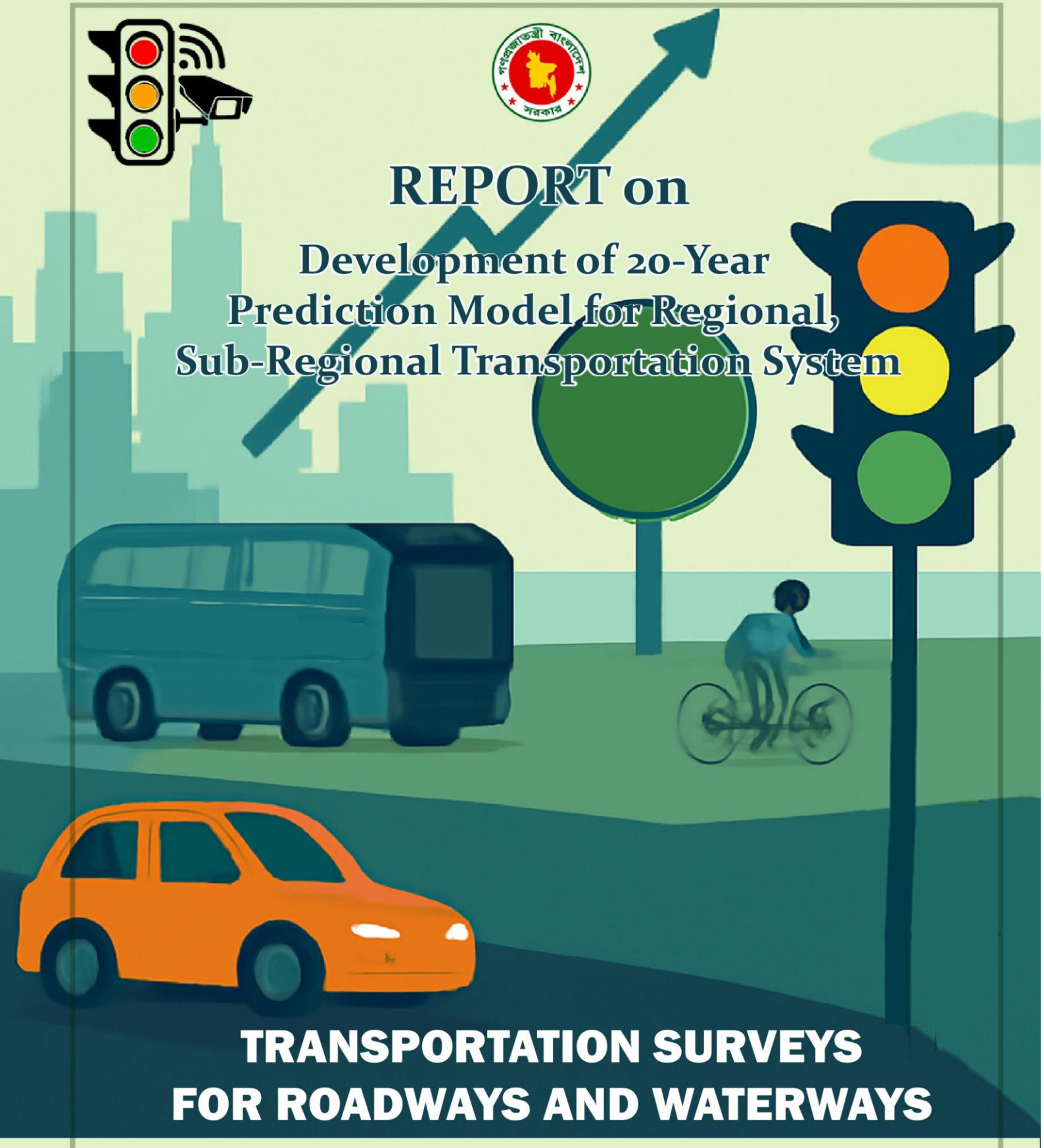

REPORT on

Development of 20-Year Prediction Model for Regional, Sub-Regional Transportation System

TRANSPORTATION SURVEYS FOR ROADWAYS AND WATERWAYS

CLIENT

Preparation of Development Plan for Meherpur Zilla Project (MZDP)

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GOVERNMENT OF THE PEOPLE'S REPUBLIC OF BANGLADESH
Urban Development Directorate (UDD)

Report on Development of 20-Year Prediction Model for Regional, Sub-Regional Transportation System

On
Transportation Surveys for Roadways and Waterways (Package-3)

Under
Preparation of Development Plan for Meherpur Zilla Project

Submitted to
Ahmed Akhtaruzzaman
Senior Planner & Project Director
"Preparation of Development Plan for Meherpur Zilla Project."
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August 2025

Table of Contents

Chapter 1

Introduction

Chapter 1: Introduction

Transportation plays a pivotal role in facilitating socio-economic growth, improving accessibility, and connecting people and resources. In the context of Meherpur District—a strategically important area in southwestern Bangladesh—the development of a sustainable and efficient transportation system is essential to support ongoing urbanization, economic activity, and regional integration.

Following the submission of the Mobilization, Inception, Survey and Interim Report- this Model Preparation Report on Regional and Sub-regional Transportation System presents the findings and analysis of detailed transportation surveys conducted across the district. The report encompasses the objective of capturing existing travel behavior, evaluating traffic volumes and applying four step model to predict and to prepare travel demand modeling.

The report is grounded in a comprehensive survey methodology that integrates modern data collection tools, including tablet-based digital questionnaires, GPS-enabled field documentation, and GIS-based spatial analysis. Surveys were carried out at major road intersections, household levels, and along key water routes to assess vehicular movement, origin-destination patterns, goods transport dynamics, and user perceptions.

A key strength of this survey phase lies in its spatially integrated approach. All collected data—both attribute and spatial—have been geo-tagged, quality-checked, and linked to a centralized GIS database. This allows for visualization and interpretation of transportation patterns in a spatial context, enabling more informed planning decisions.

In alignment with the Terms of Reference (ToR), this report intends to develop travel demand modeling for next twenty years. Origin-Destination analysis, traffic volume survey at critical intersections, applying the four-step model- (i.e., trip origin, trip distribution, modal choice and network assignment) to project the base year trip applying multiple liner regression model in order to get the travel demand in the next twenty years.

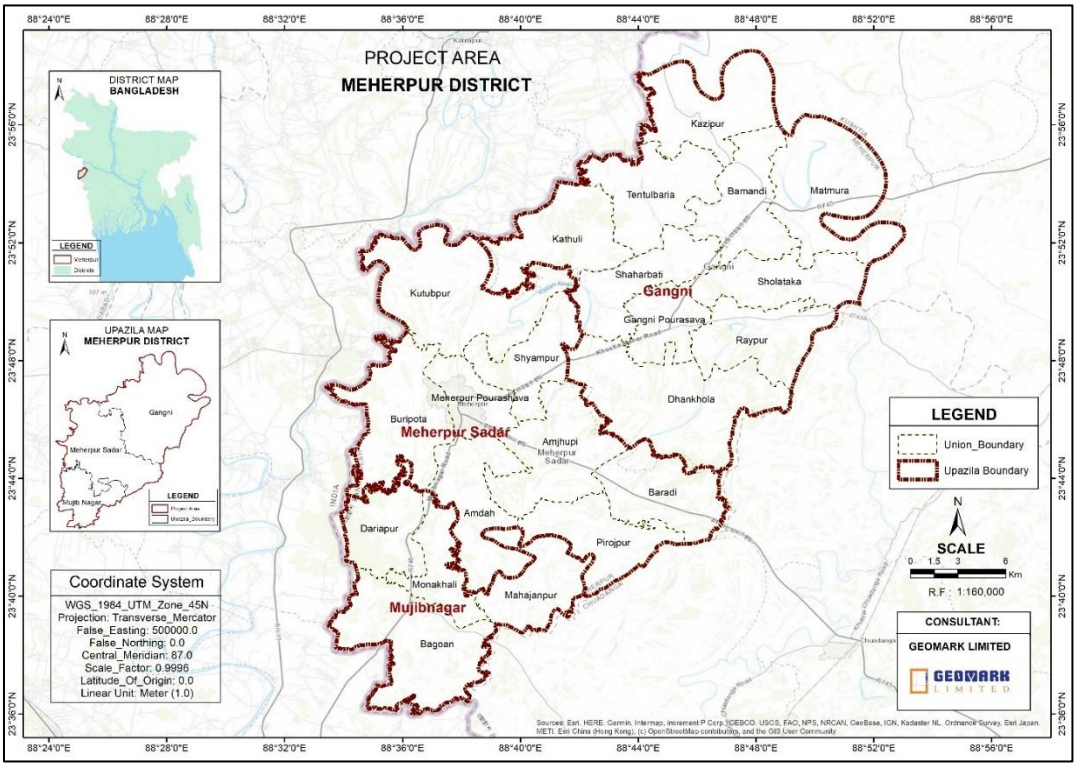
Through this effort, the project aspires to create a transportation framework that not only meets current demands but also anticipates future growth, reinforcing Meherpur's potential as a well-connected and economically vibrant region.

1.1 Project Location

Meherpur is a district in southwest Bangladesh that lies in the northwest of Khulna Division. Its borders are to the east and west, respectively, with the districts of Chuadanga and Kushtia in Bangladesh and the Indian state of West Bengal. Meherpur was a Nadia district subdivision prior to independence. The district is 716.08 square kilometers (276.48 square miles) in size. Meherpur Sadar Upazila, Mujibnagar Upazila, and Gangni Upazila are the three upazilas that make up Meherpur district. Meherpur, which is home to more than 0.7 million people, is a significant hub for trade and agriculture in the area. The district headquarters is located in the town of Meherpur, which is also the largest town in the district.

Meherpur's historical significance and rich cultural legacy are well-known. There are numerous historic sites and ruins in the area. The yearly Baruni Mela, which is conducted in honor of the Hindu god Shiva, is one of Meherpur's most colorful and bright celebrations.

Meherpur's economy is based mostly on agriculture, with a sizable section of people working in farming and associated fields. Rice, wheat, and jute are just a few of the crops that may be produced in the area because of its rich soil and temperate temperature. Meherpur's public services and infrastructure are both deficient.



Map 1.1: Project Area

1.2 Objectives and Purpose of the Project

The overarching goal of this project is to prepare a comprehensive Development Plan for Meherpur District. An essential component of this initiative is gaining a clear and data-driven understanding of the district's existing transportation network. To achieve this, a series of detailed traffic and transportation surveys have been conducted. The objective of this project is to support the sustainable and integrated development of the upazilas by optimizing transportation and traffic systems that are crucial for the mobility, connectivity, and livelihood of marginal communities. The project aims to assess existing transport infrastructure and services, identify current challenges and future demands, and develop a long-term, data-driven transportation planning framework. This includes integrating transportation with land use and economic activities, ensuring and enhancing access to growth centers and services by enriching connectivity. The approach emphasizes the use of digital surveys, GIS-based spatial analysis, and simulation models to ensure that transport development supports broader socio-economic goals and the holistic development. The objectives are following:

- ✓ **To assess and analyze the existing transportation systems** of the project area, including road capacity, multimodal operations and seasonal variations.
- ✓ **To develop a digital, GIS-based transportation database** through real-time surveys and spatial data collection for informed decision-making.
- ✓ **To simulate traffic flow and transportation operations** for identifying bottlenecks, evaluating safety, improving efficiency, and supporting emergency evacuation planning.
- ✓ **To forecast future transportation demand** and develop an integrated 20-year transport and land use model aligned with regional development and accessibility goals.
- ✓ **To assist UDD in preparing a comprehensive, sustainable, and resilient development plan**, ensuring transportation is integrated with land use, socio-economic development, and climate adaptation strategies.

Being more specific

- ✓ To study existing transportation system of the project area.
- ✓ To analyze the future traffic movement and demand of the project area generated by Land Port.
- ✓ Fixation of the policy statements to be satisfied by the plan.
- ✓ Transportation and traffic data collection.

- ✓ Preparation of the methodology for the computer-based travel demand forecasting model following 4-step modeling technique,
- ✓ Development of sub-models for various steps involved in model building, i.e., trip generation, trip distribution, mode choice model and traffic assignment models, etc.
- ✓ To develop a transportation master plan for the study area spanning twenty years' time horizon targeting government's Vision 2041 for optimizing resources available from all modes of transport

Chapter 2

Review of Plan and Policies

Chapter 2: Review of Plan and Policies

This chapter explains the interrelationship between the Project Area Development Plan and the country's national development plans. The development plans studied in this report include the Eighth Five Year Plan, Sustainable Development Goals and New Urban Agenda etc.

Development plans are established with the country's overall requirements and objectives for various development areas. Policies, plans, and objectives are formulated to achieve development goals, and budgets are allocated. The sectoral budgets are further subdivided into programs and initiatives within each sector for execution by multiple ministries. Any local development effort must link to national-level plans to achieve coherence and integrity with the country's overall development to accomplish national development goals. Therefore, it is vital to investigate the relationship between the Development plans and the country's national development plans.

2.1 Development Plans

Development Plans are comprehensive and strategic planning instruments designed to guide the physical, social, economic, and environmental growth of a region or locality over a defined period. These plans provide a spatial and policy-based framework for sustainable development, ensuring the efficient use of land, balanced distribution of infrastructure and services, and equitable socio-economic advancement.

2.1.1 Eighth Five Year Plan

Allocation

The 8FYP allocated 17.4% of the Annual Development Plan (ADP) to the transport and communication sector. However, in the 2023-24 fiscal year, the transport and communication sector received 28.88% of the ADP allocation, which is 11.48% more than the 8FYP's allocation.

Development initiatives

The government has taken various development initiatives to implement the 8FYP, including programs to develop information and communication technology infrastructure, human resources, and e-governance.

Transport and communication sector contribution to GDP

The transport and communication sector contributed 7.34% to GDP in 2021-22 and 7.32% in 2022-23.

Connectivity

The 8FYP aims to ensure connectivity with regional and international transport networks.

The duration of the 7th Five Year Plan (7FYP) ended in June2020. However, due to the Covid-19 pandemic the 8FYP has been delayed. The General Economics Division of the Planning Commission (GED) had to revisit and revise the targets and strategies in view of the pandemic. The 8th Five Year Plan, a projected course of action for a period of 5 year (July 2020 – June 2025), represents the first phase of the country's Perspective Plan 2041 (PP2041).

Broad Themes of the Plan

There are mainly two broad themes of the plan. Those are the following:

Promoting Prosperity

The plan has emphasized on appropriate policies, frameworks and devised suitable and sustainable development strategies for promoting prosperity. For this, the first step is to bring Bangladesh closer to attaining Upper Middle-Income Country (UMIC) status, major Sustainable Development Goal (SDG) targets, and eliminating extreme poverty.

Fostering Inclusivity

A broad-based strategy of inclusiveness with a view to empowering every citizen to participate fully and benefit from the development process and helping the poor and vulnerable with social protection- based income transfers has been adopted in the plan.

Integration with Planning Projects

The 8FYP's development plan placed a strong emphasis on the necessity of narrowing the economic gap between rural and urban areas while increasing the production share of industry and contemporary services. By strengthening the non-farm sectors of the rural academy, it also places focus on reducing the gap between rural and urban economies. The same vision is the focus of this project. It can reduce the economic gap between urban and rural areas by providing urban area services in a rural location. This project achieved the 8FYP vision during this procedure.

The budget allocation for the transportation sector was given top priority in line with the 7FYP policy. The objective for the transportation sector for the 7FYP is to create a system of transportation that is effective, sustainable, safe, and regionally balanced, in which different modes complement one another, interface effectively where possible, and engage in healthy competition with one another. The masterplan will be designed in the project's final phase and will employ the same approach. Future population and need projections will be used to suggest new highways. It will fulfill the 8FYP's transportation objective during this period.

2.1.2 Sustainable Development Goals

(SDGs) are a set of seventeen global goals established by the United Nations in 2015 as part of the 2030 Agenda for Sustainable Development. They are designed to address a broad range of global challenges, including poverty, inequality, climate change, environmental degradation, peace, and justice. Each goal has specific targets (169 in total) and indicators to measure progress. On the other hand, Localization of the Sustainable Development Goals (SDGs) refers to the process of adapting, implementing, and monitoring the SDGs at the local level, aligning the goal of SDG with local contexts, priorities, capacities, and resources. It ensures that sustainable development is driven from the ground up, engaging local governments, communities, and stakeholders.

The Physical Feature Survey and Plan Preparation for Meherpur District aligns directly with several SDGs by providing the foundational data and planning framework necessary to support evidence-based development. The project particularly contributes to:

- **SDG 6 – Clean Water and Sanitation** and **SDG 13 – Climate Action**: Through the mapping of river systems, khals (canals), and drainage networks, the project enables better water management and climate resilience planning.
- **SDG 9 – Industry, Innovation, and Infrastructure**: The data collected on transport networks, utilities, and built environments will guide future infrastructure planning and investment.
- **SDG 11 – Sustainable Cities and Communities**: By identifying and documenting physical features, infrastructure, land use, and urban dynamics, the project supports inclusive, safe, resilient, and sustainable urban development.
- **SDG 17 – Partnerships for the Goals**: The project emphasizes collaboration among government agencies, local authorities, and communities, reinforcing participatory planning processes.

By integrating SDG principles into data collection, analysis, stakeholder engagement, and planning outputs, this project contributes to building a sustainable and equitable future for Meherpur District. It lays the groundwork for development strategies that are environmentally responsible, socially inclusive, and economically viable.

2.1.3 Relation of Meherpur District Transportation Project with Transportation Planning and SDGs

The Meherpur District Transportation Project embodies comprehensive transportation planning principles that directly contribute to Sustainable Development Goals (SDGs) by addressing the following key aspects:

Integrated Transport and Land Use Planning

The project applies transportation planning to analyze current transport networks, forecast future travel demand, and assess the impacts of land use changes. This ensures efficient allocation of resources, guides sustainable urban and rural development, and supports SDG 9 (Infrastructure) and SDG 11 (Sustainable Cities).

Capacity Analysis and Traffic Impact Assessment

Through detailed capacity studies and traffic impact analysis, transportation planning identifies bottlenecks and designs improvements to enhance mobility and accessibility. This supports safer and more reliable transport services essential for economic activities and everyday life, contributing to SDG 8 (Decent Work and Economic Growth) and SDG 11.

Climate-Resilient and Disaster-Aware Planning

Incorporating simulations of extreme weather and disaster scenarios within transportation planning helps design resilient infrastructure and emergency evacuation strategies. This directly aligns with SDG 13 (Climate Action) by reducing vulnerability and enhancing adaptive capacity in transport systems.

Multimodal and Sustainable Transport Solutions

The project's focus on modeling multimodal operations (automobiles, motorcycles, bicycles, pedestrians) promotes inclusive and environmentally sustainable mobility options. This supports the transition toward low-emission transport systems and accessibility for all population groups, contributing to SDG 3 (Good Health), SDG 10 (Reduced Inequalities), and SDG 13.

Data-Driven Decision Making and Institutional Strengthening

Comprehensive data collection, GIS database management, and regular reporting facilitate evidence-based transportation planning and policy formulation. This strengthens institutional capacity and coordination (SDG 17 – Partnerships) for better governance and implementation of sustainable transport initiatives.

The Meherpur District Transportation Project leverages advanced transportation planning methodologies—integrating land use, traffic analysis, climate resilience, and multimodal solutions—to create a sustainable, inclusive, and adaptive transport system that supports the achievement of key SDGs at the regional level.

2.1.4 New Urban Agenda

The New Urban Agenda (NUA), adopted at the United Nations Conference on Housing and Sustainable Urban Development (Habitat III) in 2016, provides a global framework for sustainable urban development. It emphasizes inclusive, safe, resilient, and sustainable cities and human settlements and supports the implementation of the Sustainable Development Goals (SDGs), particularly Goal 11 – *Sustainable Cities and Communities*.

Key principles of the New Urban Agenda include:

- ✓ **Leave No One Behind**: Promoting inclusive urbanization that ensures equal access to opportunities, services, housing, and participation for all, including marginalized groups.
- ✓ **Sustainable Urban Development for All**: Encouraging compact, integrated, and connected cities that use resources efficiently and minimize environmental impact.
- ✓ **Urban Governance and Planning**: Strengthening urban governance through inclusive, participatory decision-making and supporting long-term, integrated urban and territorial planning.
- ✓ **Resilience and Risk Reduction**: Enhancing the resilience of cities to natural and man-made risks, including climate change and disasters.
- ✓ **Local Implementation**: Empowering local authorities with tools, data, resources, and autonomy to effectively implement sustainable urban policies and actions.

Relation of the New Urban Agenda to Transportation Planning

The New Urban Agenda (NUA) provides guiding principles that align closely with sustainable transportation planning efforts in the Meherpur District region:

Leave No One Behind – Inclusive Mobility

Transportation planning under the project focuses on equitable access, ensuring marginalized and vulnerable groups can safely and affordably access transport services. This supports the NUA principle of inclusive urbanization by promoting accessibility for all users including pedestrians, cyclists, and public transit-dependent populations.

Sustainable Urban Development for All – Compact and Efficient Transport Networks
The project promotes integrated land use and transportation planning to create connected, compact urban and rural settlements. Efficient use of transportation infrastructure reduces environmental impacts, aligns with the NUA's call for resource efficiency, and supports sustainable mobility solutions.

Urban Governance and Planning – Participatory and Integrated Decision-Making
By engaging local authorities, communities, and stakeholders in data collection, GIS mapping, and planning processes, the project strengthens governance capacity and participatory decision-making. This leads to long-term, integrated transport and urban planning consistent with the NUA's focus on good urban governance.

Resilience and Risk Reduction – Climate-Resilient Transport Systems
Incorporating climate adaptation and disaster risk mitigation into transportation planning addresses the NUA's priority to build resilient cities. Simulations of disaster scenarios and evacuation planning enhance the ability of transport infrastructure to withstand shocks.

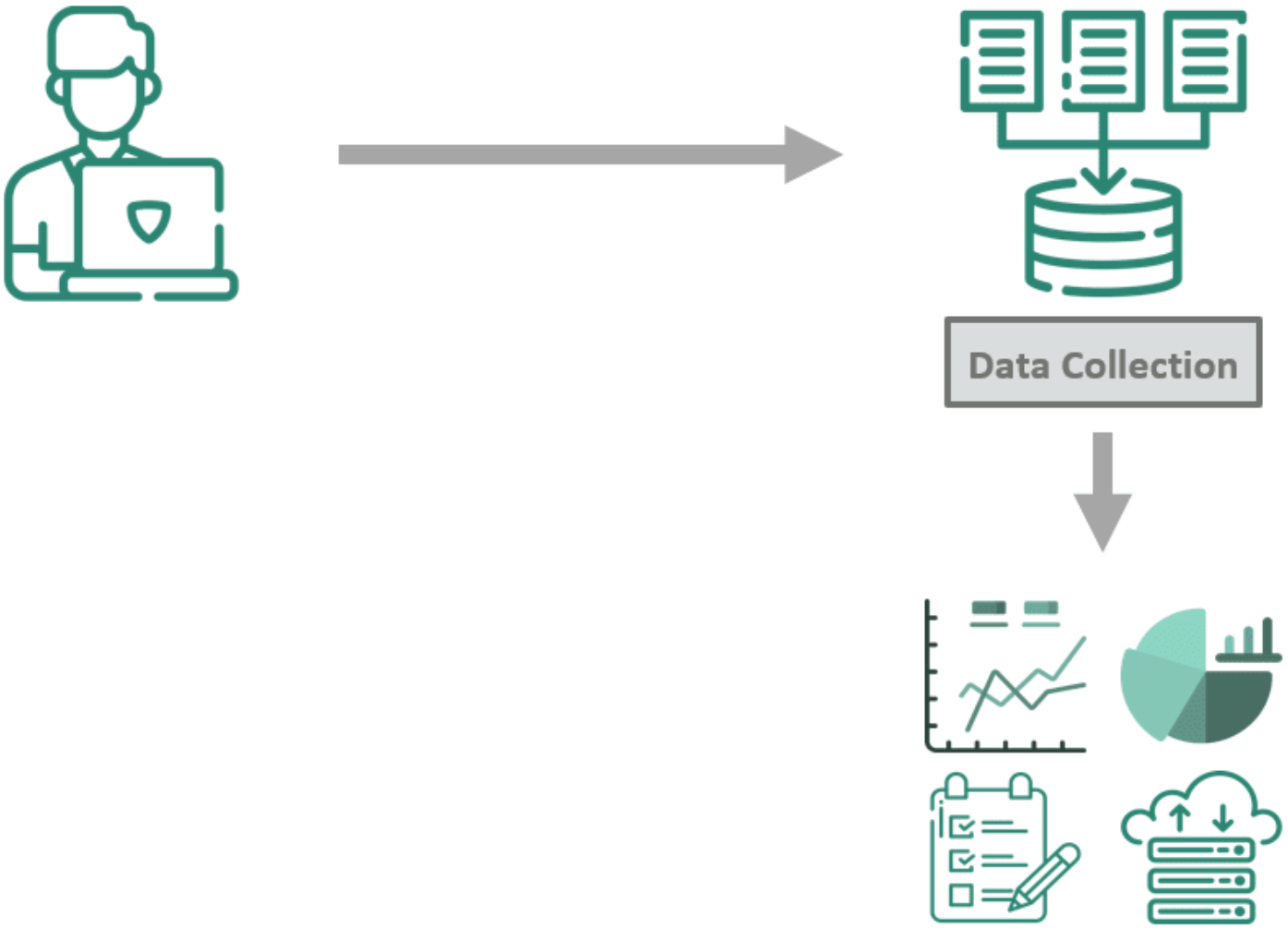
Local Implementation – Empowering Local Authorities
The project enhances local authorities' capacity through real-time data sharing, GIS database management, and training, empowering them to effectively implement sustainable transport policies and adapt plans over time, consistent with the NUA's emphasis on local action.

2.2 Land Use Guidelines and Implications of National Land Transport Policy

A prerequisite for development is strong infrastructure. Land transport policy is essential to ensure adequate physical and institutional infrastructure of transport for national development. Roads and transport are an integral part of human life. In pursuit of livelihood, the people of Bangladesh spend a significant amount of time and money on commuting and transportation in their limited lives. Therefore, the National Land Transport Policy has been formulated in the light of the Government's commitment to establish a safe, affordable, modern, technologically sound, environment friendly and acceptable transport system in the light of globalization. Important guidelines of the National Land Transport Policy are as follows:

- ✓ Providing safe and reliable transportation services.
- ✓ Removal of unnecessary regulation and formulation of regulations conducive to providing transport services in the public interest.
- ✓ Rent control.
- ✓ Identify the role of public and private sector.
- ✓ Maintaining economic and environmental balance.
- ✓ Ensuring maximum utilization of government funds as well.
- ✓ Expanding role of transport in growing economic activity.
- ✓ Reduction in transportation cost for export products as well.
- ✓ Traffic growth is consistent with economic development.
- ✓ Formulation of transport system for Dhaka metropolis.
- ✓ Introduction of centralized transport system.
- ✓ Introduction of alternative transport systems.
- ✓ Creating awareness about better living and safety.
- ✓ Poverty alleviation.

The project's activities—such as conducting reconnaissance and physical feature surveys, engaging with local authorities and communities, and preparing development plans in both Bangla and English—align with the NUA's core principles of participatory planning, social inclusion, and spatial justice. The emphasis on collecting data related to infrastructure, land use, population distribution, and environmental features further supports integrated and equitable urban development strategies.



Chapter 3

Socioeconomic Data Analysis from Household Interview Survey (HIS)

Chapter 3: Socioeconomic Data Analysis from Household Interview Survey (HIS)

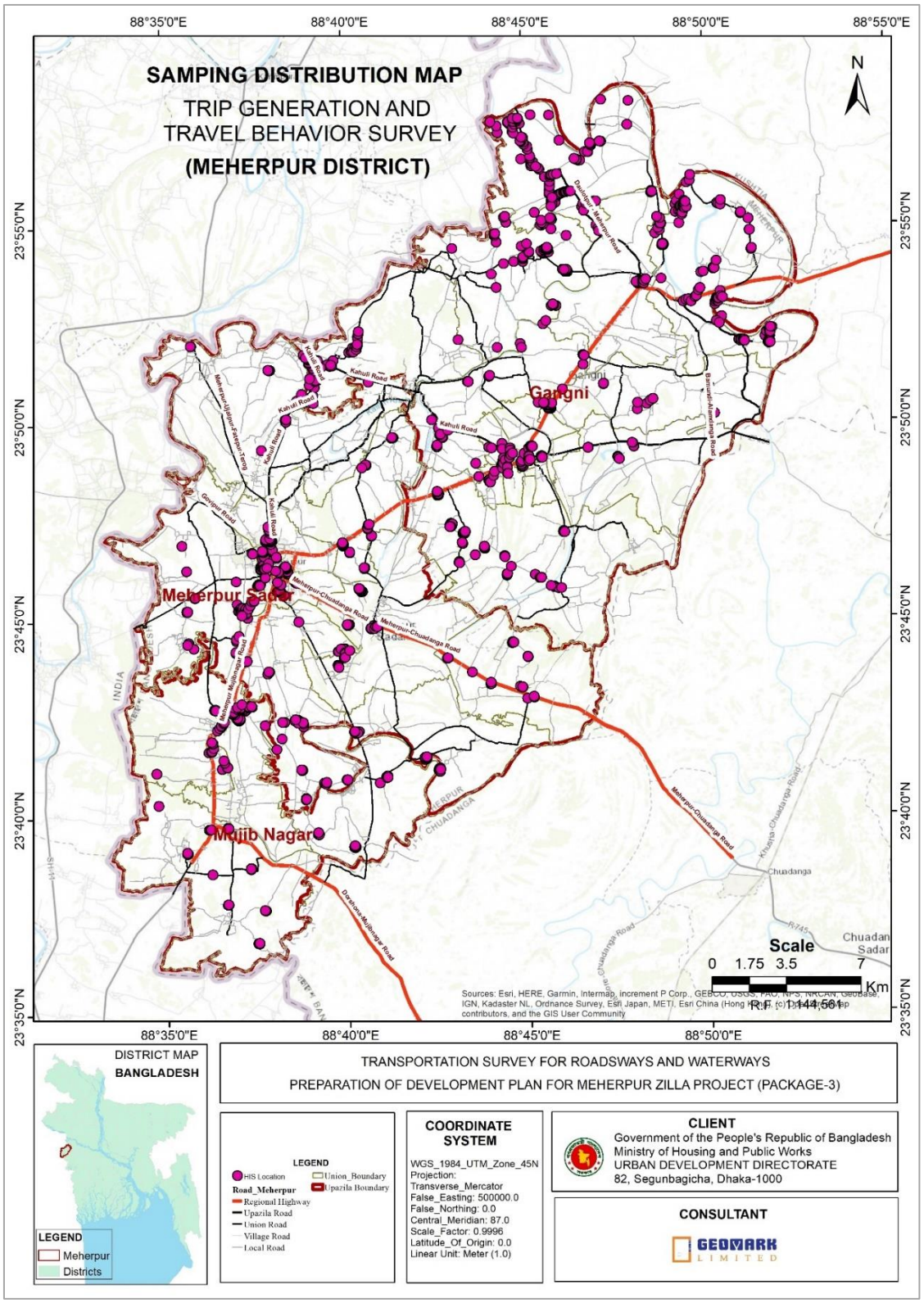


Figure 3.1: Sampling Distribution for Household Interview Survey (HIS)

3.1 Age Group of the Household Head

The distribution of household heads by age group shows a clear concentration in the middle-aged categories. Very young household heads are rare. The number of household heads begins to increase noticeably from the 20–24 age group and continues to rise through the 40–49 bracket. A sharp growth is observed in the 30–39 age group, followed by a peak in the 40–49 age group, which accounts for the largest share of household heads. Beyond this point, the distribution gradually declines, with the 50–59 group still maintaining a significant presence, while the 60–64 group shows a sharp drop. Interestingly, the 65+ category shows a modest increase again, indicating that a portion of households continue to be headed by elderly members. Overall, the data suggests that household leadership is most commonly assumed during the middle-adult years, particularly between 30 and 59, when individuals are typically most active in economic and social responsibilities.

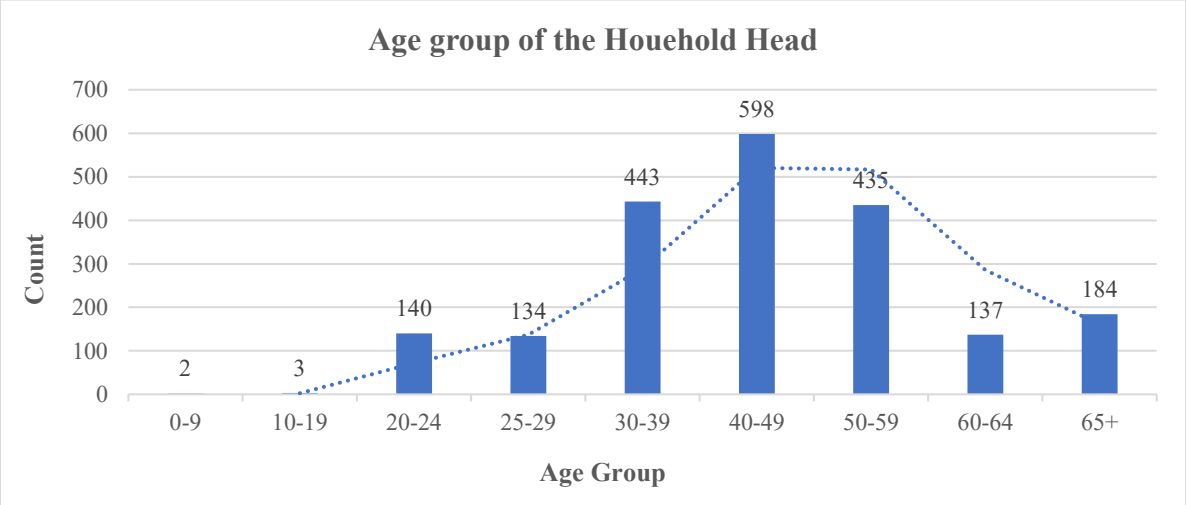


Figure 3.2: Age group of the Household Head

3.2 Income Group of the Household Head

The income distribution of household heads indicates a strong concentration in the lower-income categories. The majority of households fall within the less than 20,000 BDT monthly income group, representing 1,249 heads, followed by 763 heads in the 20,000–40,000 BDT category. Beyond this level, the number of household heads drops sharply, with only 51 falling into the 40,000–60,000 BDT group and very few households reported in higher income brackets. Specifically, 7 heads are recorded in the 60,000–80,000 BDT range, while only 3 each fall into the 80,000–100,000 BDT and above 100,000 BDT groups. This pattern clearly shows

that household leadership is heavily concentrated among the lower-income strata, highlighting economic vulnerability and limited income diversity. The data reflects a community where most households operate within modest financial means, with only a small proportion attaining higher income levels.

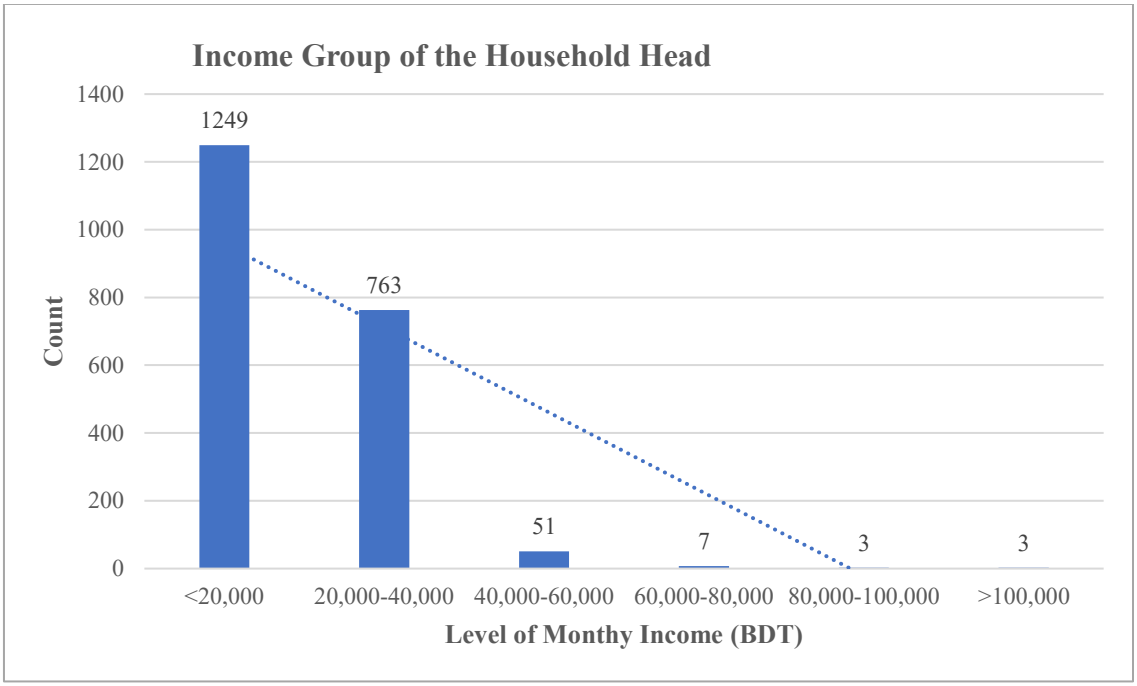


Figure 3.3: Income group of the Household Head

3.3 Education Level of the Household Head

The educational profile of household heads demonstrates a predominance of low levels of formal education. The largest share, 814 heads, falls into the below primary category, while another significant portion, 496 heads, completed only up to class six to ten. Beyond this stage, the numbers decline substantially, with 277 household heads completing SSC and 246 reaching HSC level. At the tertiary stage, 147 heads hold a BA/BSc degree, while only 56 have attained MA/MSc or equivalent higher education. A small number of household heads have studied in Madrasha institutions (5), pursued vocational training (1), or fall under the others category (9). This pattern reveals that the majority of household heads have limited formal education, with very few progressing to advanced or specialized studies. Overall, the data underscores the prevalence of low educational attainment, which may influence household decision-making, employment opportunities, and socio-economic mobility.

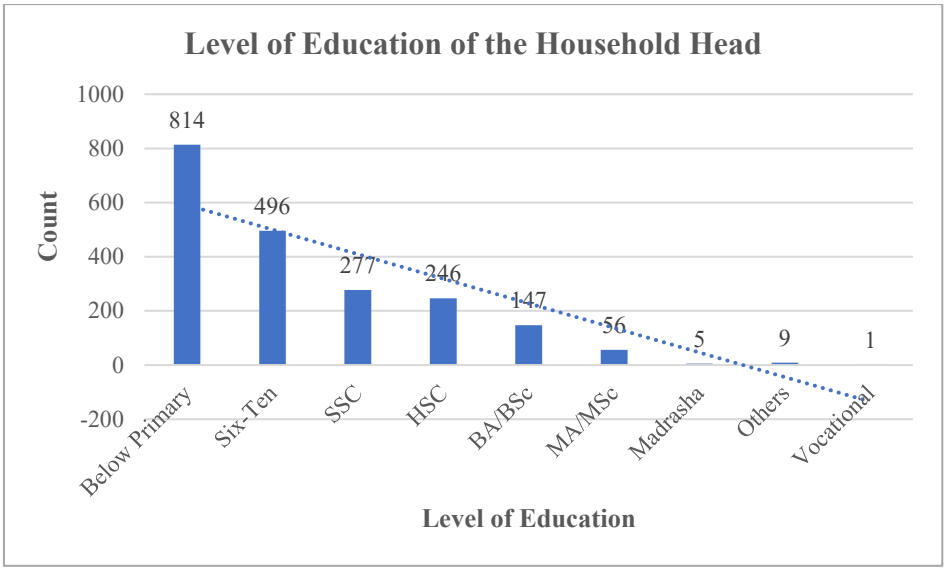


Figure 3.4: Education Level of the Household Head

3.4 Trip Ratio (Total Number of Trip /Total Number of Household)

The chart illustrates the relationship between household income and average trip generation. It shows a clear upward trend: households earning less than 20,000 make about 1.71 trips per household, those in the 20,000–40,000 income range make 1.96 trips, and households earning between 40,000–60,000 make the highest, at 2.37 trips per household. This indicates that trip-making behavior is positively correlated with income level. In other words, as household income increases, the number of trips per household also rises, reflecting greater mobility associated with higher economic capacity.

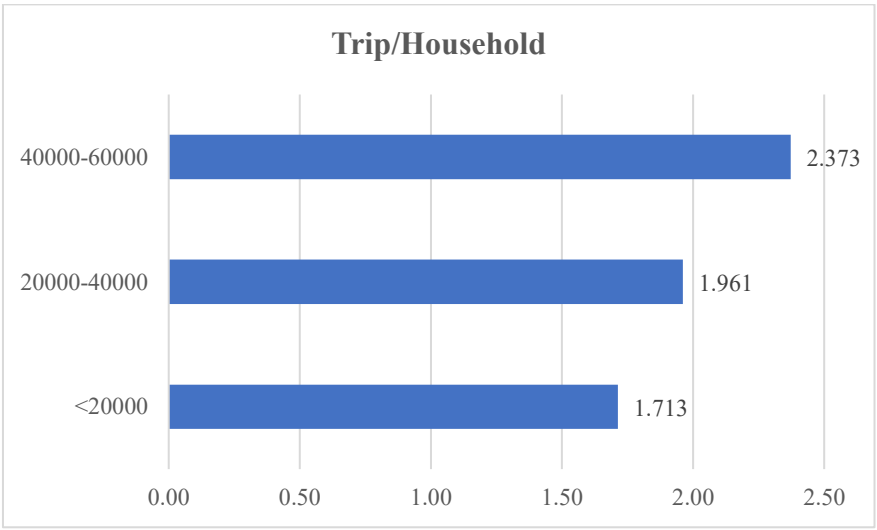


Figure 3.5: Trip Ratio (Total Number of Trip/Total Number of Household)

Chapter 4

Network Development and Representation

Chapter 4: Network Development and Representation

4.1. Development of the Traffic Analysis Zone

Each Union and Paurashava is considered as a Traffic Analysis Zone (TAZ). Thus, 22 TAZ is been Prepared. Total of 4 TAZ lies between Mujibnagar Upazila territory, where total of 8 falls in Meherpur Sadar Upazila and the rest (10) belongs to Gangni Upazila.

Table 4.1: Description of Traffic Analysis Zone (TAZ)

TAZ No	Union Name	Upazila Name	Area (sq.km)	Population	Density
1	Kazipur	Gangni	35.18	42147	1198.04
2	Tentulbaria	Gangni	33.65	32656	970.461
3	Bamandi	Gangni	29.93	29499	985.6
4	Matmura	Gangni	45.89	47546	1036.09
5	Sholataka	Gangni	28.24	25081	888.137
6	Raypur	Gangni	29.20	21256	727.945
7	Gangni Pourasava	Gangni	17.27	3289	190.446
8	Shaharbati	Gangni	27.41	25596	933.82
9	Kathuli	Gangni	33.40	24449	732.006
10	Kutubpur	Meherpur Sadar	55.60	46285	832.464
11	Shyampur	Meherpur Sadar	24.31	23294	958.206
12	Dhankhola	Gangni	60.16	44458	738.996
13	Baradi	Meherpur Sadar	29.89	25860	865.172
14	Amjhupi	Meherpur Sadar	38.22	36345	950.942
15	Meherpur Pourashava	Meherpur Sadar	16.02	4304	268.664
16	Buripota	Meherpur Sadar	40.15	39717	989.215
17	Amdah	Meherpur Sadar	32.25	33045	1024.65
18	Pirojpur	Meherpur Sadar	27.59	25409	920.95
19	Mahajanpur	Mujibnagar	25.51	20882	818.581
20	Monakhali	Mujibnagar	18.52	21750	1174.41
21	Dariapur	Mujibnagar	23.63	21173	896.022
22	Bagoan	Mujibnagar	46.25	41960	907.243

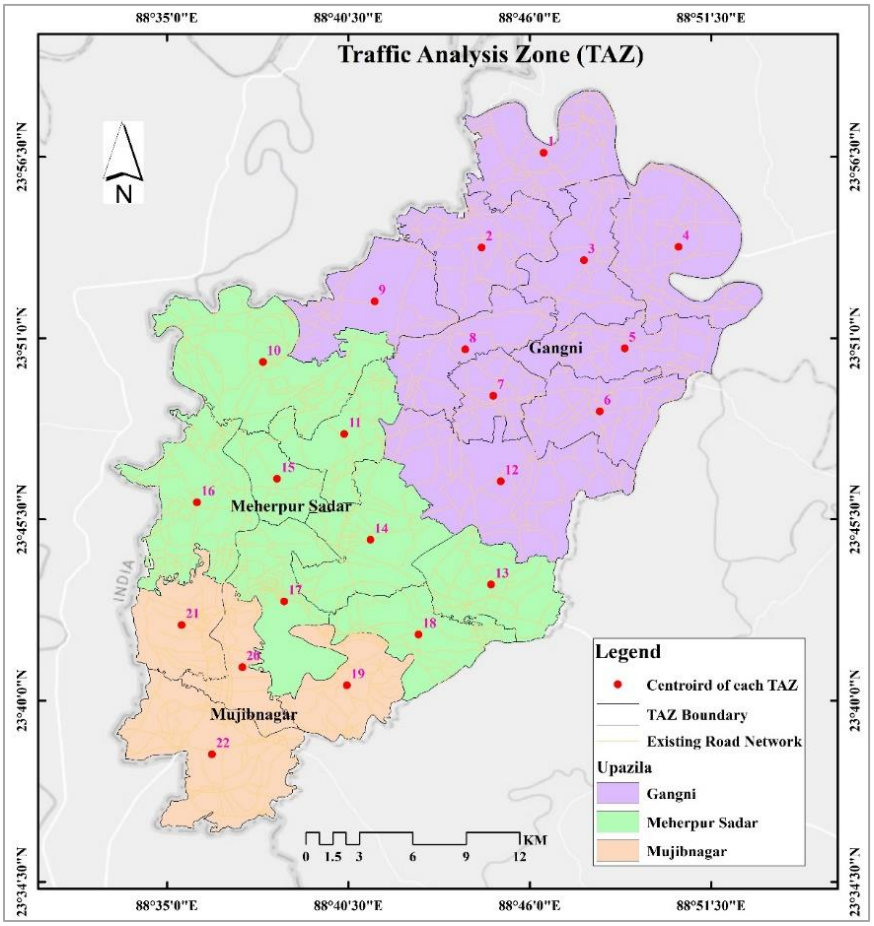


Figure 4.1: Traffic Analysis Zone (TAZ) of Meherpur District

4.2. Existing Road Network

The existing road network of the study area shows the local road network dominates, with a total length exceeding 1,000 kilometers, making it by far the most extensive category. This indicates the predominance of rural accessibility roads that provide last-mile connectivity within settlements and villages. In contrast, the union road network contributes a moderate share, with a total length of around 200 kilometers, serving as secondary links between local and higher-order roads. The regional highway and upazila road categories are comparatively limited in length, each accounting for less than 150 kilometers, which reflects the relatively sparse development of mid-level road infrastructure within the area. The village road network is the least represented, contributing only a minimal length to the overall system.

The analysis highlights that while local roads provide the backbone of the transport network, there is a noticeable deficiency in higher-order roads such as regional highways and upazila roads. This imbalance implies that although local accessibility is relatively well ensured, connectivity to regional and national corridors remains weak.

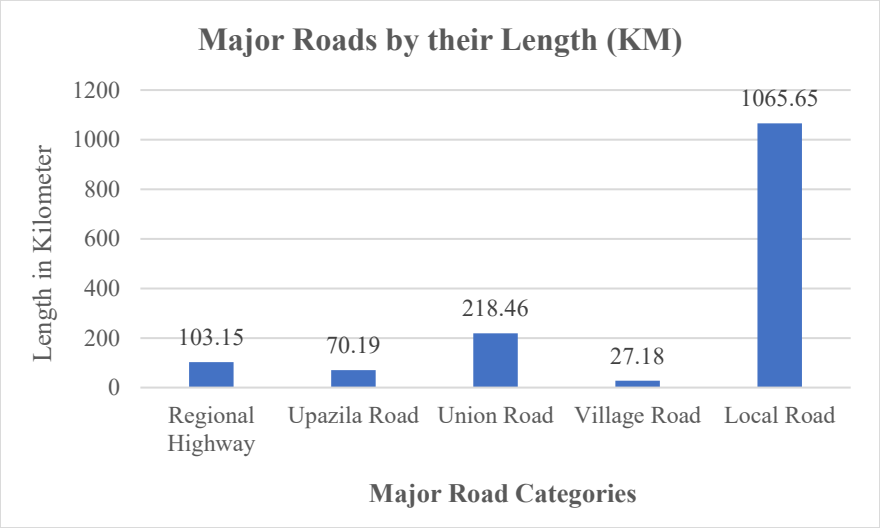


Figure 4.2: Total Length of Existing Road Network across all major Road Categories

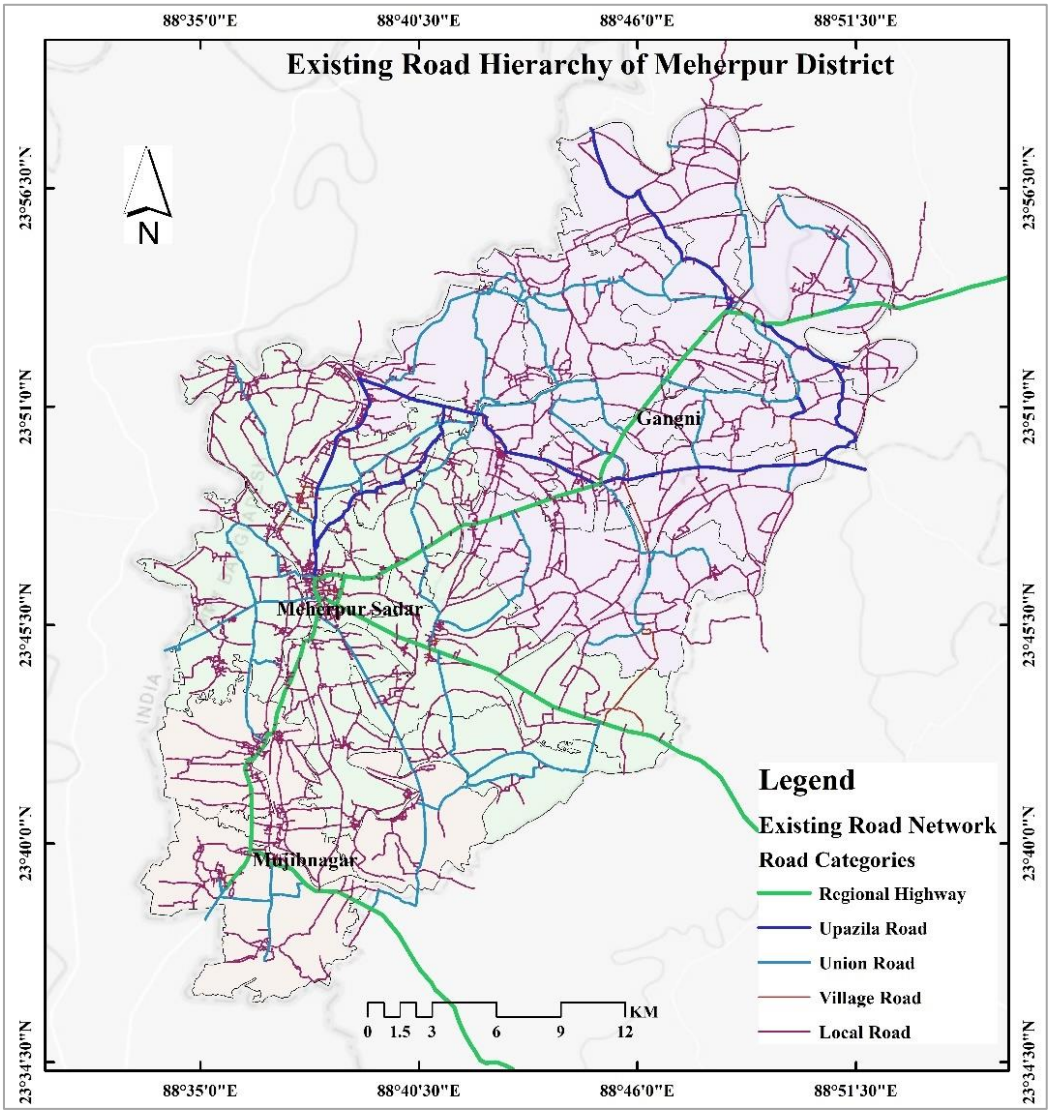
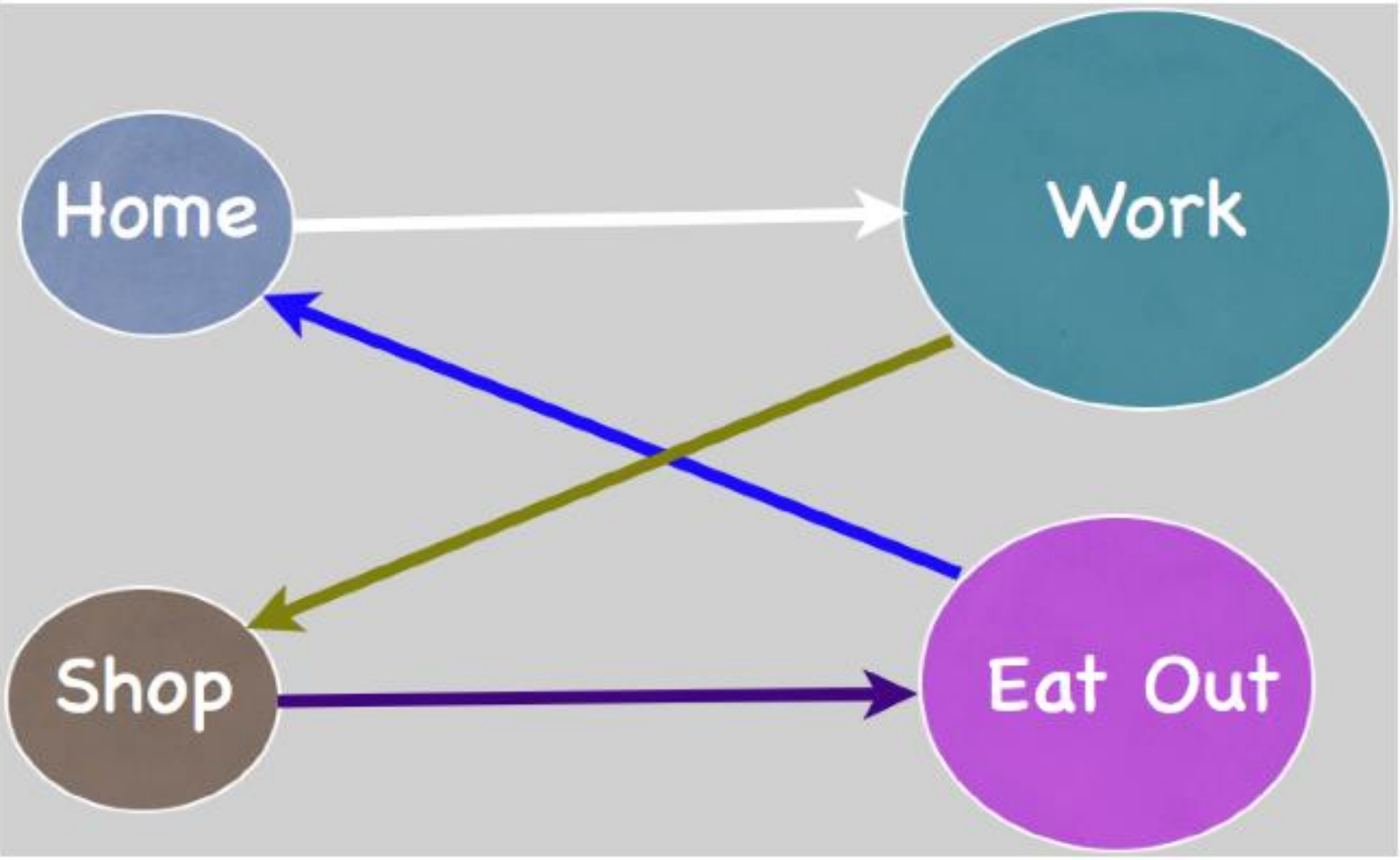


Figure 4.3: Existing Road Network across all major Road Categories



Chapter 5
Trip Generation

Chapter 5: Trip Generation

Trip generation data analysis is made based on Household Interview Survey (HIS) data. Based on, from where a trip is generated, in other word, the origin of trip is been categorized into four major categories: Home-Based Work (HBW), Home-Based Education (HBE), Home-Based Others (HBO), and Non-Home-Based (NHB). Total of 2186 number of trip maker from 2076 households have been surveyed with a structured questionnaire.

