered a high vehicular population since 1994, due to economic liberalization and delicensing of auto industry. From 1996 to 2011 the number of vehicles has a growth of about 2.00 times which numbers to 4.04 lakh in 2011 (Government of West Bengal, 2012). Due to the city's booming economy, it has drawn people from Bihar, Jharkhand, North Bengal, North-East, Sikkim and other parts of India in search of livelihood.

1.1 Area of study:

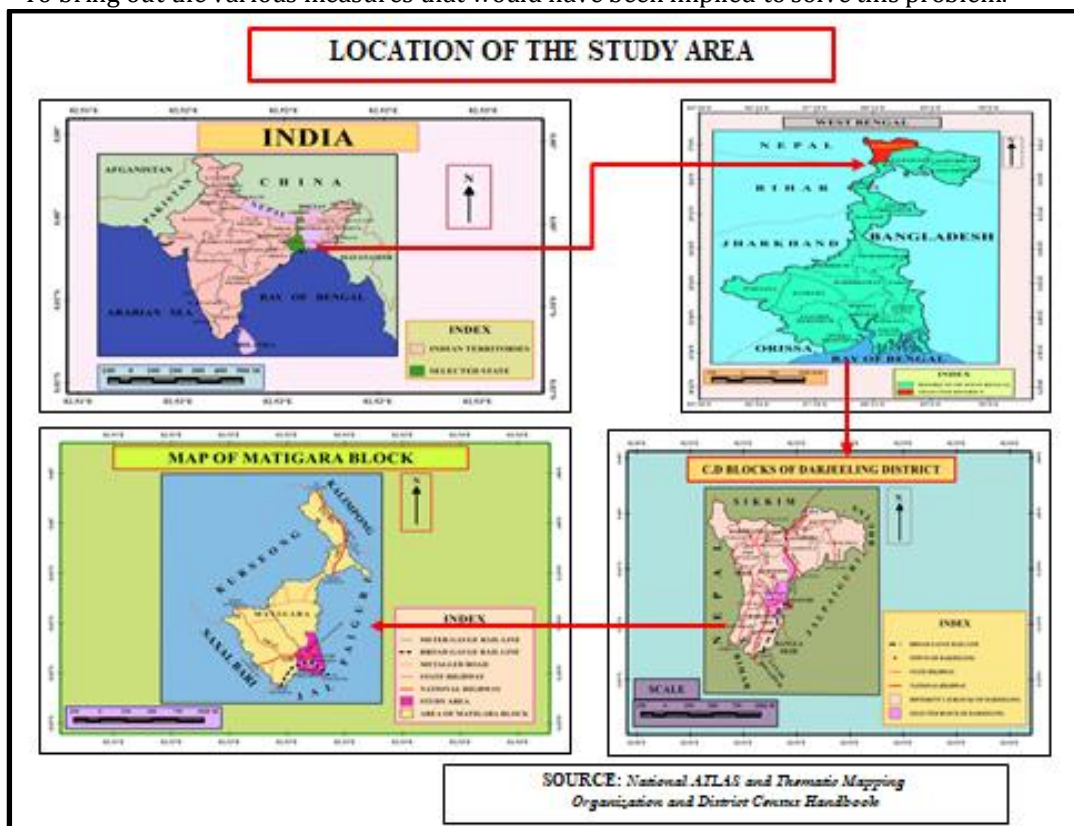
Siliguri is situated at the base of the Himalaya mountains in the plains of Darjeeling District by the side of River Mahananda. It is the 2nd largest city in West Bengal and known as the gateway of North-Eastern India. Presently it has got four (4) C.D. Blocks namely -Matigara, Phansidewa, Naxalbari&Khoribari and one Corporation area - Siliguri Municipal Corporation under its administrative jurisdiction. The city Siliguri lies between Longitude 88 deg. 26 sec. East longitude Latitude 27 deg. 43 sec North Latitude. The city comprises of an area of 260 sq.km. which divided into 47 wards

1.2 Objectives

The major objectives of this research work are enumerated below:

- To state the traffic volume of approaching road of Air View More Traffic Intersection Point.
- To analyse the role of various land use pattern on Air View More Traffic Congestion.
- To measure the degree of traffic congestion on each road.
- To point out the major causes of traffic congestion at this location.
- To make an assessment on perception study of Passengers, Shop Owners, Drivers.

- To bring out the various measures that would have been implied to solve this problem.



1.3 Data base and Methodology

This research work is based on both primary and secondary data, collected from different sources. Primary data was generated from count of vehicles and measuring the level of different automobile pollutants at five traffic intersection points. However the data based on perception about fuel consumption and expenditure, health status, problem of pollution, source of pollution in terms of various mode of vehicles, different pollution control strategies from the traffic policemen, bus, auto and taxi drivers, pedestrians and passengers as well as respondents of Air View More.

The methodology adopted can be divided into the following parts:

Pre-Field: In this phase, general literature survey was carried out and collection of maps and secondary data for registered vehicular population, status of automobile pollution level and fuel efficiency was done from various Government and non-Government Source. A structured questionnaire was prepared to collect the data from the respondents, passengers, drivers, shop owners as well as traffic police at various intersection point.

