STRUCTURE OF TRANSPORT NETWORK AND PATTERN OF REGIONAL DEVELOPMENT: A CASE STUDY OF JHARKHAND

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DOCTOR OF PHILOSOPHY

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DECLARATION

I do hereby declare that the thesis entitled **"STRUCTURE OF TRANSPORT NETWORK AND PATTERN OF REGIONAL DEVELOPMENT: A CASE STUDY OF JHARKHAND"** submitted by me is a bonafide work and that it has not been submitted to any other university for the award of any other degree.

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Dedicated to the Most Deprived Population of India-
Rural Tribals

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STRUCTURE OF TRANSPORT NETWORK AND PATTERN OF REGIONAL DEVELOPMENT: A CASE STUDY OF JHARKHAND

Abstract

Introduction

Transport is regarded as the basic facilitator of development in any area as it not only provides physical connectivity between two spatially separated locations but also allows spatial interactions of goods and people between them. The basic impulse of the countries investing in transport infrastructure programme has been to induce development in the region directly or indirectly by stimulating economic growth in the short run and consequently overall socio-economic development in the long run. The performance of Jharkhand is poor in terms of total surfaced road. The structure of rural transport network in Jharkhand is poorly developed and only 21.2 percent of villages in the state have immediate access to all-weather roads compared to the all India average of 53.3 percent in 2001.

The state of Jharkhand holds a strategic position of national importance as it has 40 percent of India's mineral resources. However, it is a paradoxical situation that in spite of being a mineral resource rich state, the state has widespread poverty and is deficit in some of the basic infrastructure facilities. The performance of the state has been poor in terms of major indicators of socio-economic development when compared to all India figures. Jharkhand ranks among the lowest only above Assam in terms of Net State Domestic Product (NSDP) and it occupied the lowest rank only above Orissa in terms of poverty ratio in the all India state level ranking in 2004-05. The relationship between infrastructure development and growth seems to be directly related to Jharkhand. Since economic and social development literally moves into the areas connected with improved transport connectivity, the development of road transport forms an essential part for over all development of the state.

This study examines the structure of road transport system and its relationship with regional development in the state of Jharkhand.

Objectives of the Study

Its main objectives are:

1. To study the historical evolution of the transport system and the development of road transport infrastructure in Jharkhand;

2. To analyze the spatial structure of transport network at the urban and rural levels in the state in order to delineate areas which are endowed with or are deficient in transportation facilities;

3. To study the level of accessibility and the travel behavior patterns in areas with varying levels of physical connectivity at the rural level;

4. To study the relationship of transport development with the urban and rural attributes and levels of regional development in Jharkhand.

Data Source and Methodology

The analysis is based on both primary and secondary sources of data. The historical evolution of the transport system and the development of road transport infrastructure in Jharkhand has been studied in terms of ancient, medieval, colonial and post independence periods. Historical facts and figures related to the development of transportation network were extracted from various secondary sources. The development of transport infrastructure is further studied for the Five Year Plan periods. Transport development programmes, such as the PMGSY and Bharat Nirman, which are initiated by the Central Government have also been studied. The spatial structure of transport network at the urban and rural levels was analysed with the graphical method. At the urban level, the measures of transport connectivity of the entire network and the measures of nodal accessibility are calculated with the help of Geographical Information System (GIS) techniques.

At the rural level, the connection of all weather roads to the inhabited villages is taken as the measures to study transport accessibility. Statistical techniques for computation and GIS techniques for mapping and analysis have been adopted for both urban and rural analysis. The level of accessibility and the travel behavior patterns are analyzed with eight selected sample villages, which have varying levels of physical connectivity. Firstly, the levels of rural

accessibility are assessed with the help of indicators of potential accessibility, relative accessibility and the availability of transport provisions in the sample villages. Secondly, the travel behaviour pattern is assessed by analysing the mobility patterns of the population in the sample villages. Stratified Sampling is done for the selection of the sample districts, blocks and villages. The relationship between transport development and the urban and rural attributes of the region are related with the transport indicators. At the urban level, a functional classification of towns is done on the basis of dominant function. The socio-economic indicators of development are related to transport development indicators with statistical and other methods.

Results

The evolution of transport systems in the state of Jharkhand has revealed that the transport network before the colonial period was very rudimentary in form and was primarily internal with very little scope of development. The development of the transport system gradually gained momentum in the colonial period with the introduction of modern means of transport and development of roadways and railways. With the focus on mining and industrial activities and urbanisation in some areas, the orientation of the transport system was concentrated towards these locations. During the post-Independence period, economic exploitation of resources continued with the transport system that was inherited from the colonial period. Road transport development in the state, during the Five Year Plan periods, showed poor level of performance. The growth of total and surfaced road length has shown a declining trend. The rural road connectivity in the state has shown the poorest performance among all Indian states. Although significant physical progress in the rural road connectivity was noticed in the region during the initial plan period of the PMGSY scheme, but in subsequent years the progress showed a declining trend.

The results of the measures used to assess the degree of connectivity show that the urban centres in the state are not adequately connected to the network and some degree of complexity in the network was also observed. The nodal accessibility indices have differed among the urban centres in Jharkhand. In general the urban centres located near the centre of the network have more transport advantages. The ownership of non-motorised means of transport predominates in the rural areas of Jharkhand. It is more among the sample villages of Simdega district than

Chatra district and the villages in Simdega district located in the most connected block of Bolba have higher ownership of vehicles mainly bicycles. The relative accessibility of the villages to the service centres is found to be high in the village with better physical accessibility. The remotest villages in both the districts have the poorest levels of relative accessibility. The mobility patterns of the villagers among the sample villages show that the sample villages, which have higher levels of physical connectivity have higher levels of mobility. The relation between rural accessibility pattern and travel mobility pattern shows that the villages with better levels of physical accessibility comprising of pucca road, nearness to bus stop and nearness to block headquarter have higher transport mobility.

Transport accessibility shows distinct relationship with urban characteristics. The towns in the state that have a higher nodal accessibility show a positive relationship between social and economic indicators of development. Transport accessibility also shows distinct relationship with towns specializing in different types of functions. Transport accessibility has a direct relationship with various socio-economic development indicators at the rural district level. The sample villages in Simdega district that have better physical accessibility show better performance with regard to both social and economic indicators. These villages are located in the block that also has better rural connectivity with pucca roads. The sample villages in Simdega district that have poor physical connectivity show better performance in terms of the social indicators. These villages show poor performance with regard to the economic indicators of development. These villages are located in the block that has poor rural connectivity with pucca roads. The sample villages in Chatra district that have better physical accessibility show moderate performance with regard to social indicators and better performance with regard to economic indicators. These villages are located in the block that has comparatively better rural connectivity with pucca road. The sample villages in Chatra district that have poor physical accessibility show the poorest performance in terms of social indicators. However these villages show better performance in terms of economic indicators.

Thus, the village level analysis of the relationship between transport accessibility and socio-economic development shows a complex relationship. There are other related factors that are associated in the relationship between transport accessibility and regional development at the urban as well as the rural levels. However, it is evident from the study that transport accessibility

is associated either directly or indirectly with the socio-economic development at the regional level in some form or the other.

Chapter 1
INTRODUCTION

1.1 Introduction

Transport is regarded as the basic facilitator of development in any area as it not only provides physical connectivity between two spatially separated locations but also allows spatial interactions of goods and people between them. The basic impulse of the countries investing in transport infrastructure programme has been to induce development in the region directly or indirectly by stimulating economic growth in the short run and consequently overall socio-economic development in the long run. In the Less Developing Countries the focus is on the role of transport for promoting rapid economic development.[1] In recent decades there has been a growing realization about the potential role of transport development in achieving the UN's Millenium Development Goals (MDGs), which range from halving global poverty and hunger, to protecting the environment, improving health and sanitation and tackling discrimination against women.[2]

The state of Jharkhand holds a strategic position of national importance as it has 40 percent of India's mineral resources. However, it is a paradoxical situation that in spite of being a mineral resource rich state, the state has many development deficiencies. It has widespread poverty and is deficit in some of the basic infrastructure facilities. The Human Development Report of UNDP, which has used the Multidimensional Poverty Index (MPI) based on variables such as access to education, health, electricity, sanitation, drinking water, cooking fuel and assets, has shown that 77 percent of Jharkhand's population is poor.[3] Poor infrastructure and lack of institutional development are identified as the two major constraints to growth in such a situation.[4] Studies have also shown that most of the districts in the state that are 'food insecure'

[1] B.S. Hoyle (1973): *Transport and Development*, Macmillan, London.

[2] AITD (2005): "The Role of Transport Development in Achieving the Millennium Development Goals -Access, Transport and Infrastructure" *The Asian Journal*, Vol. 12. No. 1.

[3] B. Debroy, L. Bhandari and V. Singh (2011): *Transforming Jharkhand: The Agenda for Action, Report of the Chief Minister's Committee for the Development of Jharkhand*, Govt. of Jharkhand, Ranchi, p. 22.

[4] World Bank (2007): *Jharkhand: Addressing the Challenges of Inclusive Development, Poverty Reduction and Economic Management*, India Country Management Unit, South Asia, Report No. 36437 - IN

have poor rural connectivity.[5] The inadequacy of road transport has been a deterrent to growth and according to a World Bank report, the under provision of all weather roads has been one of the bottlenecks to growth in Jharkhand.[6]

1.2 Objectives of the Study

This study examines the structure of road transport system and its relationship with regional development in the state of Jharkhand. Its main objectives are:

1. To study the historical evolution of the transport system and the development of road transport infrastructure in Jharkhand;

2. To analyze the spatial structure of transport network at the urban and rural levels in the state in order to delineate areas which are endowed with or are deficient in transportation facilities;

3. To study the level of accessibility and the travel behavior patterns in areas with varying levels of physical connectivity at the rural level;

4. To study the relationship of transport development with the urban and rural attributes and levels of regional development in Jharkhand.

1.3 Research Questions

The following research questions emerge from the above objectives:

1. How has the transport system evolved in Jharkhand?
2. What is the present level of road transport development and the overall structure of transport network in the state?
3. Which are the areas that are endowed with or are deficient in transport infrastructure?
4. What is the relationship between rural accessibility and travel behavior pattern in rural Jharkhand?
5. What is the relationship between transport development and rural and urban attributes in Jharkhand?

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[5] Institute for Human Development and United Nation Food Programme (2008): *Food Security Atlas of Rural Jharkhand*, New Delhi: Institute for Human Development.

[6] World Bank (2007), *Op. cit.*

6. What is the relationship between transport development and regional development in Jharkhand?

1.4 Data Base

The analysis is based on both primary and secondary sources of data. The secondary data used in the analysis are obtained from the following sources:

1. District Gazetteers of Bihar, Hazaribag, Ranchi, Santhal Parganas, Singhbhum and Palamau
2. Historical Maps - Rennell's Map of 1783 and 1792
3. Census of India, 1991, District Census Handbook, Block Maps
4. Census of India, 2001, Village Directory, Jharkhand
5. Census of India, Household Table, 2001 and 2011
6. Census of India, Bihar, Town Primary Census Abstract, 1991
7. Census of India, Jharkhand, Town Primary Census Abstract, 2001
8. Directorate of Economics & Statistics, Dept. of Planning and Development, Govt. of Jharkhand, http://www.desjharkhand.nic.in/stateincom.html
9. http://jharkhand.nic.in/bpl_list.html in B. Debroy, L. Bhandari and V. Singh (2011): *Transforming Jharkhand: The Agenda for Action, Report of the Chief Minister's Committee for the Development of Jharkhand,* Govt. of Jharkhand, Ranchi
10. Base Maps from Jharkhand Space Applications Centre, Department of Information and Technology, Govt. of Jharkhand, Ranchi
11. Basic Road Statistis of India, 2004-05, 2005-06, 2006-07 & 2007-08, Ministry of Road Transport and Highways, Transport Research Wing, Govt. of India, New Delhi, morth.nic.in/wrutereddata/mainlinkFile/File417.pdf
12. Pradhan Mantri Gram Sadak Yojana (PMGSY), www.pmgsy.nic.in
13. Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, 2002-03, http://lus.dacnet.nic.in/dt_lus.aspx

Primary data was collected from the sample villages through a household survey. The information collected from the fieldwork are related to demographic and socio-economic attributes of the population, transport availability, travel behavior, modes of travel and other related characteristics.

1.5 Methodology

The methodology used in the analysis for the above objectives is briefly discussed here. The historical evolution of the transport system and the development of road transport infrastructure in Jharkhand has been studied in terms of ancient, medieval, colonial and post independence periods. Historical facts and figures related to the development of transportation network were extracted from various secondary sources. The development of transport infrastructure is further studied for the Five Year Plan periods. Transport development programmes, such as the PMGSY and Bharat Nirman, which are initiated by the Central Government have also been studied.

The spatial structure of transport network at the urban and rural levels was analysed with the graphical method. At the urban level, the measures of transport connectivity of the entire network and the measures of nodal accessibility are calculated with the help of Geographical Information System (GIS) techniques. At the rural level, the connection of all weather roads to the inhabited villages is taken as the measures to study transport accessibility. Statistical techniques for computation and GIS techniques for mapping and analysis have been adopted for both urban and rural analysis. The methods used are further discussed in detail in the chapters.

The level of accessibility and the travel behavior patterns are analyzed with eight selected sample villages, which have varying levels of physical connectivity. Firstly, the levels of rural accessibility are assessed with the help of indicators of potential accessibility, relative accessibility and the availability of transport provisions in the sample villages. Secondly, the travel behaviour pattern is assessed by analysing the mobility patterns of the population in the sample villages. Stratified Sampling is done for the selection of the sample districts, blocks and villages.

The relationship between transport development and the urban and rural attributes of the region are related with the transport indicators. At the urban level, a functional classification of towns is done on the basis of dominant function.

The socio-economic indicators of development are related to transport development indicators with statistical and other methods. The details of which are given in the relevant chapter.

1.6 Literature Survey

Transport studies have been associated with various disciplines and literature on it is very diversified. Geographical studies on transport have focused on the spatial changes and its effect on the regional pattern of growth. Through the literature review, an attempt is made to link prior research with the present study. The survey of literature have been divided into three broad categories- first, the concept and measures of the structure of transport, second, the theoretical studies on transport and regional development, and third, some evidences on the relationship between transport and regional development in India and Jharkhand.

1.6.1 The Structure of Transport Network

The concept of the structure of transport network is fundamental to the study on transportation. The structural property of the network implies the degree of connections. The network is made up of nodes and vertices. This is defined as the connectivity of the network. It is also referred by some as physical accessibility. The Victoria Transport Policy Institute states that, "Connectivity refers to the directness of links and the density of connections in path or road network." However, the basic aim of transport is to provide accessibility. Sources reveal that it is difficult to define accessibility because of its relative association with various components such as the location, opportunities, distance, time, cost, ease of travel, etc. Accessibility is defined as "the opportunity for contact or interaction from a given point or location, in relation to other locations."[7] According to Morris, Dumble and Wigan, accessibility has been defined as "some measure of spatial separation of human activities that denotes the ease with which activities may be reached from a given location using a particular transportation system."[8] Hansen (1959) has

[7] P.L. Knox and S.A. Marston (2001): *Places and Regions in Global Context: Human Geography*, 2nd edition, Prentice Hall, New Jersey, p. 39.

[8] J.M. Morris, P.L. Dumble and M.R. Wigan (1979): "Accessibility Indicators for Transport Planning", *Transportation Research,* Vol. 13A, pp. 91.

defined accessibility "as potential of opportunities for interaction".[9] Knox has stressed on the aspect of effective accessibility which not only includes distance but also the configuration of networks along which communication takes place. He further emphasized that "connectivity is also an important aspect of accessibility, because contact and interaction are dependent on channels of communication and transportation."[10]

1.6.2 Measures of Transport Connectivity and Accessibility

According to Singh, "the degree of accessibility is an index of the extent of transportation development in a region and provides an instrument to measure the effectiveness of a transportation cover."[11] In the literature, several broad applications of accessibility indicators are identified. These include the evaluation of the transport and landuse system, modeling travel choice situations, modeling urban development, etc. Significant studies on transport accessibility consider the characteristics of population actually residing in the study area and define accessibility of an area as the average opportunities that the residents of the area possess to take part in a particular activity or a set of activities.[12] Accessibility is measured using the two approaches, viz. the graphical approach and the activity-interaction approach. These are part of the network approach which has remained the basic tool in measuring the accessibility indices[13]. The measure to assess the connectivity and efficiency levels of the entire network was given by the Kansky. This measure comprises of three main indices viz. Alpha, Beta, and Gamma. Alpha Index is the ratio between the actual number and maximum possible number of loops. Beta Index is the number of links per node, and Gamma Index is the ratio between the actual and maximum possible number of links.[14] According to Hilling, "there is a close correlation between high indices of connectivity and high technical and socio-economic status."[15]

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[9] H. Hansen (1959): "How Accessibility Shapes Land Use", *Journal of American Institute of Planners*, 25 (2), p. 73.

[10] P.L. Knox and S.A. Marston (2001): *Op. cit.*, p. 40.

[11] J. Singh (1964): *Transport Geography of South Bihar*, Banaras Hindu University Press, Varanasi, p. 99.

[12] A.K. Sharma and A. Luthra (1996): "Concept and Application of Accessibility: A Retrospect", *Spatio-Economic Development Record*, Vol. 3, No. 4, July-August, pp. 37-42.

[13] A.K. Sharma and A. Luthra (2001): "Approaches to Accessibility Measurement: A Theoretical Evolution", *Spatio-Economic Development Record*, Vol. 8, No. 2, March-April, pp. 19-43.

[14] *Ibid*.

[15] D. Hilling (1996): *Transport and Developing Countries*, Routledge, London, p.36.

1.6.3 Relationship between Transport and Development

The relationship between transport and development has long been researched but studies show that the relationship is often complex and it becomes difficult to measure the effects of transport on regional development. Sources reveal that "there is no direct causal relationship between transport provision and development and that new road are permissive rather than automatic triggers of development."[16] There are indirect measures to assess the relation between the two. Literature reveals that there are three possible relationships between transportation and development. These are - i) a positive effect on the development process, ii) a permissive effect on the development process, and iii) a negative effect.

Von Thunen's work in 1826 on "The Isolated State", where the relationship between an agricultural region and an urban region (trading centre) is described, clearly brings out that the improved transport infrastructure had a beneficial effect on the land owners.[17] Hart, in his study had shown that there are strong links between changes in transport and changes in the urban and regional patterns.[18] The role of transport in bringing about structural change in Malaya was important. As the major arteries and later feeder linkages diffused they provided the basic integrating mechanism in the mordernization process.[19] Thus, with improved connectivity, economic and social development literally moves into the connected areas.

According to Hoyle and Knowles, the relationship between transport and development has a long pedigree and all existing transport networks have been inherited from the recent or more distant past.[20] Some of the factors which influence the complex relationship between transport and development are environmental characteristics and constraints; historical trends and

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[16] B. Hoyle and J. Smith (1998): "Transport and Development: Conceptual Frameworks", in Hoyle, B. and R. Knowles (ed.): *Modern Transport Geography*, edition 2, John Wiley and Sons, England, p. 32.

[17](i) T.J. Rehann (1993): "Highway Investment and Regional Economic Development: Decision Methods and Empirical Foundation", *Urban Studies*, Vol. 30, No.2, pp. 437-450; (ii) P. Rietveld (1989): "Infrastructure and Regional Development, A Survey of the Multiregional Economic Models", *The Annals of Regional Science*, Vol.23, pp. 255-274.

[18] T. Hart (1992): "Transport, the Urban Pattern and Regional Change, 1960-2010", *Urban Studies*, Vol. 29, Nos.3/4, pp. 483-503.

[19] T.R. Leinbach (1975): "Transport Development and Modernization in Malaya", *Geografisks Annaler, Series B, Human Geography*, Vol. 57, No. 1, pp. 63-67.

[20] B. Hoyle and R. Knowles (1998): "Transport Geography: An Introduction", in Hoyle, B. and R. Knowles (ed): "Modern Transport Geography", edition 2, John Wiley and Sons, England, p. 16.

conditions; economic political and demographic circumstances; technological changes; and trading conditions.[21] The relationship between transport and development at the global scale has resulted in a number of spatial models like i) the Vance model (1970), which illustrates the development of sea transport links and the growth of the urban hierarchy in North America, ii) the Rimmer model (1977), which outlined the development of a hybrid transport system in less-developed countries, derived from the colonization process by which metropolitan powers used revolutionary modes of transport to penetrate indigenous systems and to gain both political control and cultural and economic dominance, and iii) the Taaffe, Morrill and Gould model (1963), which shows how in a developing country, a transport network may gradually evolve from a pre-colonial situation of under development, through a period of external political intervention to the period of political independence. It has been derived from research in Ghana and Nigeria. The simple association between levels of economic development and transport provision reflects that the world's poorer countries perform worst on most measures of transport availability, use and investment.[22] However, countries invest a major share in building its transport infrastructure as it is regarded as an important input to induce growth in the region.

According to conventional thinking, transport investments are made to support development. Impact assessment studies on road improvement projects have revealed that the impact of road development programmes in developing countries is qualitatively more significant compared to that in advanced countries.[23] According to Leinbach , "modern transport infrastructure is a key driver and symbol of development with 40 percent of all public expenditure being spent on transport in the developing countries."[24] Some of the empirical evidences (Table 1.1) show the impact of road improvement programmes and their outcomes that have affected the regional development of the area.

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[21] *Ibid*.

[22] D. MacKinnon, G. Pirie and M. Gather (2008): "Transport and Economic Development", in Knowles, R., J. Shaw and I. Docherty (ed.): *Transport Geographies: Mobilities, Flows and Spaces*, Blackwell Publishing, London, p. 23

[23] B. Rout and A.R. Saha (2003): "Socio-Economic Impact Evaluation of Transport Projects: Development of methodology", *Technical papers-Seminar on 'Integrated Development of Rural and Arterial Road Network for Socio-Economic Growth', Vol. 1,* New Delhi, 5-6 Dec. pp.I-125 - I-138.

[24] D. MacKinnon, G. Pirie and M. Gather (2008): *Op. cit.*, p. 24

Table 1.1

Impact studies of Road Transport and Regional Development

Sl. No	Name of Road Project.	Country and period of project	Basic goal of the project	Outcome of the project
1.	New York Metropolitan Highway Loop	Europe 1930-1944	Ease traffic conditions in Manhattan and to decentralize and relocate activities in the suburbs.	Population and employment decentralization of the metropolitan areas.Home-to-work traffic is being diverted to the ring areas within or between municipalities.
2.	Controlled Access Highways	Pennsylvania,U.S. 1940-1970	Stimulate economic growth and development in lagging regions.	Proximity to the Controlled Access Highway enhanced the demographic growth of the nonmetropolitan areas.('spillover' from metropolitan areas).
3.	Appalachian Development Highway System.	Appalachia,U.S. 1965-1972	Improve the socio-economic conditions in the lagging Appalachian region.	Initially cities outside the Appalachian Region received greater benefits than those within but with continuous out-migration to the cities in the extended region ,it resulted in improvement of the depressed people of Appalachia.
4.	Trans-European Road Network	European Union. 1991-2002.	Link Common Market and bring about Regional Development.	The impact studies of road network suggests that the planned links will appreciably modify levels of accessibility to economic activity centres ,thus reduce distances and bring the peripheral regions to the central ones.
5.	National Trunk Highway System	China, 1995-2020	Improve accessibility levels across the nation.	The impact of the road project suggests that in the initial phase, it will tend to bring about worsening spatial disparity especially in the lagging and mountainous southwest but as time progresses and as it extends to the more remote parts of the country, it is likely to result in spatially more balanced growth.

Source: G. Kuzur (2006): *Structural Characteristics of the Regions along the Golden Quadrilateral Highway Project (1991-2001),* M.Phil. Dissertation, JNU, New Delhi.

1.6.4 Transport Network and Regional Development in India

The initial works of transport studies relating to Indian conditions were miniscule and were more descriptive in nature. Literature on transport using quantitative and scientific

techniques started emerging only during the 1960s. Singh[25] provided a systematic analysis of the structure of transport in south Bihar. Subsequent literature on regional studies on transport geography followed. The relation of transport network and regional development were not addressed directly. However, studies by Thavaraj[26] showed that the development of railways in resource rich areas brought about indirect developmental benefits.

In pre-colonial India, commerce was limited by the locational advantages that certain centres offered. With the advent of the Europeans and the subsequent development of industrialization and a service industry, greater emphasis was put on improved transport, storage and communication facilities.[27] Since, the colonial period the importance of road building in India has been increasing not only for administrative and strategic purposes but also for marketing and commercialization purposes.[28] A national settlement system emerged in the country with the building of the railway network system and was further reinforced with the rapid development of the road transport system, which increased mobility of goods and people by reducing the physical distances between settlements.[29]

However, the road development programmes have been spatially unbalanced mainly because the colonial economy was centered on major metropolitan centers, ports, capitals of British provinces and princely states wherein 'islands' of economic development were surrounded by extensive areas of underdevelopment.[30] There has been an enormous growth of traffic in India after independence and the Government has been taking continuous steps to tackle the challenging traffic and transportation problem. Several schemes and programmes of road development have been taken up. The first scheme to come up was the Nagpur plan in 1943. This

[25] J. Singh (1964): *Op. cit.*

[26] M. J. K. Thavaraj (1972): "Regional Imbalances and Public Investment in India (1860-1947)", *Social Scientist*, Vol. 1, No. 4. Nov., pp. 3-24.

[27] D. Mookherjee, and R.L. Morril (1973): *Urbanization in a Developing Economy: Indian Perspectives and Patterns*, Saga Publications, London.

[28] A. Khan (2003): "Road Transport Network Development in India", in Vaidya, B. C. (ed.): *Readings in Transport Geography- A Regional Perspective*, Concept Publishing Company, New Delhi, pp. 19-45.

[29] M. Alam (1984): "The National Settlement System of India", in Bourne, S., R. Sinclair and K. Dziewonski (ed.): *Urbanisation and Settlement Systems*, Oxford University Press, New York, pp. 467-71.

[30] L.S. Bhat (1984): "Spatial Perspectives in Socio-Economic Development from National and Regional Angles", in Sundaram, K. V. (ed.): *Geography and Planning*, Concept Publishing Company, New Delhi.

was followed by several other road development plans and programmes proposed by the Government with the basic aim of classifying, upgrading and improving road connectivity for a balanced development of the country.

1.6.4.1 Transport Network and Urban Characteristics

Transport is an integral thread of the urban fabric. This element effects and sustains location, growth, rank-size, and morphology of urban areas. Every process of urban growth, concentration, centralization, de-concentration, decentralization, etc., is dependent on transport for its functioning.[31] Thus, urbanization and transport are dependent on each other. According to Rodrigue, every city relies on the need for mobility of passengers and freight where the main nodes are employment zones.[32] In a study in the Coimbatore region, transport and its relationship with the urban attributes have been analysed.[33] Studies related to accessibility and the spatial land use pattern of an urban area was done by Manglik and Gupta.[34] Studies related to land transformation such as conversion of agricultural land to non-agricultural land, ribbon like development, commercial area development, rise in land value and rise in vacant land along the main arteries of a city were also undertaken.[35] Similar study by Mondal, in the Mewat region has established a positive relationship between transportation and non-primary activities.[36]

The study of road transport and social interface in India by Nangia and Mahajan (1998)[37] discusses the crucial role of the roads in improving the country's economic performance and

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[31] J. Singh (1964), *Op. cit.*

[32] *Ibid.,* p. 59.

[33] H. Ramachandran (1977): *Transportation and Urban Attributes in the Coimbatore Region- A Case Study of an Interacting System*, Ph.D. Thesis, CSRD, JNU, New Delhi.

[34] S. Manglik and S. Gupta (2000): "Accessibility and Land use Relationship in a Medium-Sized Town of Uttar Pradesh: Case Study-Bulandshahr", *Spatio-Economic Development Record*, Vol. 7, No. 3, May-June, pp. 29-35.

[35] S. Fazal (2004): "The Role of Accessibility in Land Transformation: A GIS Based Study of Growing Urban Centre in a Developing Economy", *Asian Profile*, Vol. 32, No.1, pp. 61-76.

[36] M.S. Mondal (2004): "Transportation Accessibility and Non-Primary Activities- A Case Study of Mewat Region", *Indian Journal of Regional Science*, Vol XXXVI, No.2, pp. 59-67.

[37] S. Nangia and L.C. Mahajan (2003): "Road Transport Network and Social Interface in India", in Vaidya, B. C. (ed.): *Readings in Transport Geography- A Regional Perspective*, Concept Publishing Company, New Delhi, pp. 46-63.

well-being of its people. The demographic characteristics of a place influence the national, regional and local transportation requirement. The strong linkages between transport and production as well as trade, facilitates economic development in certain areas. As a result of which migration of population to the economically developed region takes place. These phenomena enhance the process of urbanization and consequently a structural shift from agrarian base to industry and manufacturing takes place giving rise to the emergence of new growth centres.

1.6.4.2 Transport Network and Rural Development

Rural roads are an important sector in rural development, which deals in all aspects of development including agriculture, health, education, forestry, fisheries, small-scale industries, trade, commerce, etc., that depends on good communication[38]; thereby promoting integrated rural development needed for social justice, national integration and economic uplift.[39] Some empirical evidences of the relationship between road transport and socio-economic development characteristics of the region are discussed below.

A sample study of some of the villages in Uttar Pradesh by Wilbanks (1969) has revealed a positive relationship between accessibility to transportation facilities and technological development in agriculture.[40] Another study in Haryana region by National Council of Applied Economic Research (NCAER) (1983) has shown that the villages located in proximity to roads were better off in terms of public health, literacy rates and housing conditions. In addition, these villages had the advantage of a number of agro-service centres, warehouses, market centres, and

[38] K.M. Lakshmana Rao and K. Jayasree (2003): "Rural Infrastructure Planning with Emphasis on Road Network Connectivity by Coplanar Concurrent Theory", *GIS Development, Transportation*, www.gisdevelopment.net/application/utility/transport/mi03151.htm

[39] K.L. Thapar (2001): "Transport in Rural India", in Thorat, S.K. (ed.): *Rural Development Problem and Prospect*, Pravaranagar, Pravara Rural Development Association, pp. 275-290.

[40] S. Gupta (1995): "Transport Accessibility and its Impact on Mobility Patterns and Socio-economic Development of Villages in Urban Fringes: Case Study- Delhi", in Technical Papers- Seminar on "*Integrated Development of Rural and Arterial Road Network for Socio-Economic Growth*", New Delhi, 5-6th December, Vol.1, pp. I-223-I-236.

other public utility services besides having a large share of surplus in the nearby mandis.[41] Along with these benefits they also have higher ownership of assets in comparison to families in inaccessible (remote) areas.[42]

A district level study of nine districts by Central Road Research Institute (CRRI) (1987) showed that 'all weather roads' has more significant impact in terms of socio-economic development than 'fair weather roads.' The presence of a road has a great impact on agricultural landuse, cropping pattern, production and consumption, income structure and travel characteristics. The aggregate level of non-agricultural employment tends to increase with accessibility.

The study conducted by the Asian Institute of Transport Development (AITD) for the National Highway Authority of India and the World Bank[43] shows that proximity to the National Highway 2, within an influence zone of 4-5 km on either side, has a significant influence on major aspects of socio-economic well-being of the rural population. The study revealed that the rural population benefited from greater opportunities of employment and earnings in non-farm activities, access to education and health facilities, higher household income and asset holdings. The study also makes a note that the four-laning of the national highways is expected to promote new kinds of economic activities and thus improve the socio-economic conditions of the rural population living near the highway.

The economic value of the area along a road is observed to be high as is the case along the Ramnad Mandapam Road in South India, where within a period of four years area under cultivation, agricultural output, and industrial output increased substantially. Concerning the role of transport in broader issues such as that of poverty, much work is being done by AITD. In one of its studies, it has revealed that with the improvement of physical accessibility or connectivity across the states, poverty-ratio also declines concomitantly.[44]

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[41] *Ibid*.

[42] K.L. Thapar (2001), *Op. cit.*

[43] Asian Institute of Transport Development (2003): *Socio-economic Impact Evaluation of 4-Laning of NH2 between Agra and Dhanbad on Rural Population*, Report submitted to the NHAI, New Delhi.

[44] K.R. Bandyopadhay (2007): "Physical Accessibility and Poverty", *Poverty Alleviation and Pro-Poor Growth in India*, AITD, New Delhi.

Studies have also established that the relationship between transport and development is very complex. A study of the accessibility of roads in Mysore state has depicted that the degree of inaccessible areas is maximum in developed regions in contrast to semi-developed to undeveloped areas.[45] In addition, the study by CRRI (1987) discussed above, makes a note that the inter-relationship between road and socio-economic development is complex. Thus, the debate continues.

According to Thorat, Fan and Hazell, "government expenditure on roads has by far the largest impact on rural poverty and for each increase in road investment of Rs. 1 million, 165 poor people would be lifted above the poverty line."[46]

1.6.5 Transportation Network and Regional Development in Jharkhand

Studies related to the transport and the socio-economic developments in the region have been few. Literature related to transport development is available from the colonial period. The literature on the status of transportation is mostly descriptive in nature. Bradley-Birt (1903)[47] gave a descriptive account of the Chotanagpur region with a special focus on the transportation scenario specially along the Grand Trunk road cutting across the chotanagpur region. A more systematic and detailed study was given by Singh (1964)[48] on the geography of transportation in south Bihar. Munshi (1980)[49] gave an account of the development of transport in eastern India under the British Raj. Singh (1988)[50] gave a detailed account of road transport relating it to the economic development in the state of Bihar. The state provisioning has primarily focused on the construction of roads and setting up of bus routes catering to the major markets rather than local

[45] S.I. Hullar, Dharwar and B.N. Sinha (1971): "Accessibility of Roads in Mysore State", *National Geographical Journal of India*, Vol. XVII, Part 2-3, June-Sept, pp. 78-89.

[46] S. Thorat, S. Fan and P. Hazell (1999): *Linkages between Government Spending, Growth and Poverty in Rural India*, International Food Policy Research Institute, Research Report 110, Washington, D.C.

[47] F. B. Bradley-Birt (1903): *Chota Nagpore: A Little-Known Province of the Empire*, Smith, Elder, & Co., Waterloo Place, London.

[48] J. Singh (1964): *Op. cit.*

[49] S.K. Munsi (1980): *Geography of Transportation in Eastern India Under the British Raj*, K P Bagchi & Company for Centre for Studies in Social Sciences, Calcutta.

[50] R.K. Singh (1988): *Road Transport and Economic Development*, Deep and Deep publications, New Delhi.

needs.[51] According to Rao, long distance transport needs of Santhal women and men, and other transportation needs for marketing forest produce are not addressed. The "forest regions" are cut off from potential inclusion, mostly because there are no viable roads by which to reach them.[52]

In the pre-colonial period, Jharkhand was devoid of any major transport channels mainly because of its hilly topography and dense forests. During the colonial period, the introduction of modern transportation facilitated the economic exploitation of important mineral resources and some development of the industrial-economic and agro-economic regions of Chotanagpur.[53] The regional settlement system, which emerged from the mining and industrial activity in the state, however, formed 'enclave economies.' Growth were limited only to these industrial areas and failed to percolate to lower levels of the region.

The transport development in the post-Independence period was focused on these already developed regions thereby resulting in vast regional disparities in the state. Even at the national level, the performance of the state has been poor in transportation infrastructure. According to the recent study by Planning Commission, only three-fifths of the nearly 6 lakh villages in India are connected by all weather roads[54] of which Jharkhand ranks lowest in terms of rural connectivity with only 21.2 percent of the villages having access to all-weather roads compared to the all India average of 53.3 percent in 2001 (Appendix I a). The performance of Jharkhand is also poor in terms of total surfaced road and it has the fifth lowest position only above the states of Goa, Meghalaya, Mizoram and Sikkim in terms of total road length in the all India ranking in 2004.[55] Although ambitious programmes like the National Highway Development Programme (NHDP) (launched in 1999) and Pradhan Mantri Gram Sadak Yojana (PMGSY) (launched in 2000) were taken up by the Central Government, but implementation and progress of such programmes has been slow in the state.

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[51] N. Rao (2001): "Enhancing Women's Mobility in a Forest Economy: Transport and Gender Relations in the Santhal Parganas, Jharkhand", *Indian Journal of Gender Studies*, Vol. 8, pp. 271-290

[52] M. Albino and S. Subramanian (2008): *Reaching Out to the Unbanked in Jharkhand State: Achievements & Hindrances in the Drive to Increase Financial Inclusion*, Institute for Financial Management and Research.

[53] P.P. Karan (1953): "Economic Regions of Chota Nagpur, Bihar, India", *Economic Geography*, Vol. 29, No. 3. (Jul.), pp. 216-250.

[54] World Bank (2007): *Op. cit.*

[55] Basic Road Statistis of India, 2004-05, 2005-06, 2006-07 & 2007-08, Ministry of Road Transport and Highways, Transport Research Wing, Govt. of India, New Delhi, morth.nic.in/wrutereddata/mainlinkFile/File417.pdf

1.7 Introducing Jharkhand

1.7.1 Physiography: The state forms a part of the Chotanagpur plateau region in central India. It is one of the oldest formations and has passed through multiple cycles of geological history. The topography of the region is rugged with Parasnath claiming to be the highest of the peak of this region. The region has rich mineral reserves within the rock layers. In contrast to the plain, the Chotanagpur plateau is a region of great unevenness and consists of a succession of plateaus, hills and valleys.[56]

1.7.2 Drainage: The rivers of the Chotanagpur plateau mostly flow through rugged topography. The river banks are usually high and steep with coverage of jungles along the slopes. Most of the rivers have a rocky bed with little deposition of silt.[57] Many rivers have originated from the Chotanagpur plateau and the main rivers draining over this rugged topography are Subernarekha, Damodar, Barakar, Sankh, North Koel, South Koel, Karo, Ajay, etc. Due to the rugged topography, the rivers flow in narrow channels and are not navigable for big boats.

1.7.3 Climate: The region experiences monsoon type of climate. The higher elevated areas of the plateau receive more precipitation. The annual precipitation is a little over the national average.

1.7.4 Natural Vegetation: The region is thickly forested and has a rich variety of flora and fauna. However, it was cleared in some portions for setting up of industries, power plants, mining operations, dam construction and for urbanization as well. Hazaribag, Chatra, Palamau are some of the areas where forest cover is most dense. The forests are an important source of seasonal income for the people. A variety of major and minor forests are extracted from the forests of this region.

1.7.5 Agriculture: The agricultural economy of the state is poorly developed mostly characterised by dependence on nature, low investment in inputs, monocropping with paddy as

[56] R.R. Diwakar (1959): *Bihar Through Ages*, Orient Longmans, Calcutta, p. 26.

[57] *Ibid.*, p. 27.

the dominant crop, inadequate irrigation facilities and small and marginal holdings.[58] Among the rain-fed lowland rice areas in Asia, the Chotanagpur plateau in India constitutes an area of particularly low agricultural productivity and a high incidence of severe poverty. The incidence of poverty among rural households in the area is estimated to be among the highest in Asia. Most rural households practice subsistence farming under adverse and risky environmental conditions. The natural resource base can be characterized as poorly suited to agriculture because of climatic, water resource, and soil conditions.[59]

1.7.6 The Non-Primary Sectors: The area being the home of rich minerals such as coal, iron-ore, mica, copper, uranium, bauxite, etc., is one of the important industrial regions of India. Major industries of the state are concentrated in Ranchi, Jamshedpur, Dhanbad and Bokaro districts. According to Sharan (1994), "the economy is dualistic in nature as urban areas with sophisticated technology coexist with rural underdeveloped areas. This duality has its roots in colonial development and got strengthened in the post-independence period."[60] A major proportion of the population are dependent on the forest for free fuel wood and for commercial use of minor forest products like kendu leaf, katha, salseeds, mahua, lac, fuel wood, chiraunji, tamarind, etc.

1.7.7 Demographic Profile: The population of Jharkhand was 26.94 million in 2001and increased to 32.96 million in 2011. The sex ratio is 947 in 2011. According to 2001 Census, the literacy rate of the state is 53.6 per cent. The population consists of 28 percent tribal people, 12 percent Scheduled Castes and 60 percent others in 2011. The population density of the state is 413 persons per square kilometre of land; it varies from as low as 148 per square kilometre in Gumla district to as high as 1167 per square kilometre in Dhanbad district. The Scheduled Tribe people mostly live in remote villages, where infrastructure is the poorest. The plateau is the home land of some of the oldest races of human civilization specially a group of different tribes.

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[58] B. Debroy, L. Bhandari and V. Singh (2011): *Op. cit.*, p. 27.

[59] P. Banik, C. Edmonds, N. Fuwa, S. P. Kam, L. Villano, and D. K. Bagchi (2004): *Natural Resource Endowments, Subsistence Agriculture, and Poverty in the Chhotanagpur Plateau*, Discussion Paper, No. 47, International Rice Research Institute.

[60] R. Sharan (1994): "Roots of Rural Stagnation in Jharkhand," *Social Change*, Mar-Jun, Vol. 24, Nos. 1 & 2, pp. 91-101.

1.8 Limitation of the Study

The main limitations of the study are:

1. Limitation of data: The state was carved out from Bihar in 2000. Separate state level data for some of the indicators is not available prior to 2000. The number of districts which were 13 in 1991, increased to 22 and 24 after 2001. Thus, data for all the newly formed districts were taken from the parent districts for some of the indicators where disaggregation was not possible.
2. Due to the operational difficulty of handling large network data sets for computation of connectivity indices, the main metalled road links such as the National Highways, State Highways and Other District roads are selected for the computation of connectivity indices.
3. Due to non-availability of detailed classification of workers in 2001 census, the study is limited to the functional classification of towns for 1991 only.
4. Due to non-availability of rural level data relating to poverty, the total figures of the districts are taken.
5. Because of the lack of data on travel behavior from the secondary sources, data from the primary field survey of the sample villages is used.
6. The selection of remote sample villages was determined by approachability, extremist activities and other constraints.

1.9 Organization of Chapters

The thesis is organized into following six chapters:

Chapter I is a general introduction to the study. The basic objectives of the present study are stated here. It also includes the literature review where prior research on the relationship between road transport and regional development implications has been dealt with. It also gives a brief account of the study area.

In Chapter II the historical evolution of transport system in Jharkhand has been discussed under the ancient, medieval, colonial and post-independence period. The recent developments in road transport under the road development programmes are also analysed.

Chapter III presents the spatial structure of transportation network at the urban and rural level. The structure of the entire network as well as the urban nodes has been evaluated by using graph theoretical indices. The transport accessibility of the rural areas are also evaluated at the district and block levels.

Chapter IV deals with the rural transport accessibility and travel patterns of the sample villages. The sample villages having varying levels of transport accessibility are analysed.

Chapter V deals with the relationship between transport and regional development at three levels including the urban, rural district and rural village levels.

Chapter VI presents the conclusions of the study.

Chapter 2
EVOLUTION OF TRANSPORT SYSTEM IN JHARKHAND

2.1 Introduction

The study of the evolution of any transport system is essential to the understanding of the historical factors involved in shaping the contemporary transport network. A transport system gradually evolves in phases and is guided by both natural and human factors as "the existence of a network necessarily implies the collaboration of nature and man, and corresponds, therefore, to a geographic and human choice."[1] The interaction of people and goods is the basic cause that has resulted in the development of transport channels between one or more locations, which are spatially separated. While the locations become important interaction places, the distance separating them become the major issue of transport analysis. With the passage of time, some locations have gained in importance while others have lost their vigor. Some new locations of importance have sprung up across all the spatial scales ranging from the global to the local. These changes are a result of the economic and social demand of the locations they service and the technical innovations in transport infrastructure.

It is a historical fact that "permanence of certain lines of communication has persisted over the centuries and new roads regularly follow old paths."[2] Thus, the spatial structure of the basic network has not much changed over the years. Apart from the historical considerations, the spatial layout of the transport network is guided by nature as "natural obstacles compel land transit to follow the lines of least resistance, to take the most convenient passages, and contribute to the establishment of roads along well-defined trails."[3] Thus, the role of physical attributes also becomes an important factor influencing the network structure.

The objective in the present chapter is to study the evolution of the transport system in Jharkhand. This evolution is discussed under four periods i) Ancient, ii) Medieval, iii) Colonial

[1] J. Deloche (1993): *Transport and Communications in India: Prior to Steam Locomotion, Vol.1, Land Transport,* French Studies in South Asian Culture and Society VII, Oxford University Press, New Delhi, p. 5.

[2] *Ibid.*

[3] *Ibid.*

and iv) Post-Independence period. As we have stated the basic structure of a transport network is a result of both the physical and human considerations, hence these are discussed first.

2.1.1 Physical Considerations

Although Jharkhand holds a strategic position between the Gangetic plains of Bihar in the north, Bengal in the east and Orissa in the South and Chhattisgarh in the west, it has been devoid of any major transport channels in the past. This was mainly because of its physical characteristics. It has a hilly and rugged topography, lack of navigable rivers, and a thick forest cover. Since topography can complicate, postpone or prevent the activities of the transport industry and act as absolute and relative barrier to movements,[4] these made the region underprivileged in terms of development linkages with the outside world.

2.1.2 Human Considerations

The physiographic disadvantage in the state was overcome by the introduction of the modern transportation innovations, which facilitated the economic exploitation of important mineral resources. This took place during the colonial era and was further strengthened during the post independence period. Thus, the regional characteristics of Jharkhand along with the evolution of the settlement system played an important role in the layout of the existing transportation system.

2.2 Evolution of the Transport System in Jharkhand

2.2.1 Ancient Period (325 B.C.-1,200 A.D.)

The state of Jharkhand had very little mention in the historical literature of the Ancient period and there is little evidence of the nature of interactions that took place in the region. The region historically had limited access to the outside world and was cut-off from the main lines of communication.

[4]J. Rodrigue, C. Comtois and B. Slack (2009): *The Geography of Transport Systems*, 2nd edition, Routledge, Taylor & Francis Group, London and New York, p. 9.

During the 6th century B.C. India was divided into sixteen Janapadas (Subah) and Jharkhand was part of Magadha, Suhama, Agra and Mexala Subahs.[5] In the Puranic literature there is mention of Karusha and Pundra as states of South Bihar, of which Pandra may have included parts of Harazibag[6] which is a district of present Jharkhand. There is lack of evidence of any interaction routes concerning Chotanagpur in particular. Before 325 B.C., South Bihar must have had only some form of primitive transport and it is doubtful if the vedic civilization ever reached Bihar.[7]

During this period between 325 B.C. and 1765, the prosperous kingdoms of Maurya, Gupta and Pala dynasties, with their patronage of Buddhism, helped the growth of monastery towns and highways.[8] The major highlight of this period associated with the transport growth in eastern India was the great highway now represented by the Grand Trunk (GT) Road connecting Taxila on the north-western frontier with Pataliputra, the capital. This route has been called Uttara Path (Northern Way) by Panini and northern route by Megasthenese.[9] These roads were unmetalled and rivers unbridged. Since this route ran along the river system, it was obvious that it did not pass by the hilly region of the Chotanagpur plateau.

However, from the historic literature and maps, the strategic location of Jharkhand is apparent. It was bounded on all four sides by historically important areas, which had good transport connectivity and were part of the earlier transport routes. In the ancient period, these routes mostly followed the path of least resistances, such as the valleys and plains. These were the i) Ganga river and the Bihar plain in the north with the Old Trade Route. Some of the important centres of this region were Pataliputra, Rajgriha, Sravasti and Bodhgaya (pilgrimage center), ii) Bengal and the port of Calcutta in its eastern part, iii) the coastal state of Orissa with Puri as its pilgrimage centre and gateway to south India, and iv) Madhya Pradesh (present

[5] Kailash (1989): "The Territorial System of Jharkhand Region During Mughal and Modern Period: A Study in the Historical Geography", *The Deccan Geographer*, Vol. XXVII, Jan-Jun, No. 1, pp. 461-474

[6] R.R. Diwakar (1959): *Bihar Through Ages*, Orient Longmans, Calcutta, p. 51.

[7] R.C. Majumder (1957): Vedic Age, London, p. 399 quoted in Singh, J. (1964): *Transport Geography of South Bihar*, Banaras Hindu University Press, Varanasi, p. 47.

[8] R. B. Singh (1966): *Transport Geography of Uttar Pradesh*, The National Geographical Society of India, Banaras Hindu University, Varanasi, p. 23.

[9] *Ibid*.

Chhattisgarh) forming the linkages between east and west India. The tract of Jharkhand was avoided and by-passed by the early invaders and the outsiders and remained isolated mainly because of its hilly topography and thick forests, which formed part of the dissected Chotanagpur plateau.

The region was traversed on some occasions as is evident from some ancient literary sources. The probability of tracks traversing the wooded hills of the Chotanagpur region was not ruled out and was used by the Maurya who perhaps had undertaken this route to proceed from to Tamralipti from Pataliputra.[10] The Chinese traveler, I-tsing, followed them in 673 and wrote about the significant flow of religious traffic in this region.[11] At least two ways led to the mouths of the Hugali river, and from there to Jagannatha-Puri - one setting forth from Banaras or Gaya and passing through the districts of Hazaribag and Manbhum, while the other proceeded southwards from Munger by way of the districts of Santhal Pargana, Birbhum and Bankura.[12]

The important routes[13] were mostly confined to the south Bihar plain comprising of i) the Great eastern trade route, which extended from Rajgir to Pataliputra on the Ganga and across to Sravasti, ii) Rajgir to Ujjaini and Pristhisthan on Godavari, through the valley of Son, iii) Rajgir to Champa and iv) The Grand Trunk road from Taxila to Pataliputra through Varanasi and Kausambi. There is mention of a route traversing Jharkhand, which was a branch road running from Rajgriha to Gaya and probably further towards the iron and copper deposits of Dhalbhum and Singhbhum.[14]

Thus, the economic activities associated to transportation were limited to the Ganga plain,[15] which lay north of the Chotanagpur plateau. Jharkhand had a subsistence economy from the very beginning, comprising of the tribal groups, who had long migrated to the area and had

[10] J. Deloche (1993): "Transport and Communications in India: Prior to Steam Locomotion", Vol.1, Land Transport, French Studies in South Asian Culture and Society VII, Oxford University Press, New Delhi, p. 40.

[11] *Ibid.*

[12] *Ibid.*

[13] See J. Singh (1964): *Transport Geography of South Bihar*, Banaras Hindu University Press, Varanasi, p. 49.

[14] *Ibid.*, p. 49.

[15] *Ibid.*, p. 47.

reclaimed the uncultivated forests and developed a system of 'embedded economy.'[16] The primitive nature of exchange of goods, i.e., barter system and forest based economy limited the scope of external trade linkages with other regions.

There is lack of mention of any centre of importance in Jharkhand during this period. It was the homeland of many tribal groups. The region (Jharkhand) was basically a "no man's land" and was mentioned as *atavi* (forest tract) by the Aryans who later migrated to this land.

2.2.2 Medieval Period

Historical sources about the interactions of Jharkhand with the external world are limited. Sources such as the Ain-I-Akbari and Akbar-Nama have mentioned only its territorial expansion[17] and Muslim historians have rarely mentioned about the hilly tracts in the south covering the districts of Ramgarh, Chotanagpur and Palamau. This area owing to its wild and inaccessible terrain was neither measured nor assessed and did not form part of any 'sarkar' (revenue division) for revenue collection.[18] Moreover, in the absence of survey records the evidence of its interaction with Bihar could not be established.[19] The land was mentioned by its old name Kokrah by Abul Fazal.[20]

The ridges of Chotanagpur, which dominate the eastern plain were impenetrable and were called Jharkhand (thickest land) by the Muslims.[21] It was avoided and was scarcely traversed unless to undertake retaliatory expeditions or to circumvent the fortified gorges on the banks of the Ganga, which formed the main artery of movements.[22]

Evidences that the region was traversed by Muslim rulers and their troops are found in some sources of the medieval period. Incursions from outside into the Chotanagpur region have

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[16] R. Sharan (1994): "Roots of Rural Stagnation in Jharkhand", *Social Change*, Mar-Jun, Vol. 24, Nos. 1 & 2, pp. 91-101.

[17] Kailash (1989): *Op. cit.*

[18] *Ibid.*, p. 55.

[19] *Ibid.*, p. 59.

[20] R. R. Diwakar (1959): *Bihar Through Ages*, Orient Longmans, Calcutta, p. 55.

[21] *Ibid.*

[22] J. Deloche (1993): *Op. cit.*, p. 40

been dated to the 16th century, when the area was invaded by Akbar's troops in 1585 and the local Raja was reduced to a tributary of the Moghuls.[23] Some evidences of its mineral wealth, which was a matter of attraction was revealed during this period. The main attraction of Chotanagpur was the availability of diamonds. Sources have revealed that after the subjugation of the area, the subahdar of Bihar sent frequent detachments to collect diamonds as tribute although they were very small in quantity.

Historical records show that Bakhtiyar Khilji (1196-1223), probably traversed the Chotanagpur to go to Bangal; likewise Firuz Sah returning from his Orissa campaign had also traversed the land. Man Singh, viceroy of Bengal under Akbar, at the time of his second expedition against the rebels in Orissa ordered his troops stationed in Rohtasgarh to take the route from Jharkhand in the direction of Medinipur. Under the reign of Sahjahan, Saistah Khan went to subjugate the raja of Palamu; finally, in 1659, Mir Jumlah circumvented the fortified city of Munger by way of the mountainous zone bordering the city to the south.[24] It had provided a way to the Royal army to cross the region and reach Bengal and Orissa from Allahabad and Awadh province.[25] Its strategic importance of linking up the coastal plains with middle Ganga plain was well known for the purpose of suppression of uprisings against the kingdom.[26]

The most important road traversing the region was the Grand Trunk Road. The credit of building the Grand Trunk Road, which ran along the southern bank of the Ganga was ascribed by the locals to the Muslim emperor, Shershah Suri.[27] Until the mid-eighteenth century, its orientation was according to the fluvial system of the Ganga river and remained as the major axis of transit of the Mughal empire. However, with the decline of Mughal power, the political power shifted to the Marathas and this resulted in the reorientation of the major axis of communication. With the shift of the Indian centre of gravity from Agra or Delhi towards Satara and Pune, the

[23] R. Gupta, P. Banerji and A. Guleria (1981): *Tribal Unrest and Forestry Management in Bihar*, CMA Monograph No. 98, IIM, Ahmedabad.