The analysis of trip purposes reveals that the majority of trips are work-related, accounting for 62.21 percent of the total 4,364 trips recorded. This indicates that commuting to workplaces remains the dominant driver of travel demand. Home-based other trips form the second-largest share at 27.68 percent, reflecting travel for shopping, social, or miscellaneous activities. Education-related trips constitute 8.59 percent, highlighting a moderate but important share of daily mobility. Non-home-based trips are minimal, comprising only 1.51 percent of total trips, and therefore represent a relatively negligible component of travel demand. Overall, the findings suggest that transport planning in the study area should primarily focus on addressing work and other activity-related travel, while still considering the notable share of education trips, with non-home-based trips being of lesser priority.

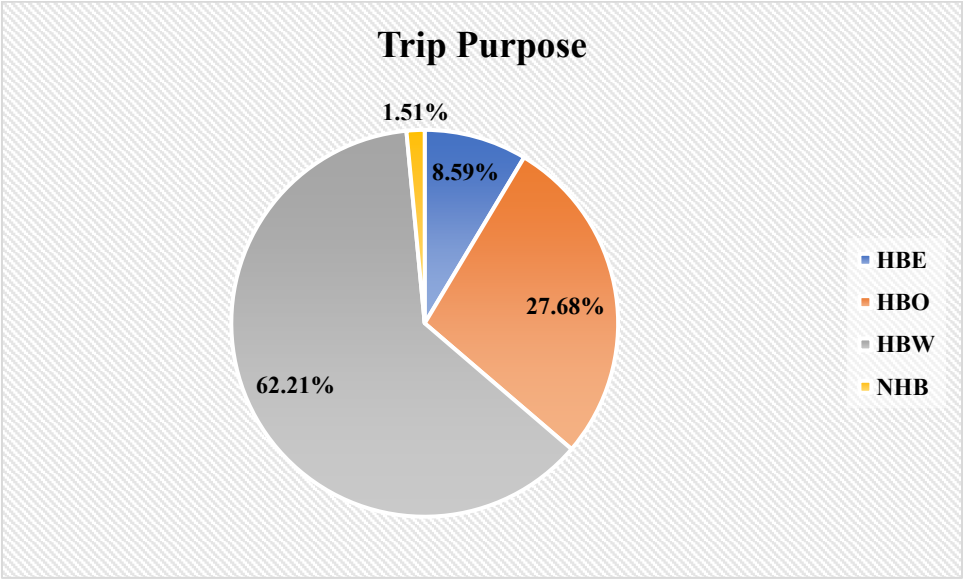


Figure 5.1: Trip Purpose across major Categories

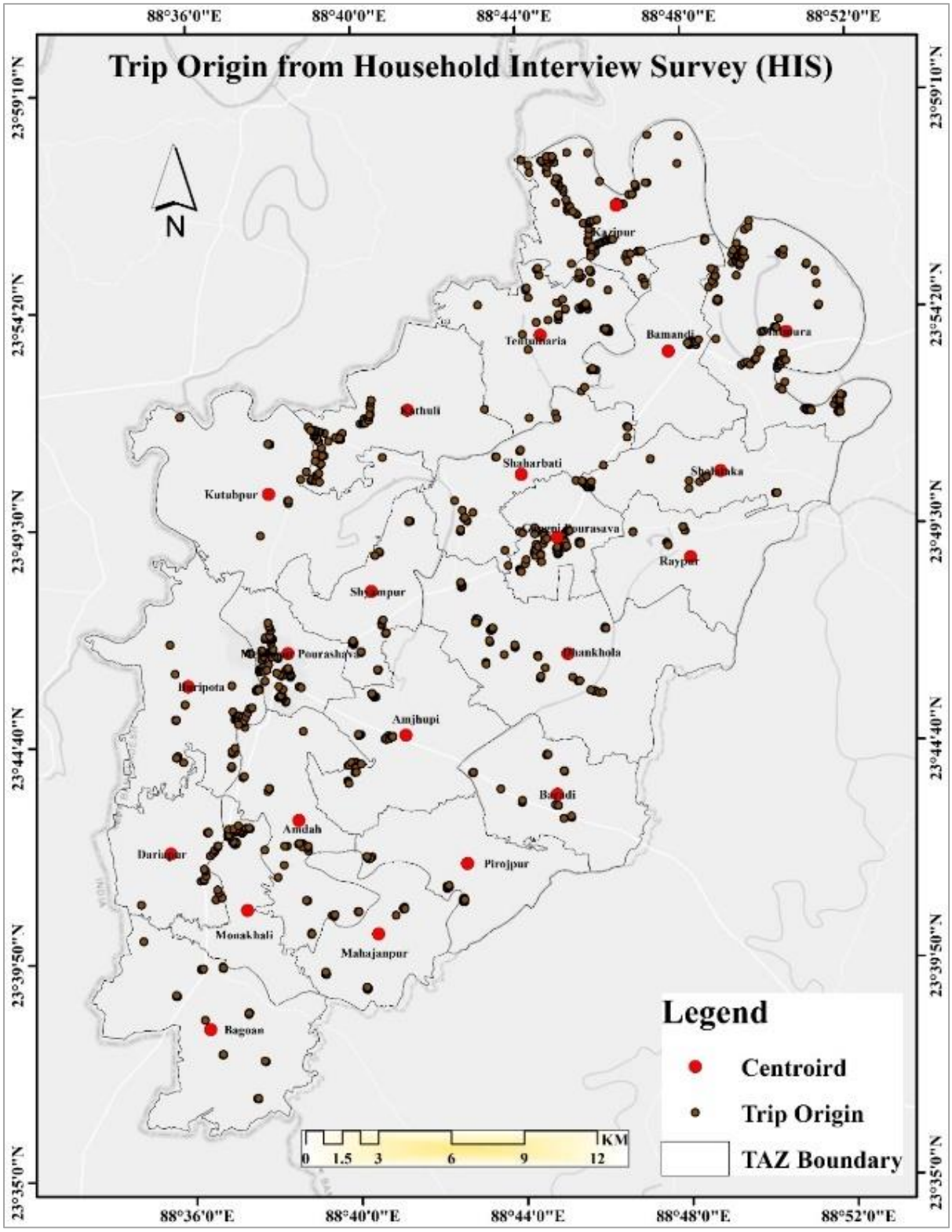


Figure 5.2: Figure: Trip Origin from Household Interview Survey (HIS)

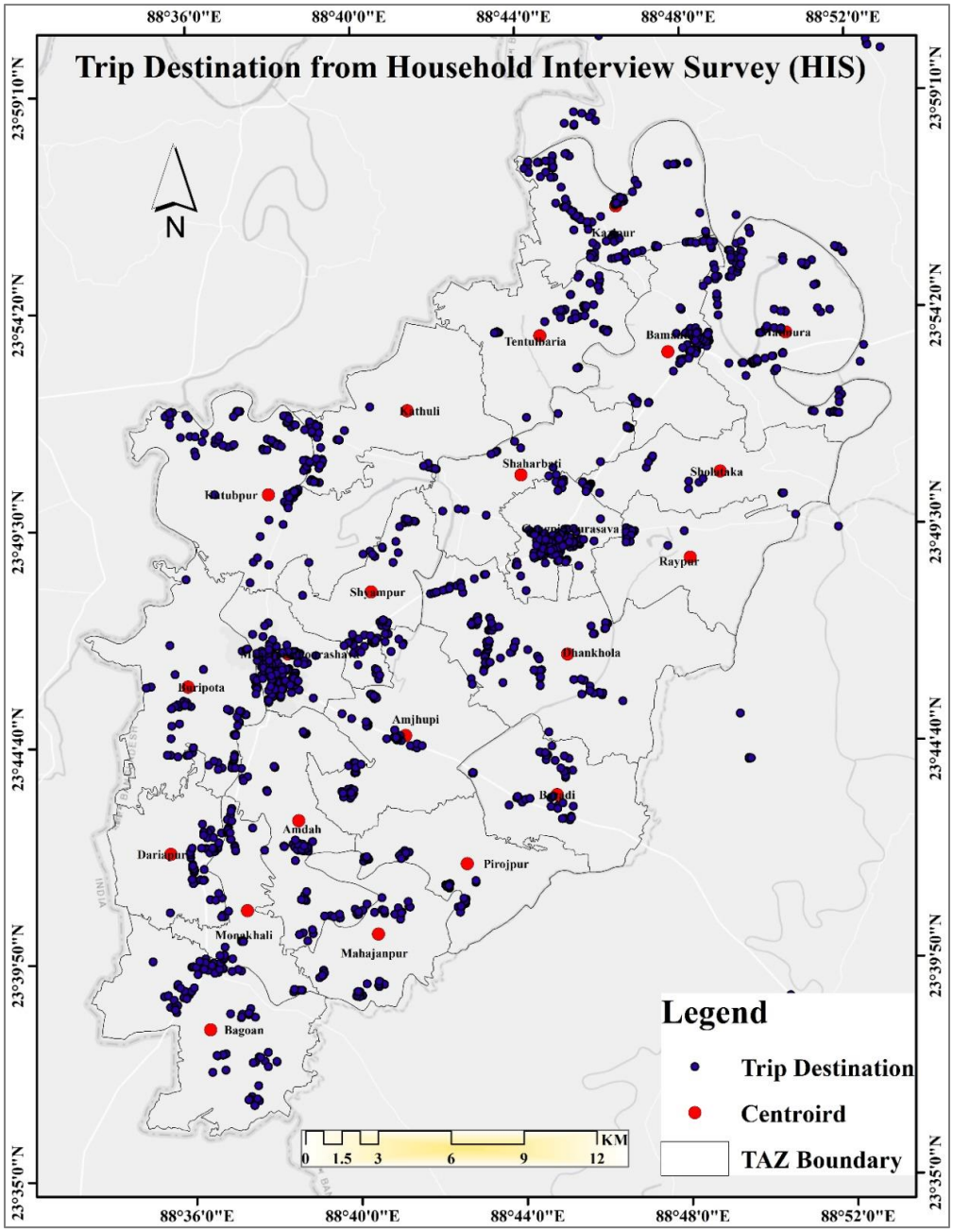


Figure 5.3: Figure: Trip Origin from Household Interview Survey (HIS)

This map illustrates the trip destinations derived from the Household Interview Survey (HIS) using a kernel density analysis across the study area. The spatial pattern highlights clear hotspots of trip attraction, where travel demand is most concentrated. The densest trip destinations are observed around Meherpur Pourashava, which shows the highest intensity in red, indicating it as the primary urban and service hub for the region. Other notable hotspots include Gangni Pourashava and Bamandi, both showing significant clustering of trips, reflecting their importance as secondary centers of activity. Smaller concentrations are visible

in areas such as Amjhupi, Matmura, Kutubpur and Kathuli pockets within the southern unions, suggesting localized travel demands. The majority of the surrounding rural areas exhibit very low trip density (blue shaded zones), indicating limited attraction compared to urban centers. Overall, the map underscores the dominance of municipal centers in shaping daily mobility patterns, with Meherpur Pourashava emerging as the core destination, while other growth nodes like Gangni and Bamandi also play important supporting roles in attracting trips.

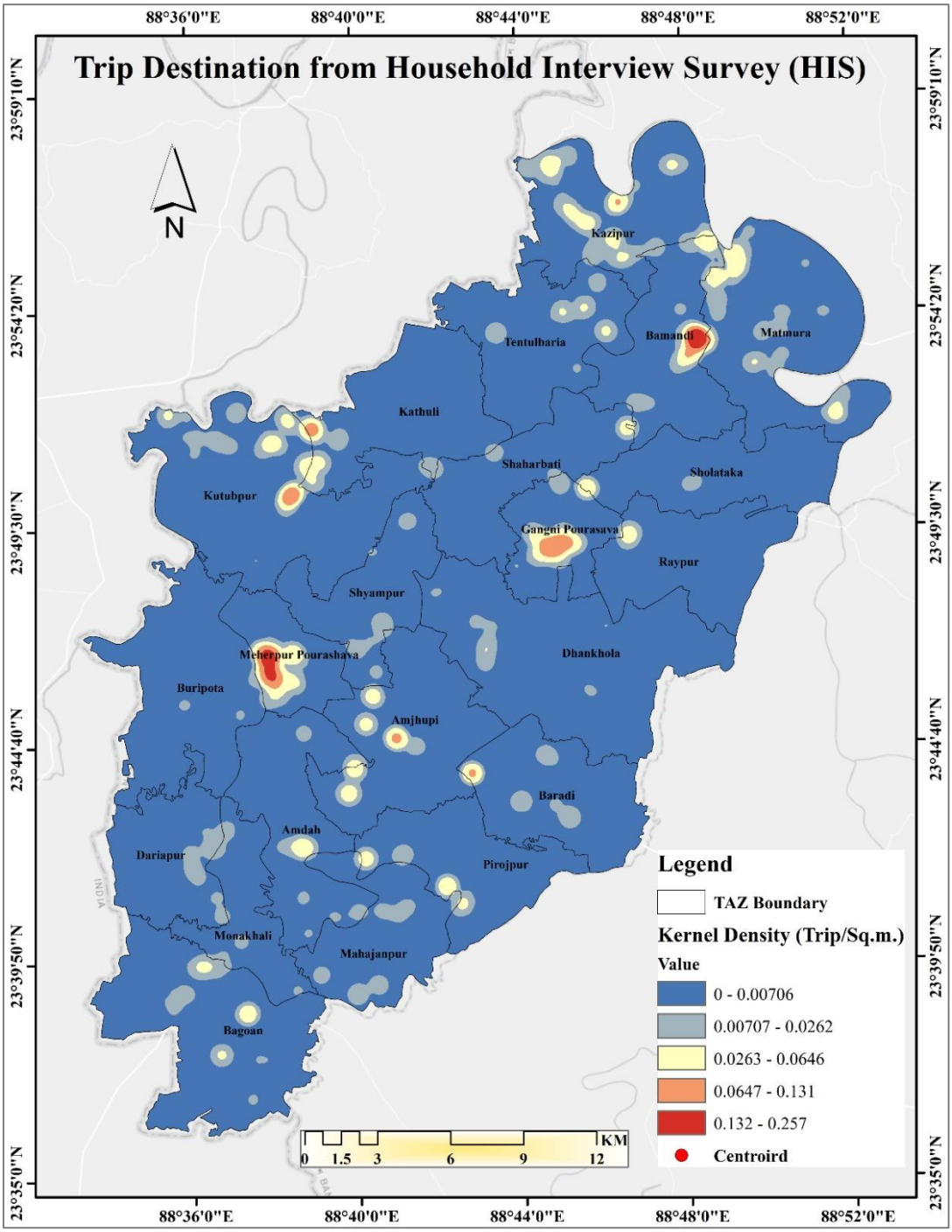


Figure 5.4: Kernel Density of Trip Destination

5.1. Household Distribution Model

Household Trip Distribution Model is prepared based on Household Interview Survey (HIS). Across numerous variables being inserted as independent variable or predictors to predict the variance of the dependent variable which is Total Number of Trip. A multiple linear regression is performed using the formula (1).

Household Size, Household Income, Number of Motorcycle, and Number of Bicycle appeared to be the key predictor to project the total number of daily trips from each household. The likeliness of trip generation increases with the inclination of household size, household income, bicycle and motorcycle ownership.

$$Y = m_1x_1 + m_2x_2 + m_3x_3 + \cdots m_nx_n + C \qquad \text{----------(1)}$$

Table 5.3: Regression Model Summary

Model Summary			
Model	R	R Square	Adjusted R Square
1	0.728	0.531	0.529
Predictors: Number of Private Car, Household Size, Number of Bicycle, Number of Motorcycle, Household Income			

Table 5.4: Coefficient Table of Regression Model

Estimating Total Number of Trips			**Sig.**
	Constant	1.403	0.000
	Predictors	**Coefficient**	**Sig.**
	Household Size	0.073	0.000
	Household Income	0.044	0.016
	Number of Motorcycle	0.053	0.044
	Number of Bicycle	0.048	0.014

5.2. Population Forecasting Method for 2025

We have considered Population and Housing Census, Community Series of Meherpur Zila. The census report of 2022 and 2011 have been retrieved from Bangladesh Bureau of Statistics Website when the 2001 hard copy has been purchased from Library. We adopted trend-adjusted Compound Annual Growth Rate (CAGR) population projection method considering two (i.e., 2001-2011, and 2011-2022) historical time span.

Growth Rate Calculation for the year 2011 considering 2001 as baseline:

$$GR_{2011} = \left[\left\{(P_{2011} - P_{2001})^{\frac{1}{\Delta t}}\right\} - 1\right] \quad \text{----- (1)}$$

Growth Rate Calculation for the year 2022 considering 2011 as baseline:

$$GR_{2022} = \left[\left\{(P_{2022} - P_{2011})^{\frac{1}{\Delta t}}\right\} - 1\right] \quad \text{----- (2)}$$

Growth Rate change (per year) is as follows:

$$GR_{(change)} = \left[\frac{\{(GR_{2022}) - (GR_{2011})\}}{\Delta t}\right] \quad \text{----- (3)}$$

Growth Rate in 2025 is:

$$GR_{2025} = \left[GR_{2022} + \left\{GR_{(change)} \times \Delta \boldsymbol{t}\right\}\right] \quad \text{----- (4)}$$

[Here, 'Δt' used in equation 1, 2, 3, and 4 is the time difference between endline and baseline]

Population projection for 2025:

$$P_{2025} = P_{2022} \times (1 + GR_{2025})^{n} \quad \text{----- (5)}$$

Here, n is the time difference between end line and baseline which is 3 here for equation 5.

Table 5.5: Population Trends for next 20 Years in Meherpur District

TAZ No	Union/Ward	Population in 2022	Population in 2025	Population in 2030	Population in 2035	Population in 2040	Population in 2045	Upazila
1	Kazipur	42130	43630	46258	49061	52033	55204	Gangni
2	Tentulbaria	32651	33794	35703	37548	39493	41349	Gangni
3	Bamandi	29492	30477	31892	32784	33716	34062	Gangni
4	Matmura	47541	49100	51195	52178	53209	53035	Gangni
5	Sholataka	25081	25878	26820	26945	27090	26398	Gangni
6	Raypur	21240	21967	23106	24052	25055	25858	Gangni
7	Gangni Pourasava	30067	31097	32708	34048	35468	36604	Gangni
8	Shaharbati	25592	26469	27840	28980	30189	31156	Gangni
9	Kathuli	24449	25323	26869	28550	30335	32277	Gangni
10	Kutubpur	46210	47847	50677	53615	56724	59949	Meherpur Sadar
11	Shyampur	23265	24062	25309	26345	27444	28323	Meherpur Sadar
12	Dhankhola	44458	45981	48363	50344	52444	54123	Gangni
13	Baradi	25834	26719	28103	29254	30474	31450	Meherpur Sadar
14	Amjhupi	36343	37546	39224	40162	41142	41306	Meherpur Sadar
15	Meherpur Pourashava	47142	48682	50727	51619	52558	52257	Meherpur Sadar
16	Buripota	39705	41180	44055	47738	51711	56733	Meherpur Sadar
17	Amdah	33045	34159	35814	36984	38207	38877	Meherpur Sadar
18	Pirojpur	25359	26250	27757	29251	30829	32382	Meherpur Sadar
19	Mahajanpur	20874	21617	22920	24308	25781	27353	Mujibnagar
20	Monakhali	21745	22447	23336	23618	23918	23579	Mujibnagar
21	Dariapur	21173	21869	22817	23288	23783	23759	Mujibnagar
22	Bagoan	41960	43458	46100	48955	51986	55263	Mujibnagar

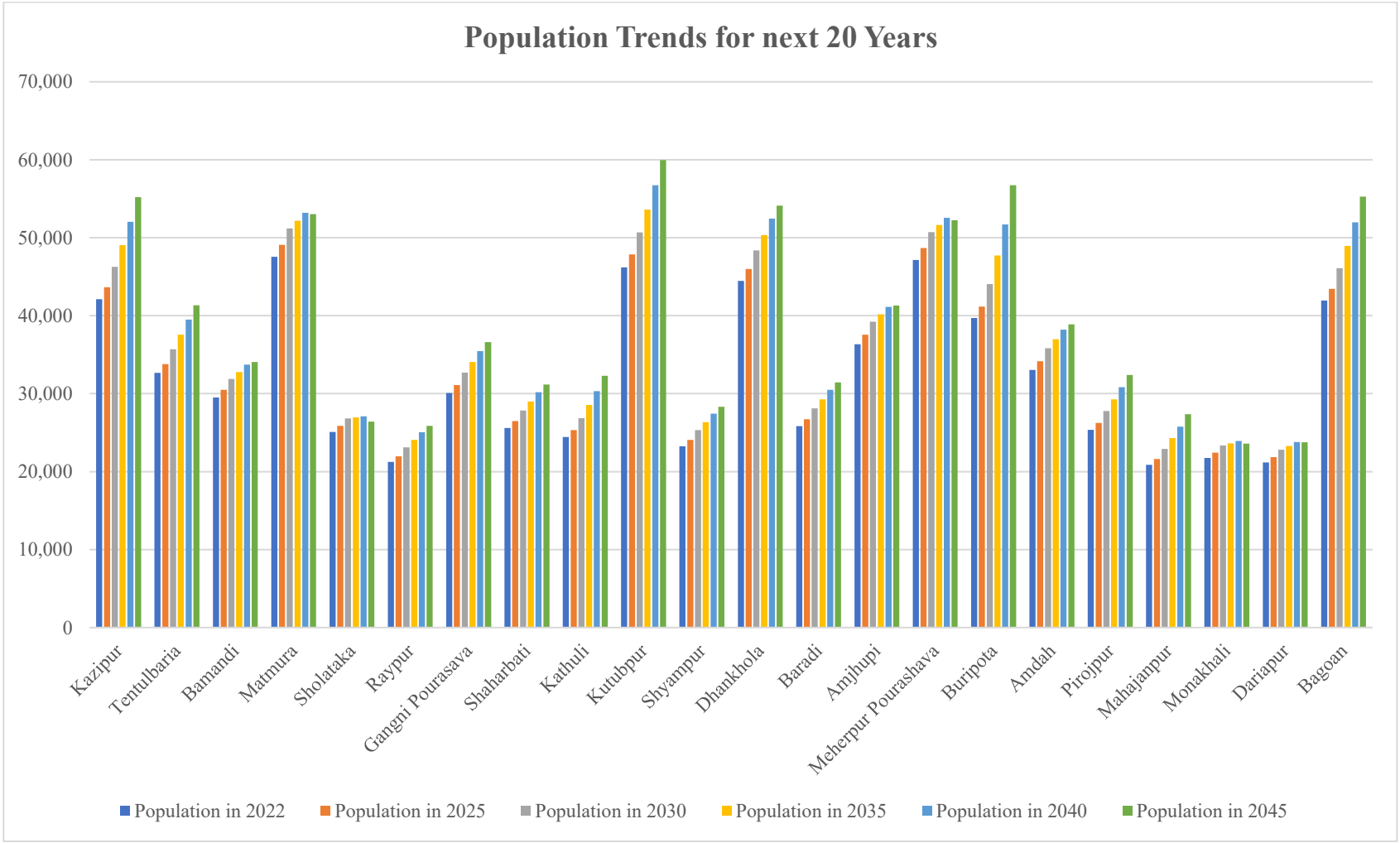


Figure 5.5: Population Trends for next 20 Years of Meherpur District

5.3. Trip Generation from each TAZ for the Year 2025

The heaviest generators of trips are Kazipur (43,148 trips/day), Meherpur Pourashava (37,951), Matmura (37,409), and Kutubpur (36,847). These zones dominate the travel landscape due to their large populations, producing well over 35,000 trips daily each.

The next tier is made up of zones that, while not at the very top, still produce between 26,000–33,000 trips daily. These include Buripota (33,371 trips/day), Amjhupi (29,045), Bagoan (28,499), Gangni Pourashava (27,291), and importantly Bamandi (26,516). What makes Bamandi stand out is its relatively high trip rate (0.87 trips/person/day), showing that residents are especially active travelers. This group forms the strong secondary layer of mobility generators, critical for regional transport planning.

Zones such as Shaharabati (26,014 trips/day, 0.98 trips/person/day), Dhankhola (27,546, 0.60 rate), Amdah (24,663), and Sholatoka (20,153) fall into the medium band. Some, like Shaharabati, generate intensity through high trip rates, while others, like Dhankhola, produce middling totals because of lower per-capita activity despite larger populations.

Finally, Shyampur (16,399), Baradi (17,367), Pirojpur (16,640), Mahajanpur (15,843), Dariapur (15,826), and Monakhali (19,329) produce the smallest trip totals. These areas remain important for basic accessibility but will not drive the bulk of regional demand.

In terms of per-capita activity, Shaharabati (0.98 trips/person/day) and Kazipur (0.99) record the highest trip rates, reflecting highly active travel behavior. Bamandi (0.87), Monakhali (0.86), and Gangni Pourashava (0.88) also show strong per-person travel intensity. Conversely, Dhankhola (0.60) and Pirojpur (0.63) report the lowest rates, highlighting zones where population size does not translate into equally high travel activity.

- Population-heavy zones (Kazipur, Meherpur Pourashava, Matmura, Kutubpur, Buripota) dominate absolute demand.
- High trip-rate zones (Shaharabati, Bamandi, Monakhali, Gangni Pourashava) demonstrate strong mobility intensity relative to size.

Both dynamics must be considered in planning, as managing volume and managing intensity require different policy responses.

Table 5.6: Trip Generation from each TAZ for the Year 2025

TAZ No	Name of Area	Total HH	Total HH Member	Trip Maker	Trip Number	Trip Rate (Trip/Person/Day)	Population in 2025	Total Trip Production
1	Kazipur	134	362	179	358	0.988950276	43630	43148
2	Tentulbaria	101	331	112	252	0.761329305	33794	25728
3	Bamandi	77	177	77	154	0.870056497	30476	26516
4	Matmura	144	441	164	336	0.761904762	49099	37409
5	Sholataka	73	217	84	169	0.778801843	25877	20153
6	Raypur	57	145	57	114	0.786206897	21967	17270
7	Gangni Pourasava	82	237	97	208	0.877637131	31096	27291
8	Shaharbati	77	175	85	172	0.982857143	26468	26014
9	Kathuli	95	266	95	190	0.714285714	25322	18087
10	Kutubpur	134	348	134	268	0.770114943	47847	36847
11	Shyampur	61	179	61	122	0.681564246	24061	16399
12	Dhankhola	124	434	128	260	0.599078341	45980	27546
13	Baradi	45	140	45	91	0.65	26718	17367
14	Amjhupi	92	265	99	205	0.773584906	37546	29045
15	Meherpur Pourashava	123	372	133	290	0.779569892	48682	37951
16	Buripota	108	327	132	265	0.810397554	41179	33371
17	Amdah	98	277	99	200	0.722021661	34159	24663
18	Pirojpur	71	224	71	142	0.633928571	26250	16640
19	Mahajanpur	59	161	59	118	0.732919255	21617	15843
20	Monakhali	62	144	62	124	0.861111111	22447	19329
21	Dariapur	54	152	55	110	0.723684211	21869	15826
22	Bagoan	87	276	90	181	0.655797101	43457	28499

5.4 Total Trip Generation of Meherpur District

The map titled "Total Trip Generation of Meherpur District" presents the spatial distribution of trip generation across all unions and municipalities in the district which provides a clear visual understanding of mobility intensity across the region. The highest levels of trip generation, represented by the darkest brown shade (36,780–42,974), are observed in Kazipur, Matmura, and Kutubpur. These unions stand out as the strongest trip generators, reflecting their relatively higher population. Moderately high trip generation zones (30,585–36,779) include Meherpur Municipality, Buripota, and Dhankhola. These areas also contribute significantly to total trip-making and function as important secondary centers, supporting employment, education, and service-related travel needs. The medium trip-generating zones (24,389–30,584) are represented by Gangni Paurashava, Kathuli, Amjhupi, Amdah, and Bagoan. Least levels of trip generation are concentrated in unions shaded in yellow (11,998–18,193). These include Baradi, Dariapur, Monakhali, Mahajanpur, Raypur, and Shyampur. These unions show comparatively limited mobility demand, reflecting their predominantly rural character, lower settlement density, or limited-service availability.

Table 5.7: TAZ-wise Trip Generation across all Major Purposes

	Trip Generation					
	HBE	HBO	HBW	NHB	Total	
TAZ Number						Union/ Municipality
1	238	21250	20534	954	42976	Kazipur
2	2043	5107	15529	204	22883	Tentulbaria
3	508	11191	8139	254	20092	Bamandi
4	5334	26290	9525	1270	42419	Matmura
5	1051	7359	13931	262	22603	Sholataka
6	265	264	15112	264	15905	Raypur
7	4731	2365	17505	236	24837	Gangni Pourasava
8	253	5828	15456	507	22044	Shaharbati
9	273	4372	21592	273	26510	Kathuli
10	276	16343	19944	553	37116	Kutubpur
11	6639	1327	8233	265	16464	Shyampur
12	558	11442	23442	279	35721	Dhankhola
13	250	500	11001	249	12000	Baradi
14	1052	263	25772	262	27349	Amjhupi
15	964	241	33996	241	35442	Meherpur Pourashava
16	7256	5302	23720	279	36557	Buripota

17	1504	683	24887	273	27347	Amdah
18	267	267	19013	266	19813	Pirojpur
19	252	252	14872	251	15627	Mahajanpur
20	271	9191	7569	270	17301	Monakhali
21	259	259	14292	259	15069	Dariapur
22	267	267	24037	266	24837	Bagoan

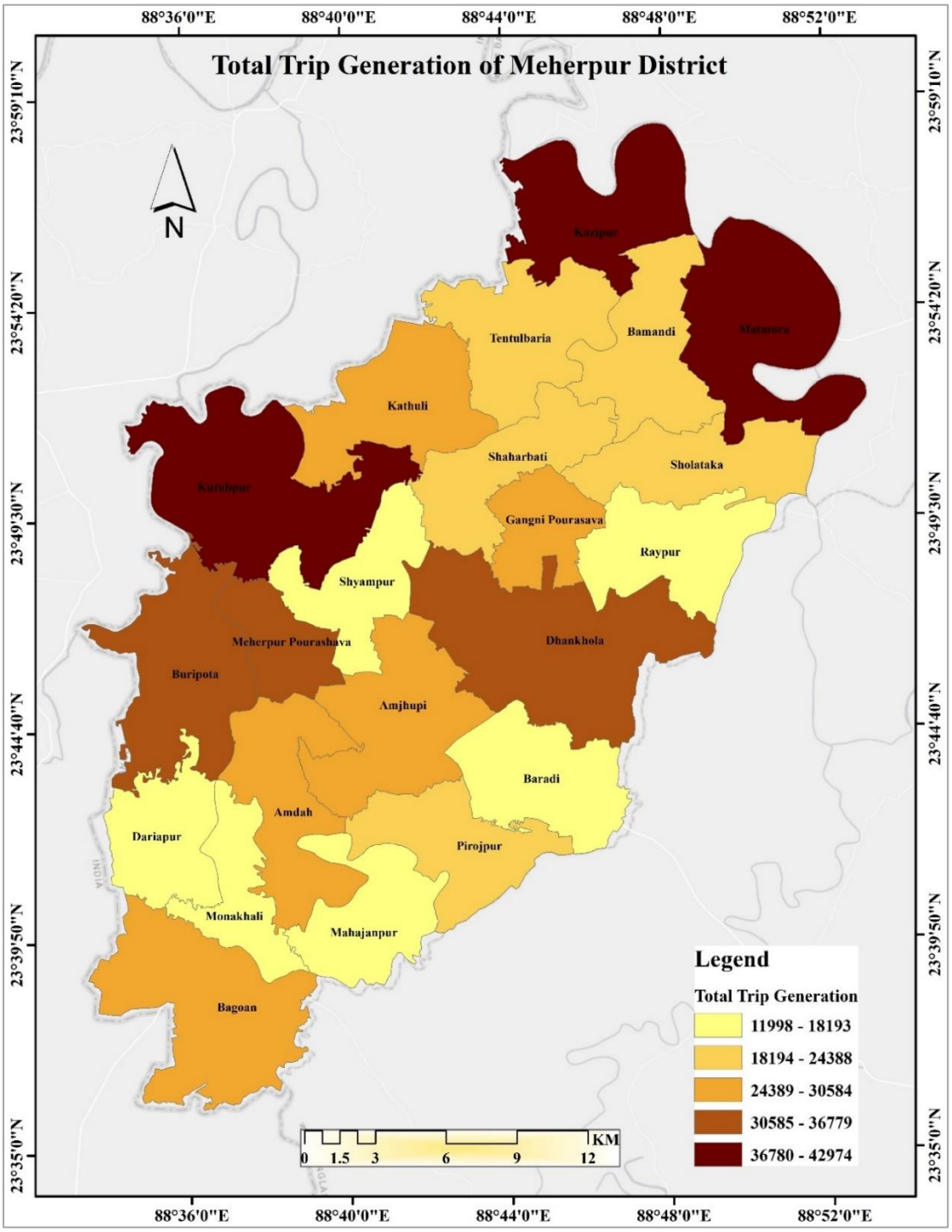


Figure 5.6: Total Trip Generation of Meherpur District

5.4.1 Trip Generation from Home-Based Education (HBE)

The map titled "Trip Generation from Home-Based Education (HBE)" illustrates how education-related trips are distributed across the unions and municipalities of Meherpur District. The highest HBE trip generation (14,342–17,867) is concentrated in Buripota Union. This indicates a high density of student population and significant educational activity in this area. Moderate zones (7291-10,815) include Gangni Municipality, Shyampur, Dhankhola, and Matmura. The rest of unions, shaded in light yellow (238–7,290) generate comparatively fewer HBE trips, which suggests limited access to educational facilities or lower concentrations of student populations.

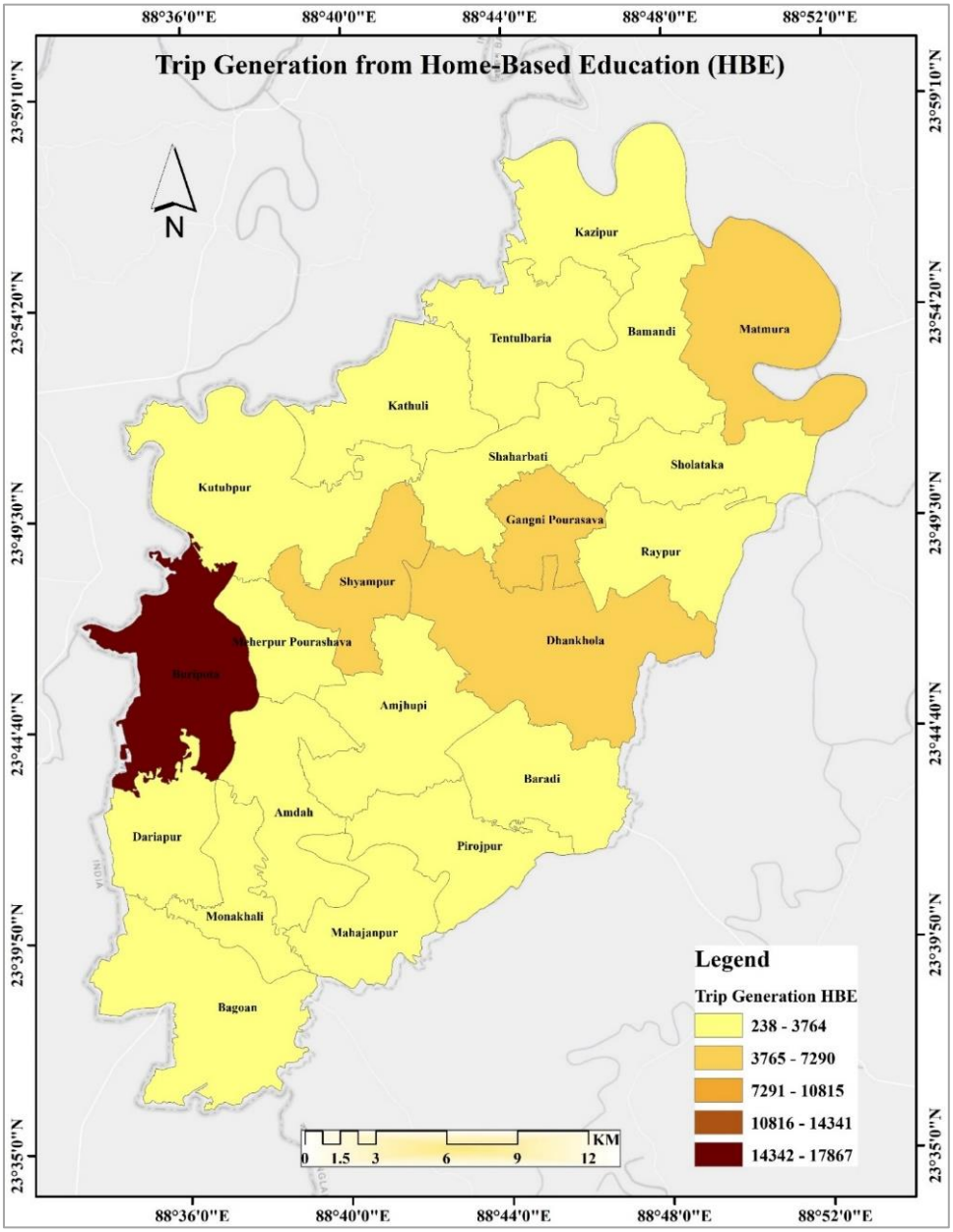


Figure 5.7: Trip Generation from Home-Based Education (HBE)

5.4.2 Trip Generation from Home-Based Work (HBW)

The map titled "Trip Generation from Home-Based Work (HBW)" shows the distribution of work-related trips across the unions and municipalities of Meherpur District. The highest levels of HBW trip generation (27,472–33,996) is concentrated in Meherpur Municipality, marking them as the district's leading centers for work-related mobility. Followed by Meherpur Municipality, Bagoan, Amdah, Amjhupi, and Kathuli also generate large volumes of commuting trips. Their range of trip generation is 20,948–27,471. A mid-range of HBW trips (14,423–20,947) is observed in Gangni Paurashava, Shaharbati, Raypur, Kutubpur, Tentulbaria, Kazipur, Pirojpur, and Mahajanpur. Least level of HBW trip generation (1,373–7,898) occur in Buripota, Monakhali, and Dhankhola, suggesting fewer employment-based travel demands, likely due to rural settings and agricultural dependence.

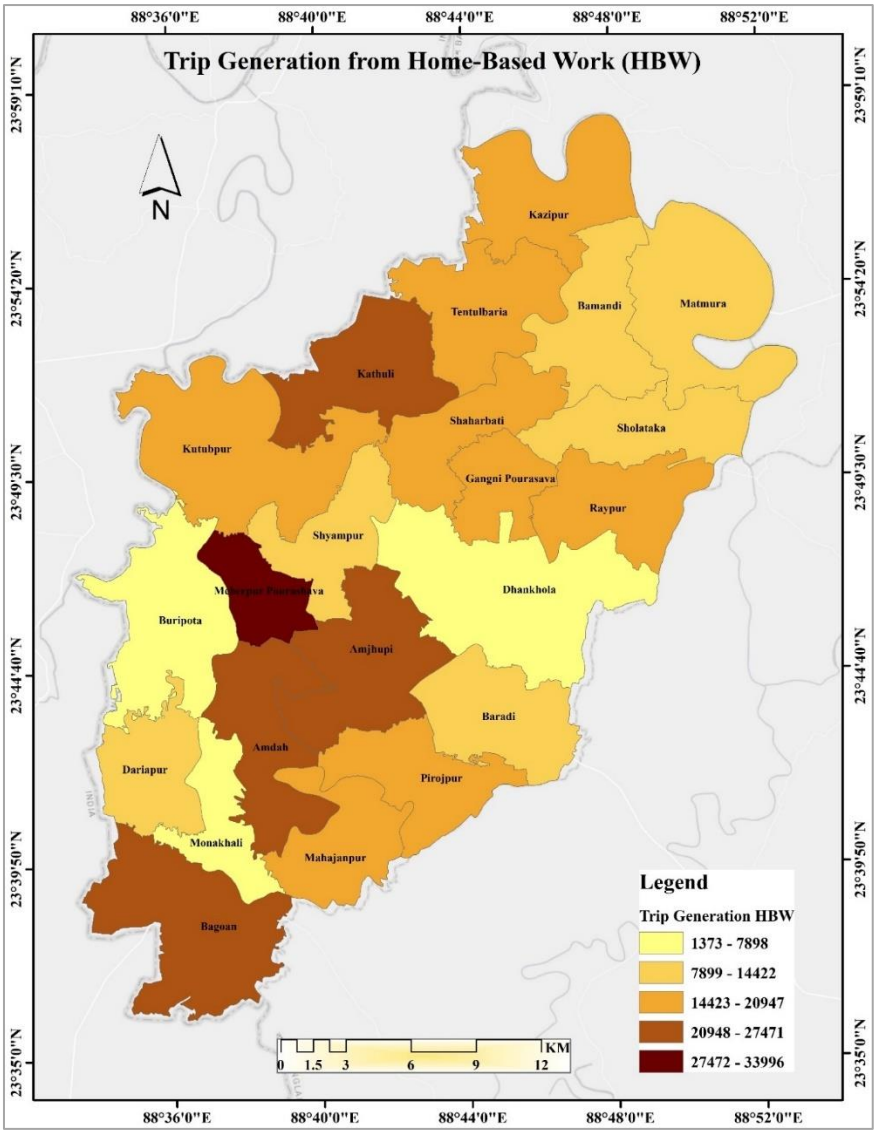


Figure 5.8: Trip Generation from Home-Based Work (HBW)

5.4.3 Trip Generation from Home-Based Others (HBO)

The map titled "Trip Generation from Home-Based Others (HBO)" depicts the distribution of trips generated for purposes other than work or education across the unions and municipalities of Meherpur District. The highest HBO trip generation (23,571–29,402) is concentrated in Dhankhola and Matmura Union. Kazpur Union also found to be high (17738–23,570) number of home-based others type of trip producer. This suggests significant activity related to shopping, social interactions, health services, and miscellaneous travel needs. However, most of the part of the district falls into least zone (240-6,072) indicates home-based shopping and others miscellaneous mobility is quite less frequent.

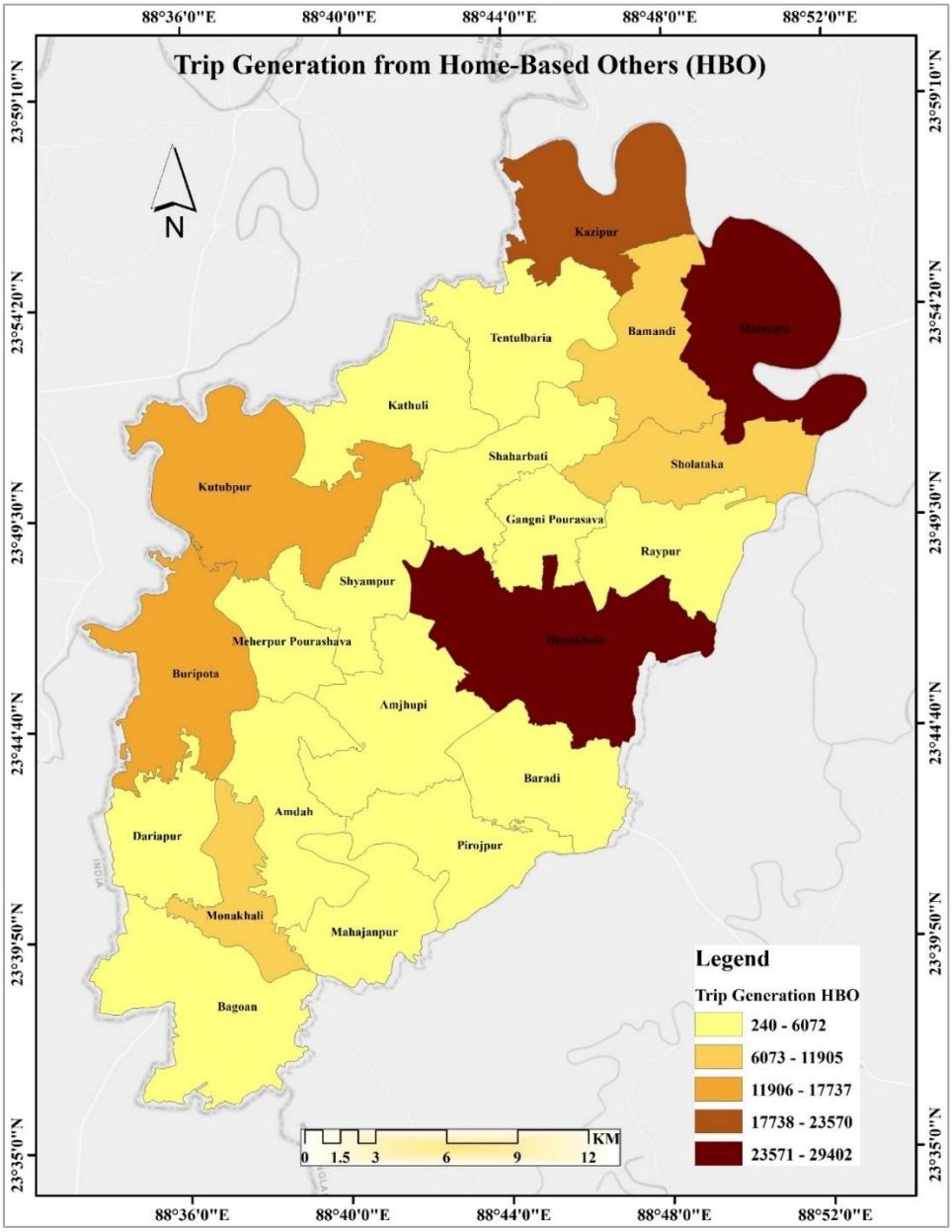


Figure 5.9: Trip Generation from Home-Based Others (HBO)

5.4.4 Trip Generation from Non-Home-Based (NHB)

The map titled "Trip Generation from Non-Home-Based (NHB)" illustrates the spatial variation of trips that begin from locations other than home (e.g., work-to-market, school-to-shopping, or other chained trips) across the unions and municipalities of Meherpur District. The highest NHB trip generation (1,058–1,270) is recorded in Matmura Union, making it the most significant contributor to non-home-based trips in the district. This indicates a strong presence of trip-chaining activities and intermediate travel demands within the union. High extent of NHB generation (844–1,057) is observed in Kazipur Union as well, while Dhankhola, Buripota, Kutubpur and Shaharbati fall into the medium range (631–843). However, most of the part of the district falls into least zone (203–630), indicating relatively low NHB trip generation.

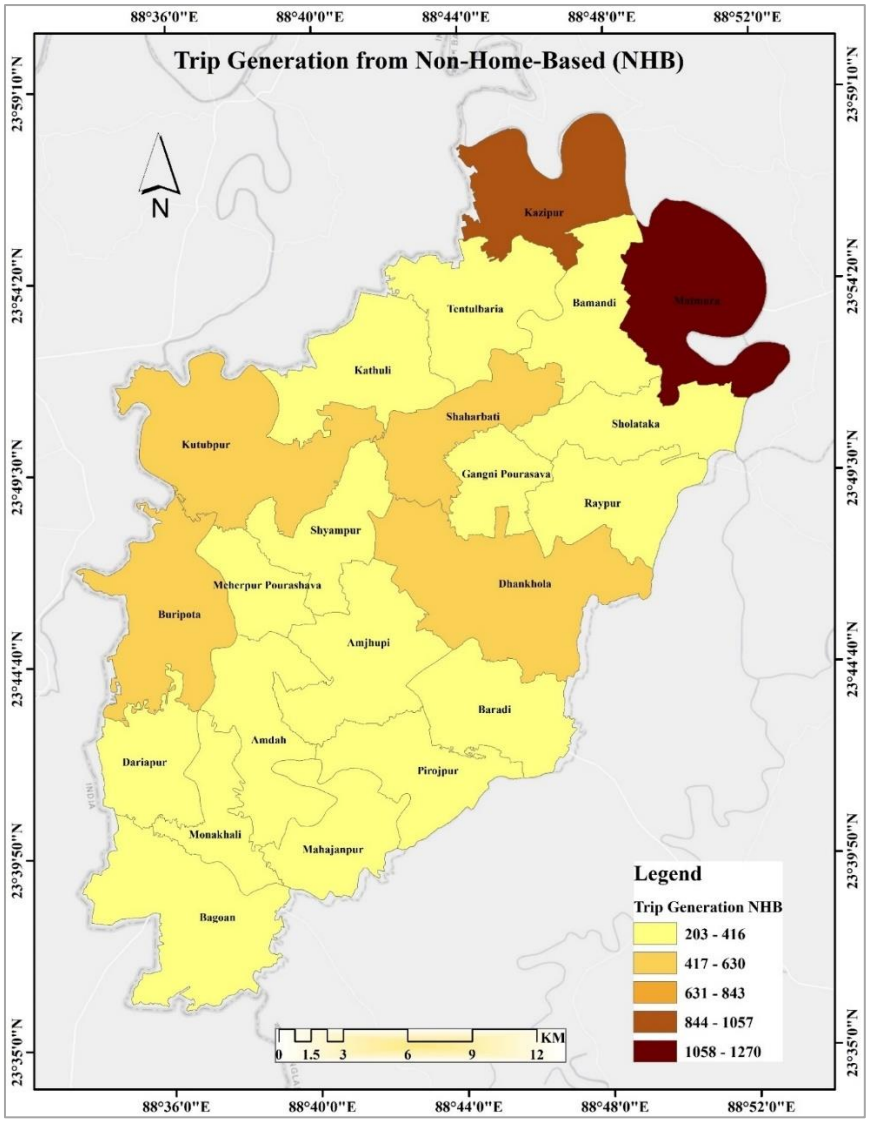
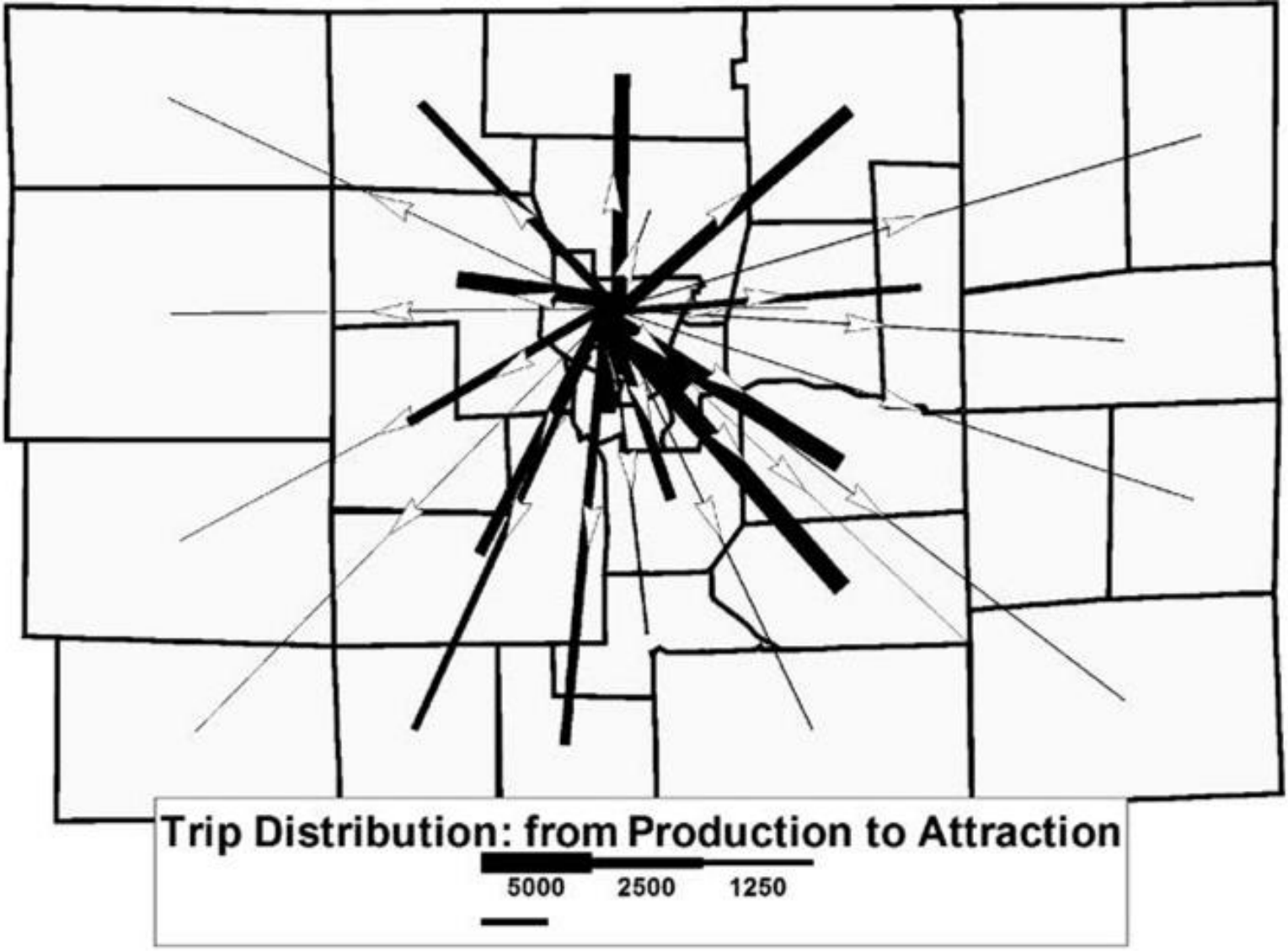


Figure 5.10: Trip Generation from Non-Home-Based (NHB)



Chapter 6

Trip Distribution

Chapter 6: Trip Distribution

Meherpur Municipality (TAZ 15) demonstrates the most dominant inter-zonal pull, attracting large volumes of trips from various zones. Also, Gangni Municipality (TAZ 7) attracts substantial trips from multiple origins, evidenced by large inflows from other unions, which highlights its importance as a secondary service and trade hub. Its strong inter-zonal attraction underscores its role in concentrating activities beyond its boundaries. This pattern confirms Meherpur's status as the primary destination for administrative, commercial, and educational functions, with Gangni acting as important supporting centers that feed significant inter-zonal flows into the municipal core.