Field: To cope with this problem stratified sampling was done on random basis. Relevant photographs have been taken during the field survey to illustrate the scenario more specifically. Same officers, experts, planner and executive in different organization were personally met and interviewed.

Post Field: This stage involves computation of master data table from the questionnaire, statistical application, cartographic representation, drawing maps using QGIS techniques, analysis of data and information obtained in order to understand the present status of vehicular growth, level of automobile emission and scenario of fuel efficiency as well as health hazard due to vehicular pollution of Siliguri Town. 21st Century GIS, professionals, Map info, Corel draw, Adobe Photoshop software have been used for digitization and drawing of maps.

II. Evolution of Transport in Siliguri City

2.1 Railway

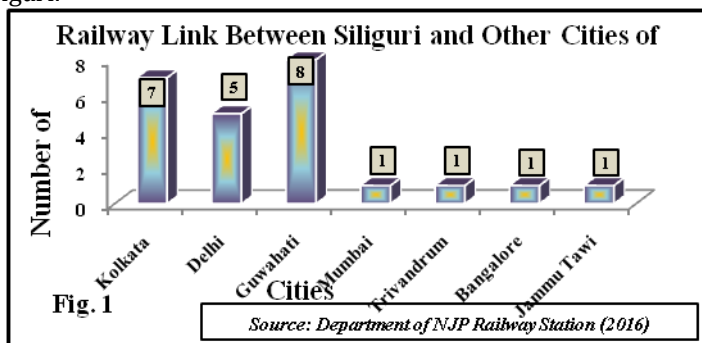
Siliguri is the 2nd largest city of west Bengal and from 1994 grew into a Municipal Corporation. Siliguri Junction is one of the three railway stations that serve Siliguri in Darjeeling district in the Indian state of West Bengal. The other two stations are: Siliguri Town and New Jalpaiguri.

Table- 1 Movement of Trains through Different Parts of India

Train Name	Destination	Time (approx.)
Darjeeling Mail	Calcutta(Sealdah)	14 hrs.
Kamrup Express	Calcutta(Howrah)	14 hrs.
Kanchenjunga Exp.	Calcutta(Sealdah)	13 hrs.
TeestaTorsa Exp.	Calcutta(Sealdah)	16 hrs.
Saraighat Exp.	Calcutta(Howrah)	13 hrs.
Uttar Banga Exp.	Calcutta(Sealdah)	13 hrs.
KanchanKanya Exp.	Calcutta(Sealdah)	14 hrs.
Mahananda Exp.	Delhi	30 hrs.
Brahmaputra Mail	Delhi	24-30 hrs.
Brahmaputra Mail	Guwahati	11 hrs.
North East Exp.	Delhi	29 hrs.
North East Exp.	Guwahati	10 hrs.
Avadh Assam Exp.	Delhi	25 hrs.
Avadh Assam Exp.	Guwahati	11 hrs.
Rajdhani Exp.	Delhi	22 hrs.
Rajdhani Exp.	Guwahati	6 hrs.
Trivandrum Exp.	Trivandrum	52 hrs.
Trivandrum Exp.	Guwahati	13 hrs.
Guwahati Dadar	Mumbai	52 hrs.
Guwahati Dadar	Guwahati	10 hrs.
Lohit Exp.	Jammu Tawi	50 hrs.
Lohit Exp.	Guwahati	20 hrs.
Guwahati Bangalore	Bangalore	49 hrs.
Dooars Exp.	Guwahati	12 hrs.

Data source: Department of NJP Railway Station (2016)

The data shows that Siliguri is the place where highly concentration of railway is available. The railway network spread all over the India from New Jalpaiguri which is near to the Siliguri town. And from this diagram (Fig. 1) Guwahati is frequently linked with Siliguri. 8 trains are daily commute with Siliguri to Guwahati and 7 trains are linked with Kolkata, 5 trains are with Delhi. And Mumbai, Bangalore, Trivandrum are also linked with Siliguri.



2.2 Road:

Siliguri is connected to Calcutta, Darjeeling, Sikkim, Jalpaiguri, Coochbehar, and entire Dooars and Terai by large network of roads. Both Public and Private buses ply to these places regularly. Most North Bengal State Transport Corporation (NBSTC) buses leave from Tenzing Norgay central bus terminal, as do more frequent private buses plying the same routes.

This is the remarkable (Fig. 2) fact that most of the places of north Bengal are directly or and other are indirectly link with Siliguri. The graph shows in Siliguri there are huge number buses and about 22 number of buses are covers near about 350 km distance from Siliguri to Kolkata. And also the neighbour areas are directly linked with frequently passes bus so Darjeeling, Kalimpong, Jalpaiguri etc. are linked with respectively 32, 20, 40 number of buses. So the area Siliguri and also Air View More Crossing are congested prone.