[24] J. Deloche (1993): *Transport and Communications in India: Prior to Steam Locomotion*, Vol.1, Land Transport, French Studies in South Asian Culture and Society VII, Oxford University Press, New Delhi.

[25] Kailash (1989): *Op. cit.*

[26] *Ibid*.

[27] Singh, J. (1964): *Op. cit.* p. 51.

axis of communication was steered towards Bengal across Gondvana, Bihar and Orissa undertaken mostly by the Maratha cavalrymen.[28]

In olden times there was a well-established trade route between Lohardaga and Gaya, passing via Balumath and Chatra that remained in use till the advent of railways early in the present century.[29] Sources also reveal of a traditional pilgrimage route from Bengal to Puri via Bankura, Purulia, Ranchi, Keonjhar and Jajpur and another route to Puri from Palamu via Singhbhum.[30]

2.2.3 Colonial Period (1700-1945)

During this period, the gradual shift of the transport system took place towards Chotanagpur. The major part of the present structure of transport has been inherited from the Colonial Period. Before steam locomotion, roads were the basic transport infrastructure in the region as the river systems of Jharkhand were not suitable for any inland navigation. However, the strategic position of Rajmahal (in Santhal Pargana district of Jharkhand) of Chotanagpur allowed the branches of the Gangetic rivers to curve sharply downstream facilitating the traffic from the northern urban centres to orient towards the delta of Bengal.[31] Minor inland navigation channels were used during monsoon months on the river Damodar, which was used for navigation below Ramgarh by small rivercraft, connecting with Bardhaman in Bengal.[32] In contrast to the earlier objectives of conquest and consolidation of control, the focus of the Colonial powers on the southern plateau was aimed at tapping the mineral wealth of the area during the late nineteenth century.[33] The era, coinciding with the era of Transport Revolution (1851 – 1947), was the most eventful in the Chotanagpur region of Jharkhand which was linked to the outside world.

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[28] J. Deloche (1993): *Op. cit.*, p. 43

[29] Kumar, N. (1970): *Bihar District Gazetteers, Ranchi*, Govt. of India, Patna.

[30] *Ibid.*

[31] J. Deloche (1994): *Transport and Communications in India: Prior to Steam Locomotion, Vol.2, Water Transport*, French Studies in South Asian Culture and Society VII, Oxford University Press, New Delhi, p. 23.

[32] *Ibid*., p. 26.

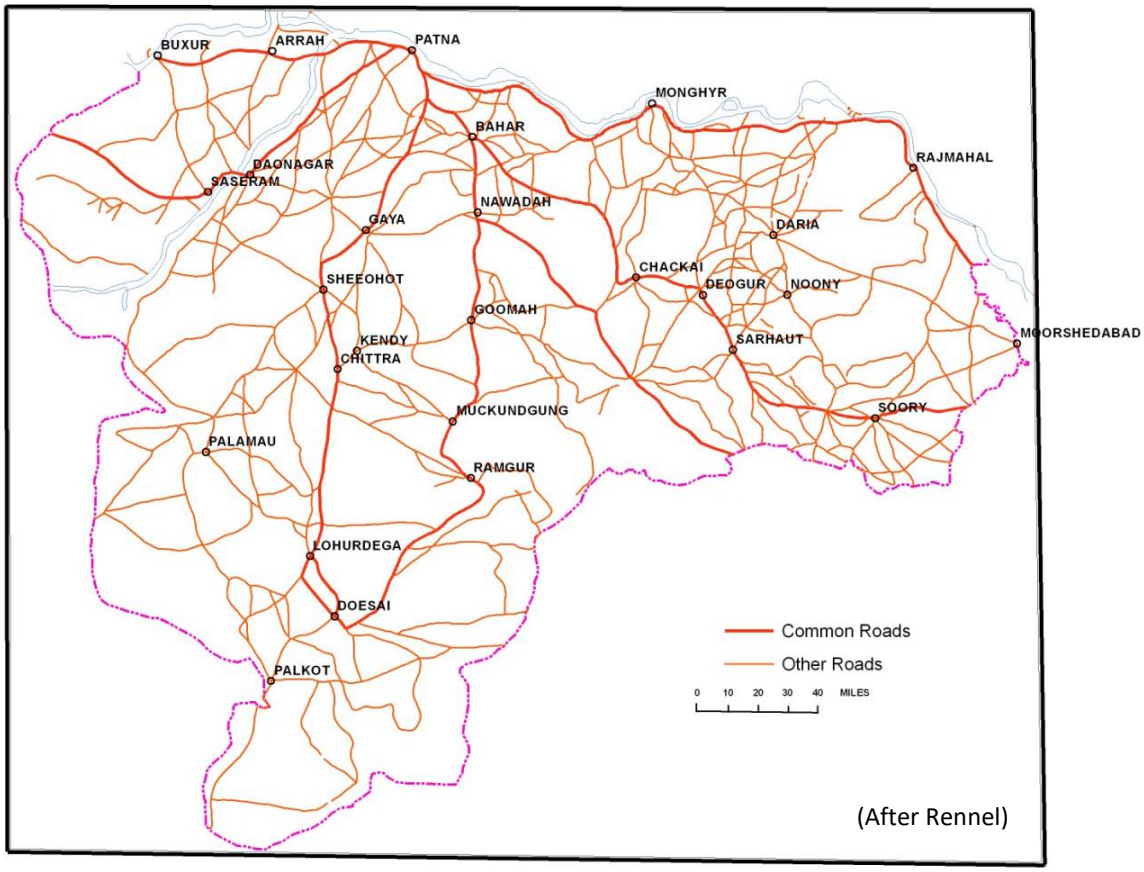
[33] J. Singh (1964): *Op. cit.*

2.2.3.1 The Road Network

1. Roads indicated on Rennell's Map

For the eighteenth century the road network of Jharkhand is given in the Rennell's Atlas of 1783 and 1792 (see Map 2.1 and Map 2.2). The 'common roads' that passed over Chotanagpur were- i) a road from Patna to Deosai, via Gaya, Chittra (Chatra) and Lohardaga, ii) the other route from Patna to Deosai was via Bihar, Nawadah, Goomah (Gomoh), Mukudganj (near Hazaribag), Ramgargh, through Chutia (Ranchi), iii) from Bihar to Murshidabad, via Gidhaur, Chakai, Deoghar, Sarhaut and Suri, and iv) from Nawadah to Calcutta via Sirampur and Tundi (in Dhanbad).[34]

Map 2.1
Roads in South Bihar
1783

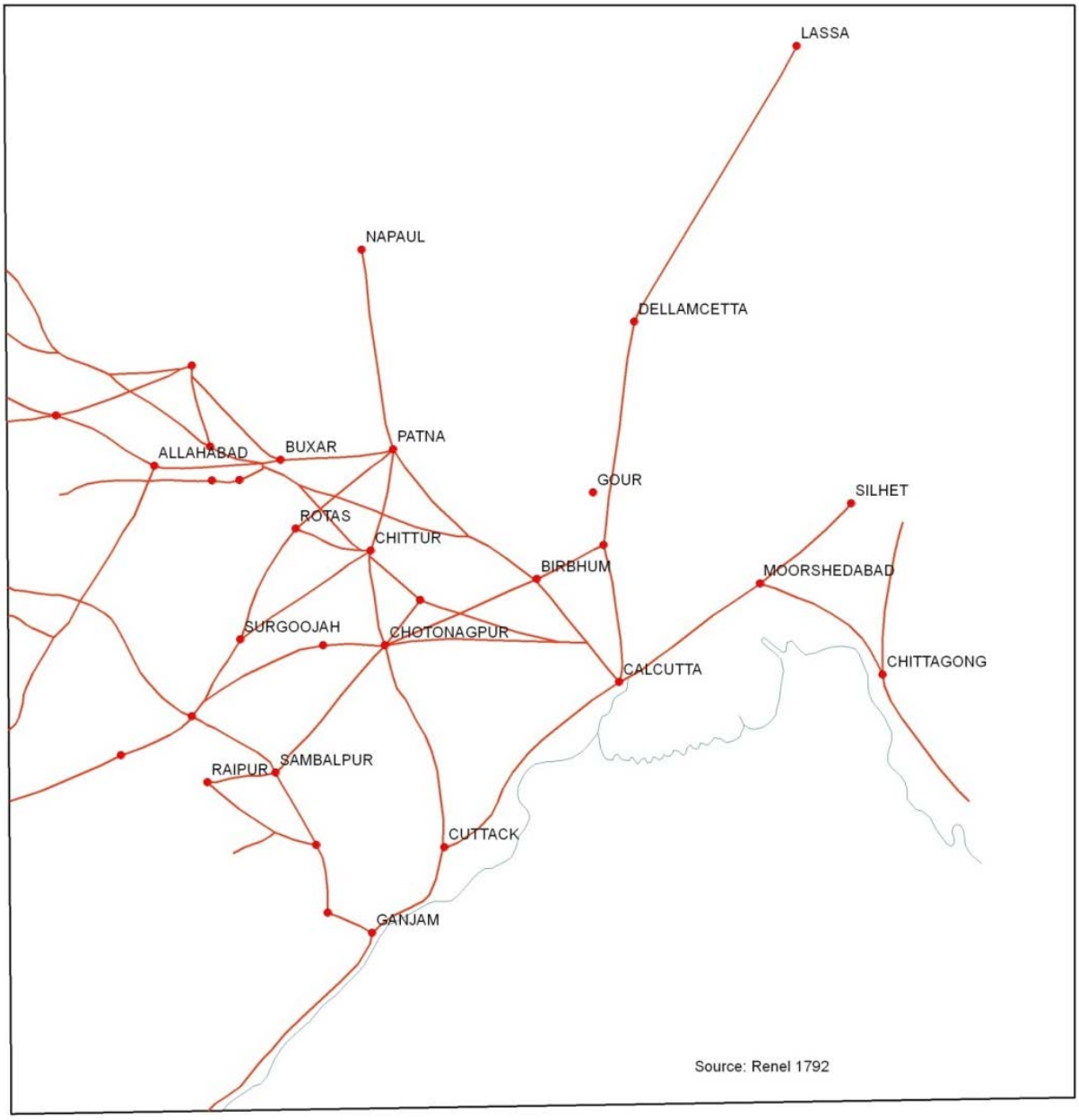


Source: J. Singh (1964): *Transport Geography of South Bihar*, Banaras Hindu University Press, Varanasi, p. 54.

[34] J. Singh (1964): *Op. cit.*, p. 53.

Map 2.2

Roads in Eastern India, 1792



Source: S.K. Munsi (1980): *Geography of Transportation in Eastern India Under the British Raj*, K. P. Bagchi and Company for Centre for Studies in Social Sciences, Calcutta, p. 14

2. The New Military Road (1781)

Sources reveal that the construction and maintenance of roads was guided by the British "*political and military*" concerns and by the 1760s, a "New Road" (also called the "New

Military Road") was completed in 1785.[35] With the focal point shifting towards Calcutta, the historic route along the Ganga started fading away in importance. The orientation of the road shifted more southward in order to control the Maratha incursions that came through central India and to extend control over the Chotanagpur region. This was the route that veered away from Hugli toward Burdwan and then across Hazaribag (in Jharkhand) not following the Mughal main route until it crossed over the Son river from there it proceeded towards Banaras along the same trajectory[36] (see Map 2.3). The internal communication routes were still underdeveloped. In most part of the region rough tracks through the forest, served as roads.

3. The Grand Trunk Road

The Grand Trunk Road cuts its way through the jungles of Manbhum and Hazaribag, opening out the wildest district to the civilizing influence of trade and commerce.[37] It connected the up-country cities of Oude, the Punjab, or North-West. The general traffic on this road comprised of a mixed group of traders from the far away centres of the north, pilgrims to Parasnath or still further to the great temple of Jagannath at Puri (in Orissa), troops marching to some new headquarters, or occasionally the camp army of the viceroy or the commander-in-chief slowly marching up country.[38] The Grand Trunk Road enters into Chotanagpur from Chirkunda, located on the banks of the river Barakar[39]and passes by Gobindpur, Parasnath Mountain, Bagodar, Barkatta and Barhi (Map 2.3).

[35] A. Anand Yang (2000): *Bazar India: Markets, Society, and the Colonial State in Gangetic Bihar*, Munshiram Manoharlal Publishers Pvt. Ltd, New Delhi, p. 33.

[36] *Ibid*., p. 33.

[37]F.B. Bradley-Birt (1903): *Chota Nagpore: A Little-Known Province of the Empire*, Smith, Elder, & Co., Waterloo Place, London, p. 178.

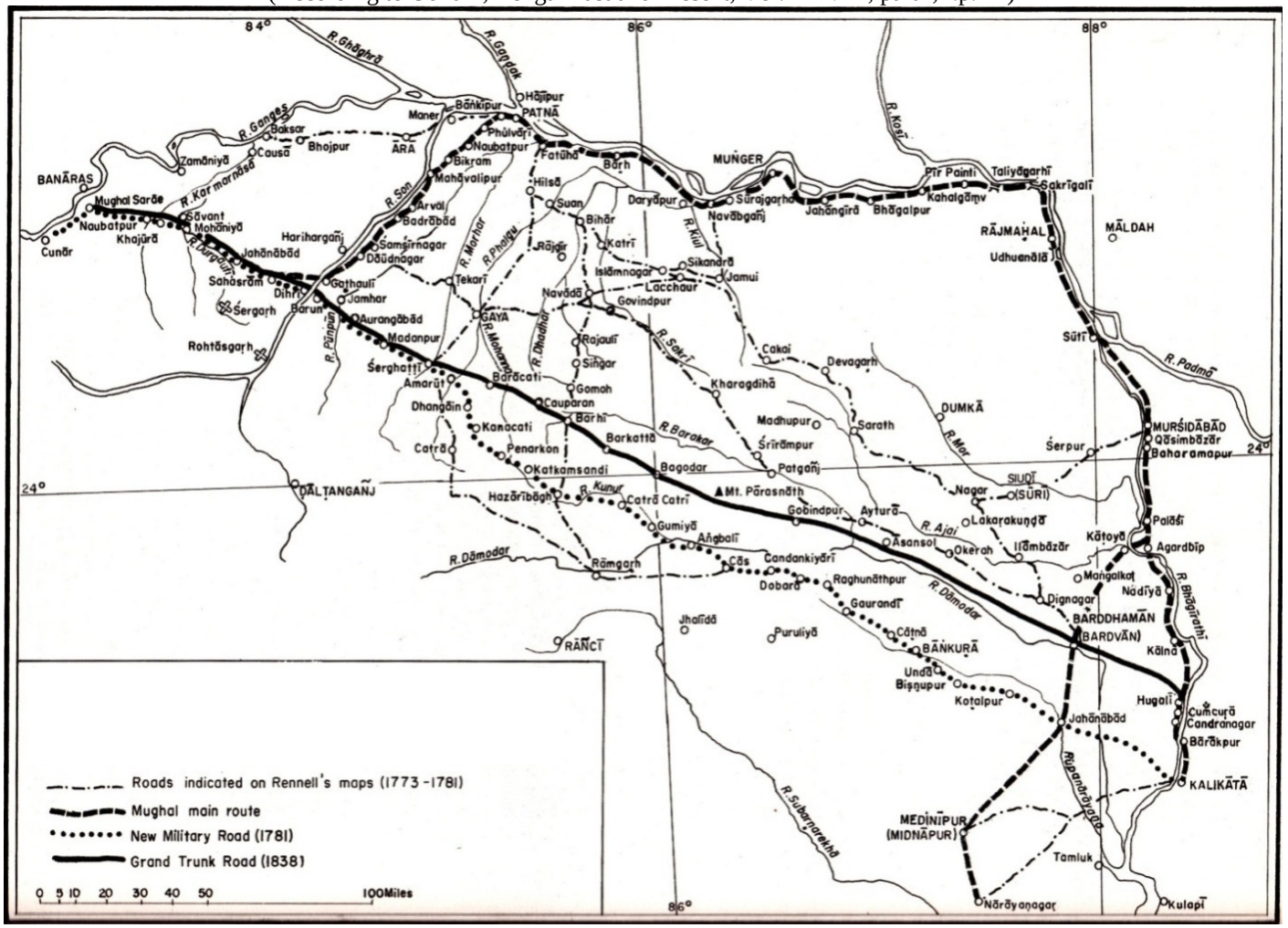
[38] *Ibid*., p. 178.

[39] *Ibid*., p. 182.

Map 2.3

The Three Courses of the Main Route Between Banaras and Kalikata (1750-1850)

(According to Odhum, Bengal Past and Present, Vol. XXVIII, part I, f.p. 21)



Source: J. Deloche (1993): *Transport and Communications in India: Prior to Steam Locomotion*, Vol.1, Land Transport, French Studies in South Asian Culture and Society VII, Oxford University Press, New Delhi, p. 42.

Some of the resting place or 'Serai' along the Grand Trunk Road were at Topechanchi, Dumri and Barhi.

Between 1858-1920, the main roads[40] were, i) The G.T. Road traversing right across the region coming from Varanasi through Sasaram, Aurangabad, Sherghaty, Barhi and Dhanbad, leading towards Calcutta; ii) The Bakhtiarpur-Ranchi Road via Bihar, Nawada, Hazaribag and Ramgarh further extended to Chaibasa from where extend two branches - one towards Jaintgarh and the other towards Baharagora; iii) The Daltonganj-Ranchi-Purulia Road; iv) The Bhagalpur-Dumka-Suri Road, and v) Dhanbad-Jamshedpur Road through Purulia.

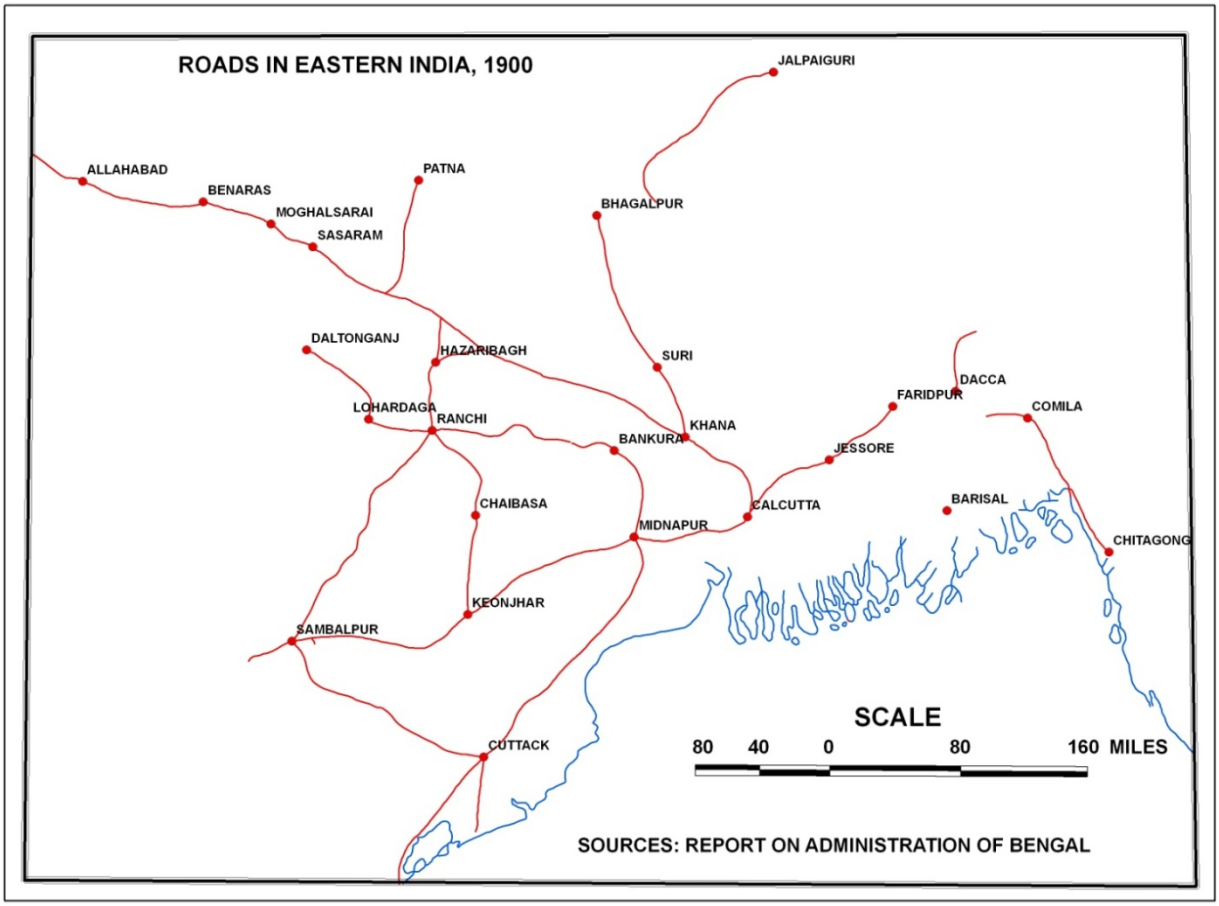
The distribution of roads in eastern India shows that there were wider linkages with the adjoining regions in 1900 (Map 2.4). The road towards Purulia in Bengal was used by the coolies who used to emigrate to the tea gardens of Sylhet, Cachar, Assam, and Darjeeling and the Duars in Bengal.[41] The journey used to be on foot. Prior to railway development, the nearest station was Purulia (in West Bengal), which was known as the gateway of Chotanagpur.

Although the east-west highway remained the primary road in the region but it failed to become a major thoroughfare because it was not kept in good repair and was prone to flooding.

[40] J. Singh, (1964): *Op. cit.,* p. 58.

[41] F.B. Bradley-Birt (1903): *Op. cit.,* p. 170.

Map 2.4



Source: S. K. Munsi (1980): *Geography of Transportation in Eastern India Under the British Raj*, K P Bagchi & Company for Centre for Studies in Social Sciences, Calcutta, p. 28.

2.2.3.2 Modal Change in Transport: Development of Railways (1858 -1920)

During the pre-industrial revolution (pre-1800), no forms of motorized transportation existed and trade was local in scope as the efficiency of land transport system was poor.

With the advent of steam railway technology in 1814, primarily used to haul coal, there was a shift in transport mode all across the globe. By the 1850s, railroad towns were being established and the railways were giving access to resources and markets of vast territories. The Geological Survey of 1866 had proved the existence of coal, economic exploitation started after twenty years. Due to the lack of railway line, the coalfields of Jherria (in Dhanbad), which was only twenty miles away from the rail terminus across the Barakar river separating Chotanagpur from Burdwan, was not exploited. The region was also

almost entirely lacking in roads. But with the survey of the land made by the East India Railway Company in 1890 and the beginning of the Jherria extention line from Barakar, the possibilities of the coal-field suddenly opened out.[42] The gradual opening up the region took place with the discovery of minerals in the Chotanagpur region and railways were given priority to carry the bulk of ores and minerals and to link it with the port of Calcutta.

2.2.3.2.1 Distribution of Railways

The railways were built in this eastern part of the country in a phased manner (Map 2.5), all its axis being oriented and converged towards the port of Calcutta. The distribution of railways into Chotanagpur evolved in the following phases:

i) The mica-rich Hazaribag plateau became a part of the rail-linked district of eastern India in 1871.
ii) The coalfields of Dhanbad, the iron-ore areas of Singhbhum and Mayurbhanj (Orissa) were first reached by railways between 1890 and 1898. The coalfields of Dhanbad and Jharia were linked twenty years later since the railway linkage of Raniganj coalfields in West Bengal.
iii) The iron-ore resource was profitably used either in large-scale iron smelting operations at Tatanagar (1911) or for export after thirty years.

The expansion and growth of railways in the Bengal-Bihar coalfields was mainly for coal traffic.

2.2.3.3 The Importance of Road Infrastructure

Roads were given importance as it helped in the economic development of Chotanagpur particularly in areas not served by the railways. The following factors were responsible for the marked development of roads:[43]

i) Linking economic regions in which the development of coal and other mines, newly opened with the railway construction, created the need for better roads.
ii) Free movement for administrative purposes which was aimed for the maintenance of law and order between the administrative centres. Thus, the Daltonganj-Ranchi,

[42] F.B. Bradley-Birt (1903): *Op. cit.,* p. 287.

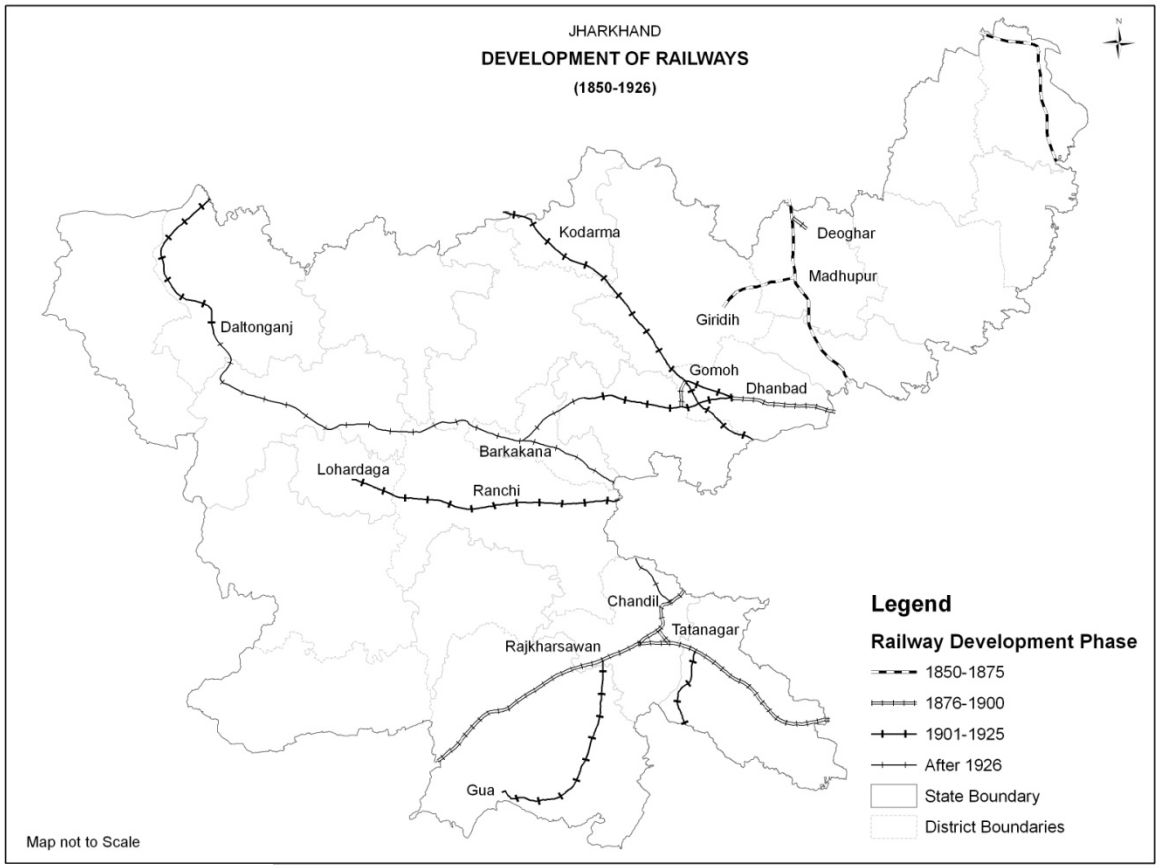
[43] J. Singh (1964): *Op. cit.,* p. 58.

Ranchi-Chaibasa and Arrah-Sasaram roads came towards the fulfillment of this need.

iii) Linking important administrative centres and the railway stations.

iv) Linking famine prone areas under which minor roads were built to provide relief operations during famines.

Map 2.5



(After J. Singh, 1964)

2.2.3.3.1 Impact of the Transport System

Stimulated by the improved means of communication, large annual fairs were started in the various centres of Chotanagpore, and traders from all quarters of Northern India penetrated into this new and hitherto unopened mart.[44] The transportation system and its regional linkages were heavily unbalanced as growth was concentrated in few pockets leaving behind vast areas of under development. Bradley-Birt observed in 1903 that leaving

[44] F.B. Bradley-Birt (1903): *Op. cit.*

behind the mining districts lying on the outskirts of the province along the lines of the rail, the primitiveness of Chota Nagpore was still undisturbed. The plateau as a whole was richly endowed with forests, particularly the southern portion in Singhbhum. Gradually, new settlement foci like Dhanbad, Tatanagar, Kodarma, Ghatsila and Dalmianagar sprang up along the transport routes, whereas the centres like Chatra, Gola and Hunterganj along old routes declined.[45]

2.2.4 Post Independence Period

Post World War II and after the partition of India, Chotanagpur became the trough of economic activity whose axis lay along the Damodar valley with a secondary centre at Jamshedpur.[46] Systematic exploitation of resources in Chotanagpur started in 1940, and brought with it, a slow but steady change from an agrarian to an industrial economy.[47]

According to a survey, "of the surfaced roads, less than half of the length was metalled. Against the all-India average of 12 miles of surfaced roads per hundred square miles of area, and 25 per 1 lakh population, the position in Chotanagpur was 11 and 18 miles respectively. Owing to poor road surface the laden weight permitted was greatly restricted, particularly for inter-state movements. The roads in the colliery areas (about 990 miles) were in poor condition, hence the number of motor vehicles operating per mile was lower (4.2) than the all-India average (5.4)."[48] The two main modes of the transport sector in Jharkhand were the Railways and Road system.

2.2.4.1 Road Transport Development during the Five Year Plan Periods

The state of Jharkhand was part of Bihar before November 2000 and thus data of the state is not available separately. The road transport information of the period before 2000, therefore, relates to the undivided Bihar state.

[45] J. Singh (1964): *Op. cit.*, p. 62.

[46] *Ibid.*, p. 61.

[47] F. Ivern (1969): *Chotanagpur Survey*, Indian Social Institute and Indraprastha Press, New Delhi, p.133.

[48] *Ibid*.

An analysis of the data of financial expenditure by Planning Commission through various Five Year Plans expenditure on transport sector as percentage to public sector has shown a decreasing trend[49] as we will see from the discussion ahead.

2.2.4.1.1 First Five Year Plan (1951-1956): Roads were recognised as a service for all forms of development - agriculture, trade, or industry. In Bihar, Hyderabad, Kutch and Mysore, it was decided to set up statutory corporations under the Road Transport Corporations Act, 1950. During the First Five Year Plan, the state of Bihar had 5337 km (10.17 per cent) of surfaced road as against 157073 km (39.26 per cent) in India. The total number of registered motor vehicles increased from 13535 from 1951 to 17807 in 1956. The density of all motor vehicles per 100 km of total road length increased from 26 per cent in 1951 to 34 per cent in 1956.

2.1.4.1.2 Second Five Year Plan (1956-1961): In 1961, the road length in Bihar increased to 13301 km (16 per cent) as against the all India road length of 235875 km (33 per cent). The total number of registered motor vehicles increased from 17807 in 1956 to 25120 in 1961. The density of all motor vehicles per 100 km of total road length decreased from 34 per cent in 1956 to 31 per cent in 1961. By 1956, Chotanagpur had a total length of 2,194.45 miles of surfaced roads, which increased to 2,482.05 miles in 1961 and in 1965. The railways were given emphasis during the Second Five Year Plan. The sections that were proposed to be doubled during the Second Five Year Plan were:

Eastern Railway			
Route	Mileage	Route	Mileage
Bokaro-Barkakana	36	Rajkharswan-Barajamda	60
Sini-Gomharria	10	Nergundi-Khurda road	26
Sini-Kandra	4	Kharagpur-Tatanagar	30

2.2.4.1.3 Third Five Year Plan (1961-1966): Railways were given priority to serve the basic industries, such as iron and steel, coal and cement. In this regard, construction of new lines was undertaken from the Second to the Third Plan, namely, Garhwa Road-Robertsganj, and Bimlagarh-Kiriburu, the programme also provided for new lines along Ranchi-Bondamunda

[49] A. Khan (2003): "Road Transport Network Development in India", in Vaidya, B. C. (ed.): *Readings in Transport Geography- A Regional Perspective*, Concept Publishing Company, New Delhi, pp. 19-45.

route. The construction of 200 miles of new lines was undertaken for the development of the coal industry. The road development programmes for the Third Plan was formulated in accordance with the broad objectives laid down in the twenty-year road development plan for the period 1961-81. Emphasis on rural roads was given priority. But the Chotanagpur area of Bihar did not form part of the plan. The total number of registered motor vehicles increased from 25120 in 1961 to 36736 in 1964. The density of all motor vehicles per 100 km of total road length increased from 31 per cent in 1961 to 45 per cent in 1964.

2.2.4.1.4 Fourth Five Plans (1969-1974): Although there had been substantial investments in development of transport and considerable expansion of transport capacities, imbalances emerged from time to time. Transport difficulties were experienced in the early years of the Third Plan, for the movement of coal from the Bengal and Bihar coalfields towards the northern, western and southern parts of the country. Major emphasis of road development was given to areas related to major industrial, mining and other development projects. Special emphasis was given to the development of rural roads. State Governments agreed to set apart about 25 per cent of the total outlay on road development for rural roads. Priority was given to roads leading to market towns. The surfaced road length in Bihar was 24454 km in 1970 as against 399494 km in India. The total number of registered motor vehicles increased from 63564 in 1969 to 98341 in 1974. The density of all motor vehicles per 100 km of total road length increased from 76 per cent in 1969 to 116 per cent in 1974.

2.2.4.1.5 Fifth Five Year Plan (1974-1979): By 1978-79, the railways were equipped to carry an estimated originating freight traffic of 250 to 260 million tonnes, of which the largest single commodity was 98 million tonnes of coal. Main emphasis was placed on completion of spill over works of the Fourth Plan, which included a number of missing bridges and road links. The total number of registered motor vehicles increased from 98341 in 1974 to 152458 in 1979. The density of all motor vehicles per 100 km of total road length increased from 116 per cent in 1974 to 171 per cent in 1979. During this period, a special plan known as Tribal Sub Plan (TSP), was initiated for the development of the tribal dominated areas in Bihar state. In this plan, a portion of the fund was allocated for the transport development of the region which mainly included districts of present state of Jharkhand.

2.2.4.1.6 Sixth Five Year Plan (1980-1985): The development of National Highways received priority and tasks like double laning including strengthening, double laning without strengthening, widening to four lanes, and construction of bye-passes were formulated.

Priority was given to the construction of rural roads under the Minimum Needs Programme, which envisages the provision of all weather link roads for all villages with a population of 1500 and above and for 50 of villages with a population of 1000-1500 within a period of ten years. It was expected to provide link roads to about 20,000 villages during the Sixth Plan period. At the regional level, 6989 km of surfaced road length was in Chotanagpur that accounted to 31 per cent of the total surfaced road length in Bihar in 1980. With regard to the road density per square km of area, the districts of Dhanbad (0.32), Hazaribag (0.15) and Singhbhum (0.13) had density greater than the state (Bihar) average density (0.13). The lowest density of surfaced road was in Giridih (0.006), followed by Palamu, Ranchi and Santhal Pargana of the Chotanagpur region in 1980. The surfaced road density per lakh of population was greater in Chotanagpur plateau region than the rest of Bihar in 1980. About 18.68 per cent of TSP funds of Bihar plan outlay were allocated to transport and communication sector during the Sixth Five Year Plan.

2.2.4.1.7 Seventh Five Year Plan (1985-1990): The major objectives of the Seventh Five Year Plan related to transport infrastructure were- i) progressive removal of the existing deficiencies in the National Highways, State Highways and major District Road systems, ii) energy conservation, iii) environmental quality of highways, iv) reduction of road accident rates, v) improvement in the road system, and vi) generation of employment. In this plan period, due attention was given to rural roads. The area under the TSP scheme was still poor with regard to rural roads. During this plan period, the target was to connect 375 villages with a length of 1382 km of surfaced roads. The allocation of funds for transport development was 17 per cent of the Bihar plan outlay.

2.2.4.1.8 Eighth Five Year Plan (1992-1997): Some of the major objectives of the Eighth Five Year Plan were- i) linking of all villages with a population of 1000 and above, and ii) special efforts to accelerate village connectivity in respect of backward regions mainly in the tribal areas. The rural road development programmes under TSP scheme gained impetus and about 25.35 per cent of the Bihar plan outlay was allocated for the transport sector during this period. Both the construction of new roads and the upgradation of the old roads were taken up in order to improve the rural connectivity. With growing work load, new construction divisions and sub-divisions were established in the plan area.

2.2.4.1.9 Ninth Five Year Plan (1997-2002): The emphasis in this plan period was on i) strengthening and improving the crucial sections of the highway network through phased

removal of deficiencies and multi-laning of high density corridors, ii) improving the road communication in remote areas such as the northeast, and iii) providing all weather connectivity to remaining villages and promoting energy conservation, safety and environment protection. The National Highways Development Project had initiated ambitious projects like the Golden Quadrilateral and the North-South and East-West corridor projects in this plan period. A portion of the Golden Quadrilateral passes through the northern part of Jharkand region. During this period, Jharkhand state was formed and separate developmental funds were allocated for the state. The rural road sector got emphasis through the Central Government Road Development Programme of the Pradhan Mantri Gram Sadak Yojana (PMGSY). The details of which are discussed in a separate section.

2.2.4.1.10 Tenth Five Year Plan (2002-2007): Improving railway freight services was the paramount concern in the Tenth Plan. The railways freight traffic continued to lose its share to road transport. Construction of expressways was given emphasis in the Tenth Plan. The Golden Quadrilateral and the North-South and East-West corridor projects initiated by National Highways Development Project were given top priority. These projects were undertaken to improve the capacity and riding quality of the major high-density corridors. The Jharkhand Highways Act of 2005 was passed and the State Highways Authority of Jharkhand was constituted. Priority was given to the connectivity of villages with rural roads and in this regard initiative was taken by the Central Government. The performance of Jharkhand was poor in terms of total road length in 2004 (Figure 2.1). With a total road length of 11783 km (Table 2.2), it was among the lowest in the state level ranking and was only above the states of Goa, Meghalaya, Mizoram and Sikkim. In terms of surfaced road, Jharkhand had a road length of 3817 km. It occupied the third lowest position (Figure 2.2), only above Mizoram and Sikkim in 2004.

Figure 2.1

TOTAL LENGTH OF ROADS IN INDIA

(As on 31st March 2004)

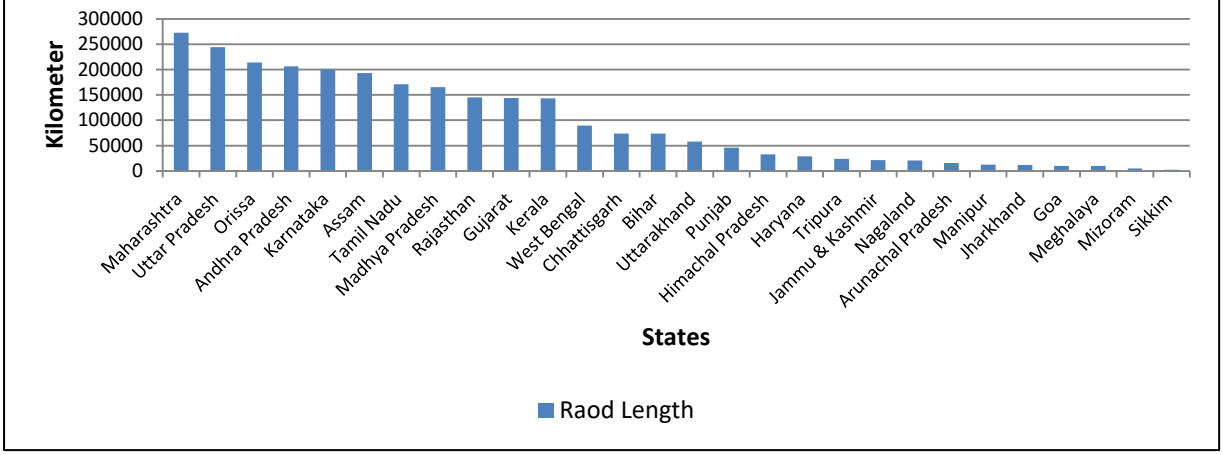
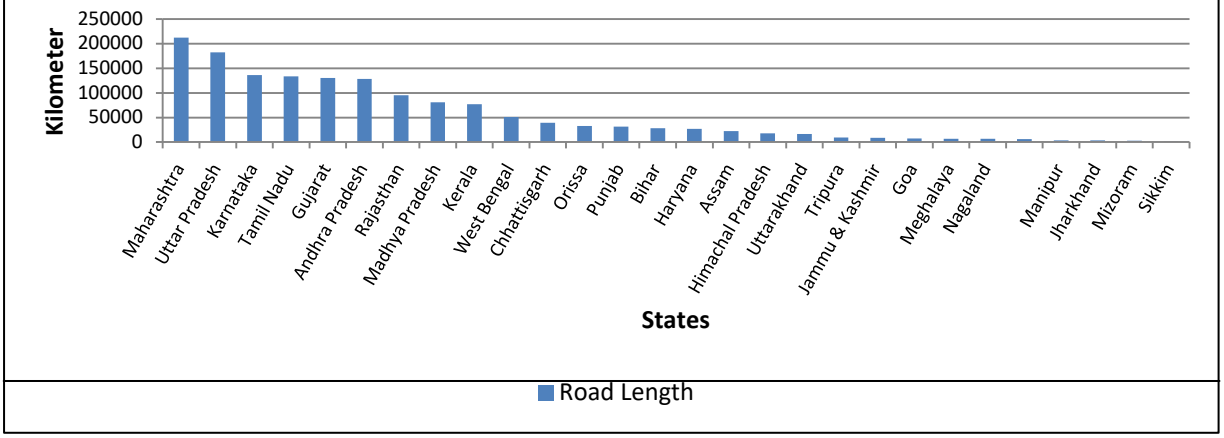


Figure 2.2

LENGTH SURFACED ROADS IN INDIA

(As on 31st March 2004)



2.1.4.1.11 Eleventh Five Year Plan (2007-2012): The Eleventh Plan gave emphasis to the improvement of rural infrastructure for inclusive growth of the economy and launched the Bharat Nirman Programme in 2005 for the upgradation of rural infrastructure. Under this programme the main objectives were to provide electricity to the remaining 125000 villages and to 23 million household, to connect the remaining 66802 habitations with all weather roads and construct 146185 km of new rural road network; to provide drinking water to 55067 uncovered habitations; to provide irrigation to an additional 10 million hectares; and connect the remaining 66822 villages with telephones.

The road length per 100 square km of area in 2008 showed that the state of Jharkhand ranked the lowest only above Arunachal Pradesh, Uttarakhand and Jammu and Kashmir

(Figure 2.3). In terms of road length per lakh population, the performance of Jharkhand was the poorest as it occupied the lowest rank in 2008 (Figure 2.4 and Table 2.2).

Figure 2.3

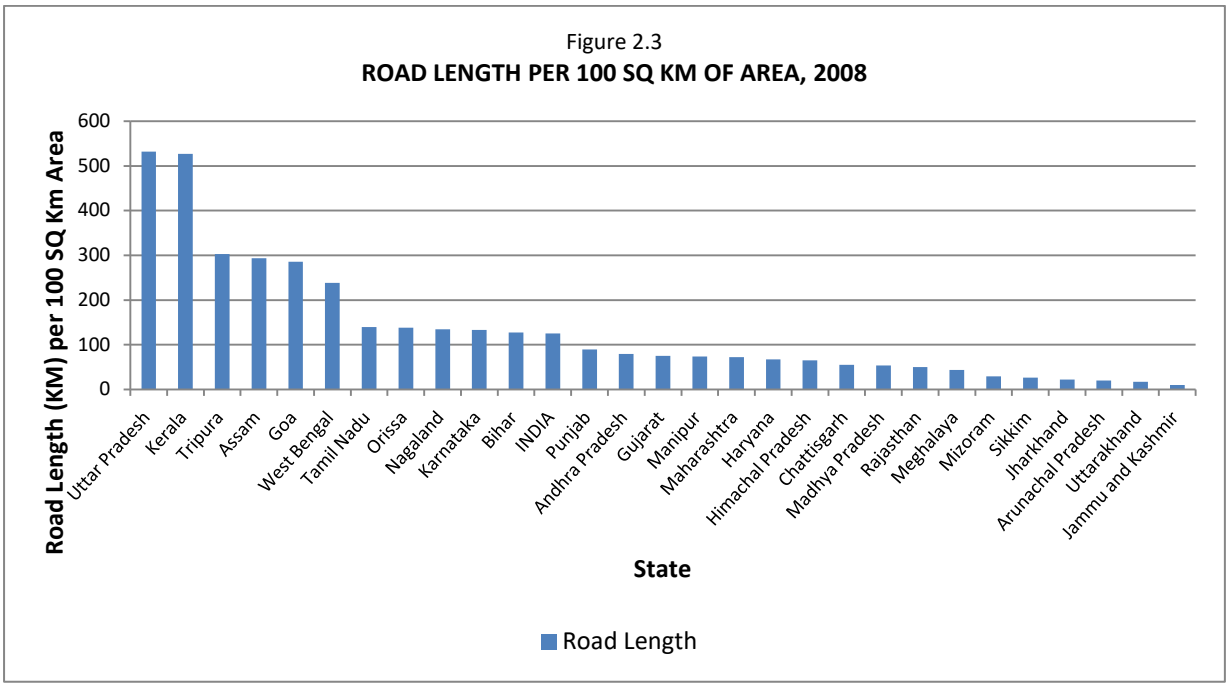


Figure 2.4

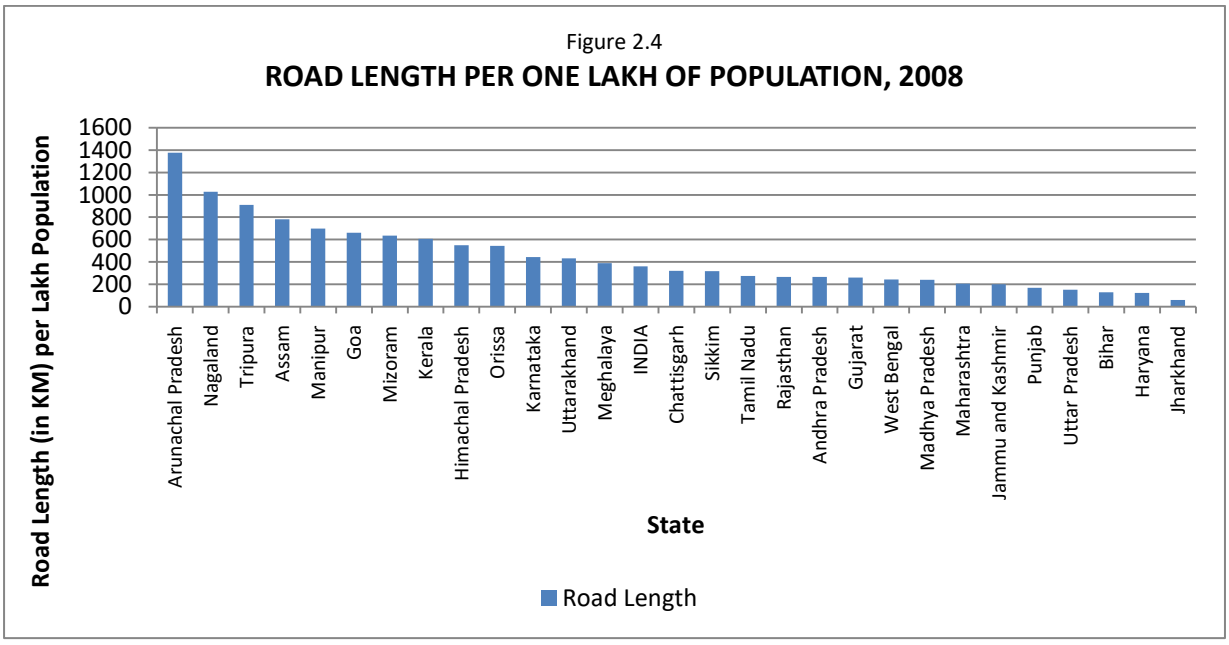


Table 2.1

Growth of Total and Surfaced Length of Roads in Jharkhand, 2004-2008

(in Kms.)

	Total / Surfaced Road Length in km.	2004	2005	2006	2007	2008
Jharkhand	Total	11783	18038	18055	18071	17531
	Surfaced	3817	10053	10052	10050	10037
	Growth of Total Roads (per cent)		53.08	0.09	0.09	-0.13
	Growth of Surfaced Roads (per cent)		163.37	-0.01	-0.02	-0.13

* Exludes 10.6 lakh km. of roads under PMGS Yojana and JR Yojana.

The growth of total road length was 53.08 per cent while that of surfaced road length was 163.37 per cent in 2004-2005 (Table 2.1). Since then the growth of total and surfaced road length has sharply declined till 2008.

Table 2.2

Total and Surfaced Length of Roads in India as on 31st March (Statewise), 2004-2008

in Kms.

States	Total / Surfaced	2004	2005	2006	2007	2008
Andhra Pradesh	T	206125	209124	213703	214859	218175
	S	128308	130119	131690	132743	135097
Arunachal Pradesh	T	15712	17751	17216	17430	16494
	S	6062	10325	10480	10585	9755
Assam	T	192980	208788	215819	223450	230334
	S	22422	24366	24959	25931	26612
Bihar	T	73834	119958	120127	120127	120127
	S	28491	57807	58136	58136	58136
Chhattisgarh	T	73993	72322	73892	73705	74434
	S	39160	40676	42110	41984	43528
Goa	T	10240	10331	10420	10523	10569
	S	7369	7436	7462	7602	7664
Gujarat	T	143660	143419	144777	145631	146630
	S	129981	129715	131123	131672	132321
Haryana	T	28673	28657	29055	29397	29726
	S	26754	26770	27016	27502	27703
Himachal Pradesh	T	32582	23452	23614	34954	36298
	S	17956	19480	19504	20318	21197
Jammu & Kashmir	T	21095	21811	22043	22058	22323
	S	8962	9626	9862	9876	10141
Jharkhand	T	11783	18038	18055	18071	17531
	S	3817	10053	10052	10050	10037
Karnataka	T	200112	210415	214211	253901	255454
	S	136288	132008	134927	149491	153143
Kerala	T	143276	169516	187147	197454	204757
	S	76943	91363	105862	112236	116446
Madhya Pradesh	T	165340	163920	164801	165407	165740
	S	80660	79210	81625	82422	82426
Maharashtra	T	272684	220937	220447	223142	223322
	S	212001	175341	175007	177556	178045
Manipur	T	12599	16502	16502	16502	16502
	S	3839	6682	6682	6682	6682
Meghalaya	T	9701	9662	9691	9752	9839
	S	6687	6241	6270	6283	5472

Table 2.2

Total and Surfaced Length of Roads in India as on 31st March (Statewise), 2004-2008

in Kms.

States	Total / Surfaced	2004	2005	2006	2007	2008
Mizoram	T	4898	5426	5974	6144	6158
	S	2764	3215	3130	5096	5169
Nagaland	T	20647	26241	22085	21947	22304
	S	6570	10587	9516	9518	9540
Orissa	T	213820	215141	215214	215300	215404
	S	32670	30331	30143	30504	30645
Punjab	T	45767	46490	45165	45135	45178
	S	31662	38859	37474	37441	37487
Rajasthan	T	144898	149753	152435	159902	171479
	S	95196	100718	104140	112216	123594
Sikkim	T	2063	2076	2118	1873	1873
	S	1652	1654	1605	1418	1418
Tamil Nadu	T	170823	176209	179348	180823	181213
	S	133175	138736	143646	146869	147346
Tripura	T	23856	31716	31731	31731	31733
	S	9080	12180	12180	12180	12182
Uttarakhand	T	58054	35659	36061	39167	41041
	S	16783	16237	17318	18441	20192
Uttar Pradesh	T	244442	256683	263555	272362	284673
	S	182057	168901	175151	185823	202492
West Bengal	T	89699	195679	199052	208415	211770
	S	51164	39222	41247	42973	49111
INDIA*	T	2669996	2842180	2890784	2995781	3047783
	S	1526055	1545119	1585614	1640935	1691051

* Exludes 10.6 lakh km. of roads under PMGS Yojana and JR Yojana.

