Selected Physical & Socio-economic Determinants of Rural Population Distribution in Birbhum

CHAPTER XVII

Road Density and Population Distribution

The power of an area to attract and support population may be influenced by its location in relation to other areas and to the major transportation routes. Roads are the lifelines of the economy of a region. These vital channels promote agricultural development and form an integral part of the area it serves. Roads represent important linkages in the process of improvement of agriculture in any area. In Birbhum these contribute significantly towards mobilization of resources and help to reduce the gap between urban and rural sectors. It was realised early that to exploit the agricultural potential roads should be developed on a priority basis for a complete change in the agricultural scene. A network of roads comprising trunk roads, (Photo 19), link roads, approach roads and village roads (Photo 28), provide access to markets of all types (Photo 29). Normally, roadways are preferred to railways because they involve less capital investment and are more flexible in character. It is one of the reasons why complex networks of roads are developed in most agricultural areas. For the development of inherent agricultural potentials of this area, accessibility is a dire need as road transportation plays an important role in marketing different commodities. Till recently, rural road transportation was inadequate in Birbhum. This is a major reason for the limited success in dairying and in growing of fruits and vegetables. Unmetalled rough roads of remote rural areas create even greater difficulty especially where summer (kharif) marketing coincides with winter (rabi) sowing. It is the urgent need of the district that the roads be maintained as all weather roads for boosting up the agrarian economy.

17.1 Road development

On the whole the development of roads in Birbhum started early in the 19th century when the British Commercial Resident took an interest in factory construction. The only road serviceable throughout the year was the one from Suri to Burdwan through Surul. A road to Katwa and another to Deoghar and also one to Murshidabad were repaired from time to time but could not be kept in good condition. In 1910 there were 1,057 km of roads under District Board. Of this 293 km were metalled. Some of these roads connect the district headquarters Suri with Sainthia, Dumka (Jharkhand), Rajnagar, Mahamadabazar and Ajay river. Bolpur, Dubrajpur, Nalhati, Sainthia and Rampurhat are connected with neighbouring Jharkhand state and other district of West Bengal. At present, inter-district and inter-state communication is maintained by a large number of metalled roads, some of which are Suri-Bankura, Suri-Durgapur, Suri-Burdwan, Suri-Berhampore, Bolpur-Durgapur, Rampurhat-Dumka, Muraroi-Pakur, Suri-Deoghar and Sainthia-Dumka.

The district is provided with a network of bus-services radiating mostly from Suri, Sainthia, Bolpur and Rampurhat and providing cheap communication facilities to almost every place of some importance not only within the district but also several such places in the adjoining districts, even crossing the boundaries of the state. Most of these bus services are privately owned.
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With a view to showing the spatial variation in the road network in Birbhum district, block wise data on roads was obtained from the office of the Executive Engineer, Public Works Department, Suri, Birbhum, and District Board Office at Bolpur and Suri and published maps (Birbhum District Census 1991). Such data have been used to determine the block wise road density, i.e. road length in km per sq km area. These road density values have been utilized to draw a choropleth map showing the distribution of roads in different blocks (Fig. 47). Examination of this map reveals that road density is very low in all the blocks, varying between 0.38 km / sq km to 0.11 km / sq km. The highest road density occurs in Nalhati II and Suri I. Poorest road density is found in Rajnagar and Khoyrasoi blocks. Muraroi I, Rampurhat I, Bolpur-Sriniketan, Sainthia and Mayureswar II have road density between 0.25 km and 0.32 km per sq km. The rural population distribution map may be compared with this map of road density in Birbhum to find out if there is any relationship between the two phenomena.

17.2 Relationship between rural population density and road density

When the distribution of rural population is compared with that of rural road density certain similarities become evident. It is noted that population distribution is sparse in the west and much more dense in the north and east. The blocks with low population density are Rajnagar and Mahammadabazar in the western part of the district. Khoyrasoi too has low density of population. High density is found in Muraroi I & II, Nalhati II and Rampurhat II in the north. Road density too appears to decrease from east to west and. Road density is higher in the south and southeast in Mayureswar II, Sainthia, Bolpur-Sriniketan and Nanur blocks. For rural density quite the opposite is found to prevail as revealed by the map in the inset. While both road and population density are high in Nalhati II in the north, Suri I is characterised by high road density but low population density. Support for such superficial observations can be obtained through statistical analysis of the two sets of data. To describe the general relationship between the two variables in quantitative terms or to map the varying degree of correspondence between the two, statistical analysis is found to be a better choice.