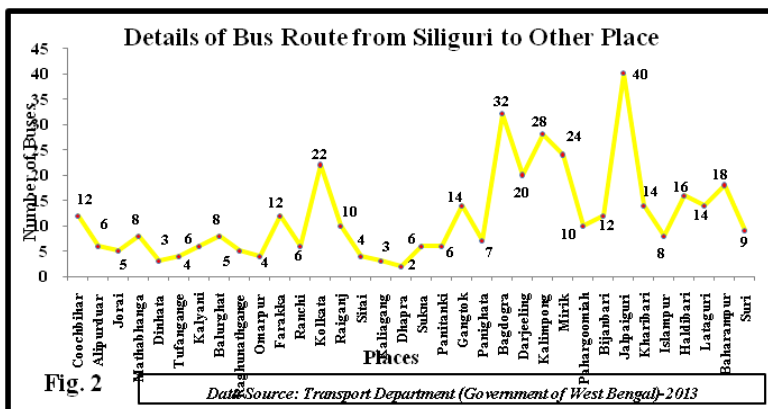


Fig. 2 Date Source: Transport Department (Government of West Bengal)-2013

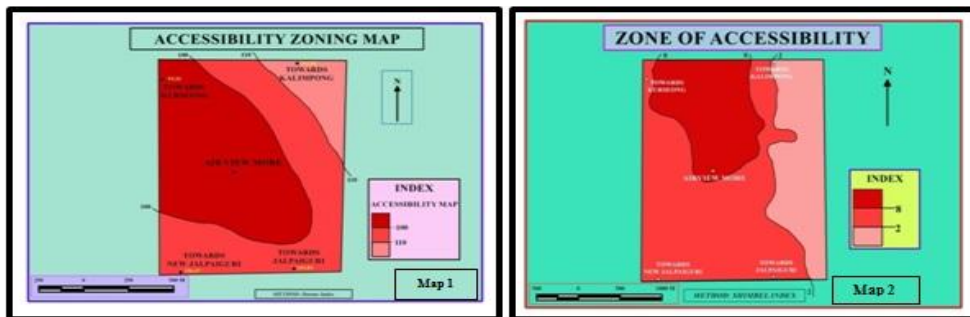
III. Accessibility and Connectivity Measures of Air View More Intersection Point and adjacent road side area with another nodes

Several measures have been taken into consideration to measure the degree of accessibility and connectivity of Air View More Traffic Intersection point followed by four approaching xing.

3.1 Accessibility measures:

Accessibility can measure based on Detour Index Method provided the map of Air View More Intersection Point and associated traffic node. From this prepared map, it reveals the fact that, Air View More is underlying the zone of Highly accessible and it is quite obvious, during Railway Platform Construction of Siliguri Junction since last fifteen years, Siliguri Traffic Police have been (Map 1) diverted the pressure of vehicles from New Jalpaiguri Road to Kurseong followed by Hill Curt Road, in this regard traffic pressure quite less compared to that of other nodes. However Burdwan Road is comparatively less accessible due to less number of connectivity and it directly connects with HillCurt Road followed Kalimpong it considers to be under less accessible zone because of not direct connectivity, all the connectivity can be identified indirectly.

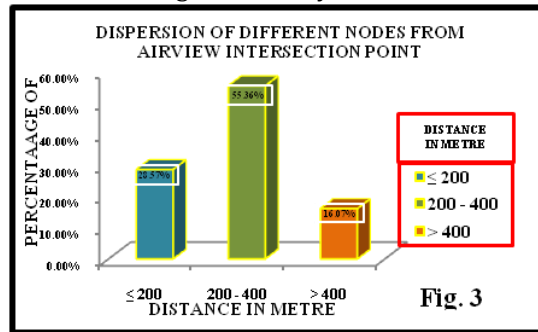
Here the Shimbel Matrix measure (Map 2) method can apply where the three zone of accessibility can be drawn and from this map, it reveals that, Air View More Crossing is underlying in more accessible zone followed by Kurseong and Kalimpong Traffic node. So during peak and lean hour of the day Voluminous pressure of traffic could be observed and passing through this traffic node and it creates loot of congestion, however New Jalpaiguri and Jalpaiguri is underlying under moderately accessible zone, so due to existence of highly appreciable accessible zone Air View Traffic node is considered to be more congested traffic node forever.



Source: Data Compiled and Computed by the Authors, 2017

3.2 Dispersion of Different Nodes from Air View More Traffic Intersection Point:

A diagram has been prepared based on dispersion technique(Fig. 3) starting from Air View More Intersection Point Traffic node, here a very clear picture has been revealed that, approximately 30 numbers of nodes are located in relation to Air View More Traffic node and it is less than 200 metre in distance. whereas almost 56 nodes are situated within the distance of 200-400 metre that means sparsely distributed and 16 nodes are far away from Air View More Intersection Point which are more than 400 metre that means there traffic nodes are scatterly distributed and somehow the vehicles are passing through this Air View More Intersection Point Traffic nodes from different corner as a result more congestion pressure could be observed throughout the day.