In Figure 6.1 Rows implies Trip Productions (Origins): Each row represents trips generated from a TAZ whereas, Columns represents Trip Attractions (Destinations): Each column represents trips attracted to a TAZ. Diagonal Cells = Intra-zonal Trips: High values along the diagonal (e.g., 32373 in TAZ-1 & TAZ-12, 31257 in TAZ 15) show that a large share of trips remain within the same zone. This indicates significant localized travel activity. Sparse Flows Elsewhere: Many cells are filled with low values (279, 558, 1116) or zeros, suggesting that most zones exchange only a limited number of trips, with concentration in a few key centers.

In essence, TAZ 15 (Meherpur Municipality), and TAZ 7 (Gangni Municipality) stand out as major trip hubs, with high levels of both production and attraction. The dominance of diagonal values indicates that intra-zonal trips are more frequent than inter-zonal trips, which is typical in semi-urban and union-level areas where most daily needs are met locally. However, the presence of strong inter-zonal flows shows that municipal centers act as primary attractors, drawing trips for work, education, and services from surrounding unions.

Table 6.1: TAZ to TAZ Trip Origin and Trip Distribution

TAZ Origin/TAZ Destination	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22
1	**32373**	279	4465	1116	0	0	2511	0	0	558	0	279	0	279	1116	0	0	0	0	0	0	0
2	558	**15070**	2232	3628	0	0	1116	0	0	0	0	0	279	0	0	0	0	0	0	0	0	0
3	1395	0	**16744**	1116	0	0	558	0	0	279	0	0	0	0	0	0	0	0	0	0	0	0
4	0	0	11163	**27629**	0	0	3069	0	0	0	0	0	0	0	558	0	0	0	0	0	0	0
5	279	1953	279	0	**8930**	279	7814	1395	0	0	0	0	0	1395	279	0	0	0	0	0	0	0
6	279	0	2232	0	0	**5581**	4186	837	0	0	0	0	0	0	1953	0	837	0	0	0	0	0
7	0	0	279	0	0	0	**20931**	558	279	0	0	279	0	0	2511	0	0	0	0	0	0	0
8	279	0	1395	558	1953	0	7256	**4186**	3348	1395	0	1395	0	0	279	0	0	0	0	0	0	0
9	558	0	0	0	0	0	3069	0	**10326**	3348	279	1116	0	0	7814	0	0	0	0	0	0	0
10	0	279	0	0	0	0	558	0	2790	**27908**	279	0	0	0	5302	0	0	0	0	0	0	0
11	0	0	0	0	0	0	0	558	0	558	**12279**	0	0	558	2232	0	0	0	0	0	279	0
12	0	0	279	0	0	0	1674	0	0	0	0	**32373**	0	0	1116	0	0	0	0	279	0	0
13	0	0	0	0	0	0	0	0	0	0	0	279	**10884**	558	279	0	0	0	0	0	0	0
14	0	0	0	0	0	0	0	0	0	0	1395	0	0	**20931**	3907	0	0	1116	0	0	0	0
15	0	0	0	279	0	0	279	0	558	558	279	279	279	0	**31257**	1116	0	279	0	0	279	0
16	0	0	0	1116	0	0	0	0	0	0	0	279	0	0	12558	**18698**	837	0	279	558	1953	279
17	0	0	0	0	0	0	0	0	0	279	0	279	0	2790	4465	1395	**17023**	279	279	0	0	558
18	0	0	0	0	0	0	0	0	0	0	0	0	0	558	1116	0	0	**16744**	837	558	0	0
19	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1116	0	558	279	**12000**	837	279	558
20	0	0	0	0	0	0	0	0	0	0	0	0	0	279	1395	0	0	0	0	**13116**	2511	0
21	0	0	0	0	0	0	0	0	0	0	0	0	0	0	837	0	0	0	0	1116	**12837**	279
22	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1116	0	0	0	0	2232	0	**21489**
	Kazipur	Tentulbaria	Bamandi	Matmura	Sholataka	Raypur	Gangni Pourasava	Shaharbati	Kathuli	Kutubpur	Shyampur	Dhankhola	Baradi	Amjhupi	Meherpur Pourashava	Buripota	Amdah	Pirojpur	Mahajanpur	Monakhali	Dariapur	Bagoan

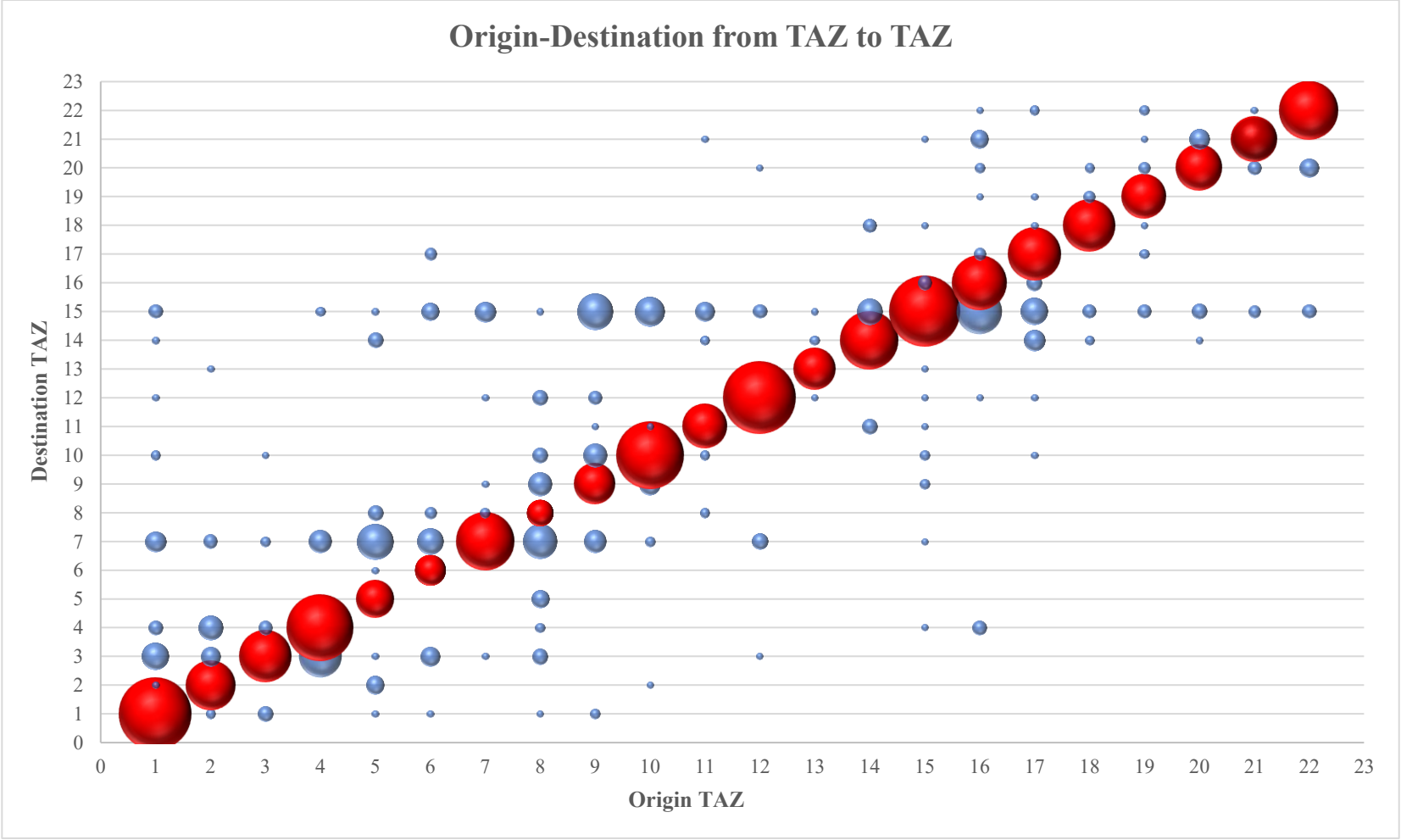


Figure: 6.1: Trip Distribution from one TAZ to another

The analysis of inter-TAZ connectivity shows how the different unions and municipalities within Meherpur district are linked in terms of trips generated and received. Here, each zone's outward connections (attracted to) and inward connections (attracted by) were measured. The results reveal a strong centralization around the two Pourasavas. Meherpur Pourashava connects with at least eleven zones and attracts trips from as many as twenty, making it the most dominant hub in the district. Gangni Pourasava follows a similar but smaller pattern, with six outward connections and twelve inward, confirming its role as a secondary center. Beyond the two municipalities, several unions demonstrate medium-level connectivity. For instance, Bamandi and Dhankhola- the unions found attracted by at least nine other Unions or Paurashva where they are attracted to at least five. Amjhupi and Monakhali also produces more inward connections (attracted by) than outward (attracted to). By contrast, unions such as Sholakata, Raypur, Shaharbati and Kathuli appeared to be connected to diiferent TAZ more as trip producers. These Unions are atracted to at least nine, sevel, ten, and seven Union/Paurashava respectively when they are attracted by two to five Unions/Paurashava only. These indicates indicating weaker attraction power and greater dependence on larger centers.

Trip production and attraction results add further depth to this picture. Meherpur Pourashava again emerges as the primary destination, attracting more than 80,000 trips compared to producing around 35,000. This imbalance reflects its function as the service and economic hub where people travel for work, trade, and services. Gangni Pourasava also displays high attraction, drawing nearly 50,000 trips while producing only about half of that, reinforcing its role as a sub-center within the district. Union Matmura and Kazipur also found to be producing more than 40,000 trip each in everyday. On the contrary, Unions such as Shyampur, Baradi, Pirojpur, Mahajanpur, Monakhali, and Dariapur have both production and attraction of less than 20,000. Additionally, several unions act more as origins than destinations. Kazipur, Matmura, Sholataka, Shaharbati, Kathuli, Buripota, and Amdah- all produce more trips than they attract, suggesting they function primarily as residential zones feeding trips into the urban centers. At the same time, unions like Kutubpur, Dhankhola, Baradi, Pirojpur, and Bagaon show relatively balanced production and attraction levels, pointing to a mix of local activity and external connectivity. These balanced zones help stabilize the network by supporting both neighborhood-scale trips and inter-union flows.

When both analyses are combined, a clear spatial hierarchy emerges. At the core, Meherpur Pourashava dominates as the main trip magnet, with Gangni Pourasava as its strong

secondary counterpart. Surrounding these hubs are a set of moderately connected unions that play intermediary roles, followed by more peripheral unions that rely heavily on central destinations. The overall system reflects a core-periphery structure, where trips flow from outer residential areas toward urban centers, supported by intermediate nodes that keep the network cohesive.

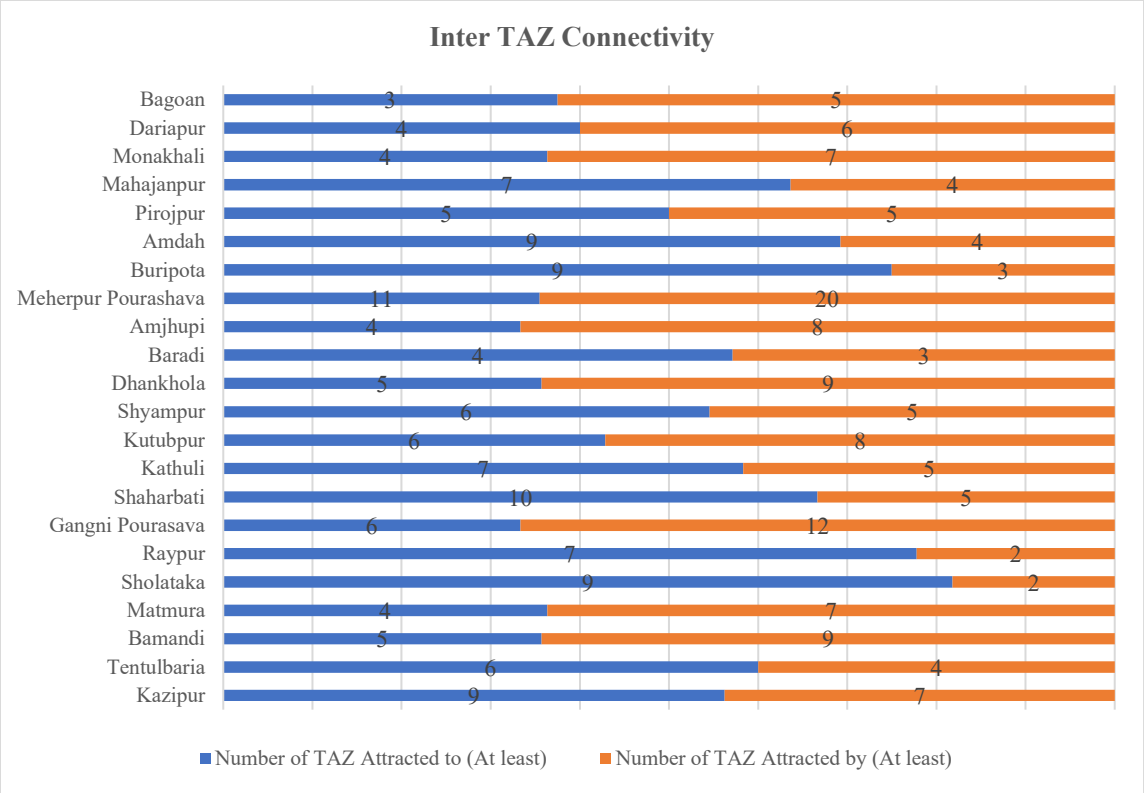


Figure 6.2: Inter TAZ Connectivity

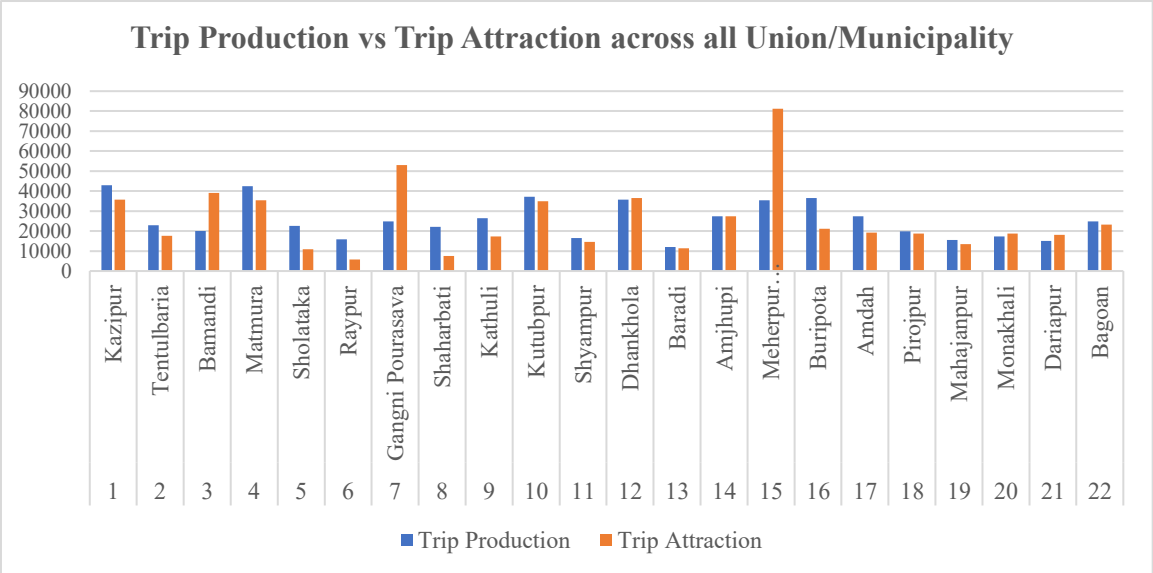


Figure 6.3: Trip Production vs Trip Attraction across all Union/Municipality

6.1 TAZ to TAZ Trip Attraction with Major Purpose

The trip generation results show that different zones produce significantly varying numbers of trips depending on their socio-economic and functional characteristics. For Home-Based Education (HBE), the highest production is observed in TAZ 16 (17,867 trips) indicates Buripota has relatively larger number of school-going population. Against the production, the attraction in this category (HBE) is found much lower (10,366) in Buripota. This is very opposite for Gangni Paurashava. When, 4730 observations are found in this (HBE) category, it attracts more than double (10098 trips) which indicates larger students come to Gangni Paurashva from its surrounding Unions.

In the case of Home-Based Work (HBW), the largest trip attraction (77,899 trips) is found in TAZ 15 (Meherpur Municipality), followed by (37371 trips) TAZ 7 (Gangni Municipality). Both these municipalities attract more than double compared to its production in this particular type (HBW) of trip. This indicates that municipalities serve as the strongest work trip producers.

For Home-Based Other (HBO) trips, TAZ 12 (Dhankhola) shows the highest attraction (30,092 trips), followed by TAZ-4 (21965 trips in Matmura) and TAZ 1 (17662 tips in Kazipur). However, the trip production is almost equal (29402, 26289, and 21249 in Dhakhola, Matmura, and Kazipur respectively) for these unions in this particular segment of trip (HBO). The finding fears lack of employment opportunity in these Unions which leads their people miscellaneous non-economic or non-income generating mixed activities. In terms of Non-Home-Based (NHB) trips, the maximum attraction (1061 trips) is recorded in TAZ 4 (Matmura), and TAZ 1 (792 trips in Kazipur). The production is also almost equal (1270 and 954 respectively). While the rest both generates and attracts fewer than 600 NHB trips. However, Dhankhola is largest TAZ as well as Union in terms of area and also the second highest in terms of population as per Bangladesh Bureau of Statistics. Therefore, the trip production appeared to be higher in in number. Also, for being largest Union Dhankhola is connected to several number of TAZs. The trip generation-attraction ratio is near one indicates the union has no major attraction hub despite having largest area of land and second largest population.

Taken together, these results highlight a clear spatial hierarchy of trip-making across the district. Meherpur (TAZ-15) and Gangni Municipality (TAZ-7) emerge as the dominant employment and service hub, generating and attracting the largest volumes of HBW trips.

Table 6.2: TAZ to TAZ Trip Generation and Trip Attraction across all Major Purposes

	Trip Generation						Trip Attraction			
	HBE	HBO	HBW	NHB			HBE	HBO	HBW	NHB
TAZ Number					Union/ Municipality	TAZ Number				
1	238	21250	20534	954	Kazipur	1	198	17663	17067	793
2	2043	5107	15529	204	Tentulbaria	2	1569	3924	11932	156
3	508	11191	8139	254	Bamandi	3	988	21763	15825	492
4	5334	26290	9525	1270	Matmura	4	4457	21966	7958	1061
5	1051	7359	13931	262	Sholataka	5	506	3543	6708	126
6	265	264	15112	264	Raypur	6	98	97	5568	97
7	4731	2365	17505	236	Gangni Pourasava	7	10098	5049	37372	502
8	253	5828	15456	507	Shaharbati	8	86	1992	5283	173
9	273	4372	21592	273	Kathuli	9	178	2853	14092	178
10	276	16343	19944	553	Kutubpur	10	259	15360	18744	520
11	6639	1327	8233	265	Shyampur	11	5852	1170	7256	233
12	558	11442	23442	279	Dhankhola	12	558	10605	24000	1395
13	250	500	11001	249	Baradi	13	238	478	10491	237
14	1052	263	25772	262	Amjhupi	14	1051	262	25773	262
15	964	241	33996	241	Meherpur Pourashava	15	2207	550	77899	550
16	7256	5302	23720	279	Buripota	16	3349	2512	15069	279
17	1504	683	24887	273	Amdah	17	1058	481	17524	192
18	267	267	19013	266	Pirojpur	18	251	251	17944	251
19	252	252	14872	251	Mahajanpur	19	215	215	12749	215
20	271	9191	7569	270	Monakhali	20	292	9932	8180	292
21	259	259	14292	259	Dariapur	21	312	312	17202	312
22	267	267	24037	266	Bagoan	22	248	248	22419	248

The bar chart shows the distribution of "other types of trips." The largest share is Market/Shopping trips (54.24%), followed by Social/Relative or Friend visits (32.20%). Much smaller proportions are seen for Medical/Hospital trips (6.78%), Recreation/Leisure trips (5.08%), and religious trips (1.69%). So, what this really means is that beyond work or school, most people are traveling either for shopping or to visit relatives and friends, while recreational, medical, and religious trips make up only a small fraction.

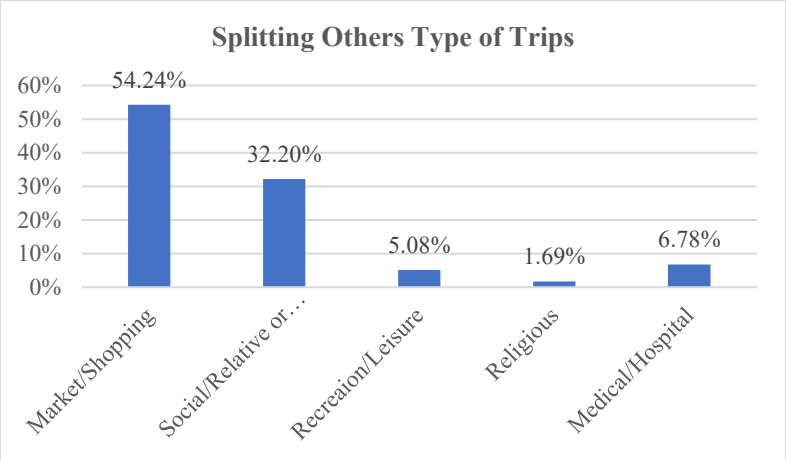


Figure 6.2: Splitting Others Type of Trips

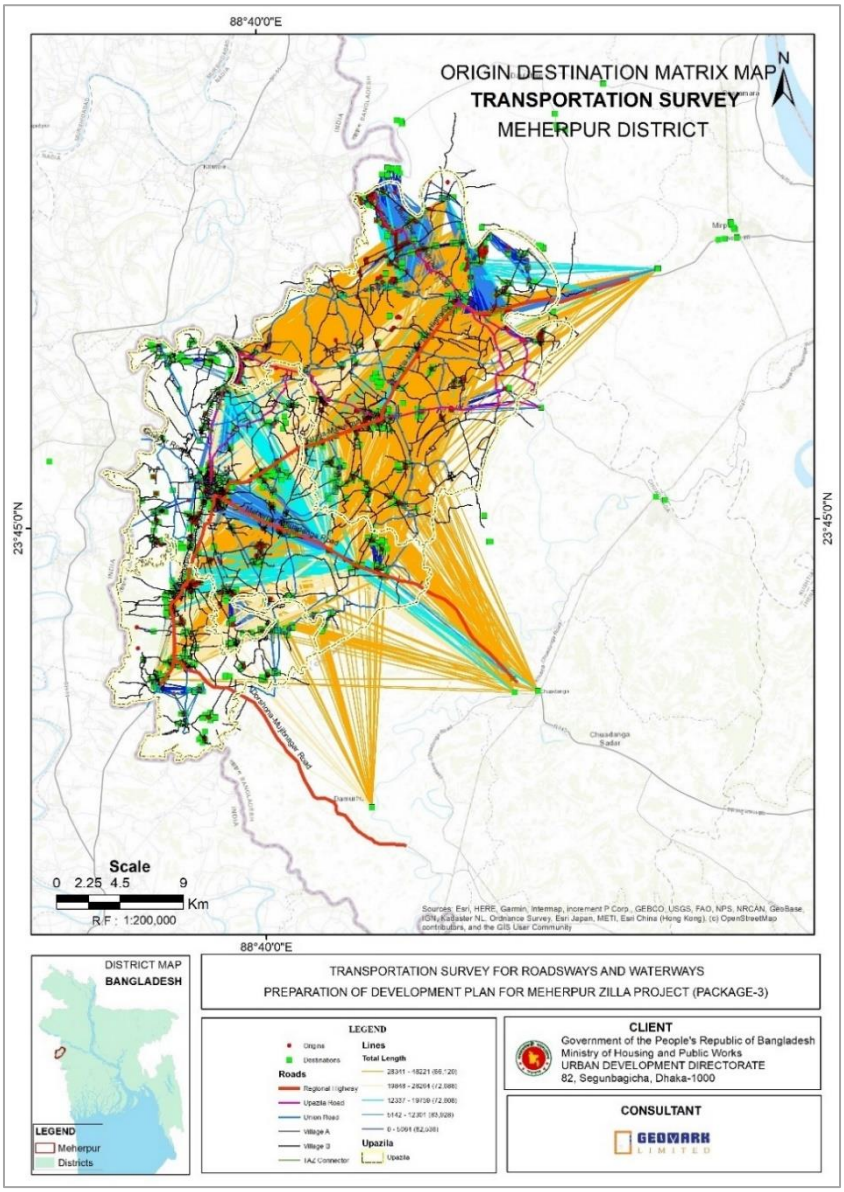


Figure 6.3: Trip-Origin-Destination Matrix Map based on Household Interview Survey (HIS)

6.2 Trip Attraction of Population (Meherpur District)

The map titled "Total Trip Attraction of Meherpur District" illustrates the spatial distribution of trip attraction across all unions and municipalities. The highest levels of trip attraction (66,135–81,203) are concentrated in Meherpur Municipality, making it the most dominant hub for incoming trips. This reflects its role as the primary administrative, commercial, and service center of the district, where residents from surrounding areas travel for employment, education, trade, and access to higher-order services. The second-highest attraction levels (51,066–66,134) are observed in Gangni Paurashava, indicating its importance as a secondary urban center. This zone attracts large volumes of trips due to its strong presence of commercial activities, service functions, and connectivity to rural surroundings.

Overall, the map highlights a clear urban-centric trip attraction pattern, dominated by Meherpur Municipality, followed by Gangni Paurashava. This confirms the concentration of service and employment opportunities in municipal areas, while peripheral unions remain primarily trip-generating rather than attracting zones. The results underline the importance of strengthening transport connectivity towards municipalities to manage the heavy inflow of trips and support balanced regional mobility.

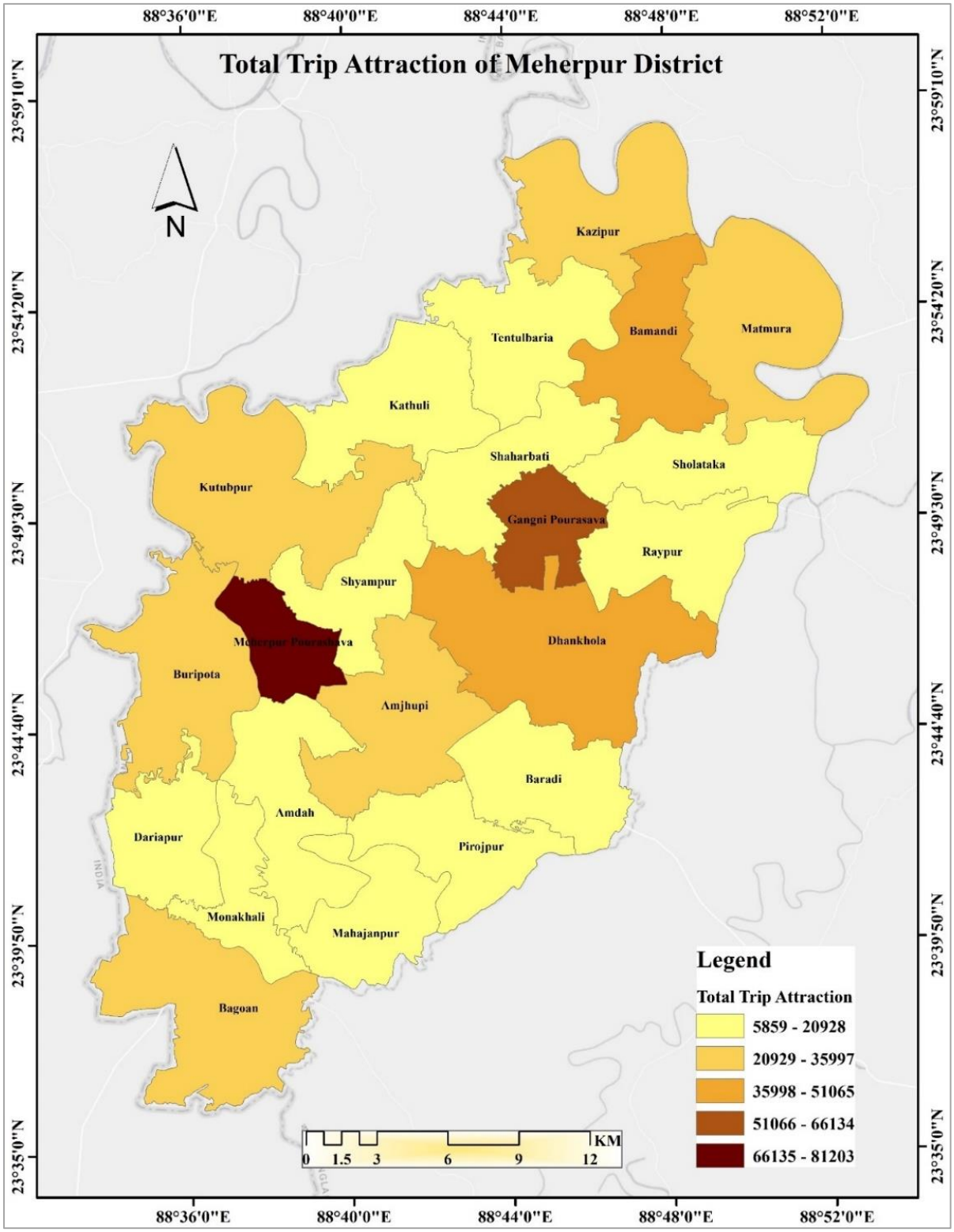


Figure 6.4: Total Trip Attraction of Meherpur District

6.2.1 Trip Attraction from Home-Based Education (HBE)

The map titled "Trip Attraction from Home-Based Education (HBE)" illustrates the spatial variation of education-related trip destinations across Meherpur District. In case of Home-Based Education (HBE), the highest production is observed in TAZ 16 (17,867 trips) indicates Buripota has relatively larger number of school-going population. Against the production, the attraction in this category (HBE) is found much lower (10,366) in Buripota. This is very opposite for Gangni Paurashava. When, 4730 observations are found in this (HBE) category, it attracts more than double (10098 trips) which indicates larger students come to Gangni Paurashva from its surrounding Unions.

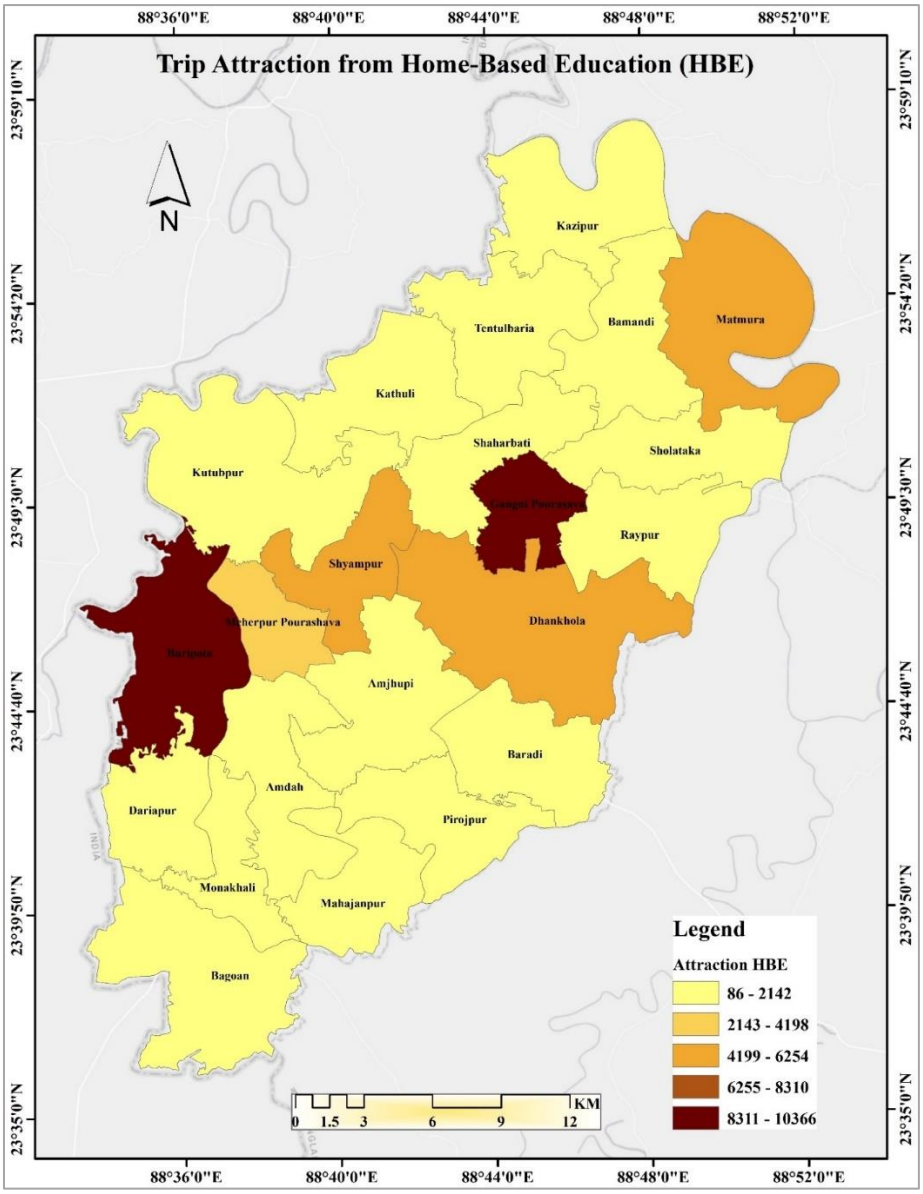


Figure 6.5: Trip Attraction from Home-Based Education (HBE)

6.2.2 Trip Attraction from Home-Based Work (HBW)

The map titled "Trip Attraction from Home-Based Work (HBW)" shows the spatial pattern of work-related trip destinations across the unions and municipalities of Meherpur District. In the case of Home-Based Work (HBW), the largest trip attraction (77,899 trips) is found in TAZ 15 (Meherpur Municipality), followed by (37371 trips) TAZ 7 (Gangni Municipality). Both these municipalities attract more than double compared to its production in this particular type (HBW) of trip. This indicates that municipalities serve as the strongest work trip producers.

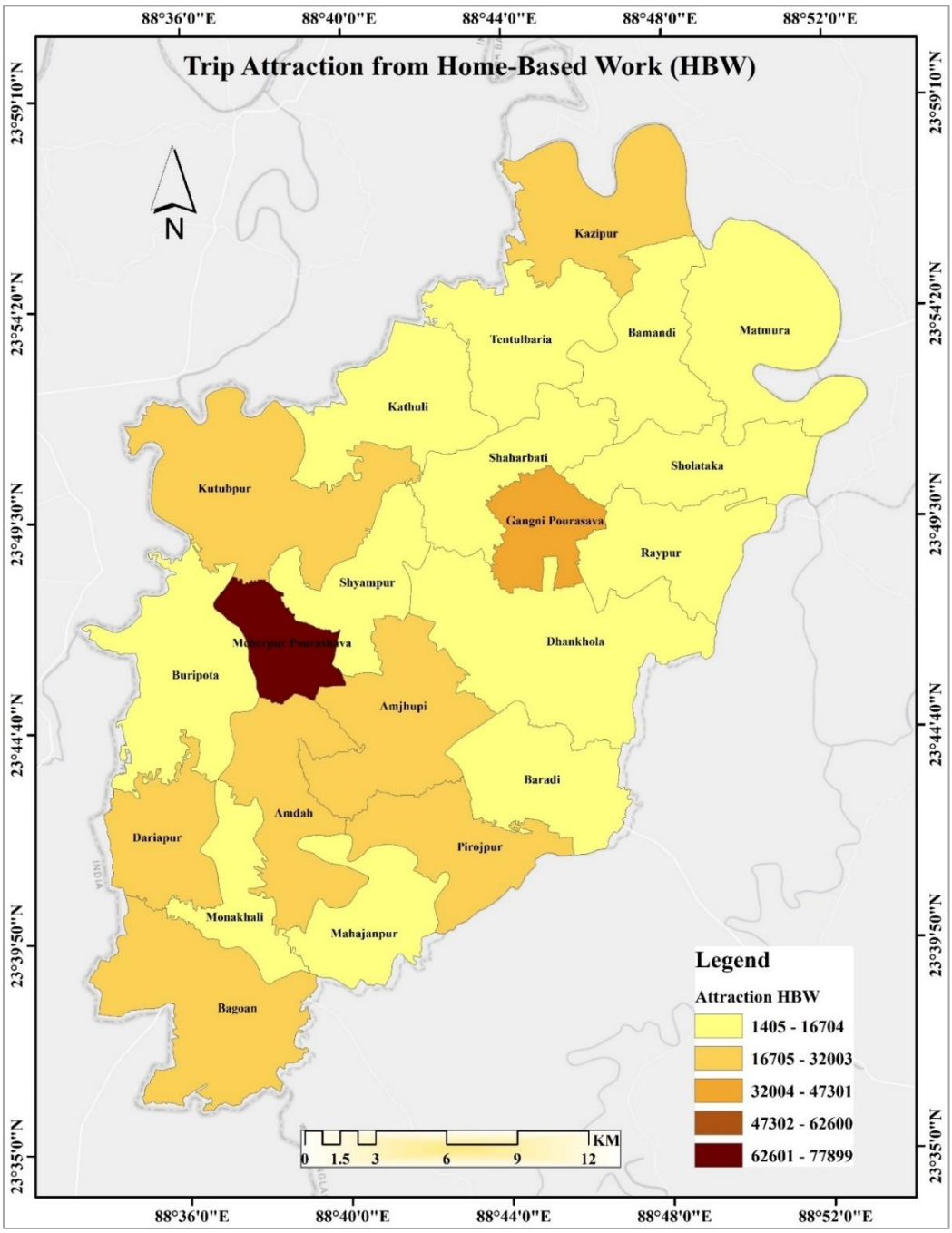


Figure 6.6: Trip Attraction from Home-Based Work (HBW)

6.2.3 Trip Attraction from Home-Based Others (HBO)

The map titled "Trip Attraction from Home-Based Others (HBO)" illustrates the distribution of trips made for purposes other than work or education. For Home-Based Other (HBO) trips, TAZ 12 (Dhankhola) shows the highest attraction (30,092 trips), followed by TAZ-4 (21965 trips in Matmura) and TAZ 1 (17662 tips in Kazipur). However, the trip production is almost equal (29402, 26289, and 21249 in Dhakhola, Matmura, and Kazipur respectively) for these unions in this particular segment of trip (HBO). The finding fears lack of employment opportunity in these Unions which leads their people miscellaneous non-economic or non-income generating mixed activities.

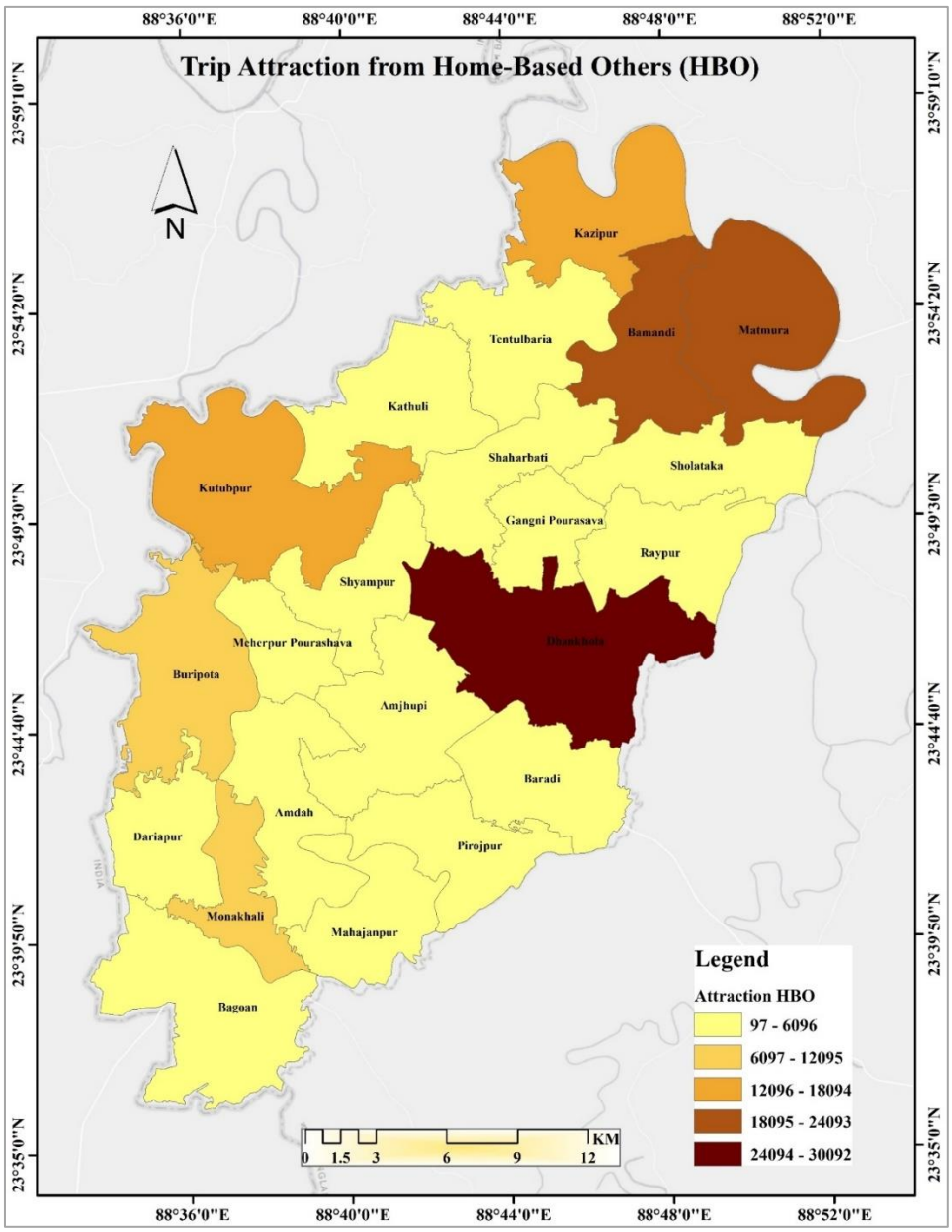


Figure 6.7: Trip Attraction from Home-Based Others (HBO)

6.2.3 Trip Attraction from Non-Home-Based (NHB)

The map titled "Trip Attraction from Non-Home-Based (NHB)" shows the distribution of trips that do not originate from nor ended at home, which highlights the areas that function as intermediate destinations in daily travel chains. In terms of Non-Home-Based (NHB) trips, the maximum attraction (1061 trips) is recorded in TAZ 4 (Matmura), and TAZ 1 (792 trips in Kazipur). The production is also almost equal (1270 and 954 respectively). While the rest both generates and attracts fewer than 600 NHB trips.

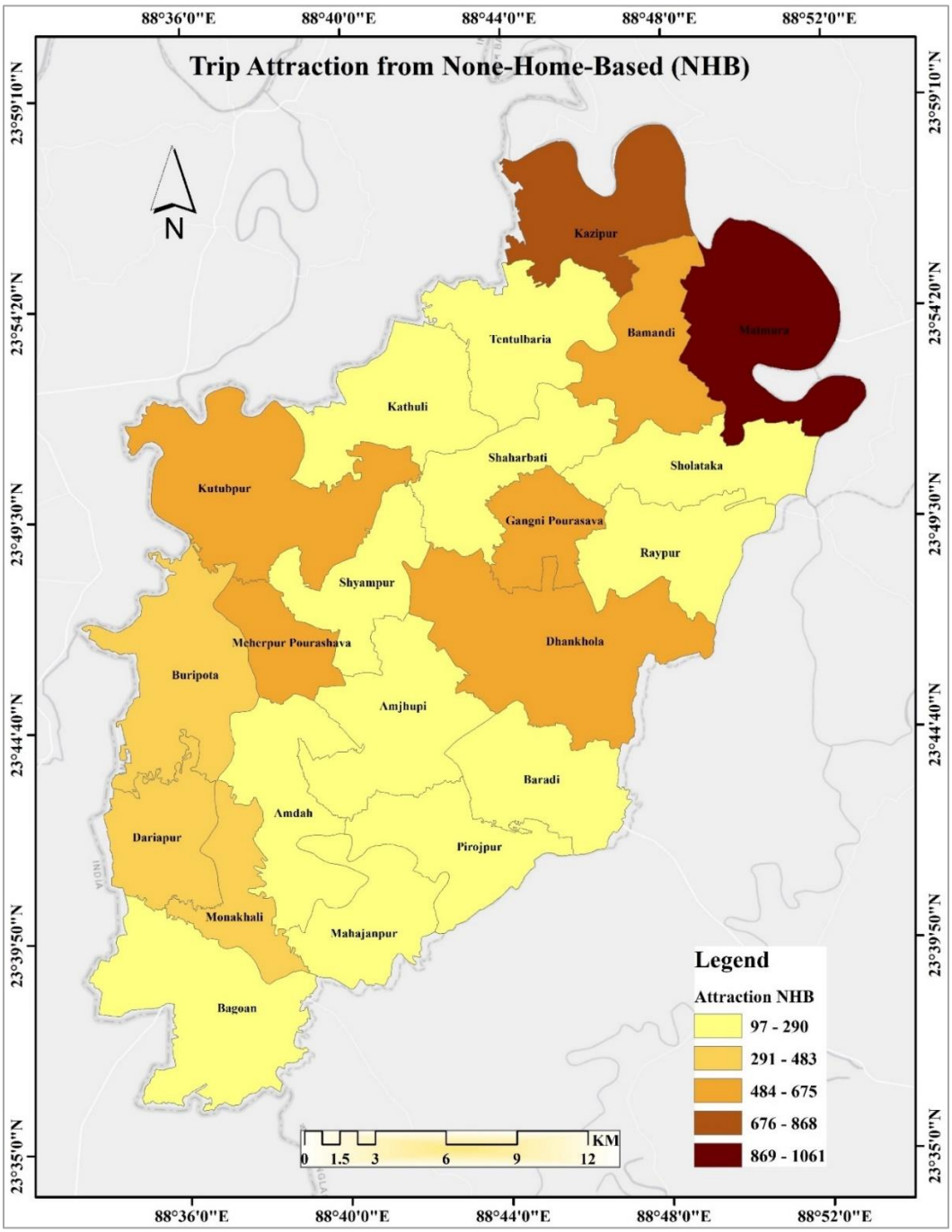
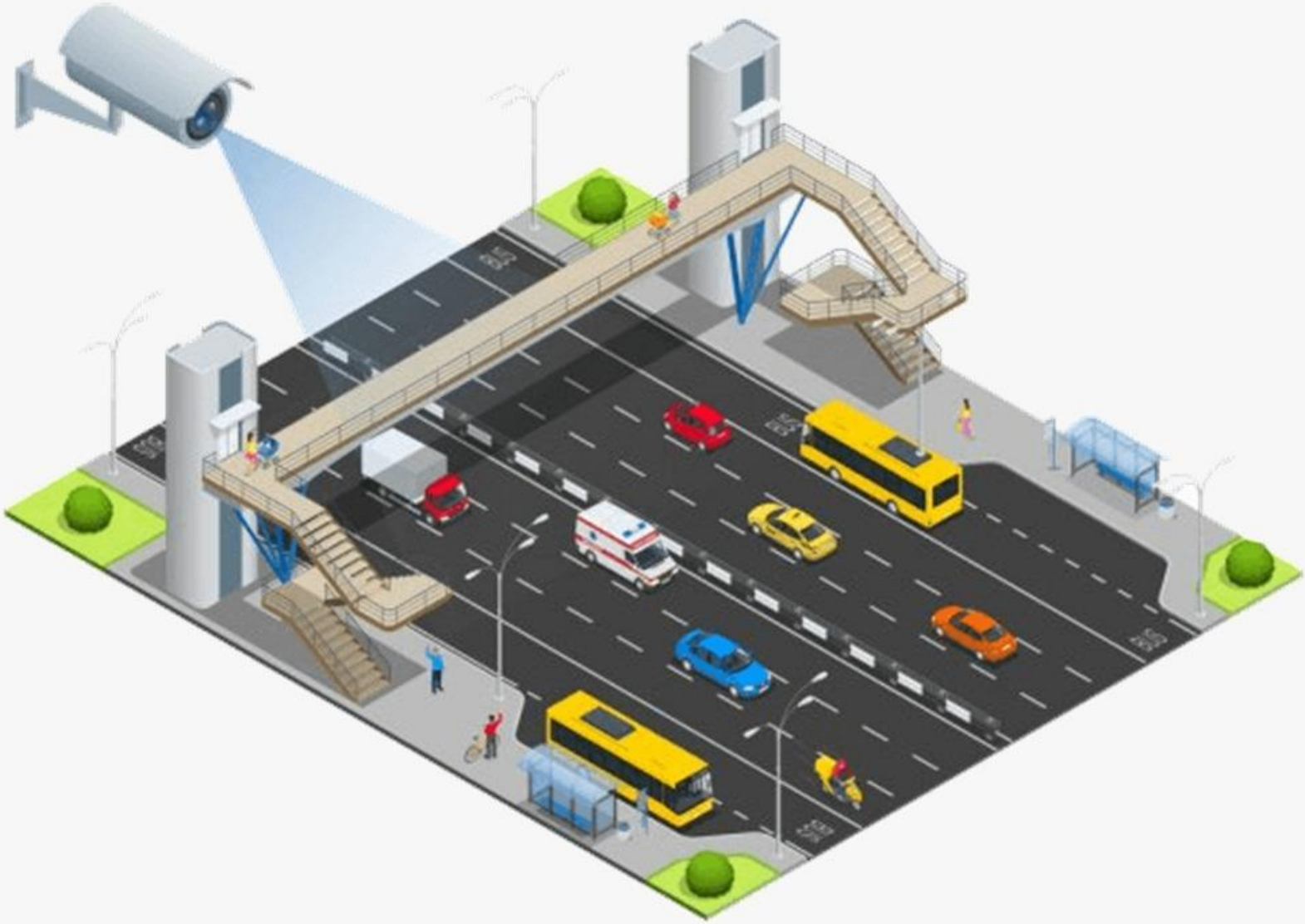


Figure 6.8: Trip Attraction from Non-Home-Based (NHB)



Chapter 7

Analyzing Origin-Destination (O-D) Survey

Chapter 7: Analyzing Origin-Destination (O-D) Survey

7.1. Location Map for all Cordons

The destination of a trip is considered to be the place of attraction of its respective trip. Therefore, attraction count is actually the destination count. Thus, the destination purpose is the reason behind the attraction. Number of Attraction (e.g., Job) availability in each cordon from total of 21 cordons (i.e., 11 Inner Cordon and 10 Outer Cordon), destination TAZ and purpose of trip is analyzed and thus, the number of attractions of each TAZ is found. The next table presents the description as well as the address of routes. At every cordon not located at an intersection, Origin–Destination (O–D) roadside interview surveys were conducted. These surveys provided information on modal choice, trip origins and destinations, and the purposes behind trip generation. In parallel, Video Traffic Surveys and Traffic Volume Surveys captured modal choice and hourly traffic volumes (vehicles per hour).