Source: *Basic Road Statistis of India, 2004-05, 2005-06, 2006-07 & 2007-08*, Ministry of Road Transport and Highways, Transport Research Wing, Govt. of India, New Delhi, morth.nic.in/wruterеddata/mainlinkFile/File417.pdf

Table 2.3

Road Length in Relation to Area and Population in India as on 31st March 2008 (Statewise)

States/UTs	Total Road Length (In Kms)*	Area (km²)	Population (2008) (In Thousands)**	Road Length (in Kms)	
				Per 100 Sq.Kms. of Area	Per one lakh of Population
Andhra Pradesh	218175	275045	82375	79.32	264.86
Arunachal Pradesh	16494	83743	1198	19.7	1376.79
Assam	230334	78438	29435	293.65	782.52
Bihar	120127	94163	93633	127.57	128.3
Chattisgarh	74434	135191	23269	55.06	319.88
Goa	10569	3702	1596	285.49	662.22
Gujarat	146630	196024	56626	74.8	258.94
Haryana	29726	44212	24171	67.24	122.98
Himachal Pradesh	36298	55673	6595	65.2	550.39
Jammu and Kashmir	22323	222236	11257	10.04	198.3

Table 2.3

Road Length in Relation to Area and Population in India as on 31st March 2008 (Statewise)

States/UTs	Total Road Length (In Kms)*	Area (km²)	Population (2008) (In Thousands)**	Road Length (in Kms)	
				Per 100 Sq.Kms. of Area	Per one lakh of Population
Jharkhand	17531	79714	30181	21.99	58.09
Karnataka	255454	191791	57550	133.19	443.88
Kerala	204757	38863	33802	526.87	605.75
Madhya Pradesh	165740	308245	68737	53.77	241.12
Maharashtra	223322	307713	107972	72.57	206.83
Manipur	16502	22327	2364	73.91	698.05
Meghalaya	9839	22429	2530	43.87	388.89
Mizoram	6158	21081	970	29.21	634.85
Nagaland	22304	16579	2171	134.53	1027.36
Orissa	215404	155707	39655	138.34	543.2
Punjab	45178	50362	26722	89.71	169.07
Rajasthan	171479	342239	64534	50.11	265.72
Sikkim	1873	7096	591	26.4	316.92
Tamil Nadu	181213	130058	66106	139.33	274.12
Tripura	31733	10486	3491	302.62	908.99
Uttar Pradesh	284673	53483	190254	532.27	149.63
Uttarakhand	41041	240928	9511	17.03	431.51
West Bengal	211770	88752	86995	238.61	243.43
INDIA	4109592	3287240	1144737	125.02	359

* Includes roads reported as constructed under JRY and PMGSY

**Population figures as estimated by O/o Registrar General of India, M/O Home Affairs, Govt. of India

Source: *Basic Road Statistis of India, 2004-05, 2005-06, 2006-07 & 2007-08*, Ministry of Road Transport and Highways, Transport Research Wing, Govt. of India, New Delhi, morth.nic.in/wrutereddata/mainlinkFile/File417.pdf

2.2.4.1.12 Twelfth Five Year Plan (2012-2017): The Twelfth Plan has also given high priority to the development of rural roads among other major road development programmes in the country. According to Twelfth Plan Approach Paper, Pradhan Mantri Gram Sadak Yojona (PMGSY) roads have shown significant beneficial results to rural households because of better connectivity to markets and also easier access to health and educational facilities. Emphases have been given for the universalization of rural connectivity especially in hilly areas, Left Wing Extremist (LWE) affected areas and other sparsely populated tribal areas. The habitations with population upto 100 are also been targeted to be connected.[50] In this

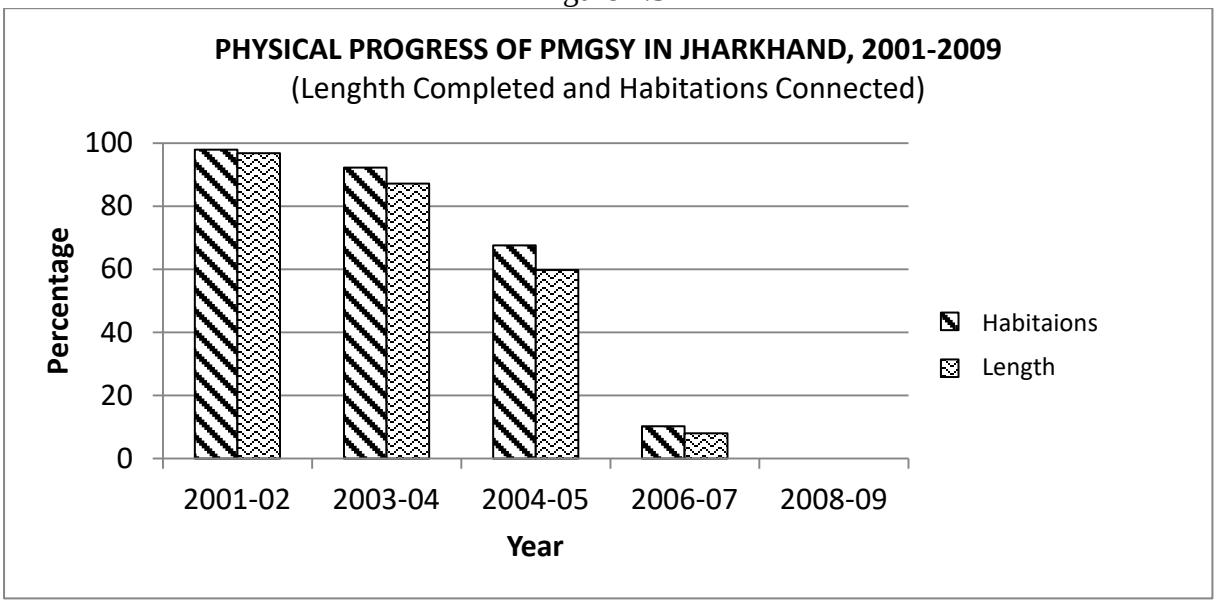
[50] Planning Commission (2011): *Faster, Sustainable and more Inclusive Growth: An Approach to the Twelfth Five Year Plan*, Govt. of India , New Delhi, p. 41.

regard, emphasis was also given to the development of state roads in the scheduled areas inhabited by tribal population. Special Programmes of road development were emphasized for some of the districts of the Tribal Sub Plan area and the LWE affected areas in Jharkhand.[51]

2.2.4.2 Rural Transport Development under the Pradhan Mantri Gram Sadak Yojana (PMGSY) Programme in Jharkhand

The Pradhan Mantri Gram Sadak Yojana (PMGSY) was initiated by the Central Government in 2001. The main aim was to provide all weather rural connectivity with the priority given to habitations with 1000 and above population followed by all habitations with a population of 500 and above. A more generous criterion was approved for habitations in the tribal, desert and mountainous regions because of the difficult terrain. The primary focus of the PMGSY is on construction of new roads. The performance of Jharkhand with regard to the completion of physical targets is satisfying in comparison to some other states of India.[52] The physical achievements of the PMGSY were quite high during the initial years of its implementation in 2001-2002 (Table 2.5).

Figure 2.5



[51] Government of India (2011): *12th Five Year Plan (2012-17) Report of the Working Group on Central Roads Sector*, Ministry of Road Transport & Highways, New Delhi, pp. 9-10, http://planningcommission.nic.in/aboutus/committee/wrkgrp12/transport/report/wg_cen_roads.pdf

[52] www.pmgsy.nic.in (2004-05).

The programme was successfully implemented in almost all the districts in Jharkhand (Appendix II a) in 2001-2002. However, rapid decline in physical progress of work under the PMGSY were observed in the subsequent years. The rural roads construction under the PMGSY was slow in the districts of Latehar, Pakur, Sahebganj, Godda, Lohardaga, Hazaribag, Giridih and Palamu in 2003-2004 (Appendix II b). Since 2003-04, the physical attainment, mainly construction, progressively declined till 2008-2009. About 67.6 per cent of new roads were completed in Jharkhand in 2004-05. The physical performance in terms of new rural road construction was high in the districts of Hazaribagh, Jamtara and Saraikela Kharsawan (Appendix II c). On the other hand, the districts of Sahebganj, Chatra and Garhwa showed poor performance in the same year. The rural road construction in Jharkhand declined sharply in 2006-2007. The districts of Jamtara, Dumka, East Singhbhum and Palamau showed significant progress in terms of construction of new road connectivity in 2007-2008 (Appendix II d). Further, the PMGSY programme showed very little physical progress in 2008-2009. The districts of Bokaro, Koderma and Hazaribagh were among the few districts which showed significant progress while Saraikela Kharsawan, Garhwa and Sahebganj showed poor performance (Appendix II e).

2.3 Conclusion

The transport network in Jharkhand has gradually evolved in phases. The transport system and its regional linkages were heavily unbalanced as growth was concentrated in few pockets leaving behind vast areas of underdevelopment. The main findings of the present study are discussed below:

1. Historically, the Jharkhand region, in comparison to its neighboring regions, was devoid of transport channels. It was avoided by early invaders and outsiders mainly because of its hilly and rugged topography, lack of navigable rivers, and, thick forest cover. The scope of external trade linkages with other regions was further limited in Jharkhand because it had subsistence and forest based economy.

2. The region was primarily avoided by Muslim rulers but few incursions and expedition of the region by the Mughals were recorded. The major development of transport during the medieval period was the building up of the Grand Trunk road, which had its orientation along the Ganga river but with the decline of Mughal power and rise of

Maratha power, this transport channel was reorientated towards the Chotanagpur region.

3. The modern means of transport was introduced into the Chotanagpur region by the Britishers mainly to tap the mineral wealth of the area during the Colonial period. The mineral rich areas of the region were gradually linked with the railway network. However, priority was given for the strengthening of the road system as it helped in linking the economic regions not served by the railways. This, in a way helped in the economic development of some of the areas in Jharkhand.

4. During the post-Independence period, economic exploitation of resources continued with the transport system that was inherited from the colonial period. Road transport development in the state, during the Five Year Plan periods, showed poor level of performance. The growth of total and surfaced road length has shown a declining trend.

5. The rural road connectivity in the state has shown the poorest performance among all Indian states. Although significant physical progress in the rural road connectivity was noticed in the region during the initial plan period of the PMGSY scheme, but in subsequent years the progress showed a declining trend.

Chapter 3
SPATIAL STRUCTURE OF TRANSPORT NETWORK

3.1 Introduction

The evolution of transport systems in the state of Jharkhand has revealed that the transport network before the colonial period was very rudimentary in form and was primarily internal with very little scope of development. The development of the transport system gradually gained momentum in the colonial period with the introduction of modern means of transport and development of roadways and railways. This facilitated the economic exploitation of resources and the movement of goods along these newly constructed channels of transit. The old channels were further strengthened after the independence. With the focus on mining and industrial activities and urbanisation in some areas, the orientation of the transport system was concentrated towards these locations. The significance of road transport over railways is more in Jharkhand as roads have the advantage of reaching difficult terrains where railways cannot reach and road can correct each and every habitation. Presently, the state is poorly developed with respect to road transport infrastructure in general and rural roads in particular vis-a-vis other states in India.

The main objective of this chapter is to analyse the spatial structure of transport network at the urban and rural levels in the state in order to delineate areas, which are endowed with or are deficient in transportation facilities.

3.2 Spatial Structure of Transport Network

Transportation systems are spatial in nature and the study of transport networks relates to the evaluation of its structure and efficiency.[1] The structure of transport includes the physical arrangement of links and nodes forming a network pattern along which the flow of goods and people takes place. The distribution of infrastructure in the transport system creates opportunities for spatial interactions that can be measured as accessibility.[2] The levels of connectivity and accessibility of the transport network varies from one place to another.

[1] M. Raza and Y. Aggarwal (1999): *Transport Geography of India: Commodity Flows and the Regional Structure of the Indian Economy*, Concept Publishing Company, New Delhi, p. 6.

[2] M. Wegener (1985): "Accessibility and Development Impacts", in Banister, D. (ed.): *Transport and Urban Development*, E & FN Spon, London, pp. 158-161.

These inequalities between locations can often be measured by the quantity of links between nodes. The lay-out of nodes and links partially depict the efficiency of the network. The efficiency of a network can be measured through graph theory and network analysis methods.

This study involves the analysis of the structure of transport network with an emphasis on the spatial variation at the urban and rural level. At the urban level, the transport network comprising of metalled roads as well as the towns of varying sizes are selected as the units of study. While at the rural level, the villages having the access to all-weather (pucca) road is selected. For the study at the rural level, the districts are taken as the units of analysis. The study is based on data from secondary sources.

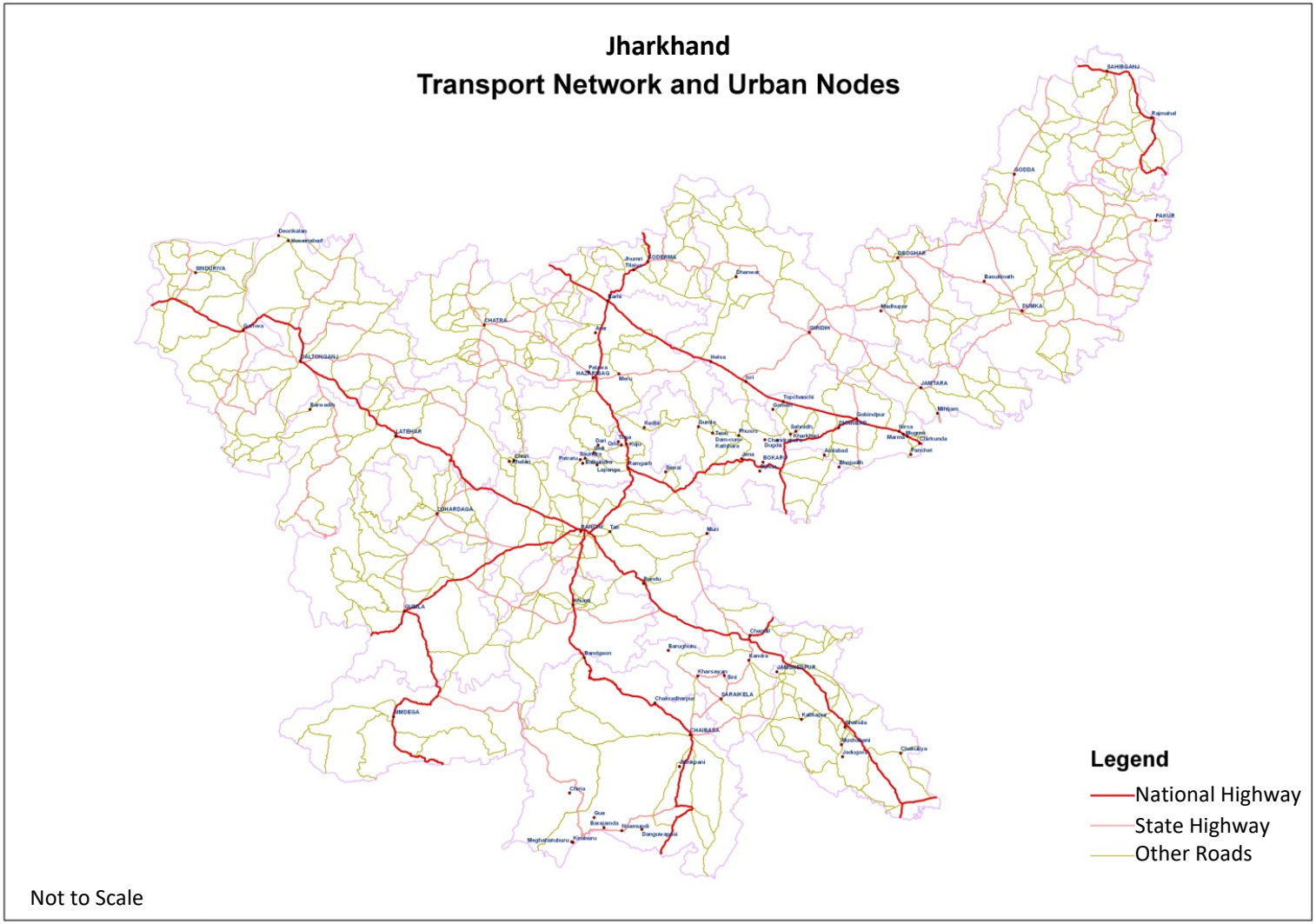
3.2.1 Spatial Structure of Transportation Network at the Urban Level

The measures of transport connectivity and accessibility are based on the graphical method. The graphical method to measure accessibility is based on the principles of networking composed of vertices (nodes) and edges (links). In the present context, 95 urban settlements of 2001 census have been designated as the nodes and the main metalled roads comprising of National Highways (NH), State Highways (SH) and Other District Roads have been designated as the links. This network has been derived from the detailed road map of Jharkhand (Map 3.1) for analysis. The degree of connectivity of the entire network and the nodal accessibility measures are used to study the spatial structure of transport network at the urban level.

3.2.1.1 Measures of Connectivity of the entire Transportation Network

The accessibility of the entire transportation network is calculated with the methodology used by K. J. Kansky. Kansky described the nature of the transportation network in three ways, i) Alpha Index, ii) Beta Index, and iii) Gama Index.

Map 3.1



Source: *Jharkhand Space Applications Center, Ranchi.*

3.2.1.1.1 Alpha Index: Alpha Index is a measure of connectivity, which evaluates the number of cycles in a graph in comparison with the maximum number of cycles. The Alpha index consists of the ratio of the observed number of fundamental circuits to the maximum number of circuits, which may exist in a network.

Alpha Index: $\alpha = \frac{e - v + 1}{2v - 5}$

Where, e = the number of edges (links)

v = the number of vertices (nodes and terminals)

The higher the alpha index, the more a network is connected. Trees and simple networks will have a value of 0. A value of 1 indicates a completely connected network. The alpha index measures the level of connectivity independently of the number of nodes. It is very rare for a network to have an alpha value of 1, because this would imply very serious redundancies. Garrison and Marble observe that multiplying the Alpha index by 100 gives it a range from 0 to 100 (instead of 0 to 1), allowing an interpretation of the value as 'per-cent redundancy'. A tree would clearly have zero redundancy and a completely connected planar network (i.e. a polygonal graph) 100 per cent redundancy.[3]

The transport network of Jharkhand has alpha value of 0.13, indicating 13 per cent redundancy (Table 3.1). The graph is approaching tree like pattern with poor connections between a set of points. It shows that the network is poorly connected, meaning that the urban centres in the state are not adequately connected to each other.

3.2.1.1.2 Beta index: Beta Index is used to evaluate the service function of the existing network. It describes the dependency of the nodes on the link lengths. It is the ratio of links and nodes.

Beta Index: $\beta = \frac{e}{v}$

Where, e = the number of edges (links)

[3] P. Haggett (1967): "Network Models in Geography", in Chorley, R. and P. Haggett (ed.): *Integrated Models in Geography*, Methuen & Co. Ltd., London, p. 634.

v = the number of vertices (nodes and terminals)

When the value of Beta Index is between 1 and 3, it could be termed as a complex network. Higher values in the beta index are produced by a complicated structure, with a high number of edges. Therefore, the increasing connectivity of the graph will be accompanied by a decreasing number of vertices, and the beta index will assume higher numerical value. Thus, the index increases in magnitude as the ratio of the number of edges to the number of vertices increases. Transportation networks having complicated structure have higher values of beta and simple structures have lower values. The Beta Index gives a measure of connectivity regardless of the size of the area involved.[4]

The transport network of Jharkhand has 385 numbers of nodes and 483 numbers of edges. Therefore, the beta index of the network is 1.25. It reflects that the network of roads linking the urban nodes is slightly complex in nature.

3.2.1.1.3 Gama Index: According to K.J. Kansky, the Gamma Index is the relationship between the number of observed links and the number of possible links in a network.

Gamma Index: $\eta = \frac{e}{3(v-2)}$

Where, e = the number of edges (links)

v = the number of vertices (nodes and terminals)

The relation between edges and vertices are expressed in a slightly different form than the alpha and beta index. Assuming a network is abstracted as a planer graph, the addition of each vertex to the system increases the minimum number of edges by three. Network connectivity as measured by gamma index indicates the degree by which the network deviates from an inter-connected graph and approximates in maximally connected graph[5].

The transport network of the state of Jharkhand shows that the Gamma Index of the network is 0.42. In terms of maximal connectivity, the network is 42 per cent connected (for

[4] S. Bhaduri (1992): *Transport and Regional Development: a Case Study of Road Transport of West Bengal,* Concept Publishing Company, New Delhi, p.135.

[5] *Ibid.,* p. 135.

convenience in interpretation, the numerical value may be expressed as a percentage of connectivity).

It can be interpretated that the overall pattern of road network comprising of the NH, SH and Other District roads are not adequately connecting all the urban centres of the state. The results of road transport network connectivity are summarized in Table 3.1.

Table 3.1
Road Network Connectivity

Alpha Index:	0.00134627937336815
Beta Index:	1.25454545454545
Gamma Index:	42.0365535248042
Number of Vertices:	385
Number of Edges:	483

Based on the Alpha, Beta and Gamma Indices, the connectivity of the network can be designated as nearly average connected network.

3.2.1.2 Measures of Nodal Accessibility

The Nodal accessibility measures have been used to study the level of accessibility of each node or urban centre to the associated urban centres in the network. The study involves the degree to which an individual node is connected to the total transportation network system. The following nodal accessibility measures have been selected for the purpose:

i. Direct Connectivity (degree of a node)
ii. Geographic Accessibility (Ingram's Accessibility Index)
iii. Route Factor (Hay's Accessibility Index) or Tortuosity Ratio
iv. Detour Index
v. Distance to nearest Class I town

3.2.1.2.1 Direct Connectivity (Degree of a Node)

The most basic measure of accessibility involves network connectivity where a network is represented as a connectivity matrix (C1), which expresses the connectivity of each node with its adjacent nodes. The number of columns and rows in this matrix is equal to the number of nodes in the network and a value of 1 is given for each cell where there is a connected pair and a value of 0 for each cell where there is an unconnected pair. The

summation of this matrix provides a very basic measure of accessibility, also known as the degree of a node.[6]

$C1=\sum_j^n cij$

Where, C1= degree of a node

Cij= connectivity between node i and node j (either 0 or 1).

n= number of nodes.

The transport network has 95 nodes (towns), however, to create a topology of the entire network, the other nodes, at the junction points of two links and terminal nodes, are also taken into consideration. The topology is built in Arc GIS 9 software and the connectivity matrix (0-1 matrix) is created (Appendix III a). The nodes representing the towns are selected from the connectivity matrix and the values are added row wise. This gives the degree of a node. The following table 3.2 shows the Degree of a Node or Direct Connectivity of each urban node in the network in 2001.

Table 3.2

Direct Connectivity of Urban Nodes in Jharkhand, 2001

Urban Nodes	Number of Direct Connections	Rank	Urban Nodes	Number of Direct Connections	Rank
Ranchi	4	1	Tati	2	3
Barhi	4	1	Topa	2	3
Kuju	4	1	Meru	2	3
Saraikela	4	1	Noamundi	2	3
Giridih	4	1	Orla	2	3
Gobindpur	4	1	Jhumri Tilaiya	2	3
Garhwa	3	2	Kedla	2	3
Daltonganj	3	2	Bundu	2	3
Gumla	3	2	Chakradharpur	2	3
Chatra	3	2	Sewai	2	3
Khunti	3	2	Barughutu	2	3
Patratu	3	2	Kharsawan	2	3
Hazaribag	3	2	Muri	2	3
Ramgarh	3	2	Helsa	2	3
Koderma	3	2	Tenu Dam-cum-Kathhara	2	3
Jhinkpani	3	2	Sini	2	3
Chaibasa	3	2	Dhanwar	2	3
Gumia	3	2	Jena	2	3
Phusro	3	2	Isri	2	3
Chandil	3	2	Kandra	2	3
Jamshedpur	3	2	Sijhua	2	3
Topchanchi	3	2	Bokaro	2	3
Kharkhari	3	2	Gomoh	2	3
Ghatsila	3	2	Dugda	2	3
Deoghar	3	2	Sahnidh	2	3
Nirsa	3	2	Kalikapur	2	3
Jamtara	3	2	Amlabad	2	3
Chirkunda	3	2	Dhanbad	2	3

[6] J. Rodrigue, C. Comtois and B. Slack (2009): *The Geography of Transport Systems*, 2nd edition, Routledge, Taylor & Francis Group, London and New York, p 70.

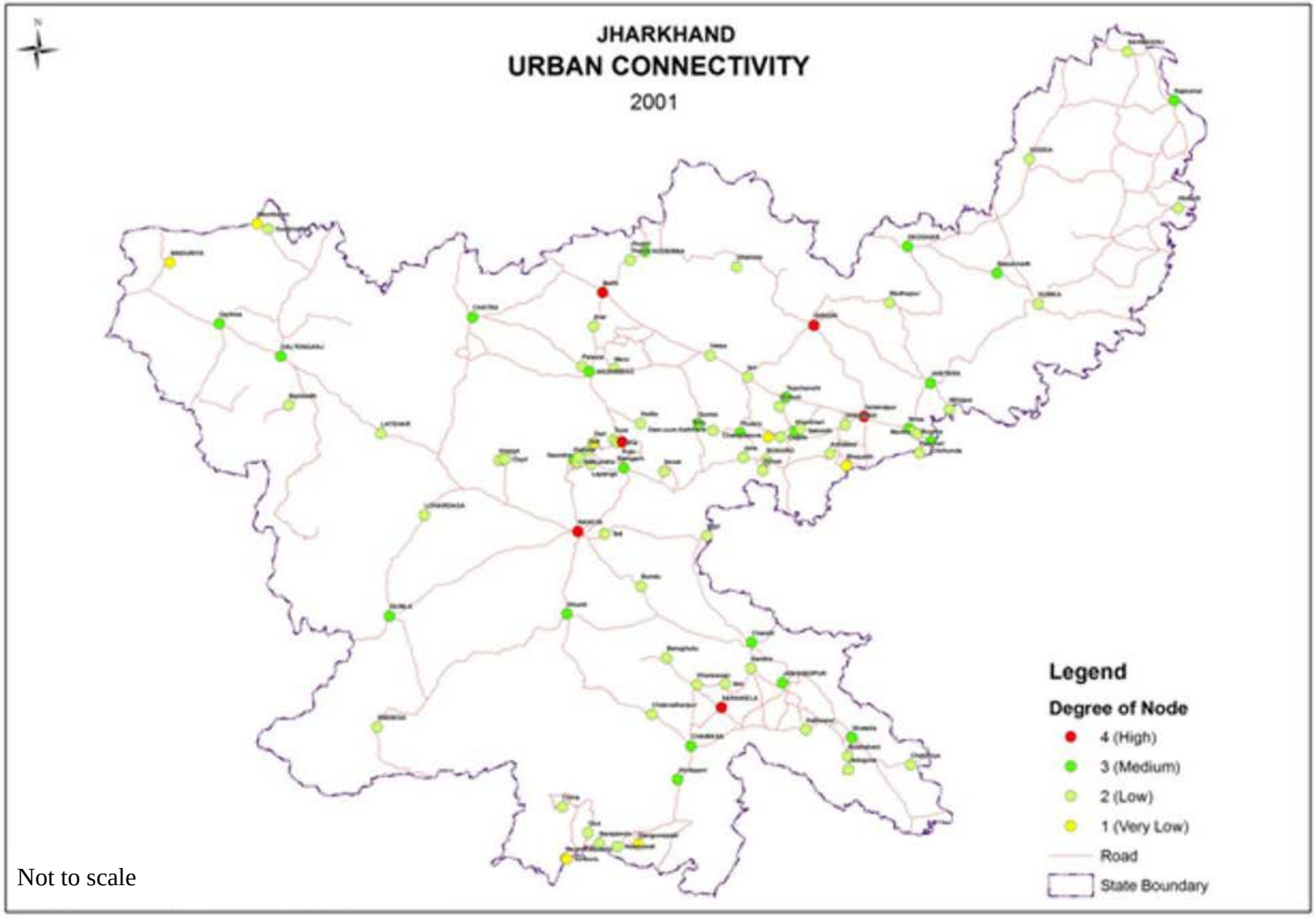
Table 3.2

Direct Connectivity of Urban Nodes in Jharkhand, 2001

Urban Nodes	Number of Direct Connections	Rank	Urban Nodes	Number of Direct Connections	Rank
Basukinath	3	2	Mushabani	2	3
Rajmahal	3	2	Jadugora	2	3
Husainabad	2	3	Madhupur	2	3
Barwadih	2	3	Chakuliya	2	3
Simdega	2	3	Mugma	2	3
Latehar	2	3	Marma	2	3
Lohardaga	2	3	Panchet	2	3
Khelari	2	3	Mihijam	2	3
Churi	2	3	Godda	2	3
Chiria	2	3	Dumka	2	3
Meghahatuburu	2	3	Sahibganj	2	3
Balkundra	2	3	Pakur	2	3
Saundra	2	3	Sinduriya	1	4
Palawa	2	3	Deorikalan	1	4
Gidi	2	3	Kiriburu	1	4
Gua	2	3	Dari	1	4
Lapanga	2	3	Danguwapasi	1	4
Ara	2	3	Chandrapura	1	4
Barajamda	2	3	Bhojudih	1	4

The towns of Ranchi (capital of Jharkhand), Barhi, Kuju, Saraikela, Giridih and Gobindpur are the most connected as they have the highest degree of direct connections in comparison to all other nodes in the network. The other important urban nodes having higher degree of direct connections are Garhwa, Daltonganj, Gumla, Chatra, Kunti, Patratu, Hazaribag, Ramgarh, Koderma, Jhinkpani, Chaibasa, Gumia, Phusro, Chandil, Jamshedpur, and Deoghar. The towns which have exhibited poor connectivity (only one) are Sinduriya, Deorikalan, Kiriburu, Dari, Danguapasi, Chandrapura and Bhojudih. All the towns except Dari and Chandrapura have poor connectivity due to their location in the extreme end of the network, i.e, located near the borders of the state (see Map 3.2).

Map 3.2


JHARKHAND
URBAN CONNECTIVITY
2001
Legend
Degree of Node
4 (High)
3 (Medium)
2 (Low)
1 (Very Low)
Road
State Boundary
Not to scale

3.2.1.2.2 Ingram' Accessibility Index (Geographical Accessibility)

Ingram used distance as measure of accessibility for Hamilton, Ontario urban area. He calculated relative and integral accessibility as:

- Ingram's Relative Accessibility Measure:

$$Aij = dij$$

Where, Aij = accessibility index for zone/ node i

*d*ij = separation between zones i and j measured by time, distance, cost, etc.

- Ingram's Integral Accessibility Measure:

$$Ai = \sum_{j=1}^{n} dij / n$$

Where,

A*i* = accessibility index for zone/ node *i*

*d*ij = separation between zones i and j measured by time, distance, cost, etc

n = number of zones/ nodes

Distance is taken as the major attribute for calculating Ingram's Accessibility Index. The lower its value, the more a location is accessible. Ingram's Integral accessibility measure is also referred to as Geographic Accessibility. According to Rodrigue, "the Geographic accessibility of a location is the summation of all distances between other locations divided by the number of locations."[7]

$$A(G)=\sum_i^n(\sum_j^n dij)/n$$

Where, A(G) = Geographical Accessibility

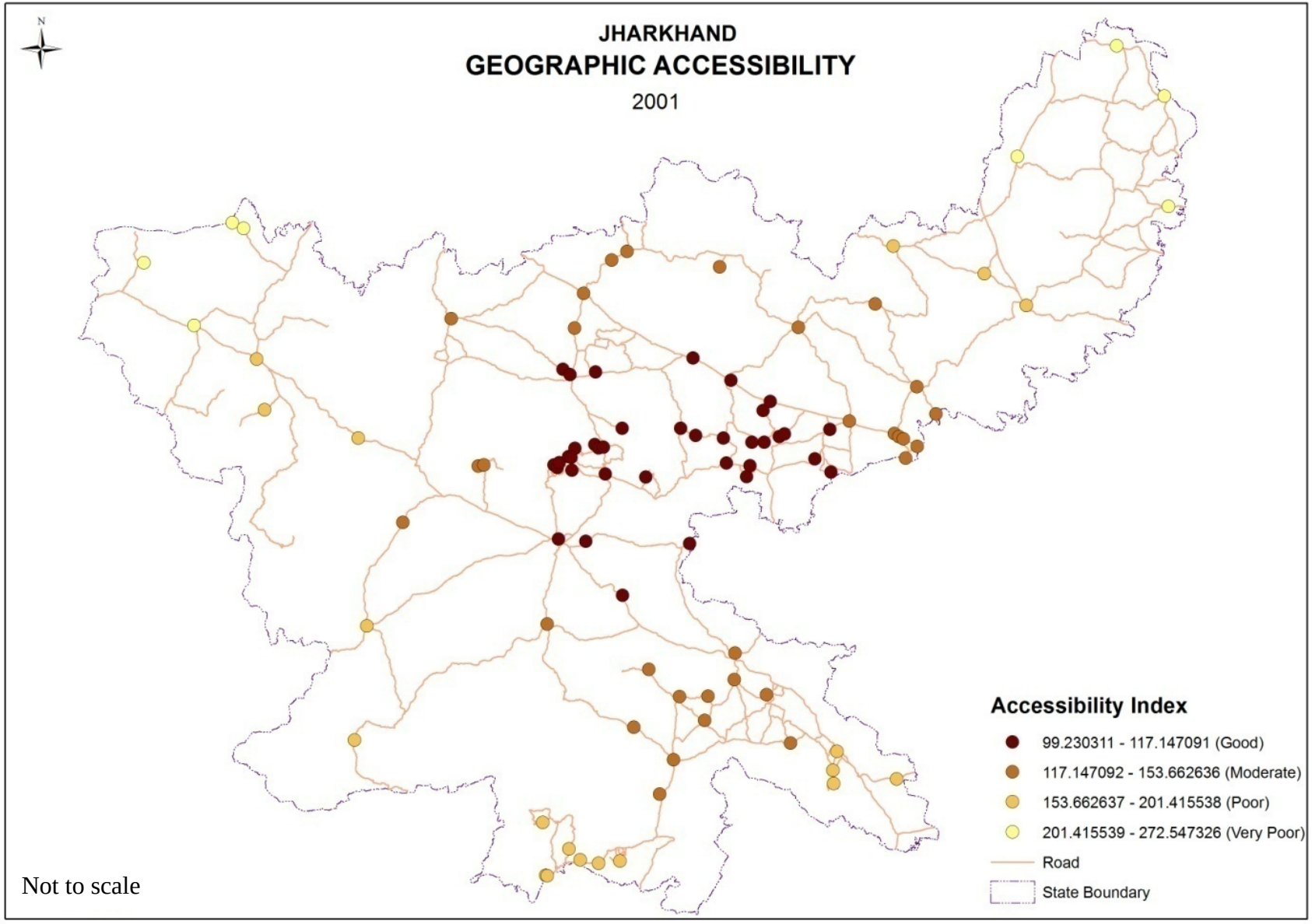
dij = shortest path distance between location i and j

n = number of locations

The shortest path distances between the urban nodes are calculated (Appendix III b). The spatial pattern of Geographic Accessibility shows that the accessibility gradually increases from the core areas to the peripheral areas (see Table 3.3 and Map 3.3). The areas of good Geographical Accessibility are confined to the coal mining areas of the Damodar river valley of which the main urban nodes are Bokaro, Ranchi and Hazaribag urban areas. The most accessible urban centres in the network are Sewai, Tenu Dam-

[7] J. Rodrigue, C. Comtois and B. Slack (2009): *The Geography of Transport Systems*, 2nd edition, Routledge, Taylor & Francis Group, London and New York, p.70.

Map 3.3


JHARKHAND
GEOGRAPHIC ACCESSIBILITY
2001
Accessibility Index
99.230311 - 117.147091 (Good)
117.147092 - 153.662636 (Moderate)
153.662637 - 201.415538 (Poor)
201.415539 - 272.547326 (Very Poor)
Road
State Boundary
Not to scale

cum-Kathara, Jena, Gumia, Phusro, Ramgarh, Sijua and others located as cluster of nodes in the central part of the network. The least accessible places are located in the peripheries of the network comprising of the urban centres of Rajmahal, Sahibganj, Sinduriya, Pakur, Deorikalan, Garhwa, Husainabad, Godda, Daltonganj, Barwadih and others.

Table 3.3

Geographic Accessibility among the Towns of Jharkhand

Rank	Town	Geographic Accessibility Index	Rank	Town	Geographic Accessibility Index
1	Sewai	99.2	49	Barhi	131.0
2	Tenu Dam-Cum-Kathhara	100.3	50	Nirsa	131.0
3	Jena	100.5	51	Mugma	132.1
4	Gumia	100.7	52	Jamshedpur	132.7
5	Phusro	101.2	53	Marma	133.2
6	Ramgarh	101.5	54	Saraikela	133.5
7	Sijhua	102.1	55	Panchet	133.5
8	Kuju	102.2	56	Dhanwar	134.1
9	Kedla	102.3	57	Chakradharpur	135.8
10	Bokaro	102.4	58	Chirkunda	137.0
11	Orla	102.6	59	Jhumri Tilaiya	137.5
12	Muri	102.8	60	Koderma	139.0
13	Chandrapura	103.1	61	Jamtara	141.3
14	Topa	103.2	62	Chaibasa	143.4
15	Dugda	104.5	63	Mihijam	144.4
16	Lapanga	105.2	64	Madhupur	145.0
17	Dari	105.5	65	Kalikapur	147.6
18	Religarha	105.5	66	Lohardaga	147.8
19	Gidi	106.0	67	Chatra	149.9
20	Kharkhari	106.8	68	Jhinkpani	153.7
21	Gomoh	107.0	69	Ghatsila	157.3
22	Tati	107.3	70	Mushabani	161.6
23	Saundra	107.3	71	Latehar	161.8
24	Balkundra	107.7	72	Deoghar	162.5
25	Sahnidh	107.8	73	Jadugora	165.5
26	Patratu	108.3	74	Gumla	168.1
27	Isri	108.6	75	Chiria	171.0
28	Topchanchi	109.0	76	Gua	175.8
29	Bundu	110.5	77	Danguwapasi	176.2
30	Ranchi	111.0	78	Chakuliya	177.3
31	Helsa	111.0	79	Noamundi	178.0
32	Amlabad	112.1	80	Barajamda	178.2
33	Meru	112.5	81	Basukinath	178.8
34	Hazaribag	115.1	82	Dumka	185.8
35	Bhojudih	115.4	83	Kiriburu	187.2
36	Dhanbad	116.2	84	Meghahatuburu	187.2
37	Palawa	117.1	85	Simdega	191.6
38	Chandil	120.9	86	Barwadih	194.6
39	Gobindpur	121.0	87	Daltonganj	201.4
40	Barughutu	121.9	88	Godda	215.1
41	Ara	123.8	89	Husainabad	226.0

Table 3.3

Geographic Accessibility among the Towns of Jharkhand

Rank	Town	Geographic Accessibility Index	Rank	Town	Geographic Accessibility Index
42	Khunti	124.0	90	Garhwa	227.1
43	Churi	124.3	91	Deorikalan	230.6
44	Khelari	125.7	92	Pakur	250.0
45	Kandra	126.0	93	Sinduriya	253.8
46	Giridih	126.2	94	Sahibganj	272.1
47	Kharsawan	127.2	95	Rajmahal	272.5
48	Sini	127.8			

3.2.1.2.3 Hay's Accessibility Index (Route Factor Ratio)

This measure is called as the Route Factor Ratio which is a ratio of the route distance and geodetic distance (crow-flies).

Route Distance: $Ai = \sum_{j=1}^{n} dij$

Where, Ai = the accessibility of node i with respect to all other nodes in the network

dij = the route distance between node *i* and *j*

n = the number of nodes in the network

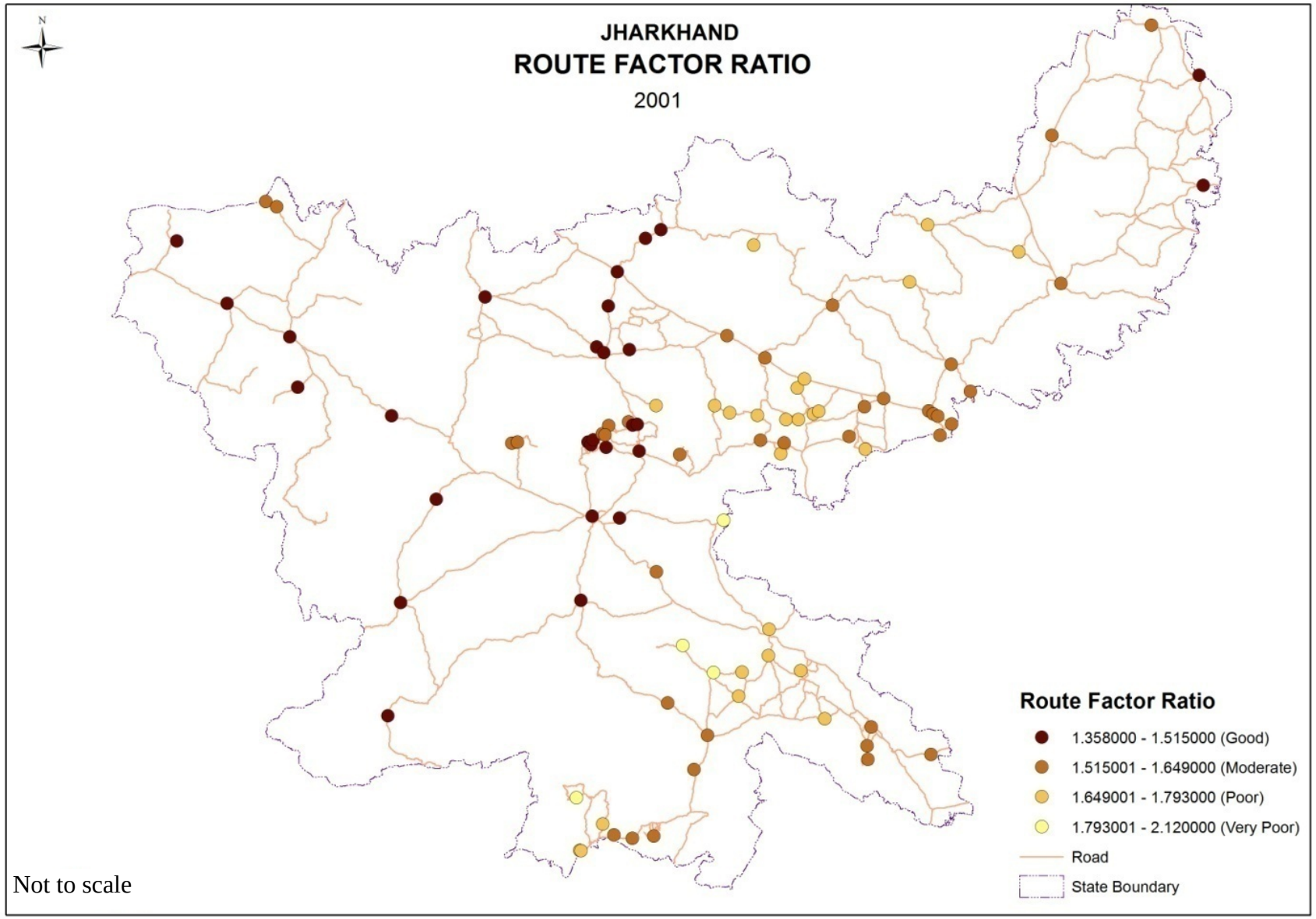
Geodetic Distance: The formula is same as that of route distance with the difference that instead of route distance, crow-fly distance (Appendix III c) between the nodes is taken.

Route Factor = Route Distance/ Geodetic Distance

Nodes with Route Factor nearing 1 will mean better accessibility and better served by the network. Route factor explains that the nodes that are more accessible may not be better served because there may be a large residual between route distance and geodetic distance.

Map 3.4 shows a distinct pattern of transport accessibility measured with the help of the Route Factor Ratio of the urban nodes in the state. The nodes which are better served by the transport network are mostly located along the central and western part of the region. The network has been more efficient in this part than in the mining and industrial regions of Dhanbad, Bokaro and Jamshedpur.

Map 3.4


JHARKHAND
ROUTE FACTOR RATIO
2001
Route Factor Ratio
1.358000 - 1.515000 (Good)
1.515001 - 1.649000 (Moderate)
1.649001 - 1.793000 (Poor)
1.793001 - 2.120000 (Very Poor)
Road
State Boundary
Not to scale

The urban centres which have route factors nearing 1 are Garhwa, Daltonganj, Chatra, Barhi, Ranchi, Latehar, Gumla, Hazaribag, Khunti and Palawa. The urban centres which have high residuals are Barughutu, Chiria, Kharsawan, Muri, Deoghar, Sini, Chandrapura, Gua, Dugda and Kedla (Table 3.4).

Table 3.4
Town Ranking by Route Factor Index in Jharkhand

Rank	Town	Aggregate Route Distance (KM)	Aggregate Straight Line Distance (KM)	Route Factor Index	Rank	Town	Aggregate Route Distance (KM)	Aggregate Straight Line Distance (KM)	Route Factor Index
1	Garhwa	29298.51	21576.30	1.358	49	Noamundi	27205.40	16906.91	1.609
2	Daltonganj	26383.59	19134.48	1.379	50	Jhinkpani	23506.63	14597.95	1.610
3	Chatra	19687.30	14240.20	1.383	51	Chaibasa	21953.36	13626.86	1.611
4	Barhi	17207.16	12444.89	1.383	52	Chakradharpur	20800.31	12903.17	1.612
5	Ranchi	14646.74	10547.79	1.389	53	Giridih	19429.21	11993.58	1.620
6	Latehar	21417.99	15375.35	1.393	54	Churi	19150.61	11809.95	1.622
7	Gumla	22292.47	15964.88	1.396	55	Godda	33167.57	20436.47	1.623
8	Hazaribag	15376.89	10937.70	1.406	56	Chakuliya	27379.24	16843.76	1.625
9	Khunti	16612.28	11781.68	1.410	57	Jena	15537.97	9543.45	1.628
10	Palawa	15730.87	11128.97	1.414	58	Ghatsila	24409.52	14945.52	1.633
11	Sinduriya	34199.05	24113.48	1.418	59	Amlabad	17413.62	10648.88	1.635
12	Ara	16902.54	11761.42	1.437	60	Panchet	20766.80	12681.22	1.638
13	Ramgarh	13931.34	9639.43	1.445	61	Mushabani	25156.75	15352.98	1.639
14	Lohardaga	20335.39	14040.85	1.448	62	Isri	16906.22	10314.54	1.639
15	Jhumri Tilaiya	19010.96	13060.57	1.456	63	Jadugora	25795.95	15722.51	1.641
16	Simdega	26500.99	18197.56	1.456	64	Mihijam	22507.68	13713.35	1.641
17	Meru	15574.70	10684.66	1.458	65	Bokaro	16026.65	9723.78	1.648
18	Pakur	34820.70	23754.33	1.466	66	Barajamda	27922.56	16928.77	1.649
19	Patratu	15201.79	10286.37	1.478	67	Kharkhari	16800.03	10146.60	1.656
20	Koderma	19519.55	13207.04	1.478	68	Sahnidh	16958.34	10237.59	1.656
21	Balkundra	15203.69	10227.03	1.487	69	Madhupur	23004.18	13778.79	1.670
22	Saundra	15169.21	10197.45	1.488	70	Phusro	16063.69	9611.97	1.671
23	Lapanga	14927.06	9994.77	1.493	71	Gumia	15991.98	9561.84	1.672
24	Rajmahal	38772.13	25892.00	1.497	72	Kiriburu	29754.36	17781.23	1.673
25	Kuju	14553.40	9709.03	1.499	73	Kalikapur	23485.90	14021.20	1.675
26	Barwadih	27865.70	18486.73	1.507	74	Meghahatuburu	29794.09	17783.98	1.675
27	Tati	15422.58	10196.64	1.513	75	Topchanchi	17391.62	10358.93	1.679
28	Orla	14764.05	9744.51	1.515	76	Kandra	20180.93	11966.99	1.686
29	Topa	14999.82	9802.67	1.530	77	Sijhua	16495.46	9703.49	1.700
30	Deorikalan	33558.51	21911.60	1.532	78	Tenu Dam-Cum-Kathhara	16203.08	9526.57	1.701
31	Husainabad	33049.38	21471.12	1.539	79	Gomoh	17318.32	10167.17	1.703
32	Dumka	27322.42	17652.92	1.548	80	Saraikela	21688.32	12679.31	1.711
33	Nirsa	19442.01	12446.22	1.562	81	Jamshedpur	21567.57	12603.54	1.711
34	Mugma	19644.13	12547.25	1.566	82	Basukinath	29107.95	16982.47	1.714
35	Sahibganj	40496.49	25846.30	1.567	83	Chandil	19721.43	11486.03	1.717

Table 3.4
Town Ranking by Route Factor Index in Jharkhand

Rank	Town	Aggregate Route Distance (KM)	Aggregate Straight Line Distance (KM)	Route Factor Index	Rank	Town	Aggregate Route Distance (KM)	Aggregate Straight Line Distance (KM)	Route Factor Index
36	Marma	19832.57	12656.25	1.567	84	Dhanwar	21974.52	12744.10	1.724
37	Chirkunda	20442.87	13011.93	1.571	85	Bhojudih	18965.59	10964.11	1.730
38	Gidi	15831.31	10065.78	1.573	86	Kedla	16847.49	9720.64	1.733
39	Jamtara	21119.90	13427.40	1.573	87	Dugda	17233.58	9925.90	1.736
40	Sewai	14866.76	9426.88	1.577	88	Gua	29101.05	16700.37	1.743
41	Religarha	15812.10	10024.20	1.577	89	Chandrapura	17302.48	9796.95	1.766
42	Gobindpur	18150.51	11492.66	1.579	90	Sini	21632.85	12140.73	1.782
43	Bundu	16625.62	10494.87	1.584	91	Deoghar	27666.78	15433.80	1.793
44	Helsa	16730.63	10548.61	1.586	92	Muri	18188.94	9765.41	1.863
45	Danguwapasi	26615.52	16737.53	1.590	93	Kharsawan	22669.07	12087.66	1.875
46	Dari	15938.76	10019.96	1.591	94	Chiria	31782.68	16244.51	1.957
47	Dhanbad	17749.07	11043.73	1.607	95	Barughutu	24554.59	11584.57	2.120
48	Khelari	19204.15	11941.40	1.608					

3.2.1.2.4 Detour Index

Detour Index is a measure of the efficiency of a transport network in terms of how well it overcomes distance or the friction of space. Thus, the topographical constraint for the development of transport network can be analysed with the help of the Detour Index.
The closer the detour gets to 1, the more the network is spatially efficient.[8]

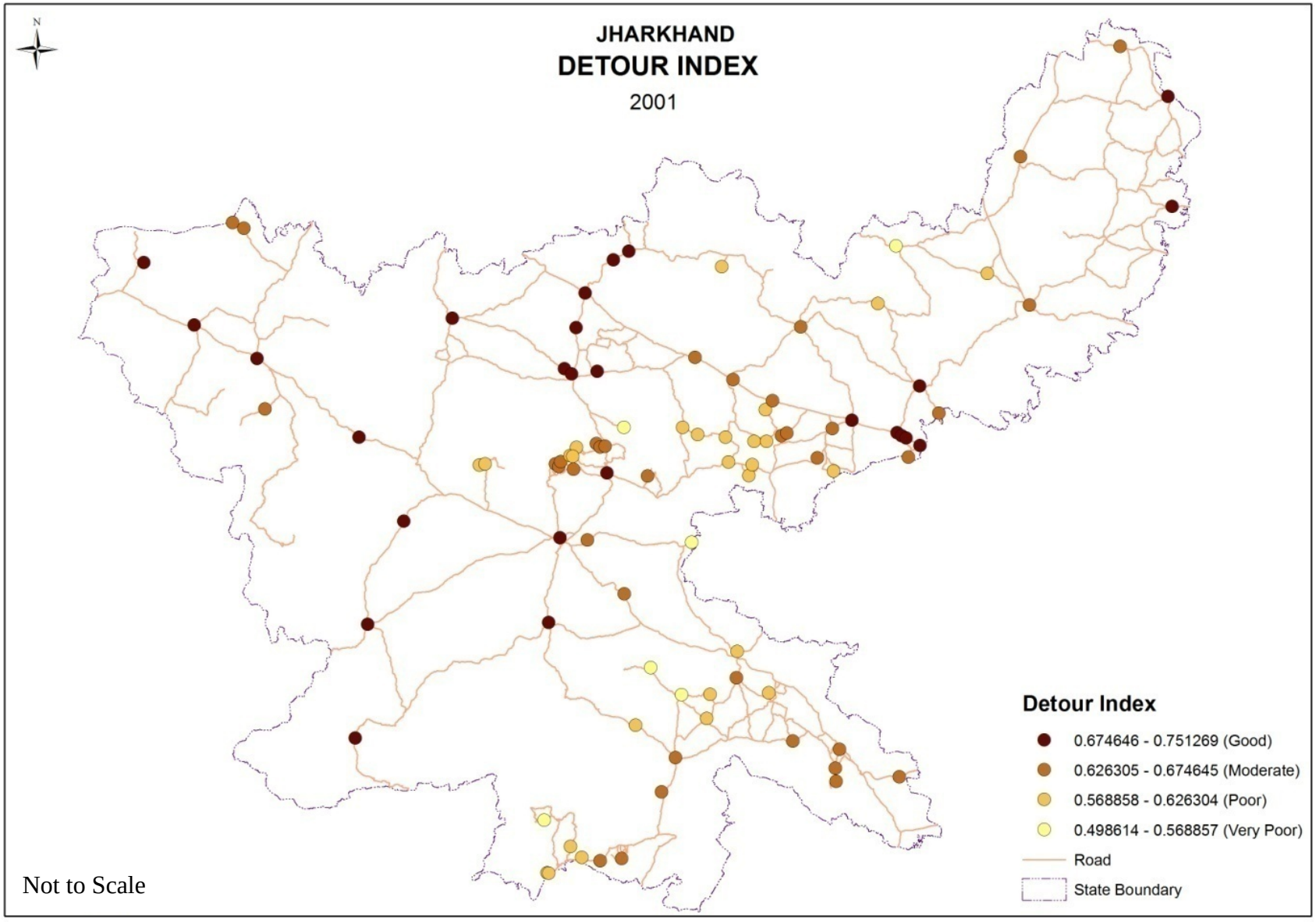
DI =DD/DT

Where, DI is Detour Index, DD is crow-fly distance and DT is route distance between the two nodes.

The urban centres having a detour value of above 0.7 are Barhi, Garhwa, Chatra, Hazaribag, Ranchi, Daltonganj, Palawa, Gumla, Khunti and Ara. These areas have efficient Detour ratios. The efficiency of network is less among the towns of Barughutu, Chiria, Kedla, Muri, Kharsawan, Deoghar and Gua as they are accessible by making a long Detour (Table 3.5).

[8] J. Rodrigue, C. Comtois and B. Slack (2009): *The Geography of Transport Systems*, 2nd edition, Routledge, Taylor & Francis Group, London and New York, p. 29.

Map 3.5


JHARKHAND
DETOUR INDEX
2001
Detour Index
0.674646 - 0.751269 (Good)
0.626305 - 0.674645 (Moderate)
0.568858 - 0.626304 (Poor)
0.498614 - 0.568857 (Very Poor)
Road
State Boundary
Not to Scale

Detour Index measures the efficiency of the network due to topographical constraint. About 22 percent of the towns in the state have a Detour between 1 and 1.5. The majority of the towns, about 76 percent, have a Detour between 1.5 and 2. There are many towns in the area which have shown a Detour of more than 2, 3 and even 4, which is a clear example of the physical constraints of the region.

