International Journal of Multidisciplinary Research and Development
Online ISSN: 2349-4182 Print ISSN: 2349-5979
www.allsubjectjournal.com
Volume 2; Issue 12; December 2015; Page No. 22-28

Role of transportation network in urbanization: A case study of north 24 Parganas district, West Bengal

[1]Priyanka Kundu, [2]Ranjan Basu

[1]Research Scholar, Department of Geography, University of Calcutta, West Bengal, India.

[2]Professor, Department of Geography, University of Calcutta, West Bengal, India.

Abstract
Transportation network is the artery of any urban center and is one of the important infrastructural parameter in the economic development. North 24 Parganas district is a very important center for urbanization within West Bengal. But it is necessary to explain the effect of road network development on the pattern of urbanization. National and State Highways as well as Railways are very important in the flow and movement of industrial goods and mobility of the industrial workers and hence are very much effective in connecting the remotely placed inaccessible areas with the accessible one and thereby both the inter-district and inter-state network systems get well developed. The roads under the Public Works Department are there to connect the intra-district centers and thus a well-connected network system is emerged. On the basis of the degree of industrial development and the growth of the Class-I towns, it is evident that the growth center has shifted towards the western side of the district. Hence the nature of the growth of the urban sprawl is also towards the western direction of the district. This is an attempt towards drawing an analytical description of the relationship between the pattern of urbanization and growth of the urban transport network.

Keywords: network analysis, growth center, forward and backward linkage, degree of interaction, urban agglomeration, spread effect

1. Introduction
Transport plays a crucial role in the development of any region. It is of immense importance as it contributes to the linkage development and movement of passengers and goods within and outside the region. District North 24 Parganas has a strategic importance due to its adjacent location to Kolkata and is the gateway to Eastern India. The pattern of transport network development has conformity with the level of economic development. Thus an attempt has been made to make transport network analysis and to understand the pattern of interaction, linkage development along with its resultant impact on the growth and development of the district.

2. Objectives
This academic endeavour has been taken up to fulfill the following objectives:

i. To analyse the connectivity and accessibility of the road and railways network.
ii. To derive the degree of interaction between the growth centers and its adjacent hinterland area.
iii. To assess the impact of transport network development on the regional growth pattern and on the nature of urban expansion.
iv. To estimate the nature of linkage development and
v. To predict the potential growth centers to be expanded due to spread effect.

3. Location of the study area
District North 24 Parganas lies between 21°25′30′′N and 23°16′50′′N latitude and 88°01′10′′E and 89°06′15′′E longitude. It has artificial land frontier as well as natural water boundaries. Nadia district lies to its north and the Bay of Bengal to its south. Eastern part is bounded by the territory of Bangladesh. On the west it is adjacent to Kolkata and the river Hugli. The south-west boundary of the district separates it from South 24 Parganas.

4. Materials and Methods
This paper has a strong secondary database as well as primary data set derived out of field observations. The transport network and development related data have been derived from the Bureau of Applied Economics and Statistics, Government of West Bengal, Census of India, 2001 and 2011, District Human Development Report of North 24 Parganas district. Degree of Interaction along with passengers and commodity movement related data have been derived through survey and procurement of primary data.

The following quantitative techniques have been applied in order to process the available data:

i. The techniques of network analysis such as Connectivity indices (Alpha, Beta, Gamma index, Cyclomatic number after Kansky, 1963) and Shimbel's method of nodal accessibility (1953) which is synonymous with connectivity matrix have been adopted to show the pattern of network growth within district.
ii. Gravity potential analysis (Reilly, 1929) has been adopted to explain the degree of interaction between the growth centers and the hinterland area.
iii. Crowding index (O'Brien, 1996) has been used to get the centers or nodes of population concentration.
iv. Deprivation index has been calculated from the parameters of economic development in the district.

v. Commuting Zones approach (Karlsson and Olsson, 2006) has been used to get the pattern and intensity of commutation.

Index of spread effect has also been considered to get the potential centres of expansion.