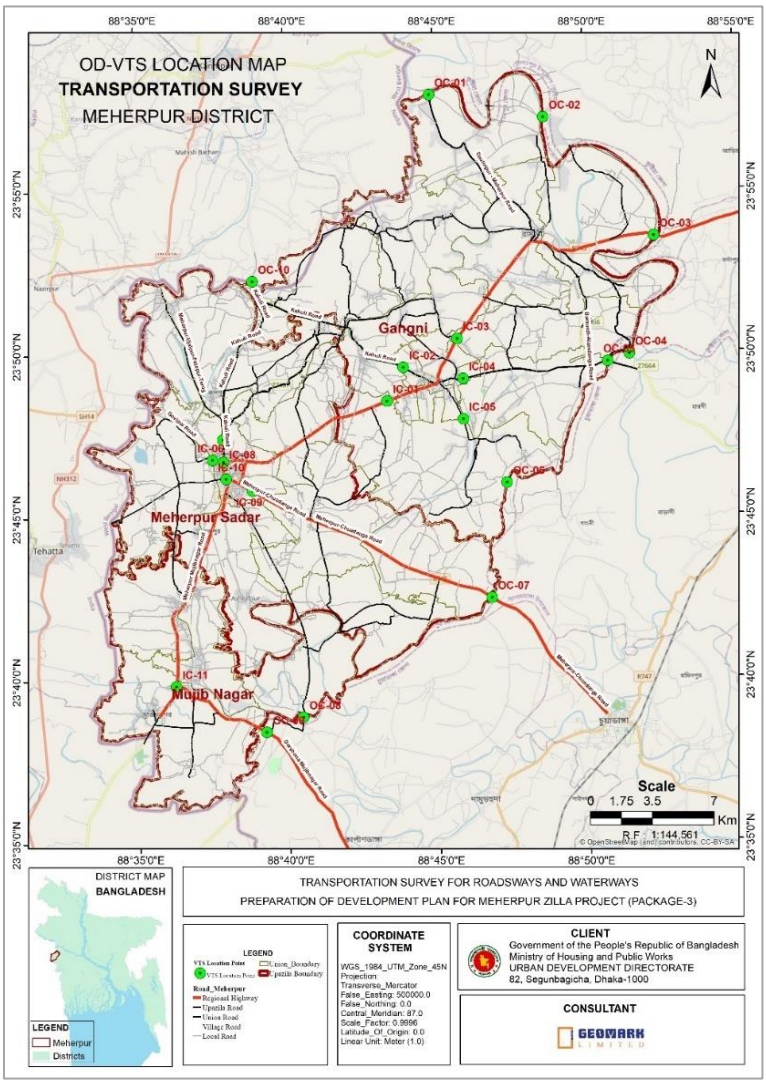


Figure 7.1: OD-VTS Location Map

Table 7.1: Route Description of each Cordon

SL No	Intersection Type (if any)	Cordon Type	Cordon Code	Route Name & Direction	Total Trip Recorded in 24 hours
1.	N/A	Inner Cordon	IC_01	Dhaka to Meherpur-Meherpur to Dhaka Direction	9733
2.	N/A	Inner Cordon	IC_02	Gangni to Kathuli Bazar-Kathuli Bazar to Gangni Direction	6302
3.	N/A	Inner Cordon	IC_03	Meherpur to Kushita-Kushtia to Meherpur Direction	8310
4.	N/A	Inner Cordon	IC_04	Hat Boalia to Gangni-Gangni to Hat Boalia Direction	5899
5.	N/A	Inner Cordon	IC_05	Gangni to Dhankhola Road- Dhankhola Road to Gangni Direction	3540
6.	N/A	Inner Cordon	IC_06	Thana Road to Govipur-Govipur to Thana Road Direction	8122
7.	N/A	Inner Cordon	IC_07	Meherpur to Kathuli-Kathuli to Meherpur Direction	11954
8.	T Intersection	Inner Cordon	IC_08_I	Hazi Foyez Uddin Road to Thana Road 1- Thana Road 1 to Hazi Foyez Uddin Road Direction	11216
9.	T Intersection	Inner Cordon	IC_08_II	Thana Road 1 to Thana Road 2- Thana Road 2 to Thana Road 1 Direction	9064
10.	T Intersection	Inner Cordon	IC_08_III	Foyez Road to Thana Road 1- Thana Road 1 To Foyez Road Direction	7327
11.	N/A	Inner Cordon	IC_09	Chuadanga To Meherpur-Meherpur To Chuadanga Direction	17614
12.	T Intersection	Inner Cordon	IC_10_I	Chuadanga to Mujibnagar-Mujibnagar to Chuadanga Direction	5554
13.	T Intersection	Inner Cordon	IC_10_II	Mujibnagar to Meherpur-Meherpur to Mujibnagar Direction	8679
14.	T Intersection	Inner Cordon	IC_10_III	Chuadanga to Meherpur-Meherpur to Chuadanga Direction	5331

15.	Major/Largest Intersection	Inner Cordon	IC_11_I	Mujibnagar Road to Darshana- Darshana to Mujibnagar Road Direction	7629
16.	Major/Largest Intersection	Inner Cordon	IC_11_II	Chuadanga to Meherpur-Meherpur to Chuadanga Direction	10949
17.	Major/Largest Intersection	Inner Cordon	IC_11_III	Darshna-Mujibnagar Road to Kedargonj Road-Kedargonj Road to Darshana-Mujibnagar Road Direction	1137
18.	Major/Largest Intersection	Inner Cordon	IC_11_IV	Darshana to Darshana Mujibnagar- Darshana Mujibnagar to Darshana Direction	3330
19.	Major/Largest Intersection	Inner Cordon	IC_11_V	Mujibnagar to Kedarpur-Kedarpur to Mujibnagar Direction	1927
20.	Major/Largest Intersection	Inner Cordon	IC_11_VI	Kedarganj to Darsana-Darsana to Kedarganj Direction	1881
21.	N/A	Outer Cordon	OC_01	Meherpur to Daulotpur-Daulotpur to Meherpur Direction	2676
22.	N/A	Outer Cordon	OC_02	Natnapara to Bamundi-Bamundi to Natnapara Direction	5331
23.	N/A	Outer Cordon	OC_03	Bamundi to Kushtia-Kushtia to Bamundi Direction	11380
24.	N/A	Outer Cordon	OC_04	Hatboalia to Bamundi-Bamundi to Hatboalia Direction	6044
25.	N/A	Outer Cordon	OC_05	Hatboalia to Gangni-Gangni to Hatboalia Direction	3841
26.	N/A	Outer Cordon	OC_06	Jalshuka to Gangni- Gangni to Jalshuka Direction	1263
27.	N/A	Outer Cordon	OC_07	Meherpur to Chuadanga-Chuadanga to Meherpur Direction	6617
28.	N/A	Outer Cordon	OC_08	Mohajanpur to Atkabar-Atkabar to Mohajanpur Direction	5118
29.	N/A	Outer Cordon	OC_09	Mujibnagar to Darshana-Darshana to Mujibnagar Direction	7996

30.	N/A	Outer Cordon	OC_10	Meherpur to Kathuli Bazar-Kathuli Bazar to Meherpur Direction	2717

7.2. Origin-Destination from One Cordon to Another

7.2.1 Origin-Destination & Purpose from Inner Cordon-1

The origin & destination of trip generation from Inner Cordon-01 mostly located within the TAZ-7 and TAZ-12. Total 1602 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. IC-01 is located at Bashbaria of Dhankhola Union in TAZ-12.

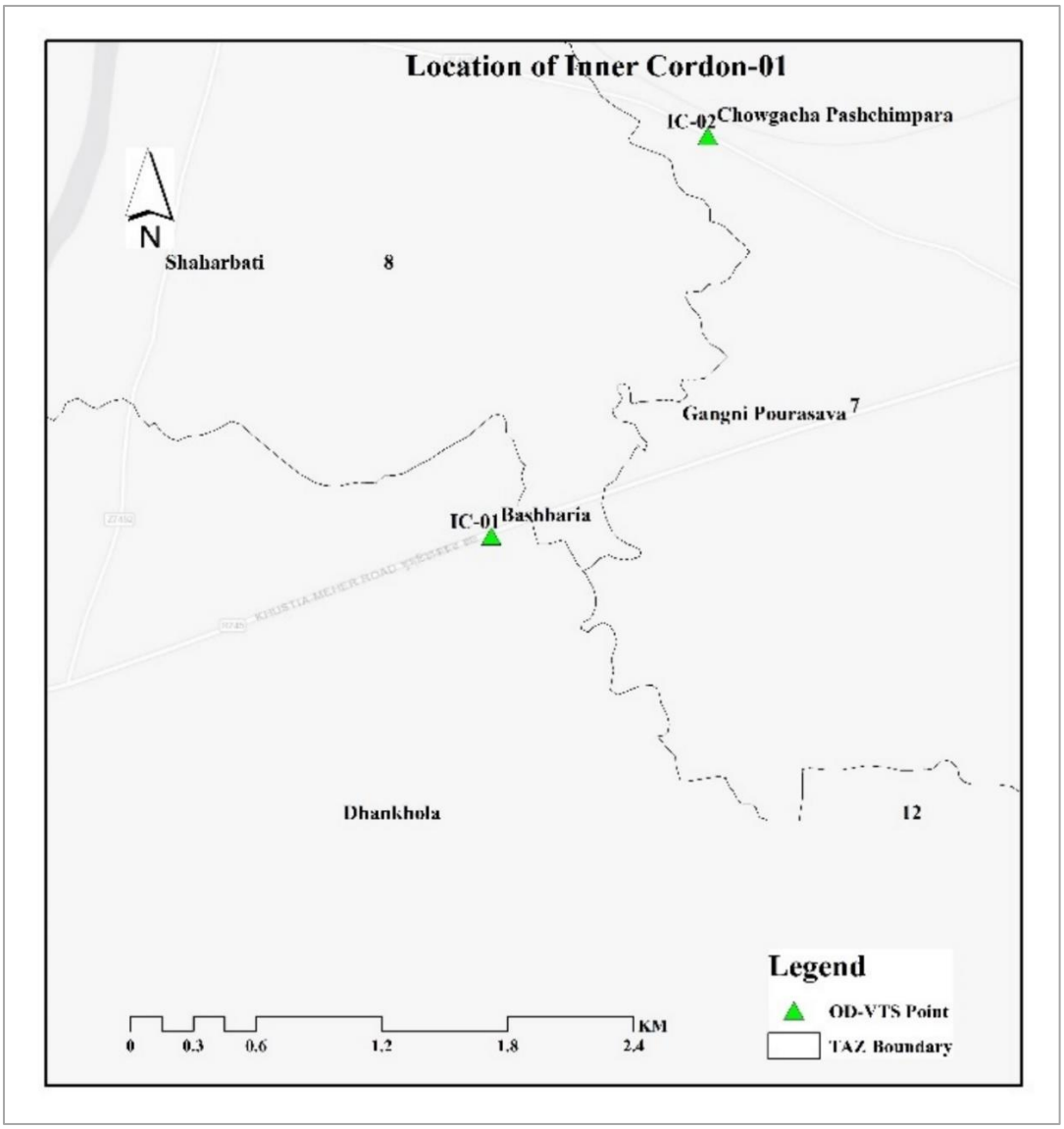


Figure 7.2: Location of Inner Cordon-01

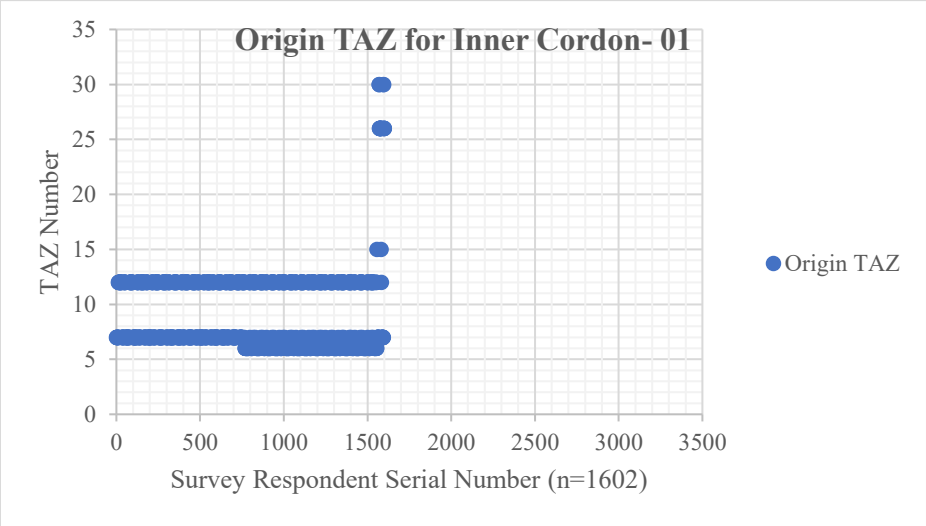


Figure 7.3: Origin TAZ for Inner Cordon-01

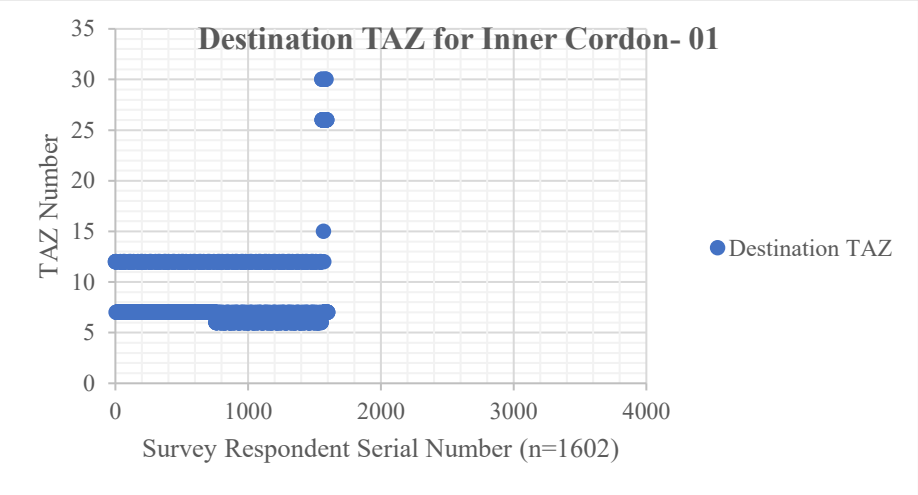


Figure 7.4: Destination TAZ for Inner Cordon-01

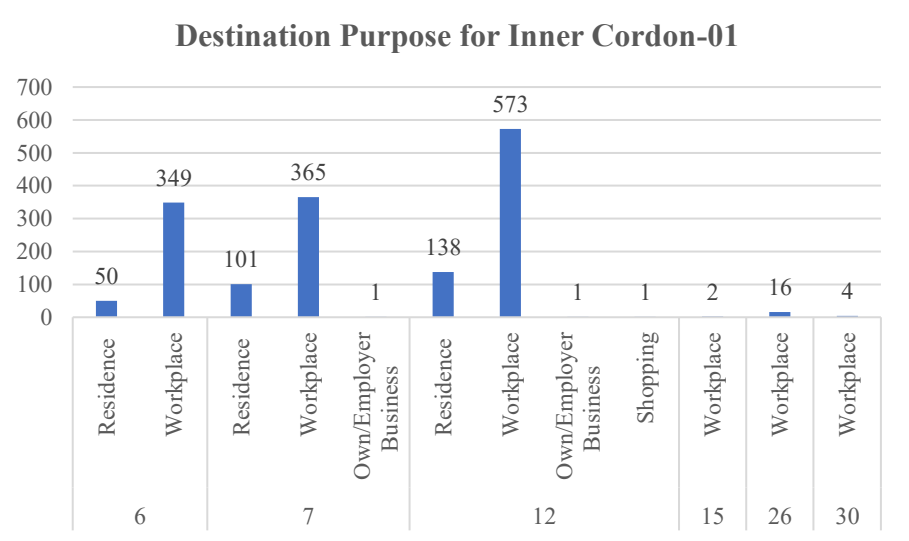


Figure 7.5: Destination Purpose for Inner Cordon-01

7.2.2 Origin-Destination & Purpose from Inner Cordon-2

The origin & destination of trip generation from Inner Cordon-02 mostly located within the TAZ-6 and TAZ-8. Total 1602 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. IC-02 is located at Chowgacha Pashchimpara of Gangni Paurashava in TAZ-7.

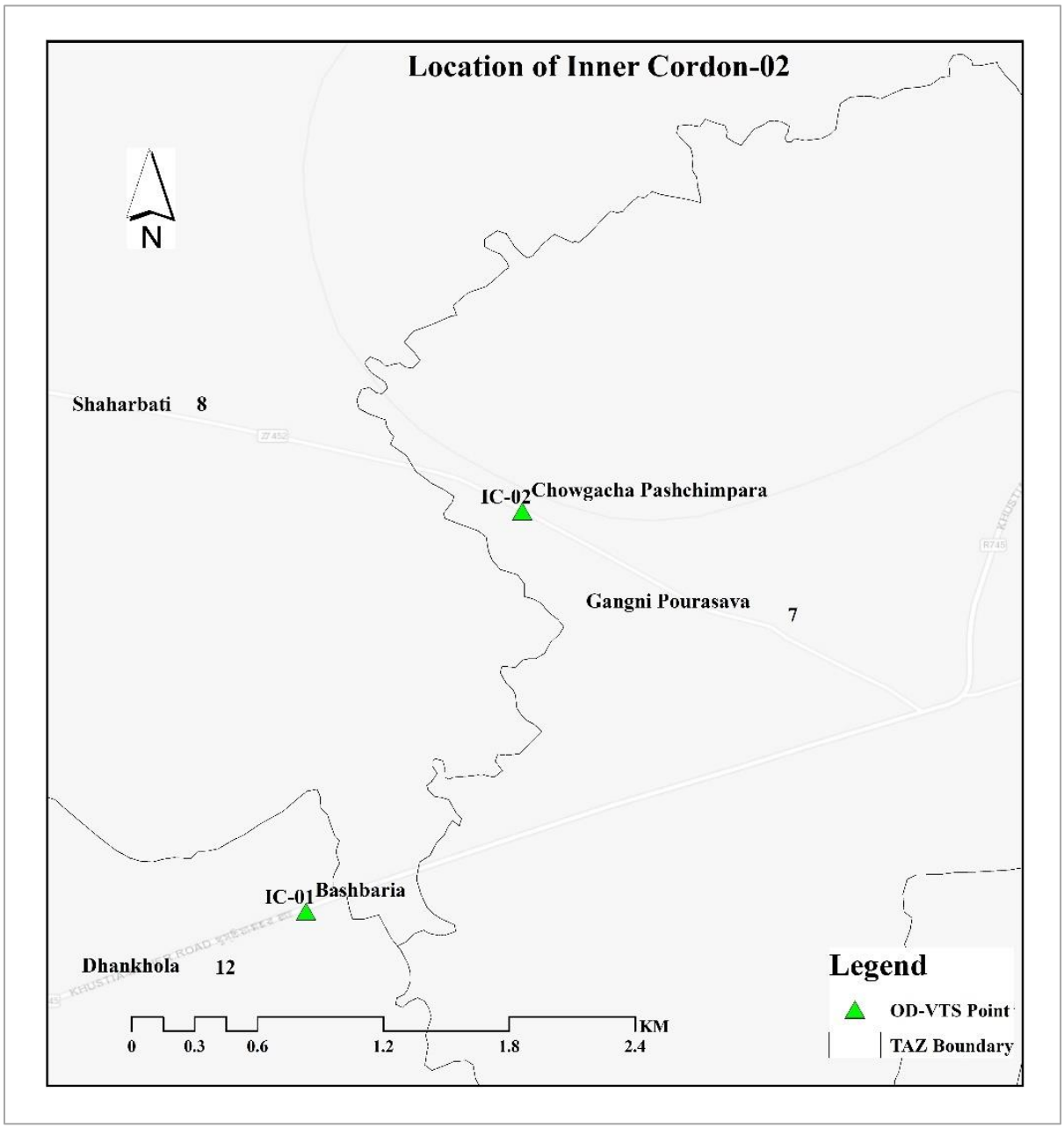


Figure 7.6: Location of Inner Cordon-02

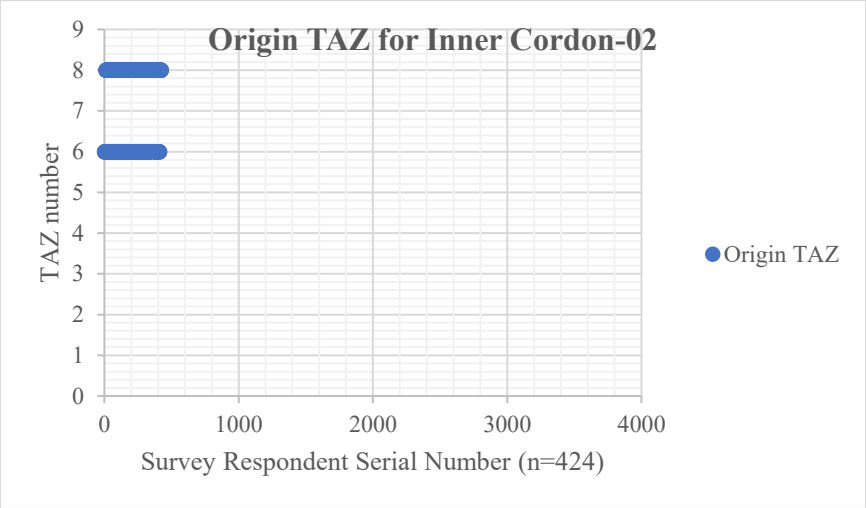


Figure 7.7: Origin TAZ for Inner Cordon-02

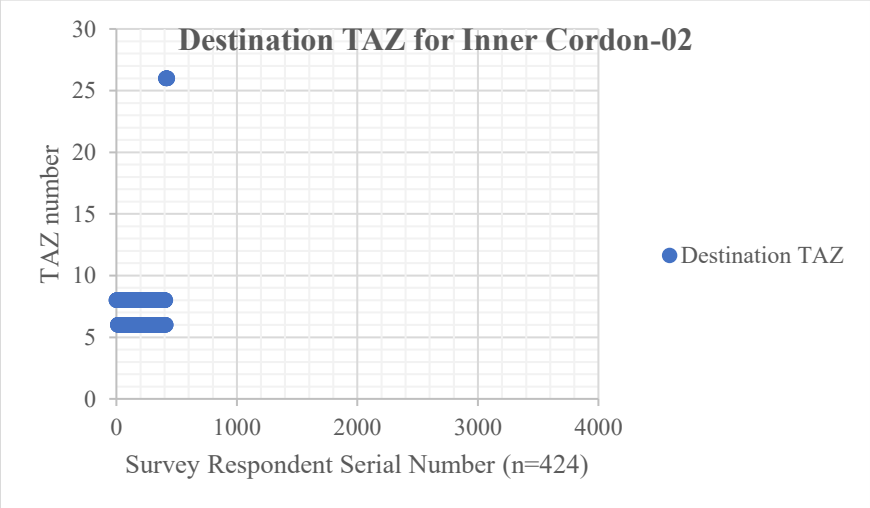


Figure 7.8: Destination TAZ for Inner Cordon-02

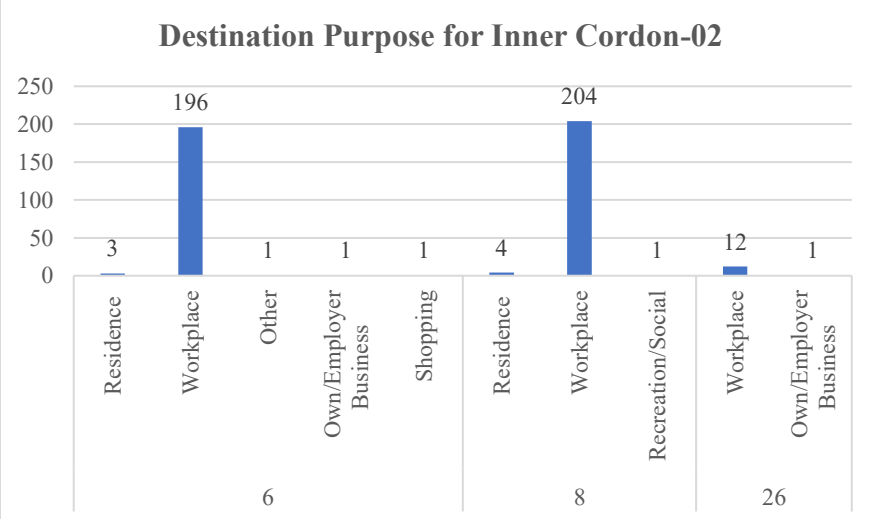


Figure 7.9: Destination Purpose for Inner Cordon-02

7.2.3 Origin-Destination & Purpose from Inner Cordon-3

The origin & destination of trip generation from Inner Cordon-03 mostly located within the TAZ-3 and TAZ-7. Total 1843 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. IC-03 is located at Chengara Bustand of Sholataka in TAZ-5. Home-based Work appeared to be the most dominant purpose behind trip generation.

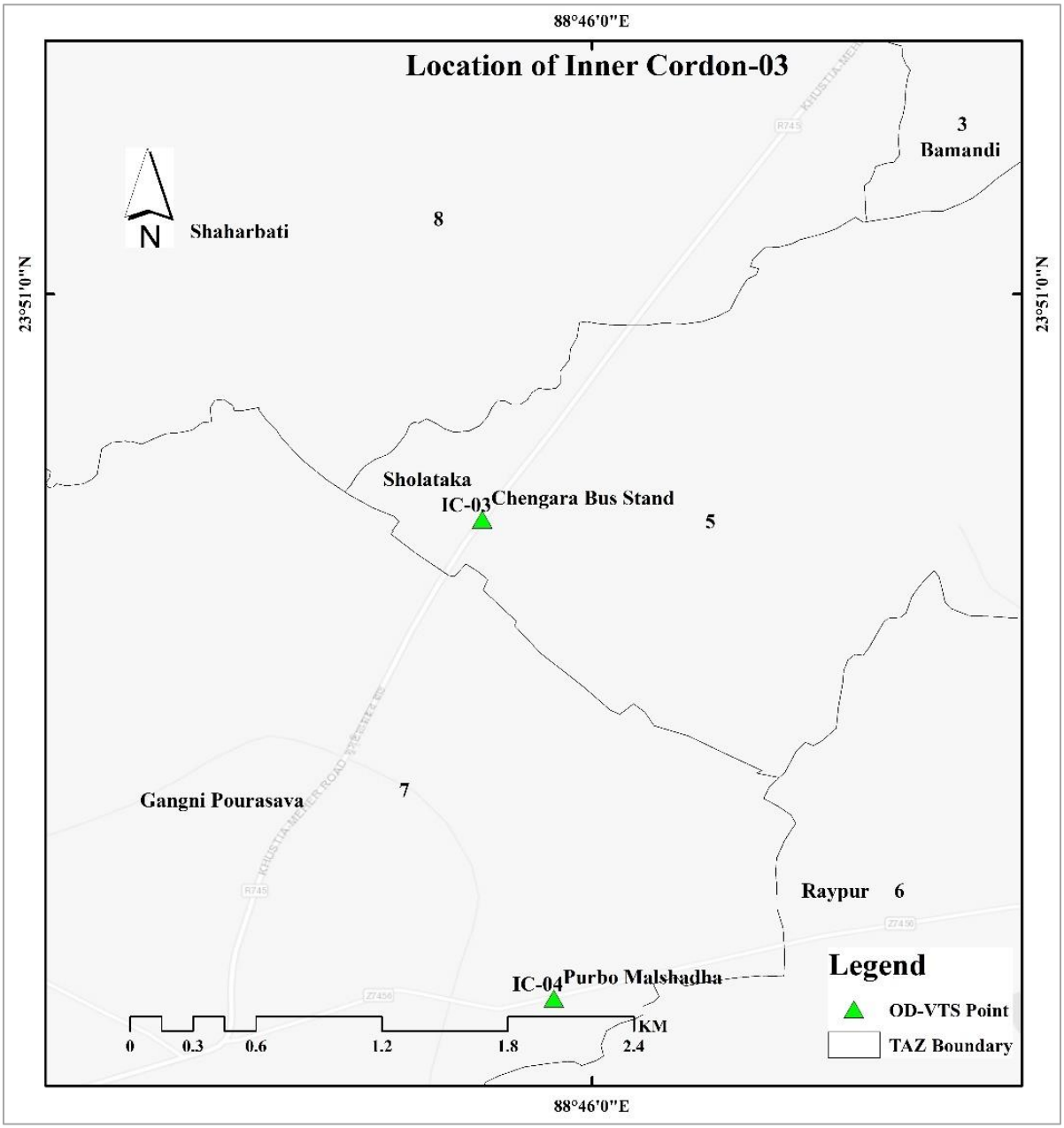


Figure 7.10: Location of Inner Cordon-03

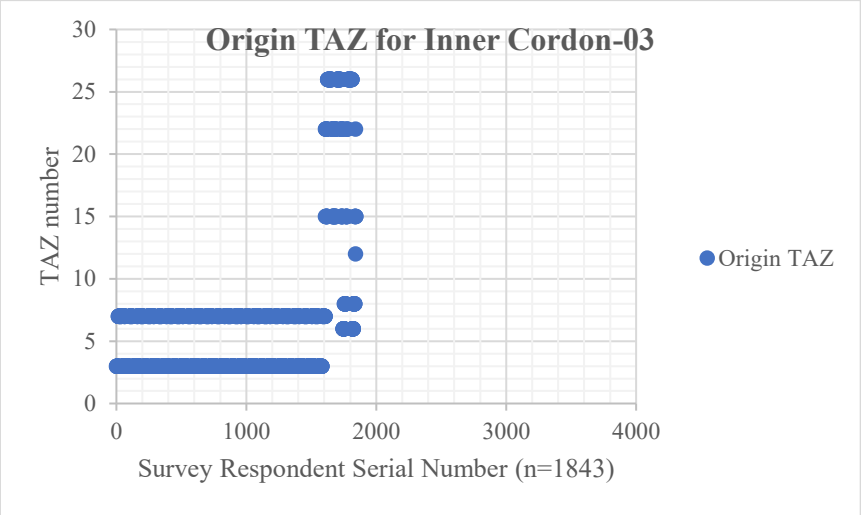


Figure 7.11: Destination TAZ for Inner Cordon-03

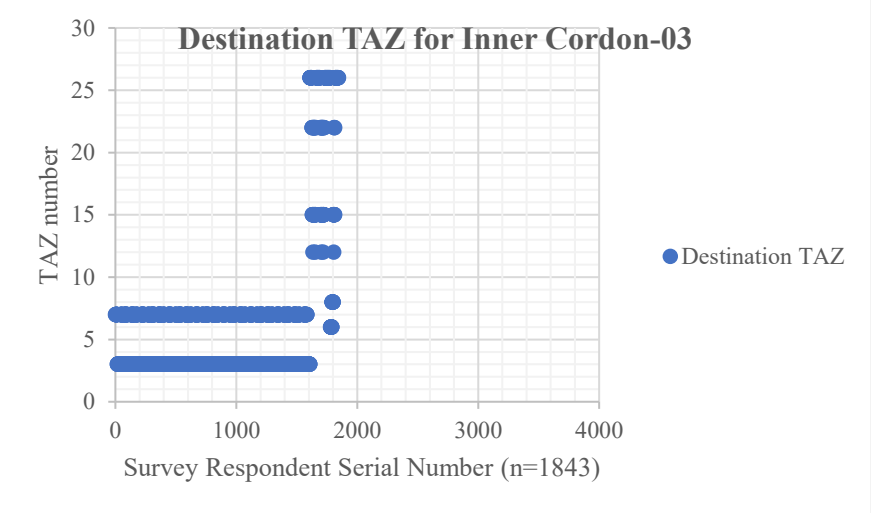


Figure 7.12: Destination TAZ for Inner Cordon-03

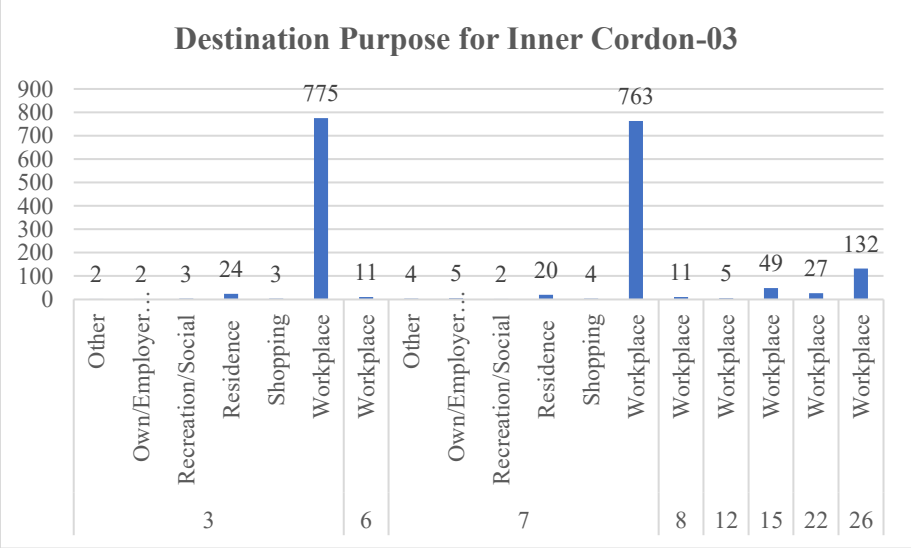


Figure 7.13: Destination Purpose for Inner Cordon-03

7.2.4 Origin-Destination & Purpose from Inner Cordon-4

The origin & destination of trip generation from Inner Cordon-04 mostly located within the TAZ-6, TAZ-10, TAZ-11, and TAZ-28. Total 571 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. IC-04 is located at Purbo Malshadha of Gangni Paurashava in TAZ-7. Home-based Work appeared to be the most dominant purpose behind trip generation.

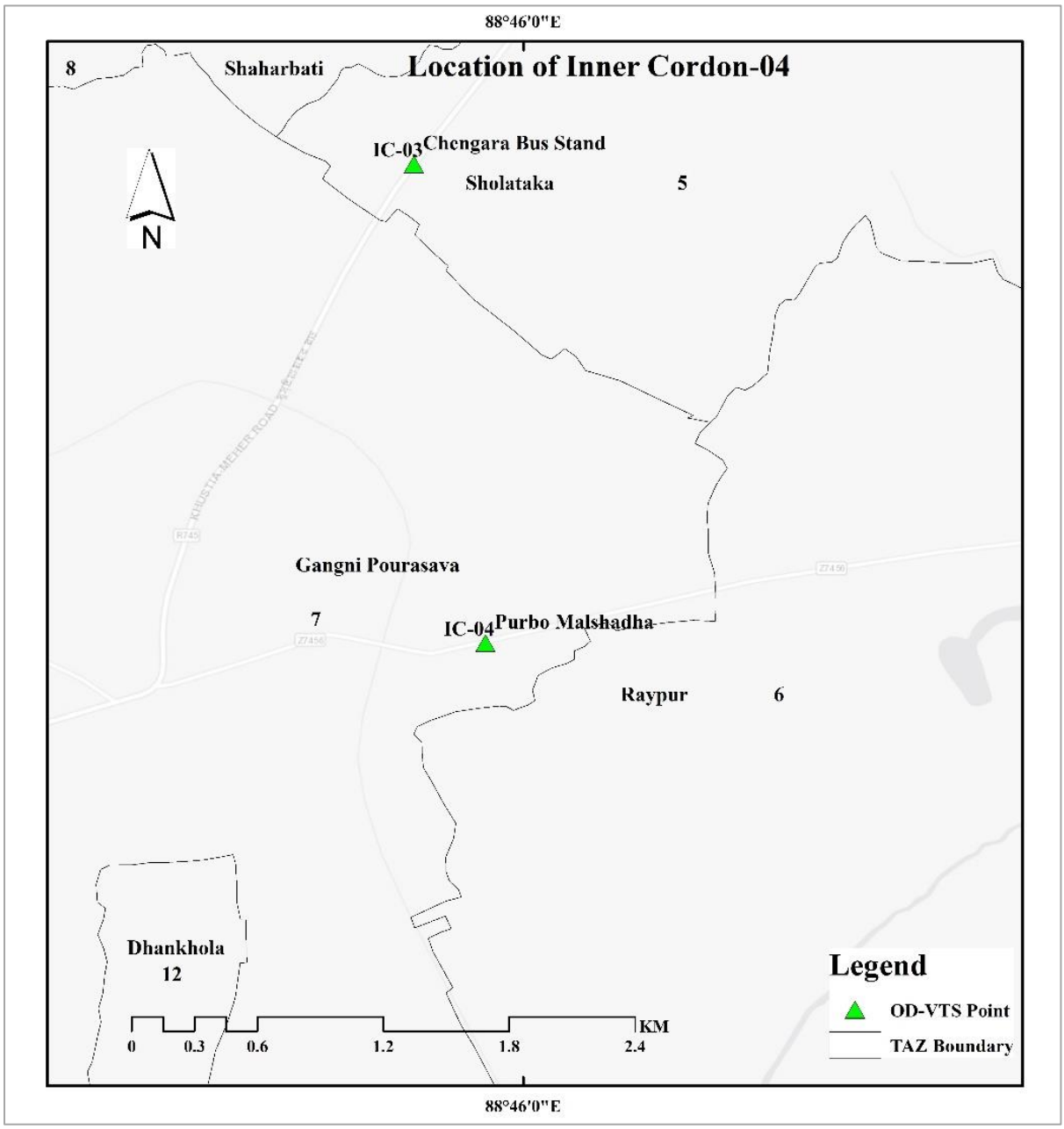


Figure 7.14: Location of Inner Cordon-04

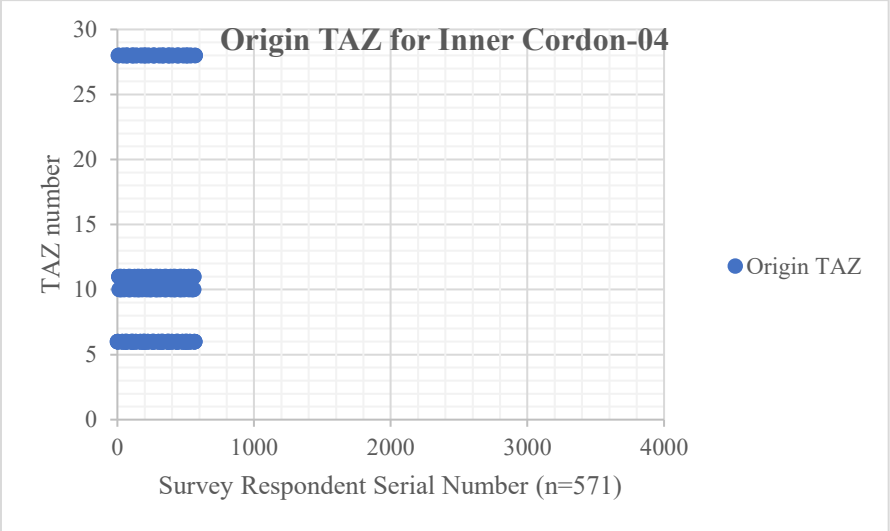


Figure 7.15: Origin TAZ for Inner Cordon-04

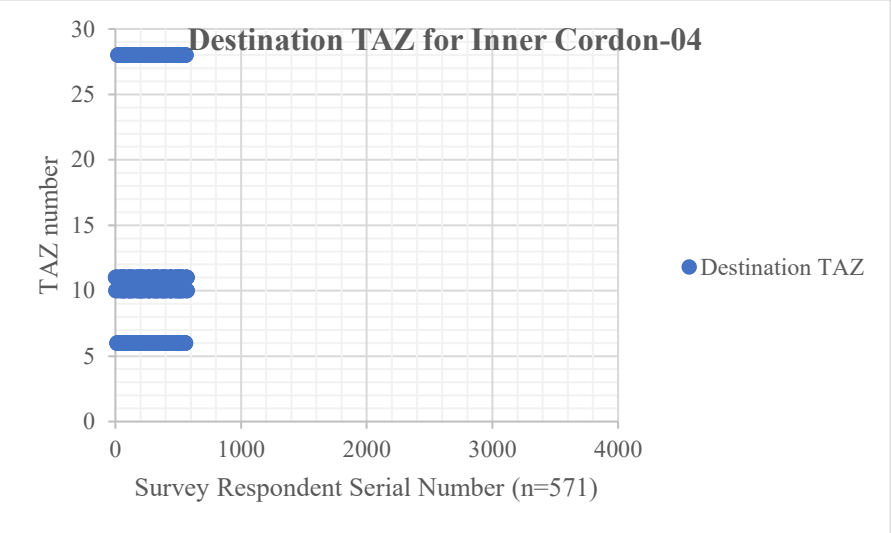


Figure 7.16: Destination TAZ for Inner Cordon-04

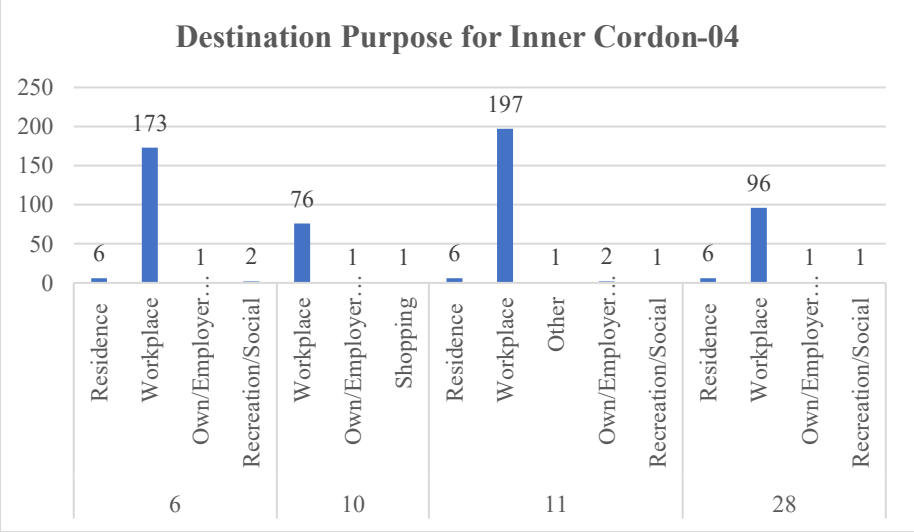


Figure 7.17: Destination Purpose for Inner Cordon-04

7.2.5 Origin-Destination & Purpose from Inner Cordon-5

The origin & destination of trip generation from Inner Cordon-05 mostly located within the TAZ-4, TAZ-6, TAZ-7, TAZ-8, TAZ-9, TAZ-12, and TAZ-26. Total 471 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. IC-05 is located at Gangni-Dhankhola road of Dhankhola in TAZ-12. Home-based Work appeared to be the most dominant purpose behind trip generation.

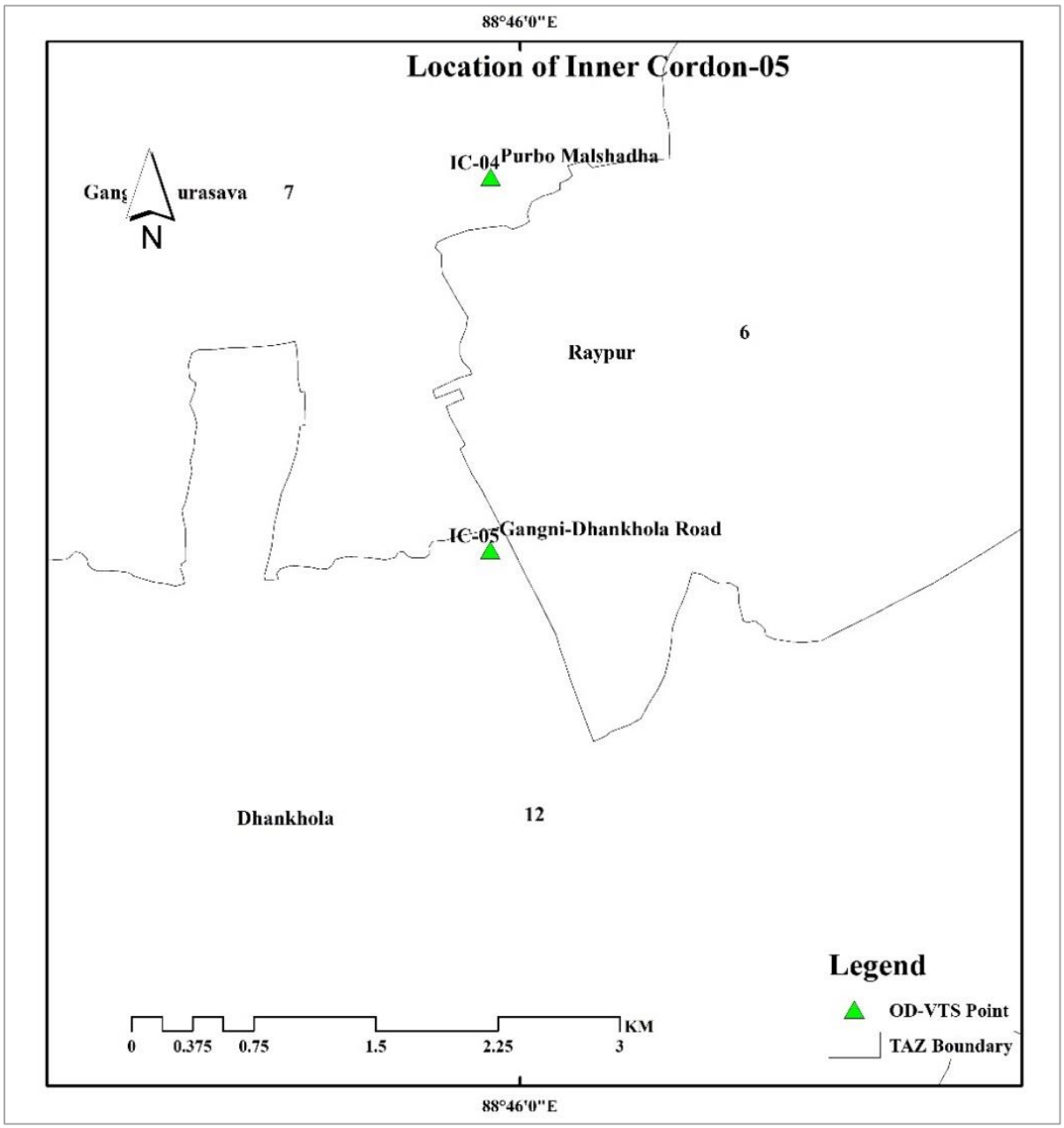


Figure 7.18: Location of Inner Cordon-05

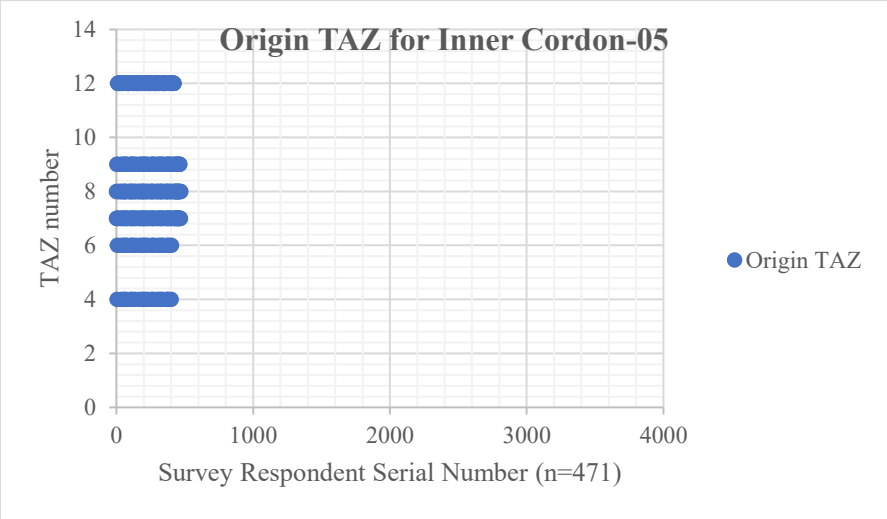


Figure 7.19: Origin TAZ for Inner Cordon-05

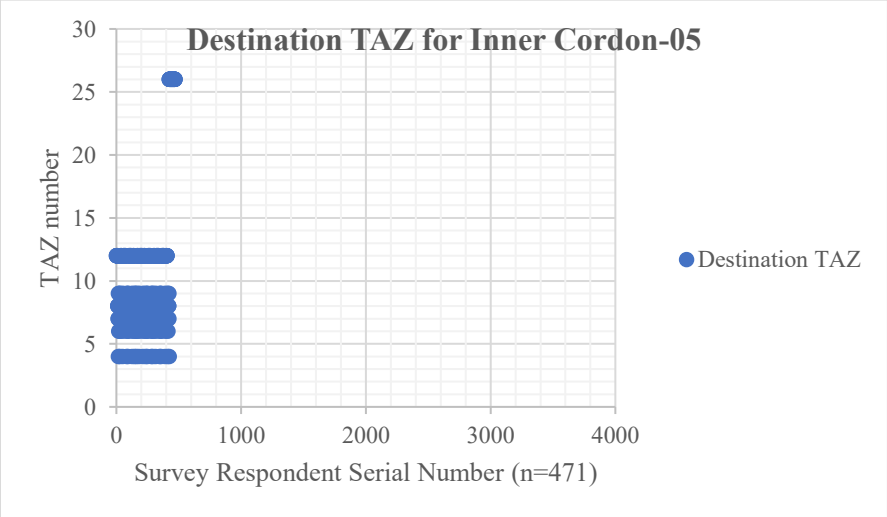


Figure 7.20: Destination TAZ for Inner Cordon-05

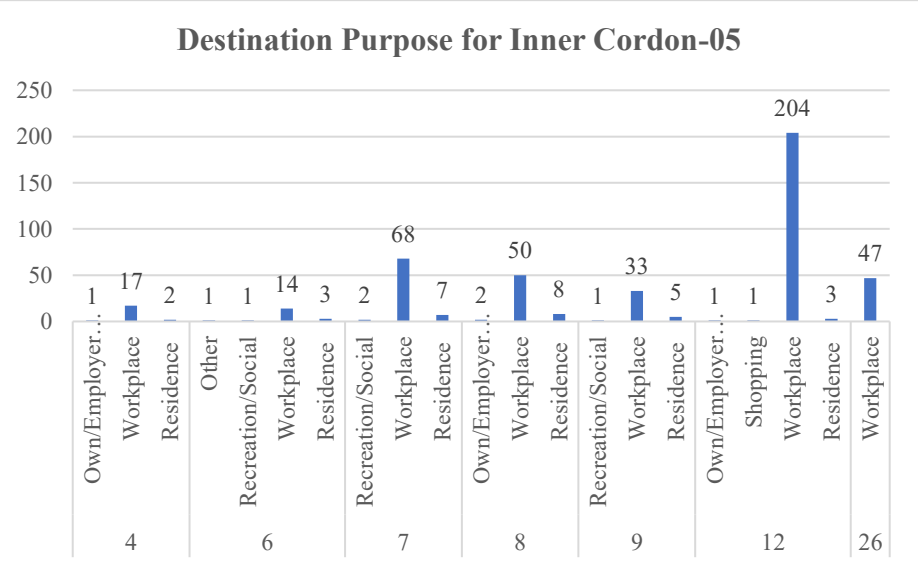


Figure 7.21: Destination Purpose for Inner Cordon-05

7.2.6 Origin-Destination & Purpose from Inner Cordon-6

The origin & destination of trip generation from Inner Cordon-06 mostly located within the TAZ-15, TAZ-16. Total 1787 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. IC-06 is located at Govipur Bridge that connects Buripota (TAZ-16) Union and Meherpur Municipality (TAZ-15).