The topography of Chotanagpur which forms the base of the state of Jharkhand is predominantly rugged and forested. About 22 percent of the towns in the state have a detour between 1 and 1.5. The majority of the towns about 76 percent have a detour between 1.5 and 2. There are many towns in the area which have shown a detour of more than 2, 3 and even 4, which is a clear example of the physical constraint that the area has witnessed since ancient times. The disadvantage of transport is found to be more in some of the urban centres in Jharkhand with a detour index above 4 (Map 3.5).

Table 3.5

Town Ranking by Average Detour Index in Jharkhand

Rank	Town	Average Detour Index	Rank	Town	Average Detour Index
1	Barhi	0.751269	49	Jhinkpani	0.643683
2	Garhwa	0.729343	50	Topchanchi	0.643079
3	Chatra	0.728466	51	Jadugora	0.641368
4	Hazaribag	0.727065	52	Sahnidh	0.640515
5	Ranchi	0.722686	53	Kalikapur	0.639976
6	Daltonganj	0.721399	54	Danguwapasi	0.639544
7	Palawa	0.719601	55	Noamundi	0.637975
8	Gumla	0.718843	56	Amlabad	0.636885
9	Khunti	0.710286	57	Topa	0.635909
10	Ara	0.710055	58	Bundu	0.634121
11	Latehar	0.708366	59	Kandra	0.632912
12	Nirsa	0.706736	60	Godda	0.632235
13	Mugma	0.703776	61	Mihijam	0.631251
14	Marma	0.702351	62	Sewai	0.631088
15	Jhumri Tilaiya	0.700808	63	Jena	0.626304
16	Pakur	0.699253	64	Chakradharpur	0.625651
17	Ramgarh	0.699151	65	Gomoh	0.62516
18	Chirkunda	0.69865	66	Jamshedpur	0.624359
19	Gobindpur	0.696735	67	Saraikela	0.622649
20	Meru	0.693763	68	Bokaro	0.622052
21	Sinduriya	0.693383	69	Chandil	0.621919
22	Koderma	0.687183	70	Barajamda	0.619208
23	Lohardaga	0.683883	71	Phusro	0.61308

Table 3.5

Town Ranking by Average Detour Index in Jharkhand

Rank	Town	Average Detour Index	Rank	Town	Average Detour Index
24	Rajmahal	0.680808	72	Madhupur	0.610967
25	Simdega	0.680004	73	Kiriburu	0.605385
26	Jamtara	0.679829	74	Sijhua	0.60496
27	Dhanbad	0.674645	75	Gidi	0.604823
28	Dumka	0.673671	76	Meghahatuburu	0.604649
29	Helsa	0.668778	77	Khelari	0.604499
30	Kuju	0.666181	78	Gumia	0.603487
31	Panchet	0.659613	79	Dugda	0.599277
32	Ghatsila	0.656785	80	Religarha	0.598989
33	Patratu	0.655882	81	Churi	0.598776
34	Chaibasa	0.654862	82	Bhojudih	0.597946
35	Tati	0.653822	83	Basukinath	0.597612
36	Isri	0.653554	84	Tenu Dam-Cum-Kathhara	0.596302
37	Chakuliya	0.653486	85	Dari	0.592773
38	Barwadih	0.653047	86	Sini	0.589496
39	Orla	0.649883	87	Chandrapura	0.582722
40	Mushabani	0.648887	88	Dhanwar	0.581288
41	Sahibganj	0.648088	89	Gua	0.576919
42	Lapanga	0.647499	90	Deoghar	0.568857
43	Saundra	0.647175	91	Kharsawan	0.566696
44	Deorikalan	0.646552	92	Muri	0.552317
45	Kharkhari	0.644188	93	Kedla	0.549867
46	Balkundra	0.644152	94	Chiria	0.507158
47	Husainabad	0.643826	95	Barughutu	0.498614
48	Giridih	0.643709			

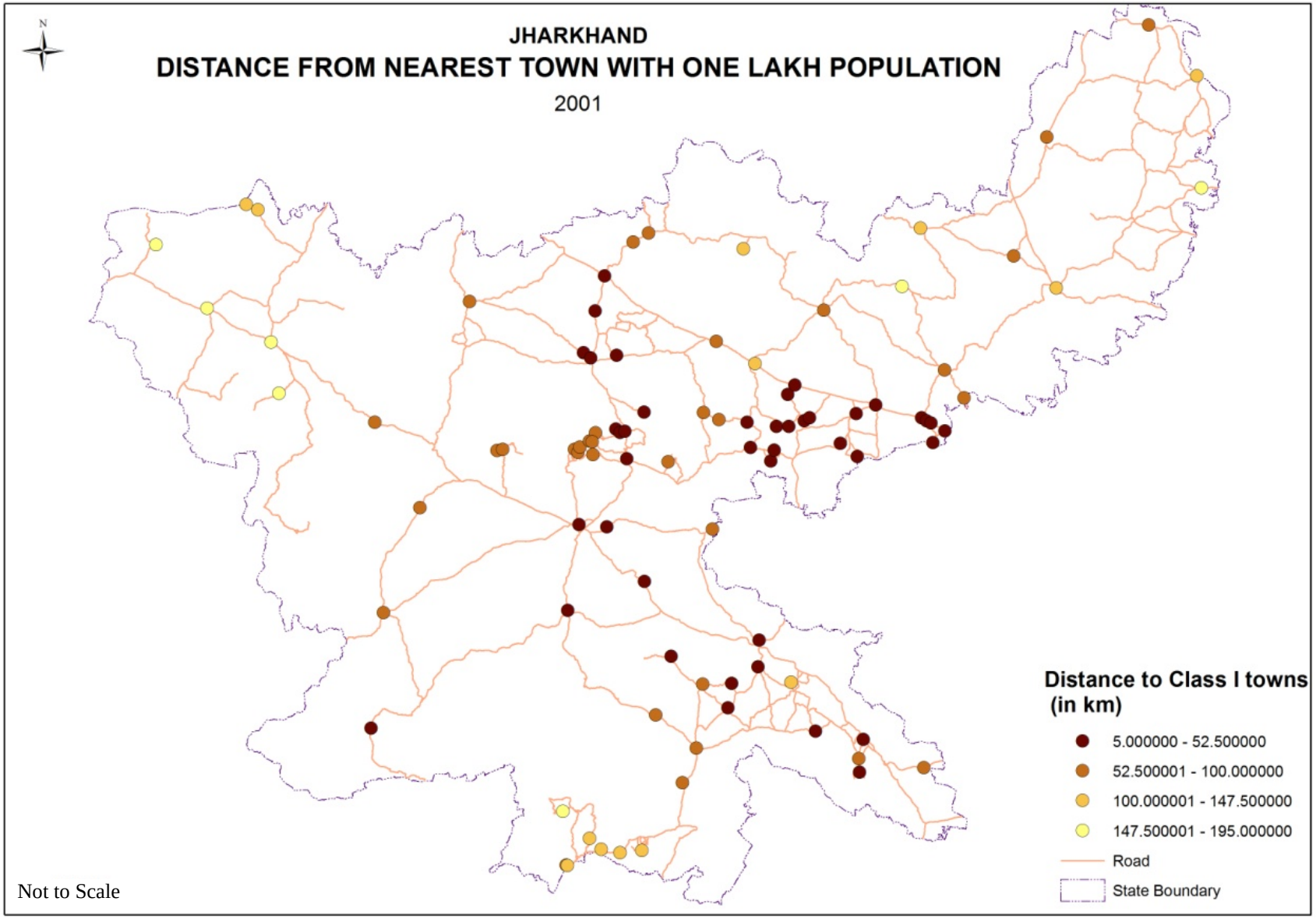
3.2.1.2.5 Distance to nearest Class I Town

Network development and connectivity pattern is controlled by the location of higher order centres, the nearness to which is considered advantageous than the urban centres located at a distance.[9]

The distance to the nearest class I node from each of the 95 urban nodes have been computed and is considered to be an inverse indicator of transport facility. If the node itself is

[9] S. Bhaduri (1992): *Op. cit.*, p. 151.

Map 3.6


JHARKHAND
DISTANCE FROM NEAREST TOWN WITH ONE LAKH POPULATION
2001
N
Distance to Class I towns (in km)
5.000000 - 52.500000
52.500001 - 100.000000
100.000001 - 147.500000
147.500001 - 195.000000
Road
State Boundary
Not to Scale

a Class I town then the distance of this town to any other Class I town nearest to it is measured. The distance measured is the shortest actual route distance. Table 3.5 is interpreted in the manner that higher the value lesser is the transport facility of that particular node and vice-versa.

The towns which are closer to class I towns are mostly found along the central and eastern region. These are mostly the industrial centres of the region. The towns located in the peripheries are more distant from the class I towns. The table shows that Barwadih, Daltonganj, Sinduria and Madhupur are located distant from Class I towns in comparison to Palawa, Kalikapur, Meru and Gobindpur which are located near Class 1 towns (Map 3.6).

Table 3.6

Distance of Towns from Various Places

Town/Census Town Name	Nearest City (Having 1 Lakh and Above population)	Distance in Km.	Rank	Town/Census Town Name	Nearest City (Having 1 Lakh and Above population)	Distance in Km.	Rank
Palawa	Hazaribag	5	1	Giridih Ua	Dhanbad	61	23
Kalikapur	Jamshedpur	6	2	Religara Alias Pachhiari	Hazaribag	64	24
Meru	Hazaribag	12	3	Gidi	Hazaribag	64	24
Gobindpur	Dhanbad	12	3	Chatra	Hazaribag	65	25
Jena	Bokaro Steel City	15	4	Kodarma	Hazaribag	65	25
Tati	Ranchi	16	5	Churi	Ranchi	65	25
Sahnidih	Dhanbad	25	6	Muri	Ranchi	65	25
Chandrapura	Bokaro Steel City	25	6	Gumia	Bokaro Steel City	66	26
Kandra	Jamshedpur	25	6	Tenudam-Cum-Kathhara	Bokaro Steel City	66	26
Jadugora	Jamshedpur	25	6	Chaibasa	Jamshedpur	68	27
Kharkhari	Dhanbad	26	7	Patratu	Hazaribag	71	28
Chandil	Jamshedpur	26	7	Sewai	Hazaribag	72	29
Sini	Jamshedpur	27	8	Chakradharpur	Jamshedpur	74	30
Nirsa	Dhanbad	30	9	Musabani	Jamshedpur	74	30
Amlabad	Bokaro Steel City	30	9	Saunda	Hazaribag	75	31
Bhojudih	Bokaro Steel City	30	9	Godda	Bhagalpur	75	31
Bokaro	Phusro	31	10	Sahibganj	Bhagalpur	75	31
Phusro Ua	Bokaro	31	10	Jamtara	Dhanbad	75	31
Khunti	Ranchi	32	11	Chakulia	Jamshedpur	77	32
Topchanchi	Dhanbad	35	12	Lohardaga	Ranchi	80	33
Mugma	Dhanbad	35	12	Jhinkpani	Jamshedpur	81	34
Barhi	Hazaribag	36	13	Balkundra	Hazaribag	82	35
Barughutu	Hazaribag	36	13	Hesla	Hazaribag	87	36
Marma	Dhanbad	36	13	Basukinath	Bhagalpur	87	36
Gomoh	Dhanbad	37	14	Gumla	Ranchi	93	37

Table 3.6

Distance of Towns from Various Places

Town/Census Town Name	Nearest City (Having 1 Lakh and Above population)	Distance in Km.	Rank	Town/Census Town Name	Nearest City (Having 1 Lakh and Above population)	Distance in Km.	Rank
Sijhua	Bokaro Steel City	37	14	Latehar	Ranchi	96	38
Kuju	Hazaribag	38	15	Meghahatuburu Forest Village	Jamshedpur	100	39
Seraikela	Jamshedpur	38	15	Kiriburu	Jamshedpur	101	40
Chirkunda Ua	Dhanbad	41	16	Deoghar Ua	Giridih	110	41
Dhanbad	Chirkunda	41	16	Hussainabad	Gaya (Bihar)	110	41
Ramgarh Ua	Ranchi	41	16	Isri	Dhanbad	110	41
Ranchi Ua	Ramgarh	41	16	Danguapasi	Jamshedpur	110	41
Ara	Hazaribag	42	17	Dumka	Bhagalpur	115	42
Topa	Hazaribag	42	17	Rajmahal	Bhagalpur	123	43
Kedla	Hazaribag	44	18	Dhanwar	Dhanbad	125	44
Orla	Hazaribag	44	18	Noamundi	Jamshedpur	129	45
Bundu	Ranchi	45	19	Jamshedpur	Ranchi	130	46
Simdega	Raurkela (Orissa)	45	19	Deorikalan	Gaya (Bihar)	133	47
Ghatshila	Jamshedpur	45	19	Barajamda	Jamshedpur	138	48
Hazaribag Ua	Ramgarh	50	20	Gua	Jamshedpur	147	49
Panchet	Dhanbad	50	20	Garhwa	Gaya (Bihar)	150	50
Dugda	Bokaro Steel City	50	20	Pakaur	Bhagalpur	155	51
Lapanga	Hazaribag	55	21	Chiria	Jamshedpur	156	52
Dari	Hazaribag	60	22	Madhupur	Bhagalpur	172	53
Jhumri Tilaiya	Hazaribag	60	22	Sinduria	Gaya (Bihar)	180	54
Mihijam	Dhanbad	60	22	Daltonganj	Ranchi	195	55
Khelari	Ranchi	60	22	Barwadih	Ranchi	195	67
Kharsawan	Jamshedpur	60	22				

3.2.1.3 Relation between the Nodal Accessibility Indicators

The Table 3.7 gives the transport indicators that are strongly related:

1. Urban centres/nodes with high Detour Index, (less friction of distance) have higher degrees of direct connectivity to the network. Detour Index which measures the efficiency of a transport network in terms of how well it overcomes friction of distance, shows that the nodes with less friction of distance are more accessible and have more direct connectivity in the network structure.

2. Geographical Accessibility and distance to Class I towns are positively correlated. This implies that the transport accessibility is high (when Geographical Accessibility index is low) among the towns that are located near the Class I towns.

3. Urban centres/nodes with high Detour Index, (less friction of distance) have poor route factor index value. Both these indices measure the efficiency of the network by comparing direct distance and actual shortest distance, but the ratio used is inverse of one another, so they are negatively correlated with each other.
4. Urban centres/nodes with high Node Degree have low Route Factor value. This implies that the Route Factor nearing one (low) are more accessible and will have more connectivity.

Table 3.7
Correlation between the Indicators of Transport Accessibility of the Urban Centres (2001)

Indicators		Direct Connectivity (Degree of Node)	Geographical accessibility	Route Factor	Detour Index	Distance to Nearest Class I Town
Direct Connectivity (Degree of Node)	Pearson Correlation	1	-.105	-.206(*)	.368(**)	-.151
	Sig. (2-tailed)	.	.310	.045	.000	.145
Geographical Accessibility	Pearson Correlation	-.105	1	-.195	.188	.655(**)
	Sig. (2-tailed)	.310	.	.059	.068	.000
Route Factor	Pearson Correlation	-.206(*)	-.195	1	-.888(**)	-.090
	Sig. (2-tailed)	.045	.059	.	.000	.385
Detour Index	Pearson Correlation	.368(**)	.188	-.888(**)	1	-.039
	Sig. (2-tailed)	.000	.068	.000	.	.705
Distance to Nearest Class I Town	Pearson Correlation	-.151	.655(**)	-.090	-.039	1
	Sig. (2-tailed)	.145	.000	.385	.705	.

3.2.1.4 Aggregate Accessibility of the Urban Centres

The Accessibility score of the individual urban centres are calculated by combining all the accessibility measures with the help of Principal Component Analysis.

The urban centres of Barhi and Ranchi have the most transport advantages. The other towns are that of Garhwa, Chatra, Hazaribag, Gumla, Daltonganj and Khunti. The urban centres which have the maximum transport disadvantages are Barughutu, Chiria, Muri, Kharsawan, Chandrapura, Kedla, Bhojudih and others as indicated in Table 3.8 and Map 3.7.

Map 3.7

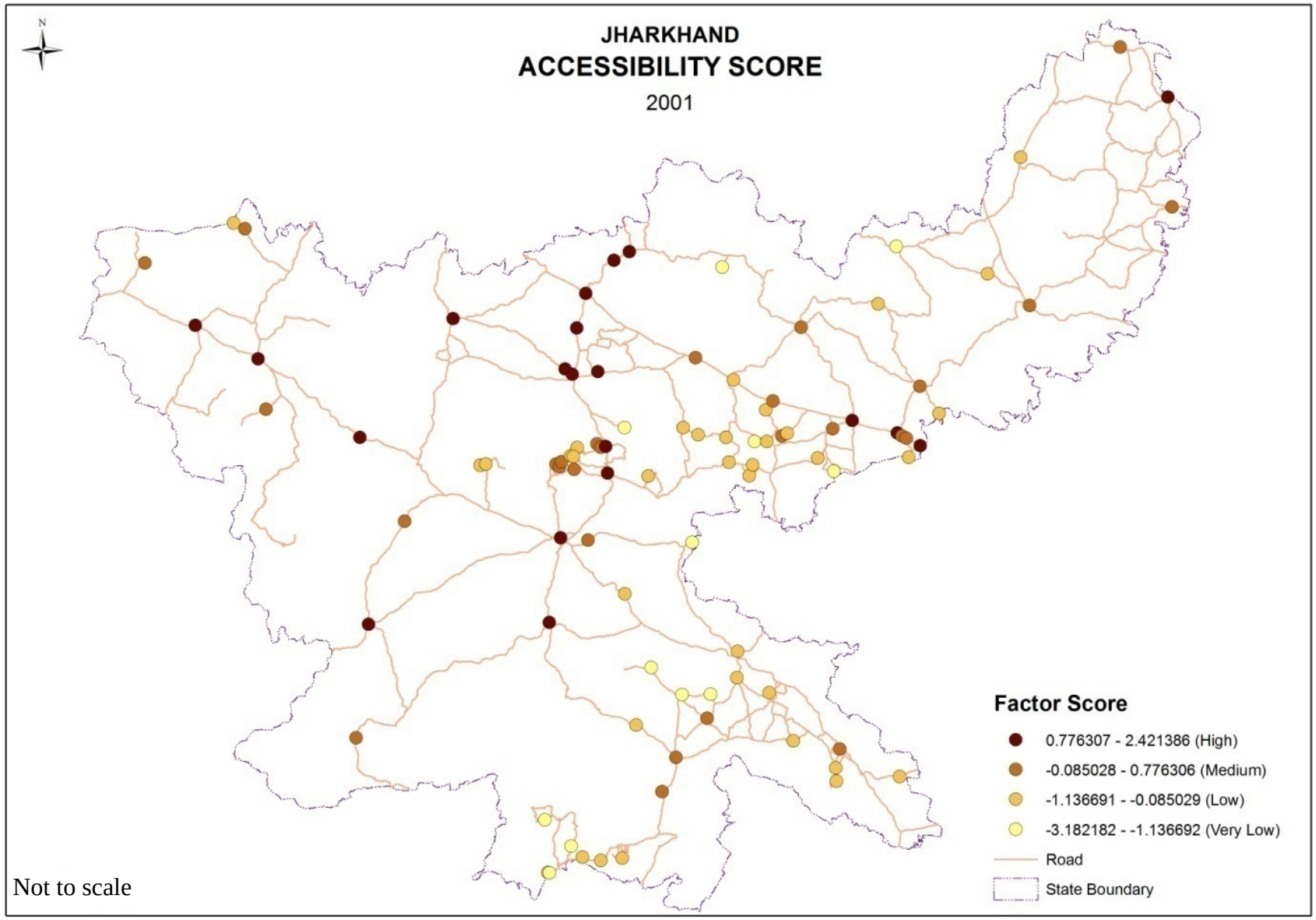

JHARKHAND
ACCESSIBILITY SCORE
2001
Factor Score
0.776307 - 2.421386 (High)
-0.085028 - 0.776306 (Medium)
-1.136691 - -0.085029 (Low)
-3.182182 - -1.136692 (Very Low)
Road
State Boundary
Not to scale

Table 3.8

Accessibility Score Among the Towns of Jharkhand, 2001

Sl.No.	Urban Nodes	Factor Score 1	Rank	Sl.No.	Urban Nodes	Factor Score 1	Rank
1	Barhi	2.421386	1	49	Chakuliya	-0.1139	49
2	Ranchi	2.108367	2	50	Bundu	-0.16014	50
3	Garhwa	1.797791	3	51	Mushabani	-0.20693	51
4	Chatra	1.784421	4	52	Jadugora	-0.20762	52
5	Hazaribag	1.693241	5	53	Sewai	-0.21483	53
6	Gumla	1.617603	6	54	Phusro	-0.24016	54
7	Daltonganj	1.566678	7	55	Isri	-0.25668	55
8	Khunti	1.553891	8	56	Amlabad	-0.27751	56
9	Ramgarh	1.302395	9	57	Godda	-0.27769	57
10	Gobindpur	1.287897	10	58	Chandil	-0.28563	58
11	Palawa	1.277393	11	59	Noamundi	-0.28656	59
12	Kuju	1.208643	12	60	Sahnidih	-0.30811	60
13	Latehar	1.130212	13	61	Deorikalan	-0.30946	61
14	Koderma	1.071564	14	62	Kalikapur	-0.31704	62
15	Ara	1.057339	15	63	Jena	-0.33979	63
16	Nirsa	1.028984	16	64	Chakradharpur	-0.35856	64
17	Rajmahal	0.952239	17	65	Mihijam	-0.37404	65
18	Chirkunda	0.910205	18	66	Gumia	-0.38994	66
19	Jhumri Tilaiya	0.890962	19	67	Jamshedpur	-0.39462	67
20	Meru	0.873148	20	68	Gidi	-0.43314	68
21	Pakur	0.776306	21	69	Kandra	-0.46565	69
22	Simdega	0.752184	22	70	Bokaro	-0.46851	70
23	Patratu	0.743982	23	71	Khelari	-0.53247	71
24	Lohardaga	0.730904	24	72	Basukinath	-0.5592	72
25	Jamtara	0.676477	25	73	Danguwapasi	-0.57154	73
26	Mugma	0.592472	26	74	Barajamda	-0.61056	74
27	Giridih	0.579136	27	75	Gomoh	-0.62664	75
28	Marma	0.573602	28	76	Churi	-0.63929	76
29	Sinduriya	0.451351	29	77	Meghahatuburu	-0.76937	77
30	Chaibasa	0.32646	30	78	Sijhua	-0.81064	78
31	Ghatsila	0.316811	31	79	Madhupur	-0.83019	79
32	Tati	0.304232	32	80	Religarha	-0.89389	80
33	Dumka	0.280692	33	81	Tenu Dam-cum-Kathhara	-0.9414	81
34	Lapanga	0.245506	34	82	Dari	-0.99049	82
35	Saunda	0.232819	35	83	Dugda	-1.0019	83
36	Orla	0.212117	36	84	Deoghar	-1.13669	84
37	Jhinkpani	0.21016	37	85	Kiriburu	-1.14737	85
38	Balkundra	0.196679	38	86	Sini	-1.19289	86
39	Dhanbad	0.159414	39	87	Dhanwar	-1.22739	87
40	Seraikela	0.122907	40	88	Gua	-1.33314	88

Table 3.8
Accessibility Score Among the Towns of Jharkhand, 2001

Sl.No.	Urban Nodes	Factor Score 1	Rank	Sl.No.	Urban Nodes	Factor Score 1	Rank
41	Kharkhari	0.116933	41	89	Bhojudih	-1.34505	89
42	Barwadih	0.10135	42	90	Kedla	-1.45324	90
43	Helsa	0.098787	43	91	Chandrapura	-1.60978	91
44	Sahibganj	0.097132	44	92	Kharsawan	-1.7673	92
45	Husainabad	0.061232	45	93	Muri	-1.88661	93
46	Topa	0.033519	46	94	Chiria	-2.7149	94
47	Topchanchi	0.018142	47	95	Barughutu	-3.18218	95
48	Panchet	-0.08503	48				

The accessibility indicators at the urban level have shown vast regional disparities.

3.2.2 Transportation Accessibility in Rural Areas

The objective of this section is to identify the areas which have advantages and the areas which are deficient in terms of road transportation in the rural areas of the state. The rural district level provision of transport and communication facilities shows vast disparities. The attributes that are provided by the Census are availability of communication, bus, railway facilities and approach to the villages with Pucca Road, Mud Road and Foot Path.

3.2.2.1 Measures of Rural Accessibility

The rural study is based on the 24 districts of the state. The 2001 Census data of 18 districts of Jharkhand have been disaggregated for present 24 districts for this study. The structure of transport has been studied taking into account the rural connectivity of all weather roads. In the rural context, the census criteria for accessibility i.e, provision of all-weather roads to all inhabited villages, have been used to study the structure of transportation network of the entire state. The percentages of villages with approach to all weather roads to total inhabited villages are ranked and cartographic techniques are used for mapping and analysis.

Table 3.9

Transport and Communication Facilities in Jharkhand Villages, 2001

Sl. No.	District	Facilities			Approach to			Total	Facilities			Approach to		
		Communication	Bus	Railway Service	Pucca Road	Mud Road	Foot Path	Villages	Communication	Bus	Railway Service	Pucca Road	Mud Road	Foot Path
		Number of Villages							Percentage of Villages					
1	Bokaro	72	61	9	158	585	464	621	11.6	9.8	1.4	25.4	94.2	74.7
2	Chatra	54	51	0	172	1198	837	1343	4.0	3.8	0.0	12.8	89.2	62.3
3	Deoghar	174	146	40	304	2138	1273	2356	7.4	6.2	1.7	12.9	90.7	54.0
4	Dhanbad	101	77	22	482	993	641	1121	9.0	6.9	2.0	43.0	88.6	57.2
5	Dumka	203	186	3	495	2427	1604	2666	7.6	7.0	0.1	18.6	91.0	60.2
6	Garhwa	105	99	5	180	800	670	858	12.2	11.5	0.6	21.0	93.2	78.1
7	Giridih	150	125	21	474	2246	1748	2532	5.9	4.9	0.8	18.7	88.7	69.0
8	Godda	106	104	1	341	1261	947	1633	6.5	6.4	0.1	20.9	77.2	58.0
9	Gumla	134	129	10	167	864	633	944	14.2	13.7	1.1	17.7	91.5	67.1
10	Hazaribag	101	92	2	322	1042	542	1235	8.2	7.4	0.2	26.1	84.4	43.9
11	Jamtara	100	96	3	198	976	543	1071	9.3	9.0	0.3	18.5	91.1	50.7
12	Khunti	50	45	5	169	660	379	754	6.6	6.0	0.7	22.4	87.5	50.3
13	Kodarma	54	47	6	116	462	326	526	10.3	8.9	1.1	22.1	87.8	62.0
14	Latehar	94	84	13	169	702	636	745	12.6	11.3	1.7	22.7	94.2	85.4
15	Lohardaga	11	7	7	99	319	142	352	3.1	2.0	2.0	28.1	90.6	40.3
16	Pakur	99	94	10	198	801	589	1128	8.8	8.3	0.9	17.6	71.0	52.2
17	Palamu	258	221	27	412	1569	1107	1720	15.0	12.8	1.6	24.0	91.2	64.4
18	Pashchimi Singhbhum	186	179	13	367	1516	894	1639	11.3	10.9	0.8	22.4	92.5	54.5
19	Purbi Singhbhum	184	160	10	266	1480	712	1610	11.4	9.9	0.6	16.5	91.9	44.2
20	Ramgarh	66	32	37	114	264	126	308	21.4	10.4	12.0	37.0	85.7	40.9
21	Ranchi	173	164	24	335	1200	813	1298	13.3	12.6	1.8	25.8	92.4	62.6
22	Sahibganj	79	52	22	300	914	952	1307	6.0	4.0	1.7	23.0	69.9	72.8
23	Saraikela Kharsawan	71	60	12	258	1066	617	1138	6.2	5.3	1.1	22.7	93.7	54.2
24	Simdega	92	84	8	120	399	280	449	20.5	18.7	1.8	26.7	88.9	62.4
	Total	2717	2395	310	6216	25882	17475	29354	9.3	8.2	1.1	21.2	88.2	59.5

Source: *Census of India, 2001, Jharkhand Village Directory.*

The two main means of transport in Jharkhand are Railways and Roads. Only 1.1 per cent of the villages are connected with railway connections (Table 3.9). The districts of Hazaribag, Bokaro, Dhanbad and Lohardaga have comparatively better rail connectivity. The district of Chatra has no railway connectivity. In regard to provision of bus services to rural areas, Simdega district has better position followed by Gumla, Palamu and Ranchi. The provision of bus services is poorly developed in Lohardaga and Chatra. The status of rural transport facilities in the state of Jharkhand is also poorly developed in comparison to the all-India picture.

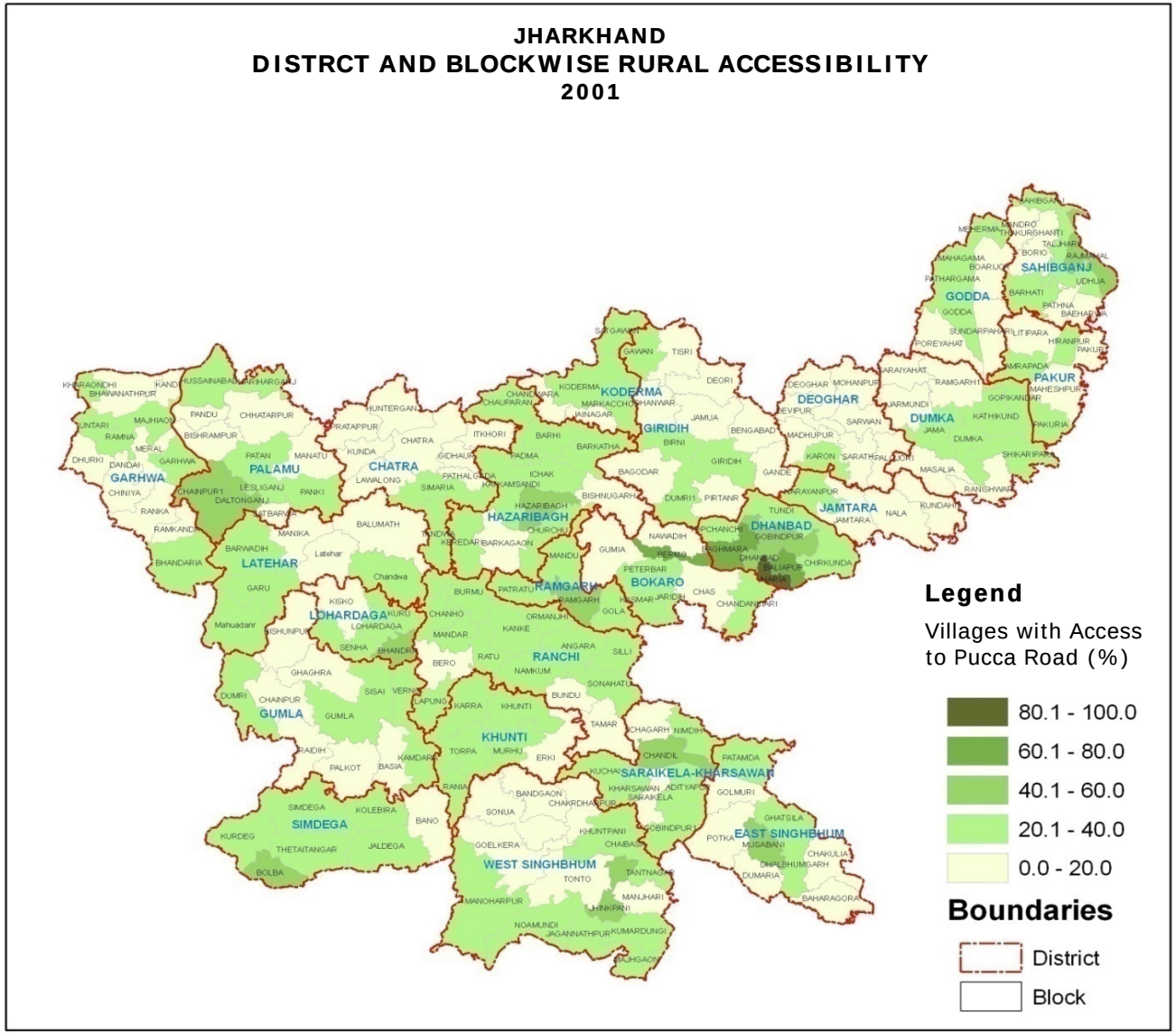
The approach to pucca road is an important development indicator for the villages. At the district level, the physical accessibility of villages with all-weather roads is very poor. In Jharkhand, 21.2 percent of the inhabited villages have access to all-weather roads (Table 3.10). Out of the 24 districts of Jharkhand, Dhanbad is the only district which has the maximum rural connectivity (43 percent) with pucca road for inhabited villages followed by the districts of Ramgarh, Lohardaga, Simdega, Hazaribag, Bokaro and Ranchi, where the percentage of pucca road connectivity is above 25 percent. The least connected districts are Chatra and Deoghar, where the percentage of villages with pucca road is below 13 percent.

Table 3.10
Ranking of Districts based on Approach to Pucca Road

Rank	District	Villages with Pucca Road				Percentage of Villages with Pucca Road	
		Uninhabited	Yes	No	Total	To Total Village	To Inhabited Village
1	Dhanbad	92	482	639	1213	39.7	43.0
2	Ramgarh	15	114	194	323	35.3	37.0
3	Lohardaga	1	99	253	353	28.0	28.1
4	Simdega	1	120	329	450	26.7	26.7
5	Hazaribag	144	322	913	1379	23.4	26.1
6	Bokaro	25	158	463	646	24.5	25.4
7	Ranchi	21	374	1102	1497	25.0	25.3
8	Palamu	185	412	1308	1905	21.6	24.0
9	Sahebganj	512	300	1007	1819	16.5	23.0
10	Latehar	26	169	576	771	21.9	22.7
11	Saraikela-Kharsawan	45	258	880	1183	21.8	22.7
12	Khunti	3	130	446	579	22.5	22.6
13	Pashchimi Singhbhum	35	367	1272	1674	21.9	22.4
14	Kodarma	123	116	410	649	17.9	22.1
	Grand Total	3261	6216	23138	32615	19.1	21.2
15	Garhwa	48	180	678	906	19.9	21.0
16	Godda	671	341	1292	2304	14.8	20.9
17	Giridih	224	474	2058	2756	17.2	18.7
18	Dumka	262	495	2171	2928	16.9	18.6
19	Jamtara	91	198	873	1162	17.0	18.5
20	Gumla	4	167	777	948	17.6	17.7
21	Pakur	122	198	930	1250	15.8	17.6
22	Purbi Singhbhum	140	266	1344	1750	15.2	16.5
23	Deoghar	350	304	2052	2706	11.2	12.9
24	Chatra	121	172	1171	1464	11.7	12.8

Source: *Census of India 2001, Jharkhand, Village Directory.*

Map 3.8



Source: *Census of India, 2001, Village Directory*.

The blockwise map (Map 3.8) showing the spatial pattern of the level of rural accessibility in Jharkhand depicts that the central region of the state around the state and district capital of Ranchi is well connected, however the maximum rural connectivity is present in the eastern region mainly covering the blocks in the district of Dhanbad. In this district the villages under the CD block of Jharia-Cum-Jorap-Onkar-Cum-Sindri has full connectivity. Above 60 percent of the villages with pucca road are found in the blocks of Baliapur and Baghmara in Dhanbad district, and in the block of Bermo in Bokaro district (Table 3.11). Moderate levels of accessibility (40-80 percent) are found in the blocks of Dhanbad and Gobindpur in the district of Dhanbad, Musabani block in Purbi Singhbhum, Hazaribag block in Hazaribag district, Bhandra block in Lohardaga, Daltangang in Palamu.

Table 3.11

Rural Accessibility in Terms of Percentage of Villages with access to Pucca Road, 2001

	Accessibility (Percentage of Villages)					
District	Below 20	20-40	40-60	60-80	80-100	Grand Total
Bokaro	3	4		1		8
Chatra	8	2				10
Deoghar	7	1				8
Dhanbad		3	2	2	1	8
Dumka	5	5				10
Purbi Singhbhum	5	3	1			9
Garhwa	8	6				14
Giridih	8	4				12
Godda	3	5				8
Gumla	6	5				11
Hazaribag	2	8	1			11
Jamtara	3	1				4
Khunti	1	5				6
Koderma	1	3				4
Latehar	3	4				7
Lohardaga	1	3	1			5
Pakur	3	3				6
Palamu	5	5	2			12
Ramgarh		3	1			4
Ranchi	3	11				14
Sahibganj	4	4	1			9
Saraikela-Kharsawan	2	5	1			8
Simdega	1	5	1			7
Paschimi Singhbhum	6	8	1			15

3.2.2.2 Relation between Transport Attributes in Rural Areas

The relationship between transport accessibility indicators that are strongly correlated with each other are:

1. Villages with communication facilities and bus services
2. Villages with communication facilities and railway services
3. Villages with pucca road and railway services.

The correlations (Table 3.12) show that accessibility of villages with pucca road is independent of bus service facilities, and with approach to the villages with mud road and foot path.

Table 3.12

Correlation between Indicators of Transport Facilities on Rural Areas

Correlations							
Villages with Services Available		Communication Facility	Bus Service	Railway Service	Pucca Road	Mud Road	Foot Path
Communication Facility	Pearson Correlation	1	.888(**)	.580(**)	0.362	0.214	0.104
	Sig. (2-tailed)	.	0	0.002	0.076	0.303	0.621
Bus Service	Pearson Correlation	.888(**)	1	0.153	0.119	0.298	0.27
	Sig. (2-tailed)	0	.	0.465	0.57	0.148	0.191
Railway Service	Pearson Correlation	.580(**)	0.153	1	.564(**)	-0.047	-0.263
	Sig. (2-tailed)	0.002	0.465	.	0.003	0.824	0.204
Pucca Road	Pearson Correlation	0.362	0.119	.564(**)	1	0.002	-0.171
	Sig. (2-tailed)	0.076	0.57	0.003	.	0.993	0.413
Mud Road	Pearson Correlation	0.214	0.298	-0.047	0.002	1	0.125
	Sig. (2-tailed)	0.303	0.148	0.824	0.993	.	0.552
Foot Path	Pearson Correlation	0.104	0.27	-0.263	-0.171	0.125	1
	Sig. (2-tailed)	0.621	0.191	0.204	0.413	0.552	.

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).

3.3 Conclusion

The regional variations in road transport facilities are evident both at the urban level as well as at the rural level. The conclusions in this chapter are

1. The results of the measures used to assess the degree of connectivity show that the urban centres in the state are not adequately connected to the network and some degree of complexity in the network was also observed. The relationship between the number of observed links and the number of possible links show that the network is only 42 percent connected.

2. The nodal accessibility indices have differed among the urban centres in Jharkhand. In general the urban centres located near the centre of the network have more transport advantages. Most of the urban centres have lesser degrees of direct connectivity. The result shows that the towns of Ranchi, Barhi, Kuju, Saraikela, Giridih and Gobindpur are the most connected as they have higher degrees of direct connectivity in comparison to all other urban centres in the network. The towns which have exhibited poor connectivity are Sinduriya, Deorikalan, Kiriburu, Dari, Danguapasi, Chandrapura and Bhojudih.

3. The Ingram's Accessibility or Geographical Accessibility index shows that the most accessible urban centres in the network are located as cluster of nodes in the central part of the network. Some of the top ranking towns in terms of higher accessibility are Sewai, Tenu Dam-cum-Kathara, Jena, Gumia, Phusro, Ramgarh and Sijua. The least accessible places are located in the peripheries of the network comprising of the urban centres of Rajmahal, Sahibganj, Sinduriya, Pakur, Deorikalan, Garhwa, Husainabad, Godda, Daltonganj, Barwadih and some others.

4. The nodal accessibility measure, which shows the efficiency of the network by comparing direct distance with shortest actual distance between pair of nodes, reveal that the urban centres which have efficient route factor ratio are Garhwa, Daltonganj, Chatra, Barhi, Ranchi, Latehar, Gumla, Hazaribag, Khunti and Palawa. The urban centres which have high residuals are Barughutu, Chiria, Kharsawan, Muri, Deoghar, Sini, Chandrapura, Gua, Dugda and Kedla.

5. Similar to Route Factor ratio, Detour Index measures the efficiency of the network due to topographical constraint. It shows that Jharkhand has significant level of physical constraints as majority of the towns have high Detour index. The urban centres of Barhi, Garhwa, Chatra, Hazaribag, Ranchi, Daltonganj, Palawa, Gumla, Khunti and Ara have efficient detour ratios. The accessibility of towns of Barughutu, Chiria, Kedla, Muri, Kharsawan, Deoghar and Gua is complex with long detours.

6. The towns which are closer to class I towns are mostly found along the central and eastern region. These are mostly the industrial and mining centres of the region. The towns located at the peripheries are more distant from the class I towns. Barwadih, Daltonganj, Sinduria and Madhupur are located distant from Class I towns in comparison to Palawa, Kalikapur, Meru and Gobindpur which are located near Class 1 towns.

7. The relationship between the transport indices shows that there is a positive correlation between Detour Index and Direct Connectivity. The urban centres which have efficient detour ratios with less friction of distance, have higher degree of direct connectivity within the network.

8. The urban nodes that have higher transport accessibility in terms of Geographical Accessibility are located near the class I towns. It implies that the urban centres, which have higher transport disadvantage in terms of relative distance to other urban centres in the network, are also located further away from the class I towns.

9. There is a negative correlation between Detour Index and Route Factor Ratio. The urban centres with high Detour Index, (less friction of distance) have poor route factor index value as both these ratios are inverse to each other.

10. The status of rural transport facilities in the state of Jharkhand is poorly developed in comparison to the all-India picture. The approach to rural areas with pucca roads is more in the districts of Dhanbad, Hazaribag, Lohardaga, and in rural hinterlands along the industrial centres of Bokaro and Ranchi. The least connected areas with pucca road are Chatra and Deoghar districts. In terms of provision of bus services to rural areas, Simdega district has better position followed by

Gumla, Palamu and Ranchi. The provision of bus services is poorly developed in Lohardaga and Chatra.

Chapter 4
RURAL TRANSPORT ACCESSIBILITY AND TRAVEL PATTERNS

4.1 Introduction

The structure of rural transport network in Jharkhand is poorly developed and only 21.2 percent of villages in the state have immediate access to all-weather roads compared to the all India average of 53.3 percent in 2001 (see Appendix IV a). The distribution of all weather roads in the rural areas has shown spatial variation at the district level as Dhanbad has the highest rural connectivity with 43 percent while Chatra has the lowest connectivity where only 13 percent of the villages have all weather roads. The problem is compounded in some districts which have no railway connectivity as is the case in Chatra. According to the World Bank, the under provision of all weather roads has been considered to be one of the bottlenecks to growth in Jharkhand.[1]

The distribution of transport infrastructure creates opportunities for spatial interactions that can be measured as accessibility. The main purpose of transport is to provide accessibility which is defined as the ability to make a journey for a specific purpose.[2]

The objective of this chapter is to study the level of accessibility and the travel behavior patterns in areas with varying levels of physical connectivity at the rural level. The analysis is based on information collected from primary survey of the eight sample villages. However, secondary data have also been used for sampling purpose and for supplementary analysis.

4.2 Sampling Design

This initial stage of selection of sample districts and blocks are computed with secondary data sources. Using Census data on the village level approach to pucca road,

[1] The World Bank (2007): *Jharkhand: Addressing the Challenges of Inclusive Development*, Report No. 36437-IN, Poverty Reduction and Economic Management, India Country Manager Unit, South Asia, Washington, DC.

[2] S. Nutley (1998): "Rural Areas: The Accessibility Problem", in Hoyle, B. and R. Knowles (ed.): *Modern Transport Geography*, edition 2, John Wiley and Sons, England, p. 187.

two types of districts are selected viz., those with the highest and those with the lowest rural all weather road and minimal railway connectivity.

Table 4.1

Ranking and Sampling of Districts based on Approach to Pucca Road

Rank	District	Villages with Pucca road				Percentage of Villages with Pucca Road	
		Uninhabited	Yes	No	Total	to Total Villages	To Inhabited Villages
1	Dhanbad	92	482	639	1213	39.7	43
2	Ramgarh	15	114	194	323	35.3	37
3	Lohardaga	1	99	253	353	28	28.1
4	Simdega	1	120	329	450	26.7	26.7
5	Hazaribagh	144	322	913	1379	23.4	26.1
6	Bokaro	25	158	463	646	24.5	25.4
7	Ranchi	21	374	1102	1497	25	25.3
8	Palamu	185	412	1308	1905	21.6	24
9	Sahebganj	512	300	1007	1819	16.5	23
10	Latehar	26	169	576	771	21.9	22.7
11	Saraikela-Kharsawan	45	258	880	1183	21.8	22.7
12	Khunti	3	130	446	579	22.5	22.6
13	Pashchimi Singhbhum	35	367	1272	1674	21.9	22.4
14	Kodarma	123	116	410	649	17.9	22.1
15	Garhwa	48	180	678	906	19.9	21
16	Godda	671	341	1292	2304	14.8	20.9
17	Giridih	224	474	2058	2756	17.2	18.7
18	Dumka	262	495	2171	2928	16.9	18.6
19	Jamtara	91	198	873	1162	17	18.5
20	Gumla	4	167	777	948	17.6	17.7
21	Pakur	122	198	930	1250	15.8	17.6
22	Purbi Singhbhum	140	266	1344	1750	15.2	16.5
23	Deoghar	350	304	2052	2706	11.2	12.9
24	Chatra	121	172	1171	1464	11.7	12.8
	Jharkhand	3261	6216	23138	32615	19.1	21.2

Source: *Census of India 2001, Village Directory*.

Table 4.1 reveals that Dhanbad followed by Ramgarh and Lohardaga have higher ranks with regard to rural connectivity but these districts also have good railway connectivity. Thus, Simdega district, occupying the fourth rank is selected as the most connected district with minimal railway connectivity. The district of Chatra is selected as the least connected one with no railway connectivity. Within these two districts the most and least connected blocks, which are Bolba and Thethaitanger in Simdega (Table 4.2) and Simaria and Kunda blocks in Chatra (Table 4.3) are selected.

Table 4.2

Ranking and Sampling of Blocks based on Approach to Pucca Road in Simdega District

Rank	Block	Villages with Approach to Pucca Road				Percent Villages with Approach to Pucca Road	
		Uninhabited Villages	Yes	No	Grand Total	Total Villages	Inhabited Villages
1	Bolba	0	11	15	26	42.31	42.31
2	Kurdeg	1	18	27	46	39.13	40.00

Table 4.2

Ranking and Sampling of Blocks based on Approach to Pucca Road in Simdega District

Rank	Block	Villages with Approach to Pucca Road				Percent Villages with Approach to Pucca Road	
		Uninhabited Villages	Yes	No	Grand Total	Total Villages	Inhabited Villages
3	Kolebira	0	18	35	53	33.96	33.96
4	Thethaitangar	0	17	44	61	27.87	27.87
5	Jaldega	0	20	59	79	25.32	25.32
6	Simdega	0	20	72	92	21.74	21.74
7	Bano	0	16	77	93	17.20	17.20
Total		1	120	329	450	26.67	26.73

Source: *Primary Survey, 2011.*

Table 4.3

Ranking and Sampling of Blocks based on Approach to Pucca Road in Chatra District

Rank	Block	Villagees with Approach to Pucca Road				Percent Villages with Approach to Pucca Road	
		Uninhabited Villages	Yes	No	Grand Total	Total Villages	Inhabited Villages
1	Simaria	4	33	63	100	33	34.38
2	Tandwa	2	20	64	86	23.26	23.81
3	Hunterganj	25	36	209	270	13.33	14.69
4	Pratappur	12	21	143	176	11.93	12.8
5	Itkhori	36	30	211	277	10.83	12.45
6	Chatra	29	25	252	306	8.17	9.03
7	Gidhaur	1	2	35	38	5.26	5.41
8	Pathalgora		1	29	30	3.33	3.33
9	Lawalaung	10	3	90	103	2.91	3.23
10	Kunda	2	1	75	78	1.28	1.32
11	**Total**	**121**	**172**	**1171**	**1464**	**11.75**	**12.81**

Source: *Primary Survey, 2011.*

The sample villages are selected from these four blocks. Since the objective is to study the levels of rural accessibility and travel behaviour of the villages with varying levels of physical connectivity, sample villages have been selected on the basis of the following combination of criteria (Table 4.4).

Table 4.4

The Criteria used for Selection of Sample Villages

Criteria	Simdega District				Chatra District			
	Bolba Block		Thethaitangar Block		Simaria Block		Kunda Block	
	Saraslongri	Kadopani	Deobahar	Koronjo	Dilho	Lutidih	Kunda	Harul
I- Pucca Road	√	√	√	X	√	√	√	X
II- Close to Bus Stop	√	√	X	√	√	√	√	X
III- Close to Block Headquarter	√	X	X	X	X	X	√	X

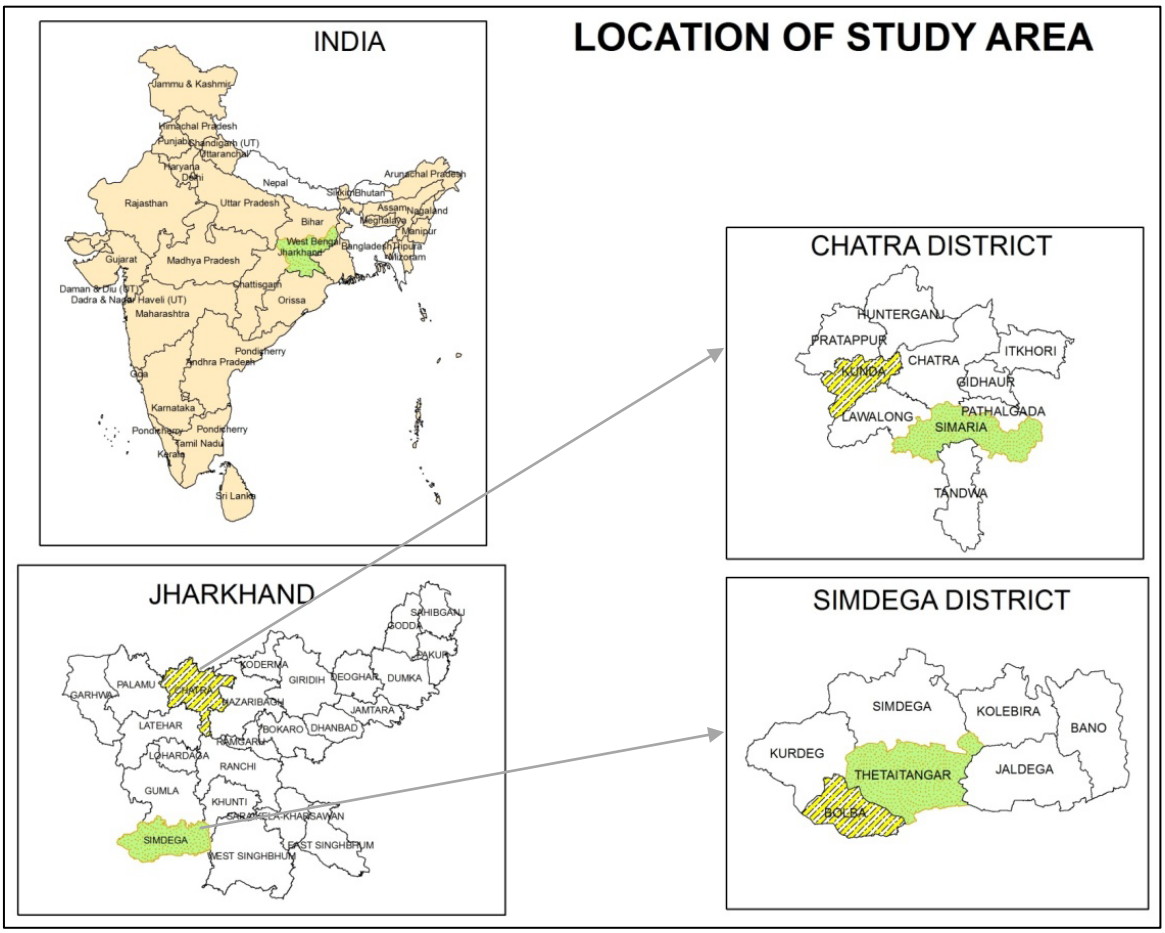
Source: *Primary Survey, 2011.*

4.3 General Profile of the Sample Districts and Villages

4.3.1 Simdega District

Simdega district was carved out of Gumla district in 2004. The region forms the southern portion of the district. It is bounded by Palkot Hills and Gumla Plateau in the north, the state of Orissa in the south, South Ranchi Hills and Singhbhum district in the east and the state of Chhattisgarh in the west. The total geographical area of the district is 3757 sq. km. with a population of 5,47,967 persons (Census of India, 2001). It comprises of Kurdeg, Bolba, Thethaitangar, Jaldega, Simdega, Bano, and Kolebira C.D. Blocks. The region has rugged topography with steep slopes and narrow valleys. It also has isolated hills with uneven surface which have been formed due to erosion in the Chotanagpur Plateau. The major rivers of the district are the South Koel and the Sankh (Map 4.1).

Map 4.1



The sample villages of Saraslongri and Kadopani are selected from Bolba block (Map 4.2) while Deobahar and Koronjo are selected from Thethaitanger block (Map 4.3) in Simdega district.