As an initial step towards such analytical study, the regression of density of rural population on rural road density has been employed. Fig. 48 shows a scatter diagram in which rural population density i.e. D values have been shown along the Y-axis and road density i.e. J values (obtained from the choropleth map of road density at the areal center of the C. D. blocks) have been shown along the X-axis (Appendix 1, Table N). The values of D and J at the areal center of each block have been taken as paired values for the scatter diagram and subsequent regression analysis. These paired values, whose location in the scatter diagram show graphical correlation between the variables have been utilized to draw the regression line, that is the straight line of best fit. The regression line obtained by the method of least squares is \( D_c = 315.21 + 960.84 \times J \), which shows the linear relationship between road density (J) and rural population density (D). Stated in statistical terms according to this relationship a C. D. block in Birbhum district with road density 0.2 km / sq km is expected to support a rural population density of 507 persons per sq km approximately (\( D_c = 315.21 + 960.84 \times 0.2 = 507 \, \text{persons approx.} \)).
Fig. 48: Scatter diagram (road density and rural population density)

\[ D_c = 315.21 + 260.84 \, J \]
In a similar manner, the 'expected' \((D_c)\) rural population density is computed for each block. The values, thus obtained may be plotted at the areal centre of blocks and isopleths are drawn through them. If such an attempt were made there would be two population density maps, one showing the actual distribution and the other depicting what the density distribution pattern would be if it were entirely dependent on road density as defined by the regression line. In order to find out the strength of relationship, i.e., the degree of association between rural population density and road density, the Pearson product moment correlation coefficient has been employed. This shows that the correlation coefficient \((r)\) is 0.42. The value of \(r\) is obtained thus:

\[
\frac{N \sum JD - (JD)(\sum J) - (D)(\sum D)}{\sqrt{(N\sum J^2 - (\sum J)^2)} \times \sqrt{(N\sum D^2 - (\sum D)^2)}}
\]

where,
- \(r\) = Correlation coefficient
- \(J\) = Independent variable, i.e. road length in km / sq km
- \(D\) = Dependent variable, i.e. rural population density
- \(N\) = Number of pairs of observed values.
- \(\Sigma\) = Summation

For a sample size 19 the critical value of the correlation coefficient at 5% level (two-tailed) is 0.456. Therefore, this correlation coefficient is not significant at 5% level. But, it is significant at 10% level. In other words, the null hypothesis that the correlation coefficient is zero is rejected. The Student’s ‘\(t\)’ test has also been applied to test the significance of the \(r\). The value of \(t\) works out as follows:

\[
\frac{r \sqrt{(n-2)}}{\sqrt{1-r^2}} = \frac{-0.42 \sqrt{(19-2)}}{\sqrt{1-(0.42)^2}} = 1.91
\]

The critical value of \(t\) with 17 degrees of freedom at 5% level (two sided) is 2.11. Hence the calculated value of \(t\) is not significant at that level. Taking the Pearson correlation coefficient, the explained variation = \(r^2 \times 100\) i.e. \(0.42^2 \times 100 = 0.18\). Thus about 18% of the total variation in \(D\) i.e. rural population density is explained by \(J\) i.e. percentage of literates. Since the correlation coefficient of 0.42 does not indicate a perfect positive relationship between road density and rural population density, the maps showing the ‘relief’ of these two variables will not match perfectly. The two will differ considerably from each other. Such differences are absolute residuals \((D - D_c)\). From the absolute residual values standardised residuals have been calculated and plotted at the areal centre of the respective blocks for the preparation of a second isopleth map (Fig 49). This map depicts the relationship between road density and rural population density.

The impact of road density upon rural population density is evident from the above mentioned map. The white colour indicates areas where the relationship appears to be very close. The darker the shading the weaker is the impact of road density on population distribution. Such darker shading with plus values is found to occur in the north and in the east in parts of Muraroi II.
Fig. 49: Relationship between rural population density and road density

Legend
Standardised residuals
$(D-D_c)/SE_D$

- 1.5
- 1.0
- 0.5
0
+ 0.5
+ 1.0
+ 1.5

D - $D_c$ = Number of persons / sq km more or less than normal
Normal is $D_c = 315.21 + 960.84J$
Population density (D), road density (J)
Standard error of estimate = $SE_D$

Scale
5 10 15 km
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Nalhati I & II, Rampurhat II, Mayureswar I, Mayureswar II, Labpur, and Nanur. This indicates that in such areas population density is higher than what is expected if road density were the only determinant. Western part of Rampurhat I and Sainthia, parts of Mahammadbazar, Dubrajpur, Rajnagar, Suri I & II, Blopur-Sriniketan and Illambazar show negative values. Negative values indicate that rural population density in these areas is below the level ‘expected’ for the given road density. White areas indicating close correspondence between the two variables are seen in Murari I & II, Nalhati I, Rampurhat I, Mayureswar, Sainthia, Suri, Illambazar and western part of Khoyrasol. The isopleth of zero departure in the map brings out the fact that all other factors affecting the distribution of population remaining constant the density of rural population is the same as is to be expected from road density alone. Areas of high departure values whether plus or minus in the map indicate that road length per unit area is not a significant influence upon the distribution of rural population in those parts of the district.
Photo 27. Power pylon in harvested rice paddy

Photo 28. Dusty unmetalled road in Joydeb-Kenduli village from the bank of Ajay river to Radhabinod temple. The modern market building contrasts with the older structures nearby.
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Photo 29. Close up of the new market place in Kenduli

Photo 30. Neglected but exquisitely worked terracotta façade of Radhabinod temple in Kenduli