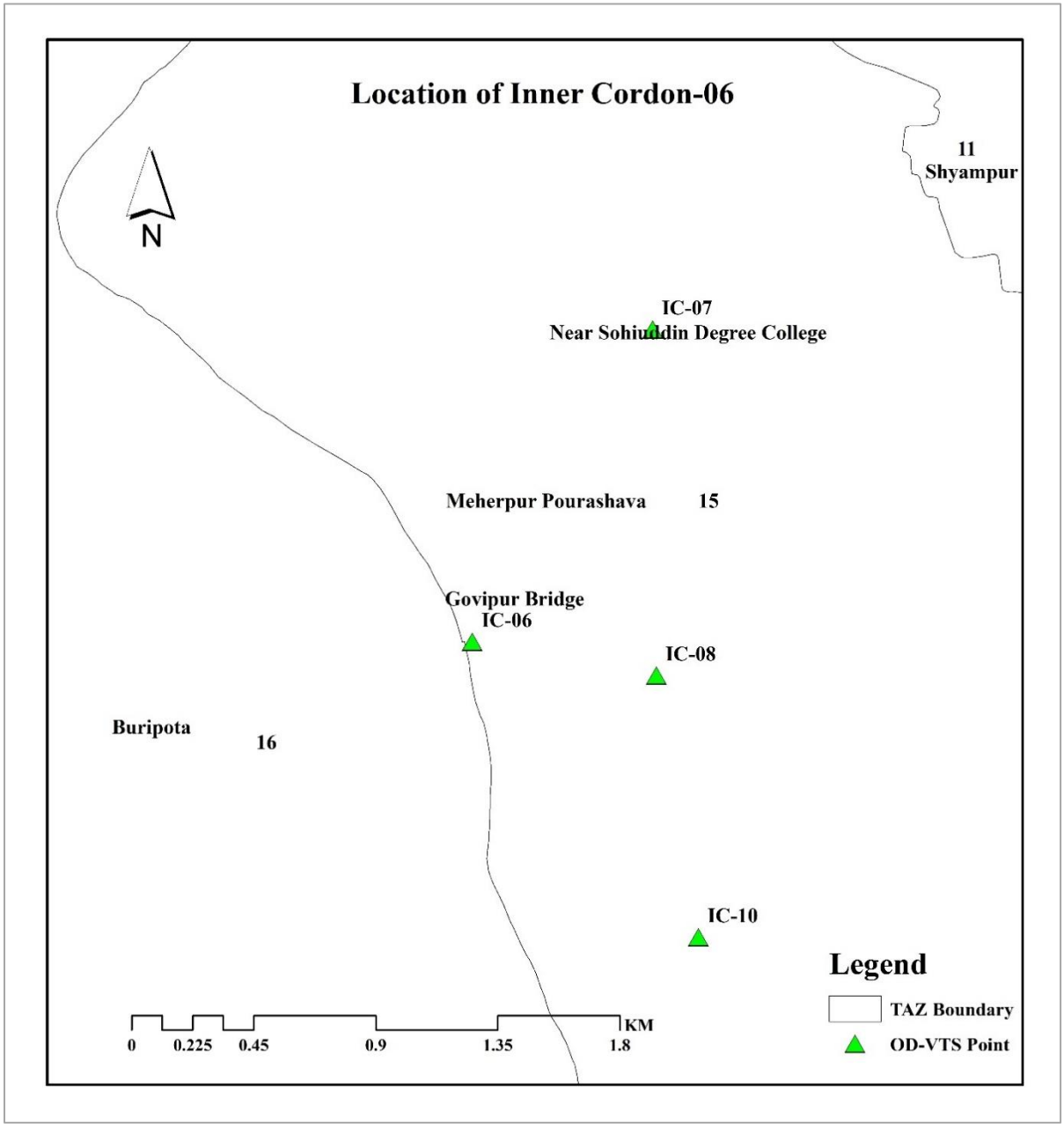


Figure 7.22: Location of Inner Cordon-06

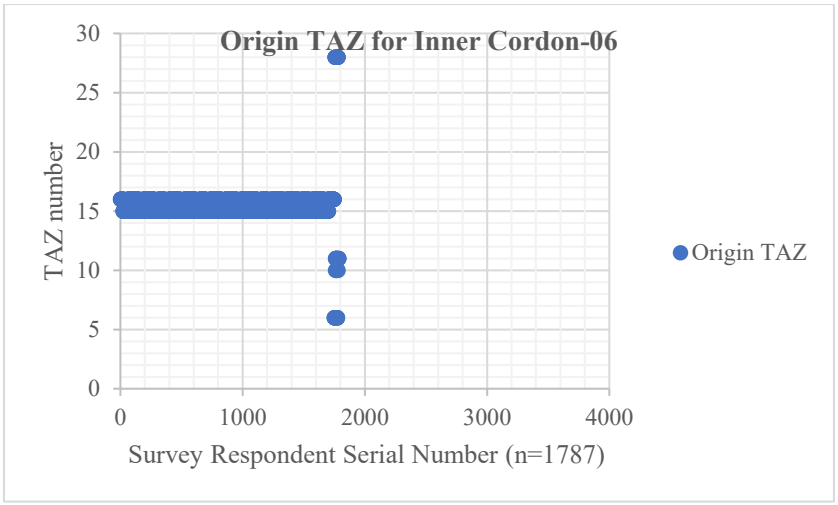


Figure 7.23: Origin TAZ for Inner Cordon-06

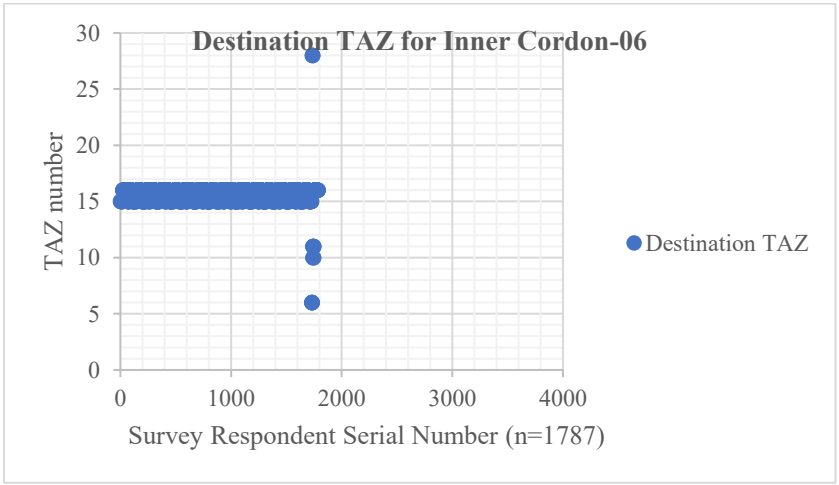


Figure 7.24: Destination TAZ for Inner Cordon-06

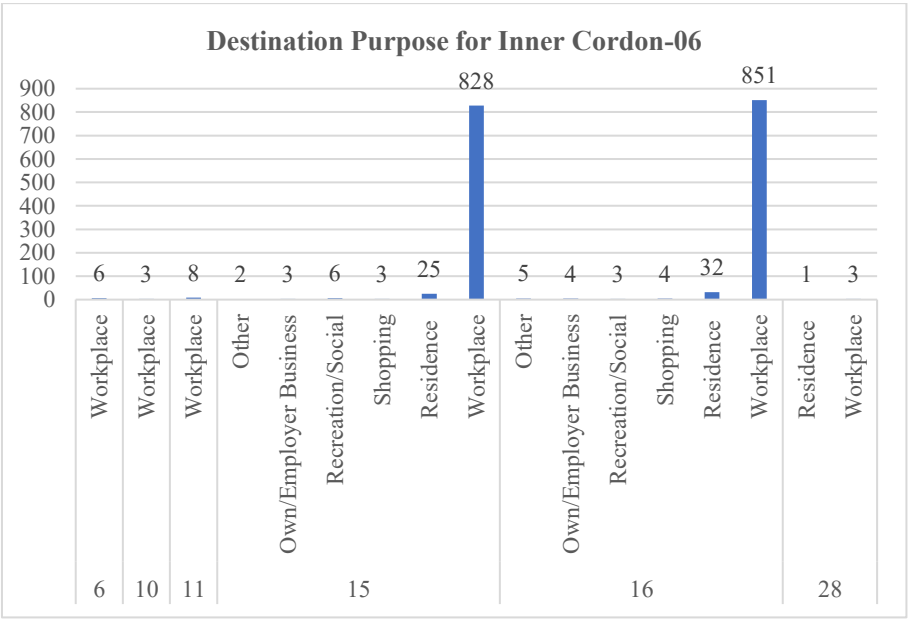


Figure 7.25: Destination Purpose for Inner Cordon-06

7.2.7 Origin-Destination & purpose from Inner Cordon-07

The origin & destination of trip generation from Inner Cordon-07 mostly located within the TAZ-10, TAZ-11, and TAZ-15. Total 2039 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. IC-07 is located near Shohiuddin Degree College in Meherpur Municipality (TAZ-15).

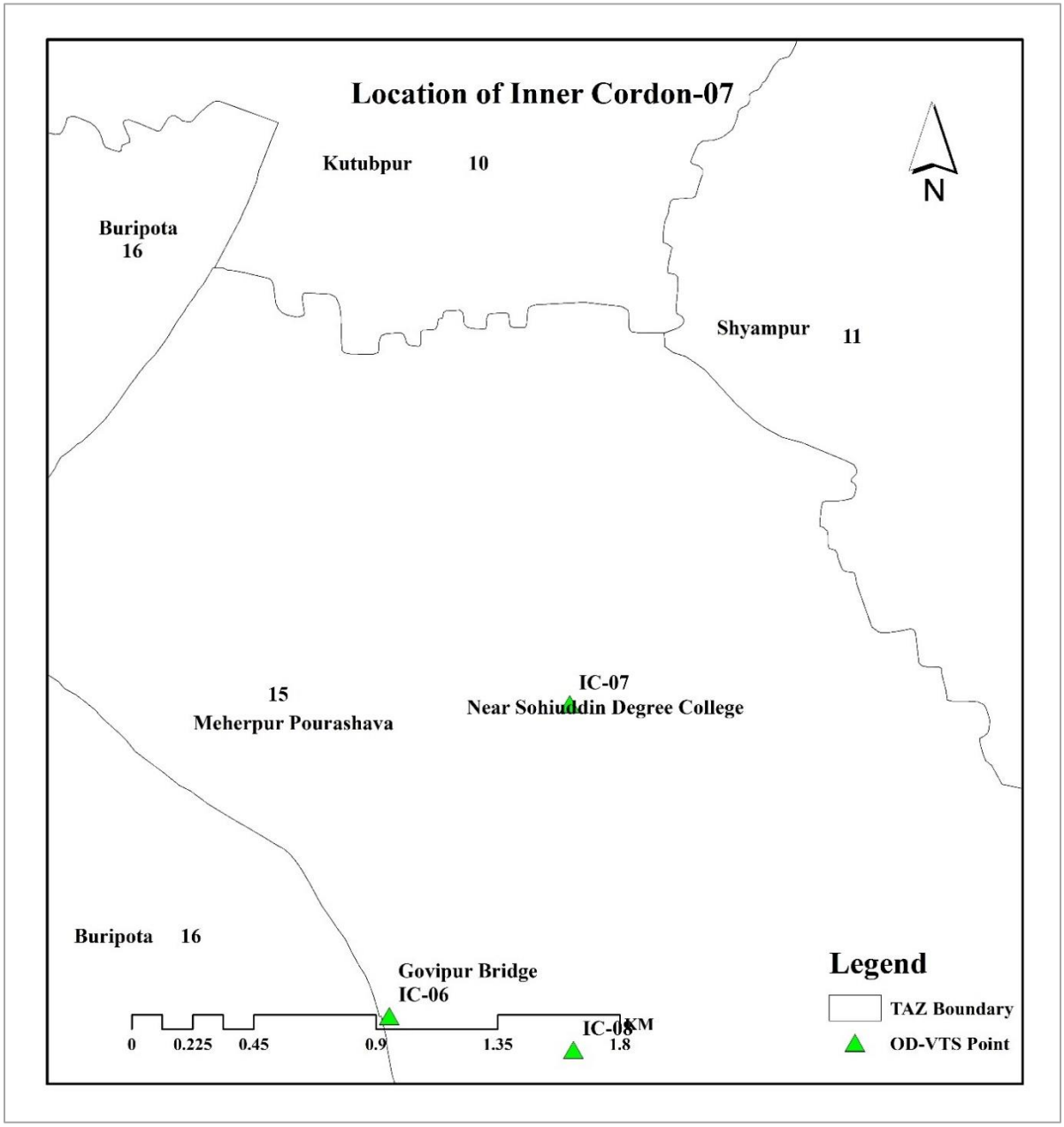


Figure 7.26: Location of Inner Cordon-07

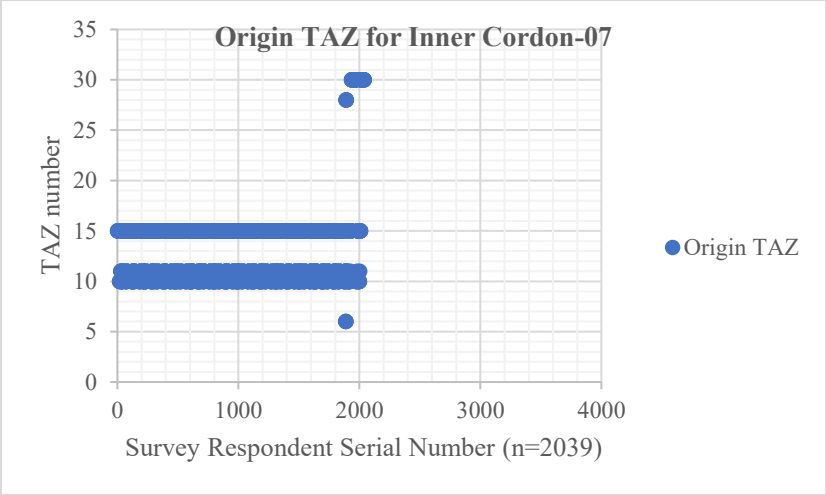


Figure 7.27: Origin TAZ for Inner Cordon-07

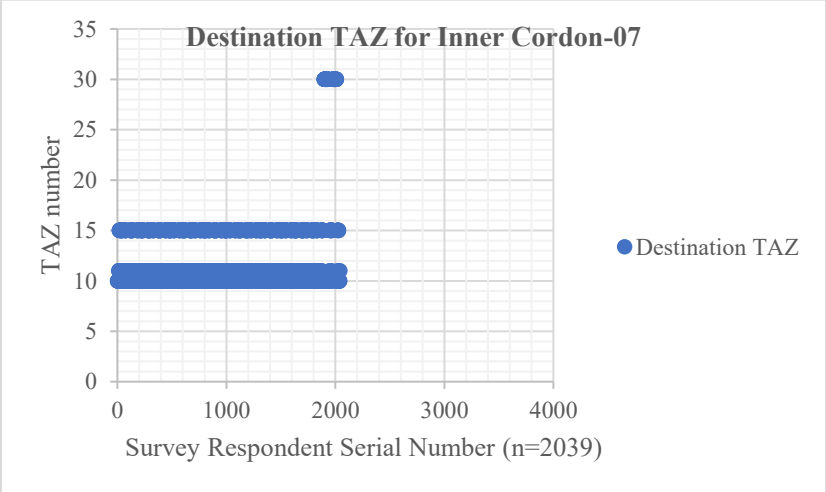


Figure 7.28: Destination TAZ for Inner Cordon-07

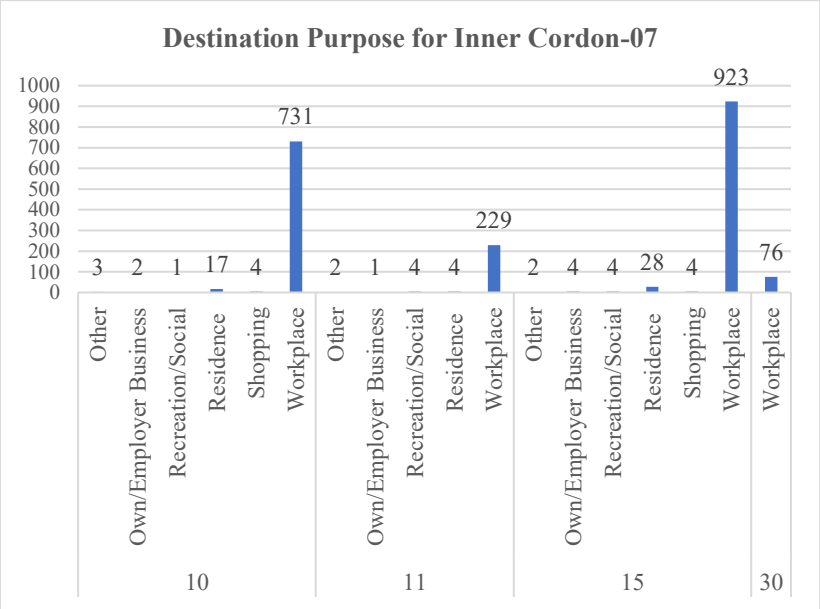


Figure 7.29: Destination Purpose for Inner Cordon-07

7.2.8 Origin-Destination & Purpose from Inner Cordon-08

Inner Cordon-08 is located at Boro Bazar-Char Rastar Mor in Meherpur Paurashava. It is considered to be a critical junction and been studied more detailed in the Section 8.1.8.

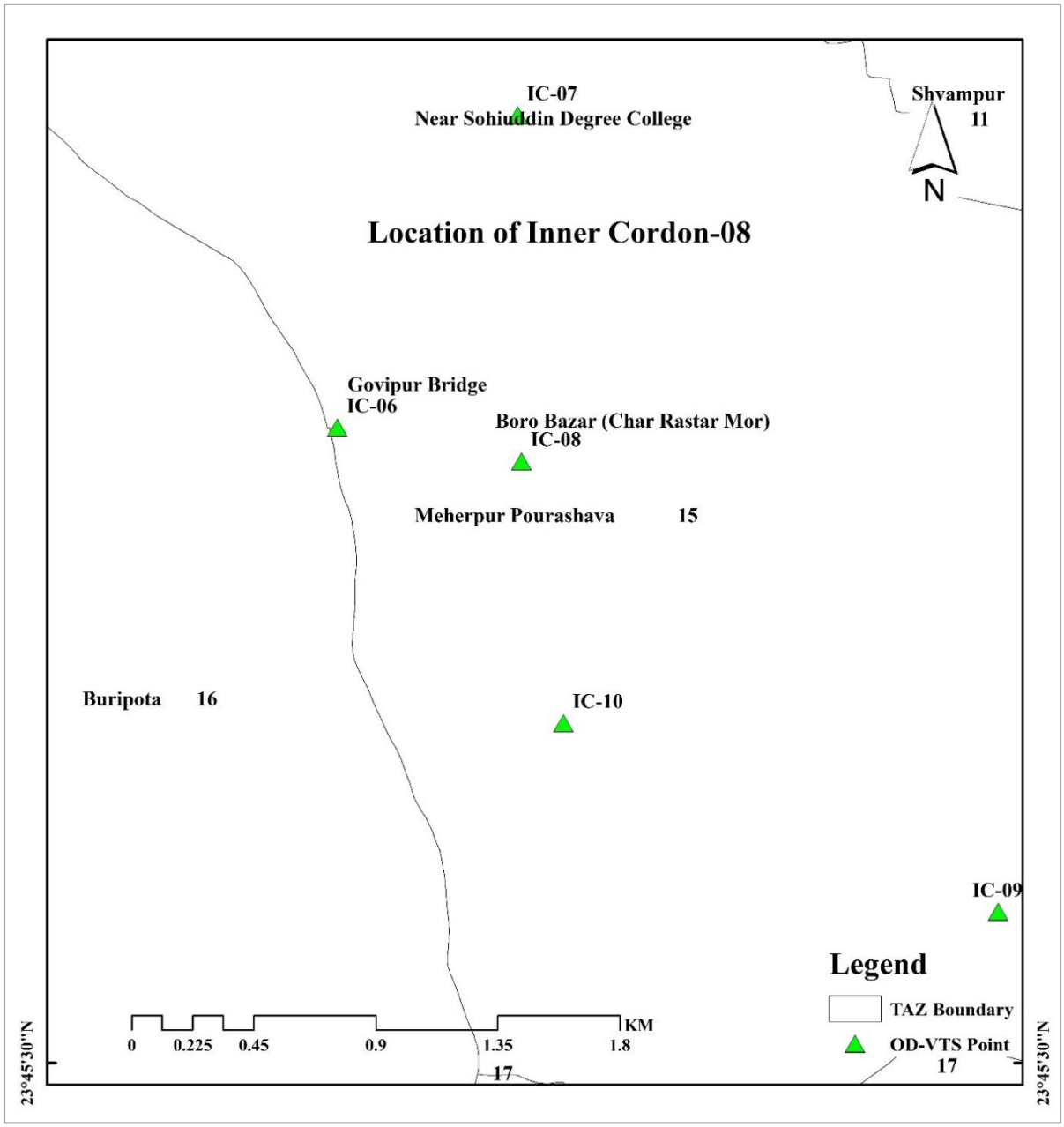


Figure 7.30: Destination Purpose for Inner Cordon-08

7.2.9 Origin-Destination & Purpose from Inner Cordon-09

The origin & destination of trip generation from Inner Cordon-09 mostly located within the TAZ-10, TAZ-11, TAZ-12, TAZ-13, TAZ-14, TAZ-15, and TAZ-16. Total 3100 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-

based Work appeared to be the most dominant purpose behind trip generation. IC-09 is located at Chuadanga-Meherpur Road in Meherpur Municipality (TAZ-15).

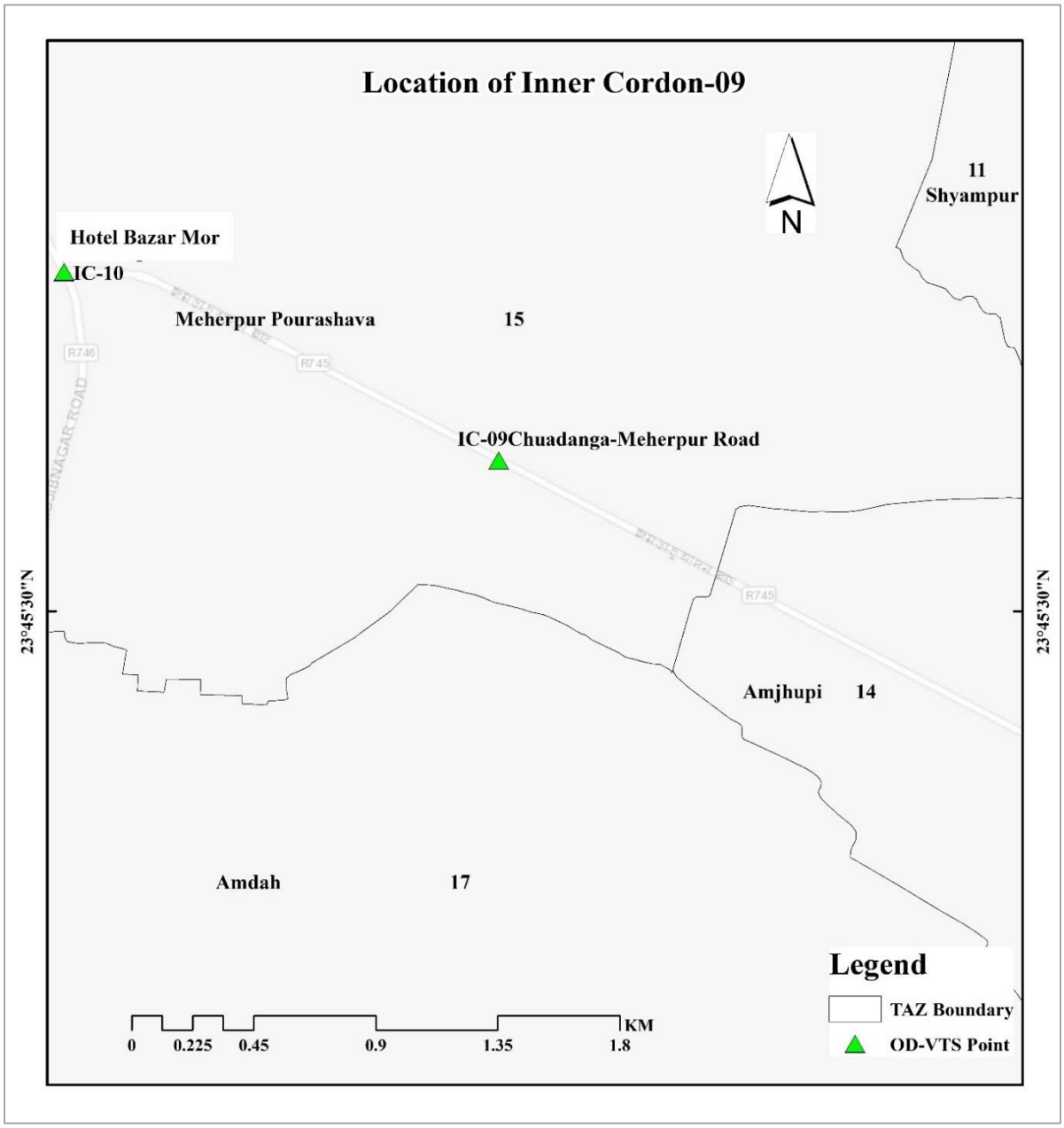


Figure 7.31: Location of Inner Cordon-09

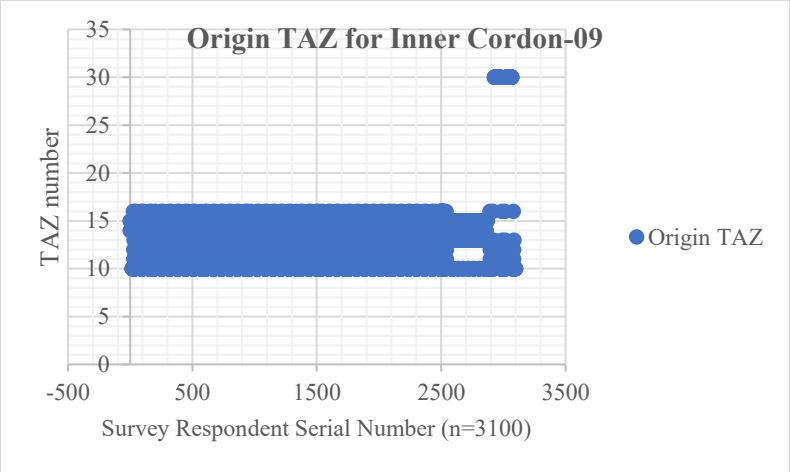


Figure 7.32: Origin TAZ for Inner Cordon-09

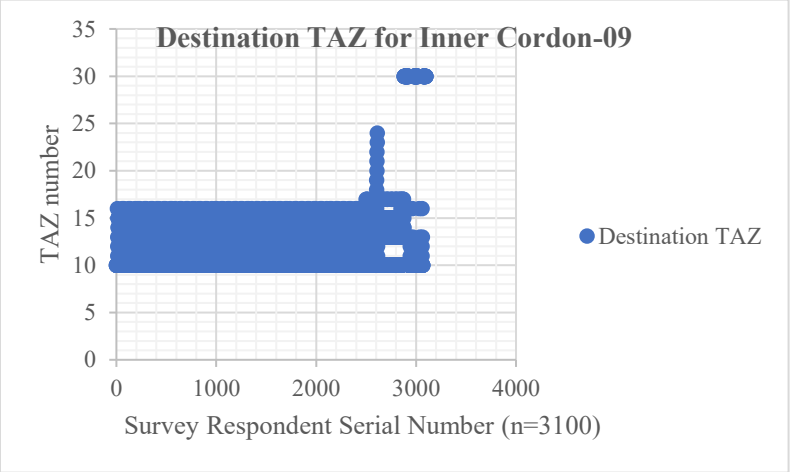


Figure 7.33: Destination TAZ for Inner Cordon-09

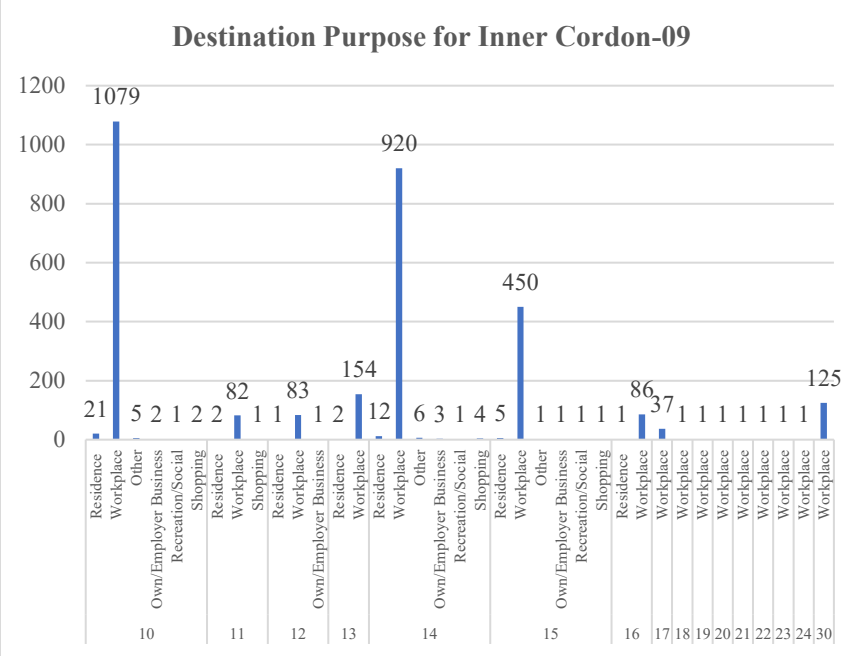


Figure 7.34: Destination Purpose for Inner Cordon-09

7.2.10 Origin-Destination & Purpose from Inner Cordon-10

Inner Cordon-10 is located at Hotel Bazar Mor in Meherpur Paurashava. It is considered to be a critical junction and been studied more detailed in the Section 8.1.10.

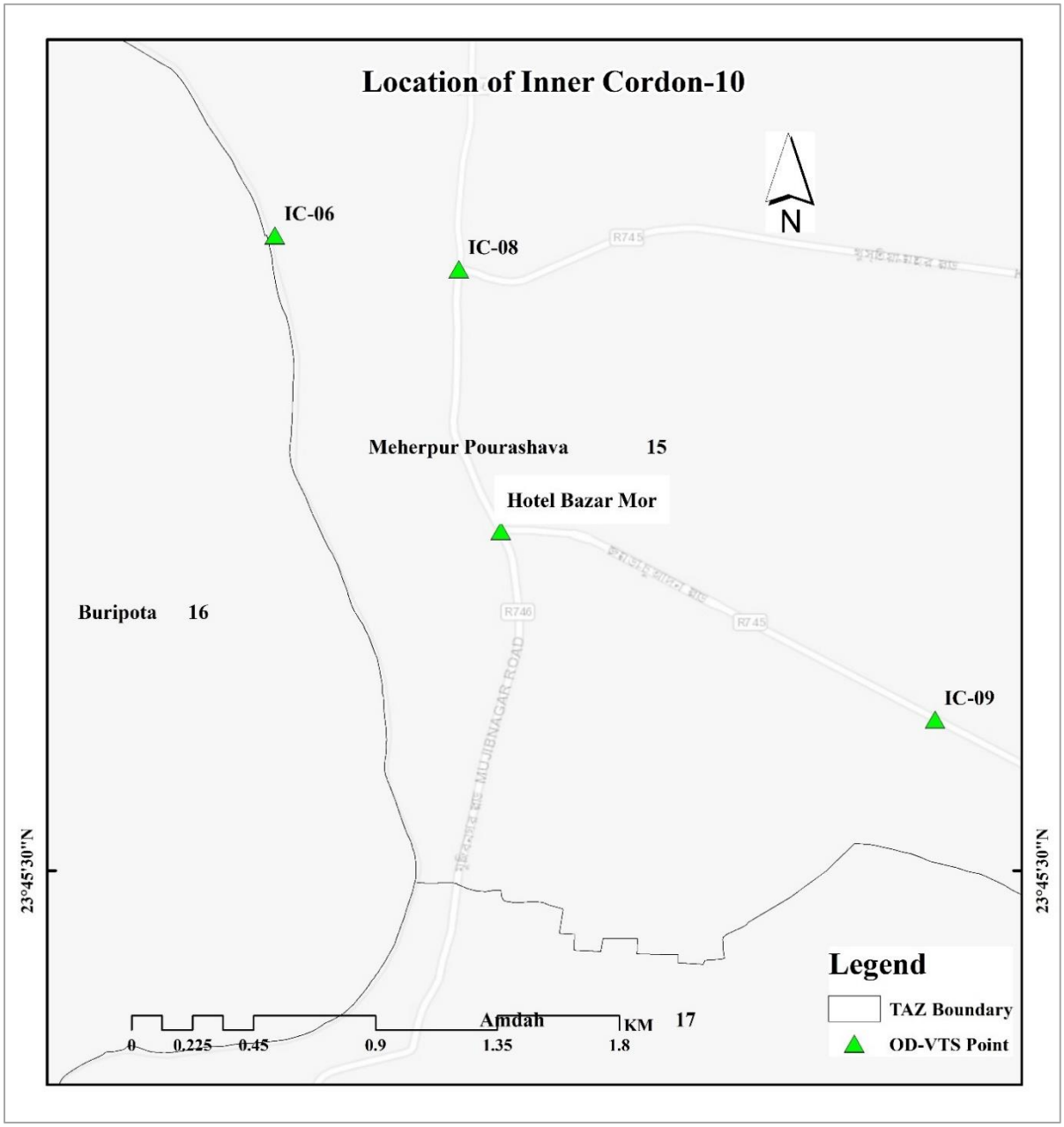


Figure 7.35: Location of Outer Cordon-10

7.2.11 Origin-Destination & Purpose from Inner Cordon-11

Inner Cordon-11 is located at Kedarganj Mor in Bagoan (TAZ-22). It is considered to be a critical junction and been studied more detailed in the Section 8.1.11.

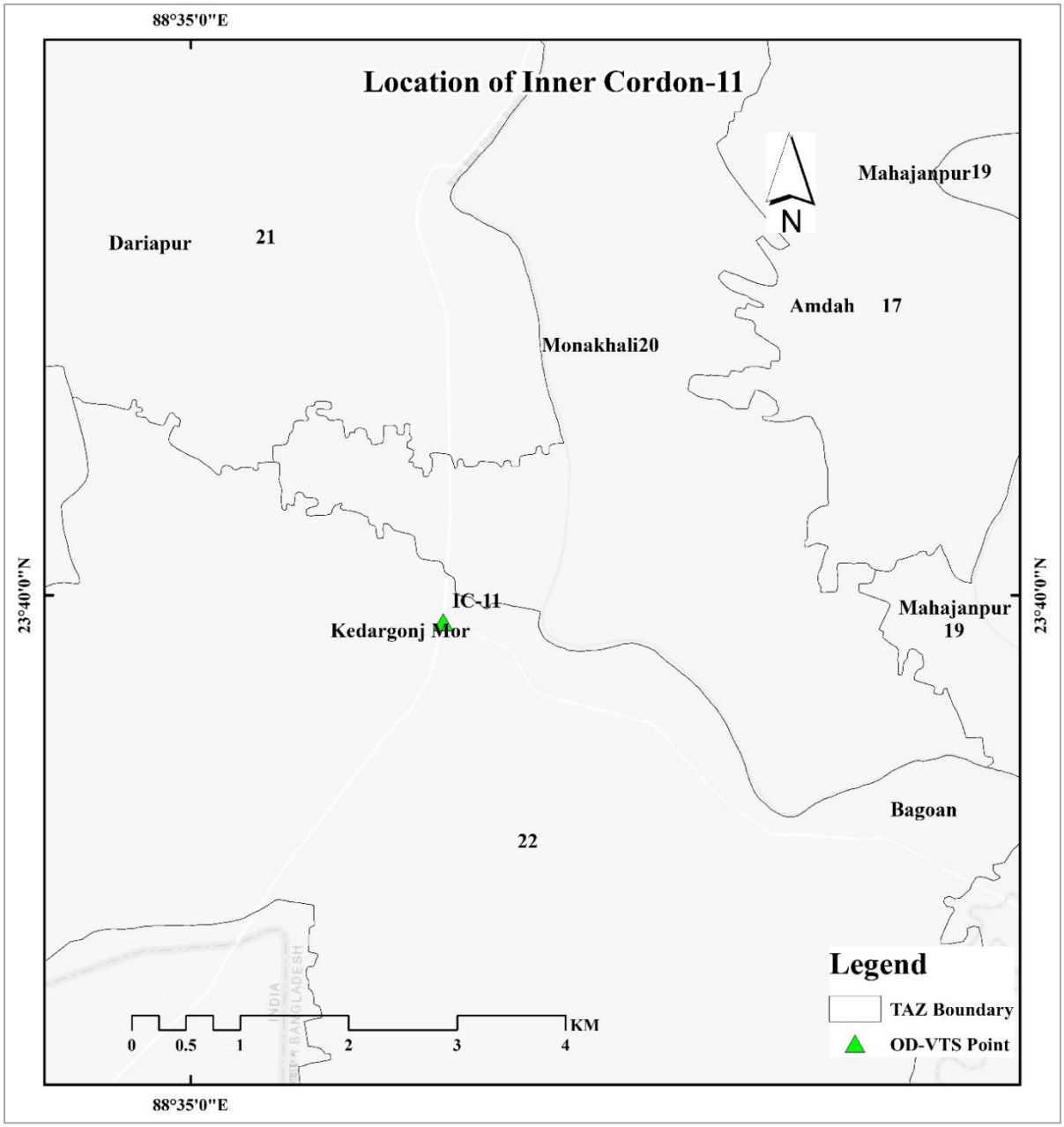


Figure 7.36: Location of Inner Cordon-11

7.2.12 Origin-Destination & Purpose from Outer Cordon-01

The origin & destination of trip generation from Outer Cordon-01 mostly located within the TAZ 01, TAZ-07, TAZ-23, and TAZ-25. Total 702 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-01 is located at Daulotpur- Meherpur Road at the edge of Kazipur Union (TAZ-1).

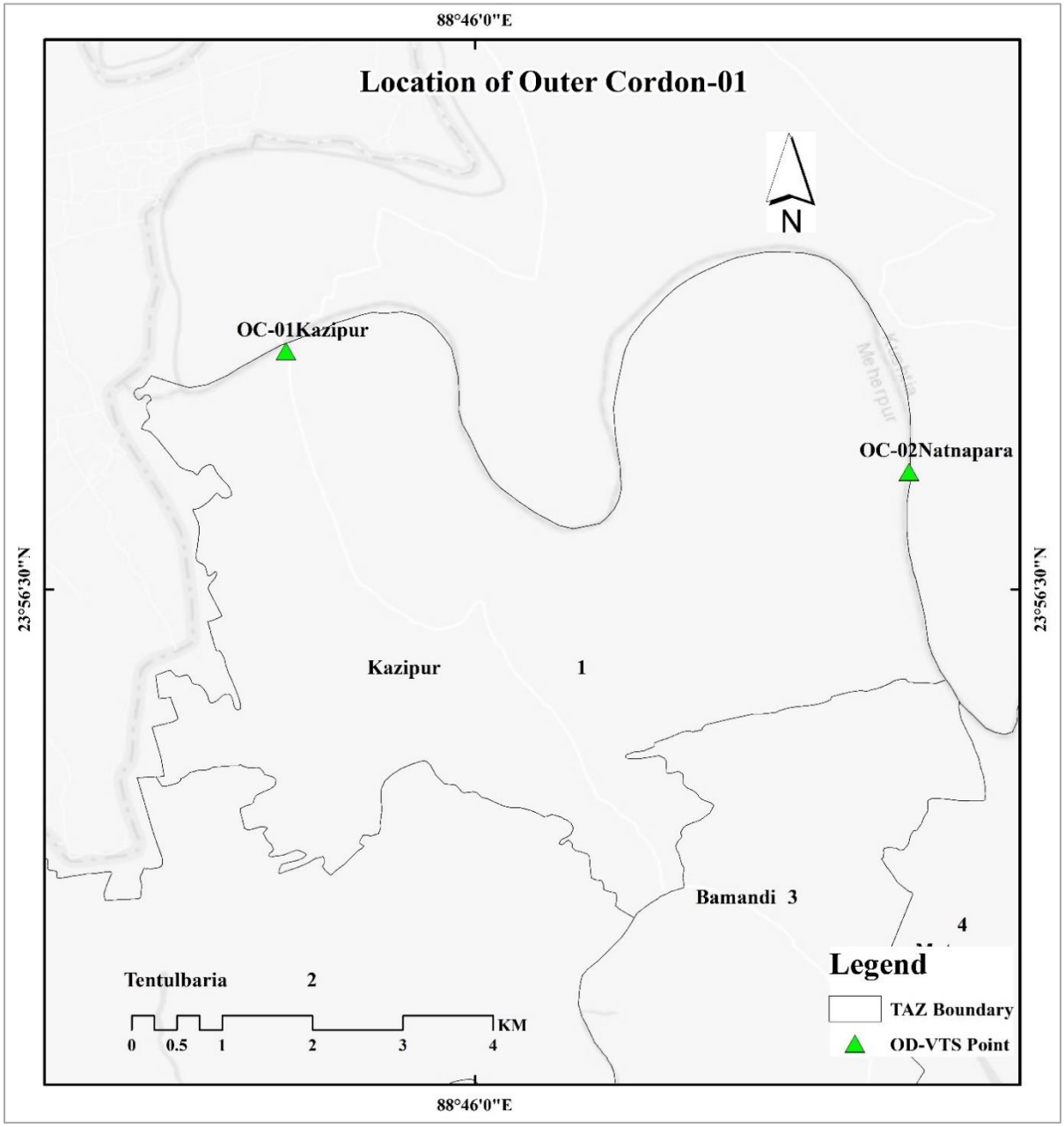


Figure 7.37: Location of Outer Cordon-01

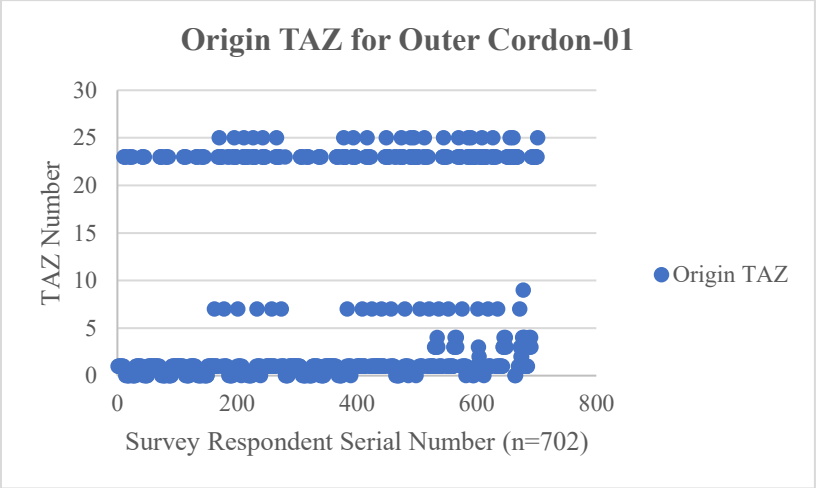


Figure 7.38: Origin TAZ for Outer Cordon-01

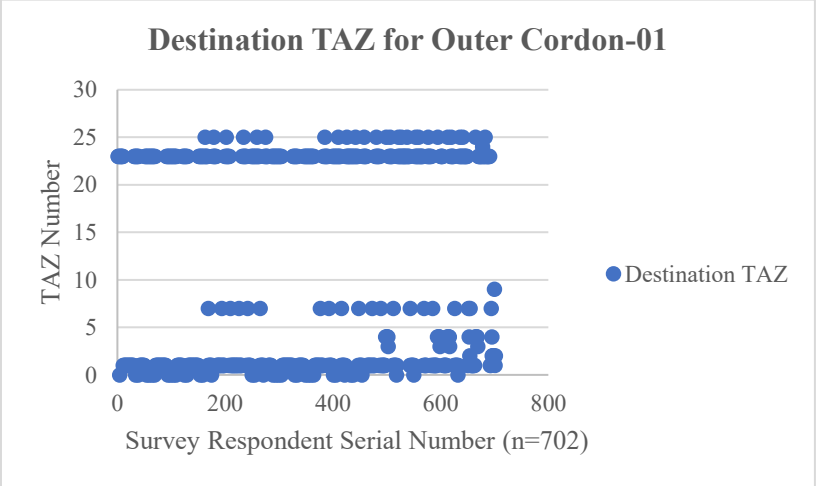


Figure 7.39: Destination TAZ for Outer Cordon-01

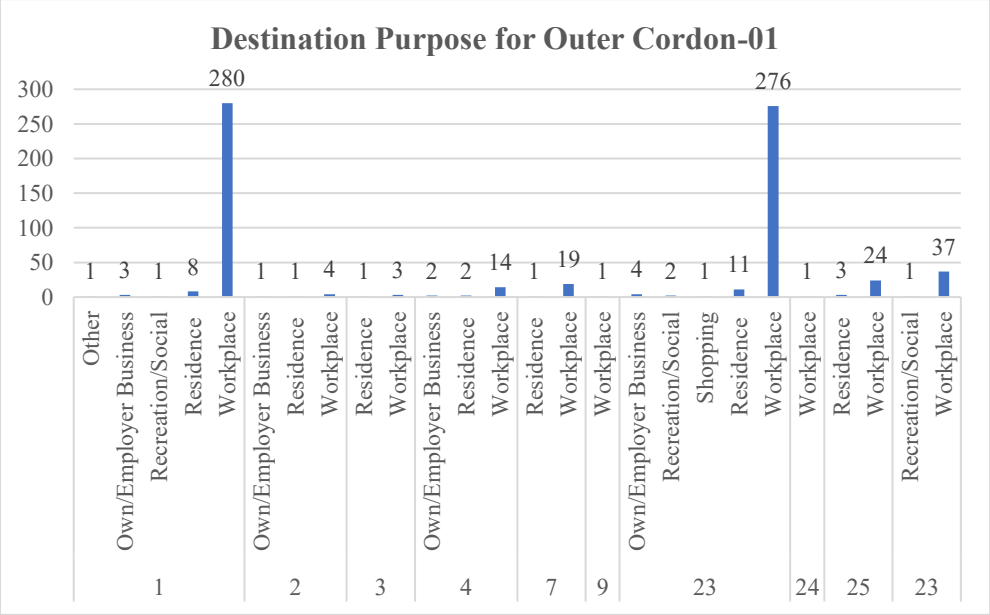


Figure 7.40: Destination Purpose for Outer Cordon-01

7.2.13 Origin-Destination & Purpose from Outer Cordon-02

The origin & destination of trip generation from Outer Cordon-02 mostly located within the TAZ-01, and TAZ-24. Total 931 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-02 is located at Natnapara which is eventually located in Daulotpur of Kushtia, near TAZ 1 which is Kazipur Union.

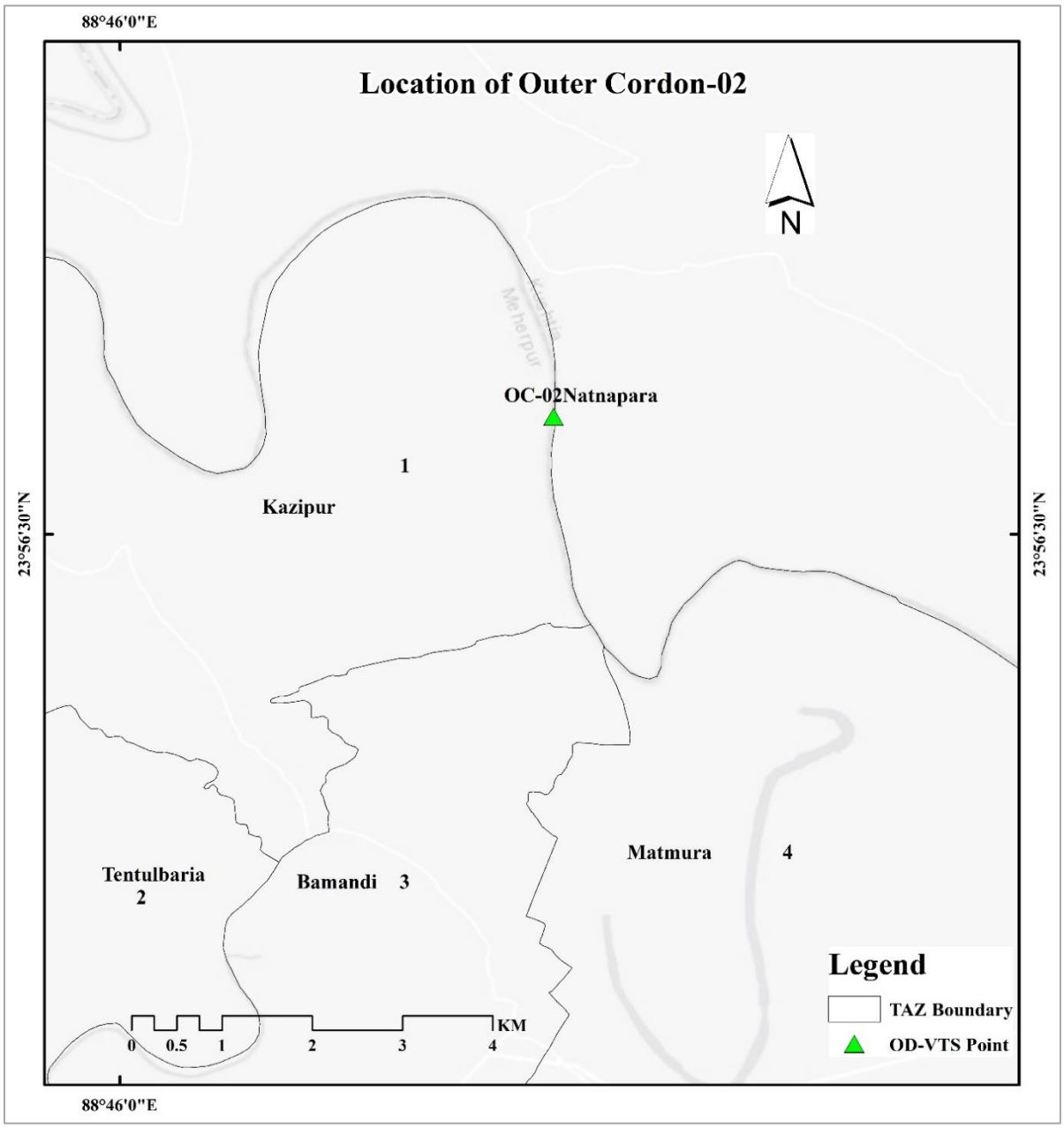


Figure 7.41: Location of Outer Cordon-02

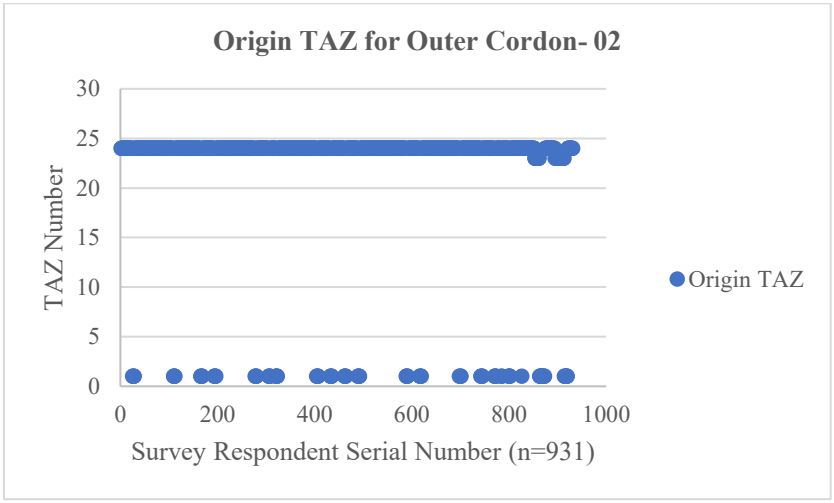


Figure 7.42: Origin TAZ for Outer Cordon-01

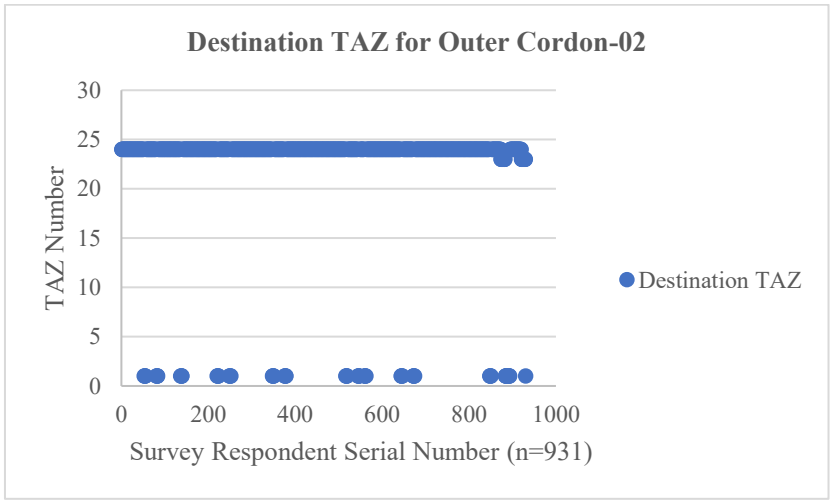


Figure 5.35: Destination TAZ for Outer Cordon-02

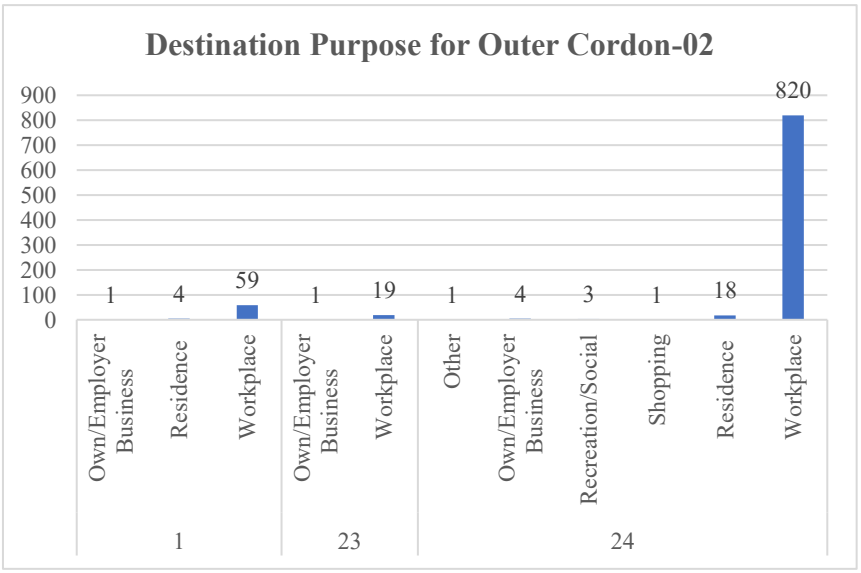


Figure 5.36: Destination Purpose for Outer Cordon-02

7.1.14 Origin-Destination & Purpose from Outer Cordon-03

The origin & destination of trip generation from Outer Cordon-03 mostly located within the TAZ-01, TAZ-04, TAZ-25 and TAZ-26. Total 1740 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-03 is located at Meherpur-Kushtia Highway near Khalishakundi Bridge and TAZ-4, Matmura Union.