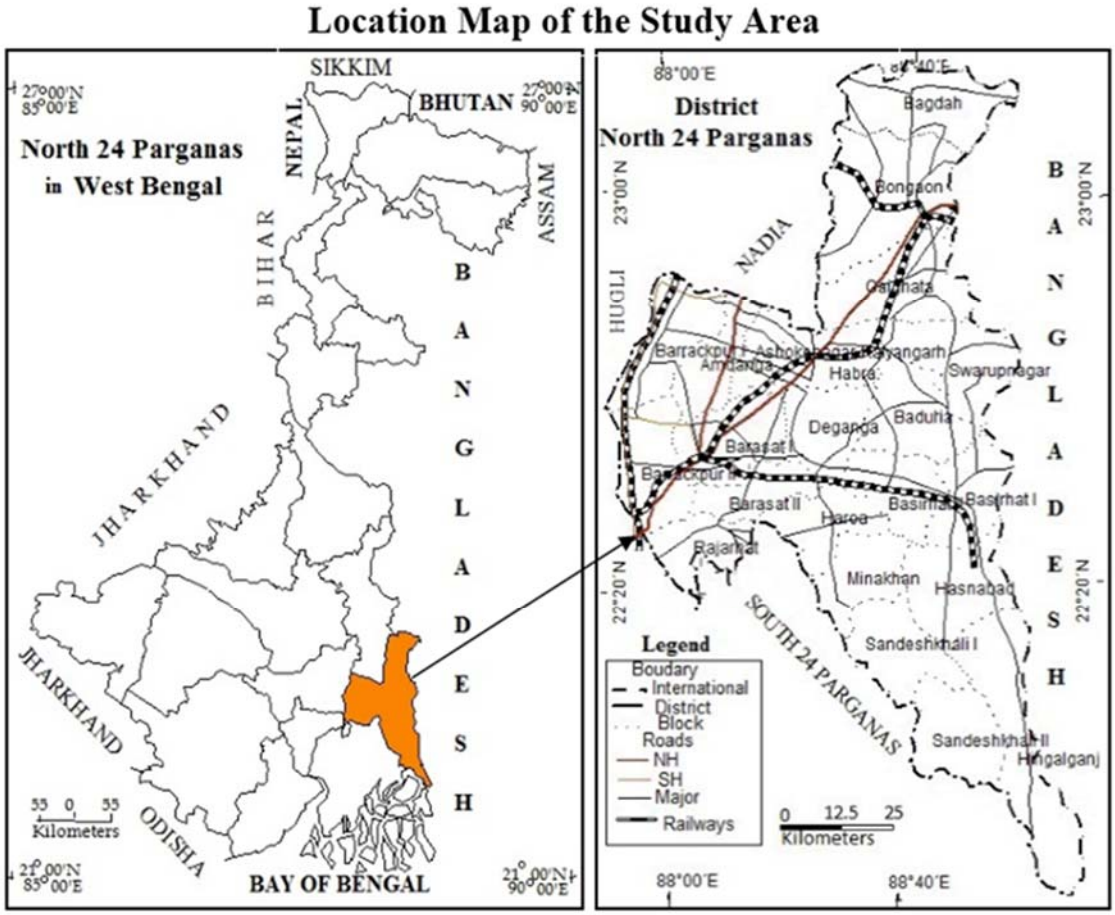


Fig 1A **Fig 1B**

Source: Census of India, 2011

5. Structural Analysis of Transport Networks

District North 24 Parganas has a well-knit road network plan and it is very much important for the passenger flow and commodities movement.

5.1 Road Network

Road networks in North 24 Parganas have the following characteristics:

- **Development of Road Network**: District North 24 Parganas has a well-knit road network plan. National and State Highways are very much influential in the flow and movement of industrial goods and migration of industrial workers. The roads under the Public Works Department (PWD roads) are there to connect the intra-district centers and thus a well-connected network has developed.
- **New Road Development Projects:** The district of North 24 Parganas is now getting the benefit of the highway projects of the Central and State Governments. For the district the major thrust is on internalizing and optimizing the benefits of the two major transport infrastructural projects of the State Government. The State Government has constructed a new expressway to connect NH34 and NH35 on one hand and NH2 and NH6 on the other. On the river Ganga a new bridge known as Nivedita Setu has been constructed. The newly constructed Belghoria Expressway belongs to North 24 Parganas. There is another newly constructed Expressway that connects NH34 via Kalyani in Nadia. All these have opened up for a new prospect of industrial development in the district. They are along Kalyani-Dum Dum Expressway the most part of which belongs to the western part of North 24 Parganas which is gradually emerging as the new industrial hub of the district. This is largely due to the fact that it has a very good regional transport linkage.
- **Connectivity Indices**: Kansky (1963) formulated the method of connectivity indices like Alpha index, Beta index, Gamma index, Cyclomatic number. The Aggregate result of all these indices may be termed as Aggregate Transportation Score (ATS). In Fig 2A Barasat, Bongaon, Habra these CD Blocks have maximum connectivity with major National, State Highways and PWD Roads and hence their ATS values are of higher ranges. It is very much important to note here that if one compares Fig 2A with Fig 4, then it would be clear that higher range of density of road coverage is not always conformal with the maximum connectivity of road. Greater density of roads may not be used properly because roads have significance for having greater number of concentration with other roads due to interconnection among NH34 and NH35. Barasat and Bongaon exhibit higher level of connectivity.