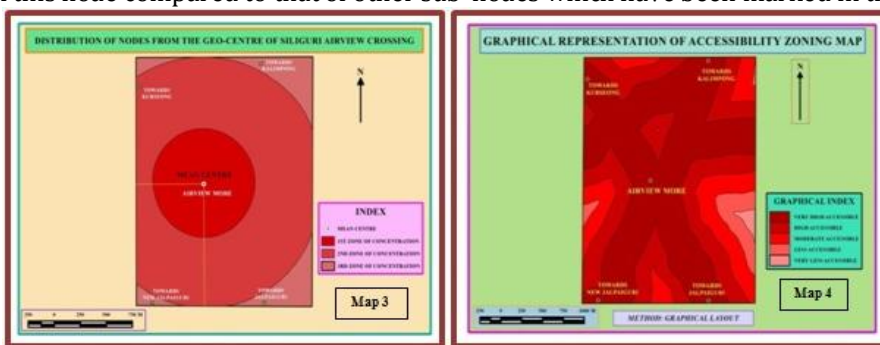


SOURCE:- Data Computed by Researchers, 2017

3.4 Distribution of Node from the Geo-Centre of Air View More Traffic Intersection Point:

Another map has been prepared by the researcher based on centrality of mean centre and it reveals the fact that Air View More Crossing is mean (Map 3) to located within the first zone of concentration where the congestion level is more due to more nodality index value whereas Kurseong is located within the second zone of concentration and it means this nodes are sparsely distributed which are already been revealed earlier, however New Jalpaiguri and Kalimpong and Jalpaiguri are also located within Third zone that means sparse pattern, so in the diversion of traffic all the traffic nodes are equally depend on Air View More Traffic Intersection Point so it means create lot of traffic congestion during peak and lean hour of traffic.

However another graphical layout (Map 4) has been prepared and it means to prepare through layout selection method and from this method, it point out that, all the four nodes including Air View More Traffic Intersection point has been located under highly accessible zone, whereas far away from the main node accessibility became less because of far distance and less connectivity, so that creation of congestion is more predominant in this node compared to that of other sub-nodes which have been marked in this map.

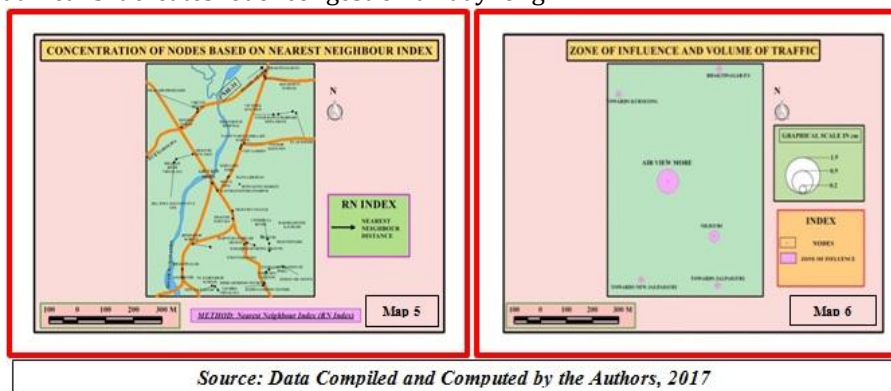


Source: Data Compiled and Computed by the Authors, 2017

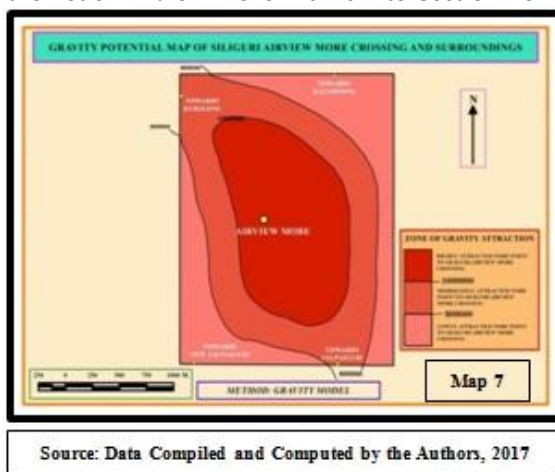
3.5 Zone of Potentiality and Concentration Measure:

Here Nearest Neighbour Index method (Map can apply to show the concentration of various location of nodes from the main traffic nodes which means(Map 5) Air View More Traffic node and here the R_N Index value is calculated (0.25) and the result shows that all the nodes are clusterly distributed than random one and the map shows that Sevoke Road is more nearest concentration in relation to other nodes whereas Jalpaiguri, Kurseong as well as Burdwan Road tare in the nature of Balanced Concentration whereas Sevoke Road is located in the context of dispersion in nature which means more revelence of traffic congestion. A

zone of influence map (Map 6) has been prepared based on volume of traffic, therefore Air View More Traffic Intersection Crossing has prevalent for more traffic volume which approximately more than 60 lakhs throughout the day, however Sevoke Road and Hill Curt Road Intersection Point in Siliguri has the volume of vehicles more than 4 lakhs during peak and lean hours of traffic, however towards Kalimpong and New Jalpaiguri has the volume of vehicles more than 35Thousands during peak and lean hours of traffic, however other traffic node has significant number of vehicles which are passing through Air View More Traffic node that means it creates lot of congestion all day long.