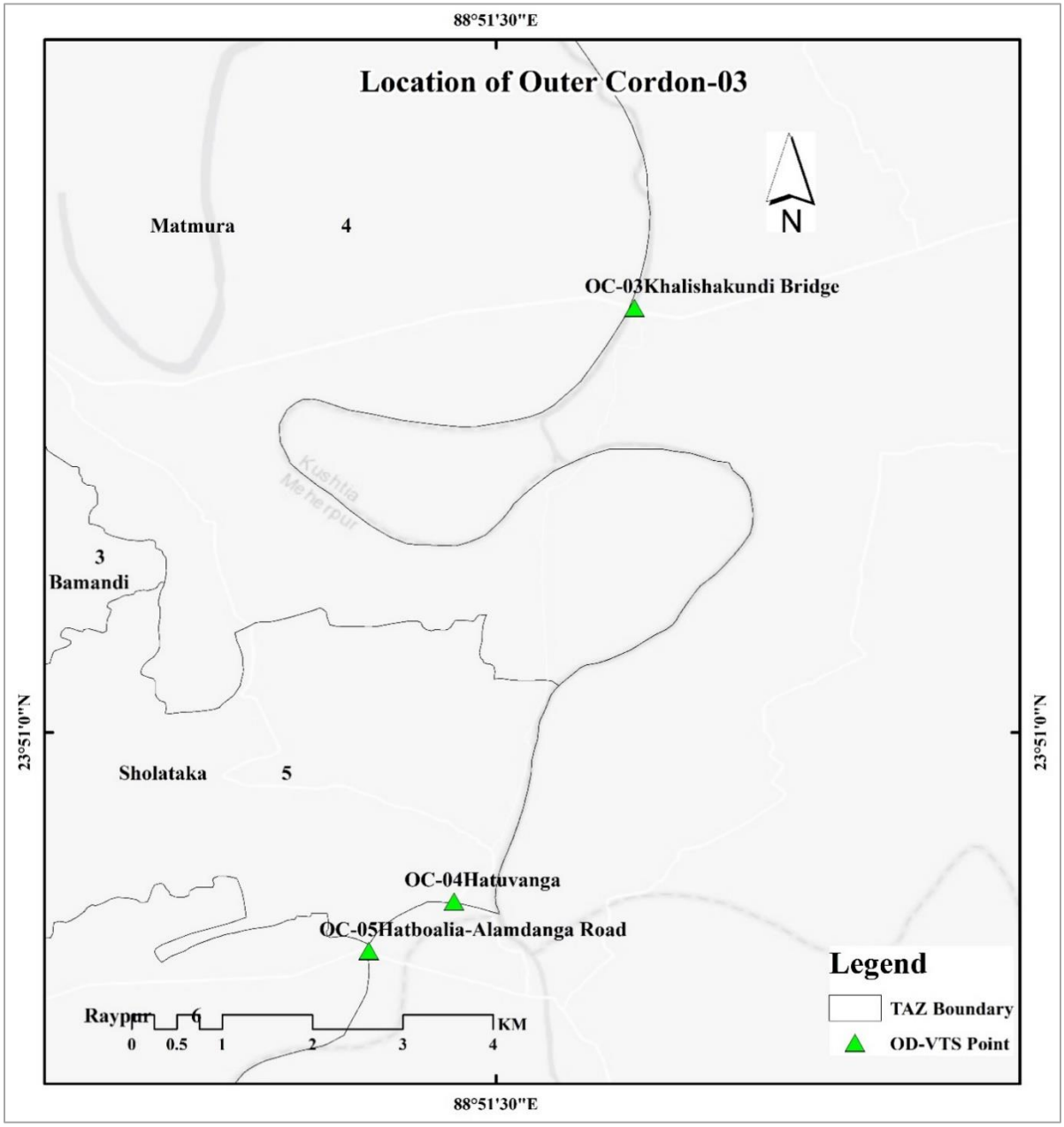


Figure 7.41: Location of Outer Cordon-03

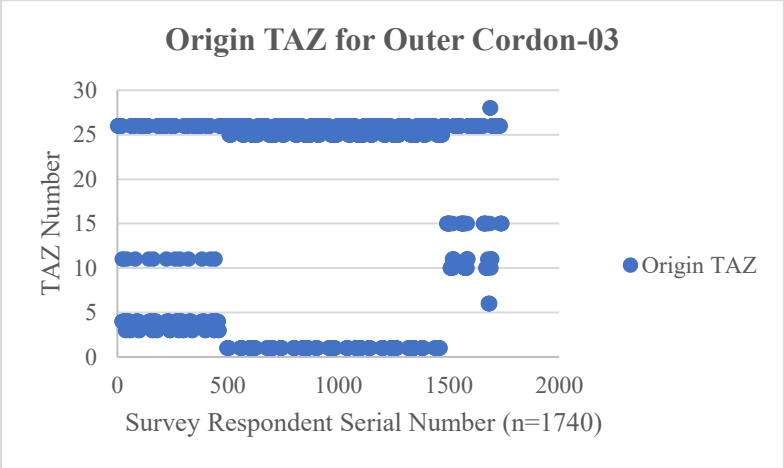


Figure 7.42: Origin TAZ for Outer Cordon-03

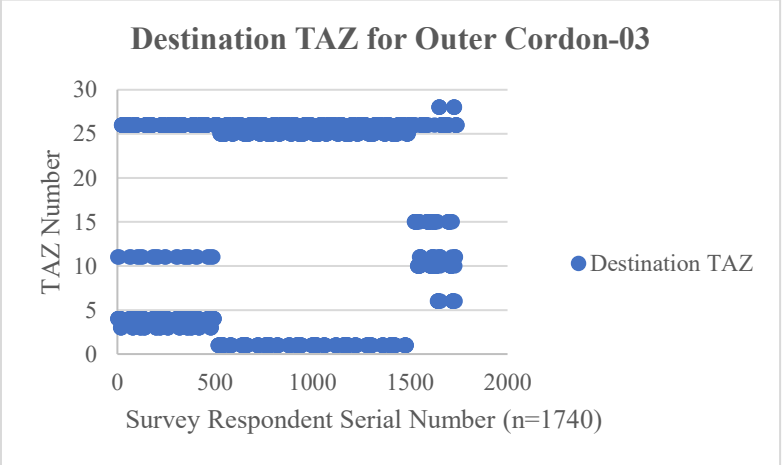


Figure 7.43: Destination TAZ for Outer Cordon-03

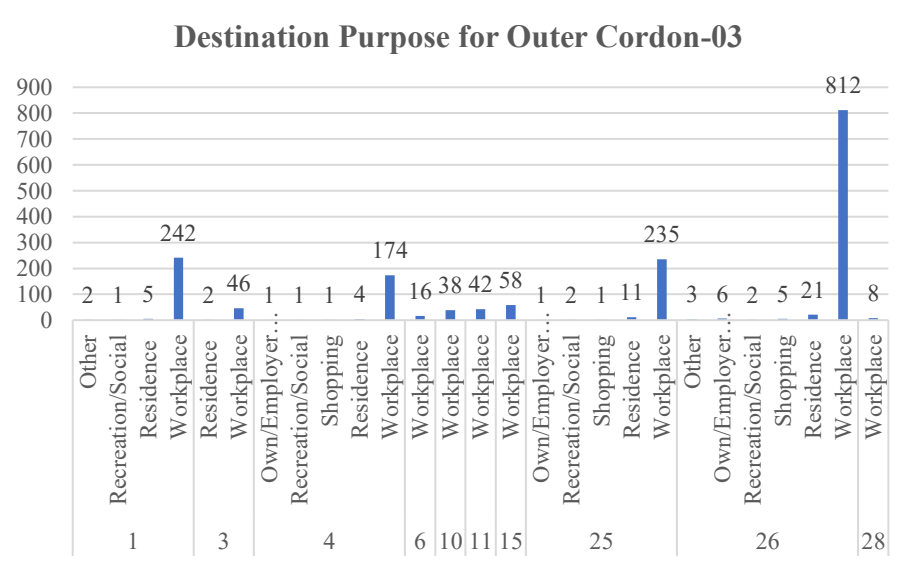


Figure 7.44: Destination Purpose for Outer Cordon-03

7.2.15 Origin-Destination & Purpose from Outer Cordon-04

The origin & destination of trip generation from Outer Cordon-04 mostly located within the TAZ-05, TAZ-06, and TAZ-28. Total 1754 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-04 is located near Hatuvanga which is located near Mathavanga River and also near to Sholataka (TAZ-5) and Raypur Union (TAZ-6).

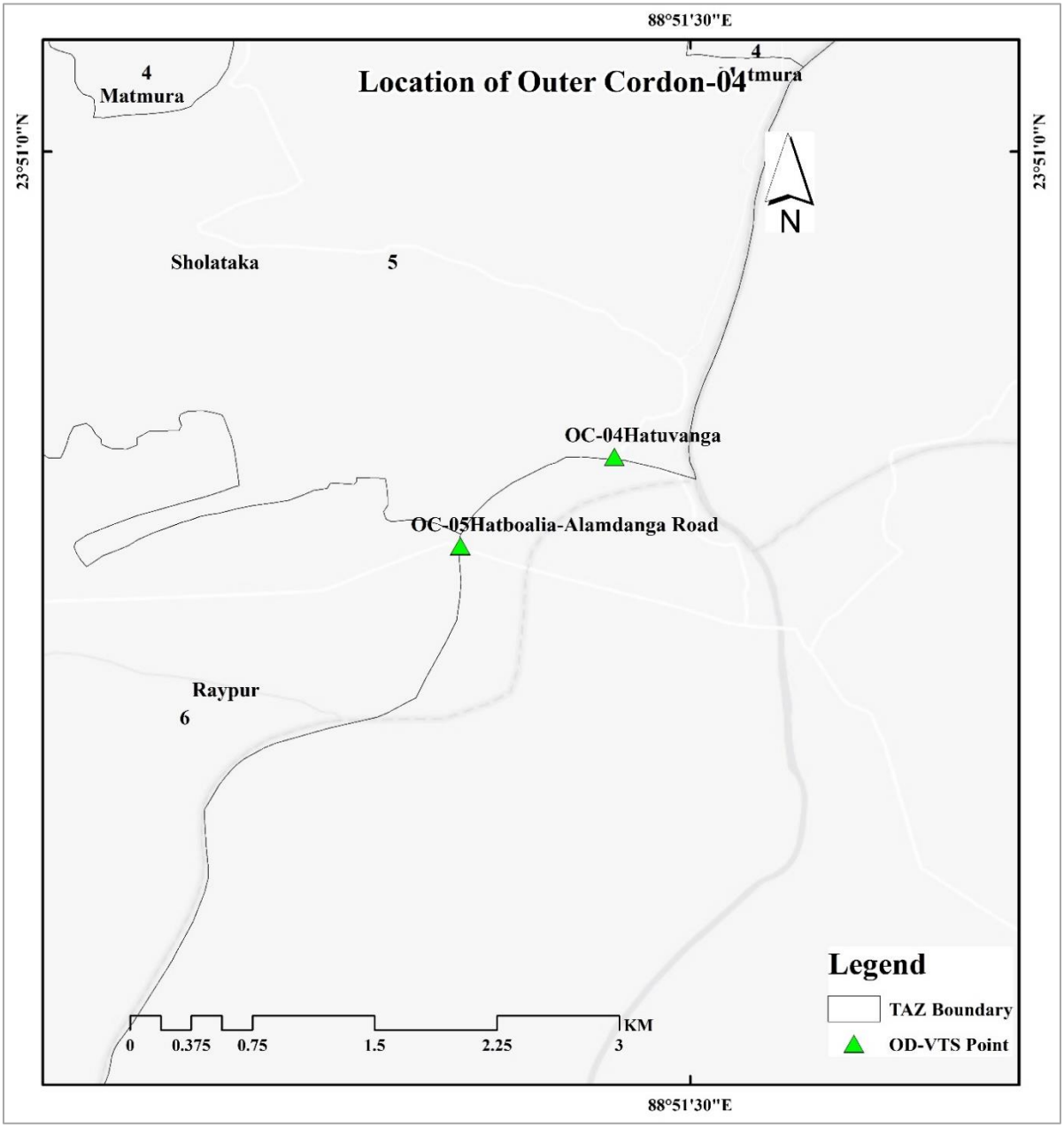


Figure 7.45: Location of Outer Cordon-04

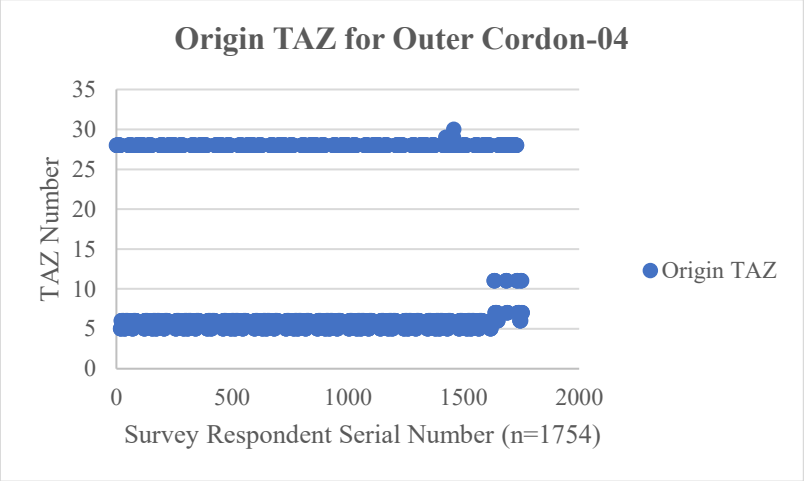


Figure 5.40: Origin TAZ for Outer Cordon-04

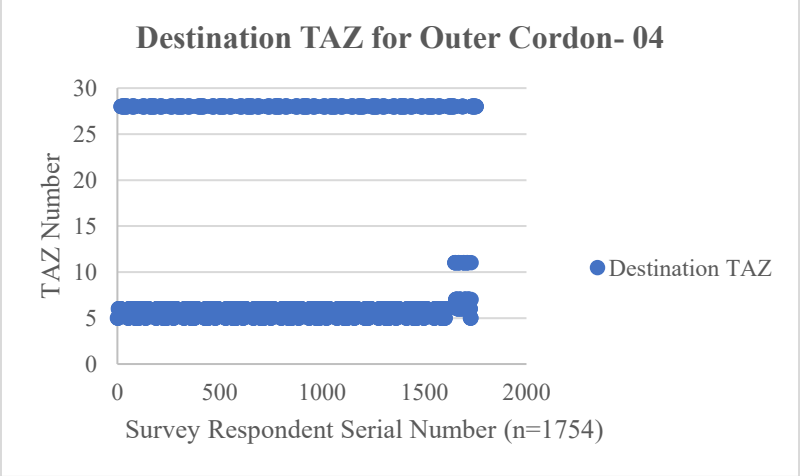


Figure 5.41: Destination TAZ for Outer Cordon-04

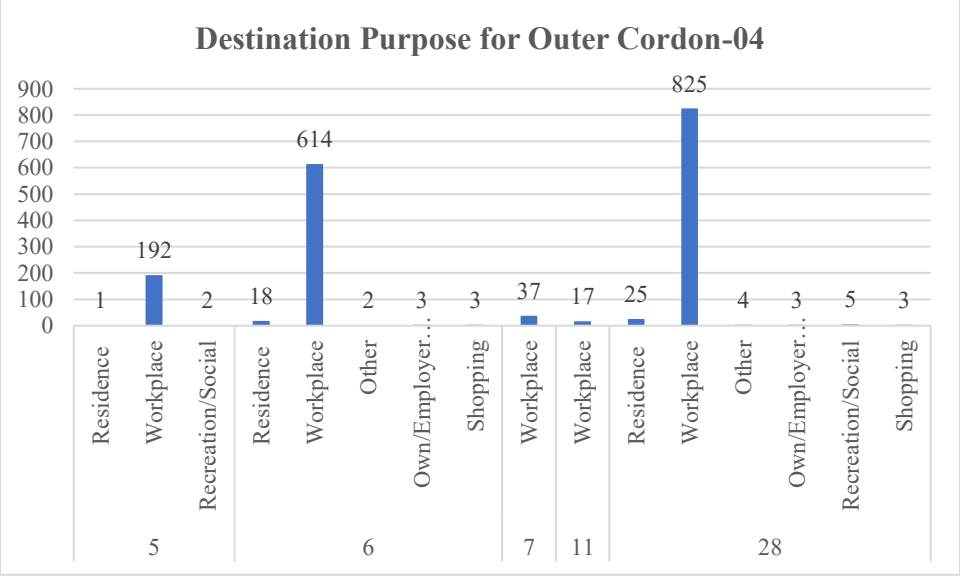


Figure 5.42: Destination Purpose for Outer Cordon-04

7.2.16 Origin-Destination & Purpose from Outer Cordon-05

The origin & destination of trip generation from Outer Cordon-05 mostly located within the TAZ-05, TAZ-06, and TAZ-28. Total 1517 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-05 is located at Hatboalia-Alamdanga Road which is also located near near to Sholataka (TAZ-5) and Raypur Union (TAZ-6).

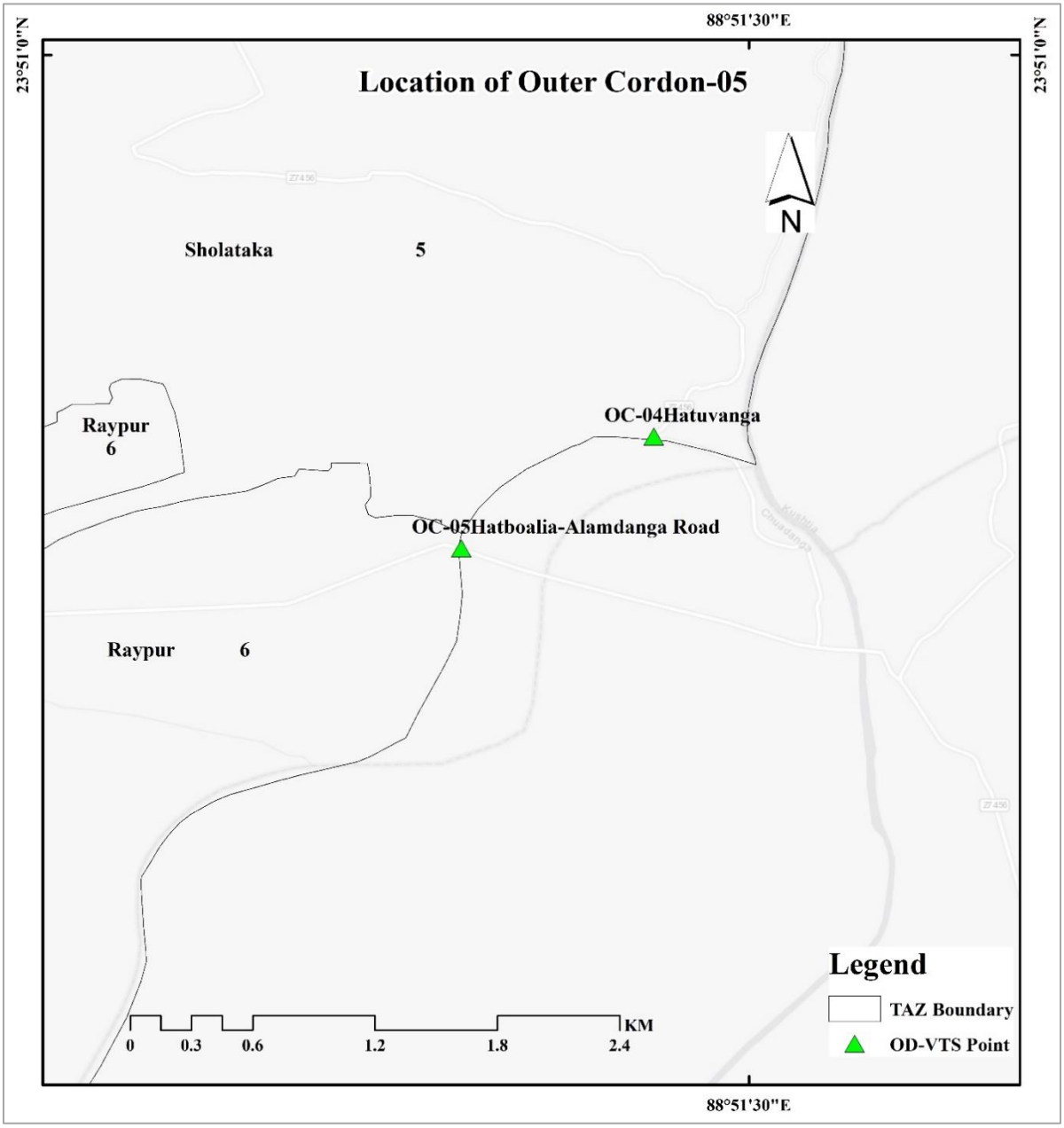


Figure 7.45: Location of Outer Cordon-05

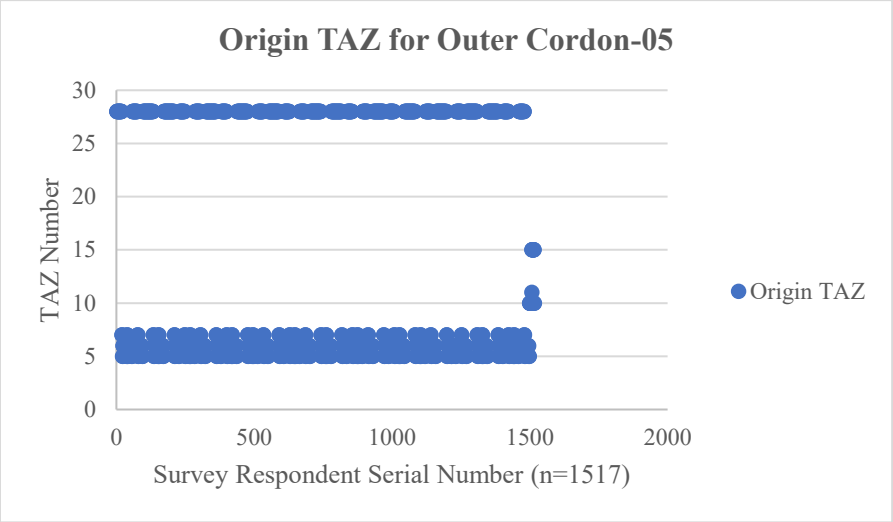


Figure 7.46: Origin TAZ for Outer Cordon-05

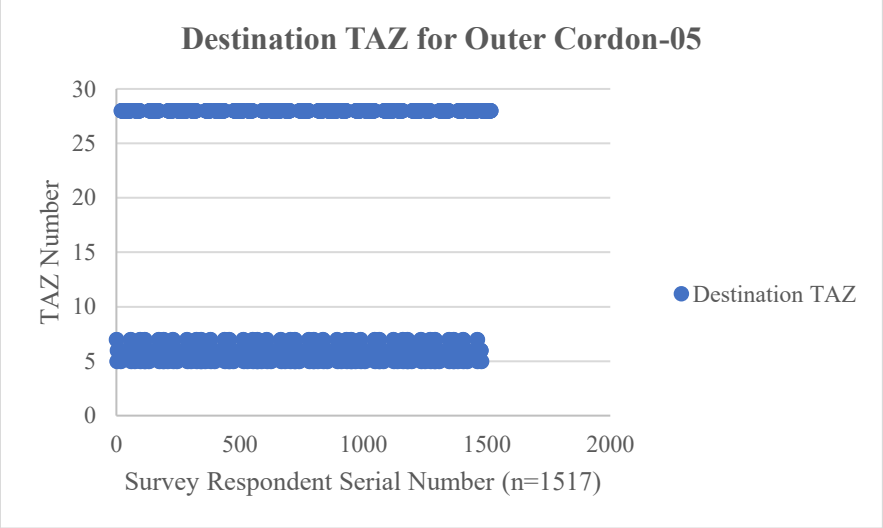


Figure 7.47: Destination TAZ for Outer Cordon-05

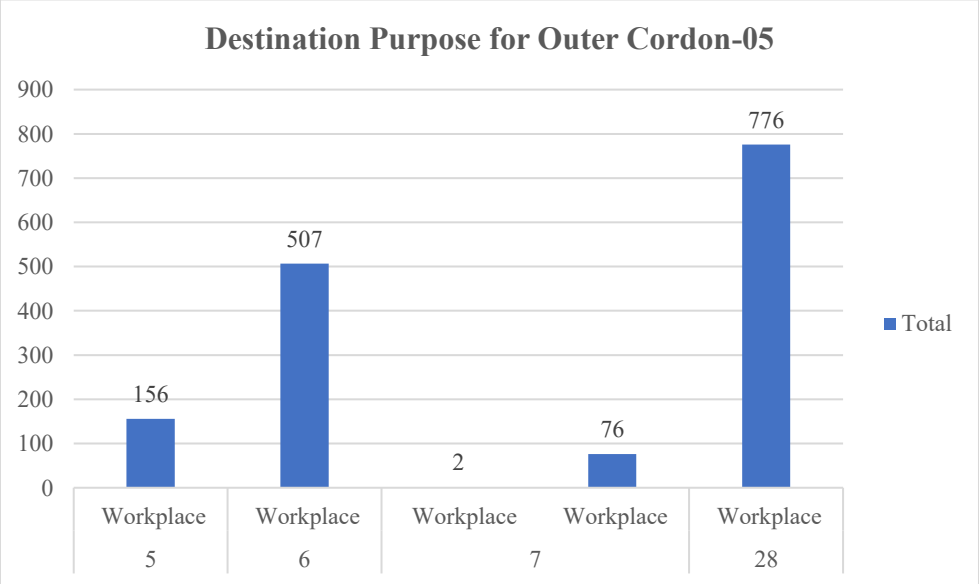


Figure 7.48: Destination Purpose for Outer Cordon-05

7.2.17 Origin-Destination & Purpose from Outer Cordon-06

The origin & destination of trip generation from Outer Cordon-06 mostly located within the TAZ-12, TAZ-28, and TAZ-30. Total 1000 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-06 is located at Jalshuka near Dhankhola Union (TAZ-12).

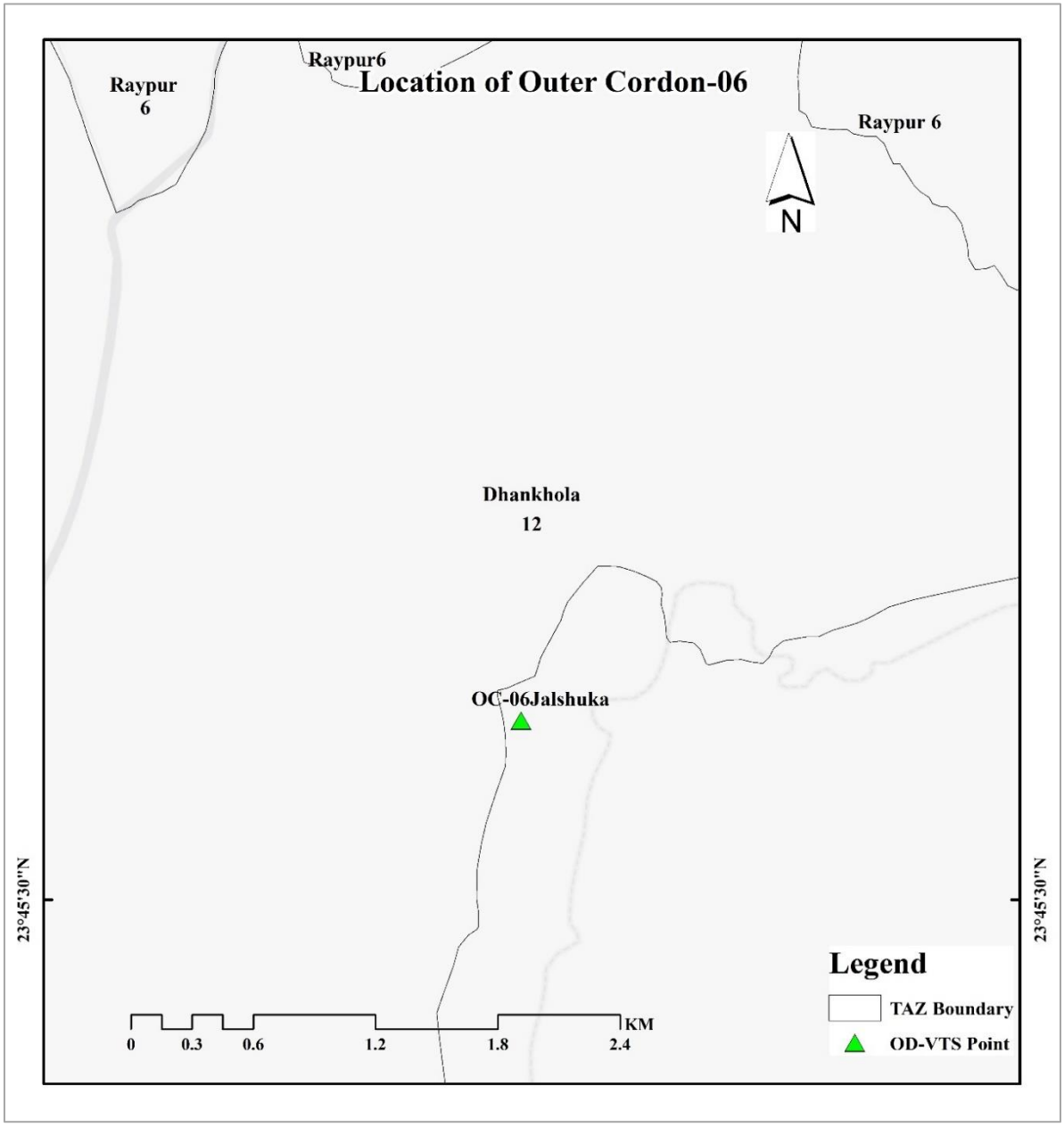


Figure 7.49: Location of Outer Cordon-06

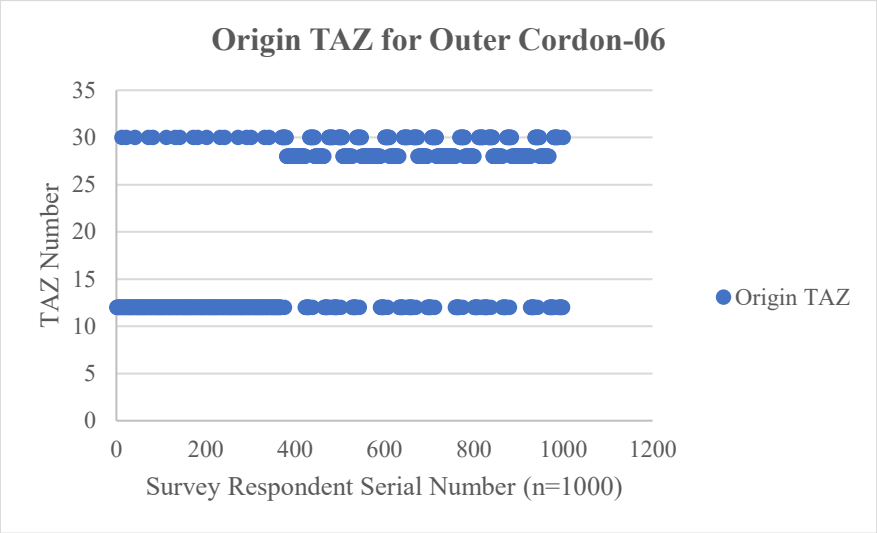


Figure 7.50: Origin TAZ for Outer Cordon-06

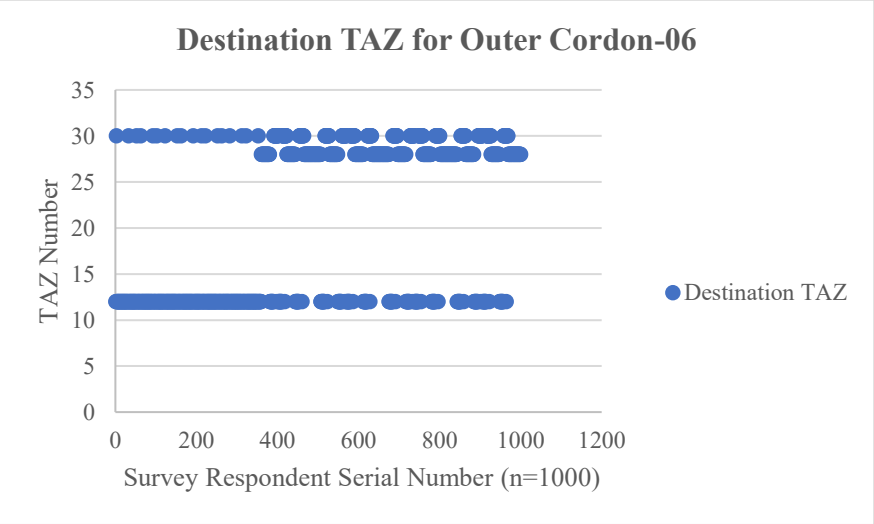


Figure 7.51: Destination TAZ for Outer Cordon-06

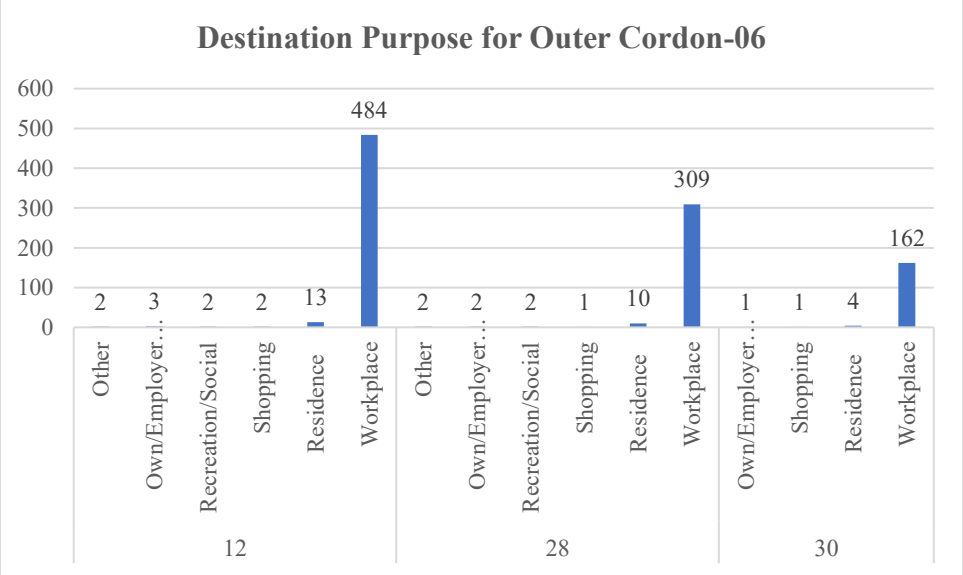


Figure 7.52: Destination Purpose for Outer Cordon-06

7.2.18 Origin-Destination & Purpose from Outer Cordon-07

The origin & destination of trip generation from Outer Cordon-07 mostly located within the TAZ-13, TAZ-15, and TAZ-30. Total 1677 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-07 is located at Meherpur-Chuadanga Road near Ukilbari Bus Stand near Baradi Union (TAZ-13).

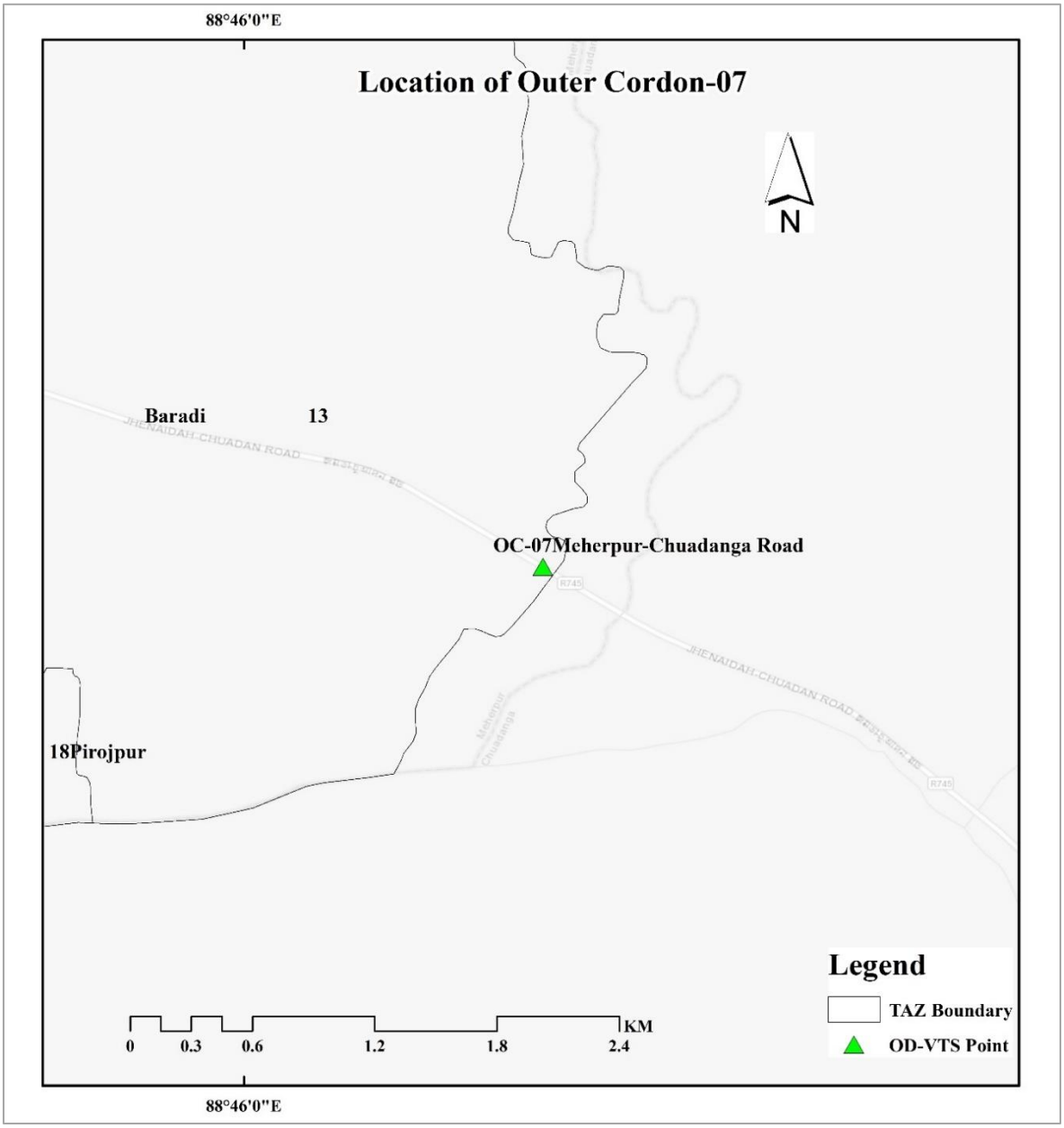


Figure 7.53: Location of Outer Cordon-07

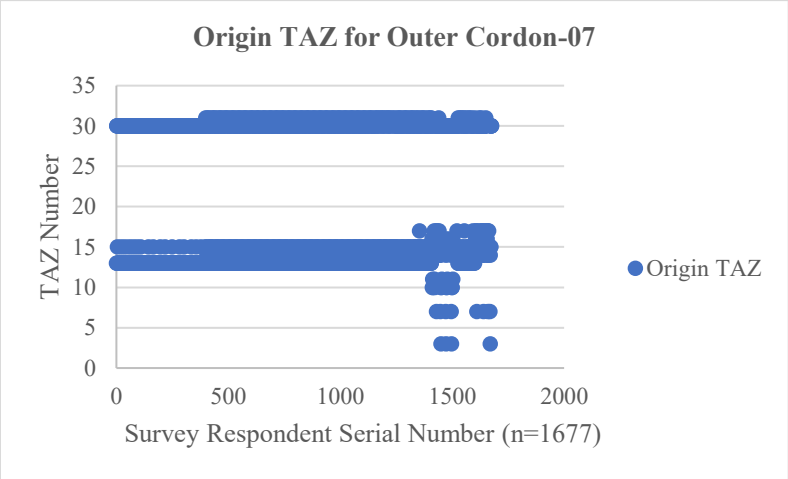


Figure 7.54: Origin TAZ for Outer Cordon-07

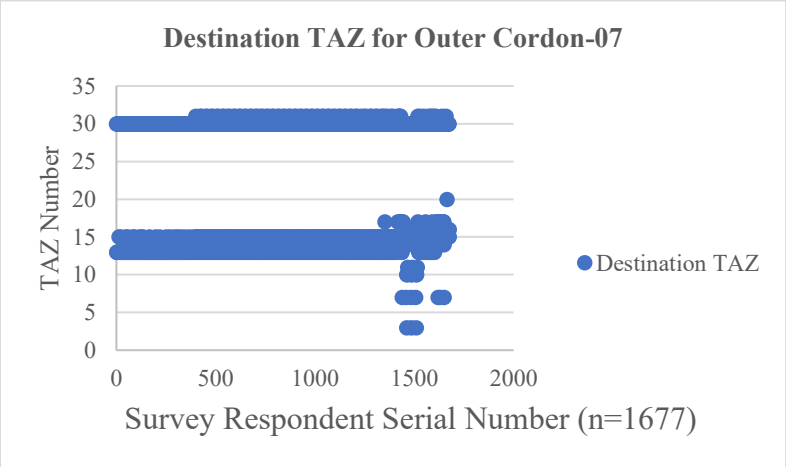


Figure 7.55: Destination TAZ for Outer Cordon-07

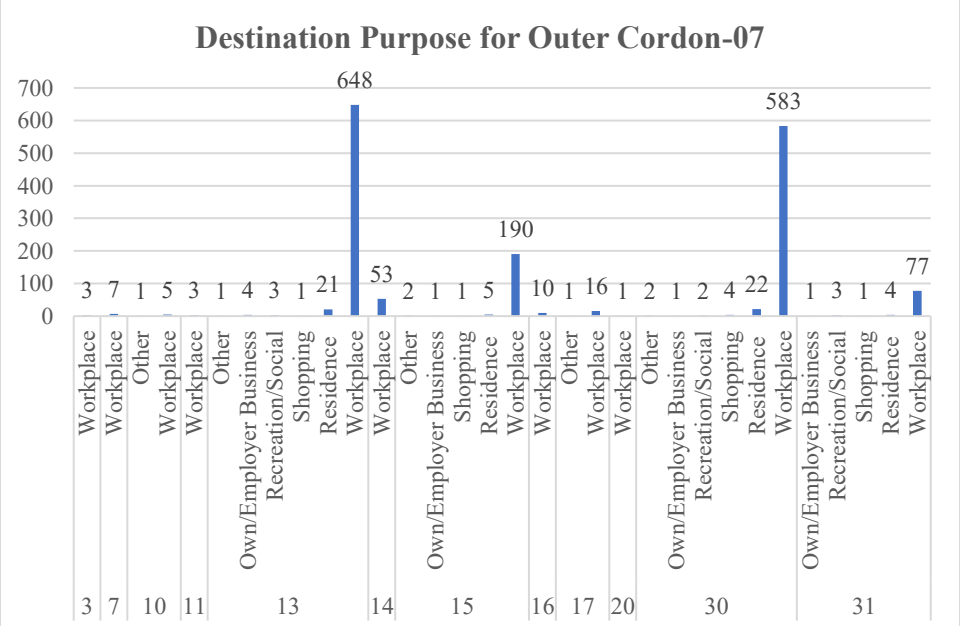


Figure 7.56: Destination Purpose for Outer Cordon-07

7.2.19 Origin-Destination & Purpose from Outer Cordon-08

The origin & destination of trip generation from Outer Cordon-08 mostly located within the TAZ-19, and TAZ-33. Total 1101 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-08 is located at Atkabar Road near Union (TAZ-19).

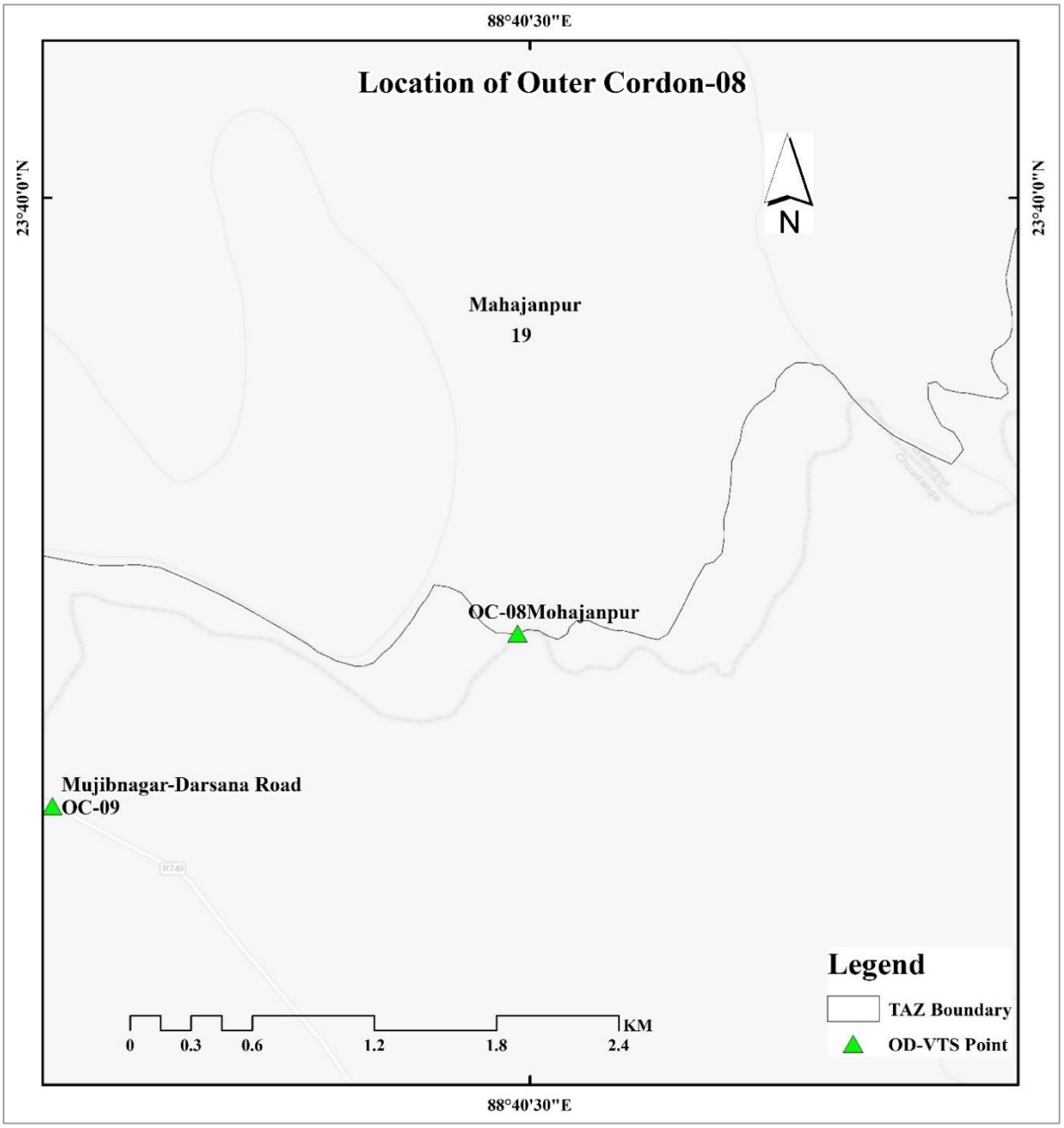


Figure 7.57: Location of Outer Cordon-08

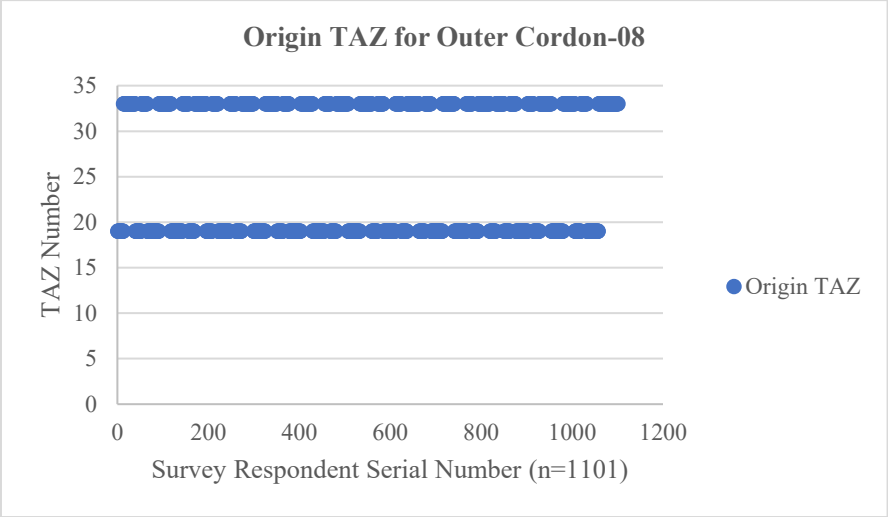


Figure 7.58: Origin TAZ for Outer Cordon-08

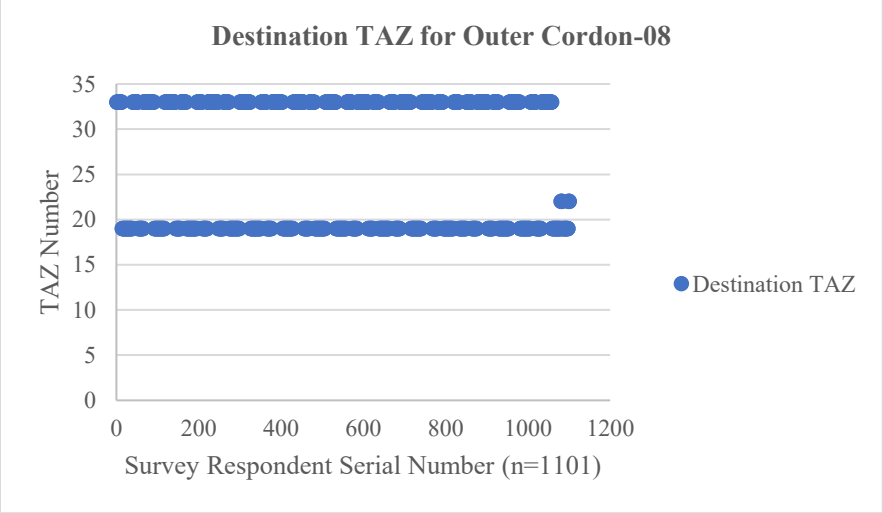


Figure 7.59: Destination TAZ for Outer Cordon-08

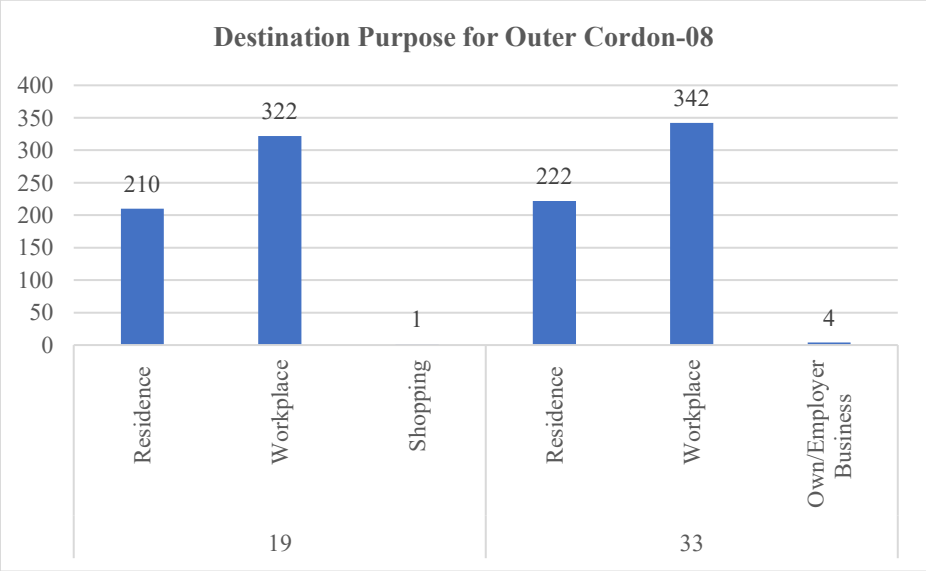


Figure 7.60: Destination Purpose for Outer Cordon-08

7.2.20 Origin-Destination & Purpose from Outer Cordon-09

The origin & destination of trip generation from Outer Cordon-09 mostly located within the TAZ-22, and TAZ-33. Total 1695 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. Home-based Work appeared to be the most dominant purpose behind trip generation. OC-09 is located at Darsana-Mujibnagar Road near Atkabar-Mujibnagar Bus Stand as well as Bagoan Union (TAZ-22).