- **Degree of Connectivity or Nodal Accessibility:** Shimbel (1963) had formulated this method of Nodal Accessibility which is very much similar to the Degree of Connectivity. This implies the degree of coverage of the stretches of different types of road network. Fig 3A displays a clear picture of efficient roads which are running through Barasat, Dum Dum and Barrackpur. The degree of connectivity may be defined as to what extent any growths centre or node is accessible to other isolated nodes in a region. In this context Barasat due to its central location, Barrackpur and Dum Dum due to its proximity to the linear pattern of development have a high degree of Nodal Accessibility. This efficiency in the degree of Nodal Accessibility is due to several factors such as: a. Connectivity with the Arterial Roads. b. web like network development with the National and State Highways and PWD Roads. c. Inter and Intra District Network linkage development. Development of some Expressways, flyovers etc and Impact of some feeder roads with the major roads.

5.2 Railway Network*:*

Railway Transport is one of the modes of transport for movement of people and commodities in India [Mukherjee, 2003]. Railways provide transportation facilities for various commodities from the rich hinterland area to the growth centre.

- **Development of Railway Network:** In North 24 Parganas district Railway network was developed surrounding the districts of Haora, Hugli and South 24 Parganas district. This suburban railway network has multiple links of railway network. Eastern Railway extends over the district. Dum Dum plays a role of a junction station. There are two links radiating outward from Dum Dum. One of those extends up to Krishnanagar railway station. Another extends up to Bongaon. From Bongaon some other three important links are bifurcated outwards from Barasat to Basirhat. Besides another important railway linkage also exists.