However while the gravity potentiality has been measures, Air View More Traffic Nodes is underlying within highly attracted zone in relation to Air View More Intersection Point Crossing and here gravity potential value (Map 7) is maximum which is more than 17 lakhs but Hill Curt Road joining towards Jalpaiguri to towards Kurseong is located within the zone of Moderately attracted node point to Air View More Crossing where the potential value is more than 8lakhs but a significant fact has been revealed that Burdwan Road and Sevoke towards New Jalpaiguri and Kalimpong are located within the zone of lowly attracted node point to Air View More Crossing where the potential value is approximately more than 7 lakhs so obviously this two nodes are less access the node Air View More Traffic Intersection Point compared to that of others.



IV. Connectivity Indices Measures in an Around Air View More Traffic Intersection Point:

Several connectivity indices have been taken into consideration to measure the degree of connectivity. Here several index value can be calculated.

- (i) According to **Theta Index(θ)** Calculated Value is 3.10 that means all the circuit is related to Air View More Intersection Point Traffic node are well connected and more than good connected.
- (ii) The **Alpha Index (α)** indicates the high circuit connected because the value (0.92) indicates good sense of connectivity.
- (iii) While the **Beta (β) Index** has been calculated, the value represents 1.76, that means all the circuits are well connected, so that Air View More traffic node is well circuit connected with all the other nodes significantly.
- (iv) **Gamma (γ) Index** has been calculated and again it reveals the good circuit connectivity (0.61) because the more number of the major and sub nodes are well connected with Air View More Crossing so that vehicular pressure could be observed very predominantly throughout the day.

- (v) Another measure can be taken into consideration while the **Network Density** value can be calculated. Here the value is 0.79 that means the degree of connectivity and circuits are well connected and not only that in an around Air View More Intersection Point distribution of traffic nodes per sq. metre area reveals the more density compared to that of other area in Siliguri.
- (vi) However **Pi - Index (π)** has been calculated based on nodes located in spatial order in an around Air View More Traffic Intersection Point and the calculated value (1.81) reveals the fact that like the other calculated connectivity measure, here more nodes can like the value of Pi-Index, that means Air View More is well connected with other sparsely distributed traffic node and it creates more congestion level.
- (vii) **Eta Index (η)** has been calculated based on edges located in spatial order in an around Air View More Traffic Intersection Point and the calculated value is (1.76), that means all the nodes are well connected with Air View More Crossing. This traffic point is well connected all of the part of surrounding area, so it creates more congestion level and pollution level is increasing day by day.

V. Change Detection from the Temporal Image of Land Use Map of the Study Area:

Change detection is very important parameter in order to identify the changing scenario of land use change of any selected study area. Therefore downloaded various image are used to measure the change detection of various temporal image based on several land use features such as main arterial road, sub-arterial road, residential area, vegetative cover, water bodies, waste land, river Mahananda as well as Rail line. Therefore three temporal image has been selected which include 2004, 2011, and 2017 and there basically simplify the change detection nature of various features of land use and land cover. Therefore the following temporal image reveals the fact that almost 40% of the area cover with residential area where as 50% area is covered with natural vegetation, park and garden as it is the part of Siliguri megacity area (2004). Here (2011) due to expansion of the urbanization process and urban settlement growth vegetation cover has decreased rapidly as a result level of pollution has been increasing and Siliguri megacity converts into heat island. Tremendous change detection has been observed from the image 2017 compared to that of 2004 and 2011. Here same situation has been observed similar to that of 2010 and 2017. Most of the wasteland has converted to residential area because of huge urbanization and encroachment of landscape.



VI. Measuring Congestion Level at Siliguri Air View More Crossing

1. DR and TTI of Different Roads

Table 3

Roads	Peak period travel time in sec.	Off peak period travel time in sec.	Delay rate (DR) in sec.	Travel time index(TTI)
Approaching				
Surya SenAvenue(SSA)	598	146	452	4.095
Burdwan Road(BR)	1074	289	785	3.716
NabinSenSarani(NSS)	234	208	26	1.125
Hill Curt Road(HCR)	796	348	448	2.287
Church Avenue(CA)	230	160	70	1.437
Sevoke Road Connector(SRC)	680	220	460	3.091

Data source: collected and Computed by the authors,

2. Q-index of different roads

Table 4

Roads Approaching	Average speed (km per hour)	Differences between max and min speed	No of speed changes	Q-index
Surya SenAvenue (SSA)	38	40	40	150.208
Burdwan Road(BR)	25	30	52	115.563
NabinSenSarani(NSS)	50	20	30	456.435
Hill Curt Road(HCR)	40	30	41	208.232
Church Avenue(CA)	30	30	40	158.114
Sevoke Road Connector(SRC)	60	30	36	333.333

Data source: collected and Computed by the authors, 2016

3. LLDI Of different roads

Table 5

RoadsApproaching	Length of waiting vehicle in metre	Duration of congestion in second	LLDI
Surya SenAvenue(SSA)	136	195	26520
Burdwan Road (BR)	204	362	73848
NabinSenSarani(NSS)	256	27	6912
Hill Curt Road(HCR)	67	187	12529
Church Avenue(CA)	288	254	73152
Sevoke Road Connector(SRC)	70	45	3150