4.3.1.1 Physical Setting of the Sample Villages

The general physical setting of the sample villages are discussed below:

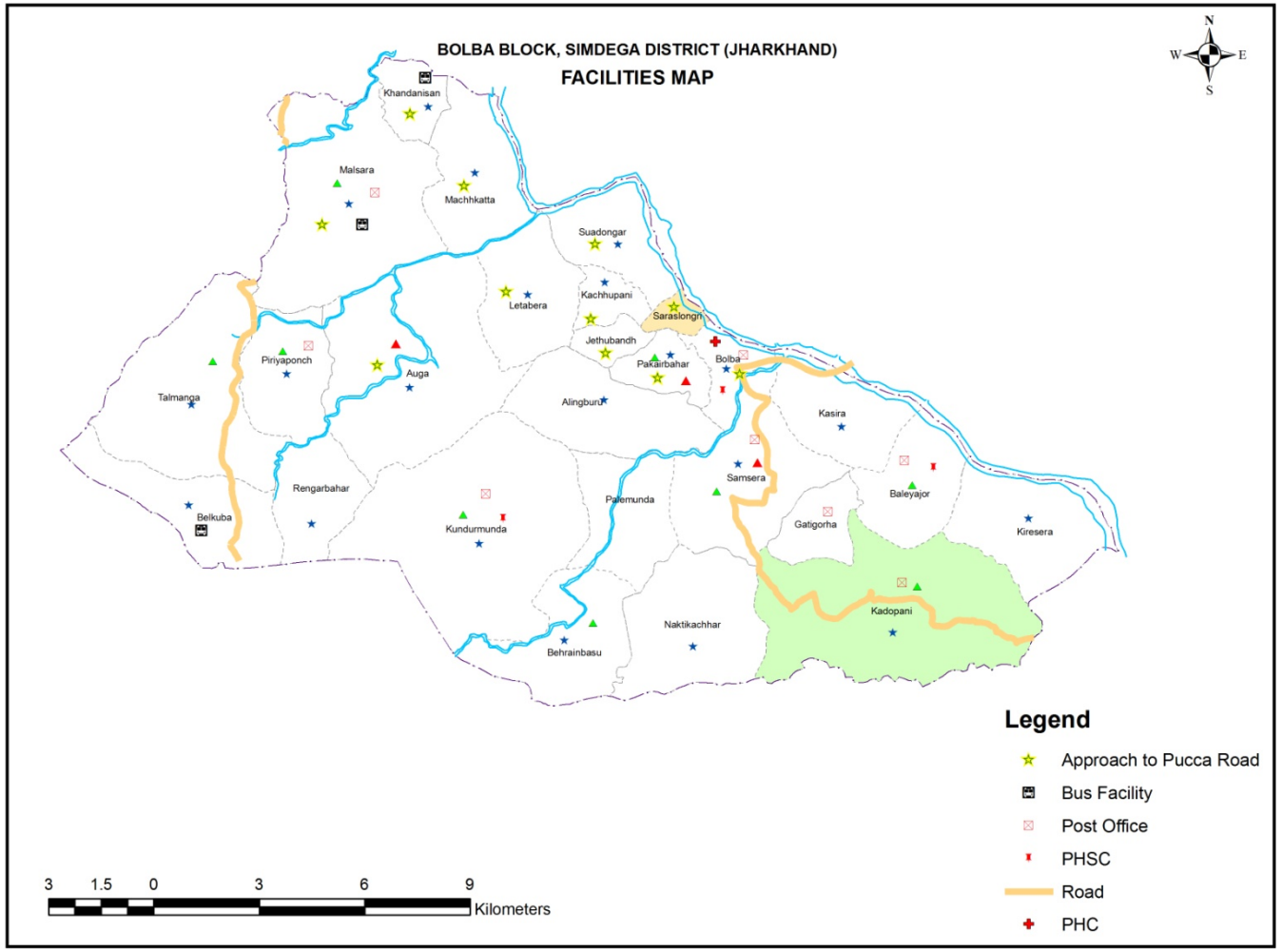
Saraslongri: The village is bounded by river in two sides. It has a hilly topography along the river. The village has accessibility to the pucca road.

Kadopani: The village has rugged topography with numerous streams. It has dense forest cover. This village has access to pucca road approach.

Deobahar: The western part of the village has a hilly topography which is drained by Chihra stream. The northern boundary of the village follows the river. The tolas are located away from the main road. The pucca road covers a very short length. The hilly ridge is towards the southern boundary of the village. A number of mud roads crisscrossing the village area.

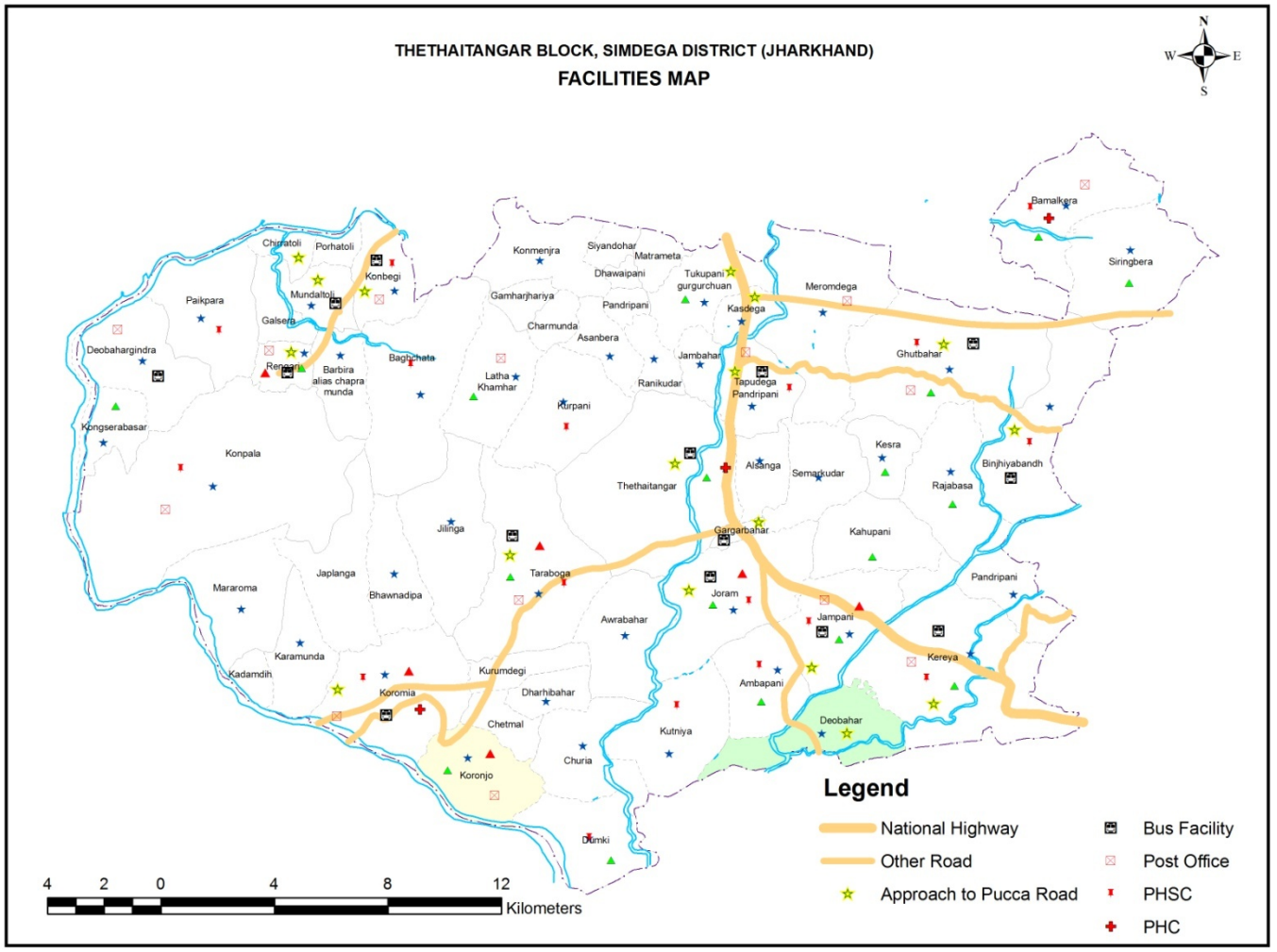
Koronjo: The eastern part of the village is hilly and forested. The village does not have pucca road connectivity. There are mud roads but due to lack of bridges and culverts in the streams and rivers Sankh, the village remains isolated as no movement of vehicles becomes possible in this part, specially during monsoon season.

Map 4.2



Source: *Census of India, 1991*

Map 4.3



Source: *Census of India, 1991*

4.3.2 Chatra District

Chatra district was carved out of the western part of the old Hazaribag district. It is historically known as the gateway to Chotanagpur having a rich glorious past. Northern part of the district touches present Bihar and is surrounded by Hazaribagh, Koderma, Ranchi, Latehar and Palamu districts. It has a total area of 3706 sq. km out of which about 60 per cent area is covered by forest compared to about 29 per cent forest area of Jharkhand. Chatra district has diverse physiographic features as it spreads over the Upper and Lower Hazaribagh Plateau having elevation of 450 meter. The major rivers in the district are Yamuna, Barki, Chako, Damodar and Garhi. It receives an annual rainfall of about 1250 mm. mostly during rainy season. The district experiences extreme climate during summer and winter. Net sown area is very small compared to the state average due to its physiography. Out of a total of 790680 population, 748690 are rural and only 41990 are urban. The district is primarily rural. The occupational structure of Chatra is dominated by primary activities. Only 18.29 percent of the total workers are non-agricultural workers.

4.3.2.1 Physical Setting of the Sample Villages

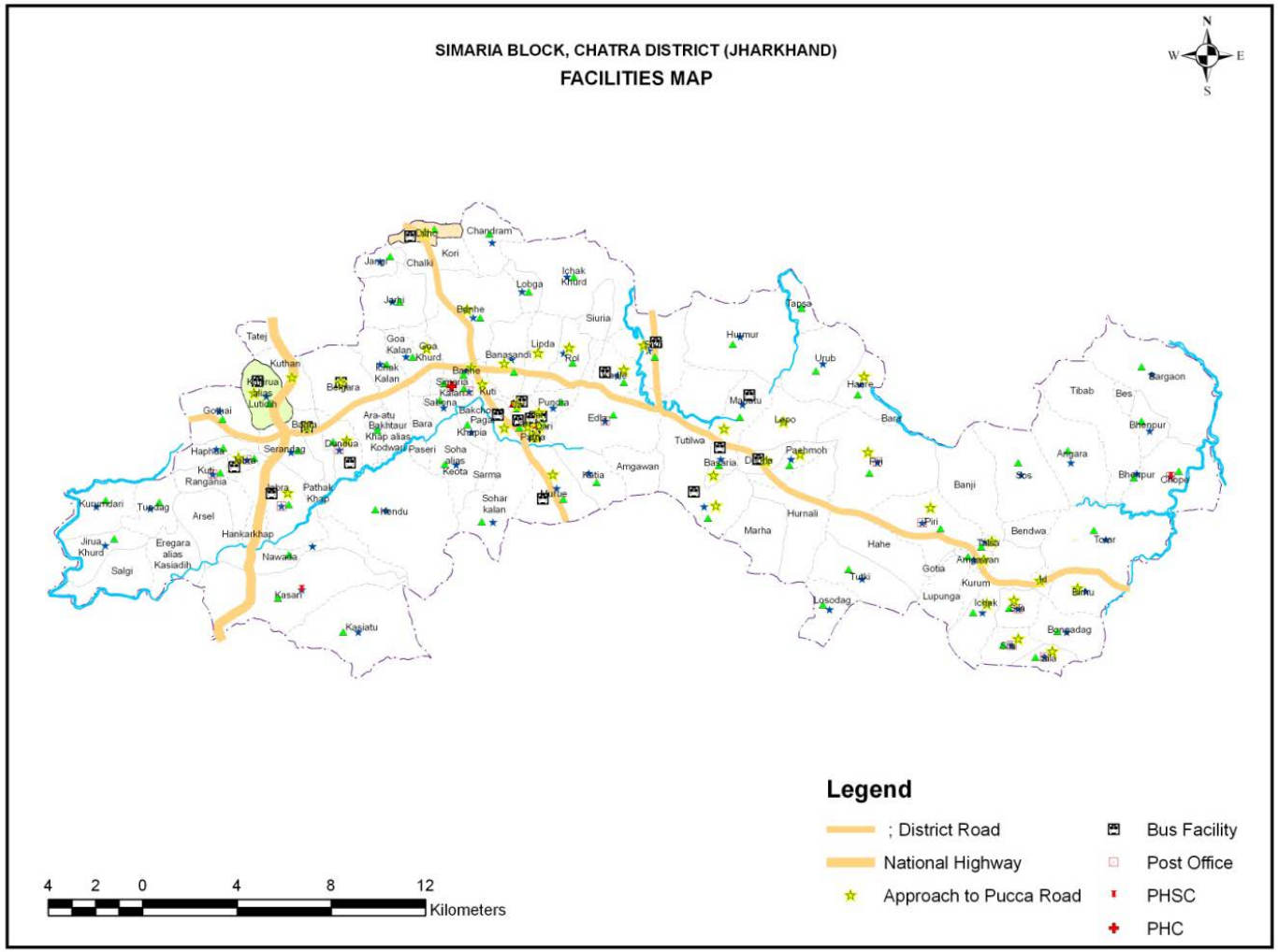
The sample villages of Dilho and Lutidih were selected from Simaria block (Map 4.4) while Kunda and Harul were selected from Kunda block (Map 4.5). The general physical setting of the sample villages are discussed below:

Dilho: The village has pucca road. The topography of the villages are mostly plain. There are agricultural fields and water bodies which are used for irrigation purposes.It has access to pucca road.

Lutidih: The village is located along the State Highway. The northern portion of the village is hilly and densely forested. The southern portion of the village has plain land, which is used for cultivation. The village has water bodies that are used for irrigation purposes.

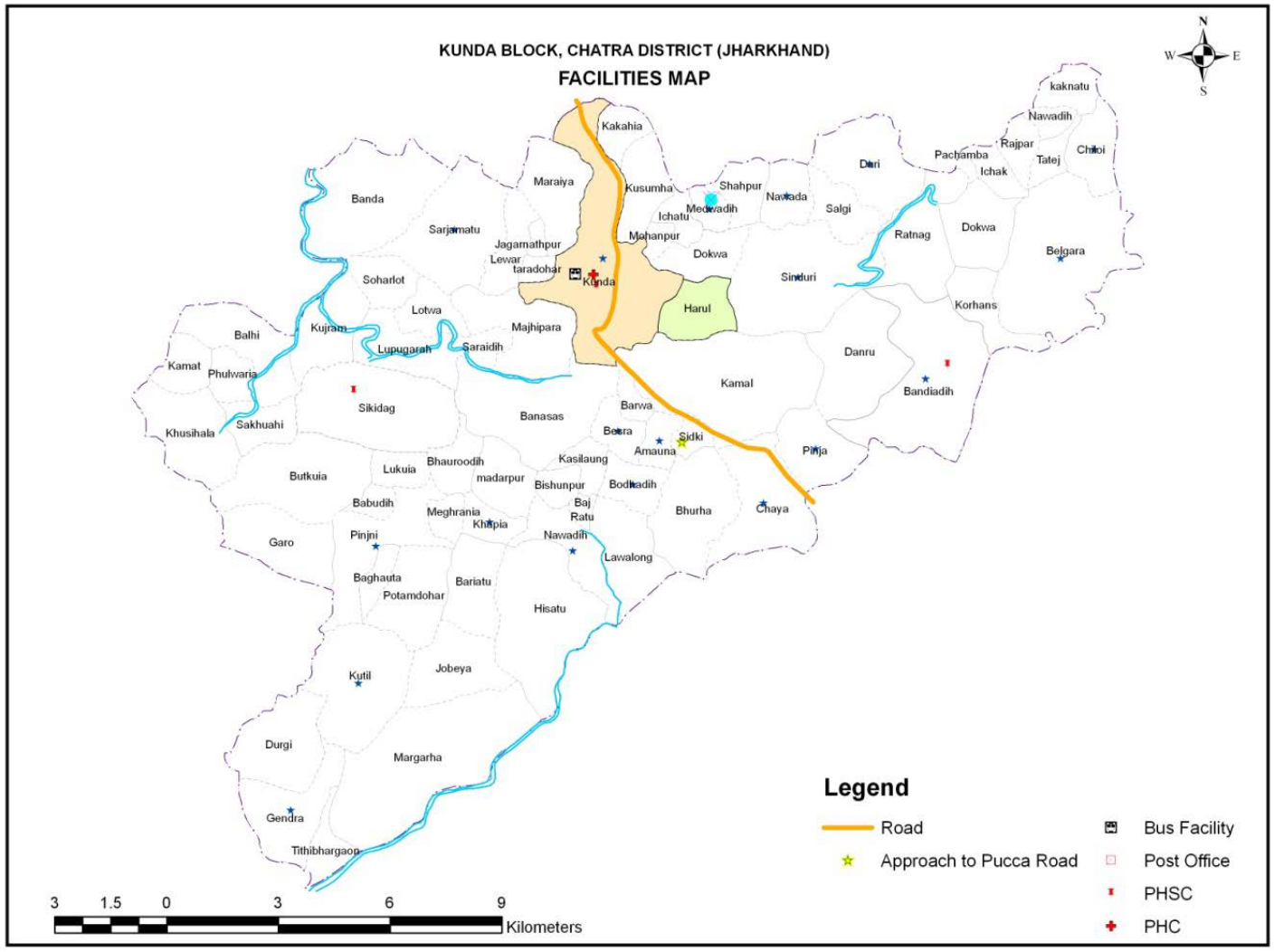
Kunda: the village has pucca road connectivity. The northern portion of the village is hilly and has dense forest cover. It has plain land used for agricultural purposes and also has adequate provision of irrigation facilities. The settlement is of linear pattern.

Map 4.4



Source: *Census of India, 1991*

Map 4.5



Source: *Census of India, 1991*

Kunda is connected with pucca road.

Harul: this village lies adjacent to Kunda village but is devoid of pucca road connectivity. The topography of the village is hilly and undulating. The plain land towards the western portion is used for cultivation. This village also has irrigation facilities.

The total size of the sample consists of 388 households with a total of 1804 population (Table 4.5).

Table 4.5

District, Block and Village wise Sample Households and Population

District	Block	Village	Number of Households	Population
Simdega (most connected)	Bolba (most connected)	Saraslongri (have pucca road)	48	220
		Kadopani (have pucca road)	44	198
		Total	92	418
	Thethaitangar (least connected)	Deobahar (have pucca road)	51	266
		Koronjo (no pucca road)	45	228
		Total	96	494
Chatra (least connected)	Simaria (most connected)	Dilho (have pucca road)	50	240
		Lutidih (have pucca road)	50	244
		Total	100	484
	Kunda (least connected)	Kunda (have pucca road)	50	214
		Harul (no pucca road)	50	194
		Total	100	408
Total			388	1804

The demographic, social and economic characteristics of the sample villages are discussed in detail in the next chapter.

The analysis is done at two levels. At the first level, the levels of rural accessibility are assessed with the help of indicators of potential accessibility, relative accessibility and the availability of transport provisions in the sample villages. At the second level, the travel behaviour pattern is assessed by analysing the mobility patterns of the population in the sample villages.

4.4 Rural Accessibility

Accessibility has been defined by Nutley as "people's ability to gain access to certain facilities relative to the ability of the prevailing transport system to overcome the distance barriers involved".[3] Studies on accessibility are often classified into two aspects[4] viz., process based measure and outcome based measure. The process based measure involves the opportunities that are available and evaluates the performance of the transport system. The outcome based measure assesses the actual utilization of the transport facilities and relates to the travel behaviour of the individuals. The present analysis of rural accessibility implies the opportunities that are available to make a journey while the travel behavior pattern includes the actual mobility pattern of the population in the sample villages. The levels of rural accessibility are assessed through the measures of potential accessibility, relative accessibility and transport provisions.

4.1.1 Potential Accessibility

According to Nutley, "Potential accessibility is determined by various factors such as physical fitness and car ownership, as well as public transport availability".[5] However, at the present level potential accessibility involves the following opportunities that are available to the individuals. These indicators are the ownership of transport vehicles (motorised and non-motorised) and physical mobility of the population in the sample villages. The indicator of physical mobility is further categorised into three aspects, viz., the proportion of physical disability and elderly people, and the economic condition of the household in the sample villages.

4.1.1.1 Ownership of Transport Vehicles

In rural areas the ownership of any means of transport is regarded as an advantage because these areas mostly lack transport provisions both public and private. In India, the major ownership in terms of transport vehicle is of bicycle, which is owned by 44.8 per

[3] S. Higgs and S. D. White (1997*):* "Changes in Service Provision in Rural Areas. Part 1: The Use of GIS in Analysing Accessibility to Services in Rural Deprivation Research", *Journal of Rural Studies*, Vol. 13, No. 4, pp. 441-450.

[4] Md. Kamruzzaman and J. Hine (2011): "Participation Index: A Measure to Identify Rural Transport Disadvantage?", Journal *of Transport Geography*, 19, pp. 882-899.

[5] S. Nutley (1998): "Rural Areas: The Accessibility Problem", in Hoyle, B. and R. Knowles (ed.): *Modern Transport Geography*, edition 2, John Wiley and Sons, England, p. 187.

cent households in the country in 2011. It goes as high as 84.3 per cent in Lakshadweep followed by Punjab, Odisha (Orissa), Chhattisgarh, Jharkhand, Chandigarh, West Bangal, Assam, Puduchery (Pondichery), Bihar, Tamilnadu and Haryana above the national average (Table 4.6). The non-motorised mode of transport predominates in the rural areas of Jharkhand as the state ranks third only after Punjab and Uttar Pradesh in terms of ownership of bicycles. In 2011, the state ranks above the national average and also above the neighbouring states of Chhattisgarh, Odisha (Orissa), West Bengal and Bihar in terms of bicycle ownership (Table 4.6). The non-motorised mode of transport (bicycle) is even higher than the ownership. It was 49.26 percent in 2001 and increased to 60.78 percent in 2011 in Jharkhand, recording a growth of 52.05 percent between 2001 and 2011 (Table 4.7 and 4.7a). The ownership of motorised two wheeler transport is low, with 3.97 household having scooter or motorcycle in 2001 which increased to 9.45 percent in 2011. The ownership of motorised four wheeler transport is the lowest among transport assets. It was 0.58 percent in 2001 and increased to 1.10 percent in 2011.

Table 4.6

Statewise Ownership of Transport Vehicles in India, 2011

Sl. No.	India/ State/ Union Territory #	Households having assets			
		Total No. of Households (Excluding institutional households)	Bicycle	Scooter, Motor cycle, Moped	Car, Jeep, Van
	India	246692667	44.8	21	4.7
1	Lakshadweep	10703	84.3	38.4	2.3
2	Uttar Pradesh	32924266	67.8	19.6	3.8
3	Punjab	5409699	66.4	47.5	13.1
4	Odisha	9661085	61.0	14.5	1.8
5	Chhattisgarh	5622850	61.0	15.6	2.3
6	Jharkhand	6181607	58.8	16.1	2.8
7	Chandigarh	235061	57.5	46.7	25.7
8	West Bengal	20067299	57.2	8.5	2.2
9	Assam	6367295	55	10.2	3.8
10	Puducherry	301276	51.5	46.6	5.6
11	Bihar	18940629	48.7	8.1	1.7
12	Tamil Nadu	18493003	45.2	32.3	4.3
13	Haryana	4717954	44.8	33.3	10.5
14	Manipur	507152	44.6	19.8	6
15	Madhya Pradesh	14967597	39.7	18.8	2.7
16	Tripura	842781	39.3	8.2	2.2
17	Gujarat	12181718	34.8	34.1	6.1
18	Karnataka	13179911	33.9	25.6	6.3
19	Andhra Pradesh	21024534	32.1	18.6	2.7
20	Uttarakhand	1997068	31.3	22.9	6.2
21	NCT of Delhi	3340538	30.6	38.9	20.7
22	Maharashtra	23830580	30.5	24.9	5.9

Table 4.6

Statewise Ownership of Transport Vehicles in India, 2011

Sl. No.	India/ State/ Union Territory #	Households having assets			
		Total No. of Households (Excluding institutional households)	Bicycle	Scooter, Motor cycle, Moped	Car, Jeep, Van
23	Daman & Diu	60381	30.4	31.5	5.9
24	Rajasthan	12581303	28.6	24.1	4.7
25	Goa	322813	24.6	56.9	24.6
26	Dadra & Nagar Haveli	73063	24.4	25.5	5.7
27	Kerala	7716370	20.5	24.1	10.2
28	Arunachal Pradesh	261614	19.5	14	7.9
29	A & N Islands	93376	18.3	24.7	6.9
30	Meghalaya	538299	13.3	5.4	5.4
31	Jammu & Kashmir	2015088	10.3	12.9	7.5
32	Himachal Pradesh	1476581	9.5	15.5	8.3
33	Nagaland	399965	7.9	6.3	7.8
34	Mizoram	221077	4.3	13.8	7.3
35	Sikkim	128131	0.9	2.8	8.3

Source: *Census of India, 2011, Household Assets*

Table 4.7

Mode of Transport in Rural India, 2001-2011 and Ranking of States based on Cycle as Mode of Transport 2011

State/Union Territory	Total households		Bicycle		Scooter/ Motorcycle/ Moded		Car/ Jeep/ Van		None of the specified mode of transportation	
	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001
India	16782673	138271559	46.20	42.80	14.30	6.70	2.30	1.30	47.20	54.50
Punjab	3315632	2775462	72.30	74.10	44.80	27.00	10.00	3.70	18.30	22.00
Uttar Pradesh	25475071	20590074	71.50	71.10	15.30	6.70	2.30	1.50	24.90	27.30
Jharkhand	4685965	3802412	60.80	49.30	9.50	4.00	1.10	0.60	36.20	49.50
Chhattisgarh	4384112	3359078	60.60	58.20	9.30	5.90	0.80	0.60	37.10	39.80
Odisha	8144012	6782879	60.00	49.40	9.80	4.50	0.90	0.60	37.20	49.40
West Bengal	13717186	11161870	58.20	54.30	5.70	3.10	1.20	1.20	40.40	44.70
Assam	5374553	4220173	56.90	47.00	7.60	3.30	2.10	1.20	41.10	52.00
Bihar	16926958	12660007	48.80	40.10	6.60	2.40	1.40	0.70	48.60	59.00
Tamil Nadu	9563899	8274790	46.10	39.90	25.50	10.70	1.80	1.10	43.20	56.60
NCT of Delhi	79115	169528	44.20	48.70	38.50	20.70	10.80	7.30	34.70	38.90
Haryana	2966053	2454463	43.00	46.20	27.90	13.20	5.80	2.40	42.20	48.60
Manipur	335752	296354	40.80	31.80	12.90	7.00	3.60	2.00	54.00	65.50
Tripura	607779	539680	36.80	27.60	4.70	2.00	1.30	0.80	60.20	71.10
Karnataka	7864196	6675173	36.50	27.80	16.90	7.30	2.50	1.40	54.20	68.40
Madhya Pradesh	11122365	8124795	36.40	38.30	12.00	6.00	1.10	0.90	57.20	59.00
Andhra Pradesh	14246309	12676218	31.40	30.00	11.20	5.10	0.90	0.50	61.20	67.40
Maharashtra	13016652	10993623	30.20	28.30	18.50	8.00	2.40	1.60	59.30	67.80
Gujarat	6765403	5885961	29.00	29.30	23.00	11.80	2.80	1.80	56.40	64.10
Uttarakhand	1404845	1196157	27.50	25.90	15.10	6.20	3.30	1.30	65.20	71.60
Rajasthan	9490363	7156703	24.20	31.70	17.30	7.30	2.90	1.70	64.10	64.40

Table 4.7

Mode of Transport in Rural India, 2001-2011 and Ranking of States based on Cycle as Mode of Transport 2011

State/Union Territory	Total households		Bicycle		Scooter/ Motorcycle/ Moded		Car/ Jeep/ Van		None of the specified mode of transportation	
	2011	2001	2011	2001	2011	2001	2011	2001	2011	2001
Goa	124674	140755	22.80	30.60	51.80	33.20	17.90	6.80	37.50	50.00
Arunachal Pradesh	195723	164501	20.10	16.40	11.30	4.40	5.30	1.40	69.20	79.90
Kerala	4095674	4942550	15.90	15.70	19.70	7.40	8.00	2.90	66.80	78.40
Meghalaya	422197	329678	14.90	11.80	3.90	1.50	2.80	1.30	80.90	86.40
Himachal Pradesh	1310538	1097520	9.30	9.10	14.40	6.20	6.70	1.80	76.50	85.90
Jammu & Kashmir	1497920	1161357	7.40	9.20	7.90	3.90	3.60	1.50	84.80	87.50
Nagaland	284911	265334	7.20	7.60	5.00	2.00	5.00	2.40	84.90	89.00
Mizoram	104874	79362	2.80	2.30	7.20	2.50	2.50	1.10	89.10	94.70
Sikkim	92370	91723	0.60	0.40	2.40	1.40	5.30	1.50	92.40	97.00

Source: *Census of India, 2011*

Table 4.7a

Percentage of Rural Households Owning Transport Assets (2001-11)

Rural		number of assets			percentage of household owning		
Jharkhand	Total no of household	Bicycle	Scooter/ Motorcycle	Car/ Jeep/ Van	Bicycle	Scooter/ Motorcycle	Car/ Jeep/ Van
2011	4685965	2848226	442950	51760	60.78	9.45	1.10
2001	3802412	1873209	151114	22012	49.26	3.97	0.58
Growth '2001-2011		52.05	193.12	135.14			

Source: *Census of India, 2001 and 2011*

Among the sample villages, the ownership of total transport vehicles is more in Simdega district than in Chatra district. The village of Kadopani which has provision of pucca road and close proximity to bus stop but away from Block headquarter, has the maximum number of households (125 percent) with transport vehicles among the sample villages in Simdega district (Table 4.10). In Chatra, the sample village of Kunda which has pucca road connectivity, is near to bus stop and block headquarter, has the most number of households (88 percent) owning transport vehicles while it is poorest (24 percent) in Harul village which is the most disadvantaged as it is devoid of pucca road and is distant from both bus stop and block headquarter. The share of non-motorised transport vehicles is more than the motorised in all of the sample villages in the study area except for the village of Kunda which has pucca road provision and is located in close

proximity to the bus stop and the block head quarter and Harul which has no transport provision is is away from block headquarter (Table 4.11).

4.4.1.1.1 *Ownership of Non-Motorised Modes of Transport*

Bicycles are the predominant non-motorised modes of transport and are regarded to be "faster, safer and more reliable than walking and cheaper than motorised transport."[6] The district level analysis of transport vehicle ownership in Jharkhand in 2001 and 2011 shows that, the most connected district of Simdega occupies the fifth position with regard to bicycle ownership with 58.3 percent in 2001 and 74.5 percent in 2011 (Table 4.8 and Table 4.9). The district of Chatra which has the least connectivity with all weather roads also has the least proportion of bicycle ownership with 39.3 percent in 2001 and 50.22 percent in 2011.

The bicycle is the predominant mode among all the sample villages of the study areas. However, the sample villages of Simdega have more number of households owning bicycles than that in Chatra. The households owning more than one bicycles are found in the villages of Kadopani (122.7 percent) and Koronjo (102.2 percent). Both of these are among the set of villages that are located away from the block headquarter. The village of Saraslongri, has 91.7 percent of the households owning bicycles, while it is 70.6 percent in the village of Deobahar (Table 4.10). The village of Dilho which is remotely located from block headquarter has the maximum number of households (58 percent) owning bicycles.

4.4.1.1.2 *Ownership of Motorised Means of Transport*

The ownership of motorised transport vehicles in Jharkhand both two wheelers and four wheelers are above the averages of the adjoining states of Chhattisgarh, Odisha, West Bengal and Bihar but below the national average. The household Ownership of two wheeler motorised transport vehicles comprising of Scooter, Motorcycle or Moped was 16.1 percent as against the national average of 21.0 percent in 2011. The household ownership of four wheeler motorised transport vehicles comprising of car, jeep or van was 2.8 percentage against the national average of 4.7 percent in 2011. The ownership of

[6] J. Heyen-Perschen (2001): *Non-Motorised Transport and its Socio-economic Impact on Poor Households in Africa: Cost-benefit Analysis of Bicycles of Ownership in Rural Uganda, Results of an Empirical Case Study in Cooperation with FABIO/BSPW* (Jinja, Uganda), Hamburg, p. 10.

motorised two wheeler and four wheeler transport vehicles in Simdega and Chatra districts are below the state average of Jharkhand in 2011. However, Chatra fairs better than Simdega in this respect as the ownership of two wheeler motorised transport is 6.60 percent in Simdega as against 7.15 percent in Chatra. Similarly, in the case of four wheeler motorised transport vehicles, Simdega has 0.76 percent of vehicle ownership while Chatra has 0.96 percent vehicle ownership.

The ownership of two wheeler motorised vehicles, mainly motorbicycles and jeeps, are very low among all the sample villages of Simdega and Chatra district. The performance of the households owning two wheeler motorised transport vehicles in the sample villages of Kunda (44 percent) and Lutidih (30 percent) in Chatra district are better than the sample villages of Simdega district (Table 4.10). The sample villages of Koronjo and Saraslongri in comparison to the other two sample villages in Simdega district have recorded a high level of ownership of motorised two wheeler transport vehicles.

Table 4.8

Ownership of Transport Vehicles among Rural Households in Jharkhand, 2011

District	Total number of households	Bicycle	Scooter/ Motorcycle /Moped	Car/ Jeep/ Van	Bicycle	Scooter/ Motorcycle /Moped	Car/ Jeep/ Van
JHARKHAND	4685965	2848226	442950	51760	60.78	9.45	1.10
Jamtara	135540	106962	12727	1175	78.92	9.39	0.87
Purbi Singhbhum	215676	161998	23446	2024	75.11	10.87	0.94
Saraikella-Kharsawan	165883	124254	19245	1647	74.90	11.60	0.99
Lohardaga	80295	60065	6563	589	74.81	8.17	0.73
Simdega	108683	80965	7175	827	74.50	6.60	0.76
Khunti	93762	66238	5425	602	70.64	5.79	0.64
Gumla	176770	124484	12390	1470	70.42	7.01	0.83
Ranchi	322679	225649	40310	4295	69.93	12.49	1.33
Deoghar	214896	148401	19746	1798	69.06	9.19	0.84
Dhanbad	207157	141029	40393	3476	68.08	19.50	1.68
Bokaro	204021	134960	29155	3693	66.15	14.29	1.81
Dumka	255926	165495	17831	2034	64.67	6.97	0.79
Pashchimi Singhbhum	256019	158200	16758	1756	61.79	6.55	0.69
Ramgarh	97889	59908	17308	2092	61.20	17.68	2.14
Giridih	356247	207359	46983	4680	58.21	13.19	1.31
Pakur	167362	96550	7798	707	57.69	4.66	0.42
Hazaribagh	252871	141978	34289	4992	56.15	13.56	1.97
Godda	239500	126375	16003	1272	52.77	6.68	0.53
Kodarma	90207	45462	11615	1321	50.40	12.88	1.46
Chatra	170239	85487	12179	1638	50.22	7.15	0.96
Latehar	122902	58912	5910	850	47.93	4.81	0.69
Palamu	316135	142492	19004	5805	45.07	6.01	1.84

Table 4.8

Ownership of Transport Vehicles among Rural Households in Jharkhand, 2011

District	Total number of households	Bicycle	Scooter/ Motorcycle /Moped	Car/ Jeep/ Van	Bicycle	Scooter/ Motorcycle /Moped	Car/ Jeep/ Van
Sahibganj	193809	82465	7094	848	42.55	3.66	0.44
Garhwa	241497	102538	13603	2169	42.46	5.63	0.90

Source: *Census of India, 2011*

The ownership of Jeep is rare among all the sample villages of the study are except for Lutidih and Kunda where some motorised four wheeler transport vehicle ownership is recorded.

Table 4.9

Ownership of Transport Vehicles among Rural Households in Jharkhand, 2001

Sl. No.	District	Total number of households	Numbers			Percentage		
			Bicycle	Scooter, Motor, Cycle, Moped	Car, Jeep, Van	Bicycle	Scooter, Motor, Cycle, Moped	Car, Jeep, Van
1	Jamtara	1,06,727	69,445	3,660	396	65.1	3.4	0.4
2	Lohardaga	61,100	39,575	2,278	202	64.8	3.7	0.3
3	Purbi Singhbhum	1,76,969	1,08,808	10,787	1,149	61.5	6.1	0.6
4	Ranchi	2,63,497	1,58,568	13,045	1,573	60.2	5	0.6
5	Simdega	94,448	55,040	2,671	415	58.3	2.8	0.4
6	Deoghar	1,66,501	96,242	5,487	760	57.8	3.3	0.5
7	Dhanbad	2,05,914	1,17,909	21,131	2,678	57.3	10.3	1.3
8	Saraikela-Kharsawan	1,36,991	77,543	6,120	751	56.6	4.5	0.5
9	Bokaro	1,71,904	95,151	11,639	1,387	55.4	6.8	0.8
10	Gumla	1,49,241	82,738	4,945	635	55.4	3.3	0.4
11	Khunti	80,378	44,266	2,748	368	55.1	3.4	0.5
12	Ramgarh	90,897	48,119	6,987	810	52.9	7.7	0.9
13	Hazaribagh	2,12,021	1,07,145	9,893	1,845	50.5	4.7	0.9
14	Kodarma	66,657	31,774	2,744	585	47.7	4.1	0.9
15	Giridh	2,86,647	1,36,023	10,854	1,779	47.5	3.8	0.6
16	Pashchimi Singhbhum	2,11,120	97,795	6,138	710	46.3	2.9	0.3
17	Dumka	2,09,983	93,163	6,687	823	44.4	3.2	0.4
18	Godda	1,90,107	76,589	5,716	932	40.3	3	0.5
19	Garhwa	1,71,674	68,669	3,225	910	40	1.9	0.5
20	Chatra	1,25,198	49,211	2,436	595	39.3	1.9	0.5
21	Palamu	2,40,110	91,951	5,727	1,456	38.3	2.4	0.6
22	Pakur	1,26,943	48,191	2,078	358	38	1.6	0.3
23	Latehar	99,340	35,259	2,088	528	35.5	2.1	0.5
24	Sahebganj	1,58,045	44,035	2,030	367	27.9	1.3	0.2
	Jharkhand	**38,02,412**	**18,73,209**	**1,51,114**	**22,012**	**49.3**	**4**	**0.6**

Source: *Census of India 2001, Household Table*

Table 4.10

Vehicle Ownership Pattern in the Sample Villages

Village	Number of Households	Number of Households Having Ownership of Vehicles				Percentage of Households Owning			
		Cylce	Motor Cycle	Jeep	Total	Bicycles	Motor Bicycles	Jeep	Ownership of any vehicle
Saraslongri	48	44	4		48	91.7	8.3	0	100
Kadopani	44	54	1		55	122.7	2.3	0	125
Deobahar	51	36	1		37	70.6	2	0	72.5
Koronjo	45	46	6		52	102.2	13.3	0	115.6
Dilho	50	29	13		42	58	26	0	84
Lutidih	50	15	15	2	32	30	30	4	64
Kunda	50	20	22	2	44	40	44	4	88
Harul	50	5	7		12	10	14	0	24
Total	388	249	69	4	322	64.2	17.8	1.03	83

Source*: Primary Field Work, 2011*

Table 4.11

Share of Motorised and Non-Motorised Vehicle ownership to Total Vehicles in the Sample Village

Ownership of Vehicles	Simdega District (most connected - MC)				Chatra District (least connected - LC)				Total
	Bolba Block – MC		Thethaitangar Block – LC		Simaria Block – MC		Kunda Block – LC		
	Saraslongri	Kadopani	Deobahar	Koronjo	Dilho	Lutidih	Kunda	Harul	
Cylce	44	54	36	46	29	15	20	5	249
Motor Cycle	4	1	1	6	13	15	22	7	69
Jeep						2	2		4
Total	48	55	37	52	42	32	44	12	322
Cylce	91.7	98.2	97.3	88.5	69	46.9	45.5	41.7	77.3
Motor Cycle	8.3	1.8	2.7	11.5	31	46.9	50	58.3	21.4
Jeep	0	0	0	0	0	6.3	4.5	0	1.2
Total	100	100	100	100	100	100	100	100	100

Source*: Primary Field Work, 2011*

4.4.1.2 Summary of Results of Transport Vehicle Ownership among the Sample Villages with varying levels of Physical Connectivity

The pattern of transport vehicle ownership in the sample villages with varying levels of physical connectivity are shown in the Table 4.12. The villages occupying the maximum and minimum positions in terms of transport vehicle ownership are represented as ‘highest’ and ‘lowest’ respectively in the Table.

1. The village of Deobahar which has pucca road facility but is distant in location from the nearest bus stop facility and block headquarter (service centre), has the minimum number of households owning both non-motorised (bicycles) and motorised (motorcycle) transport vehicles.

2. The village of Harul which has the poorest level of physical connectivity has the minimum number of households owning both non-motorised (bicycles) and motorised (motorcycle) transport vehicles.

3. Kadopani and Dilho are the villages that are both close to pucca road and close to bus stop, have the highest number of households owning non-motorised (bicycles) transport vehicles.

4. Koronjo village that is close to bus stop but lacks pucca road and is away from block headquarter has the highest motorised (motorcycle) transport vehicles ownership.

5. Kunda village that has higher levels of physical connectivity also has highest motorised (motorcycle) transport vehicles ownership.

Table 4.12
Summary of Results of Transport Vehicle Ownership among the Sample Villages with varying levels of Physical Connectivity

Criteria	Simdega District				Chatra District			
	Bolba Block		Thethaitangar Block		Simaria Block		Kunda Block	
	Saraslongri	Kadopani	Deobahar	Koronjo	Dilho	Lutidih	Kunda	Harul
I- Pucca Road	√	√	√	X	√	√	√	X
II- Close to Bus	√	√	X	√	√	√	√	X
III- Close to Block Office	√	X	X	X	X	X	√	X
Households owning Bicycle (%)		Highest	Lowest		highest			lowest
Households owning Motorcycle (%)			Lowest	highest			highest	lowest

Source*: Primary Field Work, 2011*

4.4.1.3 Physical Mobility

The physical mobility of the individuals in the sample villages are assessed with the three indicators - proportion of population with physical disability, proportion of elderly population and proportion of households with BPL cards.

4.4.1.3.1 Physical disability

One of the important factors of personal mobility is physical mobility or physical fitness to travel. Table 4.13 shows the cases of different impairments among the population of the sample villages. The total disabled in Saraslongri village is most (4.55 percent) among the sample villages of the study area. About 3 percent of the sample population in Saraslongri has locomotor disability, while 2 percent was recorded in Koronjo village in Simdega district. Although the village of Saraslongri is in an advantageous position in terms of location as it has pucca road and is close to bus stop and block headquarter, the situation of Koronjo is dismal as it lacks pucca road and is far from the block headquarter which provides educational, health and other services to the population.

Table 4.13

Impairments in the Sample Villages

Village	Impairments (Disability)					Total Disabled	Total Population
	Visual	Vocal	Mental	Locomotor	Hearing		
Deobahar	1	1	1	1	0	4	266
Koronjo	0	0	1	4	1	6	228
Saraslongri	0	1	0	6	3	10	220
Kadopani	0	0	0	1	0	1	198
Dilho	2	1	1	1	0	5	240
Lutidih	1	1	0	1	0	3	244
Kunda	0	0	0	1	0	1	214
Harul	0	0	3	1	0	4	194
Total	4	4	6	16	4	34	1804
Percentage to total population of the village							
Deobahar	0.38	0.38	0.38	0.38	-	1.50	-
Koronjo	-	-	0.44	1.75	0.44	2.63	
Saraslongri	-	0.45	-	2.73	1.36	4.55	
Kadopani	-	-	-	0.51	-	0.51	
Dilho	0.83	0.42	0.42	0.42	-	2.08	
Lutidih	0.41	0.41	-	0.41	-	1.23	
Kunda	-	-	-	0.47	-	0.47	
Harul	-	-	1.55	0.52	-	2.06	
Total	0.22	0.22	0.33	0.89	0.22	1.88	

Source*: Primary Field Work, 2011*

4.4.1.3.2 Mobility among the Elderly Population

In the sample villages, the elderly people are more in Koronjo and Deobahar of Thethaitanger block in Simdega district while there are fewer in Lutidih village of Simaria block and Harul village of Kunda block in Chatra district (Table 4.14).

Table 4.14

Proportion of Elderly Population in the Sample Villages

Villages	Total Population	65+ Years	Percentage of elderly
Deobahar	266	12	4.51
Koronjo	228	15	6.58
Saraslongri	220	3	1.36
Kadopani	198	3	1.52
Dilho	240	7	2.92
Lutidih	244	11	4.51
Kunda	214	4	1.87
Harul	194	7	3.61
Total	1804	59	3.27

Source*: Primary Field Work, 2011*

4.4.1.3.3 Economic Condition of the Households

Economic constraints are an important determinant of transport accessibility. In the present case the economic status of the households is assessed with the possession of BPL cards in the households. It is assumed that households with BPL card will have fewer opportunities to make a journey than the non-BPL card holder household because of affordability. The study shows that the sample villages of Chatra district have lesser proportion of BPL card holders and has greater opportunities to make a journey than the sample villages of Simdega district where the proportion of BPL card holders are more. Among the sample villages in Simdega district, Kadopani has the highest proportion of BPL families (98.99 percent) followed by Saraslongri (89.55 percent), Deobahar (85.34 percent) and Koronjo (78.95 percent). In Chatra, the village of Dilho has the most proportion of BPL families, followed by Harul, Lutidih and Kunda (Table 4.15).

Table 4.15
Households having BPL Cards among the Sample Villages

District	Block	Villages	Houselohd with BPL card (%)
Simdega	Bolba	Saraslongri	89.55
		Kadopani	98.99
	Thethaitanger	Deobahar	85.34
		Koronjo	78.95
Chatra	Simaria	Dilho	50.00
		Lutidih	47.13
	Kunda	Kunda	30.84
		Harul	49.48

Source*: Primary Field Work, 2011*

4.4.2 Relative Accessibility

Relative accessibility is measured by considering the relative distance to nearby facility centres. According to Bisht, Mishra and Fuloria, "Studies which have considered the spatial perspective of accessibility argue that the distance is an extremely important variable affecting the access to resources".[7] Accessibility of the village to opportunity centres is evaluated in terms of the inter-spatial distance between the location of the village and the location of the opportunity centres. The further the distances between these two locations, greater is the disadvantage of the village concerned. The distance to essential opportunities from the sample villages are classified into nodal service centres, educational, health and market facility centres.

4.4.2.1 *Distance to Nodal Service Centres*

The distance to the nearest town, district headquarter and block headquarter have been considered as the nodal service centres. The nearness of the village to an urban centre increases the growth potential of the village as it provides both economic and social opportunities of development. In the study area, the respective district headquarter towns are the nearest urban centre of the sample villages. The villages of Deobahar (24 km) and Koronjo (31 km) are more accessible to an Urban centre than Saraslongri (39 km) and Kadopani (50 km) to the District Headquarter town of Simdega (Table 4.16).

[7] S. S. Bisht, V. Mishra and S. Fuloria (2009): *Census Based Accessibility Index: a Tool for Policy Initiatives Evaluation, IGIDR Proceedings/Project Report Series*, IIM, Bangalore, p. 6.

Table 4.16
Distance of Places of Travel from Sample Villages

Places of Travel	Simdega District				Chatra District			
	Thethaitangar Block		Bolba Block		Simaria Block		Kunda Block	
	Distances from Villages							
	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
Nearest Town	24	31	39	50	12	20	55	60
Block Office	11	17	4	15	8	15	0	8
District Office	24	31	39	50	12	20	55	60

Source*: Primary Field Work, 2011*

In Chatra, the villages of Dilho (12 km) is the nearest to District Headquarter town of Chatra. The village of Lutidih is still closer (20 km) than the remotely located villages of Kunda (55 km) and Harul (60 km).

The Block Headquarter (BHQ) centre, although not included in census town category, is an important service centre in the block. Among the sample villages in Simdega district, the village of Saraslongri is nearer to BHQ than Deobahar, Koronjo and Kadopani. In contrast, the sample villages in Chatra are nearer to BHQ. Kunda village is the most advantageous as BHQ is located in the village.

4.4.2.2 *Distance to* E*ducational Facility Centres*

The physical accessibility to schools and college increases the educational opportunities of the students. Physical distance to school is cited as a major barrier to participation for rural children in India and in most Indian villages primary schools are one km away, middle schools are at three km away and secondary and higher secondary are five km away from the village center.[8] The distance to the following educational opportunity centres are studied for the sample villages:

1. Primary School
2. Middle School
3. High School
4. Senior secondary school
5. College

[8] M. Mukherjee (2011): *Do Better Roads Increase School Enrollment? Evidence from a Unique Road Policy in India,* Department of Economics, Syracuse University, New York.

All the sample village have a primary school located in the village except for Koronjo (3 km away) and Saraslongri (4 km) in Simdega (Table 4.17). In terms of distance to middle school, the villages located at more than 5 Km is Harul village (8 km) in Chatra district. The distance to High School is more in all the sample villages except for Saraslongri (4km) and Koronjo village (3 km) in Simdega district and Kunda and Lutidih village in Chatra district. The distance is more for Kadopani (15 km)

The senior secondary schools are located at greater distance (above 12 km) in almost all the sample villages of the study area expect for Saraslongri (4 km). The villages of Harul (60 km) and Kunda (55 km) are the most remote in Chatra district and Kadopani (35 km in Simdega district. The facility of higher education to the sample villages are available only in the District Headquarters and are similar to the situation discussed in the earlier section with regard to distance to nearest urban facility centre.

Table 4.17
Distance of Places of Travel (Educational Facilities) from Sample Villages

Places of Travel	Simdega District				Chatra District			
	Thethaitangar Block		Bolba Block		Simaria Block		Kunda Block	
	Distances from Villages							
	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
Primary School	0	3	0	0	0	0	0	0
Middle School	0	3	4	0	0	0	0	8
High School	7	3	4	15	12	3	0	8
Senior Secondary School	12	18	4	38	12	20	55	60
College	24	31	39	50	12	20	55	60

Source*: Primary Field Work, 2011*

4.4.2.3 *Distance to Health Facility Centres*

Limited physical access to primary health care is a major factor contributing to the poor health of populations in developing countries, particularly in mountain areas with rugged topography, harsh climate and extensive socioeconomic barriers[9]. The position of

[9] Perry, B and Gesler, W (2002): *Physical Access to Primary Health Care in Andean Bolivia,* Department of Geography and Planning, Appalachian State University, USA.

Jharkhand in terms of its health facilities is very bad as there is one PHC for every 58 villages in Jharkhand, while in Kerela there is one for every one and half villages. [10]

The accessibility of the sample villages to various facility centres are evaluated in terms of its location and distance to these opportunity centres. The lesser the distance between the village and the opportunity centre, the better the accessibility and vice-versa. The distance to the following health opportunity centres are studied:

1. PHC
2. PHSC
3. Referral Hospital
4. District Hospital

The Primary Health Sub Centre (PHSC) facility is available in the villages of Dilho (0 km), Kunda (0 km) and Lutidih (3 km) in Chatra district. The sample villages of Koronjo (3 km), Kadopani (3 km), Saraslongri (4 km) and Deobahar (4 km) are located within walkable distance to PHSC in Simdega district. Harul village is distant (8 km) to PHSC facility. With regard to location of Primary Health Centre (PHC), the distance is more from Kadopani (15 km) and Lutidih (15 km). The better health facilities available in Referral Hospitals and District Hospitals are distant to all the sample villages. Among these villages the remote villages of Kadopani and Harul are the most disadvantaged ones with regard to relative accessibility to District and Referral Hospitals (Table 4.18).

Table 4.18

Distance of Places of Travel (Health Facilities) from Sample Villages

Service Centre	Simdega District				Chatra District			
	Thethaitangar Block		Bolba Block		Simaria Block		Kunda Block	
	Distances from Villages							
	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
PHSC	4	3	4	3	0	3	0	8
PHC	11	5	4	15	8	15	0	8
District Hospital	24	31	39	50	12	20	55	60
Referral Hospital/ CHC	11	17	26	37	8	15	46	60

Source*: Primary Field Work, 2011*

[10] Institute for Human Development and United Nation Food Programme (2008): *Food Security Atlas of Rural Jharkhand,* Institute for Human Development, New Delhi.

4.4.2.4 *Distance to Market Facility Centres*

Rural roads are an important form of public infrastructure, which provides the access to both markets for buying agricultural inputs and consumables, selling of agricultural outputs and forest products and a place of social interaction. According to studies on the central tribal areas including Jharkhand, "Remoteness from state and markets results in social isolation, undeveloped civil society and poor governance".[11] The distance to the following market facilities are discussed here:

1. Weekly market
2. Wholesale market
3. Labour Market

The weekly markets are nearer to the villages of Kadopani (0 km) and Koronjo (3km) than Saraslongri (4 km) and Deobahar (7 km) in Simdega district. The sample villages in Chatra are located near weekly markets except for Harul village (8 km). The higher order market facility centres comprising of the Labour market and Wholesale market are located in common place to each other and are located further away from all of the sample villages in the study area (Table 4.19).

Table 4.19

Distance of Places of Travel (Markets) from Sample Villages

Places of Travel	Simdega District				Chatra District			
	Thethaitangar Block		Bolba Block		Simaria Block		Kunda Block	
	Distances from Villages							
	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
Weekly market	7	3	4	0	0	3	0	8
Wholesale Market	24	31	39	50	12	20	55	20
Labour Market	24	31	39	50	12	20	55	20

Source*: Primary Field Work, 2011*

[11] D. C. Sah, A. Bhatt and T. K. Dalapati (2008): *Chronic Poverty in Remote Rural Areas: Evidence from Central Tribal Belt of India*, Project of Planning Commission, GOI, Madhya Pradesh Institute of Social Science Research, Ujjain, p. 8.

4.4.2.5 Summary of Results of Relative Accessibility of the Sample Villages to Different Facility Centres

1. The village of Saraslongri in Bolba block has the highest relative accessibility among the sample villages of Simdega district. The facilities which are located within walkable distance range of 0 to 5 km from the village location are found to be more in Saraslongri village (Table 4.20).

2. In Kunda block, the village of Kunda has the highest relative accessibility as it has the maximum number of facilities located at walkable distance from the village.