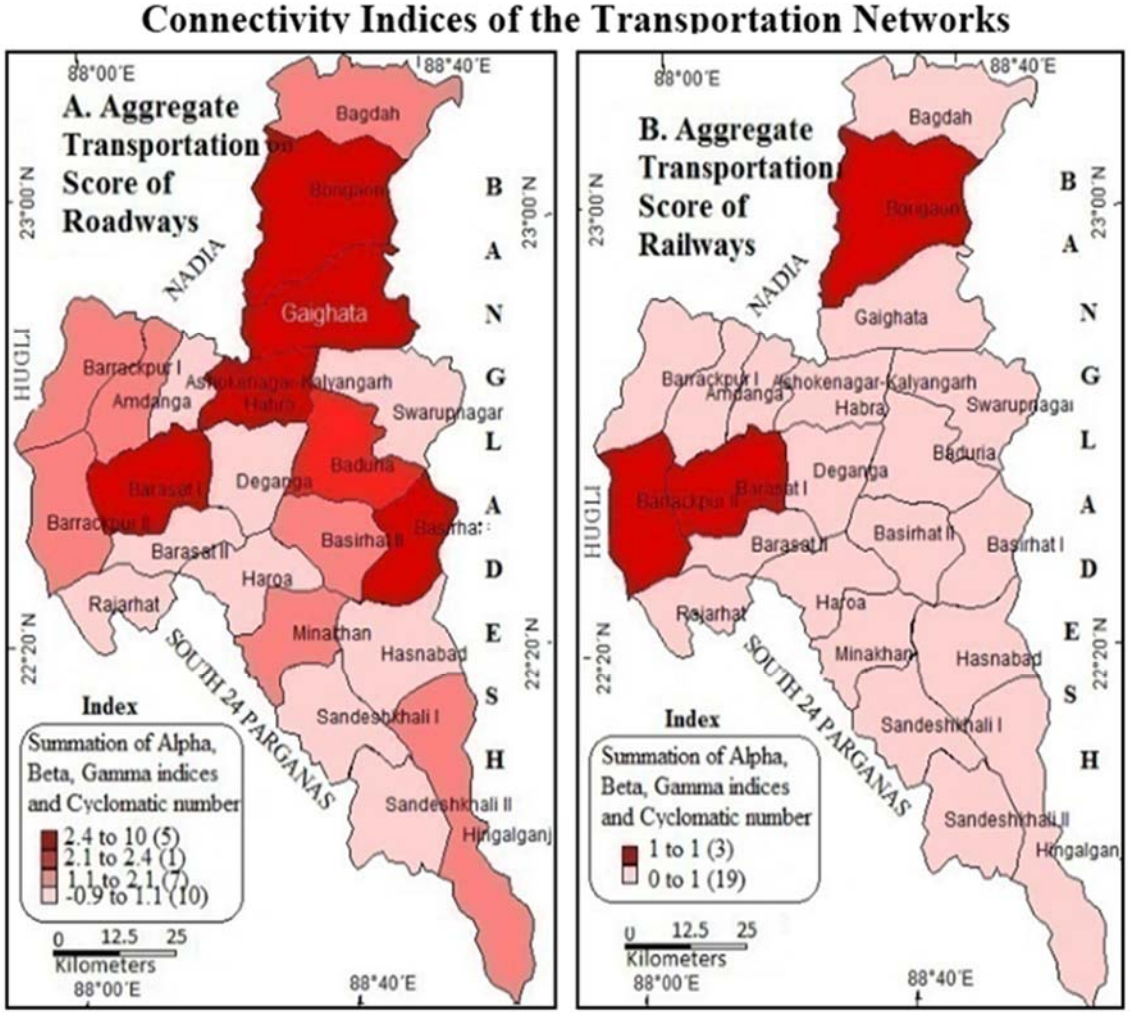


Fig. 2A Fig.2B

Source: Computed by the Author from the map of the District, 2011

- **Connectivity Indices**: The Connectivity indices (Kansky, 1963) mainly highlight the major junction point stations to be most efficiently connected node in Fig 2B. On the basis of connectivity with other links of Railways, Barasat is a well-knit node because it has multiple level of linkage development with the surrounding stations. Again Bongaon is also an important railway junction playing major role in linkage development. Dum Dum has also multiple directional railway linkage development.