Data source: collected and Computed by the authors, 2016

Table 6 4. Traffic volume and modal makes of different roads

Roads Approaching	Traffic volume during peak	Modal Mix
Surya SenAvenue(SSA)	11545	6
Burdwan Road(BR)	10268	5
NabinSenSarani(NSS)	4832	7
Hill Curt Road (HCR)	9170	4
Church Avenue(CA)	2495	9
Sevoke Road Connector(SRC)	12721	8

Data Source: Collected and Computed by the Authors, 2016

5. Area of Different Roads

Table 7

RoadsApproaching	Road Length in Meter	Road Width in Meter	Road Area in Sq. Mt.
Surya Sen Avenue (SSA)	500	9.15	4575.0
Burdwan Road (BR)	525	12.20	6405.0
NabinSenSarani (NSS)	550	6.10	3355.0
Hill Curt Road (HCR)	500	9.15	4575.0
Church Avenue (CA)	450	3.65	1642.5
Sevoke Road Connector (SRC)	550	10.36	5698.0

Data Source: Collected and Computed by the Authors, 2016

Table 8 6. Ranking of the approaching roads based on the Degree of Congestion

Degree of Congestion	DR	TTI	Q-Index	LLDI	TV	MM	RR
<div style="text-align: center;"> High ↑ ↓ Low </div>	BR	SSA	BR	BR	SRC	CA	BR
	SRC	BR	SSA	CA	SSA	SRC	SRC
	SSA	SRC	CA	SSA	BR	NSS	SSA
	HCR	HCR	HCR	HCR	HCR	SSA	HCR
	CA	CA	SRC	NSS	NSS	BR	NSS
	NSS	NSS	NSS	SRC	CA	HCR	CA

Data Source: Collected and Computed by the Authors, 2016

6.2 Traffic Congestion of Siliguri:

Siliguri has a massive number of vehicular pressure, which has been observed last 5-10 years. The total number of motorized transport which has increased exponentially but the road infrastructure is not at par which in turn results to traffic congestion in the city.

1. Duration of Traffic Signal:

Road based primary survey has been conducted to measure the degree of congestion. These are as follows:-

Table 9 Traffic Signal Duration at Various Connector of Siliguri

Road	Traffic Signal Duration In Seconds
Surya Sen Avenue	120 Seconds
Burdwan Road	135 Seconds
NabinSenSarani	70 Seconds
Hill Curt Road	120 Seconds
Church Avenue	45 Seconds
Sevoke Road Connector	90 Seconds

Source: Primary Survey, 2016

Traffic Signal duration in Air View More Traffic Intersection Point crossing, the Surya Sen Avenue and Hill Curt Road their duration is same near about 120s. In NabinSenSarani and Sevoke Road Connector there Duration of Traffic Signal is 70s and 90s and Church Avenue is 45s and Burdwan Road is 135s, which is very high compared to than that of other road. And Church Avenue is 45s, which is low compared to than that other road.

2. Length of Waiting Vehicles during the Traffic Signal:

Length of Waiting Vehicles in meter of Siliguri Table 10

Road	Length Of Waiting Vehicles In Meter
Surya Sen avenue	136
Burdwan Road	204
NabinSenSarani	256
Hill Curt Road	67
Church Avenue	288
Sevoke Road connector	70

Source: Primary Survey. 2016

Lengths of Waiting vehicles during the traffic signal in Air View More Intersection Point are different in various road ,but the Church Avenue road their waiting vehicles is very high (288) and then NabinSenSarani (256) but Surya Sen Avenue and Hill Curt Road their waiting vehicles are 136 and 67 because this road their congestion are very lower than other road.

3. Types of Vehicles or Modal Mix

Categories of Vehicles in Siliguri Table 11

Road	Types Of Vehicles Or Modal Mix
Surya Sen Avenue	Bus, Auto, Truck, Private Car, Bike, Cycle,
Burdwan Road	Private Car, Bus, Auto, Bike, Truck
NabinSenSarani	Bus, Private Car, Auto, Cycle, Truck, Bike, Van
Hill Curt Road	Bus, Truck, Private Car, Bike
Church Avenue	Bike, Bus, Lorry, Magic van, Cycle, Private Car, Toto, Taxi, Auto
Sevoke Road Connector	Private Car, Magic Van, Cycle, Taxi, Auto, Bus, Bike, OLA Cab

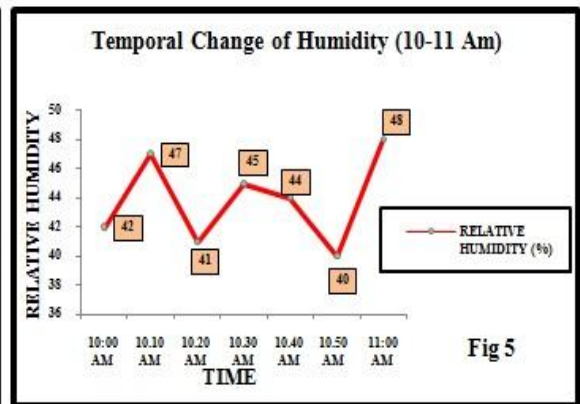
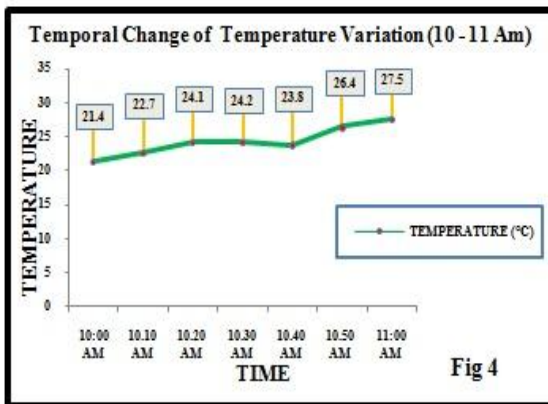
Source: Primary Survey, 2016