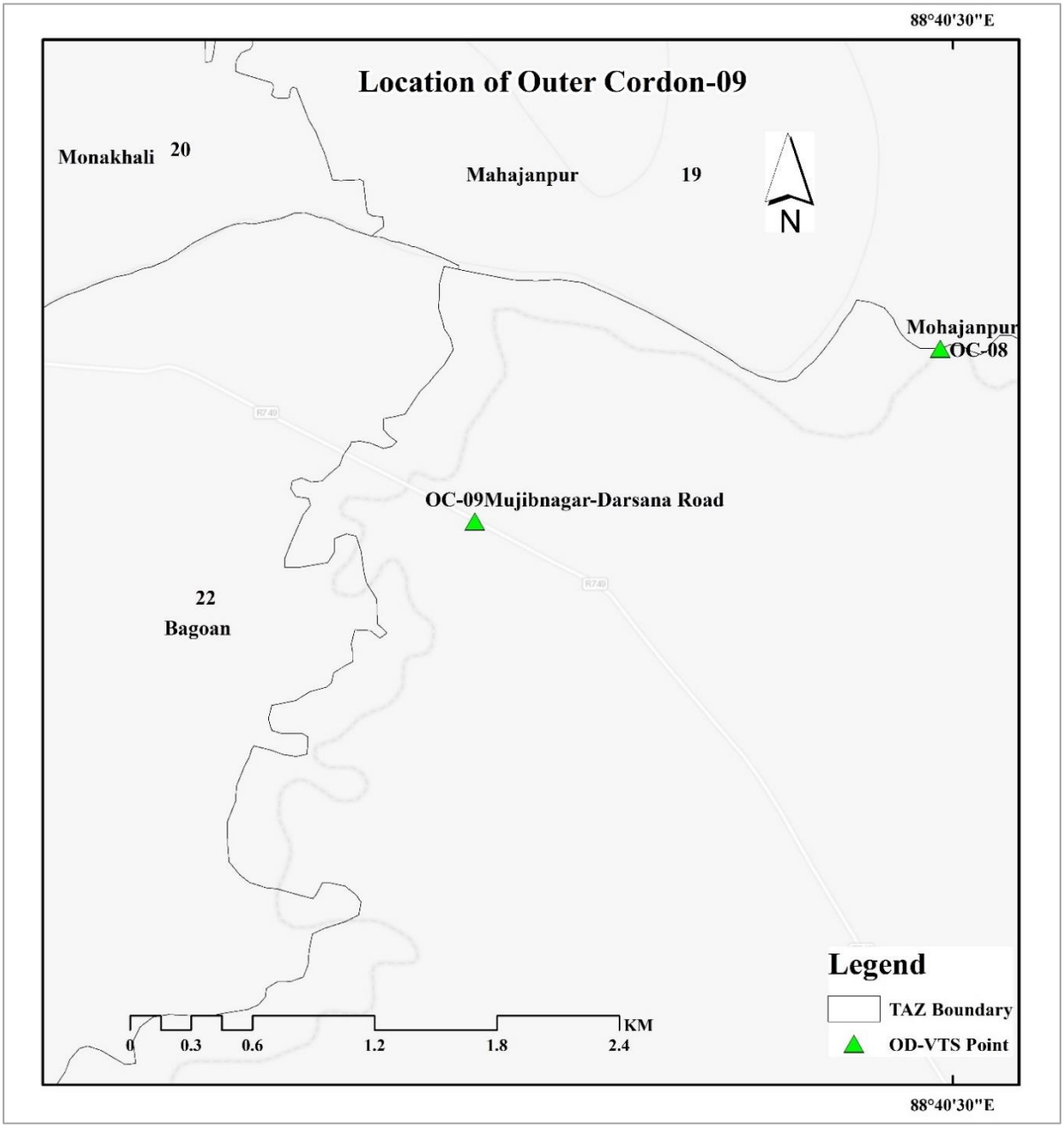


Figure 7.61: Location of Outer Cordon-09

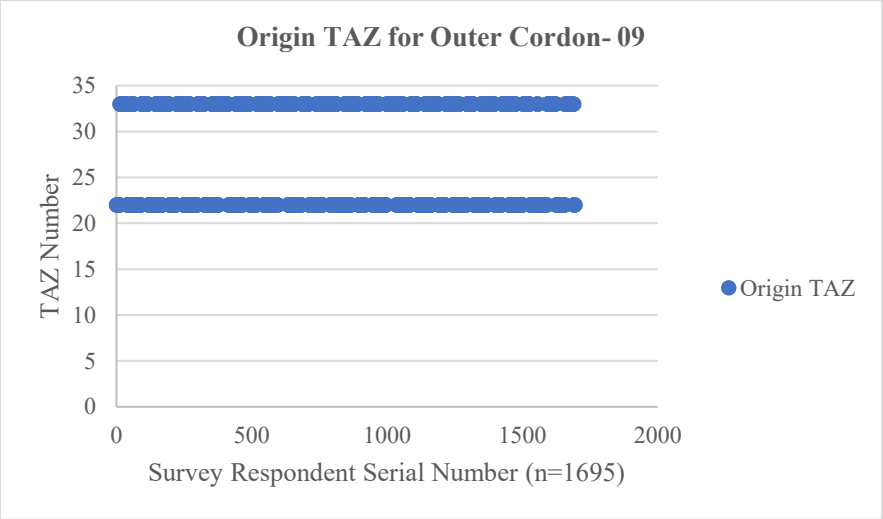


Figure 7.62: Origin TAZ for Outer Cordon-09

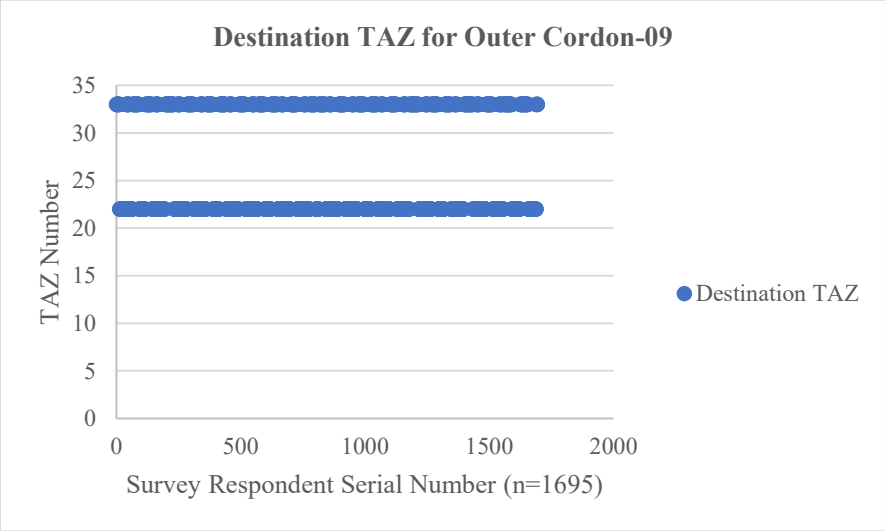


Figure 7.63: Destination TAZ for Outer Cordon-09

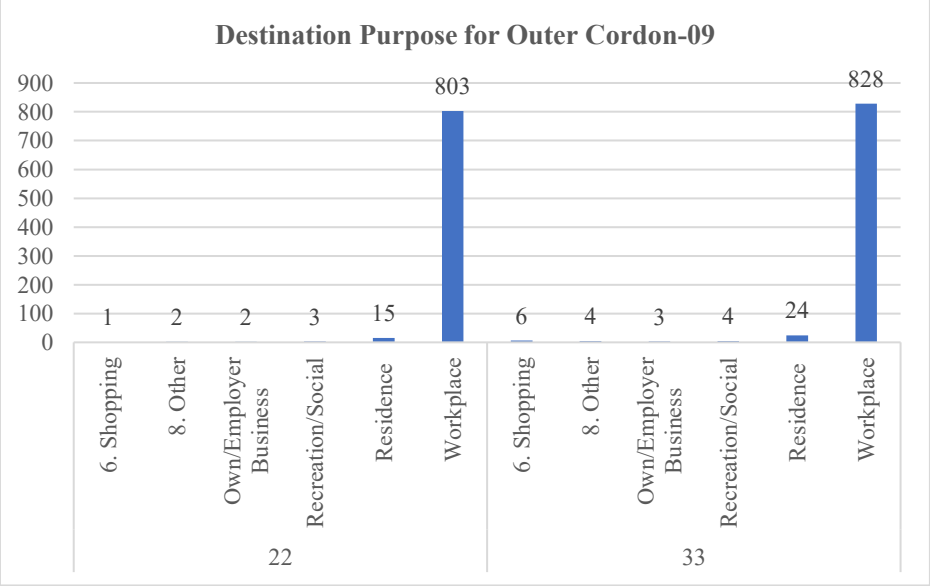


Figure 7.64: Destination Purpose for Outer Cordon-09

7.2.21 Origin-Destination & Purpose from Outer Cordon-10

The origin & destination of trip generation from Outer Cordon-10 mostly located within the TAZ-08, and TAZ-10. Total 1736 person have been surveyed placed in the X-axis, where TAZ-Number is placed in the vertical Y-axis. OC-10 is located near Kathuli Bazar of Kathuli Union (TAZ-9).

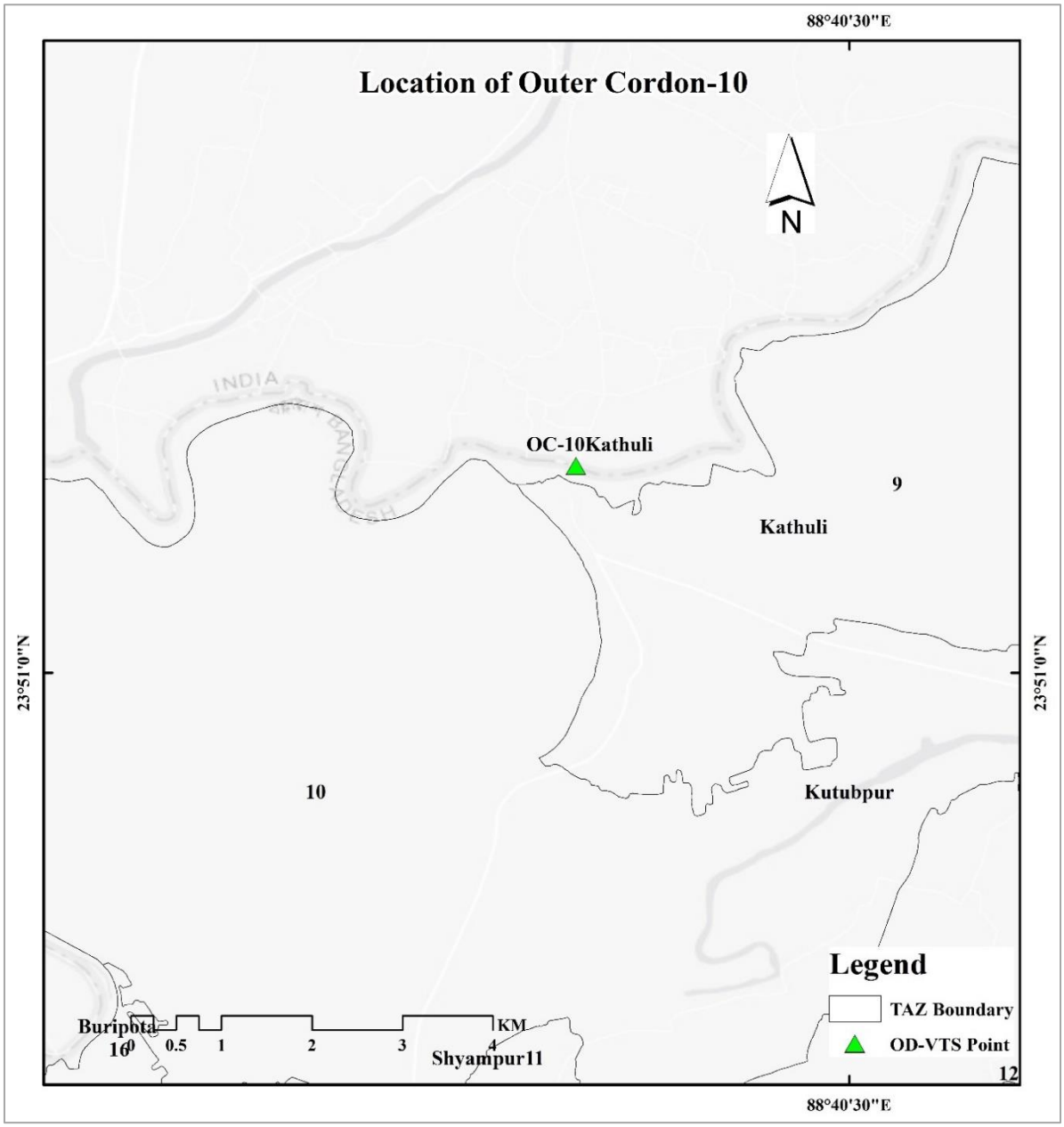


Figure 7.65: Location of Outer Cordon-10

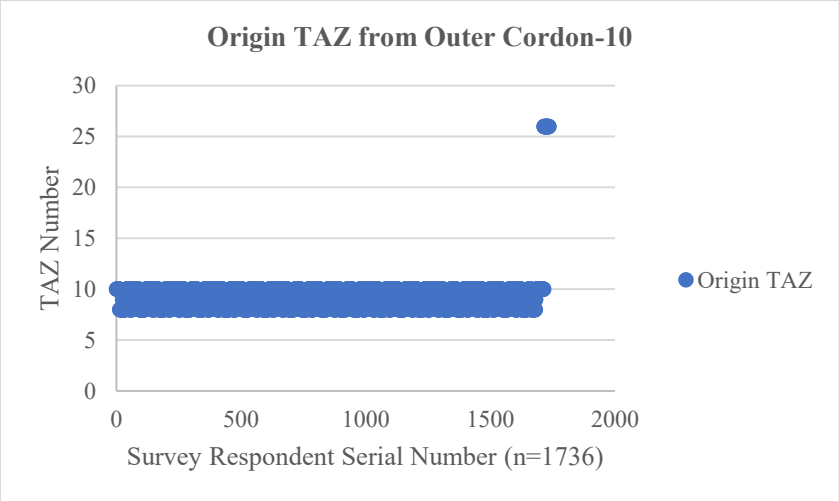


Figure 7.66: Origin TAZ for Outer Cordon-10

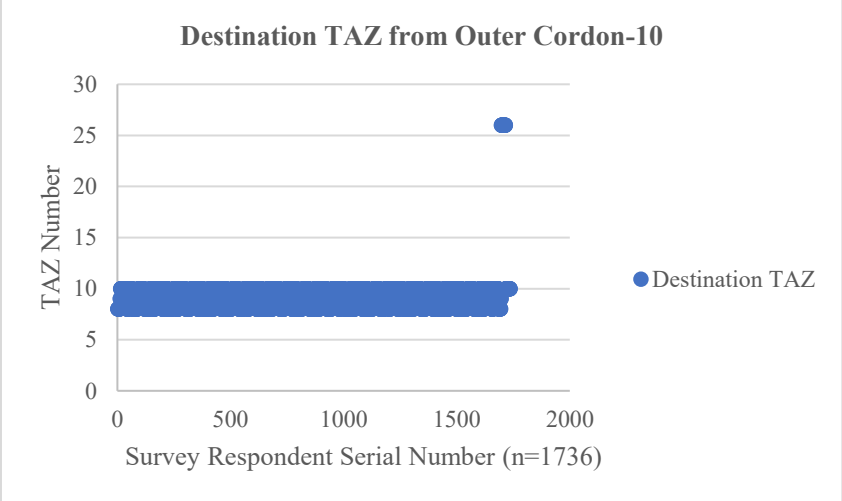


Figure 7.67: Destination TAZ for Outer Cordon-10

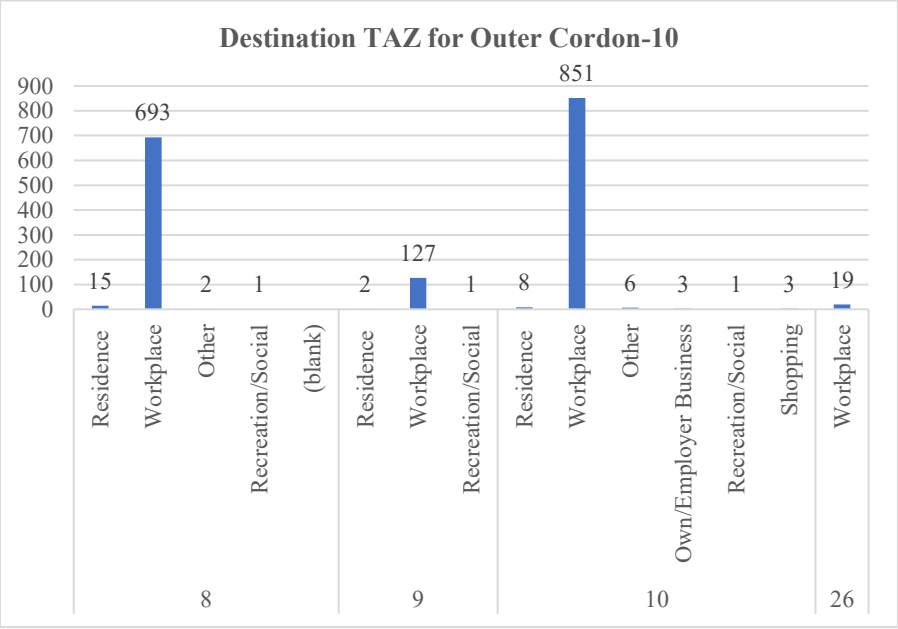


Figure 5.60: Destination Purpose for Outer Cordon-10

Chapter 8
Modal Choice

Chapter 8: Modal Choice

The major vehicular modes are- Bicycle, Rickshaw (i.e., Peddle, Battery Rickshaw), Van (i.e., Peddle, Battery), Battery Easy Bike, Motorcycle, Motorized 3-wheeler (e.g., CNG), Private Car, 4-Wheeler (e.g., Jeep), Human Hauler (e.g., Leguna, Tempo), Micro Bus (e.g., NOAH), Mini-Bus, Large Bus, Articulated Bus and Double-Decker Bus, SGV, Pickup, and Small-covered Van, Medium Truck (e.g., MCV (2-Axle)), Large Truck (e.g., LCV (3-Axle)), Container (e.g., Trailer (>3 Axle)), Tank and Lorry, Others.

8.1. Major Modal Choice across all Inner Cordon

8.1.1 Modal Choice in Inner Cordon-01

In 24 hours, across these all nineteen modes- the total number of trips considering both direction in the Meherpur-Dhaka route (Inner Cordon 01) recorded is 9733. Motorcycle, easy bike/auto, and van (peddle/motorized) appear to be most dominated vehicle in the Meherpur-Dhaka route. Motorcycle has 52.83% (f=5142) of the total (f=9733) number of trips, where 53.45% in the Dhaka to Meherpur direction and 52.46% in the Meherpur to Dhaka direction. Whereas, the share of easy bike or auto rickshaw and van (pedd-le/battery) is 13.41% and 10.51% respectively.

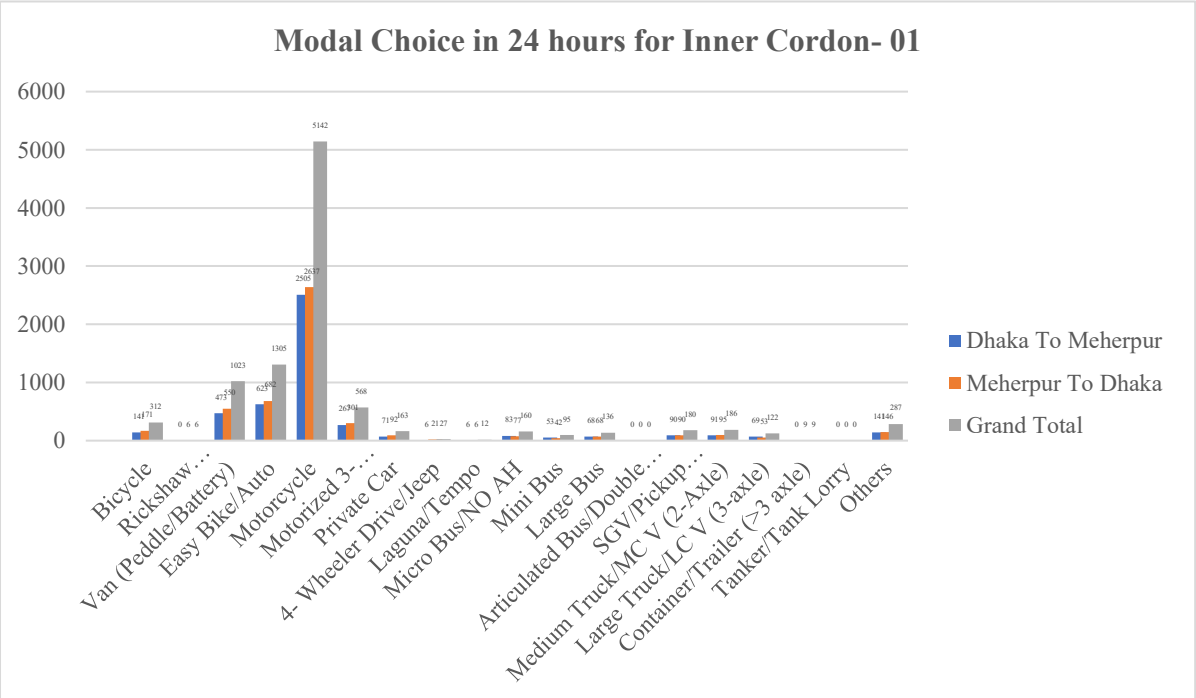


Figure 8.1: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 01

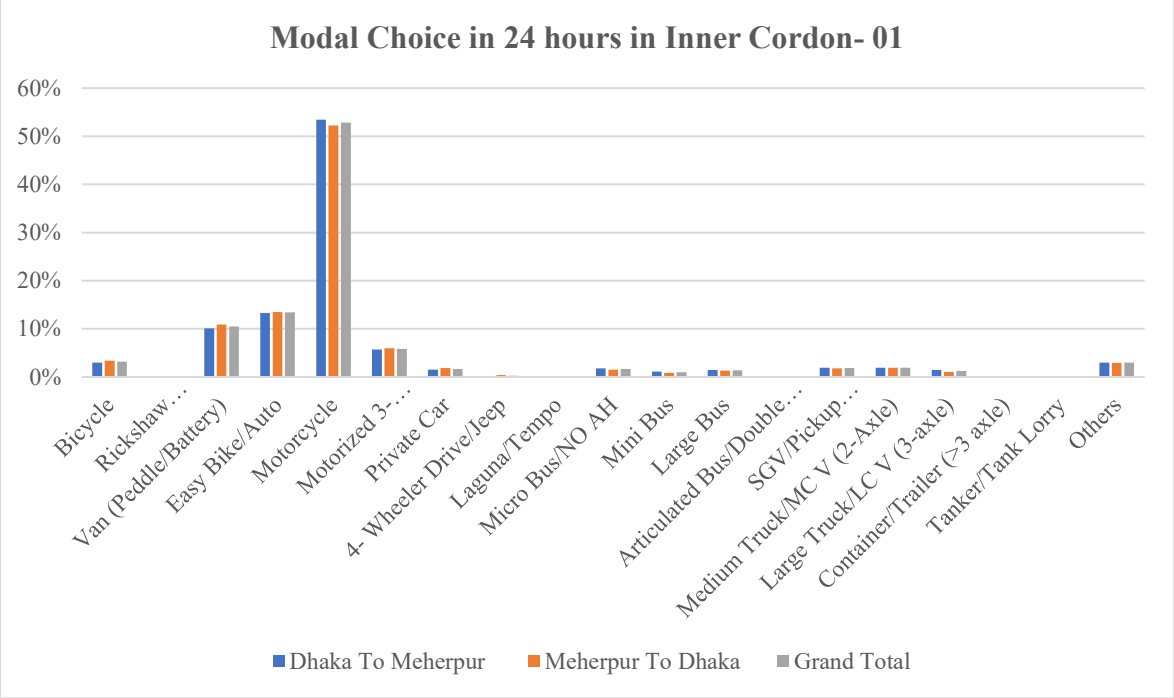


Figure 8.2: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 01

8.1.2 Modal Choice in Inner Cordon-02

The inner cordon-02 represent the Gangni-Kathuli Bazar route. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Gangni-Kathuli Bazar route (Inner Cordon 02) recorded is 6302. Motorcycle, and van (peddle/motorized) appear to be most dominated vehicle in the Gangni-Kathuli Bazar route. Motorcycle has 53.57% (f=3376) of the total (f=6302) number of trips, where 53.88% in the Gangni to Kathuli Bazar direction and 53.30% in the Kathuli Bazar to Gangni direction. Whereas, the share of van (peddle/battery) is 28.05% (F=1768). where 27.69% in the Gangni to Kathuli Bazar direction and 28.38% in the Kathuli Bazar to Gangni direction.

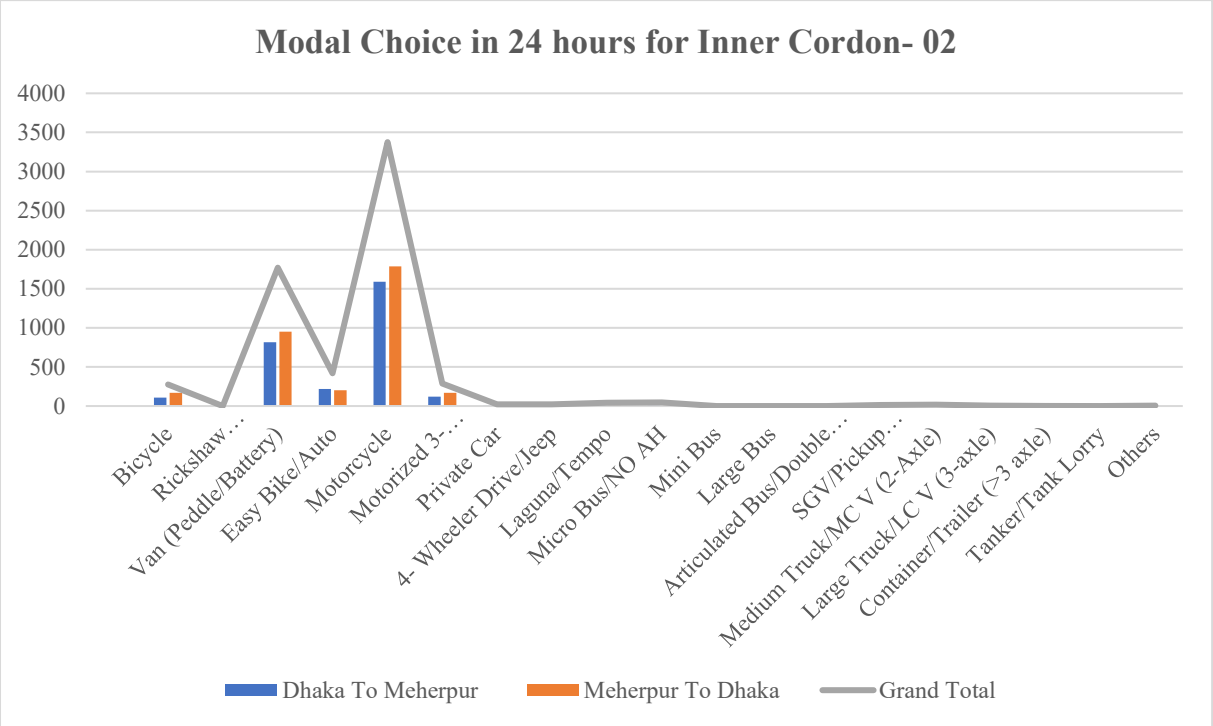


Figure:8.3: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 02

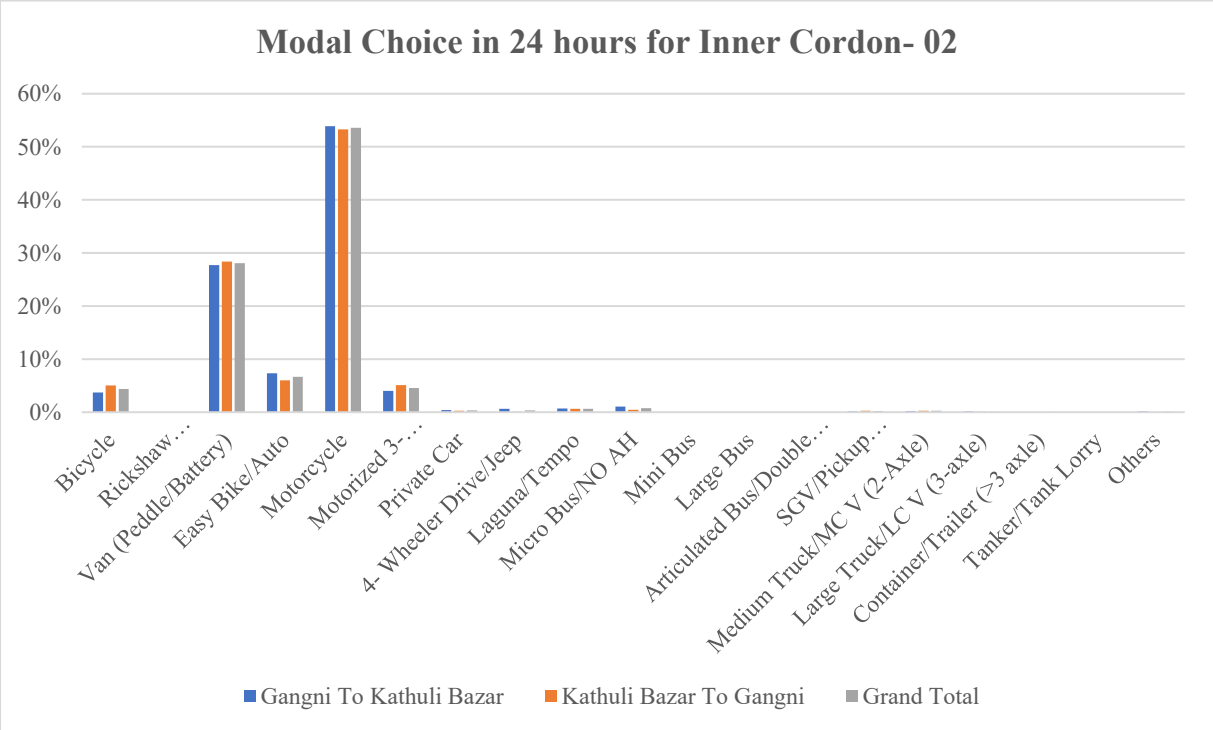


Figure 8.4: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 02

8.1.3 Modal Choice in Inner Cordon-03

The inner cordon- 03 represents the Meherpur-Kushtia route. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Meherpur-Kushtia route (Inner Cordon 02) recorded is 8310. Like the other cordon, here also motorcycle, van (peddle/ battery), easy bike/auto, and motorized three-wheeler appeared to be the dominant mode of transportation in the Meherpur-Dhaka route. Motorcycle has the largest share of 43.39% (f=3606) of the total (f=8310) number of trips, where 43.24% in the Meherpur to Kushtia direction and 43.54% in the Kushtia to Meherpur. Whereas, the share of van (peddle/ battery), easy bike or auto rickshaw and motorized three-wheeler is 13.72% (f= 1140), 12.53% (f= 1041), and 7.88% (f= 655) respectively.

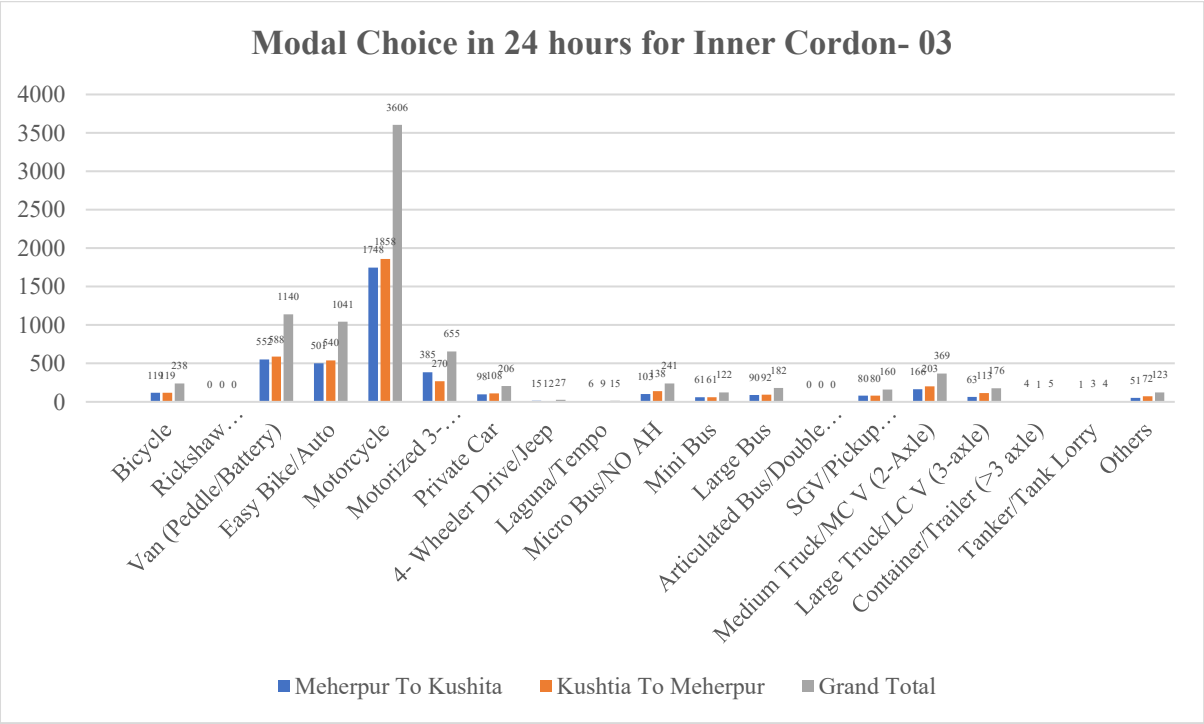


Figure 8.5: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 03

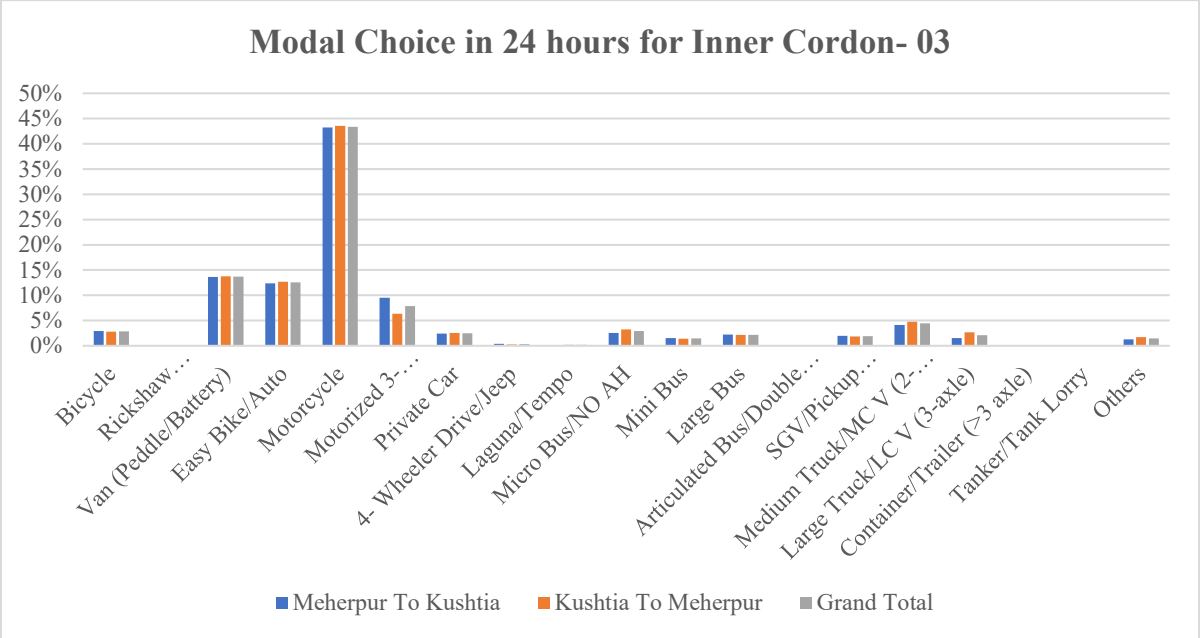


Figure 8.6: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 03

8.1.4 Modal Choice in Inner Cordon-04

The Cordon-04 represents the Hat Boalia-Gangni route. In 24 hours, across all nineteen modes, the total number of trips considering both direction is recorded 5899.Like the other cordon, here also motorcycle and van (peddle/ battery appeared to be the two most dominant modes of transportation in the Hat Boalia-Gangni route. Motorcycle has the largest share of 60.67% (f=3579) of the total (f=5899) number of trips, where 60.84% in the the Hat Boalia to Gangni direction and 60.49% in the Gangni to Hat Boalia direction. Whereas, the share of van (peddle/ battery) is 21.55% (f= 1271) of the total, 21.48% (f= 649) in the Hat Boalia to Gangni direction, and 21.61% (f= 622) in the Gangni to Hat Boalia direction.

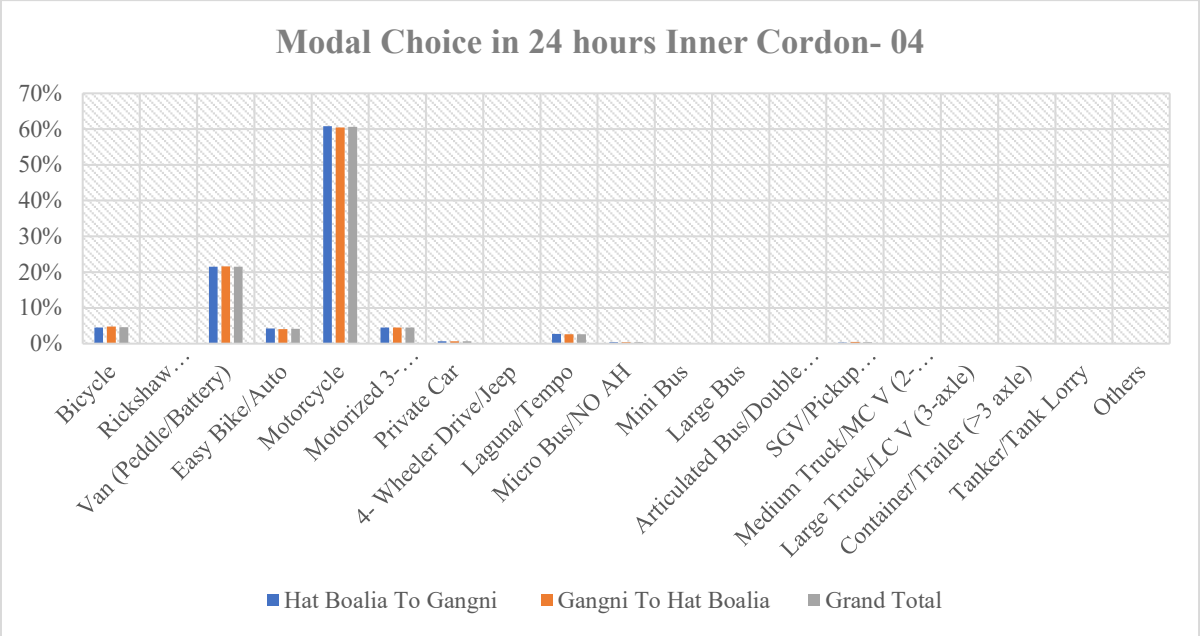


Figure 8.7: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 04

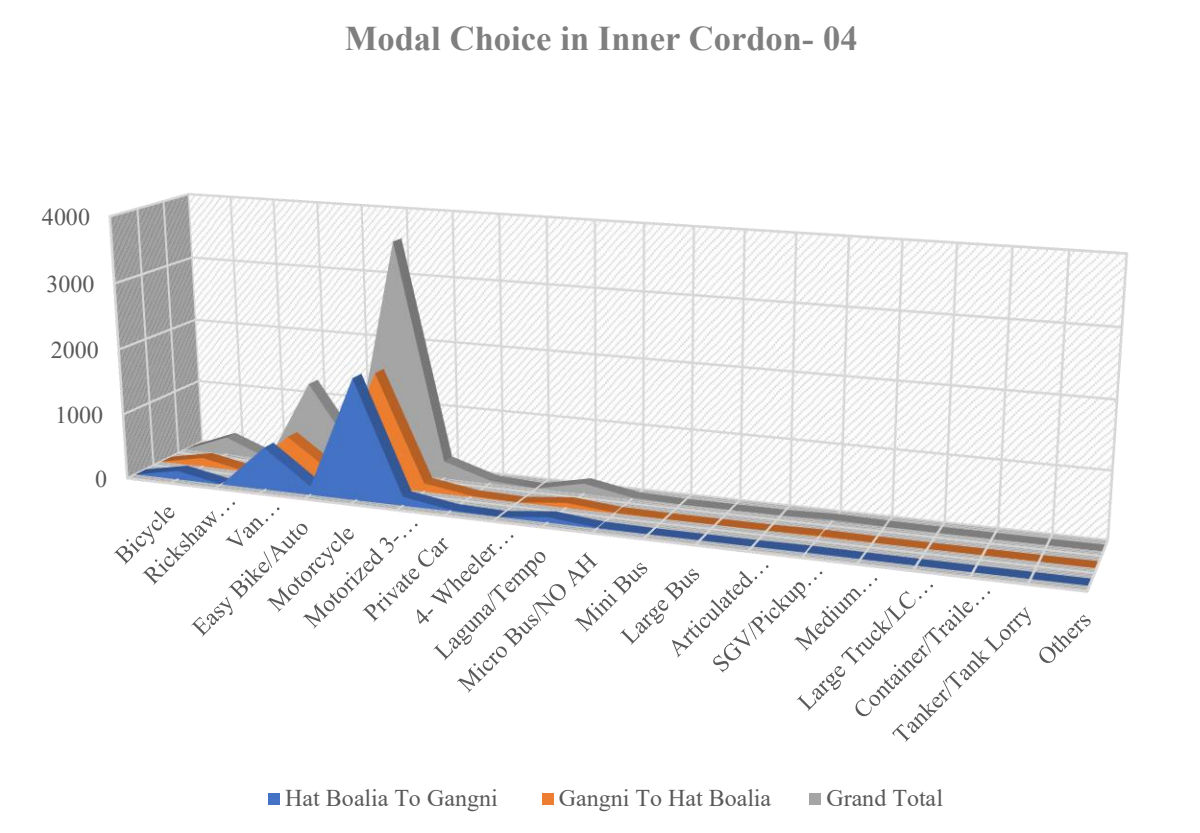


Figure 8.8: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 04

8.1.5 Modal Choice in Inner Cordon-05

Inner Cordon-05 represents Gangi-Dhankhola Road route. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Gangi-Dhankhola Road route (Inner Cordon 05) recorded is 3540. Motorcycle and van (peddle/ battery) appeared to be the two most dominant mode of transportation followed by easy bike/auto, and motorized three-wheeler in the Gangi-Dhankhola Road. Motorcycle has the largest share of 52.40% (f=1855) of the total (f=3540) number of trips, where 51.07% (f=911) in the Gangni to Dhankhola Road direction and 53.76% in the Dhankhola Road to Gangni direction. Whereas, the share of van (peddle/ battery), easy bike or auto rickshaw and motorized three-wheeler is 27.23% (f= 964), 7.09% (f= 251), and 7.18% (f= 254) respectively.

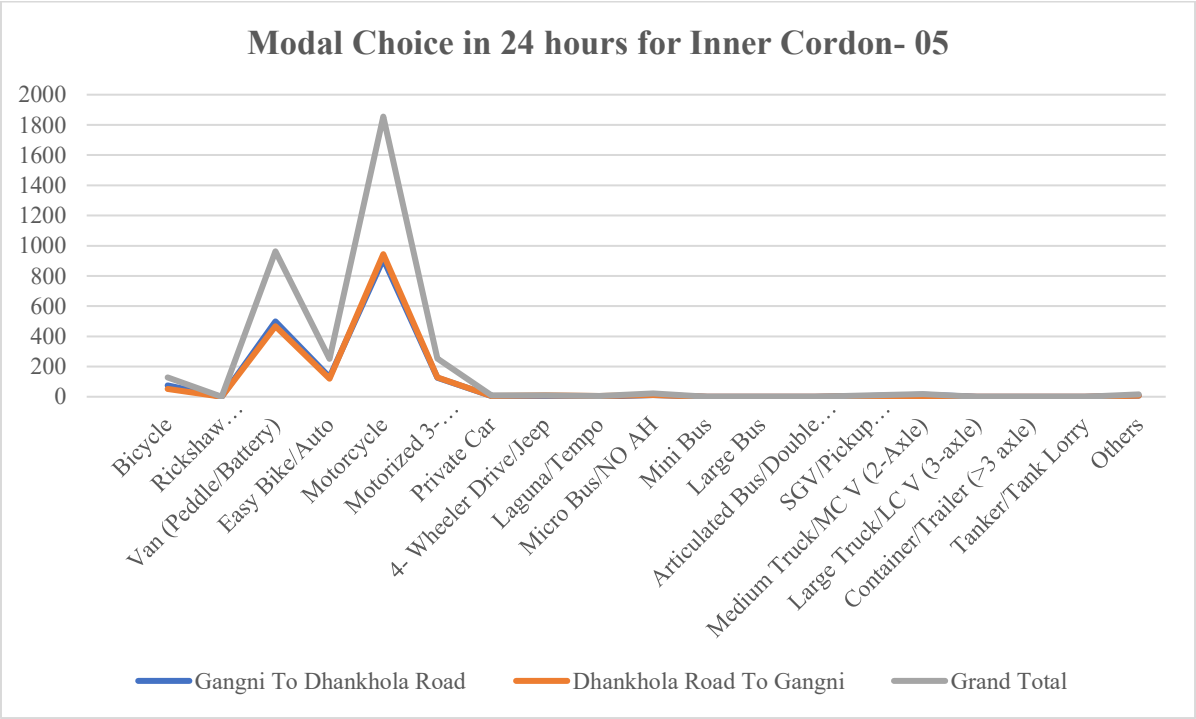


Figure 8.9: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 05

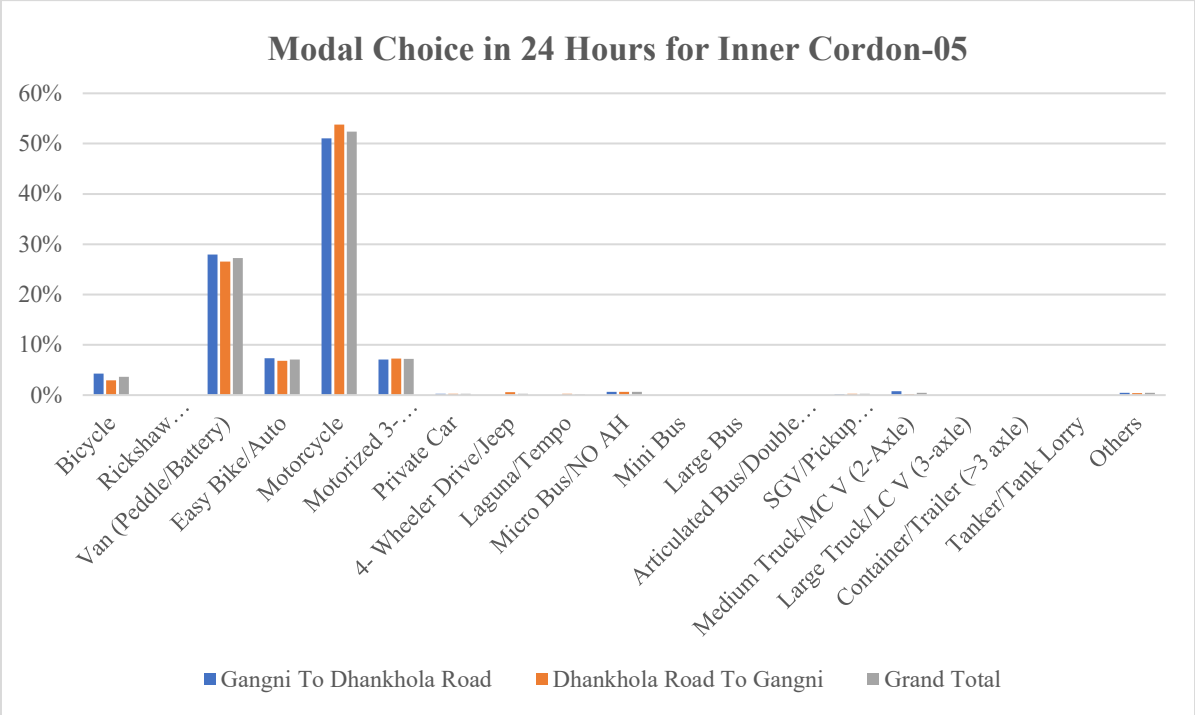


Figure 8.10: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 05

8.1.6 Modal Choice in Inner Cordon-06

Inner Cordon-06 represents Thana Road to Govipur- Govipur to Thana Road Direction. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Thana Road to Govipur- Govipur to Thana Road Direction route (Inner Cordon 06) recorded is 8122. Motorcycle, Bicycle, Rickshaw, Easy Bike and van (peddle/ battery) appeared to be the most dominant mode of transportation. Motorcycle has the largest share of 43.22% (f=3510) of the total (f=8122) number of trips, where 42.58% (f=911) in the Thana Road to Govipur direction and 43.84% in the Govipur to Thana Road direction. Whereas, the share of bicycle, rickshaw, van (peddle/ battery), and easy bike or auto rickshaw is 23.64% (f= 1920), 10.16% (f= 825), 5.85% (f=475) and 14.66% (f= 1191) respectively.

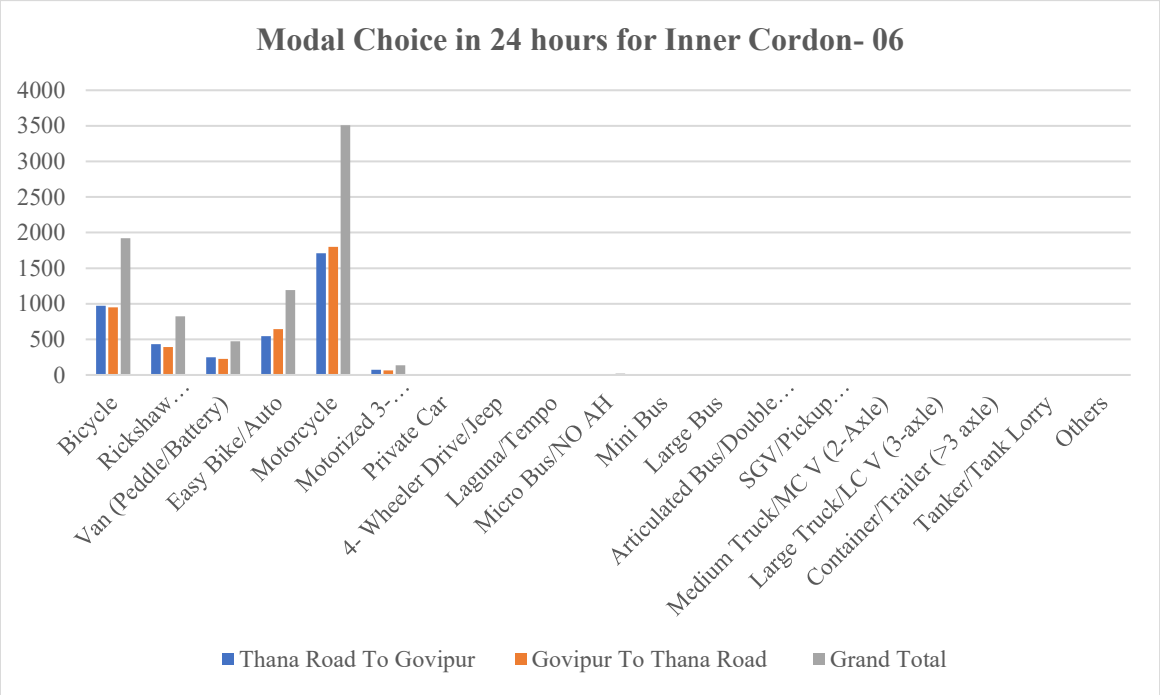


Figure 8.11: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 06

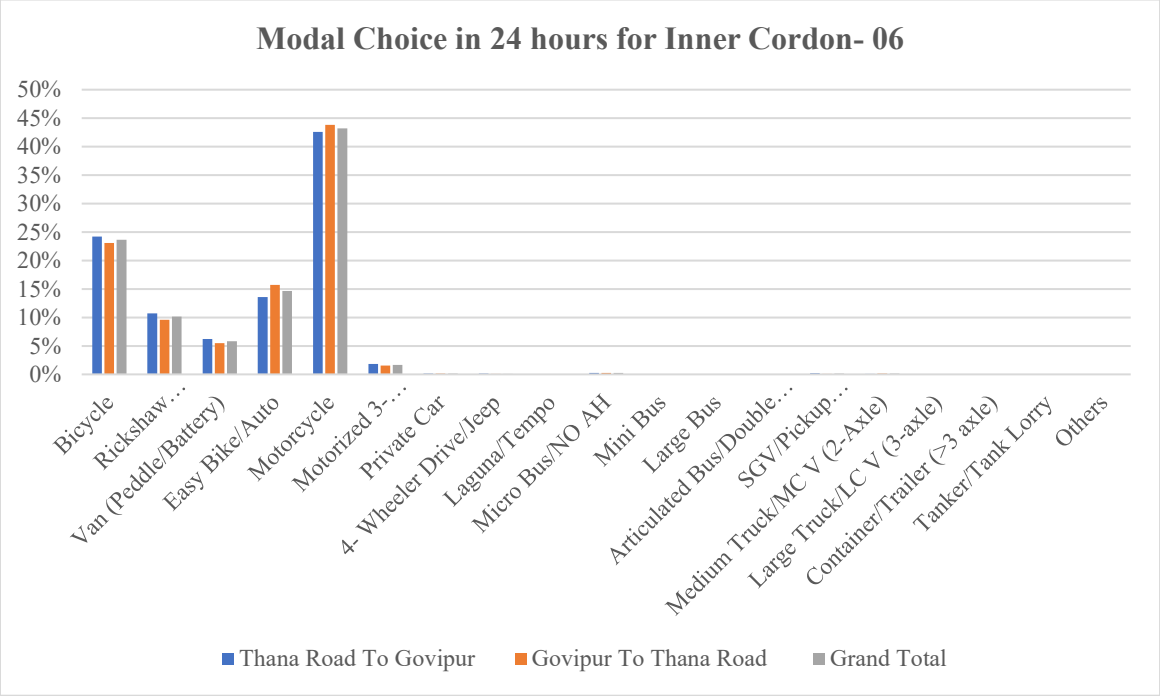


Figure 8.12: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 06

8.1.7 Modal Choice in Inner Cordon-07

Inner Cordon-07 represents Meherpur to Kathuli- Kathuli to Meherpur Direction. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Meherpur to Kathuli- Kathuli to Meherpur Direction route (Inner Cordon 07) recorded is 11954. Motorcycle, Bicycle, Rickshaw, Easy Bike and Van (peddle/ battery) appeared to be the most dominant mode of transportation. Motorcycle has the largest share of 40.15% (f=4800) of the total (f=11954) number of trips, where 42.88% (f=2440) in the Meherpur to Kathuli direction and 37.68% (f=2360) in the Kathuli to Meherpur direction. Whereas, the share of bicycle, rickshaw, van (peddle/ battery), and easy bike or auto rickshaw is 10.35% (f= 1237), 8.49% (f= 1015), 14.61% (f=1747) and 15.98% (f= 1910) respectively.