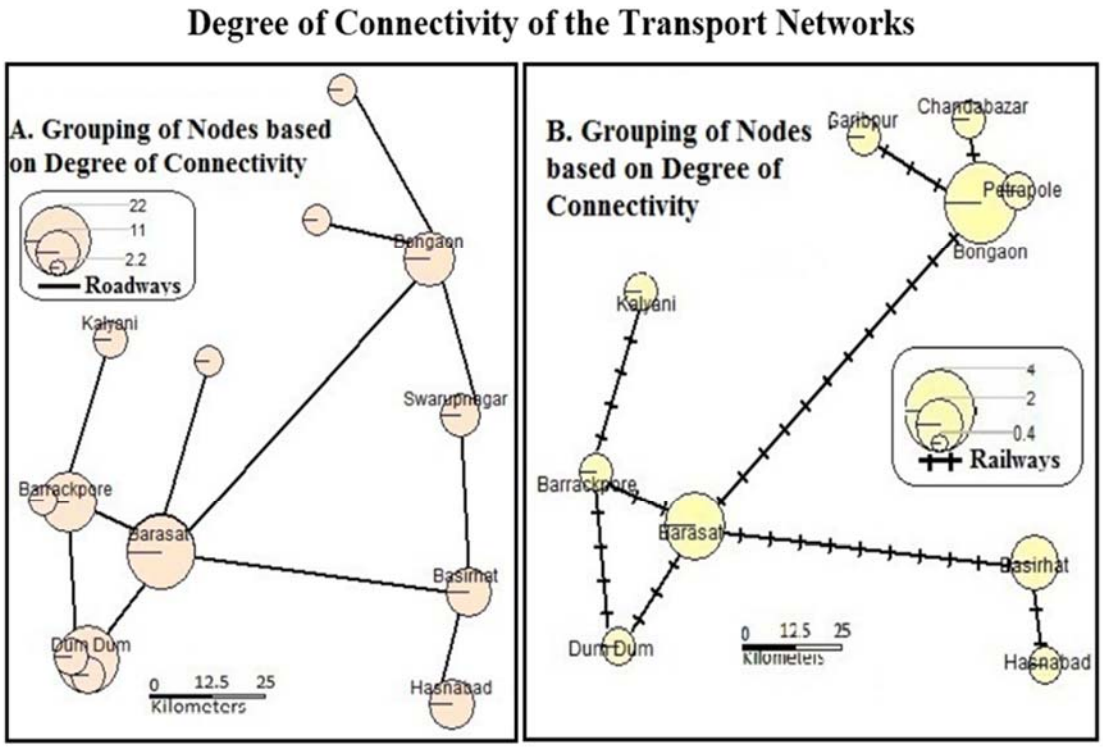


Fig 3A **Fig 3B**

Source: Computed by the Author from the map of the District, 2011

- **Degree of Connectivity:** Shimbel's method of Nodal Accessibility or Connectivity matrix represents maximum degree of connectivity.

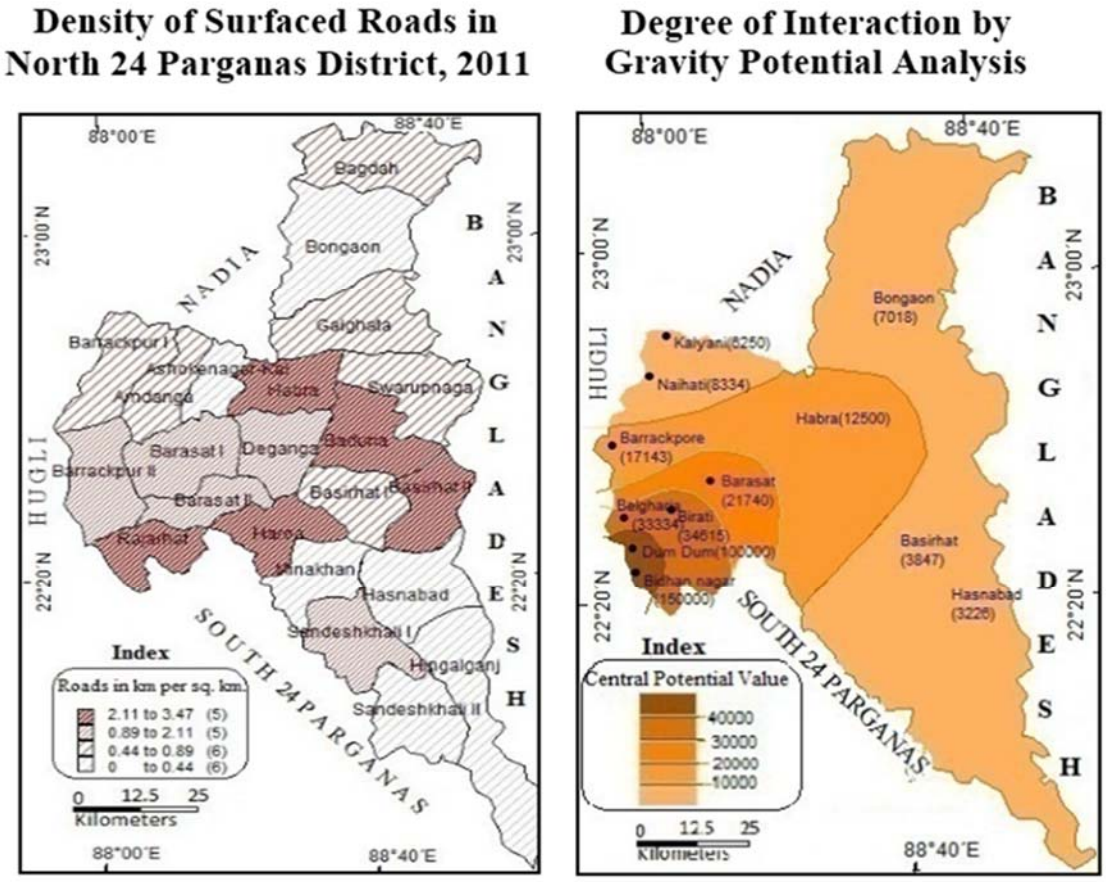


Fig. 4 **Fig. 5**

Source: Govt. of West Bengal

Source: Primary data, 2015

Fig 3B shows Barasat and Bongaon have maximum degree of railway connectivity. Variation in the degree may be due to various factors: a. Development of inter linkage under Eastern Railways among several Terminal stations. b. Areal coverage of any station which determines the capacity of keeping cars in the car shed area and Encroachment of Railway lines.