Types of vehicles in Air View More Intersection point, there are various road connected, and their mode of transport are the Bus, Auto, Privet car, Van, Bike, Cycle, Taxi etc. Surya Sen Avenue road there are total busses are 62 in one hour, and total small vehicles are 1919, and Burdwan road, total buses are the 86 and small vehicles are the 1448 which is less than Surya Sen avenue road.. The total buses in Sevoke Road is 58 and the small vehicles are the 1578 and 34 busses are the Hill Curt road and their total small vehicles are the 1146, the Church Avenue road the total buses are the 23 which is very lower than other road and small vehicles are the 866 and NabinSenSarani there are 32 buses and the total small vehicles are the 1022 which is lower than other road, so this road congestion is lower than other road.

VII. Environmental Approach of Road Traffic Congestion at Air View More Traffic Intersection Point

7.1 Temperature and Humidity Measure:

Siliguri Air View More Crossing has huge traffic pressure and tremendous level of congestion. As we know that there have relation between Temperature and Relative Humidity. So measurement of Temperature and Relative Humidity is very much significance on Environmental impact. The graph showing (Fig 4,5) the relationship between time and temperature with the help of Thermometer between 10:00 am to 11:00 am. The temperature increases 21° c to 28° c due to huge congestion and more amount of vehicles. Therefore which is approximately throughout the location of the area and traffic and other factor is influence the temperature. The graph showing the relationship between time and humidity between 10 AM - 11 AM. The temporal change of the humidity of Air View More Intersection Point is very much uplifted, so we see at time of 10 am humidity is 42% but at the time 10:10 am humidity level increases in 47%. In this 10 minutes interval the change of humidity is tremendously increases. At the time of 11 am humidity is very high respect to other. Due to more amount of vehicles pollutants in the peak hour relative humidity increases. So due high humidity level it causes environmental impact.

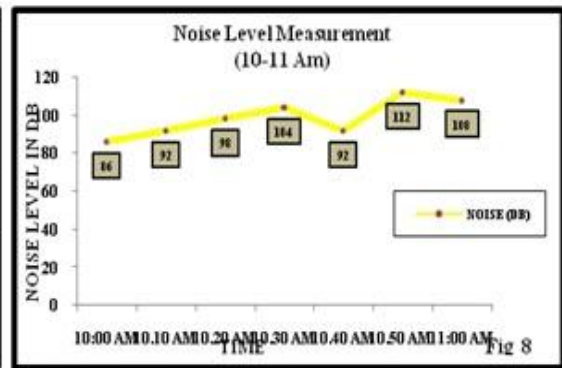
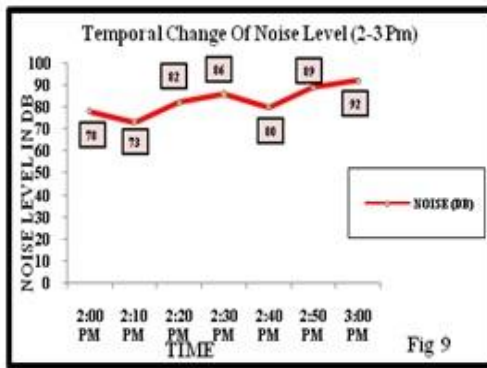


Source: Primary Data and Instrument Data Computed by the Authors, 2017

7.2 Noise Level Measurement:

With the help of Mobile app. of sound meter noise level can be measured and it is predominantly signify the fact that almost all the time. From the help of Governmental provision noise level should be within 60 Db. But Noise level is significantly high In the Air View More Traffic Intersection Point and it is approximately more than 70 dB which is definitely harmful for ear among the human being. However more noise generation could make the noise pollution in this Air View More traffic node.

It has been identified that in Air View More Intersection Point is the congested area during 10:00-11:00 am noise level is upward for vehicular pressure and traffic pressure. During the interval of 10 minutes noise level increasing gradually (Fig: 8) in the time of peak hours noise level is climbing up to more than 100 dB so environmental degradation can be occur. At the time of 10:50 am noise level is very high near about more than 112 dB, Noise pollution is very harmful for human beings. And as the time going on (Fig: 9) at the time of lean period noise level decreases under 100 dB but more than 90 dB, so at time of 2:00-3:00 pm obvious it is quite significantly harmful in this traffic node. But after the time of 2:30 pm the pollution is slowly being increased for the evening.