3. The village of Deobahar in Thethaitanger block in Simdega district has low relative accessibility as the number of facilities located within 0-5 km range is less from this village.

4. Harul village in Kunda block in Chatra district has low relative accessibility as it has the least number of facilities available from the village.

5. Among the four sample villages of Simdega district, Kadopani is the remotest and has the most transport disadvantage in terms of distance to essential opportunities from the village. In Chatra district, the sample village of Harul has the most transport disadvantage to essential opportunities. The problem is further aggravated by the lack of all weather roads in these villages (Table 4.20).

Table 4.20
Distance Range and Number of Facilities Available to the Sample Villages

Village	Distance to Facilities					
	0-5 Km		**5-10 Km**		**Above 10 Km**	
	No of facility	Type of facilities	No of facility	Type of facilities	No of facility	Type of facilities
Saraslongri	8	*Block Office, Primary School, Middle School, High School, Senior Secondary School, PHC, PHSC, Weekly market*			2	*Nearest Town, District Office, College, District Hospital, Referral Hospital/ CHC, Wholesale Market, Labour Market*
Kadopani	4	*Primary School, Middle School, PHSC, Weekly market*			6	*All Others*
Deobahar	3	*Primary School, Middle School and PHSC*	2	*High School & Weekly Market*	5	*Block Office, District Office, Senior Secondary School, College, PHC, District Hospital, Referral Hospital/ CHC, Wholesale Market & Labour Market*

Table 4.20
Distance Range and Number of Facilities Available to the Sample Villages

Village	Distance to Facilities					
	0-5 Km		**5-10 Km**		**Above 10 Km**	
	No of facility	Type of facilities	No of facility	Type of facilities	No of facility	Type of facilities
Koronjo	5	*Primary School, Middle School, High School, PHSC, & Weekly market*	1	*PHC*	4	*All Others*
Dilho	4	*Primary School, Middle School, PHSC, Weekly market*	3	*Block Office, PHC, Referral Hospital/ CHC*	3	*All Others*
Lutidih	5	*Primary School, Middle School, High School, PHSC, Weekly market*			5	*All Others*
Kunda	7	*Block Office, Primary School, Middle School, High School, PHC, PHSC, Weekly market*			3	*All Others*
Harul	1	*Primary School*	6	*Block Office, Middle School, High School, PHC, PHSC, Weekly market*	3	*All Others*

Source*: Primary Survey, 2011*

4.4.3 Public and Private Transport Provision in the Sample Villages

Both the districts lack in the provision of any public means of bus transport to these sample villages. The transport means of the villages are private buses and auto services. Both these private modes are limited in numbers and frequency. In most of the villages, the points of bus facilities are far off from the village centre. The autos run sporadically depending on the passenger demands. At the present level, the provision of private buses, their number, number of trips (frequency), quality of road and quality of transport services are included for analysis. Table 4.21 below shows the transport provision in each of the sample villages.

Table 4.21
Private Transport Provision in the Sample Villages

Villages	Transport Provision	Nearest Bus Stop (km)	Number of Buses	Number of Trips*	Quality of Roads	Quality of Transport Service
Saraslongri	Pvt. Bus	4	8	8	Poor	Poor
Kadopani	Pvt. Bus	0	2	2	Poor	Poor
Deobahar	Pvt. Bus	12	15	15	Poor	Crowded Bus

Table 4.21
Private Transport Provision in the Sample Villages

Villages	Transport Provision	Nearest Bus Stop (km)	Number of Buses	Number of Trips*	Quality of Roads	Quality of Transport Service
Koronjo	Pvt. Bus	4	2	2	Good	Crowded Bus
Dilho	Pvt. Bus	0	1	1	Good	Crowded Bus
Lutidih	Pvt. Bus	3	3	3	Good	Good
Kunda	Pvt. Bus	0	2	2	Poor	Crowded Bus
Harul	Pvt. Bus	8	2	2	Poor	Crowded Bus

*Round trip counted as one.
Source*: Primary Field Work, 2011*

In order to avail the bus service provisions, the villagers have to travel to the nearest bus stop that is often distant in location.

Among the sample villages, the village of Deobahar has the maximum number of private bus service provisions with more number of trips. The buses do not ply on the village road but on the Simdega – Rourkella NH 23 that is 12 km away from the village. The next village with good transport provision is that of Saraslongri. The village is located in close proximity to the block headquarter of Bolba. The road and bus service are of poor quality.

In Chatra, the village of Lutidih is endowed with better bus service facilities than the other sample villages. The village of Harul is the most deprived one as has no bus service facility and villagers have to travel to Kunda which is 8 km away from Harul village to avail bus services.

The quality of road implies the condition of the roads along which the buses ply from the point of the nearest bus stop. The quality is good for the villages of Koronjo, Dilho and Lutihih, while it is poor for most of the villages of Saraslongri, Kadopani, Kunda and Harul. The quality of bus service is poor among all the sample villages. Most of them run with overcrowded passengers and make single trips from and to the village in a single day. Thus the overall, private bus services are poor in terms of numbers, trips and quality of service among all the villages. The villages of Deobahar, Saraslongi and Lutidih are in a comparatively better position due to their proximity to important roads such as National Highways (Deobahar 12 km) and State Highways (Lutidih 3 km) passing near the village.

In these villages private autos ply at short distances from the block headquarter to village locations but are infrequent and often depend on the quantity of passengers. They also demand high fares which restrict their use by the villagers.

4.5 Travel Behaviour – Travel to Opportunities

The actual travel behaviour in different areas is a measure to know the level of utilization of the transport facilities that is available to the villages. These would highlight the nature of transport disadvantage in the specific locations. According to Silviani, the level of rural development can be accessed by the proportion of internal (within the village) and external (outside the village) travel, with more external travel implying that the village is more economically developed.[12]

The travel behaviour for different purposes has been studied for the sample villages having varying levels of physical connectivity. These purposes are:

a. Travel to work places- Percentage of population travelling to work place
b. Travel to health centres - Percentage of population travelling to health centres
c. Travel to markets- Percentage of population travelling to market
    i) Mode of travel to facility centres- Percentage of the number of modes used to travel to avail market facilities
    ii) Average number of trips- made by people to market facilities

4.5.1 Travel behavior to Work Places

The travel journey undertaken to work outside the village implies that the villages have more economic opportunities. According to Rolley and Humphreys (1993), "improved personal mobility with people travelling further for goods and services is a gain in welfare".[13]

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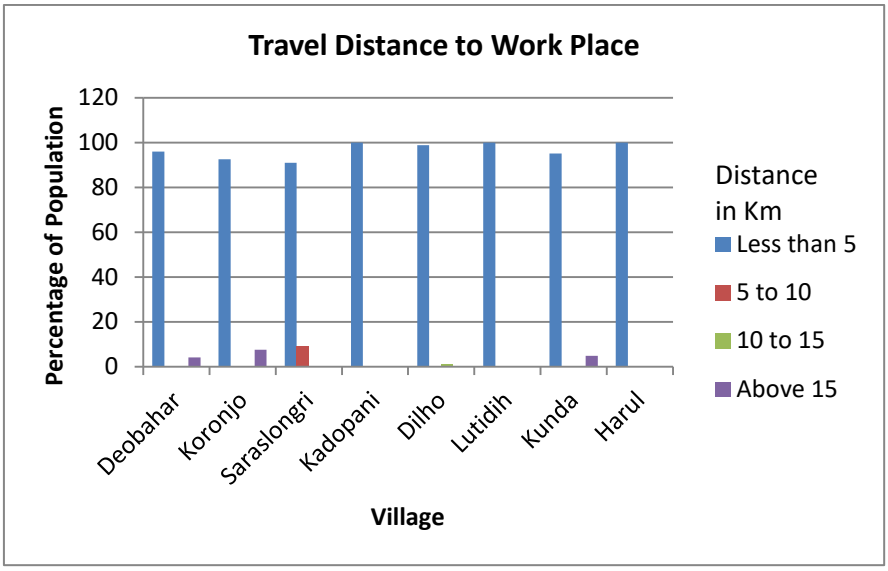
[12] Silviani, Vivi. (2000): *Identification of Rural Transport Needs: Case of Majalengka,Central Java*, Unpublished Final Project (in Indonesian), Gadjah Mada University, Yogyakarta quoted in Parikesit, D. (2005): "Measuring Impacts of Transportation Intervention on Regional Development: Comparative Assessment of Upper and Lower Level Analysis, *The Asian Journal*, Vol.12, Aug., No.1. p.1-11.

[13] Nutley, S. (2003): "Indicators of Transport and Accessibility Problems in Rural Australia", *Journal of Transport Geography*, Vol.11, p. 59.

We find in our study that the travel behavior to work is mostly local in nature and confined within the village at the individual level. The travel distance to work is within 5 km among all the sample villages of the study area.

Figure 4.1



The sample villages which have a pucca road, located close to bus stop and block headquarter, show some proportion of workers who travel to work beyond 5 km distance, outside the village. Saraslongri has few cases where the villagers travel to work ranging between a distance of 5 to 10 km, on daily basis (Table 4.22 and Figure 4.1). The distance travel to work in some cases is above 15 km in the villages of Koronjo and Deobahar village. In contrast, the travel to work is totally confined within the village in Kadopani. The travel behaviour of workers to work is local in the villages of Lutidih and Harul, followed by Dilho. Kunda is the only village in Chatra where few cases of travel to work further away from the village (above 15 km) is noticed.

Table 4.22
Travel Behaviour with Distances in the Sample Villages

	Travel Distance (km)	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
To Work	Less than 5	95.9	92.5	91	100	98.8	100	95.1	100
	5 to 10	0	0	9	0	0	0	0	0
	10 to 15	0	0	0	0	1.2	0	0	0
	Above 15	4.1	7.5	0	0	0	0	4.9	0

Source*: Primary Field Work, 2011*

4.5.2 Travel Behaviour to Health Facility Centres

The actual travel characteristics of the population in terms of visit to health centres for curative care are found to vary among the sample villages. The patients visit health centres that are located at a distance of less than 5 km in the villages of Kadopani (100 percent) and Koranjo (94 percent) in Simdega district and that of Dilho (100 percent), Kunda (100 percent) and Lutidih (98 percent) in Chatra district. The travel distance made by the villagers in Deobahar to health centres ranges from 5 to 10 km from the village location (Table 4.23 and Figure 4.2).

Figure 4.2

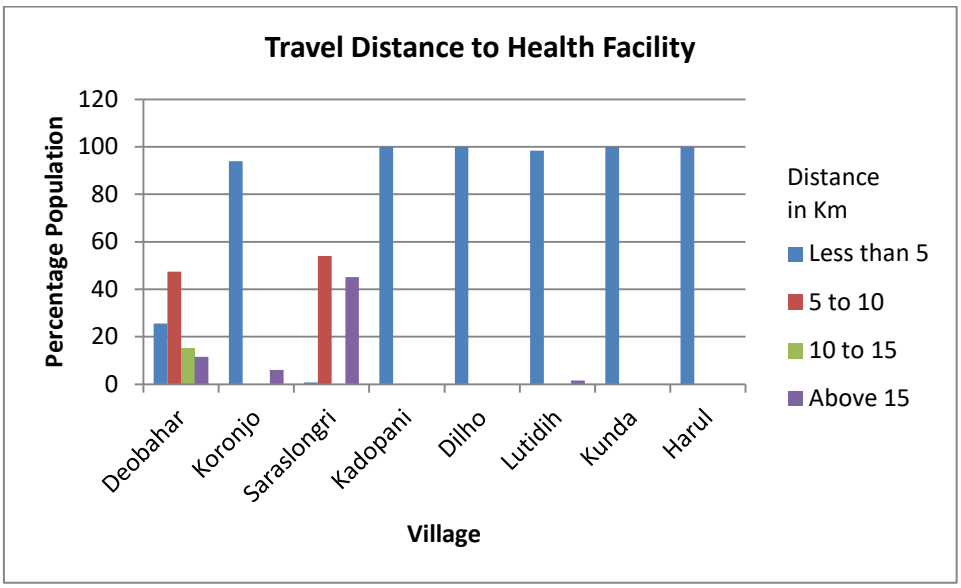


Table 4.23

Travel Behaviour with Distances in the Sample Villages

	Travel Distance (km)	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
To Medical Facility	Less than 5	25.64	93.98	0.74	100	100	98.39	100	100
	5 to 10	47.44	-	54.07	-	-	-	-	-
	10 to 15	15.38	-	-	-	-	-	-	-
	Above 15	11.54	6.02	45.19	-	-	1.61	-	-

Source*: Primary Field Work, 2011*

The places travelled for curative care for the sample villages shows that people mostly travel to the PHSC for availing curative care. This behaviour is prevalent among

the population of the sample villages in Chatra district. In Simdega district people travel to various heath facility centres even located at distant locations. The village of Saraslongri shows better results as 42.96 percent of the population travel to the District Hospitals to avail the health facilities (Table 4.24).

Table 4.24
Places of Curative Care for the Sample Villages

Village	District Hospital	Sub-Division Hospital	PHC	PHSC	Mission Hospital	Anganbari Centre	Other Hospital	RMP	Total
Deobahar	1		14	18	3	2	11	221	270
Koronjo	21	6		138		5			170
Saraslongri	61		75	5		1			142
Kadopani				17					17
Dilho				57					57
Lutidih	1			61					62
Kunda				54					54
Harul				50					50
Total	84	6	89	400	3	8	11	221	822
Percentage									
Deobahar	0.37	0.00	5.19	6.67	1.11	0.74	4.07	81.85	100.00
Koronjo	12.35	3.53	0.00	81.18	0.00	2.94	0.00	0.00	100.00
Saraslongri	42.96	0.00	52.82	3.52	0.00	0.70	0.00	0.00	100.00
Kadopani	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00
Dilho	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00
Lutidih	1.61	0.00	0.00	98.39	0.00	0.00	0.00	0.00	100.00
Kunda	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00
Harul	0.00	0.00	0.00	100.00	0.00	0.00	0.00	0.00	100.00
Total	10.22	0.73	10.83	48.66	0.36	0.97	1.34	26.89	100.00

Source*: Primary Field Work, 2011*

4.5.3 Travel Behaviour to Market Facility Centres

The travel behaviour of the individuals to avail market facilities shows a more dispersed pattern. At the individual level, the distance travelled to market in the sample villages of Simdega is more dynamic as people travel longer distances away from their village location. The Koronjo village shows varying travel characteristics in this regard. Although majority of the villagers go to nearby weekly markets (within 5 km) there are cases where individuals travel longer distances (18 percent) to distant markets. The travel behaviour of individuals of the villages of Chatra district is local in nature as is found in Lutidih and Kunda. However, majority of the visits to weekly markets range from a

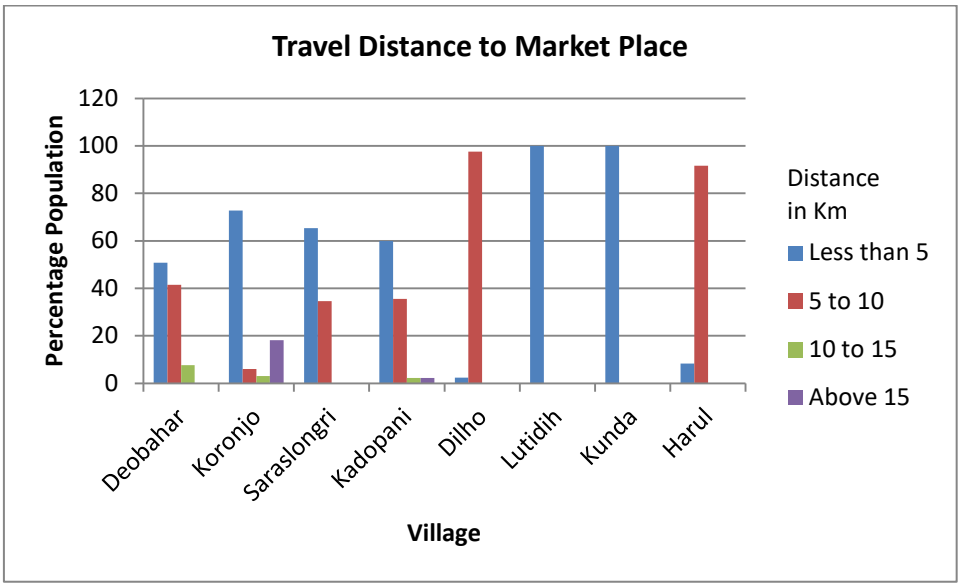
distance of 5 to 10 km in the case of Dilho (97.56 percent) and Harul (91.67 percent) villages (Table 4.25 and Figure 4.3).

Table 4.25
Travel Behavour with Distances in the Sample Villages

To all markets	**Travel Distance (km)**	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul
	Less than 5	50.77	72.73	65.35	60.0	2.44	100.0	100.0	8.33
	5 to 10	41.54	6.06	34.65	35.56	97.56	-	-	91.67
	10 to 15	7.69	3.03	-	2.22	-	-	-	-
	Above 15	-	18.18	-	2.22	-	-	-	-

Source*: Primary Field Work, 2011*

Figure 4.3



The proportion of individuals travelling to market places varies among the sample villages in both the districts. The proportion of population in the remote villages of Kadopani and Harul as well as the village of Deobahar which has poor physical connectivity, travel less to the market. The proportion of population in Saraslongri and Kunda villages with higher levels of physical accessibility travel more to the market places. Similar trend is followed by Koronjo village, which has moderate levels of physical accessibility (Table 4.26).

Table 4.26

Travel to Market in the Sample Villages

Villages	Gross responses for travel to market for all purposes	Share of persons travel to market for all purposes (%) weekly
Deobahar	198	9.8
Koronjo	341	16.87
Saraslongri	376	18.6
Kadopani	140	6.93
Dilho	243	12.02
Lutidih	249	12.32
Kunda	275	13.61
Harul	199	9.85
Total	2021	100

Source*: Primary Field Work, 2011*

The travel to markets is made for various economic purposes relating to the purchase of agricultural inputs, selling of agricultural surplus and forest products and for buying consumables. Table 4.27 shows the various purposes for travel to market. Most of the travel to markets is made to buy consumable (38 percent), to sell agricultural products (32 percent) and to buy agricultural inputs (31 percent). However, a considerable proportion of the visits to markets are also undertaken to sell forest products (11 percent).

Table 4.27

Travel to Market for Various Purposes

Village	Purpose				Total Sample
	Buy Agricultural Inputs	Sell Agricultural Product	Buy Consumables	Sell Forest Product	
Deobahar	55	49	55	39	266
Koronjo	81	59	115	86	228
Saraslongri	77	103	129	67	220
Kadopani	27	46	62	5	198
Dilho	81	81	80	1	240
Lutidih	83	83	83		244
Kunda	91	89	91	4	214
Harul	66	66	66	1	194
Total	561	576	681	203	1804
Percentage					
Deobahar	20.7	18.4	20.7	14.7	100.0
Koronjo	35.5	25.9	50.4	37.7	100.0
Saraslongri	35.0	46.8	58.6	30.5	100.0
Kadopani	13.6	23.2	31.3	2.5	100.0
Dilho	33.8	33.8	33.3	0.4	100.0
Lutidih	34.0	34.0	34.0	0.0	100.0

Table 4.27
Travel to Market for Various Purposes

Village	Purpose				Total Sample
	Buy Agricultural Inputs	Sell Agricultural Product	Buy Consumables	Sell Forest Product	
Kunda	42.5	41.6	42.5	1.9	100.0
Harul	34.0	34.0	34.0	0.5	100.0
Total	31.1	31.9	37.7	11.3	100.0

Source*: Primary Field Work, 2011*

The travel to market is made mostly on foot by the villagers in Harul village, followed by Dilho and Lutidih. The Kunda village has the largest proportion of bicycle users. In Simdega district, the mode to market is on foot as well as with bicycles. The travel on foot is predominant in Deobahar, Saraslongri and Kadopani village. The travel with bicycles is more in Koronjo village (Table 4.28).

Table 4.28
Travel Mode to Market Place in the Sample Villages

Village	Bicycle	Walk	Jeep	Auto/Tempo	Tractor	Car	Motorcycle	Total
Percentage								
Deobahar	29.5	57.5	0.0	13.0	0.0	0.0	0.0	100.0
Koronjo	45.8	39.3	0.0	12.4	0.5	0.5	1.5	100.0
Saraslongri	41.5	56.7	0.0	1.8	0.0	0.0	0.0	100.0
Kadopani	38.7	55.5	0.0	5.0	0.0	0.0	0.8	100.0
Dilho	3.7	92.7	0.0	3.7	0.0	0.0	0.0	100.0
Lutidih	36.5	63.5	0.0	0.0	0.0	0.0	0.0	100.0
Kunda	87.2	6.4	3.2	3.2	0.0	0.0	0.0	100.0
Harul	4.2	95.8	0.0	0.0	0.0	0.0	0.0	100.0
Total	38.3	54.9	0.3	5.8	0.1	0.1	0.4	100.0

Source*: Primary Field Work, 2011*

Table 4.29
Number of Trip by the Individuals to Markets in a Week

Villages	1	2	3	4	5	6	7	8	Total	Total trips
Saraslongri	2.82	3.52	24.65	0.00	0.70	58.45	4.93	4.93	100.00	20.31
Kadopani	2.08	27.08	68.75	2.08	0.00	0.00	0.00	0.00	100.00	6.87
Deobahar	40.00	60.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	10.73
Koronjo	8.04	35.71	11.61	16.96	0.00	27.68	0.00	0.00	100.00	16.02
Dilho	98.78	0.00	0.00	1.22	0.00	0.00	0.00	0.00	100.00	11.73
Lutidih	100.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	100.00	12.16
Kunda	17.86	80.95	1.19	0.00	0.00	0.00	0.00	0.00	100.00	12.02
Harul	98.59	1.41	0.00	0.00	0.00	0.00	0.00	0.00	100.00	10.16
Total	42.20	24.61	11.73	3.00	0.14	16.31	1.00	1.00	100.00	100.00

Source*: Primary Field Work, 2011*

The no of trips to market made by the individuals are more in Saraslongri and Koronjo in Simdega district and Lutidih and Kunda in Chatra district. Less no of trips are undertaken by the villagers in Kadopani and Harul village. The trip rates are more in Saraslongri (Table 4.29)

4.5.4 Summary of Travel Pattern to Various Facility Centres in the Sample Villages with Varying Levels of Physical Connectivity

The summary of the pattern of travel behaviour (Table 4.30) in the sample villages with varying level of physical connectivity are discussed below.

1. The mobility levels of population in Saraslongri village is high in terms of visits to the market, travel to work and travel to health facility centres outside village.
2. The travel mobility levels is high in Kunda village in terms of visits to the market and travel to work outside the village.
3. The mobility in Deobahar and Dilho village is high in terms of external travel outside the village to avail market facilities.
4. The village of Koronjo exhibit low mobility levels in terms of travel to market facilities outside the village.
5. The travel mobility of population in Kadopani and Harul village is low and pattern of travel in internal in nature for these villages.

Table 4.30
Pattern of Travel Behaviour in Sample Villages

District	Block	Village	Travel to market (proportion of visits)	Travel to Work outside Village	Travel to Any Market outside Village	Travel Health facility centres outside Village
Simdega	Bolba	Saraslongri	√ (Most)	√ □(Most)	-	√□(Most)
		Kadopani	X (Least)	X (Least)	-	X (Least)
	Thethaitangar	Deobahar	-	-	√□(Most)	-
		Koronjo	-	-	X (Least)	-
Chatra	Simaria	Dilho	-	-	√ (Most)	X (Least)
		Lutidih	-	X (Least)	X (Least)	√□(Most)
	Kunda	Kunda	√ (Most)	√□(Most)	X (Least)	X (Least)
		Harul	X (Least)	X (Least)	-	X (Least)

Source*: Primary Field Work, 2011*

4.6 Relation between Rural Accessibility and Travel Pattern

The analysis of rural transport in terms of accessibility (opportunities available) and travel behaviour (actual use) helps us to come to some broad conclusions. The villages with better levels of transport opportunities comprising of pucca roads, nearness to bus stop and nearness to block headquarter shows higher transport mobility. In the study it became evident that the villages with better levels of transport opportunities comprising of pucca road, nearness to bus stop and nearness to block headquarter make more external travels for work.

4.7 Conclusion

1. The ownership of non-motorised means of transport predominates in the rural areas of Jharkhand. It is more among the sample villages of Simdega district than Chatra district and the villages in Simdega district located in the most connected block of Bolba have higher ownership of vehicles mainly bicycles.

2. The most remotely located village in Bolba block has the highest proportion of households with bicycle ownership. Similar pattern is observed in the sample villages in Thethaitanger block, where the most remotely located village has higher proportion of households with bicycle ownership. The better means of vehicle ownership, mainly motorcycles, are significantly found among the sample villages in Chatra district than the sample villages of Simdega district. The remotely located village in Kunda block of Chatra district has minimum number of households owning both means of transport, viz., bicycles and motorcycles.

3. The personal mobility affected by the level of physical fitness has shown that the village of Saraslongri in Bolba block followed by Koronjo village in Thethaitanger block has more mobility problems as the percentage of disabled persons comprising of mainly locomotor disability are more here.

4. The personal mobility affected by the age factor, has shown that the elderly people (65 years and above) are found to be more in Koronjo and Deobahar villages of Thethaitanger block in Simdega district while in Chatra district it comprises of the villages of Lutidih in Simaria block and Harul in Kunda block.

5. The personal mobility affected by the economic condition of the household shows that the sample villages of Chatra district have lesser proportion households with BPL card and has greater opportunities to make a journey than the sample villages of Simdega district where the proportion of households with BPL card are more. The remote village in Bolba block has higher proportion of BPL households. Among the sample villages in Chatra district, the village with higher physical accessibility has lower proportion of BPL households.

6. The relative accessibility of the villages to the service centres is found to be high in the village with better physical accessibility. The sample village with better physical accessibility in Bolba block also has access to larger number of facilities located within walkable distance range of 0 to 5 km from the village location. Similar pattern is also recorded in Chatra district where the sample village in Kunda block with better physical has access to larger number of facilities located at walkable distance from the village.

7. The remotest villages in both the districts have the poorest levels of relative accessibility. The sample village which has poorer physical accessibility in Thethaitanger block of Simdega district has lower levels of relative accessibility as the number of facilities located within 0-5 km range are fewer in this village. The same is observed for the remote village- Harul village in Chatra district.

8. The village of Deobahar has the highest number of private bus service that make more trips. However, the problem for this village is that these buses do not ply on the village road but on the Simdega – Rourkella NH 23 that is 12 km away from the village. The next village with good transport provision is that of Saraslongri which is located in close proximity to the block headquarter of Bolba. In Chatra, the village of Lutidih is endowed with better bus service facilities than the other sample villages. The village of Harul is the most deprived one as has no bus service facility and villagers have to travel to Kunda which is 8 km away from Harul village to avail bus services.

9. The quality of road service from the point where buses are available is good for the villages of Koronjo, Dilho and Lutidih. While it is poor for most of the villages of Saraslongri, Kadopani, Kunda and Harul. The quality of bus service is

poor among all the sample villages. Most of them run with overcrowded passengers and make single trips from and to the village in a single day. In these villages private autos in some occasions ply at short distances from the block headquarter to village locations but they are sporadic in nature.

10. The mobility patterns of the villagers among the sample villages show that the sample villages, which have higher levels of physical connectivity such as Saraslongri village and Kunda, have higher levels of mobility. The proportion of villagers travelling to avail market facilities are more in these villages. The external travel to work centres is also high in these villages. However, in terms of the external travel behaviour to health centres, the village of Saraslongri makes the more external travel while Kunda makes the least external travel outside the village. The external mobility of the villages of Deobahar and Dilho is high for journeys made for availing market facilities.

11. The village of Koronjo exhibit low mobility levels in terms of travel to market facilities outside the village. The travel mobility of population in Kadopani and Harul village is low and pattern of travel in internal in nature for these villages.

12. The relation between rural accessibility pattern and travel mobility pattern shows that the villages with better levels of physical accessibility comprising of pucca road, nearness to bus stop and nearness to block headquarter have higher transport mobility.

Chapter 5
TRANSPORT AND REGIONAL DEVELOPMENT

5.1 Introduction

Transport played an important role in the development of the economic regions in Jharkhand since the colonial period. Prior to this period Jharkhand remained isolated mainly because of the absence of transportation linkages. Transport infrastructure developed only after its rich resources were discovered. Growth in Jharkhand was limited only to a few industrial areas and failed to percolate to lower levels of the region. "The growth of mining and industrial activities resulted into the formation of an 'enclave economy' with very little linkages with the hinterland."[1] This created disparities in the development of this region. Till recently, disparities have prevailed not only between the urban and rural areas but also between the state and the India level.

According to the World Bank, poor status of infrastructure and lack of institutional development were identified as the two major constraints to growth in Jharkhand.[2] In terms of road infrastructure provision, the state ranks the lowest in terms of road length per one lakh population and rural connectivity with pucca roads (discussed in previous chapters). The performance of the state has been poor in terms of major indicators of socio-economic development when compared to all India figures. Jharkhand ranks among the lowest only above Assam in terms of Net State Domestic Product (NSDP) and it occupied the lowest rank only above Orissa in terms of poverty ratio in the all India state level ranking in 2004-05 (Appendix V a). The relationship between infrastructure development and growth seems to be directly related to Jharkhand. Since economic and social development literally moves into the areas connected with improved transport connectivity, the development of road transport forms an essential part for over all development of the state.

The main objective of the present chapter is to study the relationship of transport development with the urban and rural attributes and regional development in Jharkhand.

[1] R. Sharan (1994): "Roots of Rural Stagnation in Jharkhand", *Social Change*, Mar-Jun, Vol. 24, Nos. 1 & 2, pp. 91-101.

[2] The World Bank (2007): *Jharkhand: Addressing the Challenges of Inclusive Development*, Report No. 36437-IN, Poverty Reduction and Economic Management, India Country Manager Unit, South Asia, Washington, DC, p.9.

The study is based on the analysis at three levels *viz.* urban level, rural district level and sample village level. For this purpose, the chapter is organized into three sections. The first section deals with the relation between transport and the urban attributes at the town level. The second section deals with the relation between transport and rural attributes at the district level. The third section deals with the relationship between transport accessibility and rural attributes at the sample village level.

Section - A

5.1 Transport and Socio - Economic Characteristics of the Urban Centres

The urban characteristics are analysed with a set of ten indicators which are broadly categorized into three aspects – demographical, social and economic. The characteristics of the structure of transport network are represented by the five transport indices that are discussed in detail in the previous chapters of the present work. The calculation on the dominant function is done for the year 1991. Required data for later periods is not available. The following indicators are used to study the relationship between transport and regional development.

Socio – economic Characteristics of the Urban Centres

The following indicators were used to analyse the socio-economic characteristics of urban centres.

- **Demographic Characteristics**

1. Population size structure
2. Population growth
3. Population density

- **Social Characteristics**

1. Male literacy
2. Female literacy

- **Economic Characteristics**

1. Male workers in household industry
2. Female workers in household industry

3. Male workers in other workers
4. Female workers in other workers
5. Dominant function of the towns

- **Transport Accessibility Indicators**

1. Direct Connectivity Index
2. Geographical Accessibility Index
3. Route Factor Index
4. Detour Index
5. Distance to Nearest Class I Town

The following methods are followed to analyse the relationship between transport accessibility and urban attributes as well as socio-economic development of the urban areas of the state:

1. Ranking of the urban attributes and the transport indicators.
2. Correlation of transport indicators with the urban attributes and the indicators of socio-economic development.

The urban characteristics are discussed first and then the relationship between the indicators of transport and urban characteristics are analysed.

5.1.1 Demographic Characteristics of the Urban Centres

According to the Census of 2001, the proportion of urban population to total population in the state stands at 22.24 percent as compared to 27.8 percent in India. The size structure of urban population when classified into six categories, shows a disparate pattern. Among the 95 towns of 2001 census, there are only ten class I cities, which have more than 1,00,000 population each. Jamshedpur (1104713 persons) and Dhanbad (1065327 persons) are the only two million cities in the state (Appendix V b). Jamshedpur forms the locational foci of industries while Dhanbad has the largest no of agglomeration towns mostly engaged in mining activities. The capital city of Ranchi with a population of 863495 is the third largest city in the state. The class I towns are mostly located in the central and eastern part of the state. The class II size category of ‘large towns’ were six in number. The class III size category forming ‘medium towns’ are 22.

Class IV, V, VI towns form the 'small town' category and are found in large number in the state (Table 5.1 and Figure 5.1).

Figure 5.1

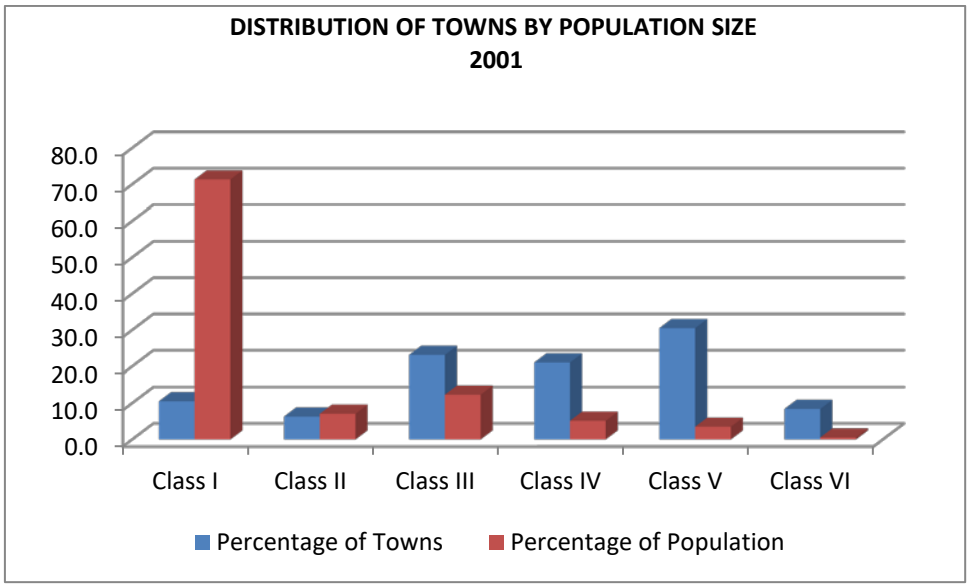


Table 5.1

Distribution of Urban Centres by Population Size, 2001

Sl. No.	Town Class	Number of Towns	Percentage of Towns	Total Population, 2001	Percentage of Population, 2001
1	Class I	10	10.5	4276072	71.3
2	Class II	6	6.3	425030	7.1
3	Class III	22	23.2	739767	12.3
4	Class IV	20	21.1	309558	5.2
5	Class V	29	30.5	210540	3.5
6	Class VI	8	8.4	32774	0.5
	Total	95	100.0	5993741	100.0

Source: *Census of India, 2001*.

The growth rate of population was high among the two million plus cities of Jamshedpur and Dhanbad in 1991-2001. Negative growth rate was recorded in about ten towns including Balkundra, Deorikalan, Chiria, Amlabad, Musabani, Giddi, Patratu, Panchet, Sini and Religara (Table 5.1). Most of these towns specialize in mining and manufacturing activities. The density of population was found to be the maximum in Dhanbad urban agglomeration, followed by the urban agglomeration towns of Jamshedpur, Chirkunda, Hazaribag, Giridih, Bokaro and Ranchi.

5.1.1.1 Relationship between Transport and Demographic Characteristics

The relationship between transport indicators and demographic characteristics of the urban centres is weak as is evident from the correlation matrix (Table 5.2). However, when the transport accessibility indices are analyzed individually, it shows that some of the larger towns have higher levels of transport accessibility in terms of more number of direct connections (refer to Table 3.1 of Chapter 3). According to Ramachandran, "there is an evident tendency for the larger centres to attract network connections as larger centres are associated with more complex functions and have the potentials for greater degree of interaction."[3] Thus, the present study has revealed some degree of association between the degree of direct connectivity and size of towns.

Table 5.2
Correlation between Transport and Demographic Characteristics

Indicators		Total Population 2001	Growth Rate 1991-2001	Population Density
Direct connectivity (Degree of Node)	Pearson Correlation	.201	.083	.057
	Sig. (2-tailed)	.051	.424	.582
Geographical Accessibility	Pearson Correlation	-.102	-.026	-.050
	Sig. (2-tailed)	.324	.802	.633
Route Factor	Pearson Correlation	-.035	.000	.013
	Sig. (2-tailed)	.738	1.000	.901
Detour Index	Pearson Correlation	.105	.092	.091
	Sig. (2-tailed)	.313	.373	.379
Distance to Nearest Class I Town	Pearson Correlation	.002	-.002	-.008
	Sig. (2-tailed)	.988	.984	.939

5.1.2 Social Characteristics of the Urban Centres

The social characteristics of the urban centres have been analysed in terms of the level of male and female literacy rate. Literacy is an important characteristic of population as improvement in literacy is important for social and economic development of the state. The levels of male (98.5 per cent) and female literacy (90.2 percent) are the highest in the town of Kalikapur, which is located near the million city of Jamshedpur (Appendix V c). Male literacy are found to be high (above 90 percent) in the towns of

[3] H. Ramachandran (1988): "Transportation and Urban Attributes: A Study of Structural Relations", in Mishra, R. P. and M. Raza (ed.): *Contributions to Indian Geography, Vol 10, Regional Development*, Heritage Publishers, New Delhi, pp. 345-365.

Meru, Sewai, Meghahatuburu, Hesla, Gumla, Hazaribag, Tati, Deoghar, Muri, Gomoh, Dumka, Chakradharpur, Mihijam, Bokaro, Barughutu, Jadugora, Ranchi and Patratu. Female literacy are high (above 80 percent) in the towns Hesla, Hazaribag, Gumla and Dumka. The lowest ranking towns showing low levels of male literacy are Rajmahal, Barajamda and Marma while the towns showing low levels of female literacy are Sijhua, Marma and Mugma towns. All these towns are located near the periphery of the state.

5.1.2.1 Relationship between Transport and Social Indicators

The relationship between transport and social indicators shows that the level of male literacy and transport accessibility are positively correlated with each other (Table 5.3). It means that the towns located close to each other (lesser travel distance) have higher male literacy rate. These towns are located in clusters mostly confined to coal mining areas in the central part of the region. However, the level of female literacy shows weak correlation with all the nodal accessibility indices.

Table 5.3
Correlation between Transport and Social Indicators

Transport connectivity index	Demographic and socio-economic attributes	Male literacy	Female literacy
Direct connectivity (degree of node)	Pearson Correlation	.022	.131
	Sig. (2-tailed)	.829	.205
Geographical accessibility	Pearson Correlation	-.216(*)	.001
	Sig. (2-tailed)	.036	.996
Route factor	Pearson Correlation	.108	-.077
	Sig. (2-tailed)	.298	.458
Detour index	Pearson Correlation	-.098	.103
	Sig. (2-tailed)	.344	.323
Distance to nearest class I town	Pearson Correlation	-.107	.027
	Sig. (2-tailed)	.303	.793

5.1.3 Economic Characteristics of the Urban Centres

The economic characteristics of the urban centres have been examined in terms of the occupational structure and the functional specialization of the urban centres. The indicators of the occupational structure comprises of ‘other workers’ and ‘workers in household industry’ which are non-primary in character. The proportion of male and female ‘other workers’ are highest in the town in Kalikapur, which is located near the industrial million city of Jamshedpur. The towns of Kharkhari, Sewai and Amlabad are the top ranking towns with regard to male ‘other workers’. The female ‘other workers are

high in the towns of Chiria, Sahnidih and Mugma. The proportion of male 'workers in household industry' are high among the towns of Hussainabad, Chatra and Dhanwar while that of female 'workers in household industry' are high among the towns of Chatra, Pakur and Dhanwar (Appendix V d).

Table 5.4
Share of Towns based on Dominant Functions in Jharkhand, 1991

Dominant Functions	No. of towns	Share of towns
Manufacturing	8	10.53
Mining & Quarrying	21	27.63
Service	22	28.95
Trade	19	25.00
Transport	6	7.89
Total	76	100

The functional classification of towns on the basis of dominant function shows the predominance of three categories of towns comprising of service towns (28.95 percent), mining and quarrying towns (27.63 percent) and trade towns (25 percent) in 1991 (Table 5.4). The dominant function of the capital city of Ranchi consists of services (Appendix V b). The majority of the towns in the state, under urban agglomerations (UA) specialize in mining and quarrying activities. Dhanbad UA has the largest number of constituent towns, specializing in mining and quarrying activities followed by trade. The towns under Deoghar UA specialize in services, Chirkunda UA and Gumia UA in manufacturing and mining, Bokaro Steel City UA in manufacturing, Phusro UA and Ramgarh UA in service and mining, Giddi UA, Barughutu UA and Kuju UA in mining, Patratu UA in mining and transport, Khelari UA in service and transport, and Jamshedpur UA in manufacturing followed by trade and transport functions.

5.1.3.1 Relationship between Transport and Economic Characteristics

The relationship between transport and occupational structure comprising of 'other workers' and 'workers in household industry' is strong. This relationship is discussed below:

1. Geographical accessibility and workers in household industry both male and female workers are positively correlated with each other while geographical

accessibility is negatively correlated with male 'other workers' and female 'other workers.' It signifies that the transport accessibility (in terms of lesser travel distances between towns) is high among the towns that have a higher proportion of 'other workers' both male and female. It is low among the towns that has a higher proportion of 'household industry workers' both male and female (Table 5.5).

2. The distance of the towns to the nearest class I town and household industry workers both male and female are positively correlated with each other while it is negatively correlated with male 'other workers'. It means that the towns that are close to class I town have a higher proportion of male workers in the 'other workers' category and a lower proportion of male and female workers in the 'household industry workers' category.

3. Route factor index and female 'other workers' are positively correlated with each other. It means that the transport accessibility is low in terms of efficiency of route in the towns that have a higher proportion of female 'other workers'.

Table 5.5
Correlation between Transport and Occupational Structure

Transport Connectivity Index	Demographic and Socio-Economic Attributes	Household industry worker Male	Household industry worker Female	Other workers Male	Other workers Female
Direct Connectivity (Degree of Node)	Pearson Correlation	.081	.062	.040	.027
	Sig. (2-tailed)	.436	.552	.699	.795
Geographical Accessibility	Pearson Correlation	.396(**)	.393(**)	-.430(**)	-.369(**)
	Sig. (2-tailed)	.000	.000	.000	.000
Route Factor	Pearson Correlation	-.147	-.198	.164	.247(*)
	Sig. (2-tailed)	.156	.055	.112	.016
Detour Index	Pearson Correlation	.090	.150	-.077	-.130
	Sig. (2-tailed)	.386	.146	.459	.209
Distance to Nearest Class I Town	Pearson Correlation	.340(**)	.349(**)	-.210(*)	-.194
	Sig. (2-tailed)	.001	.001	.041	.059

5.1.3.2 Relationship between Transport and Functional Specialization of Towns

The relationship between transport and functional specialization of the towns are discussed below:

1. Trade towns and direct connectivity (node degree) are positively correlated with each other. The relation reveals that the towns specializing in trading activities have higher levels of transport accessibility in terms of more number of direct connectivity with the associated towns in the network (Table 5.6).

Table 5.6
Correlation between Transport and Dominant Function of the Urban Centres, 1991

Transport Connectivity Index	Dominant Function	Livestock forestry fishing	Mining and quarrying	Manufacturing	Trade and commerce	Transport	Construction	Services
Direct Connectivity (Degree of Node)	Pearson Correlation	.246(*)	-.151	.034	.327(**)	-.214	.159	.083
	Sig. (2-tailed)	.032	.193	.768	.004	.064	.169	.478
Geographical Accessibility	Pearson Correlation	.218	-.327(**)	-.031	.367(**)	.040	-.070	.250(*)
	Sig. (2-tailed)	.059	.004	.791	.001	.729	.545	.029
Route Factor	Pearson Correlation	-.176	.182	-.023	-.280(*)	.111	.165	-.155
	Sig. (2-tailed)	.129	.115	.842	.014	.342	.154	.181
Detour Index	Pearson Correlation	.241(*)	-.306(**)	.035	.422(**)	-.066	-.081	.197
	Sig. (2-tailed)	.036	.007	.762	.000	.569	.487	.088
Distance from Class I Towns	Pearson Correlation	.090	-.182	.060	.216	.049	-.026	.054
	Sig. (2-tailed)	.438	.115	.604	.062	.672	.825	.644

The relationships between transport indicators and socio economic characteristics of the urban centres have shown that both the components of transport and socio-economic indicators are strongly correlated with each other in some form or the other.

2. Towns specializing in trading activities and services are positively correlated with the geographical accessibility while towns specializing in mining and quarrying activities are negatively correlated with geographical accessibility. It means that towns that are located close to each other (relative distance is less) specialize in mining and quarrying activities. Towns that are located further away from each other specialize in trade and service activities.

3. Trade towns and route factor index are negatively correlated with each other. It signifies that transport accessibility (the efficiency of transport network) is high among the towns specializing in trading activities.

4. Towns specializing in trade and livestock, forestry and fishing activities are positively correlated with Detour index while towns specializing in mining and quarrying activities are negatively correlated with this index. This relationship implies that transport accessibility (in terms of efficiency of the transport network) are high in the non-mining towns mostly specializing in trade followed by livestock, forestry and fishing activities

Section – B

5.2 Transport and Rural Socio – Economic Characteristics of the Districts

The objective of the present section is to study the relationship between transport and rural characteristics of the 24 districts for the year 2001.The following indicators were used to study the rural characteristics of the districts.

Agricultural Sector

1. Percentage of net sown area to total reporting area
2. Cropping intensity (total cropped area/net sown area*100)
3. Percentage of total irrigated area to total cropped area

Social Sector

1. Male literacy rate
2. Female literacy rate

Non-Primary Sector

1. Percentage of workers in household industry to total workers
2. Percentage of workers in other workers to total workers

Infrastructure Facilities

1. No of primary health centre (PHC) per lakh population
2. No of primary health sub centres (PHSC) per lakh population
3. Percentage of villages with primary schools
4. Percentage of villages with middle schools
5. Percentage of villages with bank facilities
6. Percentage of villages with credit societies
7. Percentage of villages with post, telegraph, and telephone facilities

Basic Amenities Sector

1. Percentage of villages with safe drinking water
2. Percentage of villages with electricity facilities
3. Percentage of villages with sanitation facilities

Economic Sector

1. Percentage of BPL households to total households
2. Per capita income

Transport Indicators (for the district level analysis)

1. Village with access to pucca road
2. Villages with bus services
3. Ownership of bicycles to total household
4. Ownership of motorcycles to total household
5. Ownership of car/ jeep to total household

The relationship between the transport indicators and the rural attributes as well as with rural socio-economic indicators of development are analysed by the following methodology:

1. Ranking of the rural attributes and transport indicators.
2. Correlation of transport indicators with the rural attributes and the indicators of rural socio-economic development of the districts.

The rural characteristics of the districts are discussed first and then their relationship with the transport indicators are analysed.

5.2.1 Agricultural Sector

The agricultural development have been represented by percentage of net sown area to total reporting area, cropping intensity, and percentage of total irrigated area to total cropped area. The cropping intensity is found to be high in the districts of Godda, Pakur and Lohardaga while it is low in Pashchimi Singhbhum, Kodarma and Latehar districts in 2002-2003 (Table 5.7). Irrigation is regarded as an important indicator for agricultural development. Jharkhand fares very poorly it terms of irrigation provisions to agricultural lands. According to World Bank, lack of irrigation facilities is another key infrastructural bottleneck to growth in Jharkhand. As a consequence of slow growth in

irrigation facilities, the agricultural sector has not been able to perform to its potential both in terms of food production as well as crop diversification.[4] Among the districts, Chatra is the best performing (44.38 percent) in terms of irrigation facilities while the poorly performing districts are Pakur (6.27 percent) and Pashchimi Singhbhum (7.77 percent).

Table 5.7

Agricultural Indicators of Cropping Intensity and Total Irrigated Area in the Districts 2001-2003 (in Hectares)

District Name	Reporting Area For Land Utilisation Statistics	Net Sown Area	Total Cropped Area	Net Sown Area (%) (NSA)	Total Cropped Area (%) (TCA)	Cropping Intensity = TCA/ NSA*100	Rank	Total Irrigated Area (%)	Rank
Bokaro	288992	38447	40449	13.30	14.00	105.21	19	22.89	6
Chatra	382050	49174	51464	12.87	13.47	104.66	20	44.38	1
Deoghar	243695	69709	79590	28.61	32.66	114.17	15	17.47	11
Dhanbad	204161	22597	26770	11.07	13.11	118.47	14	34.50	2
Dumka	377523	99223	105380	26.28	27.91	106.21	18	22.19	7
Garhwa	428826	56675	75266	13.22	17.55	132.80	4	29.49	4
Giridih	493248	66447	74438	13.47	15.09	112.03	16	12.63	17
Godda	231842	55203	83507	23.81	36.02	151.27	1	16.87	12
Gumla	534318	122570	156458	22.94	29.28	127.65	7	11.22	20
Hazaibag	571312	67905	90033	11.89	15.76	132.59	5	18.32	10
Jamtara	180704	36784	46036	20.36	25.48	125.15	9	14.26	14
Khunti*				26.53	32.03	120.71	10	13.97	15
Kodarma	156998	22097	22446	14.07	14.30	101.58	23	21.35	8
Latehar	383490	50565	51895	13.19	13.53	102.63	21	23.75	5
Lohardaga	153622	39830	55178	25.93	35.92	138.53	3	14.73	13
Pakur	180557	41700	58515	23.10	32.41	140.32	2	6.27	24
Palamu	460431	88963	106859	19.32	23.21	120.12	12	33.13	3
Pashchimi Singhbhum	567769	135840	137670	23.93	24.25	101.35	24	7.77	23
Purbi Singhbhum	556697	85632	93878	15.38	16.86	109.63	17	10.65	22
Ramgarh*				11.89	15.76	132.59	6	10.67	21
Ranchi	758394	201230	242900	26.53	32.03	120.71	11	12.47	18
Sahibganj	198780	37357	44690	18.79	22.48	119.63	13	20.11	9
Seraikela	237232	50470	63841	21.27	26.91	126.49	8	13.71	16
Simdega	379434	97528	100059	25.70	26.37	102.60	22	11.34	19

Source: i) *Directorate of Economics and Statistics, Ministry of Agriculture, Govt. of India, 2002-03, http:lus.dacnet.nic.in/dt_lus.aspx*
ii*) Village directory , 2001*
*values have been taken from parent districts

[4] The World Bank (2007): *Op. cit.,* p. 12.

5.2.1.1 Relation between Transport and Agricultural Sector

The indicators of transport are not directly correlated with the indicators of agriculture at the rural level in the districts (Table 5.8). The percentages of net sown area are negatively correlated with households having ownership of four wheeler motor vehicles (car/jeep). This relationship shows that with more access to better personal modes of travel, the dependence on agricultural sector decreases. It may also be inferred that transport vehicle ownership facilitates economic diversification.

Table 5.8
Correlations between transport accessibility and agricultural sector

Indicators		Approach to Pucca Road	Bus Facilities	Ownership of Bicycles	Ownership of Motorcycles	Ownership of Car/Jeep
Net Sown	Pearson Correlation	-.309	.048	.240	-.382	-.656(**)
	Sig. (2-tailed)	.141	.822	.258	.065	.000
	N	24	24	24	24	24
Total Irrigated Area (%)	Pearson Correlation	.064	-.188	-.370	.012	.326
	Sig. (2-tailed)	.765	.378	.075	.954	.120
	N	24	24	24	24	24
Cropping Intensity = TCA/ NSA*100	Pearson Correlation	.149	-.240	.014	-.021	-.095
	Sig. (2-tailed)	.488	.258	.948	.921	.658
	N	24	24	24	24	24

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5.2.2 Social Characteristics

The level of literacy is an important social development parameter of overall progress. The better off districts in terms of male literacy consist of Dhanbad and Ranchi (above 70 percent) followed by the districts of Ramgarh, Kodarma, Saraikela-Kharsawan, Purbi Singhbhum, Hazaribag and Bokaro (above 65 percent, see Table 5.9). The poorly performing districts in this regard are Pakur and Sahebganj. With regard to female literacy levels the better performing districts are Simdega, Dhanbad and Ranchi while the poorly performing district is that of Pakur followed by Garhwa, Sahebganj and Giridih.

Table 5.9

Rural Literacy in Jharkhand, 2001

District	Total	Male	Rank	Female	Rank
Bokaro	47.70	65.06	8	28.79	13
Chatra	41.25	53.90	20	28.06	15
Deoghar	44.55	62.22	12	25.18	18
Dhanbad	58.22	74.50	1	40.08	2
Dumka	44.36	59.17	16	29.04	12
Garhwa	37.72	53.10	21	21.18	23
Giridih	41.99	60.28	15	23.53	21
Godda	41.62	56.26	19	25.65	17
Gumla	49.05	61.80	14	36.24	5
Hazaribag	49.62	65.61	7	33.89	9
Jamtara	47.57	63.87	9	30.58	11
Khunti	49.36	62.60	11	36.20	6
Kodarma	47.40	67.71	4	27.87	16
Latehar	39.00	52.56	22	24.79	20
Lohardaga	49.04	63.85	10	34.09	8
Pakur	28.25	37.95	24	18.14	24
Palamu	44.09	58.73	17	28.22	14
Pashchimi Singhbhum	40.46	56.34	18	24.80	19
Purbi Singhbhum	51.79	66.95	6	36.08	7
Ramgarh	54.08	68.73	3	38.40	4
Ranchi	55.33	70.38	2	39.70	3
Sahebganj	33.41	43.84	23	22.35	22
Saraikela-Kharsawan	49.59	67.11	5	31.52	10
Simdega	51.09	62.07	13	40.24	1

Source: *Census of India, PCA, 2001*

5.2.2.1 Relation between Transport and Social characteristics

The indicators of transport and social indicators of development are strongly related with each other (Table 5.10). These relationships are discussed below:

1. Female and male literacy rates are positively correlated with approach to pucca road. It means that female and male literacy rates are higher in the districts which have higher levels of rural connectivity with pucca roads.
2. Female and male literacy rates are positively correlated with ownership of transport vehicles including bicycles, motorcycles, car or jeep. It reflects that male and female literacy rates are higher in districts that have higher proportion of rural households owning personal modes of conveyance either non-motorised transport

vehicles such as bicycles or motorised transport vehicles such as motorcycle, car or jeep.