6. Degree of Interaction between the Growth Centre and the Hinterland area

Efficiency of any growth pole or growth centre depends on the degree of interaction between the central and its adjacent hinterland area. There are many types of interactions such as Population flows, Trade of goods and services, Communications, Traffic flows, Goods flows, Service connections, Newspaper circulation and financial flow (Vanhove and Klassen, 1987). Two types of interactions are discussed here:

6.1 Flow of Passengers inclusive of Commuters

The term commutation involves movement of passengers daily, weekly or monthly (Lee, 1965).

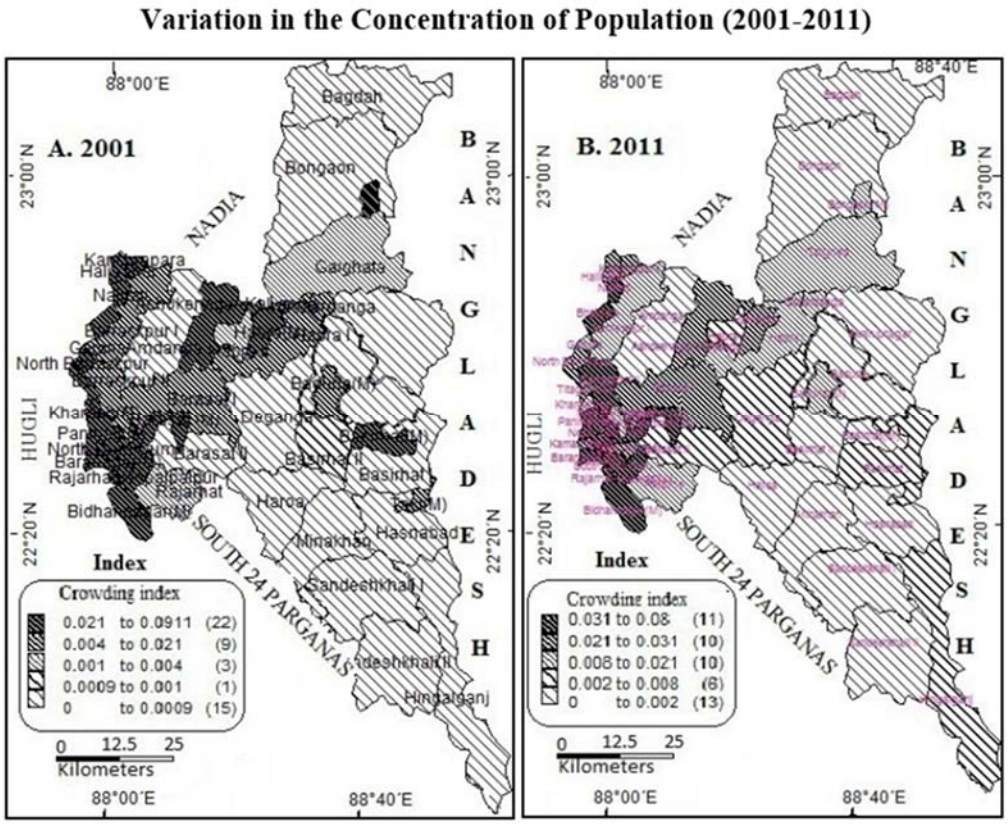


Fig. 6A **Fig.6B**

Sources: Census of India, 2001 and 2011

A huge number of passengers avail the Railway and move daily, weekly or monthly from the adjacent areas of growth centre. On the basis of the Network analysis Barasat, Dum Dum and Barrackpur have maximum degree of connectivity and accessibility. So passengers move from the surrounding areas to the nodes at maximum rate. Fig 8 represents Commuting Zones established due to Rail-road connectivity. The connecting zones (Functional region) are delineated from the mutual dependence between Municipalities which is calculated from the commuters flow in both ways (Konjhar *et al,* 2010).