Source: Primary Data and Instrument Data Computed by the Authors, 2017

VIII. Findings of the Study:

The roads are narrow and the intersections are close-spaced, it is very difficult to address the problem of congestion.

1. Lack of maintenances of signal system.
2. Illegal car parking behind the road causes traffic congestions.
3. The nearest railway platform is the main reasons of these problems.
4. The population of this area is gradually increasing day by day.
5. The repairing of the Mahananda over bridge reduced the space of the area that effect on the length of the road.
6. There have not any proper GPS traffic control system.
7. This congestion causes very much air pollution and that effect on the environment as well as on the local area.
8. The daily passengers and commuters cannot reach in their work place or their destinations for the traffic congestions.
9. As the construction work is continues, the materials for this issues are dumped on the road and that the space due to traffic is reduced and this area become congested.
10. Some roads have blocked due to the huge numbers of bikes, buses, auto and heavy vehicles which encroach road space which causes the congestions.

IX. Problems of the Study:

In this point of view there are different problem has been identified. Problems of the study are as follows –

1. Obviously illegal car parking is problem of traffic congestion.
2. Traffic police could not maintain the vehicular pressure properly.
3. Air and Noise pollution is very high so some of the passengers are feeling seek.
4. Some the commuters and drivers could not obey the traffic rule by wearing Helmet, shoes, and carrying license etc.
5. Road accident is going on every day, this is accident prone area.
6. There have no proper divider, so the haphazard flow of vehicles have been seen.
7. The road space is not comfortable for huge number of vehicles.
8. Some heavy vehicles are creates congestion.
9. As it is the base of Himalaya Mountains the physiography of this area is very weak.
10. Number of auto is very high which are using diesel engine so it increases the pollution level and also congestion level.
11. Political campaign on the road by stop communication, it is an important problem of traffic congestion.

X. Management of Traffic Congestion:

Proper strategic and effective measures should be taken by the state government and Siliguri Traffic Police for the reduction of the magnitude of traffic congestion, vehicular emission and health impact not only at Air View More Traffic Intersection Point but also for other important Traffic Intersection Points

in Siliguri city. Some of the steps that can be taken for congestion management in this locality are as following—

1. Special small multi-directional bus routes can be developed at Air View More Crossing which can take passengers to the nearest railway stations, major bus stops on National Highways or to important localities. This can be done under Public Private Partnership (PPP) Project.
2. Enhanced parking charge should be imposed on the vehicles within the CCZ to reduce parking problems and make the roads free from parked cars. New, highly developed air conditioned buses can be made to ply along the approach roads which can attract passengers who use their own cars.
3. The width of the existing roads can also be increased on both sides of the approach roads of Air View More Crossing.
4. Proper signaling system is crucial to manage the vehicular pressure and to reduce congestion. Based on vehicular pressure of each approaching roads, signaling time should be altered in different times of the day and for different roads.
5. Alternate roads can be identified to which vehicles can be diverted to reduce congestion in certain cases.
6. During peak periods, all types of goods carriages should be banned within the CCZ.
7. Efficient traffic polices are needed for reducing congestion as they can make decisions and take fast action for eliminating congestion problems in certain situations.
8. Pedestrians must have their own Right of Way (ROW) and specific delineation of roads and footpath is extremely necessary to reduce chances of accident and hence congestion problems.
9. Any kind of political or apolitical procession should be restricted on major roads, at least during the peak period, to reduce congestion problems.

Concluding Observations:

Siliguri is city taking vital role in booming of economy of West Bengal. But now due to traffic jam, vehicular emission this city is causing the major loss in the economy of North Eastern India. By reducing traffic jam, decreasing vehicular emission this city can play a very important role for the state and at the same it can be also being relief and peace for the citizen by ensuring healthy environment free from noise and pollution. To ensure a healthy generation, traffic jam must be reduced. There are lots of solutions. Some are short term and some are long term basis. It needs to work on the basis of long term plan and at the same time take care of short term solution to remove current discomforts or problems. It needs a balance so that to fulfil too much short term solution we do not ruin the long term plan. It focus should be the solution of traffic jam, strong economy and healthy environment.

Bibliography:

1. Albert, G. and Mahalel, D. (2006), "**Congestion Tolls and Parking Fees: A Comparison of the Potential Effect on Travel Behaviour**", *Transport Policy*, Vol. 13, Issue 6, pp. 496-502.
2. BhaduriSukla (2003) : **Mass Transport Services in Calcutta Metropolitan Area**, Vaidya, B.C. (ed), *Geography of Transport Development of India*, Concept Publishing Company, New Delhi
3. Blythe, P. (2005), "**Congestion Charging: Technical Options for the Delivery of Future UK Policy**", *Transportation Research Policy and Practice*, Vol. 39a, Issues 7-9, pp.571-587.
4. Cairns, S. and Goodwin, P. (2002), **Traffic Impact of Highway Capacity Reductions: What Transport Professionals Think**, ESRC TSU Working Paper, Transport Studies, University College London, London, United Kingdom.
5. Dewan, K.K.; Ahmad, I. 2007. **Carpooling: A Step to Reduce Congestion (A Case Study of Delhi)**, *Engineering Letters*, 14(1): 61-66.