Thus, rural connectivity and vehicle ownership plays an important role in social development in the rural areas of Jharkhand.

Table 5.10
Correlation Between Transport Accessibility and Social Indicator

Indicators		Approach to Pucca Road	Bus Facilities	Ownership of Bicycles	Ownership of Motorcycles	Ownership of Car/Jeep
Male literacy	Pearson Correlation	.474(*)	.109	.774(**)	.780(**)	.671(**)
	Sig. (2-tailed)	.019	.613	.000	.000	.000
	N	24	24	24	24	24
Female literacy	Pearson Correlation	.536(**)	.287	.711(**)	.633(**)	.437(*)
	Sig. (2-tailed)	.007	.174	.000	.001	.033
	N	24	24	24	24	24

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5.2.3 Economic Characteristics

The economic characteristics of the districts of Jharkhand have been evaluated in terms of two indicators viz. percentage of BPL households to total households and per capita income (in rupees). As the data of BPL households and per capita income is not available separately for rural areas, district wise, the data of total BPL households and total per capita income have been considered for analysis. However, both these database mostly refers to rural characteristics as rural population constitutes 77.76 percent of the total population in the state. These two indicators are taken as proxy to the levels of rural poverty in the districts. The per capita income is high mostly among the rural population in the industrial and mining districts of Dhanbad, East Singhbhum, Pakur and Bokaro. The poor performing districts in terms of per capita income are those of Godda, Giridih, Chatra and Palamu (Table 5.11 (a)). The BPL households are found to be the maximum (80 percent) in Chatra district, followed by Saraikela-Kharsawan (76.90 percent), Palamu (74.63 percent), Sahebganj (71.94 percent) and Simdega (71.50 percent) (Table 5.11 (b)).

Table 5.11 (a)

District wise Per Capita Income in Jharkhand, 2002-03 (at Current Prices)

Sl. No.	District	Per Capita Income (Rs.)
1	Bokaro	15281
2	Chatra	9072
3	Deoghar	12942
4	Dhanbad	21907
5	Dumka	10571
6	East Singhbhum	17910
7	Garhwa	7606
8	Giridih	9063
9	Godda	8786
10	Gumla	11454
11	Hazaribag	14924
12	Jamtara	10022
13	Kodarma	12826
14	Latehar	10396
15	Lohardaga	10244
16	Pakur	17197
17	Palamu	9106
18	Ranchi	15786
19	Sahebganj	15158
20	Saraikela-Kharsawan	14148
21	Simdega	10587
22	West Singhbhum	14393
Jharkhand		13688

Note :- 1. Hazaribag includes Ramgarh

2. Ranchi includes Khunti

Source: *Directorate of Economics & Statistics, Dept. of Planning and Development, Govt. of Jharkhand,* http://www.desjharkhand.nic.in/stateincom.html

Table 5.11 (b)

Percentage of BPL Families in Jharkhand

District	2002-07, number of BPL households *	Total No of HHs**	Percentage of BPL Households
Bokaro	82,665	3,23,718	25.54
Chatra	1,04,880	1,31,022	80.05
Deoghar	81,262	1,92,101	42.30
Dhanbad	1,35,842	4,41,141	30.79
Dumka	1,25,701	2,20,041	57.13
Garhwa	1,07,215	1,78,404	60.10
Giridih	1,76,855	3,04,437	58.09
Godda	1,17,719	1,96,203	60.00
Gumla	87,546	1,55,389	56.34
Hazaribagh+Ramgarh	2,22,810	4,00,332	55.66
Jamtara	82,070	1,16,572	70.40
Kodarma	51,282	80,106	64.02
Latehar	53,417	1,04,289	51.22
Lohardaga	36,355	68,653	52.95
Pakur	90,007	1,32,915	67.72
Palamu	1,90,158	2,54,818	74.63
Pashchimi Singhbhum	1,17,918	2,46,530	47.83
Purbi Singhbhum	1,52,560	3,66,905	41.58
Ranchi+Khunti	2,07,187	5,07,696	40.81
Sahebganj	1,25,342	1,74,221	71.94
Saraikela-Kharsawan	1,28,354	1,66,912	76.90
Simdega	71,635	1,00,185	71.50
Jharkhand	25,48,780	48,62,590	52.42

Source: * *http://jharkhand.nic.in/bpl_list.html* in Debroy, B., L. Bhandari and V. Singh (2011): *Transforming Jharkhand: The Agenda For Action: Report of the Chief Minister's Committee for the Development of Jharkhand*,, Govt. of Jharkhand, Ranchi.

** *Census of India, 2011, Jharkhand, Household and Amenities Table*.

5.2.3.1 Relationship between Transport and Economic Characteristics

The relationship between transport and economic characteristics has shown that a higher level of rural connectivity with pucca road is positively correlated with the per capita income of the districts (Table 5.12). Since the per capita income has been taken as a proxy for the levels of poverty, the relationship implies that deficiency of rural connectivity is related with higher poverty levels in the rural areas. Similar relationship

has been cited in other studies.[5] In India, studies have shown that rural poverty reductions are largely related to improvements in road infrastructure[6] and in Jharkhand most of the districts that are 'food insecure' have poor rural connectivity.[7]

The ownership of transport vehicles shows a direct relationship with poverty levels. The ownership of motorised transport vehicles comprising of motorcycles and cars or jeep is more when the per capita income is more and the percentage share of BPL households is small. Similarly, the ownership of bicycles is more when the percentage share of BPL households is small.

Thus, rural connectivity and vehicle ownership plays an important role in economic development of the rural areas in Jharkhand.

Table 5.12
Correlation between Transport and Economic (poverty) Indicators

Indicators		Approach to Pucca Road	Bus Facilities	Ownership of Bicycles	Ownership of Motorcycles	Ownership of Car/Jeep
Per Capita Income (Rs.)	Pearson Correlation	.458(*)	-.066	.263	.643(**)	.455(*)
	Sig. (2-tailed)	.024	.759	.214	.001	.026
	N	24	24	24	24	24
Percentage of BPL Households	Pearson Correlation	-.329	-.029	-.413(*)	-.620(**)	-.435(*)
	Sig. (2-tailed)	.116	.893	.045	.001	.033
	N	24	24	24	24	24

5.2.4 Non-Primary Sector

The non-primary sector comprises of 'other workers' and 'workers in household industry'. The districts of Deoghar, Pashchimi Singhbhum and Pakur show a high proportion of 'workers in household industry'. The workers under the 'other workers' category are high in the district of Dhanbad. The other districts, that are significant in this category, are Bokaro, Ramgarh and Kodarma (Table 5.13).

[5] J. Rodrigue, C. Comtois and B. Slack (2009): *The Geography of Transport Systems*, 2nd edition, Routledge, Taylor & Francis Group, London and New York, p. 203.

[6] S. Thorat, S. Fan and P. Hazell (1999): *Linkages between Government Spending, Growth and Poverty in Rural India*, International Food Policy Research Institute, Research Report 110, Washington, D.C.

[7] Institute for Human Development and United Nation Food Programme (2008): *Food Security Atlas of Rural Jharkhand*, Institute for Human Development, New Delhi.

Table 5.13
Workers in Non-Primary Sector in the Sample Villages, 2001

District	Household industry workers	Rank	Other workers	Rank
Bokaro	5.04	8	36.77	2
Chatra	3.56	18	13.70	19
Deoghar	10.63	1	25.20	11
Dhanbad	3.98	12	68.68	1
Dumka	4.84	10	13.59	20
Garhwa	2.91	23	16.59	17
Giridih	3.85	14	27.31	9
Godda	5.75	5	18.05	15
Gumla	3.77	16	9.38	22
Hazaribag	3.41	19	28.80	6
Jamtara	5.43	6	18.69	14
Khunti	3.10	22	9.23	23
Kodarma	2.88	24	35.99	4
Latehar	3.84	15	16.84	16
Lohardaga	3.27	20	12.87	21
Pakur	7.71	3	27.52	8
Palamu	3.20	21	20.14	13
Pashchimi Singhbhum	7.79	2	15.37	18
Purbi Singhbhum	4.95	9	28.77	7
Ramgarh	3.95	13	36.37	3
Ranchi	3.61	17	21.11	12
Sahebganj	6.34	4	28.83	5
Saraikela-Kharsawan	5.05	7	25.76	10
Simdega	4.06	11	7.99	24

Source: *Census of India, 2001*

5.2.4.1 Relationship between Transport Accessibility and Workers in Non-Primary Sector

The relationship between transport accessibility and workers in non-primary activities shows a positive correlation between the two components. The districts which have higher levels of rural connectivity with pucca roads are strongly correlated with workers in the 'other workers' category. A similar study in the Mewat region has established a positive relationship between transportation and non-primary activities.[8] The ownership of motorised (motorcycles and car or jeep) transport vehicles are positively correlated with 'other workers' (Table 5.14). Thus, the analysis shows that rural connectivity and ownership of personal modes of conveyance promotes the development of non-primary activities.

[8] M.S. Mondal (2004): "Transportation Accessibility and Non-Primary Activities- A Case Study of Mewat Region", *Indian Journal of Regional Science,* Vol XXXVI, No.2, pp. 59-67.

Table 5.14
Correlation between transport Accessibility and Workers in Non-Primary Sector

Indicators		Approach to pucca road	Bus facilities	Ownership of bicycles	Ownership of motorcycles	Ownership of car/jeep
Workers in household industry	Pearson Correlation	-.353	-.153	-.053	-.172	-.372
	Sig. (2-tailed)	.090	.476	.806	.422	.073
	N	24	24	24	24	24
Other workers	Pearson Correlation	.597(**)	-.190	.080	.763(**)	.801(**)
	Sig. (2-tailed)	.002	.374	.710	.000	.000
	N	24	24	24	24	24

** Correlation is significant at the 0.01 level (2-tailed).

5.2.5 Infrastructure Facilities

The investment in infrastructure and the associated provision of services are integral to the process of development.[9] At the present level, the indicators of infrastructural facilities comprises of social, economic and service infrastructure. The social infrastructure consists of health services such as primary health centres and primary health sub-centres and education services such as primary schools and secondary schools. The economic infrastructure consists of bank facilities and credit societies that are available to the villages in the districts. The service infrastructure consists of post, telegraph and telephone facilities.

The individual ranks of the districts for each infrastructural facility are aggregated in order to have a composite rank of the infrastructural facilities in the state (Table 5.15). According to the composite ranking, Simdega district tops the list with regard to the availability of infrastructural facilities to its rural areas. The districts following Simdega in the ranking order are those of Gumla, Ranchi and Lohardaga. The poorly performing districts are Deoghar, Chatra and Jamtara.

[9] S. Wanmali and Y. Islam (1995): "Rural Services, Rural Infrastructure and Regional Development in India", *The Geographical Journal*, Vol. 161, No. 2. Jul., pp. 149-166.

Table 5.15

Infrastructure Facilities Available Rural Districts, 2001

District	Number Per Lakh Population								Percentage of Village with						Summation Of Ranks
	Primary Health Centre	Rank	Primary Health Sub Centre	Rank	Primary Schools	Rank	Secondary Schools	Rank	Bank Facility	Rank	Credit Societies	Rank	Post, Telegraph	Rank	
Simdega	2.7	7	17.1	2	75.72	2	24.72	1	6.2	3	6.7	7	24.5	2	24
Gumla	3.3	4	18.2	1	71.5	6	18.96	5	4.7	5	3.9	11	18.6	6	38
Ranchi	2.5	10	8.7	7	71.49	7	20.42	3	6.4	2	5.4	8	21.2	4	41
Lohardaga	3.5	3	16	3	72.16	5	19.32	4	3.7	11	4.8	10	20.2	5	41
Ramgarh	1.2	22	7	11	72.73	4	14.94	10	8.1	1	11.7	4	27.6	1	53
Bokaro	1.6	20	5.5	16	77.62	1	18.36	6	4.7	6	12.7	3	23.7	3	55
Kodarma	3.2	5	7.8	8	51.14	18	8.75	18	5.3	4	14.4	2	9.9	13	68
Dhanbad	1.7	18	5.2	18	63.16	10	16.32	8	4	9	16.9	1	15.9	7	71
Saraikela-Kharsawan	4.2	1	7.4	9	60.9	11	12.74	13	3.7	12	3.3	13	9	14	73
Hazaribag	2.5	8	3.5	22	59.76	12	14.49	11	4.1	8	8.1	5	14.3	9	75
Garhwa	1.8	17	5.4	17	65.97	9	18.07	7	3.4	14	5.4	9	14.7	8	81
Pashchimi Singhbhum	2.7	6	5.7	14	74.5	3	20.74	2	2.3	20	2.7	17	6.3	22	84
Khunti	2	13	13.6	4	55.04	15	12.86	12	2.9	15	3.1	15	10.5	12	86
Palamu	2.5	9	2.8	23	55.12	14	12.67	14	3.9	10	3.1	14	13.4	10	94
Latehar	1.7	19	10.7	5	70.6	8	15.7	9	2.1	23	1.7	24	12.6	11	99
Giridih	1.6	21	5.6	15	48.66	20	8.73	19	4.2	7	7.3	6	8.7	16	104
Godda	2.4	11	6.6	12	54.62	16	10.96	16	2.6	18	2.3	20	9	15	108
Dumka	3.8	2	10.1	6	45.16	22	8.4	21	2.1	24	2.7	18	8.6	17	110
Pakur	2	14	7.1	10	52.84	17	7.27	23	2.9	16	2.5	19	7.3	19	118
Purbi Singhbhum	0.9	24	6.6	13	56.27	13	12.05	15	2.2	21	1.9	22	8.5	18	126
Sahebganj	1.9	15	4.7	20	45.83	21	8.65	20	2.6	19	2.9	16	7.2	20	131
Jamtara	2.2	12	4.4	21	49.3	19	8.96	17	2.2	22	1.9	23	6.9	21	135
Chatra	1.1	23	1.6	24	41.55	23	7.74	22	3.5	13	3.4	12	5.6	24	141
Deoghar	1.8	16	4.9	19	32.6	24	6.62	24	2.7	17	1.9	21	6.3	23	144

Source: *Village Directory, Census of India, 2001*

5.2.5.1 Relation between Transport and Infrastructure Facilities

The relation between transport on the one hand and social, economic and service infrastructure infrastructures on the other are positively related. Among the social infrastructure facilities the educational infrastructure provisions are strongly correlated with rural connectivity with pucca road and bus service facilities in the village at the district level (Table 5.16). On the other hand health infrastructure shows no relation with transport indicators. However, with poor levels of rural connectivity, the access to health facilities decreases. As a matter of fact Jharkhand is among the poorest among all Indian states with regard to rural health care provisions and almost all the districts in the state have very poor access to health care facilities as there is one PHC for every 58 villages in Jharkhand, while in Kerala there is one for every one and half villages. [10] The indicator of

[10] Institute for Human Development and United Nation Food Programme (2008), *Op. cit.*, p. 59.

the ownership of motorised transport vehicles mainly motorcycles and car or jeep are positively correlated with economic infrastructure facilities such as provision of bank facilities and credit societies in the village. Thus, the economic and service infrastructure facilities are strongly dependent on rural connectivity with pucca road and motorised vehicle ownership.

Table 5.16
Correlation between Transport Accessibility and Infrastructure Facilities

Indicators		Approach to Pucca Road	Bus Facilities	Ownership of Bicycles	Ownership of Motorcycles	Ownership of Car/Jeep
Primary Health Centre	Pearson Correlation	-.011	.005	.163	-.191	-.245
	Sig. (2-tailed)	.960	.982	.448	.373	.249
	N	24	24	24	24	24
Primary Health Sub Centre	Pearson Correlation	.089	.305	.352	-.082	-.270
	Sig. (2-tailed)	.680	.147	.092	.702	.201
	N	24	24	24	24	24
Primary Schools	Pearson Correlation	.556(**)	.544(**)	.272	.318	.200
	Sig. (2-tailed)	.005	.006	.198	.130	.348
	N	24	24	24	24	24
Secondary Schools	Pearson Correlation	.488(*)	.599(**)	.347	.232	.127
	Sig. (2-tailed)	.016	.002	.097	.275	.555
	N	24	24	24	24	24
Bank Facility	Pearson Correlation	.521(**)	.403	.288	.432(*)	.456(*)
	Sig. (2-tailed)	.009	.051	.173	.035	.025
	N	24	24	24	24	24
Credit Societies	Pearson Correlation	.704(**)	.068	.211	.733(**)	.848(**)
	Sig. (2-tailed)	.000	.752	.321	.000	.000
	N	24	24	24	24	24
Post, Telegraph and Telephone Facility	Pearson Correlation	.643(**)	.487(*)	.376	.466(*)	.376
	Sig. (2-tailed)	.001	.016	.071	.022	.070
	N	24	24	24	24	24

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

5.2.6 Basic Amenities Sector

The availability of basic amenities at the rural level is an important measure of the level of human development. According to NSS data, the access to electricity in rural Jharkhand is extremely low at 11 percent compared to 48 percent for rural India.[11] The

[11] The World Bank (2007): *Op. cit.,* p. 49.

present study shows that Dhanbad is the only district which has 46.8 percent of the rural households with electricity facilities (Table 5.17). The poorly performing districts with regard to rural electricity provisions are Simdega, Pakur and Latehar districts. In terms of sanitation facilities, the better performing districts are Dhanbad, Ranchi, Khunti and Palamu while the poorly performing districts are those of Simdega, Jamtara and Garhwa. Lastly the districts showing high level of performance in terms of rural households availing safe drinking water facilities are Pakur, Jamtara and Sahebganj. On the other hand the districts of Giridih, Hazaribag, Ramgarh and Gumla are poor in terms of provision of safe drinking water to the rural household.

Table 5.17

Basic Amenities in the Rural Districts, 2001

Districts	Household with basic amenities					
	Electricity	Rank	Sanitation	Rank	Safe drinking water	Rank
Bokaro	16.3	2	7.5	6	26.2	17
Chatra	4.0	17	5.6	11	30.7	15
Deoghar	8.3	8	4.3	16	35.7	13
Dhanbad	46.8	1	18.8	1	37.2	12
Dumka	4.4	14	4.6	15	46.7	6
Garhwa	4.0	16	3.1	20	46.0	7
Giridih	5.9	10	5.1	14	11.8	22
Godda	6.7	9	6.5	10	40.1	11
Gumla	3.5	19	4.1	17	14.8	20
Hazaribag	13.2	4	7.6	5	13.7	21
Jamtara	4.2	15	3.1	21	58.7	2
Kodarma	14.9	3	7.0	7	20.0	18
Khunti*	12.4	6	8.5	2	31.8	14
Latehar	3.5	20	5.5	13	43.7	9
Lohardaga	4.6	13	5.5	12	26.5	16
Pakur	3.4	21	3.6	19	66.6	1
Palamu	5.3	11	8.1	3	41.2	10
Pashchimi Singhbhum	4.8	12	3.8	18	53.1	4
Purbi Singhbhum	13.0	5	7.8	4	45.0	8
Ramgarh*	13.2	4	7.6	5	13.7	21
Ranchi	12.4	6	8.5	2	31.8	14
Sahebganj	3.8	18	6.8	8	55.5	3
Saraikela	10.4	7	6.5	9	49.8	5
Simdega	1.7	22	2.8	22	17.8	19

Source: *Census of India 2001, Household Table*

5.2.6.1 Relationship between Transport and Basic Amenities

The approach to pucca road and access of the village to electricity is positively correlated with each other (Table 5.18). The rural households with availability of

electricity facility are positively correlated with households having ownership of motorized transport vehicles mainly motorcycles and car or jeep. A similar pattern of relationship is observed between rural connectivity with pucca road and access to sanitation facilities and between rural connectivity with pucca road and ownership of motorized transport vehicles. However, the availability of safe drinking water has weak correlation with rural connectivity and transport vehicle ownership. Thus, it could be inferred that the rural areas that are connected with pucca roads are more developed than the remote areas with no pucca road with regard to the availability of basic amenities, specially electricity and sanitation facility. It could also be analyzed that the connected areas provides an opportunity for interactions (internal as well as external) thereby creating better awareness, willingness and affordability to avail the basic amenities.

Table 5.18
Correlation between Transport Accessibility and Access to Basic Amenities

Villages with		Approach to Pucca Road	Bus Facilities	Ownership of Bicycles	Ownership of Motorcycles	Ownership Of Car/Jeep
Electricity Facility	Pearson Correlation	.606(**)	-.034	.325	.741(**)	.680(**)
	Sig. (2-tailed)	.003	.880	.139	.000	.000
	N	22	22	22	22	22
Sanitation Facility	Pearson Correlation	.609(**)	-.010	.217	.746(**)	.701(**)
	Sig. (2-tailed)	.003	.964	.332	.000	.000
	N	22	22	22	22	22
Safe Drinking Water Facility	Pearson Correlation	.225	.109	.255	.067	-.076
	Sig. (2-tailed)	.313	.628	.253	.767	.737
	N	22	22	22	22	22

** Correlation is significant at the 0.01 level (2-tailed).

Section - C

5.3 Transport and Socio-Economic Characteristics of the Sample Villages

The objective of the present section is to study the relationship between transport and socio-economic characteristics of the 8 sample villages in 2011. The analysis is based on information collected from primary survey. The socio-economic attributes of the villages are discussed and their relationship with transport accessibility is analyzed.

The characteristics of the sample villages are discussed under the broad sub groups of demographic, social, economic and agricultural sectors. The components of each of these subgroups are listed below:

Demographic Sector

1. Population Density
2. Social Composition
3. Religious Composition

Social Sector

1. Literacy Rate
2. Drop-out Rate
3. Sex Ratio

Economic Sector

1. BPL Category
2. Dependency Ratio
3. Occupational Structure

Agricultural Sector

1. Total Cropped Area to Total Reporting Area (in percentages)
2. Total Irrigated Area to Total Cropped Area (in percentages)

The dependency ratio refers to the number of children aged 0-14 years plus the number of persons aged 65 years or over per 1000 persons aged 15-64 years.

The relation between the socio-economic characteristics and transport at the sample village level is studied following two approaches:

1. Association of socio-economic indicators are examined in relation to the following transport accessibility indicators using simple correlation:
   a) Ownership of vehicle –i)bicycles ii)motorcycles iii)car/jeep
   b) Transport provisions-i)number of buses ii) number of trips made by the buses

2. Association of socio-economic indicators are examined in the backdrop of the following characteristics of the villages:

i) Connectivity of the village with pucca road

ii) Proximity of the village to bus stop (within 0-5 km)

iii) Proximity of the village to block headquarter (within 0-5 km)

5.3.1 Demographic Characteristics of the Sample Villages

The village wise population composition shows a larger share of the working age-group (between 14 to 60 years) population in all the sample villages (Table 5.19). The share of people in working age group are more in Saraslongri and Kadopani villages of Bolba block followed by Koronjo village in Thethaitanger block both in Simdega district. Deobahar village had the least share of persons in the working age-group. The old age population (above 60) is more in Koronjo and Deobahar villages of Thethaitanger block of Simdega district. The share is the least in Kadopani and Saraslongri villages of Bolba block of Simdega district.

The share of school enrolled chidren is the highest in Deobahar village while it is least in Koronjo village. Children below 5 years of age, classified as pre-school children are the lowest in Kadopani and Saraslongri village. The concentration of population in this category is recorded to be high in all the sample villages of Chatra district.

Table 5.19
Percentage of Pre-School, School Going, Working Age Group and Old Age Population in the Sample Villages

Villages	Pre School Children (below 5 years)	School Going Children (5-14 years)	Working Age Group (14-60 years)	Old Age Population (above 60 years)	Total
Saraslongri	6.8	17.3	74.1	1.8	100
Kadopani	2	20.2	77.8	1.52	100
Deobahar	11.3	26.7	55.6	6.4	100
Koronjo	14	14.9	64	7	100
Dilho	12.9	22.1	61.7	3.3	100
Lutidih	15.6	18	60.7	5.7	100
Kunda	15.4	22.9	59.8	1.9	100
Harul	16	19.1	60.8	4.1	100
Total	11.9	20.3	63.9	3.9	100

Source: Primary Survey, 2011

5.3.1.1 Population Density

The density of population is high in all the sample villages of Chatra. However, the remote village of Harul has low density (Table 5.21). The sample villages of Simdega district have low density of population. The variations of density at the village level could

be attributed to the level of economic opportunities that are available as "the actual density of population of a region depends on the supporting capacity of the region that are related to the level of economic prosperity."[12]

Table 5.20
Population Density and Persons per Households among the Sample Villages

Villages	Area (sq. km)	Total Household	Total Population	Population density	Persons per household
Koronjo	1035	202	1065	1.03	5
Deobahar	1126	254	1275	1.13	5
Kadopani	2670	436	2422	0.91	6
Saraslongri	780	86	460	0.59	5
Dilho	221	140	837	3.79	6
Lutidih	431	222	1188	2.76	5
Harul	245	36	227	0.93	6
Kunda	1057	470	2453	2.32	5

Source: *Household Survey, Primary Field Work, 2011*

The sample villages of Chatra are economically better off with less proportion of BPL households than the sample villages of Simdega, where the concentration of BPL households is found to be more. The proportion of land under forest are more in all the sample villages of Simdega except for Saraslongri village (Table 5.21) and thus the land put to cultivation are less in these areas (Table 5.31). The cultivation is of subsistence type. In contrary, the percentage of land under forest cover is low in the sample villages except for Harul and the land under cultivation is also more in these areas. Such a condition enables a higher subsistence level and as a consequence the density of population is more in these villages.

Table 5.21
Percentage of Land Under Forest in the Sample Villages

Village name	Total area	Land under forest (in hectares)	Percentage of land under forest
Koronjo	1035	425.08	41.07
Deobahar	1126	363.13	32.25
Kadopani	2670	1253.99	46.97
Saraslongri	780	5.67	0.73
Dilho	221	0.00	0.00
Lutidih	431	0.00	0.00
Harul	245	194.26	79.29
Kunda	1057	721.82	68.29

Source: Household Survey, Field Work, 2011

[12] J. Singh (1964): *"Transport Geography of South Bihar"*, Banaras Hindu University Press, Varanasi, p. 33.

A significant share of the economy in the sample villages of Simdega is based on major and minor forest products. Since "the area of forest economy provides poor levels of subsistence as cultivation is generally limited"[13], the economic opportunities are poorly developed thereby resulting in low densities of population in the sample villages of Simdega. The average size of the households in the sample villages is five persons. However, it is more in the sample village of Kadopani in Simdega district and Dilho and Harul villages of Chatra district.

5.3.1.2 Social composition

The population composition of the district of Simdega mostly consists of indigenous tribes while Chatra consists of caste groups. The sample villages of Deobahar, Koronjo, Kadopani and Saraslongri of Simdega district have more number of indigenous people consisting of the Scheduled Tribe population (Table 5.22).

Table 5.22

Categorywise Sample Population in Sample Villages

Code	Village	Population					Percentage				Total
		Category				Total	Category				
		SC	ST	OBC	Others		SC	ST	OBC	Others	
1	Deobahar	0	266	0	0	266	0	100	0	0	100
2	Koronjo	0	228	0	0	228	0	100	0	0	100
3	Saraslongri	0	184	36	0	220	0	83.6	16.4	0	100
4	Kadopani	0	198	0	0	198	0	100	0	0	100
5	Dilho	50	0	190	0	240	20.8	0	79.2	0	100
6	Lutidih	111	0	6	127	244	45.5	0	2.5	52	100
7	Kunda	68	0	93	53	214	31.8	0	43.5	24.8	100
8	Harul	161	0	0	33	194	83	0	0	17	100
	Total	390	876	325	213	1804	21.6	48.6	18	11.8	100

Source: *Household Survey, Field Work, 2011*

The main category of tribes found among the sample villages are Kharia, Munda, Oraon, Chik-Baraik and Lohra (Table 5.23). On the other hand, the composition of population of the sample villages of Dilho mainly consists of 'other backward castes' and 'scheduled caste' population. Lutidih consisted of 'others' and 'scheduled caste' population. Kunda village consists of a mixed group of 'scheduled caste', 'other

[13] E. Ahmad (1965): *Bihar: A Physical, Economic and Regional Geography*, Ranchi University, Ranchi, p. 222.

backward castes' and 'others' category of social groups and lastly Harul has more of 'scheduled caste' population. The main caste groups found in these villages are Gwala, Bhuiyan, Ganjhu, Bhumihar, Chamar, Kayastha, Baniya, Bhokta, Dusad and others.

Table 5.23
Community wise Sample Population in Sample Villages

Community	Village								Total
	Deobahar	Koronjo	Saraslongri	Kadopani	Dilho	Lutidih	Kunda	Harul	
Baniya	0	0	0	0	28	0	5	0	33
Bhokta	0	0	33	0	0	0	0	0	33
Bhuiya	0	0	0	0	42	62	37	15	156
Bhumihar	0	0	0	0	0	127	0	0	127
Chamar	0	0	0	0	0	44	10	0	54
Chik-Baraik	0	33	0	0	0	0	0	0	33
Dusad	0	0	0	0	0	0	29	0	29
Ganjhu	0	0	0	0	8	0	0	146	154
Gwala	0	0	0	0	153	0	4	0	157
Halwai	0	0	0	0	0	0	5	0	5
Kahar	0	0	0	0	0	0	25	0	25
Kayastha	0	0	0	0	0	0	30	33	63
Kharia	228	139	96	0	0	0	0	0	463
Kurmi	0	0	0	0	0	0	9	0	9
Lohra	7	24	6	0	0	0	0	0	37
Munda	26	32	0	0	0	0	0	0	58
Nai	0	0	0	0	0	6	6	0	12
Oraon	5	0	82	198	0	0	0	0	285
Rajput	0	0	0	0	0	0	18	0	18
Rautia	0	0	3	0	4	0	0	0	7
Sonar	0	0	0	0	5	0	7	0	12
Teli	0	0	0	0	0	5	29	0	34
Total	266	228	220	198	240	244	214	194	1804

Source: *Household Survey, Field Work, 2011*

5.3.1.3 Religious groups

The study are has the concentration of three religious groups, viz. Hindus, Christians and Sarna (tribal) religion. Higher concentrations of population practising Christianity are found mostly in the sample village of Kadopani, followed by Deobahar, Saraslongri and Koronjo in Simdega district (Table 5.24). The other minor religious

groups of these areas comprise of the Sarna religion. Hinduism is the main religion practised among the population of sample villages of Chatra district.

Table 5.24

Distribution of Religious Groups in the Sample Villages of Simdega and Chatra District

Villages	Share of religious groups in numbers				Percentage share of religious groups			
	Christian	Hindu	Sarna	Total	Christian	Hindu	Sarna	Total
Deobahar	259	0	7	266	97.37	0.00	2.63	100
Koronjo	179	0	49	228	78.51	0.00	21.49	100
Saraslongri	184	36	0	220	83.64	16.36	0.00	100
Kadopani	198	0	0	198	100.00	0.00	0.00	100
Dilho	0	240	0	240	0.00	100.00	0.00	100
Lutidih	0	244	0	244	0.00	100.00	0.00	100
Kunda	0	214	0	214	0.00	100.00	0.00	100
Harul	0	194	0	194	0.00	100.00	0.00	100
Total	820	928	56	1804	45.455	51.441	3.104	100

Source: Household Survey, Field Work, 2011

5.3.2 Social Characteristics

The social characteristics are analyzed here in terms of the level of literacy, educational level, the level of drop outs and sex ratio in the sample villages.

5.3.2.1 Literacy Rate

The sample villages of Simdega district show better performance than the sample villages of Chatra district with regard to the level of literacy. The total literacy rates are more in Kadopani village (85.3 percent) followed by Koronjo (83.9 percent), Deobahar (69.9 percent) and Saraslongri (68.5 percent) villages of Simdega district (Table 5.25). Male literacy rates are highest in Kadopani village while it is the lowest in Deobahar village among all the sample villages in Simdega district. In Chatra, the total literacy rate is high in Lutidih village, followed by Kunda, Dilho and Harul villages. In this district, the sample village of Lutidih has the maximum male literacy rate. Female literacy rate are high in Kunda village. Harul village show the lowest performance with regard to the levels of male and female literacy amongst the sample villages in Chatra district.

Table 5.25
Level of Literacy among the Sample Villages

Village	Male literacy	Female literacy	Total literacy
Saraslongri	78.5	57.3	68.5
Kadopani	92.1	77.5	85.3
Deobahar	73.6	65.7	69.9
Koronjo	88.3	78.7	83.9
Dilho	66.4	42.0	55.7
Lutidih	82.9	45.5	66.3
Kunda	74.5	55.7	65.9
Harul	53.0	43.4	48.4

Source: *Household Survey, Primary Field Work, 2011*

The educational level of the sample villages reflects that concentration of illiterate population is more in the villages of Chatra than the sample villages of Simdega. Harul has a higher proportion of illiterate population among all the 8 sample villages. The performance of the sample villages in Simdega district is better with regard to primary, middle and high school education (Table 5.26).

Table 5.26
Educational Level of Sample Villages

Villages	Pre School	Illiterate	Below Primary	Primary	Middle	High	Intermediate	Technical	Graduate and Above	Literates without Educational Level	Total
Deobahar	9.4	26.7	25.2	10.5	11.7	12.4	2.6	0	1.5	0	100
Koronjo	12.3	13.6	20.2	7.5	11.8	25	3.9	0.9	4.4	0.4	100
Saraslongri	5.9	29.1	8.2	6.8	8.6	19.5	12.3	0	5.5	4.1	100
Kadopani	2	14.6	28.3	1	16.2	32.8	2.5	0	0	2.5	100
Dilho	9.2	38.8	16.7	3.8	13.8	12.5	3.8	0.8	0.8	0	100
Lutidih	10.7	27.5	20.5	2.9	13.1	10.2	9.8	0	4.9	0.4	100
Kunda	13.1	27.6	19.6	8.9	11.7	9.3	7	0	2.8	0	100
Harul	14.4	42.3	22.7	7.7	5.7	3.6	3.1	0	0	0.5	100
Total	9.6	27.5	20.1	6.2	11.6	15.5	5.7	0.2	2.5	0.9	100

Source: *Household Survey, Primary Field Work, 2011*

5.3.2.2 Drop-out Rate

The dropout rate from schools are more in Kadopani village (66.1 percent), followed by Saraslongri, Koronjo and Deobahar villages of Simdega district while in Chatra district the sample village of Kunda has more dropout rates followed by Harul, Lutidih and Dilho villages (Table 5.27).

Table 5.27
Drop Out cases in Sample Villages

Code	Village	Drop Out		Total	Drop Out Percent
		No	Yes		
1	Deobahar	150	20	170	11.8
2	Koronjo	104	65	169	38.5
3	Saraslongri	84	59	143	41.3
4	Kadopani	56	109	165	66.1
5	Dilho	81	44	125	35.2
6	Lutidih	81	70	151	46.4
7	Kunda	58	69	127	54.3
8	Harul	44	40	84	47.6
	Total	658	476	1134	42.0

Source: *Household Survey, Primary Field Work, 2011*

5.3.2.3 Sex Ratio

The sex ratio which is expressed as the number of females per 1000 males is regarded as an important indicator of regional development as 'the balance of sexes affects the social and economic relationships within a community'.[14] The sex ratio is more in the sample village of Kadopani followed by Saraslongri, Koronjo and Deobahar village of Simdega district (Table 5.28). The village of Deobahar has more number of out-migrant labourers (26 percent) followed by Koronjo and Saraslongri. This may be regarded as a cause of low sex ratios in these villages. The sex ratio was high in Harul village followed by Lutidih, Dilho and Kunda villages of Chatra district. The sex ratio was high in the remote villages of Kadopani village and Harul village.

Table 5.28
Sex Ratio among the Sample Population

Code	Village	Population		Total	Sex Ratio
		Male	Female		
1	Deobahar	143	123	266	860
2	Koronjo	121	107	228	884
3	Saraslongri	116	104	220	897
4	Kadopani	104	94	198	904
5	Dilho	131	109	240	832
6	Lutidih	129	115	244	891
7	Kunda	119	95	214	798
8	Harul	101	93	194	921
	Total	964	840	1804	871

Source: Household Survey, Primary Field Work, 2011

[14] R.C. Chandna, (2002): *A Geography of Population: Concepts, Determinants and Patterns*, Kalyani Publication, New Delhi. p. 178.

5.3.2.4 Relationship between Transport Vehicle Ownership and Social characteristics

The relationships of transport and social characteristics have shown that female and male literacy rate are high among the households that have ownership of non-motorised vehicles (bicycle) (Table 5.29).

Table 5.29
Correlation between Ownership of vehicles in household and Social indicators in the Sample Villages

Indicators		Male Literacy	Female Literacy	Drop Out of Children	Sex Ratio
Households with bicycle ownership	Pearson Correlation	.762(*)	.844(**)	.080	.148
	Sig. (2-tailed)	.028	.008	.850	.726
	N	8	8	8	8
Households with motorcycle ownership	Pearson Correlation	-.184	-.530	.263	-.664
	Sig. (2-tailed)	.663	.176	.529	.072
	N	8	8	8	8
Households with jeep ownership	Pearson Correlation	.125	-.323	.301	-.431
	Sig. (2-tailed)	.769	.435	.469	.286
	N	8	8	8	8
No of bus service	Pearson Correlation	.146	.203	-.515	.130
	Sig. (2-tailed)	.730	.630	.191	.760
	N	8	8	8	8
No of trips made by the buses	Pearson Correlation	.146	.203	-.515	.130
	Sig. (2-tailed)	.730	.630	.191	.760
	N	8	8	8	8

5.3.3 Economic Characteristics

The economic characteristics of the sample villages are analyzed in terms of the occupational structure, dependency ratio and proportion of BPL households. The sample villages of Simdega and Chatra district have shown variation with regard to the economic characteristics.

5.3.3.1 Occupational Structure

The occupational structure of the population shows that the majority of the workers in the sample villages of Simdega district are cultivators. Saraslongri village has about 86.9 percent of its workers as cultivators (Table 5.30). The share of workers as non-cultivators is more in Deobahar and Kadopani villages of Simdega district. The non-

cultivators mainly comprise of wage labour and are found to be the highest in Kadopani village. Deobahar and Koronjo village have more migrant labourers. The occurrence of migrant labourers from these two sample villages implies that the economic opportunities are poor in and around the villages.

In Chatra, the occupational structure is more varied. The village of Dilho has a higher proportion of cultivators. Lutidih village has almost an equal proportion of cultivators and non-cultivators while Kunda and Harul have more non-cultivators. Lutidih and Harul have more labourers. Kunda village (located along pucca road and near the block headquarter) has higher proportion of self employed workers.

Table 5.30

Main Occupation in the Sample Village

Occupation		Simdega District				Chatra District			
		Saraslongri	Kadopani	Deobahar	Koronjo	Dilho	Lutidih	Kunda	Harul
Cultivator		86.9	57.8	60.6	78.8	62.2	53	29.2	42.9
Non Cultivator	Wage Labour	5.7	30.2	8.7	5.1	29.7	36.1	29.2	46.8
	Skilled labour	0	0	0	0	2.7	2.4	1.4	0
	Petty Business	0	0	0	0	2.7	0	8.3	0
	Self Employment	0	10.3	1	0	1.4	2.4	23.6	2.6
	Govt. Job	4.9	0.9	1	0	1.4	4.8	2.8	3.9
	Pvt. Job	0	0.9	1	2.5	0	1.2	5.6	3.9
	Wood/ Veg. Selling	0	0	1.9	2.5	0	0	0	0
	Anganbari Worker	0	0	4.8	0	0	0	0	0
	Migrant Labour	2.5	0	26	11	0	0	0	0
	Total	13.1	42.2	44.2	21.2	37.8	47	70.8	57.1
Total		100	100	100	100	100	100	100	100

Source: Household Survey, Primary Field Work, 2011

The performances of the agricultural activity of the area are analyzed in terms of total cropped area and total irrigated area in the sample villages. The sample village of Lutidih in Simaria block of Chatra district and Saraslongri village in Bolba block of Simdega district are better off in terms of total cropped area as both these villages lie above the sample average (Table 5.31). In terms of irrigation facilities, the sample village of Dilho and Lutidih in Simaria block of Chatra district perform better. The sample villages of Simdega district are poorly developed with regard to the provision irrigation facility.

Table 5.31
Total Cropped Area and Total Irrigated Area in the Sample Villages

District	Village	Total cropped area to total area	Total irrigated area to total cropped area
		(in hectares)	
Simdega	Saraslongri	78.82	1.36
	Kadopani	39.64	12.85
	Deobahar	32.62	3.31
	Koronjo	47.93	11.42
Chatra	Dilho	47.19	100.35
	Lutidih	95.18	69.22
	Kunda	30.08	0.32
	Harul	20.70	7.47
Sample Average		49.02	25.79

Source: *Household Survey, Primary Field Work, 2011*

5.3.3.2 Level of Poverty

The proportions of households having BPL cards have been taken as the indicator to study the levels of poverty in the sample villages. Majority of the households in the sample villages of Simdega come under the BPL category. Among them, the remote village of Kadopani in Bolba block has more number of BPL households followed by Saraslongri, Deobahar and Koronjo villages in Simdega district (Table 5.32). One of the reasons for the incidence of poverty is the low level of economic opportunities prevailing in these areas. However, in comparison to Simdega, the sample villages of Chatra have a lower number of BPL households. The supporting capacity with regard to the agricultural sector are better developed (except for Harul) in these areas. However, among the sample villages of Chatra district, Dilho and Harul have higher proportion of BPL households.

Table 5.32
Households having BPL cards in the Sample Villages

District	Block	Villages	Household with BPL card (%)
Simdega	Bolba	Saraslongri	89.55
		Kadopani	98.99
	Thethaitanger	Deobahar	85.34
		Koronjo	78.95
Chatra	Simaria	Dilho	50.00
		Lutidih	47.13
	Kunda	Kunda	30.84
		Harul	49.48

Source: *Household Survey, Primary Field Work, 2011*

5.3.3.3 Dependency Ratio

The dependency ratio shows the population that is economically and socially dependent and need support.

Among the sample villages, the dependency ratio is the highest in Deobahar village of Simdega district followed by Kunda, Harul, Lutidih and Dilho village of Chatra district (Table 5.33). Thus, in general the sample villages of Chatra district have more dependency ratio than the sample villages of Simdega district (except for Deobahar). The dependency ratio is low in Kadopani and Saraslongri village of Simdega district. This implies that these two villages have higher potentials of economic development as "low dependency implies more savings and investments leading to higher rates of income growth."[15]

Table 5.33

Dependency Ratio in Sample Villages

Village	Population			dependency Ratio
	<14 Years	>64 Years	15-64 years	
Deobahar	101	12	153	73.9
Koronjo	66	15	147	55.1
Saraslongri	53	3	164	34.1
Kadopani	44	3	151	31.1
Dilho	84	7	149	61.1
Lutidih	82	11	151	61.6
Kunda	82	4	128	67.2
Harul	68	7	119	63.0
Total	580	59	1165	54.8

Source: *Household Survey, Primary Field Work, 2011*

5.3.3.4 Relationship between vehicle ownership and economic characteristics

The relationship between vehicle ownership and economic characteristics of the sample villages shows the following results (Table 5.34):

1. There is a positive correlation between ownership of bicycles and population in the BPL category. It could be inferred that poor households tend to use the non-motorized means of transport which also is the most affordable and

[15] B. Debroy, L. Bhandari and V. Singh (2011): *Transforming Jharkhand: The Agenda For Action, Report of the Chief Minister's Committee for the Development of Jharkhand*, Govt. of Jharkhand, Ranchi, p .25.

environmentally sustainable. These findings are similar to the findings in a Vietnam[16]study.

2. There is a negative correlation between ownership of motorcycle and population in the BPL category. It signifies that non-BPL households are economically better-off and have the opportunity to use the motorized transport.

3. A positive correlation exists between ownership of motorcycle and workers categorized as skilled labour and petty business worker. It implies that workers categorized as skilled labour and petty business worker have better transport accessibility.

4. There is a positive correlation between the number and trips of buses with anganbari workers and migrant labourers.

Table No 5.34
Correlation between Transport Accessibility and Economic Characteristics of the Sample Villages

		Dependency Ratio	BPL	Cultivator	Non-Cultivator	Wage Labour	Skilled Labour	Petty Business	Self Employment	Govt. Job	Pvt. Job	Wood& Veg. Selling	Anganbari Worker	Migrant Labour
Households with bicycle ownership	Pearson Correlation	-.689	.850 (**)	.653	-.648	-.660	-.447	-.293	-.114	-.557	-.479	.363	.052	.237
	Sig. (2-tailed)	.059	.008	.079	.082	.075	.267	.481	.788	.152	.230	.377	.903	.572
Households with motorcycle ownership	Pearson Correlation	.437	-.907 (**)	-.594	.554	.405	.739 (*)	.798 (*)	.578	.297	.540	-.375	-.426	-.491
	Sig. (2-tailed)	.280	.002	.121	.154	.320	.036	.018	.134	.475	.167	.360	.293	.217
Households with car/jeep ownership	Pearson Correlation	.342	-.679	-.597	.577	.347	.568	.580	.593	.434	.469	-.329	-.218	-.327
	Sig. (2-tailed)	.407	.064	.118	.134	.400	.142	.132	.121	.283	.242	.426	.604	.430
No. of bus services	Pearson Correlation	.201	.460	.291	-.209	-.576	-.396	-.290	-.307	-.016	-.330	.409	.893(**)	.825 (*)
	Sig. (2-tailed)	.634	.251	.484	.620	.135	.332	.486	.459	.970	.425	.315	.003	.012
No. of trips made by the buses	Pearson Correlation	.201	.460	.291	-.209	-.576	-.396	-.290	-.307	-.016	-.330	.409	.893(**)	.825 (*)
	Sig. (2-tailed)	.634	.251	.484	.620	.135	.332	.486	.459	.970	.425	.315	.003	.012

** Correlation is significant at the 0.01 level (2-tailed).
* Correlation is significant at the 0.05 level (2-tailed).

[16] DFID, Transport Research Centre, (2005): "The Role of Transport Development in Achieving the Millennium Development Goals", *The Asian Journal, Vol. 12, Aug, No.1, Access, Transport and Infrastructure,* pp. 1-13.

5.3.3.5 Relation between the Socio-economic Indicators

The relation between the socio-economic indicators (Appendix V e) of the sample villages shows that:

1. There is a positive correlation between female literacy rate and population in the BPL category. It implies that female literacy rates are higher in the BPL households.
2. There is a negative correlation between drop-out rates and 'anganbari workers'. It implies that the drop-out rate is low in the villages that have high proportion of 'anganbari workers'.
3. There is also a negative correlation between drop-out rate and 'migrant workers'. It reflects that the drop-out rates are low in the villages having high proportion of 'migrant labourers'.
4. A negative correlation exists between sex ratio and workers in 'petty business'. It implies that villages with higher sex ratios have lower proportion of workers in 'petty business' category.

5.3.4 Relationship between Transport Accessibility and Socio-Economic Indicators of Development

Since relationship between transport accessibility and socio-economic development are often not direct, the role of transport accessibility in the regional development of the villages is further assessed with the help of a relational table (Table 5.35). Such non-conventional methods were also used in other transport studies as it is stated in one of the studies that "relationships between vehicle ownership, rurality, and other variables may be explored further than is permitted by mere correlations".[17]

For the present study purpose the following socio-economic indicators have been selected from the list of rural attributes listed previously in this chapter:

Social developmental indicators:

1. Sex ratio

[17] S. Nutley (2003): "Indicators of Transport and Accessibility Problems in Rural Australia", *Journal of Transport Geography*, Vol.11, pp. 55-71.

2. Male literacy rate
3. Female literacy rate
4. Percentage of total drop-out to total population

Economic development indicators

1. Percentage of BPL household to total household
2. Dependency ratio

The relationship between transport accessibility and socio-economic development shows that the most connected (MC) block of Bolba in the MC district of Simdega with pucca road infrastructure shows better performance in terms of socio-economic development than the least connected (LC) block of Thethaitangar in (MC) Simdega district (Table 5.35). The sample villages of Saraslongri and Kadopani in the MC block of Bolba shows better performance with regard to both social and economic indicators. However, Saraslongri village has better transport accessibility than Kadopani village which is distantly located from block headquarter. Thus better transport accessibility could be one of the facilitators of socio-economic development in Saraslongri and Kadopani villages.

Table 5.35

Socio-economic and Transport Accessibility Performance of the Sample Villages

socio-economic Indicators and transport accessibility		Simdega District -Most Connected (MC)				Chatra District-Least Connected (LC)			
		Bolba Block (MC)		Thethaitangar Block (LC)		Simaria Block (MC)		Kunda Block (LC)	
		Saraslongri	Kadopani	Deobahar	Koronjo	Dilho	Lutidih	Kunda	Harul
Social	Sex Ratio	+	+	-	+	-	+	-	+
	Literacy Male	+	+	-	+	-	+	-	-
	Literacy Female	-	+	+	+	-	-	-	-
	Drop Out	+	-	+	+	+	-	-	-
Economic	BPL	-	-	-	-	+	+	+	+
	Dependency Ratio	+	+	-	-	-	-	-	-
Summary of performance (good)		**4**	**4**	**2**	**4**	**2**	**3**	**1**	**2**
Transport Accessibility	Approach to Pucca Road	√	√	√	X	√	√	√	X
	Close to Bus Stop	√	√	X	√	√	√	√	X
	Close to Block Hq.	√	X	X	X	X	X	√	X
Summary of performance (good)		**3**	**2**	**1**	**1**	**2**	**2**	**3**	**0**
summary of results		**7**	**6**	**3**	**5**	**4**	**5**	**4**	**2**

+ = good performance

- = poor performance

The least connected (LC) Thethaitangar block of Simdega district shows that the sample village of Koronjo has better performance with regard to the social development indicators than Deobahar village. Both these villages show poor performance with regard to the economic indicators of development. The level of transport accessibility in these villages also shows poor performance. Thus in this case, the poor level of transport accessibility could be cited as the reason for poor economic development of these villages.

The relationship between transport accessibility and socio-economic development shows that the sample villages in the least connected (LC) district of Chatra perform poorly with regard to socio-economic development in general and with social development in particular. The village of Lutidih show better performance with regard to social indicators than the village of Dilho both located in the most connected block (MC) of Simaria. The transport accessibility in both these villages show similar performances.

The villages of Kunda and Harul in the least connected (LC) Kunda block in (LC) Chatra district show poor performance in terms of socio-economic development indicators. The village of Kunda is the poorest performing village with regard to social development indicators. However, with regard to transport accessibility, the village of Harul shows the poorest performance.

Thus, in could be inferred from the analysis that transport accessibility is significantly related to social and economic development in the villages.

5.4 Conclusion

The study of the relationship of transport development with the urban and rural attributes and with levels of regional development has shown a distinct association at various levels in Jharkhand.

The main findings of the present study at the urban level are summarized below:

1. The urban population size structure of the towns shows the predominance of small towns, followed by medium size towns and cities. Comparative studies of ranks of population size and direct connectivity index have shown that the large towns in the network have significant numbers of direct connections with the associated

nodes in the network. Some of the larger towns with better transport accessibility are the important growth centres of the state.

2. The correlation between nodal accessibility and the urban population size, population growth and population density shows a weak correlation meaning thereby that the demographic characteristics are independent of the transport accessibility in the state in general.

3. There is a positive correlation between nodal accessibility and male literacy rates. The towns in the state that have a higher nodal accessibility also have higher male literacy rates. Such towns are mostly mining towns, which are located in clusters in the central western part of the state.

4. Towns that have higher nodal accessibility also have higher proportion of other workers, both male and female. These are towns that mostly specialize in mining and quarrying activities. These towns have greater transport advantage as they are located in close proximity to the class I towns.

5. Towns that have lower nodal accessibility, have a higher proportion of household industry workers, both male and female. These towns also specialize in trade and service activities. These towns have transport disadvantage as they are located at a greater distance from class I towns.

6. The number of direct connections with the associated nodes in the network is more among the towns specializing in trade followed by livestock, forestry and fishing activities.

7. The towns that have higher transport efficiency, in terms of route distance, have lower proportion of female ‘other workers’.

8. There is a negative correlation between Trade towns and route factor index. It signifies that transport accessibility in terms of route efficiency is high among the towns specializing in trading activities.

Thus, transport accessibility shows distinct relationship with towns specializing in different types of functions.

The main findings of the study between transport accessibility and rural attributes at the rural district level are summarized below:

1. There is a weak correlation between rural transport accessibility and the attributes of agricultural sector comprising of net cropped area and total irrigated area.

2. There is a negative relationship between the net sown area under cultivation and ownership of motorized four wheeler (car or jeep) vehicles. It can be inferred from this that the ownership of motorized four wheelers implies that the households are economically better off. Their dependence on the agricultural sector is less. Thus, indirectly better transport vehicle ownership facilitates economic diversification.

3. The relationship between transport accessibility and the social sector has revealed a strong positive correlation between each other. Female and male literacy rate are high in the villages that have pucca road connectivity. It is also high in the villages that have personal modes of conveyance either non-motorised transport vehicles such as bicycles or motorised transport vehicles such as motorcycle, car or jeep.

4. There is a positive correlation between rural connectivity with pucca road and per capita income of the districts. This relationship implies that the poorly connected villages have lesser per capita income or in other words have more poverty. Thus, rural connectivity with pucca road has a positive role in widening the scope of economic opportunities thereby reducing poverty levels in the rural areas.

5. There is a negative correlation between ownership of transport vehicles and population in the BPL category. The ownership of motorised transport vehicles comprising of bicycles, motorcycles, cars or jeep are lower in the districts that have higher proportion of population under the BPL category.