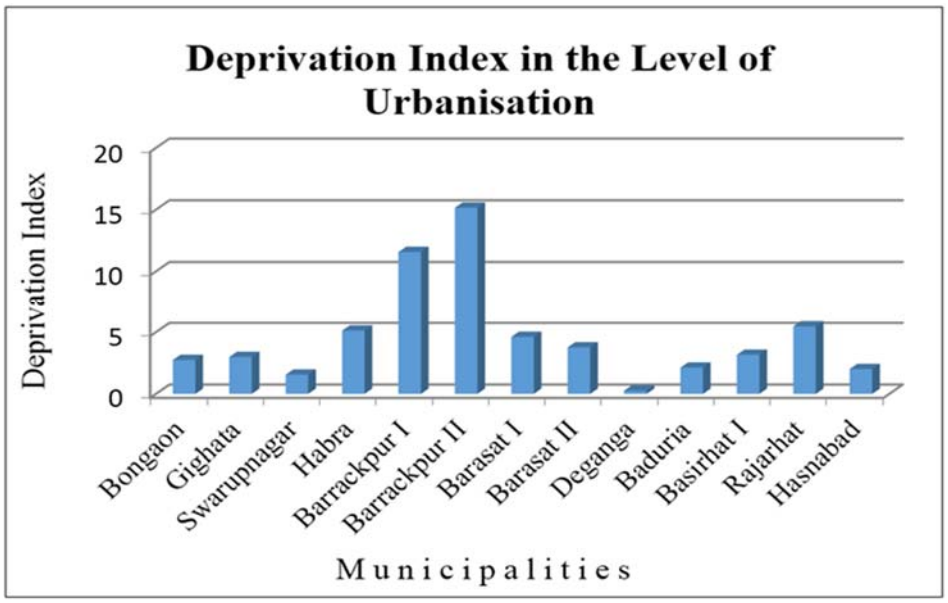
It is quite interesting to know that Kanchrapara, Bongaon, Basirhat, Hasnabad, Habra which are situated far from the growth centres of Dum Dum area have large amount of commuters related to Barrackpur and Barasat because people tend to commute from this area in search of better employment, status and social upliftment. Fig 5 displays that the highest central potential values of the commuters are around Dum Dum and Bidhan nagar area. Potential value decreases outward from its stretch.

6.2 Movement of Commodities

A functional region grows by mutual interdependence and interaction (Karlsson and Olsson, 2006). The city limits are shifted outwards by its explosive growth (Sen, 2015). The commodities which are transported from the surrounding areas like Kanchrapara, Bongaon, Basirhat and Hasnabad are vegetables, fruits, milk, fishes, raw materials for agro- based and cottage industries. On the other hand movement of commodities in form of electronics goods and monetary flow occur from Dum Dum, Barasat to its adjacent areas.

7. Impact of Transport Network on Urban Expansion and Regional growth patterns: This development of Transport network is very much important for influencing urban Expansion and regional growth pattern.

The major impact can be assessed from the following parameters:



- **Concentration of Population**: Fig 6A and B are very much important for showing the nature, concentration of population within the region. The crowding index indicates that concentration seems to be high within the stretches of Barrackpur,
  Dum Dum and Barasat area.
- **Urban Agglomeration**: Individual cities which scatter around the growth hubs have gradually evolved into urban agglomerations (Lu, 1998 and Fang, 2008). Fig 7 exhibits that urban agglomerations occur around Barrackpur-Dum Dum region.
- **Forward and Backward linkage development**: A forward and backward linkage was developed around Dum Dum and Barrackpur which ultimately forms growth hub and potential growth centres and Fig 9 has shown a linear stretch around Barrackpur-Dum Dum region and Barasat region.

