

Dedicated to my parents.

## Declaration of the candidate

I do hereby declare that the thesis entitled “A Geospatial Analysis of Road Transport Network of Siliguri City, Darjeeling District, West Bengal” has been prepared by me under the supervision of Prof. Subir Sarkar. This document describes work undertaken as part of Ph.D. programme of study at the Department of Geography and Applied Geography, University of North Bengal. All the views and opinions expressed therein remain the sole responsibility of the author, and do not necessarily represent those of the institution. The material embodied in this document being submitted by me to the University of North Bengal is original and has not been published or submitted in part or full for any other degree of any other institution. The work of other authors or any other organization or agency wherever made use of, in this document have been thoroughly acknowledged.

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## Certificate

This is to certify that **Mr. Biswajit Paul** has prepared the thesis entitled “**A Geospatial Analysis of Road Network of Siliguri City, Darjeeling District, West Bengal**” for the award of Doctor of Philosophy (Ph.D) degree in Geography and Applied Geography of University of North Bengal under my supervision. He has carried out his research work at the Department of Geography and Applied Geography of University of North Bengal and the thesis has been prepared based on the extensive field study.

It may further be mentioned that Mr. Biswajit Paul has fulfilled all other requirements as per the rules of the university regarding the submission of PhD thesis.

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### Entire Document

A Geospatial Analysis of Road Transport Network of Siliguri City, Darjeeling District, West Bengal

II

1 Chapter I 1 Introduction "Transportation is a measure of the relationship between areas and is, therefore, an essential aspect of geography" – Ullman, 1954. 1.1 Introduction Transportation system forms a measure of relationships between the regions and therefore a very crucial component of geography (Ullman, 1954). It is also stated that the transportation is essentially a geographic phenomenon (Hurst, 1974). However, the geography of transportation comes under the purview of economic geography, dealing with the study of all aspects of the transportation network that is related to a geographical area (Briney, 2020). It is the prime link between the spatial organizations and the mainstay for spatial processes and spatial patterns. Therefore, transportation implies a means or a channel of movement of humans and materials between the regions. It is also one of those activities of human society which appears almost universal. Because in everyday life people always moves over places for a different purpose which reduces the spatio-temporal gap between products and producers of any services with the consumers. The term 'transportation' has been defined as "all means of travel and moving person and goods from place to place" (New Standard Encyclopaedia, 1990) and Kansky (1963) has defined the term 'network' as "meshed of the fabric of intersecting lines and interstices". Whereas, to the geographers, it is 'a set of spatial locations which are interconnected within a system by numerous routes and lines' Human society has always been fundamentally based on the movement of people and products. There has been a huge increase in mobility and accessibility as a result of modern economic processes (Rodrigue et al, 2006). The estimation of the meaning of transportation is different in different domains. It may be understood by planners, engineers, economists, and geographers with different senses as they studied the same with different perspectives. To geographers, transportation geography is studied in terms of spatial expression examining the geographical pattern of transport (Vaidya, 1998). The subject matter of transport geography can be categorised as follows: a) Geographical pattern and distribution of the transportation system. b) Flow analysis of commodities and traffic between the places. c) Study of nodes and links over space and their impact on regional developments. d) Impact of transportation on the natural environment & socio-economic conditions. The transportation system of any place plays an important role in the development of the region as the process of import and export of various resources depends on the

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## **Preface**

Transportation is an integral part of mankind and history, as primitive as the existence of human beings. Thus the development of transportation infrastructure is an essential part of the economic as well as overall development of any region. Roads are the most common and complex network which covers a wide range of space, it is physically convenient, highly flexible and usually most operational. Roadways are suitable and readily available means of transportation for all kind of traffic be it short, medium or long distances. The availability of roads has powerful relationship with the level of development characterised by rate of economic growth and social welfare. Road transport generates new areas of economic activities by increasing productivity and revitalises the market activities which has a direct and positive impact on urbanization process. Although there are other means of transportation, road plays dominant role in local economy. Road transportation is indeed the lifeline of the local and regional economies, but the ill-managed and unplanned growth of road transportation system leads to different problems in the city. The problems include loss of time and productivity of human resources, congestion, road vulnerabilities and degradation of both the physical and socio-economic environment. At present, Siliguri is facing huge traffic congestion due to heavy traffic flow during day time and unplanned roadways, parking and footpaths. Perhaps, the only possible measure to save Siliguri from this unimaginable traffic condition lies into the proper action against unregulated plying of e-rickshaws and curb in improper parking of vehicles along the arterial roads. Peoples' awareness about the traffic rules and parking rules. Both the static and moving bottlenecks should be resolved immediately as well to avoid the interrupted traffic flow.

The whole study is divided into seven chapters including introduction and concluding remarks. First chapter deals with the general introduction, conceptual framework, literature reviews, and statement of the problem, research hypothesis, research objectives and adopted methodologies. The chapter also describes significance of the study and future scope for conduction research. The second chapter is on the overview and geographical background of the study area i.e. Siliguri city which includes geographical location, historical background, physical environment, demographic-social and economic background. In the third chapter historical and present urban road conditions have been discussed in detail. This chapter deals with the present physical and functional characteristics of the arterial road network of Siliguri based on both the primary and secondary sources of data. Fourth chapter discusses the structural properties of road network in terms of different measures of accessibility and connectivity using graph theory. Analysis of traffic flow and its characteristics is one of the primary aim of geographical research on transportation of any place. Chapter five deals with the volume of traffic flow in Siliguri city which also includes traffic volume fluctuation, travel behaviour and day-of-week variability pattern analysis. The existing problems of road traffic and transportation system are also discussed in this chapter. In chapter six, relationship between road transportation development and the level of development in

the various urban services has been established. The last chapter deals with the recommendations for transportation planning to establish a well-managed traffic condition in the city and concluding remarks.

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## **List of abbreviation**

AH: Asian Highway

CBUDP: Capacity Building for Urban Development Project

CMPO: Calcutta Metropolitan Planning Organization

DDP: Draft Development Plan

DHR: Darjeeling Himalayan Railways

IPT: Intermediate Public Transport

IRC: Indian Road Congress

ISO: International Organization for Standardization

ITDP: Institute for Transportation and Development Policy

LMV: Light Motor Vehicle

MSL: Mean Sea Level

NBSTC: North Bengal State Transportation Corporation

NH: National Highway

NHAI: National Highway Authority of India

NJP: New Jalpaiguri Platform

NTDPC: National Transport Development Policy Committee

OSM: Open Series Map

ROW: Right of Way

SH: State Highway

SJDA: Siliguri Jalpaiguri Development Authority

SMC: Siliguri Municipal Corporation

SPA: School of Planning Architecture