6. The relationship between transport accessibility and workers in non-primary activities shows a positive correlation between the two components. Rural connectivity of the villages with pucca road is strongly correlated with ‘other workers’. Also, the ownership of motorised (motorcycles and car or jeep) transport vehicles are positively correlated with ‘other workers’. Thus, rural connectivity and ownership of personal means of travel provides better economic opportunities thereby promoting the growth of non-primary activities.

7. The social, economic and service infrastructure has shown their dependence on transport accessibility. Both rural connectivity and bus service provisions are strongly correlated with the infrastructural facilities of the education sector. The economic and service infrastructure facilities are strongly correlated with approach to pucca road in the rural areas. The ownership of motorised transport vehicles mainly motorcycles and car or jeep are positively correlated with economic infrastructure facilities such as provision of bank facilities and credit societies in the rural areas.

8. The relationship between transport accessibility and the indicators of the basic amenities shows a positive correlation between each other. Rural connectivity with pucca road and access of the villages to electricity are positively correlated with each other. A similar pattern of relationship is observed between rural connectivity with pucca road and access to sanitation facilities. Thus, better transport accessibility provides better opportunities to avail these services.

The main highlights of the analysis of the relationship between transport and socio-economic characteristics of the sample villages are summarized below:

1. There is a positive correlation between bicycle ownership and literacy rate, both female as well as male literacy rates. The sample villages in the district of Simdega, which have higher rural connectivity with pucca roads, show better performance in terms of bicycle ownership and literacy rates than the villages that are located in the poorly connected district of Chatra.

2. There is a positive correlation between bicycle ownership and population in the BPL category. The ownership of bicycles is more among the economically poor households because these are more affordable than other modes of transport. The villages that are located in the most connected district of Simdega have larger proportion of households having bicycle ownership than the villages that are located in the poorly connected district of Chatra.

3. There exists a positive correlation between motorcycle ownership and workers classified as skilled labour and petty business worker. The villages located in the poorly connected district of Chatra have significant proportion of workers classified as skilled labour and petty business worker. Thus, these villages

have greater economic opportunities to own motorcycle than the villages located in the more connected district of Simdega.

4. The comparative analysis of the villages with varying levels of physical accessibility and their relationship with the socio-economic characteristics reveals a complex relationship.

5. The sample villages in Simdega district that have better physical accessibility show better performance with regard to both social and economic indicators. These villages are located in the block that also has better rural connectivity with pucca roads.

6. The sample villages in Simdega district that have poor physical connectivity show better performance in terms of the social indicators. These villages show poor performance with regard to the economic indicators of development. These villages are located in the block that has poor rural connectivity with pucca roads.

7. The sample villages in Chatra district that have better physical accessibility show moderate performance with regard to social indicators and better performance with regard to economic indicators. These villages are located in the block that has comparatively better rural connectivity with pucca road

8. The sample villages in Chatra district that have poor physical accessibility show the poorest performance in terms of social indicators. However these villages show better performance in terms of economic indicators.

Thus, the village level analysis of the relationship between transport accessibility and socio-economic development shows a complex relationship. There are other related factors that are associated in the relationship between transport accessibility and regional development at the village level. However, it is evident from the study that transport accessibility in some form or the other, either directly or indirectly is associated with the socio-economic development of the villages.

Chapter 6

CONCLUSIONS

The study of the structure of transport network and the pattern of regional development in Jharkhand has shown variations at various levels. The transport system that has evolved in phases played an important role in the regional development of some of the areas in the state. However, the level of transport development is concentrated in few pockets leaving behind vast areas of underdevelopment. The relationship between transport and socio-economic development in Jharkhand has shown distinct association at the urban and rural levels.

The main findings of the present study are discussed below:

1. Historically, the Jharkhand region, in comparison to its neighboring regions, was devoid of transport channels. It was avoided by early invaders and outsiders mainly because of its hilly and rugged topography, lack of navigable rivers, and, thick forest cover. The scope of external trade linkages with other regions was further limited in Jharkhand because it had subsistence and forest based economy.

2. The region was primarily avoided by Muslim rulers but few incursions and expedition of the region by the Mughals were recorded. The major development of transport during the medieval period was the building up of the Grand Trunk road, which had its orientation along the Ganga river but with the decline of Mughal power and rise of Maratha power, this transport channel was reorientated towards the Chotanagpur region.

3. The modern means of transport was introduced into the Chotanagpur region by the Britishers mainly to tap the mineral wealth of the area during the Colonial period. The mineral rich areas of the region were gradually linked with the railway network. However, priority was given for the strengthening of the road system as it helped in linking the economic regions not served by the railways. This, in a way helped in the economic development of some of the areas in Jharkhand.

4. During the post-Independence period, economic exploitation of resources continued with the transport system that was inherited from the colonial period. Road transport development in the state, during the Five Year Plan periods, showed poor level of performance. The growth of total and surfaced road length has shown a declining trend.

5. The rural road connectivity in the state has shown the poorest performance among all Indian states. Although significant physical progress in the rural road connectivity was noticed in the region during the initial plan period of the PMGSY scheme, but in subsequent years the progress showed a declining trend.

6. The results of the measures used to assess the degree of connectivity show that the urban centres in the state are not adequately connected to the network and some degree of complexity in the network was also observed. The relationship between the number of observed links and the number of possible links show that the network is only 42 percent connected.

7. The nodal accessibility indices have differed among the urban centres in Jharkhand. In general the urban centres located near the centre of the network have more transport advantages. Most of the urban centres have lesser degrees of direct connectivity. The result shows that the towns of Ranchi, Barhi, Kuju, Saraikela, Giridih and Gobindpur are the most connected as they have higher degrees of direct connectivity in comparison to all other urban centres in the network. The towns which have exhibited poor connectivity are Sinduriya, Deorikalan, Kiriburu, Dari, Danguapasi, Chandrapura and Bhojudih.

8. The Ingram's Accessibility or Geographical Accessibility index shows that the most accessible urban centres in the network are located as cluster of nodes in the central part of the network. Some of the top ranking towns in terms of higher accessibility are Sewai, Tenu Dam-cum-Kathara, Jena, Gumia, Phusro, Ramgarh and Sijua. The least accessible places are located in the peripheries of the network comprising of the urban centres of Rajmahal, Sahibganj, Sinduriya, Pakur, Deorikalan, Garhwa, Husainabad, Godda, Daltonganj, Barwadih and some others.

9. The nodal accessibility measure, which shows the efficiency of the network by comparing direct distance with shortest actual distance between pair of nodes, reveal that the urban centres which have efficient route factor ratio are Garhwa, Daltonganj, Chatra, Barhi, Ranchi, Latehar, Gumla, Hazaribag, Khunti and Palawa. The urban centres which have high residuals are Barughutu, Chiria, Kharsawan, Muri, Deoghar, Sini, Chandrapura, Gua, Dugda and Kedla.

10. Similar to Route Factor ratio, Detour Index measures the efficiency of the network due to topographical constraint. It shows that Jharkhand has significant level of physical constraints as majority of the towns have high Detour index. The urban centres of Barhi, Garhwa, Chatra, Hazaribag, Ranchi, Daltonganj, Palawa, Gumla, Khunti and Ara have efficient detour ratios.

The accessibility of towns of Barughutu, Chiria, Kedla, Muri, Kharsawan, Deoghar and Gua is complex with long detours.

11. The towns which are closer to class I towns are mostly found along the central and eastern region. These are mostly the industrial and mining centres of the region. The towns located at the peripheries are more distant from the class I towns. Barwadih, Daltonganj, Sinduria and Madhupur are located distant from Class I towns in comparison to Palawa, Kalikapur, Meru and Gobindpur which are located near Class 1 towns.

12. The relationship between the transport indices shows that there is a positive correlation between Detour Index and Direct Connectivity. The urban centres which have efficient detour ratios with less friction of distance, have higher degree of direct connectivity within the network.

13. The urban nodes that have higher transport accessibility in terms of Geographical Accessibility are located near the class I towns. It implies that the urban centres, which have higher transport disadvantage in terms of relative distance to other urban centres in the network, are also located further away from the class I towns.

14. There is a negative correlation between Detour Index and Route Factor Ratio. The urban centres with high Detour Index, (less friction of distance) have poor route factor index value as both these ratios are inverse to each other.

15. The status of rural transport facilities in the state of Jharkhand is poorly developed in comparison to the all-India picture. The approach to rural areas with pucca roads is more in the districts of Dhanbad, Hazaribag, Lohardaga, and in rural hinterlands along the industrial centres of Bokaro and Ranchi. The least connected areas with pucca road are Chatra and Deoghar districts. In terms of provision of bus services to rural areas, Simdega district has better position followed by Gumla, Palamu and Ranchi. The provision of bus services is poorly developed in Lohardaga and Chatra.

16. The ownership of non-motorised means of transport predominates in the rural areas of Jharkhand. It is more among the sample villages of Simdega district than Chatra district and the villages in Simdega district located in the most connected block of Bolba have higher ownership of vehicles mainly bicycles.

17. The most remotely located village in Bolba block has the highest proportion of households with bicycle ownership. Similar pattern is observed in the sample villages in Thethaitanger block, where the most remotely located village has higher proportion of households with

bicycle ownership. The better means of vehicle ownership, mainly motorcycles, are significantly found among the sample villages in Chatra district than the sample villages of Simdega district. The remotely located village in Kunda block of Chatra district has minimum number of households owning both means of transport, viz., bicycles and motorcycles.

18. The personal mobility affected by the level of physical fitness has shown that the village of Saraslongri in Bolba block followed by Koronjo village in Thethaitanger block has more mobility problems as the percentage of disabled persons comprising of mainly locomotor disability are more here.

19. The personal mobility affected by the age factor, has shown that the elderly people (65 years and above) are found to be more in Koronjo and Deobahar villages of Thethaitanger block in Simdega district while in Chatra district it comprises of the villages of Lutidih in Simaria block and Harul in Kunda block.

20. The personal mobility affected by the economic condition of the household shows that the sample villages of Chatra district have lesser proportion households with BPL card and has greater opportunities to make a journey than the sample villages of Simdega district where the proportion of households with BPL card are more. The remote village in Bolba block has higher proportion of BPL households. Among the sample villages in Chatra district, the village with higher physical accessibility has lower proportion of BPL households.

21. The relative accessibility of the villages to the service centres is found to be high in the village with better physical accessibility. The sample village with better physical accessibility in Bolba block also has access to larger number of facilities located within walkable distance range of 0 to 5 km from the village location. Similar pattern is also recorded in Chatra district where the sample village in Kunda block with better physical has access to larger number of facilities located at walkable distance from the village.

22. The remotest villages in both the districts have the poorest levels of relative accessibility. The sample village which has poorer physical accessibility in Thethaitanger block of Simdega district has lower levels of relative accessibility as the number of facilities located within 0-5 km range are fewer in this village. The same is observed for the remote village- Harul village in Chatra district.

23. The village of Deobahar has the highest number of private bus service that make more trips. However, the problem for this village is that these buses do not ply on the village road but on the Simdega – Rourkella NH 23 that is 12 km away from the village. The next village with good transport provision is that of Saraslongri which is located in close proximity to the block

headquarter of Bolba. In Chatra, the village of Lutidih is endowed with better bus service facilities than the other sample villages. The village of Harul is the most deprived one as has no bus service facility and villagers have to travel to Kunda which is 8 km away from Harul village to avail bus services.

24. The quality of road service from the point where buses are available is good for the villages of Koronjo, Dilho and Lutidih. While it is poor for most of the villages of Saraslongri, Kadopani, Kunda and Harul. The quality of bus service is poor among all the sample villages. Most of them run with overcrowded passengers and make single trips from and to the village in a single day. In these villages private autos in some occasions ply at short distances from the block headquarter to village locations but they are sporadic in nature.

25. The mobility patterns of the villagers among the sample villages show that the sample villages, which have higher levels of physical connectivity such as Saraslongri village and Kunda, have higher levels of mobility. The proportion of villagers travelling to avail market facilities are more in these villages. The external travel to work centres is also high in these villages. However, in terms of the external travel behaviour to health centres, the village of Saraslongri makes the more external travel while Kunda makes the least external travel outside the village. The external mobility of the villages of Deobahar and Dilho is high for journeys made for availing market facilities.

26. The village of Koronjo exhibit low mobility levels in terms of travel to market facilities outside the village. The travel mobility of population in Kadopani and Harul village is low and pattern of travel in internal in nature for these villages.

27. The relation between rural accessibility pattern and travel mobility pattern shows that the villages with better levels of physical accessibility comprising of pucca road, nearness to bus stop and nearness to block headquarter have higher transport mobility.

28. The urban population size structure of the towns shows the predominance of small towns, followed by medium size towns and cities. Comparative studies of ranks of population size and direct connectivity index have shown that the large towns in the network have significant numbers of direct connections with the associated nodes in the network. Some of the larger towns with better transport accessibility are the important growth centres of the state.

29. The correlation between nodal accessibility and the urban population size, population growth and population density shows a weak correlation meaning thereby that the demographic characteristics are independent of the transport accessibility in the state in general.

30. There is a positive correlation between nodal accessibility and male literacy rates. The towns in the state that have a higher nodal accessibility also have higher male literacy rates. Such towns are mostly mining towns, which are located in clusters in the central western part of the state.

31. Towns that have higher nodal accessibility also have higher proportion of other workers, both male and female. These are towns that mostly specialize in mining and quarrying activities. These towns have greater transport advantage as they are located in close proximity to the class I towns.

32. Towns that have lower nodal accessibility, have a higher proportion of household industry workers, both male and female. These towns also specialize in trade and service activities. These towns have transport disadvantage as they are located at a greater distance from class I towns.

33. The number of direct connections with the associated nodes in the network is more among the towns specializing in trade followed by livestock, forestry and fishing activities.

34. The towns that have higher transport efficiency, in terms of route distance, have lower proportion of female 'other workers'.

35. There is a negative correlation between Trade towns and route factor index. It signifies that transport accessibility in terms of route efficiency is high among the towns specializing in trading activities.

36. There is a weak correlation between rural transport accessibility and the attributes of agricultural sector comprising of net cropped area and total irrigated area.

37. There is a negative relationship between the net sown area under cultivation and ownership of motorized four wheeler (car or jeep) vehicles. It can be inferred from this that the ownership of motorized four wheelers implies that the households are economically better off. Their dependence on the agricultural sector is less. Thus, indirectly better transport vehicle ownership facilitates economic diversification.

38. The relationship between transport accessibility and the social sector has revealed a strong positive correlation between each other. Female and male literacy rate are high in the villages that have pucca road connectivity. It is also high in the villages that have personal modes of conveyance either non-motorised transport vehicles such as bicycles or motorised transport vehicles such as motorcycle, car or jeep.

39. There is a positive correlation between rural connectivity with pucca road and per capita income of the districts. This relationship implies that the poorly connected villages have lesser per capita income or in other words have more poverty. Thus, rural connectivity with pucca road has a positive role in widening the scope of economic opportunities thereby reducing poverty levels in the rural areas.

40. There is a negative correlation between ownership of transport vehicles and population in the BPL category. The ownership of motorised transport vehicles comprising of bicycles, motorcycles, cars or jeep are lower in the districts that have higher proportion of population under the BPL category.

41. The relationship between transport accessibility and workers in non-primary activities shows a positive correlation between the two components. Rural connectivity of the villages with pucca road is strongly correlated with 'other workers'. Also, the ownership of motorised (motorcycles and car or jeep) transport vehicles are positively correlated with 'other workers'. Thus, rural connectivity and ownership of personal means of travel provides better economic opportunities thereby promoting the growth of non-primary activities.

42. The social, economic and service infrastructure has shown their dependence on transport accessibility. Both rural connectivity and bus service provisions are strongly correlated with the infrastructural facilities of the education sector. The economic and service infrastructure facilities are strongly correlated with approach to pucca road in the rural areas. The ownership of motorised transport vehicles mainly motorcycles and car or jeep are positively correlated with economic infrastructure facilities such as provision of bank facilities and credit societies in the rural areas.

43. The relationship between transport accessibility and the indicators of the basic amenities shows a positive correlation between each other. Rural connectivity with pucca road and access of the villages to electricity are positively correlated with each other. A similar pattern of relationship is observed between rural connectivity with pucca road and access to sanitation facilities. Thus, better transport accessibility provides better opportunities to avail these services.

44. There is a positive correlation between bicycle ownership and literacy rate, both female as well as male literacy rates. The sample villages in the district of Simdega, which have higher rural connectivity with pucca roads, show better performance in terms of bicycle ownership and literacy rates than the villages that are located in the poorly connected district of Chatra.

45. There is a positive correlation between bicycle ownership and population in the BPL category. The ownership of bicycles is more among the economically poor households because these are more affordable than other modes of transport. The villages that are located in the most connected district of Simdega have larger proportion of households having bicycle ownership than the villages that are located in the poorly connected district of Chatra.

46. There exists a positive correlation between motorcycle ownership and workers classified as skilled labour and petty business worker. The villages located in the poorly connected district of Chatra have significant proportion of workers classified as skilled labour and petty business worker. Thus, these villages have greater economic opportunities to own motorcycle than the villages located in the more connected district of Simdega.

47. The comparative analysis of the villages with varying levels of physical accessibility and their relationship with the socio-economic characteristics reveals a complex relationship.

48. The sample villages in Simdega district that have better physical accessibility show better performance with regard to both social and economic indicators. These villages are located in the block that also has better rural connectivity with pucca roads.

49. The sample villages in Simdega district that have poor physical connectivity show better performance in terms of the social indicators. These villages show poor performance with regard to the economic indicators of development. These villages are located in the block that has poor rural connectivity with pucca roads.

50. The sample villages in Chatra district that have better physical accessibility show moderate performance with regard to social indicators and better performance with regard to economic indicators. These villages are located in the block that has comparatively better rural connectivity with pucca road

51. The sample villages in Chatra district that have poor physical accessibility show the poorest performance in terms of social indicators. However these villages show better performance in terms of economic indicators.

The highlights of the study show that the relationship between transport and socio-economic development at the urban and rural district levels has some degree of association between the two components. The village level analysis of the relationship between transport accessibility and socio-economic development shows a complex relationship. There are other related factors that are associated in the relationship between transport accessibility and regional development at the urban as well as the rural levels. However, it is

evident from the study that transport accessibility is associated either directly or indirectly with the socio-economic development at the regional level in some form or the other. This provides a base for future research in this area.

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Pradhan Mantri Gram Sadak Yojana (PMGSY), www.pmgsy.nic.in

Appendix I a

Villages with Approach to Pucca (Paved Roads) in Rural India, 2001

State Code	State	Uninhabited Village	Approach to Pucca Road	No Approach to Pucca Road	Nil information/ Not Available	Total Villages	Percentage of Village with Approach to Pucca Road*	Percentage of Village with Approach to Pucca Road#
1	Jammu & Kashmir	235	4308	2101	8	6652	64.76	67.1
2	Himachal Pradesh	2623	6368	7804	3323	20118	31.65	36.4
3	Punjab	395	11691	48	539	12673	92.25	95.2
4	Chandigarh	1	21		2	22	95.45	100.0
5	Uttrakhand	1065	4032	11729	0	16826	23.96	25.6
6	Haryana	191	6654	105	5	6955	95.67	98.4
7	Delhi	7	153	5	0	165	92.73	96.8
8	Rajasthan	1600	20810	18934	9	41353	50.32	52.3
9	Uttar Pradesh	9510	58171	39771	0	107452	54.14	59.4
10	Bihar	6083	14766	24266	0	45115	32.73	37.8
11	Sikkim	2	312	138	0	452	69.03	69.3
12	Arunachal Pradesh	202	1278	0	2585	4065	31.44	33.1
13	Nagaland	39	691	541	46	1373	50.33	51.8
14	Manipur	71	906	2	1291	2270	39.91	41.2
15	Mizoram	110	209	496	2	817	25.58	29.6
16	Tripura	12	729	0	129	870	83.79	85.0
17	Meghalaya	244	2052	3721	9	6026	34.05	35.5
18	Assam	1188	11949	13174	1	26312	45.41	47.6
19	West Bengal	1080	7013	8074	3	16170	43.37	46.5
20	Jharkhand	3261	6216	23134		32611	19.06	21.2
21	Orissa	3820	18934	251	28344	51349	36.87	39.8
22	Chhattisgarh	564	6466	12	13266	20308	31.84	32.7
23	Madhya Pradesh	3276	16732	22	35363	55393	30.21	32.1
24	Gujarat	473	15012	3039	15	18539	80.98	83.1
25	Daman & Diu	0	23	0	0	23	100.00	100.0
26	Dadra & Nagar Haveli	0	69	1		70	98.57	98.6
27	Maharashtra	2616	33842	0	7253	43711	77.42	82.4
28	Andhra Pradesh	1510	19065	7414	134	28123	67.79	71.6
29	Karnataka	1925	19315	4	8162	29406	65.68	70.3
30	Goa	12	331	16	0	359	92.20	95.4
31	Lakshadweep	16	0	8	0	24	0.00	0.0
32	Kerala	0	1363	0	1	1364	99.93	99.9
33	Tamil Nadu	917	14403	888	109	16317	88.27	93.5
34	Pondicherry	0	92	0	0	92	100.00	100.0
35	Andaman & Nicobar Islands	46	252	241	8	547	46.07	50.3
INDIA		**43094**	**304228**	**165939**	**100607**	**613922**	**49.55**	**53.3**

* Percentage to Total Villages

Percentage to Villages other than Uninhabited Villages

Source: Census of India, 2001, Village Directory

Appendix II a

Physical and Financial Progress of PMGSY Programme in Jharkhand, 2001-02

District	Road Works Sanctioned				% Completed Works				% Overall Expenditure to amount cleared by GOI	Amount as cleared by GOI[In Lakhs]
	New Connectivity		Upgradation		New Connectivity		Upgradation			
	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)		
Bokaro	8	48.23	0	0	100.0	100.0	-	-	79.2	955.6
Chatra	3	44.7	0	0	100.0	100.0	-	-	77.2	889.1
Deoghar	9	72.71	0	0	100.0	100.0	-	-	91.4	1393.0
Dhanbad	9	29.99	0	0	100.0	100.0	-	-	92.5	557.1
Dumka	11	73.6	0	0	100.0	100.0	-	-	82.1	1567.5
East Singhbhum	10	43.88	0	0	100.0	100.0	-	-	85.3	835.0
Garhwa	9	62.8	0	0	77.8	76.1	-	-	76.1	1135.7
Giridih	16	64.58	0	0	100.0	100.0	-	-	75.8	1340.8
Godda	11	64.07	0	0	90.9	80.1	-	-	77.6	1496.8
Gumla	8	56.5	0	0	100.0	100.0	-	-	94.4	1086.3
Hazaribagh	27	179.56	0	0	100.0	100.0	-	-	78.0	3824.1
Jamtara	4	24	0	0	100.0	100.0	-	-	93.2	398.6
Koderma	3	29.6	0	0	100.0	100.0	-	-	58.7	565.1
Latehar	4	24.44	0	0	75.0	58.5	-	-	73.3	423.0
Lohardaga	5	28.5	0	0	100.0	100.0	-	-	76.8	535.4
Pakur	3	19.15	0	0	100.0	100.0	-	-	79.9	431.6
Palamau	15	58.47	0	0	100.0	100.0	-	-	85.2	1056.7
Ranchi	18	108	0	0	100.0	100.0	-	-	67.4	2444.5
Sahebganj	7	33.58	0	0	100.0	100.0	-	-	79.8	629.8
Saraikela Kharsawan	6	36.86	0	0	100.0	100.0	-	-	76.1	859.3
Simdega	4	32.79	0	0	100.0	100.0	-	-	88.8	644.7
West Singhbhum	12	66.8	0	0	100.0	100.0	-	-	88.2	1186.8
Total	202	1202.81	0	0	98.0	96.8	-	-	0.0	24256.6

Source: *www.pmgsy.nic.in*

Appendix II b

Physical and Financial Progress of PMGSY Programme in Jharkhand, 2003-04

District	Road Works Sanctioned				% Completed Works				Expenditure to amount cleared by GOI	Amount as cleared by GOI[In Lakhs]
	New Connectivity		Upgradation		New Connectivity		Upgradation			
	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)		
Bokaro	10	39.38	0	0	100.0	100.0	-	-	95.0	636.7
Chatra	6	32.15	0	0	100.0	100.0	-	-	83.1	632.5
Deoghar	7	34.29	0	0	100.0	100.0	-	-	104.2	724.8
Dhanbad	12	37.34	0	0	100.0	100.0	-	-	88.7	610.0
Dumka	10	42.7	0	0	100.0	100.0	-	-	77.6	1220.9
East Singhbhum	9	56.7	0	0	100.0	100.0	-	-	79.8	1345.7
Garhwa	6	29.94	0	0	100.0	100.0	-	-	80.8	533.6
Giridih	5	42.75	0	0	80.0	65.3	-	-	95.4	751.0
Godda	6	28.9	0	0	66.7	56.7	-	-	59.3	597.6
Gumla	4	27.72	0	0	100.0	100.0	-	-	96.6	471.1
Hazaribagh	12	62.73	0	0	75.0	68.7	-	-	92.4	1519.4
Jamtara	3	18.11	0	0	100.0	100.0	-	-	100.0	412.1
Koderma	6	16.59	1	0	100.0	100.0	-	-	122.5	313.3
Latehar	2	27	0	0	50.0	40.7	-	-	88.8	384.3
Lohardaga	4	13.45	0	0	75.0	68.8	-	-	62.5	235.3
Pakur	3	18.9	0	0	66.7	29.6	-	-	69.8	524.9
Palamau	11	60.97	0	0	81.8	80.3	-	-	92.1	1219.9
Ranchi	22	70.58	0	0	100.0	100.0	-	-	96.4	1444.7
Sahebganj	3	10.53	0	0	66.7	50.7	-	-	72.1	272.6
Saraikela Kharsawan	6	25.15	0	0	100.0	100.0	-	-	97.1	501.2
Simdega	3	17.8	0	0	100.0	100.0	-	-	94.1	329.8
West Singhbhum	6	51.52	0	0	100.0	100.0	-	-	87.8	1224.2
Total	156	765.2	1	0	92.3	87.2	100.0	-	0.0	15905.6

Source: *www.pmgsy.nic.in*

Appendix II c

Physical and Financial Progress of PMGSY Programme in Jharkhand, 2004-05

District	Road Works Sanctioned				% Completed Works				% Overall Expenditure to amount cleared by GOI	Amount as cleared by GOI[In Lakhs]
	New Connectivity		Upgradation		New Connectivity		Upgradation			
	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)		
Bokaro	5	21.96	0	0	100.0	100.0	-	-	90.8	485.4
Chatra	2	23.98	0	0	0.0	0.0	-	-	11.0	461.0
Deoghar	6	20.76	0	0	100.0	100.0	-	-	91.8	563.5
Dhanbad	10	28.79	0	0	80.0	86.4	-	-	95.1	589.2
Dumka	1	6.27	0	0	100.0	100.0	-	-	75.6	190.3
East Singhbhum	6	26.77	0	0	100.0	100.0	-	-	104.6	639.5
Garhwa	3	31.1	0	0	0.0	0.0	-	-	57.2	636.4
Giridih	6	32.9	0	0	66.7	78.1	-	-	95.5	818.7
Godda	10	40.02	0	0	30.0	15.5	-	-	48.3	1132.2
Gumla	4	21.75	0	0	50.0	35.6	-	-	83.0	444.1
Hazaribagh	7	32.56	0	0	100.0	100.0	-	-	96.7	860.0
Jamtara	1	9	0	0	100.0	100.0	-	-	105.9	207.6
Koderma	2	7.8	0	0	50.0	65.4	-	-	76.1	171.0
Latehar	2	21	0	0	50.0	40.5	-	-	97.5	349.3
Lohardaga	2	17.37	0	0	50.0	11.8	-	-	57.1	390.6
Pakur	2	15.06	0	0	100.0	100.0	-	-	125.7	362.4
Palamau	6	28.96	0	0	16.7	31.1	-	-	75.2	610.8
Ranchi	15	47.87	0	0	80.0	75.4	-	-	85.7	1321.3
Sahebganj	1	3.6	0	0	0.0	0.0	-	-	71.7	188.1
Saraikela Kharsawan	5	13.62	0	0	100.0	100.0	-	-	94.2	375.8
Simdega	3	13.7	0	0	66.7	77.4	-	-	80.6	319.4
West Singhbhum	3	14.35	0	0	33.3	33.8	-	-	75.7	371.6
Total	102	479.19	0	0	67.6	59.8	-	-	0.0	11488.2

Source: *www.pmgsy.nic.in*

Appendix II d

Physical and Financial Progress of PMGSY Programme in Jharkhand, 2007-08

District	Road Works Sanctioned				% Completed Works				% Overall Expenditure to amount cleared by GOI	Amount as cleared by GOI [In Lakhs]
	New Connectivity		Upgradation		New Connectivity		Upgradation			
	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)		
Bokaro	25	146.5	0	0	0.0	0.0			48.8	4825.7
Chatra	16	99.63	0	0	0.0	0.0			42.5	2824.6
Deoghar	33	116.33	0	0	0.0	0.0			53.4	3346.2
Dhanbad	28	68.57	0	0	0.0	0.0			64.0	2216.3
Dumka	12	65.37	0	0	33.3	15.4			22.1	2021.7
East Singhbhum	16	87.56	0	0	31.3	17.4			47.7	2545.0
Garhwa	5	52.85	0	0	0.0	0.0			19.1	1639.7
Giridih	21	150.23	0	0	0.0	0.0			0.0	4219.3
Godda	17	64.13	0	0	0.0	0.0			0.0	2071.9
Gumla	8	35.87	0	0	0.0	0.0			4.0	1065.0
Hazaribagh	10	64.66	0	0	20.0	16.9			66.6	2201.6
Jamtara	9	38.05	0	0	66.7	59.3			77.7	1150.6
Koderma	15	75.73	0	0	26.7	14.6			60.8	2212.3
Latehar	5	42.6	0	0	0.0	0.0			62.3	1228.0
Lohardaga	13	51.08	0	0	7.7	4.0			24.2	1104.4
Pakur	14	62.86	0	0	0.0	0.0			66.2	1884.5
Palamau	24	105.9	0	0	20.8	26.2			57.0	2518.4
Ranchi	31	126.28	0	0	12.9	17.4			68.8	3790.7
Sahebganj	9	39.24	0	0	0.0	0.0			7.3	1445.5
Saraikela Kharsawan	27	85.9	0	0	18.5	15.0			42.5	2544.6
Simdega	6	30.1	0	0	0.0	0.0			13.8	849.3
West Singhbhum	9	70.35	0	0	0.0	0.0			51.0	2243.9
Total	353	1679.78	0	0	10.2	8.0			0.0	49949.4

Source: *www.pmgsy.nic.in*

Appendix II e

Physical and Financial Progress of PMGSY Programme in Jharkhand, 2008-09

District	Road Works Sanctioned				% Completed Works				% Overall Expenditure to amount cleared by GOI	Amount as cleared by GOI[In Lakhs]
	New Connectivity		Upgradation		New Connectivity		Upgradation			
	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)	Nos.	Length (Km)		
Bokaro	65	267.12	0	0	0.0	0.0			18.2	8315.9
Chatra	56	207.52	0	0	0.0	0.0			1.6	6049.2
Deoghar	0	0	0	0					0.0	0.0
Dhanbad	0	0	0	0					0.0	0.0
Dumka	14	42.75	0	0	0.0	0.0			0.0	1318.1
East Singhbhum	63	259.51	0	0	0.0	0.0			0.0	7187.8
Garhwa	46	219.38	0	0	0.0	0.0			0.1	6314.9
Giridih	0	0	0	0					0.0	0.0
Godda	0	0	0	0					0.0	0.0
Gumla	35	253.74	0	0	0.0	0.0			0.0	6891.3
Hazaribagh	70	249.62	0	0	0.0	0.0			15.0	7969.2
Jamtara	20	84.65	0	0	0.0	0.0			0.0	2457.8
Koderma	5	18.35	0	0	0.0	0.0			18.0	565.8
Latehar	47	246.24	0	0	0.0	0.0			7.5	6934.9
Lohardaga	12	57.85	0	0	0.0	0.0			2.3	1590.2
Pakur	32	155.7	0	0	0.0	0.0			8.6	4674.0
Palamau	141	527.69	0	0	0.0	0.0			1.7	14743.4
Ranchi	0	0	0	0					0.0	0.0
Sahebganj	26	110.18	0	0	0.0	0.0			0.1	4179.3
Saraikela Kharsawan	13	60.07	0	0	0.0	0.0			0.7	2829.7
Simdega	27	122.22	0	0	0.0	0.0			0.0	3812.1
West Singhbhum	72	273.99	0	0	0.0	0.0			7.1	8211.8
Total	744	3156.58	0	0	0.0	0.0			0.0	94045.4

Source: *www.pmgsy.nic.in*

Appendix V a

Net State Domestic Product and Poverty Status

State	**NSDP** (TE 2004-05)		**Per Capita Income** (TE 2004-05)		**Poverty Ratio** (2004-05)	
	('000 Million Rs.)	Rank	(Rs.)	Rank		Rank
Andhra Pradesh	911	5	11080	8	11.2	2
Assam	181	17	6281	15	22.3	8
Bihar	320	14	3609	17	42.1	15
Chhattisgarh	309	15	7678	12	40.8	14
Gujarat	835	7	14850	4	19.1	6
Haryana	349	13	14897	3	13.6	4
Jharkhand	*218*	*16*	*7273*	*14*	*46.3*	*16*
Karnataka	703	11	12563	6	20.8	7
Kerala	811	9	11565	7	13.2	3
Madhya Pradesh	835	7	7666	13	36.9	13
Maharashtra	2,951	1	15567	2	29.6	11
Orissa	461	12	5985	16	46.8	17
Punjab	723	10	15611	1	9.1	1
Rajasthan	888	6	8788	11	18.7	5
Tamil Nadu	1,511	4	12719	5	22.8	9
Uttar Pradesh	1,876	2	8809	10	33.4	12
W. Bengal	1,705	3	10992	9	28.6	10

Source: NSDP and Per capita Income – Computed from CSO, Various years; Poverty Ratio – Planning Commission Poverty Estimates, Computed from NSS 61st Round, 2004-05 in Institute for Human Development and United Nation Food Programme (2008): *Food Security Atlas of Rural Jharkhand*, Institute for Human Development, New Delhi.

Appendix V b

Demographic Characteristics: Population, Growth, Density and Size Classification of the Urban centres, 2001

Census Town Name	Population of town - 2001	Growth Rate 1991-2001	Density 2001	Size Classification of Towns 2001	Census Town Name	Population of town - 2001	Growth Rate 1991-2001	Density 2001	Size Classification of Towns 2001
Jamshedpur	1104713	374.6	71176.95	Million Town	Chakulia	14,325	12.65	954	Class IV
Dhanbad	1065327	688.01	196215.23	Million Town	Ara	14,165	22.11	1,732	Class IV
Ranchi	863495	47.24	8128.05	Class I	Basukinath	14,129	21.37	820	Class IV
Bokaro	497780	67.11	8789.59	Class I	Nirsa	13,902	4.91	5,286	Class IV
Phusro	174402	59.2	12478	Class I	Gidi	13,656	-5.72	1,737	Class IV
Hazaribag	135473	30.1	14478.04	Class I	Seraikela	12,270	9.77	1,376	Class IV
Deoghar	112525	77.28	8739.22	Class I	Muri	12,009	16.12	2,187	Class IV
Ramgarh	110496	82.63	6852.35	Class I	Jhinkpani	11,845	7.26	693	Class IV
Chirkunda	106227	55.57	33409.97	Class I	Gua	10,851	12.94	2,706	Class IV
Giridih	105634	26.75	14305.84	Class I	Tati	10,511	0	3,316	Class IV
Saunda	85,075	10.93	3,507	Class II	Barhi	9,933	0	2,707	Class V
Sahibganj	80,154	62.73	8,926	Class II	Palawa	9,758	55.53	6,061	Class V
Daltonganj	71,422	26.81	20,702	Class II	Kiriburu	9,554	5.65	3,605	Class V
Jhumri Tilaiya	69,503	29.73	1,359	Class II	Bhojudih	8,894	5.37	2,712	Class V
Chaibasa	63,648	12.2	7,401	Class II	Isri	8,804	46.51	2,717	Class V
Chakradharpur	55,228	15.86	8,330	Class II	Sewai	8,789	0	1,455	Class V
Madhupur	47,326	20.55	2,578	Class III	Meru	8,547	33.11	1,956	Class V
Lohardaga	46,196	45.45	3,171	Class III	Gobindpur	8,504	35.57	3,485	Class V
Gumia	45,548	10.3	1,744	Class III	Panchet	8,354	-3.43	1,385	Class V
Dumka	44,989	18.09	7,351	Class III	Dhanwar	7,926	0	3,402	Class V
Chatra	42,020	34.91	3,782	Class III	Barajamda	7,693	0	488	Class V
Gumla	39,761	39.32	3,448	Class III	Religara Alias Pachhiari	7,473	-0.86	2,244	Class V
Ghatshila	37,854	16.77	2,866	Class III	Dari	7,384	14.64	665	Class V
Godda	37,008	56.57	4,308	Class III	Lapanga	7,355	15.74	2,026	Class V
Garhwa	36,686	32.2	2,947	Class III	Barwadih	7,218	8.67	1,590	Class V
Pakaur	36,029	37.3	4,249	Class III	Jena	7,152	0	2,659	Class V
Simdega	33,981	43.08	851	Class III	Meghahatuburu Forest Village	6,887	0	4,174	Class V
Musabani	33,980	-7.94	2,419	Class III	Kandra	6,811	3.97	2,532	Class V
Mihijam	33,236	42.23	3,038	Class III	Kharsawan	6,792	18.43	976	Class V
Patratu	32,134	-3.01	1,532	Class III	Sini	6,591	-2.59	3,263	Class V
Khunti	29,282	21.09	1,228	Class III	Sinduria	5,953	0	2,731	Class V
Gomoh	28,587	29.45	2,197	Class III	Orla	5,872	0	582	Class V
Churi	25,222	28.47	1,503	Class III	Hesla	5,860	0	3,855	Class V
Hussainabad	23,441	35.44	1,865	Class III	Sahnidih	5,800	0	4,427	Class V
Jamtara	22,558	26.65	1,631	Class III	Kharkhari	5,653	0	3,306	Class V
Chandrapura	22,396	13.03	2,947	Class III	Topchanchi	5,410	0	1,644	Class V
Barughutu	21,092	26.16	3,116	Class III	Balkundra	5,372	-39.13	760	Class V
Tenudam-Cum-Kathhara	20,441	17.54	1,013	Class III	Danguapasi	5,192	2.12	1,199	Class V
Jadugora	19,565	18.53	1,998	Class IV	Topa	5,009	0	1,207	Class V
Latehar	19,082	26.56	1,422	Class IV	Amlabad	4,699	-12.02	1,626	Class VI
Dugda	18,867	24.05	1,535	Class IV	Marma	4,611	0	1,929	Class VI
Khelari	18,783	32.46	1,127	Class IV	Sijhua	4,478	0	2,054	Class VI
Bundu	18,519	15.28	1,399	Class IV	Chandil	4,347	0	3,916	Class VI
Kuju	18,040	21.79	1,262	Class IV	Chiria	3,951	-14.61	3,528	Class VI
Rajmahal	17,977	28.79	4,260	Class IV	Deorikalan	3,930	-16.72	423	Class VI
Kedla	17,586	19.88	923	Class IV	Kalikapur	3,775	0	3,701	Class VI
Kodarma	17,246	36.18	1,156	Class IV	Mugma	2,983	0	1,912	Class VI
Noamundi	16,230	6.15	564	Class IV					

Source*: Census of India, 2001 and 1991*

Appendix V c

Social Characteristics of the Urban centres, 2001

Appendix V d

Economic characteristics of the Urban centres, 2001

Towns	Literacy				Household Industry workers				Other Workers				Dominant Function (1991)
	Male	Rank	Female	Rank	Male	Rank	Female	Rank	Male	Rank	Female	Rank	
Amlabad	79.5	82	48.1	91	0.2	92	2.0	80	99.1	4	96.1	15	Mining & Quarrying
Ara	79.6	80	55.1	80	0.9	83	0.8	84	95.3	43	97.0	12	Mining & Quarrying
Balkundra	85.7	38	66.2	37	3.3	21	18.9	9	77.3	90	63.5	81	Manufacturing
Barajamda	71.4	94	48.2	90	5.4	5	7.6	26	92.3	62	88.1	47	*
Barhi	83.6	58	59.1	71	3.5	18	7.9	24	82.3	86	64.2	80	*
Barughutu	90.1	18	73.1	17	1.6	66	0.0	87	98.1	12	98.4	10	Mining & Quarrying
Barwadih	86.8	35	65.2	44	2.2	49	3.5	66	95.5	40	94.1	24	Transport
Basukinath	77.7	88	50.6	88	4.5	8	7.2	29	57.7	94	26.3	94	Trade
Bhojudih	83.8	55	59.2	70	3.1	27	2.1	79	93.0	57	95.1	17	Transport
Bokaro	90.5	15	71.1	22	2.7	30	3.8	60	94.9	47	91.8	32	Manufacturing
Bundu	82.8	61	57.1	76	3.1	25	6.2	36	75.9	91	56.1	91	Service
Chaibasa	89.4	21	77.4	9	3.4	19	6.1	37	95.9	36	93.1	30	Service
Chakradharpur	90.7	14	74.9	13	2.4	40	3.6	64	95.4	42	88.3	46	Transport
Chakulia	82.5	62	61.9	57	4.4	9	16.1	10	84.0	85	74.3	67	Trade
Chandil	82.3	63	60.8	63	2.5	37	2.5	76	90.4	68	72.1	69	*
Chandrapura	88.0	31	71.1	21	1.3	75	0.9	83	98.2	11	98.8	7	Service
Chatra	83.8	54	69.5	30	8.4	2	44.9	1	84.9	81	46.5	93	Trade
Chiria	79.7	78	53.1	82	0.9	82	0.0	90	99.1	6	100.0	2	Mining & Quarrying
Chirkunda	82.1	67	62.0	55	2.0	57	5.9	42	96.5	31	91.6	34	Manufacturing
Churi	84.9	48	61.9	56	1.6	67	3.3	70	96.9	28	87.6	49	Service
Daltonganj	89.3	22	78.0	7	3.2	23	5.9	43	94.6	49	91.5	35	Service
Danguapasi	89.6	20	64.6	46	0.7	86	0.0	91	95.1	45	80.3	62	Transport
Dari	82.3	65	60.0	64	2.0	55	9.1	18	84.4	83	58.6	87	Mining & Quarrying
Deoghar	91.8	10	77.4	8	1.8	61	8.7	21	97.4	20	89.4	41	Service
Deorikalan	79.6	81	49.0	89	5.8	4	19.6	7	42.2	95	19.1	95	Service
Dhanbad	83.9	53	64.1	49	1.8	60	4.3	56	97.1	25	93.6	28	Mining & Quarrying
Dhanwar	87.1	34	66.5	35	7.6	3	34.8	3	88.2	75	57.6	88	*
Dugda	88.5	28	61.8	58	1.4	69	6.5	31	92.7	59	89.3	42	Manufacturing
Dumka	90.9	11	80.9	5	2.1	53	6.1	41	97.2	23	92.8	31	Service
Garhwa	81.3	71	61.5	59	2.5	34	11.7	13	84.4	84	62.3	82	Trade
Ghatshila	89.0	23	72.9	18	2.0	56	6.3	35	95.6	39	91.1	38	Mining & Quarrying
Gidi	87.5	33	68.7	32	1.2	76	0.5	85	98.7	9	99.5	5	Mining & Quarrying
Giridih	85.4	43	71.3	20	3.0	28	6.1	38	95.7	37	91.7	33	Trade
Gobindpur	85.9	37	64.3	48	1.1	77	6.3	33	98.6	10	93.7	27	Trade
Godda	89.0	24	74.5	14	3.9	13	11.4	14	85.8	80	82.7	56	Service
Gomoh	90.9	12	70.6	27	1.9	58	6.1	39	92.7	58	81.9	58	Transport
Gua	85.6	40	57.1	75	2.4	39	2.9	72	97.2	24	95.7	16	Mining & Quarrying
Gumia	84.7	49	59.7	68	2.6	31	9.0	19	90.2	71	81.5	59	Manufacturing
Gumla	92.0	7	81.2	4	2.2	48	5.8	44	93.5	54	89.0	43	Service
Hazaribag	92.0	9	81.3	3	2.1	52	2.9	73	97.4	18	96.3	14	Trade
Hesla	93.3	5	82.9	2	1.8	62	0.0	86	97.5	15	98.6	9	*
Hussainabad	74.5	90	53.7	81	11.7	1	13.6	11	74.3	92	70.6	73	Trade
Isri	85.7	39	68.5	33	2.3	44	4.6	54	96.5	32	93.8	26	Trade
Jadugora	90.2	17	71.0	23	1.0	80	5.4	49	92.5	60	70.8	72	Mining & Quarrying
Jamshedpur	88.8	25	74.3	15	2.3	43	3.6	63	96.9	29	94.3	22	Manufacturing
Jamtara	87.6	32	69.2	31	4.3	10	7.4	28	92.0	63	88.3	45	Trade
Jena	85.4	45	56.1	77	1.4	71	8.5	22	97.0	27	76.6	64	*
Jhinkpani	75.5	89	51.8	86	3.7	16	19.6	8	91.1	66	60.4	86	Service

Appendix V c

Social Characteristics of the Urban centres, 2001

Towns	Literacy			
	Male	Rank	Female	Rank
Jhumri Tilaiya	84.4	50	61.4	61
Kalikapur	98.5	1	90.2	1
Kandra	82.0	70	55.6	79
Kedla	83.3	60	57.9	73
Kharkhari	78.0	86	52.0	84
Kharsawan	85.4	44	65.2	43
Khelari	80.4	74	57.3	74
Khunti	85.6	42	70.7	26
Kiriburu	88.1	30	66.2	36
Kodarma	84.2	51	63.8	50
Kuju	80.1	76	59.5	69
Lapanga	82.0	68	59.9	65
Latehar	81.0	73	59.9	66
Lohardaga	88.8	27	76.6	11
Madhupur	84.1	52	64.3	47
Marma	72.1	93	45.3	94
Meghahatuburu Forest Village	93.4	4	75.5	12
Meru	95.3	2	66.1	38
Mihijam	90.7	13	70.9	24
Mugma	73.6	91	45.6	93
Muri	92.0	8	70.7	25
Musabani	85.0	47	65.7	40
Nirsa	82.1	66	63.1	51
Noamundi	83.6	59	61.1	62
Orla	77.8	87	52.9	83
Pakaur	78.2	85	65.4	42
Palawa	79.7	79	65.4	41
Panchet	86.2	36	61.4	60
Patratu	90.0	19	70.3	28
Phusro	83.7	56	62.1	54
Rajmahal	66.5	95	47.9	92
Ramgarh	85.3	46	66.1	39
Ranchi	90.2	16	76.9	10
Religara Alias Pachhiari	79.8	77	58.7	72
Sahibganj	82.0	69	65.0	45
Sahnidih	80.3	75	56.0	78
Saunda	82.3	64	62.9	52
Seraikela	88.2	29	68.3	34
Sewai	94.6	3	78.8	6
Sijhua	73.4	92	41.3	95
Simdega	85.6	41	73.4	16
Sinduria	78.3	84	62.2	53
Sini	88.8	26	69.9	29
Tati	92.6	6	72.4	19

Appendix V d

Economic characteristics of the Urban centres, 2001

Towns	Household Industry workers				Other Workers				Dominant Function (1991)
	Male	Rank	Female	Rank	Male	Rank	Female	Rank	
Jhumri Tilaiya	3.5	17	22.5	6	90.0	72	61.2	84	Trade
Kalikapur	0.0	94	0.0	94	100.0	1	100.0	1	*
Kandra	2.2	45	4.5	55	91.0	67	88.6	44	Manufacturing
Kedla	1.4	70	3.4	68	95.7	38	86.9	51	Mining & Quarrying
Kharkhari	0.1	93	0.0	93	99.9	2	98.6	8	*
Kharsawan	3.7	15	5.5	47	81.0	88	64.8	79	Trade
Khelari	1.9	59	6.3	34	96.2	34	85.6	53	Service
Khunti	4.1	11	5.2	50	87.0	77	77.1	63	Service
Kiriburu	2.5	36	8.8	20	97.4	19	90.7	39	Service
Kodarma	2.3	42	4.1	59	90.4	69	71.5	71	Trade
Kuju	2.2	47	10.1	15	91.2	65	69.1	74	Mining & Quarrying
Lapanga	0.8	85	2.6	75	96.7	30	67.8	76	Manufacturing
Latehar	2.5	33	7.8	25	81.8	87	72.4	68	Service
Lohardaga	3.9	12	5.7	45	89.7	73	82.6	57	Service
Madhupur	5.1	7	31.3	4	93.5	53	67.3	77	Trade
Marma	0.8	84	2.2	78	99.1	5	94.5	19	*
Meghahatuburu Forest Village	0.7	87	5.5	48	99.0	7	94.5	18	*
Meru	0.3	91	4.8	52	95.4	41	65.5	78	Service
Mihijam	2.5	38	4.1	58	94.9	48	80.5	61	Trade
Mugma	1.3	73	0.0	88	98.0	13	100.0	4	*
Muri	3.3	22	10.1	17	89.4	74	75.5	65	Service
Musabani	1.5	68	6.1	40	85.9	79	62.2	83	Mining & Quarrying
Nirsa	2.0	54	2.8	74	97.9	14	97.2	11	Mining & Quarrying
Noamundi	2.8	29	7.6	27	95.2	44	91.4	36	Mining & Quarrying
Orla	0.6	88	1.6	81	91.7	64	74.6	66	*
Pakaur	2.6	32	41.9	2	93.3	55	56.1	90	Trade
Palawa	1.7	64	7.1	30	97.3	22	85.7	52	Trade
Panchet	1.0	79	4.1	57	96.4	33	94.5	20	Service
Patratu	2.2	50	5.1	51	95.1	46	87.6	48	Mining & Quarrying
Phusro	1.0	81	3.4	69	97.5	17	94.1	23	Mining & Quarrying
Rajmahal	3.8	14	25.2	5	72.2	93	53.6	92	Trade
Ramgarh	2.4	41	3.0	71	94.2	50	90.5	40	Mining & Quarrying
Ranchi	2.5	35	3.5	67	95.9	35	93.1	29	Service
Religara Alias Pachhiari	1.3	72	3.6	65	97.5	16	93.9	25	Mining & Quarrying
Sahibganj	3.4	20	12.9	12	84.6	82	72.1	70	Trade
Sahnidih	0.6	89	0.0	92	98.9	8	100.0	3	*
Saunda	1.3	74	3.8	61	97.0	26	94.4	21	Mining & Quarrying
Seraikela	3.2	24	10.1	16	90.3	70	81.0	60	Service
Sewai	0.5	90	1.0	82	99.5	3	99.0	6	*
Sijhua	0.0	95	0.0	95	97.3	21	96.9	13	*
Simdega	5.2	6	6.4	32	77.4	89	68.5	75	Service
Sinduria	2.1	51	3.6	62	86.7	78	60.6	85	*
Sini	2.2	46	5.6	46	93.8	52	87.4	50	Transport
Tati	1.8	63	8.2	23	93.1	56	56.7	89	*

Appendix V c

Social Characteristics of the Urban centres, 2001

Towns	Literacy			
	Male	Rank	Female	Rank
Tenudam-Cum-Kathhara	81.0	72	51.9	85
Topa	83.7	57	59.7	67
Topchanchi	79.2	83	50.7	87

Appendix V d

Economic characteristics of the Urban centres, 2001

Household Industry workers				Other Workers				Dominant Function (1991)
Male	Rank	Female	Rank	Male	Rank	Female	Rank	
1.6	65	4.7	53	94.2	51	91.2	37	Mining & Quarring
3.1	26	2.2	77	92.5	61	85.6	54	*
1.1	78	0.0	89	87.4	76	84.4	55	*

Source: i) Town Directory, Census of India, 2001 ii) Census of India 1991

*New Towns in 2001 census.

Appendix V e

Correlation between Socio-Economic attributes of the Sample Villages

		Male literacy rate	Female literacy rate	Drop outs	Sex ratio
Dependency ratio	Pearson Correlation	-.520	-.401	-.560	-.485
	Sig. (2-tailed)	.186	.325	.149	.224
BPL (Below Poverty Line population)	Pearson Correlation	.534	.732(*)	-.129	.509
	Sig. (2-tailed)	.173	.039	.760	.197
Cultivators	Pearson Correlation	.395	.375	-.331	.388
	Sig. (2-tailed)	.333	.360	.424	.343
Non-cultivators	Pearson Correlation	-.402	-.355	.258	-.399
	Sig. (2-tailed)	.323	.388	.538	.327
Wage labourer	Pearson Correlation	-.474	-.606	.522	.098
	Sig. (2-tailed)	.235	.112	.184	.817
Skilled labour	Pearson Correlation	-.122	-.646	.039	-.512
	Sig. (2-tailed)	.774	.084	.926	.195
Petty business worker	Pearson Correlation	-.156	-.214	.236	-.870(**)
	Sig. (2-tailed)	.712	.611	.574	.005
Self employment	Pearson Correlation	.091	.067	.554	-.583
	Sig. (2-tailed)	.829	.875	.154	.129
Govt. job	Pearson Correlation	-.314	-.655	.205	.244
	Sig. (2-tailed)	.449	.078	.626	.561
Pvt. Job	Pearson Correlation	-.284	-.056	.314	-.300
	Sig. (2-tailed)	.496	.895	.449	.470
Wood & Veg. Seller	Pearson Correlation	.284	.619	-.604	.007
	Sig. (2-tailed)	.495	.102	.113	.987
Anganbari worker	Pearson Correlation	-.084	.208	-.788(*)	-.132
	Sig. (2-tailed)	.843	.622	.020	.756
Migrant labour	Pearson Correlation	.089	.438	-.825(*)	-.063
	Sig. (2-tailed)	.834	.278	.012	.882
	N	8	8	8	8

** Correlation is significant at the 0.01 level (2-tailed).

* Correlation is significant at the 0.05 level (2-tailed).