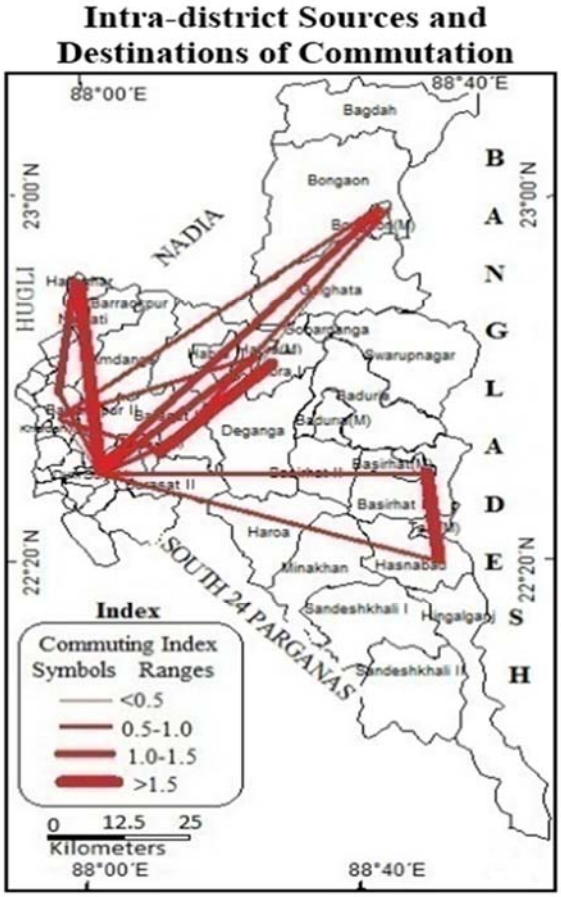


Fig. 8 **Fig.9**

Source: Primary data, 2015
Source: Census of India, 2001, 2011

8. Major Findings

Roadways and Railways are the arteries of development because these are important for freight movement and commuters flow.

i. Barrackpur-DumDum region and Barasat regions is the most efficiently connected node in the district and show the urban development and growth of the region occurs surrounding these belts. These stretches are linear in orientation.
ii. There is underlying regional disparity within the region because trend of urbanization is very much biased and centered only on the well-knit growth centre.
iii. When the scope of forward and backward linkage development finds light of the day, any region get more chance of facing the spread effect of growing outwards.
iv. With the increasing scope of the degree of interaction either through commodity flow or passengers flow, urbanization or expansion of urban agglomeration accentuates.
v. In spite of urban expansion, interior regions or outskirts area are not connected with the major growth hubs due to the absence of "last-mile connectivity" i.e. connectivity with the interior areas.
vi. Rajarhat-Gopalpur area has been developed as a pattern of growth of Satellite town. Growth of some more such satellite towns would be beneficial for the regional development.

9. Recommendations

Regarding the overall growth and balanced regional development some recommendations may be put forward:

i. Increasing the efficiency of the feeder roads to connect the most interior regions will be helpful for having the last mile connectivity of the districts.
ii. The East-West disparity in urbanization and regional development may be reduced by expanding the transport network connectivity and accessibility only.
iii. In some cases where transport network expansion is not possible immediately, growth of some satellite towns like Rajarhat area may be established by proper planning.
iv. Decentralised plan based approaches should be established for having a balanced regional development pattern in the overall district.
v. By extending the area under Backwash and Spread effect, the region will have a full-fledged development.

10. Conclusion

Lastly it may be said that the District North 24 Parganas has a moderate level of connectivity of roads and railways and this is concentrated along the river Hugli in the western side of the district. So the eastern stretches are still remaining backward where an overall efficient pattern of transport network development is needed. Both the intra and inter district network connectivity should be developed for efficient level of interaction among several regions. Besides the district needs proper planned approach for the growth and development of the district.

11. References

1. Banerjee Sayani, De Dipanwita. Level of Urbanisation: An Emperical study of North 24 Parganas. International Research Journal of Social Science. 2014; 3(10):12-20.
2. Chisti Selim. Regional Disparity in the Road Transport Network of West Bengal. EPRA International Journal of Economics and Business Review. 2015, 3(1).
3. Hao Wang, Yu Deng, Enze Tian, Kaiyong Wang. A Comparative Study of Methods for Delineating Sphere of Urban Influence: A Case Study on Central China, China, 2014.
4. Konjar Miha, Lisec Anka, Drobne Samo. Methods for Delineation of functional regions using data on Commuters. 13th Agile International Conference on Geographic Information Science, Portugal, 2010.
5. Paul Suman. Finances and Governance of Urban Local Bodies: An approach of Urban Development perspectives from a developing country, India. Journal of Urban and Regional Analysis, 2014; VI(2):181-201.
6. Sen Ramkrishna. Mobility Improvement Plan for Barasat Municipal Area. International Journal of Innovative Research and Development, 2015, 4(2).
7. Vaidya BC. Geography of Transport Development in India. New Delhi: Concept Publishing Company, 2003.