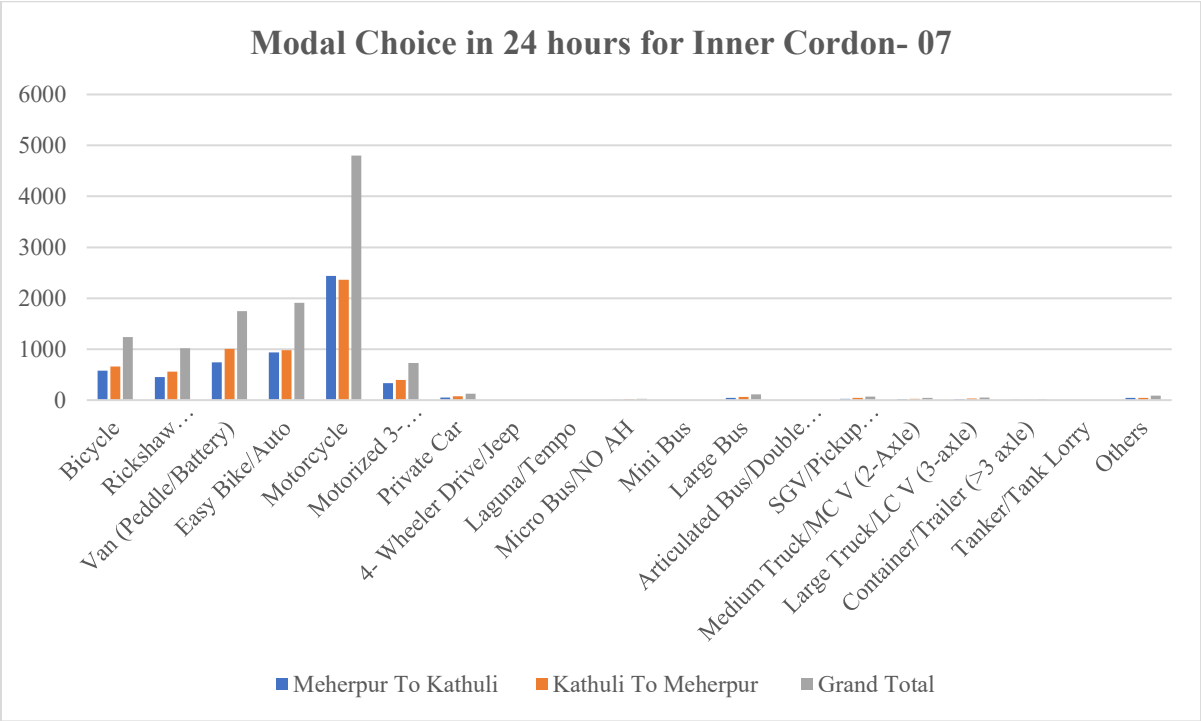
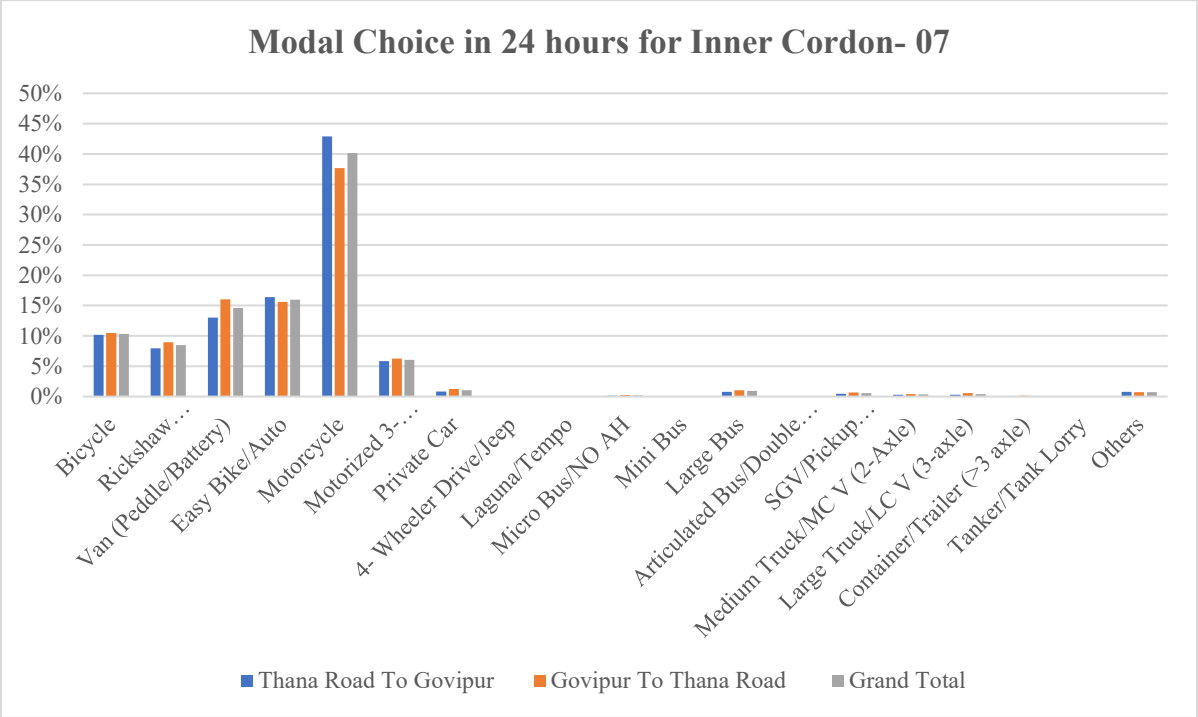


Figure 8.13: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 07



igure 8.14: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 07

8.1.8 Modal Choice in Inner Cordon-08

One of the first T-Intersection is located at Boro Bazar-Char Rastar Mor in Meherpur Paurashava. Three different routes intersects here.

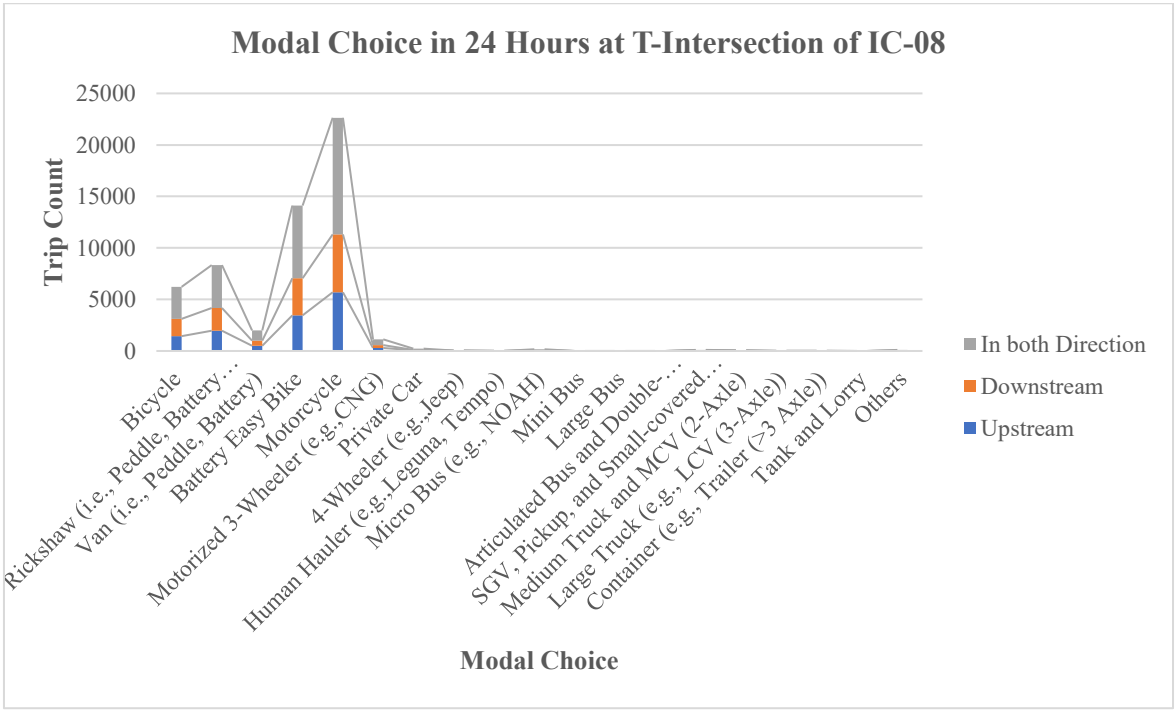


Figure 8.15: Aggregated Modal Choice at the T-Intersection 01

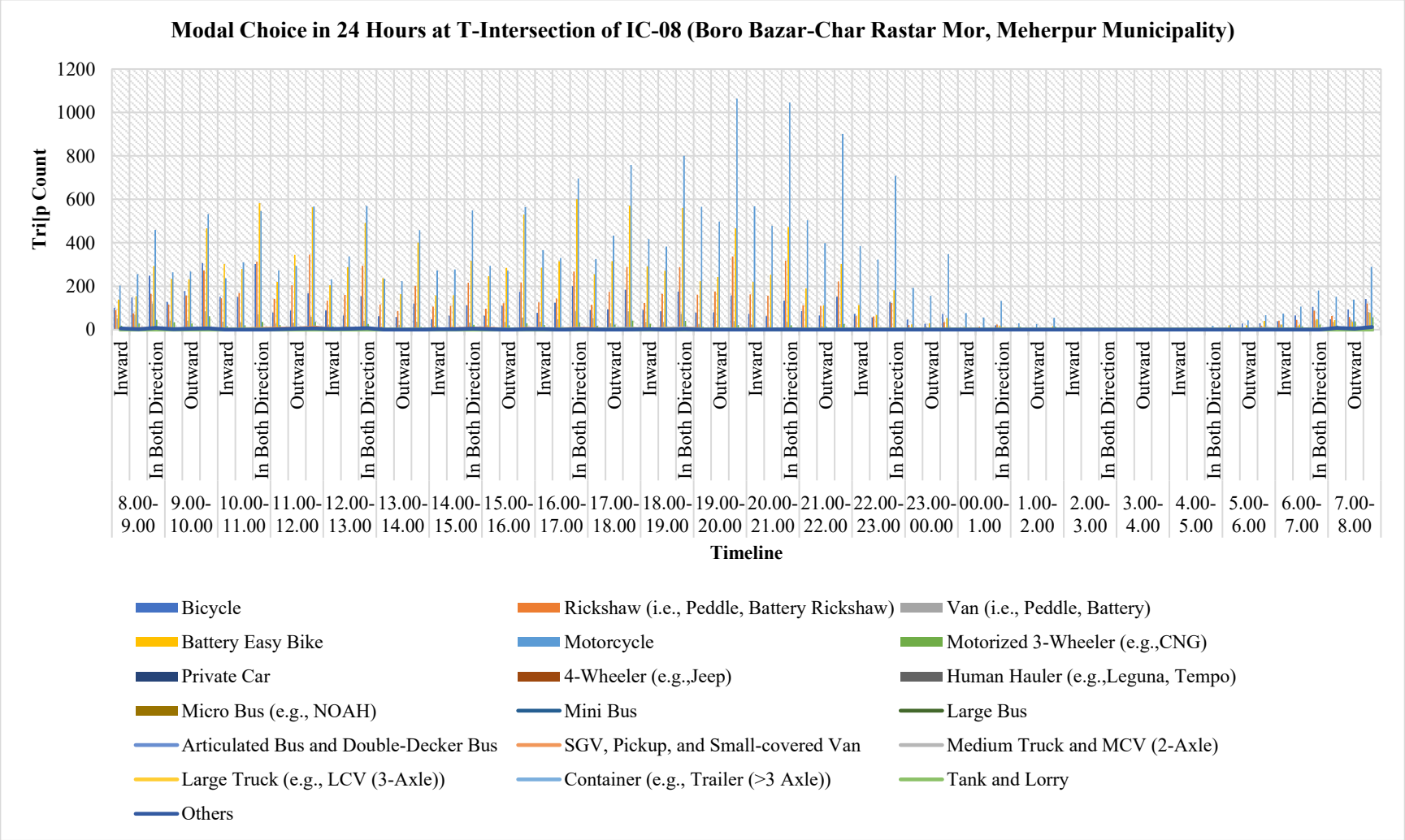


Figure 8.16: Aggregated 24 Hours Modal Choice at the T-Intersection 01 (Boro Bazar-Char Rastar Mor, Meherpur Municipality)

8.1.9 Modal Choice in Inner Cordon-09

Inner Cordon-09 represents Chuadanga to Meherpur- Meherpur to Chuadanga Direction. In 24 hours, across all nineteen modes- the total number of trips considering both direction in the Chuadanga to Meherpur- Meherpur to Chuadanga Direction route (Inner Cordon 09) recorded is 17614. Motorcycle is followed by Bicycle, Rickshaw, Van (peddle/ battery), Easy Bike, Van (peddle/ battery), and Motorized 3-Wheeler/CNG appeared to be the most dominant mode of transportation. Motorcycle has the largest share of 46.14% (f=8127) of the total (f=17614) number of trips, where 45.88% (f=4019) in the Chuadanga to Meherpur direction and 46.39% (f=4108) in the Meherpur to Chuadanga direction. Whereas, the share of bicycle, rickshaw, van (peddle/ battery), easy bike or auto rickshaw, and Motorized 3-Wheeler/CNG is 8.13% (f= 1432), 6.13% (f= 1080), 8.55% (f=1506), 12.21% (f= 2150), and 7.76 (f=1367) respectively.

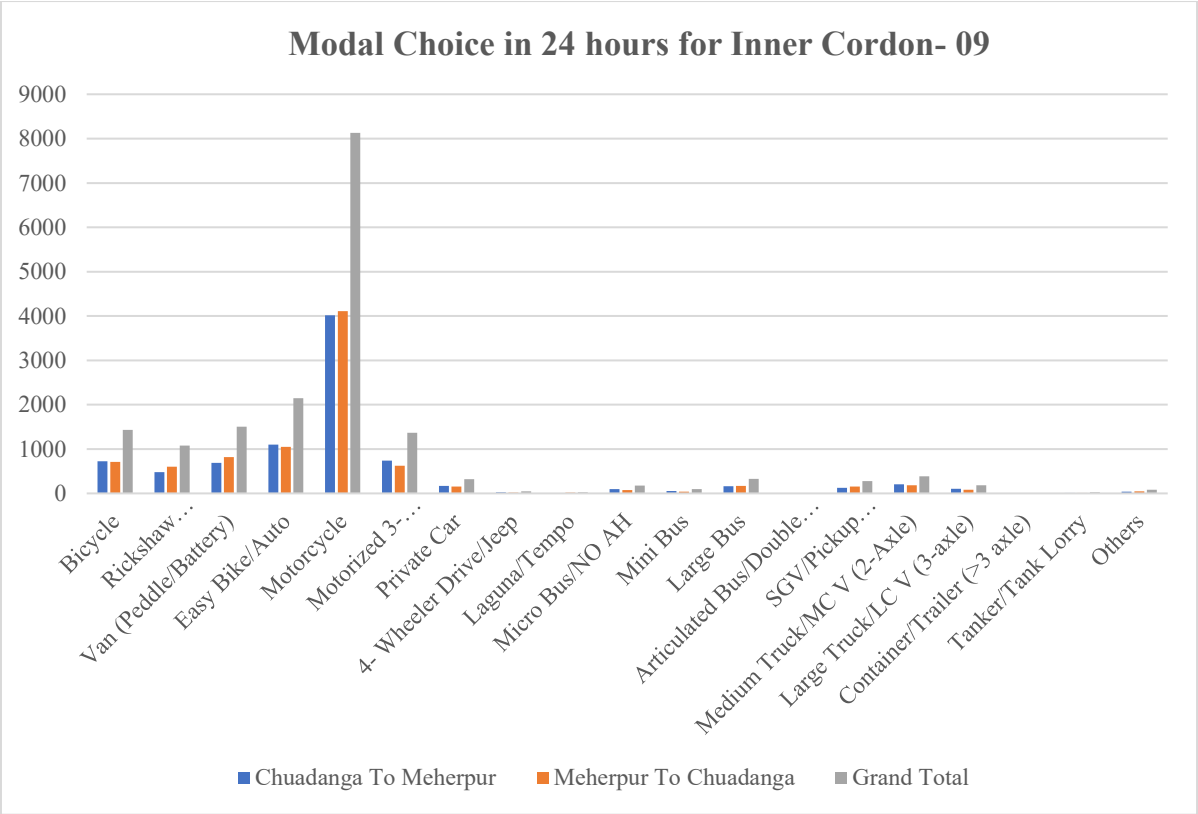


Figure 8.17: Frequency Distribution across all Modes in 24 hours for Inner Cordon- 09

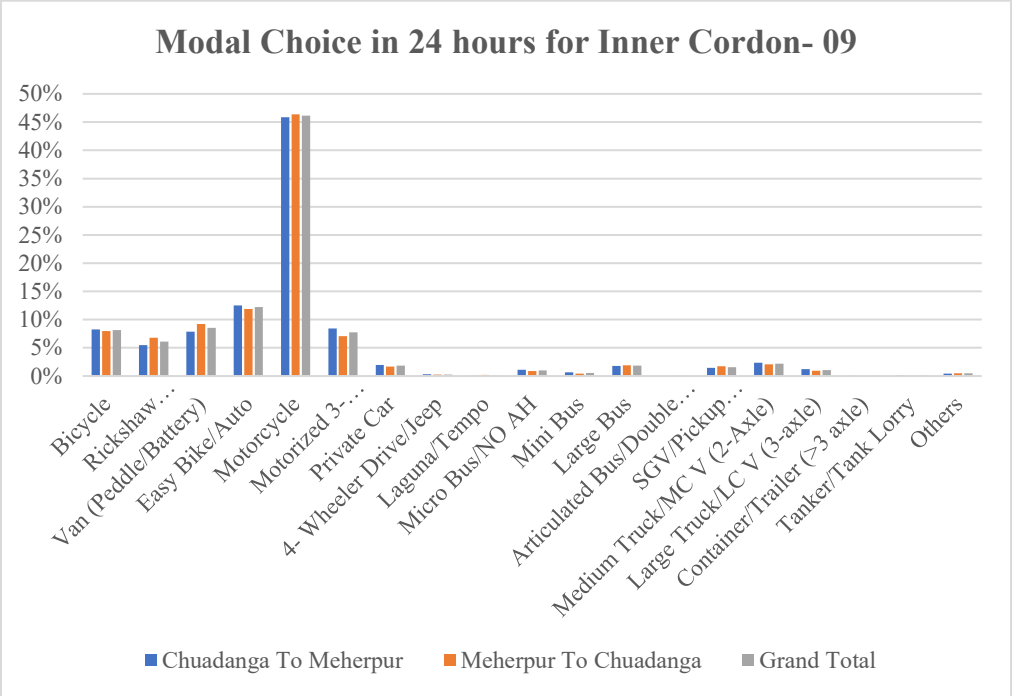


Figure 8.18: Frequency Distribution in Percentage across all Modes in 24 hours for Inner Cordon- 07

8.1.10 Modal Choice in Inner Cordon-10

T-Intersection-02, the second T-Intersection is located in the Inner Cordon-10. Three different routes intersects which is exactly at Hotel Bazar Mor in Meherpur Paurashava.

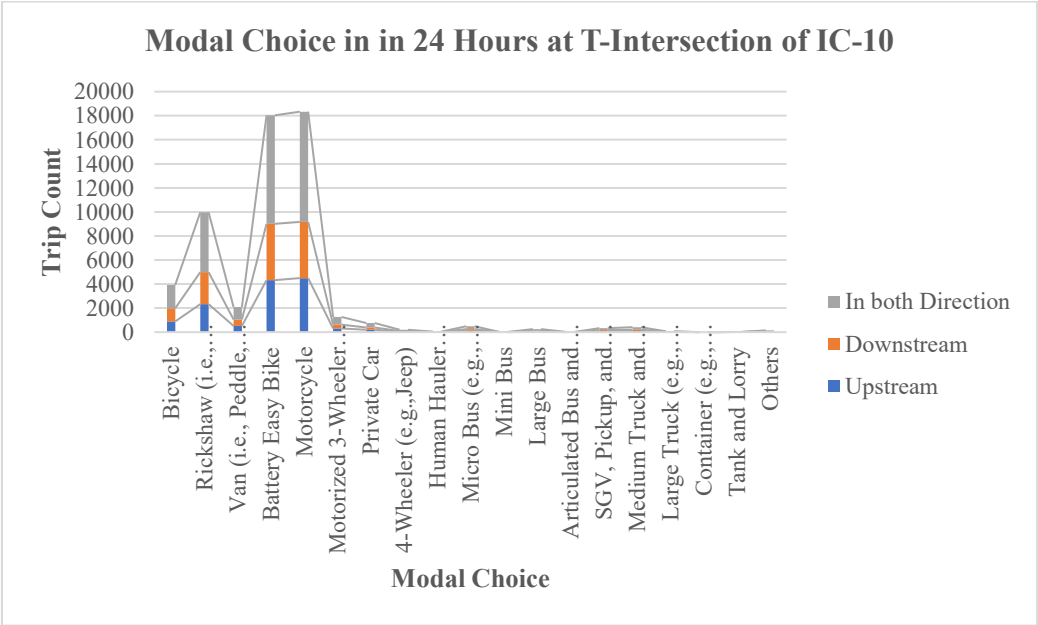


Figure 8.19: Aggregated Modal Choice at T-Intersection-02

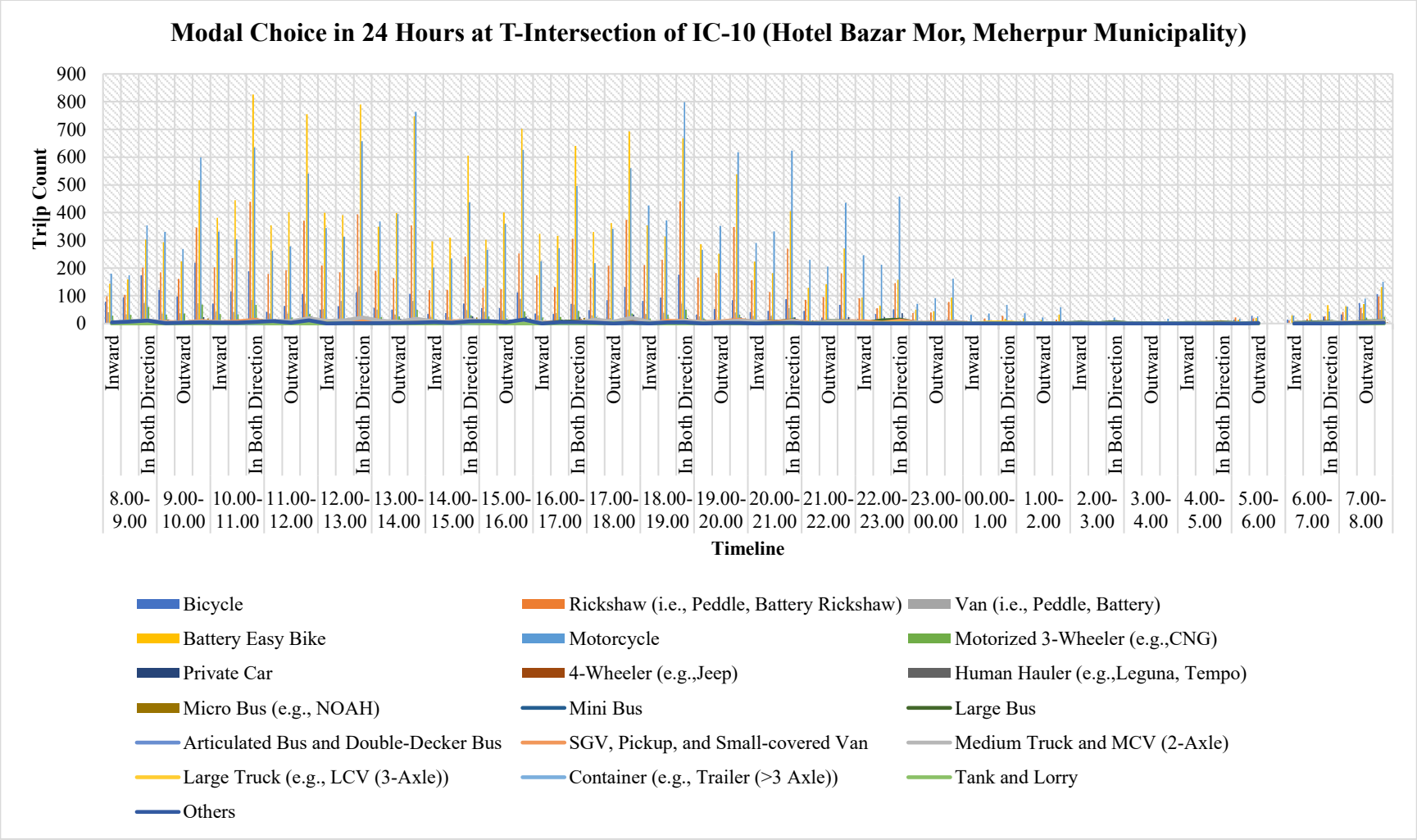


Figure 8.20: Aggregated 24 Hours Modal Choice st the T-Intersection 02 (Hotel Bazar Mor, Meherpur Municipality)

8.1.11 Modal Choice in Inner Cordon-11

Kedargonj Node

Kedargonj Node is the largest node we found. This is the intersection of six routes. Kedargonj Node located in the Inner Cordon 11.

Aggregated Modal Choice in Kedarganj Node

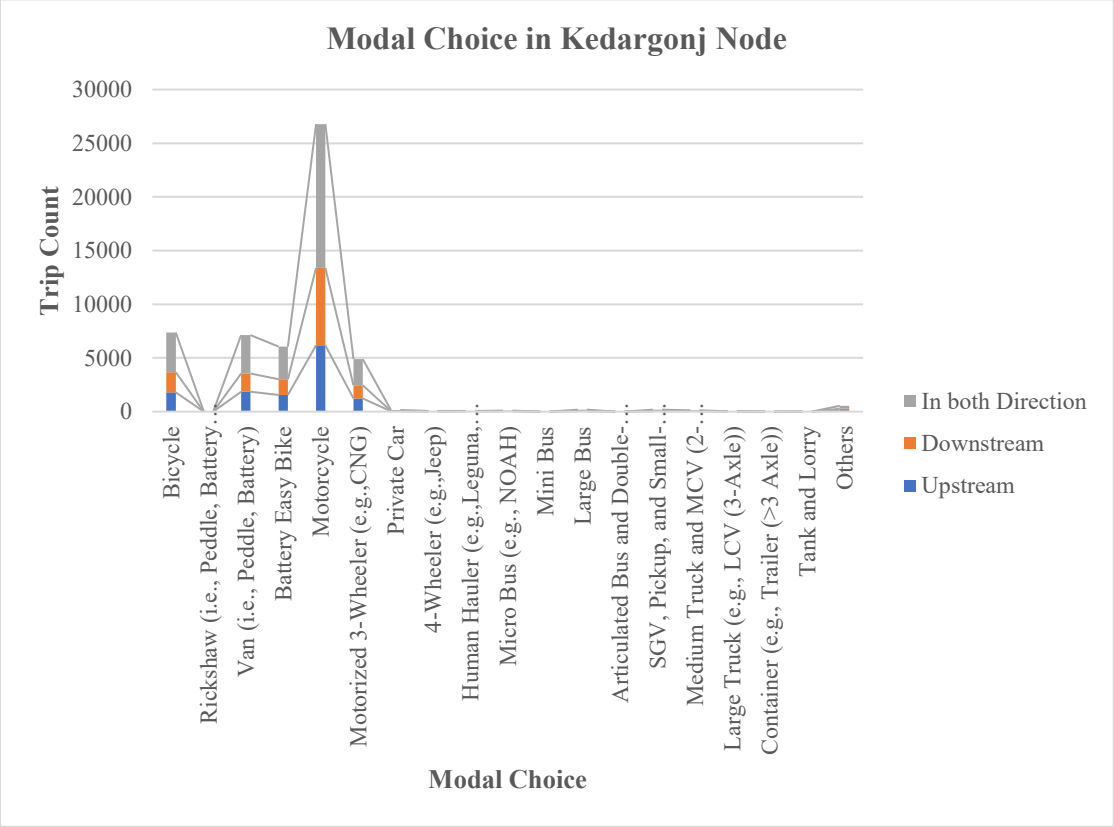


Figure 8.21: Aggregated Modal Choice at Kedargonj Node

Aggregated 24 Hours Modal Choice in Kedarganj Node

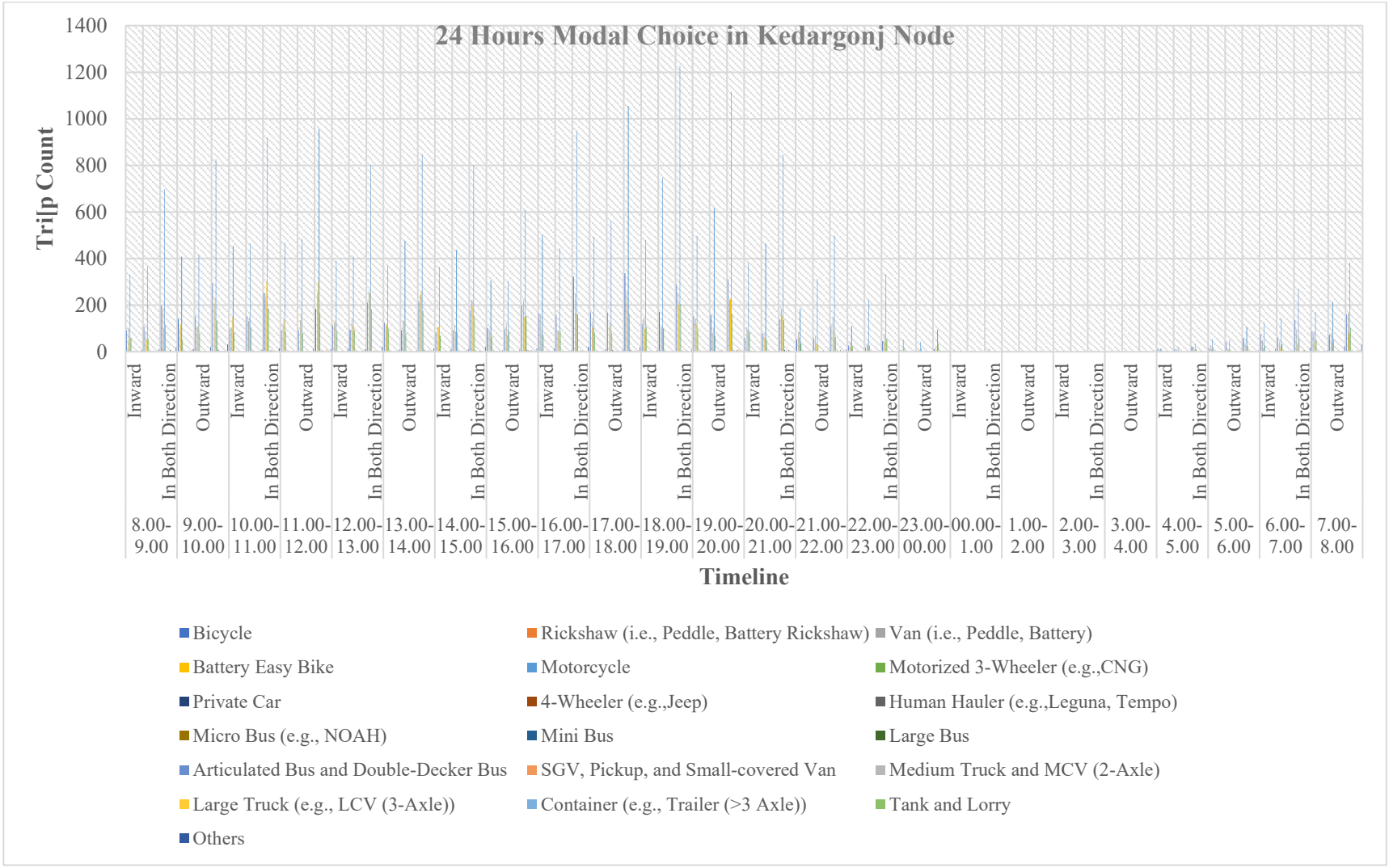


Figure 8.22: Aggregated 24 Hours Modal Choice at Kedargonj Node

8.2 Travel Mode across all major Occupational Group

The bar chart on "Travel Mode across all Major Occupational Group" presents a clear picture of how different categories of people rely on various modes of transport for their daily travel. The data highlights that informal, short-distance modes dominate across nearly all groups, while more formal transport options remain limited in use. Among all occupations, rickshaw/van and easy bike/auto stand out as the most frequently used modes, showing very high peaks across categories. These modes provide flexible, affordable, and accessible transport, which explains their dominance. In contrast, motorcycles and walking are consistently used but at much lower levels, while buses and larger vehicles hardly feature in comparison.

For agriculture and farming households, easy bike/auto and rickshaw/van are the main choices, reflecting their reliance on inexpensive and readily available transport. Similarly, businesspeople and employees—both private and public—use these modes most frequently, with motorcycles occasionally supplementing their travel needs. This suggests a strong dependence on short- and medium-distance modes for commuting to work and trade centers.

Housewives and students show a very distinct pattern. Housewives depend heavily on rickshaw/van trips, particularly for household-related activities such as shopping and local errands. Students, meanwhile, rely strongly on both rickshaw/van and easy bike/auto, highlighting the importance of affordable and frequent services for education-related trips. Other groups such as retired and unemployed individuals record comparatively fewer trips overall, yet they also exhibit the same dependence on rickshaw/van and easy bike/auto. Laborers show a mixed distribution but still reflect a preference for these affordable options.

In summary, the chart underscores the overwhelming reliance on informal para-transit modes—especially rickshaw/van and easy bike/auto—across all occupations. The low use of buses or formalized transport highlights a gap in the mobility structure, suggesting that planning efforts must focus on strengthening and regulating these informal modes while gradually expanding more structured transport services to meet the diverse needs of the community.

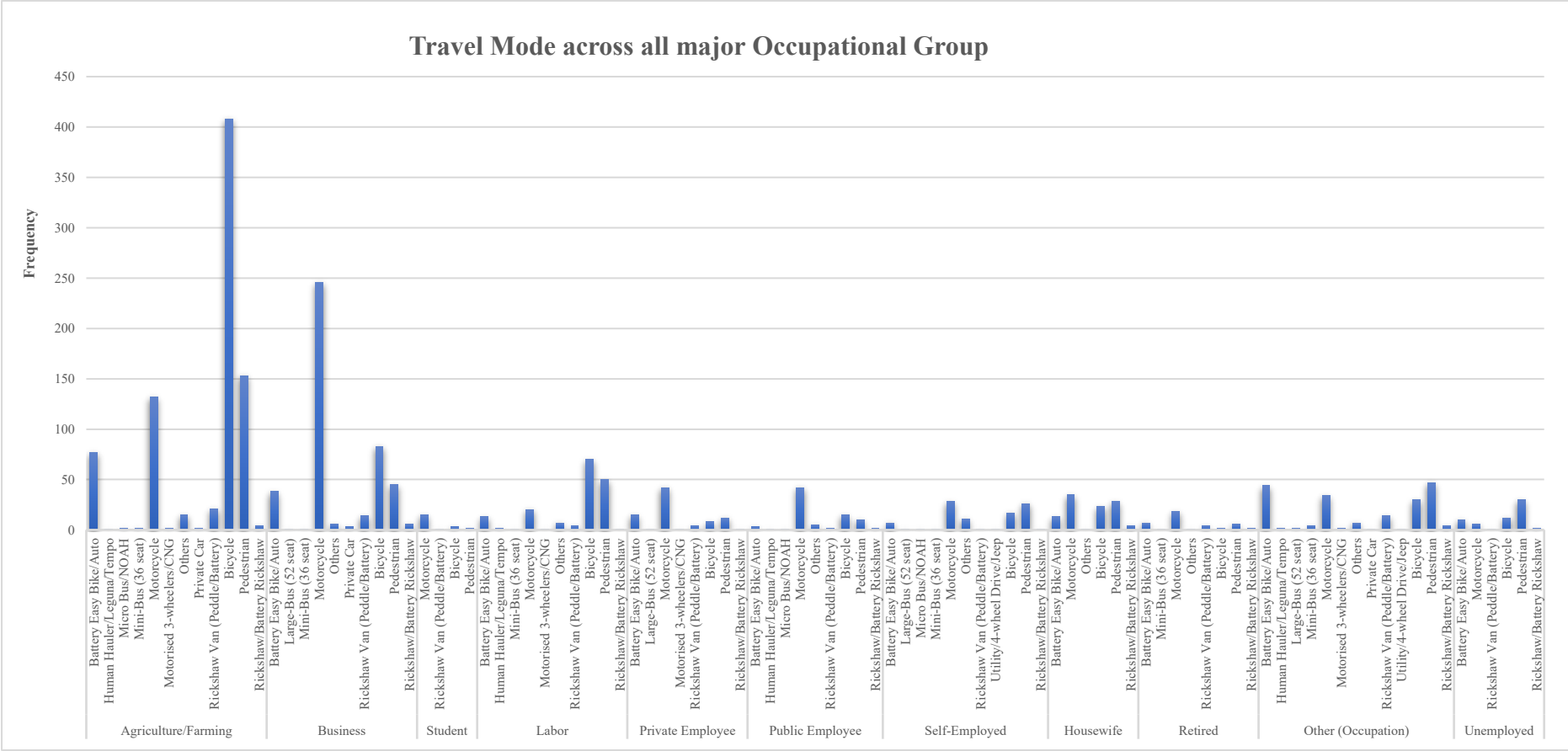


Figure 8.23: Travel Mode across all major Occupational Group

8.3 Modal choice from Household Interview Survey (HIS)

The survey reveals that motorcycles (31.67%) and bicycles (28.23%) are the dominant travel modes, followed by walking (18.20%) and battery easy bike/auto (11.92%). All other modes—including vans, rickshaws, buses, and cars—make up only small fractions (below 4% each), indicating a strong reliance on two-wheelers, non-motorized transport, and walking.

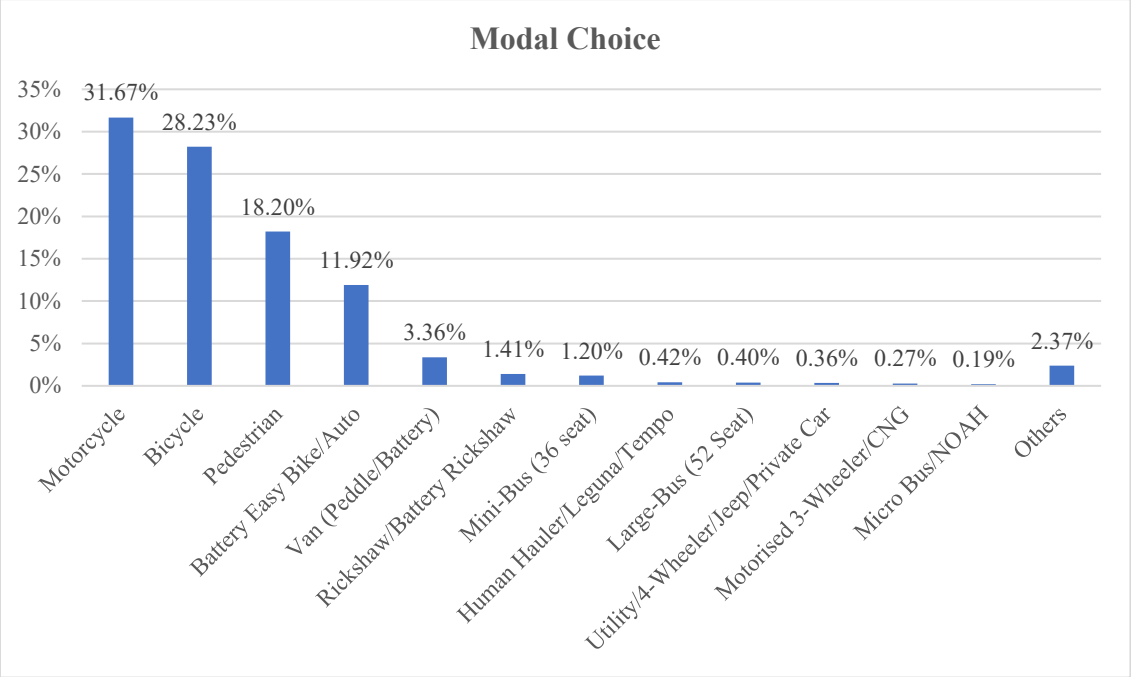


Figure 8.24: Modal choice from Household Interview Survey (HIS) (Including Walking)

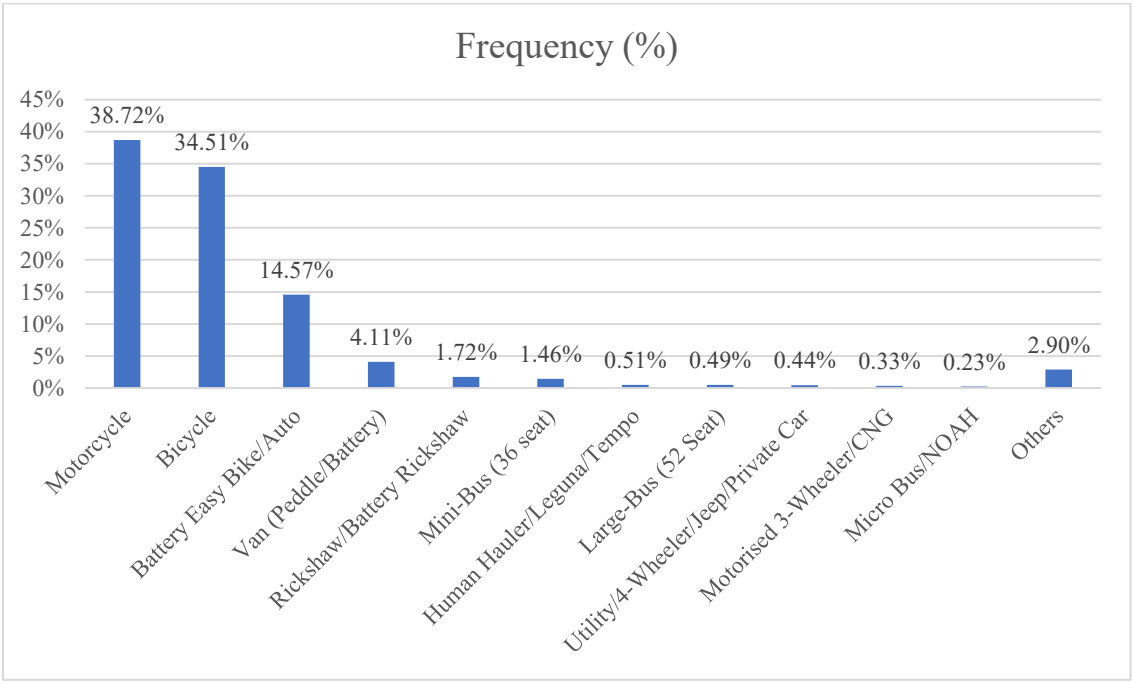


Figure 8.25: Modal choice from Household Interview Survey (HIS) (Excluding Walking)

8.4 Pedestrian Statistics across All Cordons

8.1: Pedestrian Flow across all Cordons

Cordon Code		Count		Percentage (%)	
IC_01		636		2.06%	
IC_02		1733		5.61%	
IC_03		521		1.69%	
IC_04		769		2.49%	
IC_05		926		3.00%	
IC_06		1676		5.42%	
IC_07		946		3.06%	
IC_08_I	IC_08	1341	2635	4.34%	8.52%
IC_08_II		990		3.20%	
IC_08_III		304		0.98%	
IC_09		3817		12.35%	
IC_10_I	IC_10	828	2866	3.36%	9.27%
IC_10_II		1038		3.23%	
IC_10_III		1000		6.01%	
IC_11_I	IC_11	1859	6033	6.01%	19.52%
IC_11_II		1804		5.84%	
IC_11_III		351		1.14%	
IC_11_IV		908		2.94%	
IC_11_V		561		1.81%	
IC_11_VI		550		1.78%	
OC_01		551		1.78%	
OC_02		819		2.65%	
OC_03		621		2.01%	
OC_04		903		2.92%	
OC_05		815		2.64%	
OC_06		301		0.97%	
OC_07		1332		4.31%	
OC_08		553		1.79%	
OC_09		1852		5.99%	
OC_10		608		1.97%	

The chart & Table shows pedestrian flow across all cordons, with IC_11 (Kedargonj Node) recording the highest count (6,033; ~19.52%), followed by IC_09 (Chuadanga-Meherpur Road in Meherpur Municipality) (3,817; ~12.35%), IC_08 (Boro Bazar-Char Rastar Mor, Meherpur Municipality) (2,635; ~8.52%), and IC_10 (Hotel Bazar Mor, Meherpur Municipality) (2,866; ~9.27%). Most other cordons have below 2,000 pedestrians, with the lowest observed at OC_06 (301; ~0.97%). This highlights IC_11 as the key hotspot for pedestrian movement, while outer cordons generally handle much lighter flows.

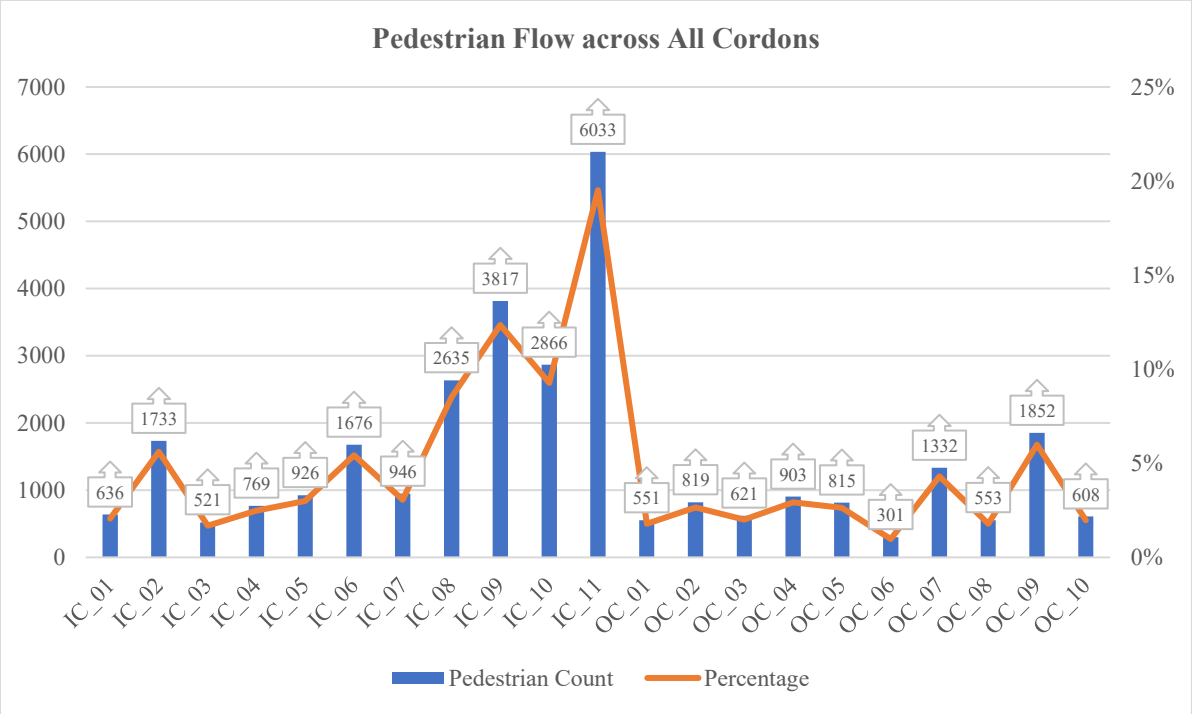


Figure 8.26: Pedestrian Flow across all Cordons

8.5 Animal Flow across All Cordons

8.2: Animal Flow across all Cordons

Cordon Code		Count		Percentage (%)	
IC_01		4		1.31%	
IC_02		5		1.63%	
IC_03		2		0.65%	
IC_04		0		0.00%	
IC_05		2		0.65%	
IC_06		0		0.00%	
IC_07		89		29.08%	
IC_08_I	IC_08	8	30	2.61%	9.80%
IC_08_II		16		5.23%	
IC_08_III		6		1.96%	
IC_09		2		0.65%	
IC_10_I	IC_10	0	0	0.00%	0.00%
IC_10_II		0		0.00%	
IC_10_III		0		0.00%	
IC_11_I	IC_11	4	14	1.31%	4.58%
IC_11_II		3		0.98%	
IC_11_III		0		0.00%	
IC_11_IV		3		0.98%	
IC_11_V		0		0.00%	
IC_11_VI		4		1.31%	
OC_01		6		1.96%	
OC_02		3		0.98%	
OC_03		99		32.35%	
OC_04		6		1.96%	
OC_05		11		3.59%	
OC_06		5		1.63%	

OC_07	3	0.98%
OC_08	1	0.33%
OC_09	20	6.54%
OC_10	4	1.31%

The chart shows animal flow across cordons, with sharp peaks at IC_07 (near Shohiuddin Degree College in Meherpur Municipality (TAZ-15)), and OC_03 (Meherpur-Kushtia Highway near Khalishakundi Bridge and TAZ-4, Matmura Union), each exceeding 100 counts and above 30% share. All other cordons record very low counts, mostly under 20, highlighting these two as the main hotspots.

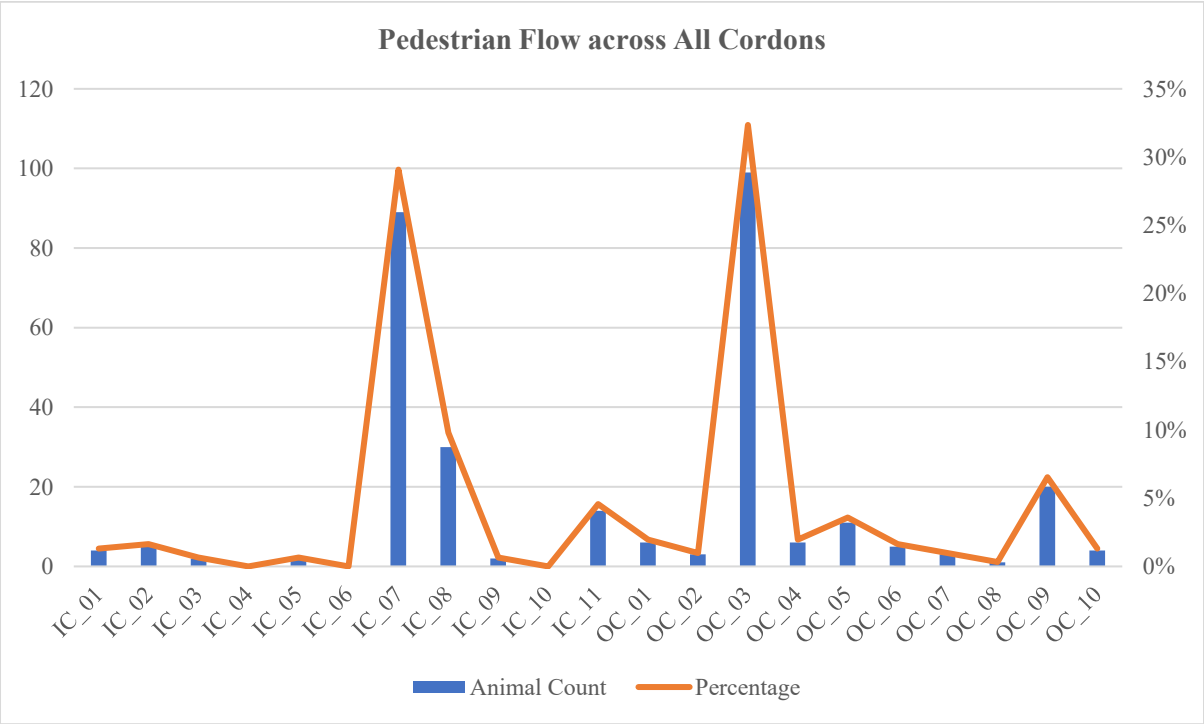
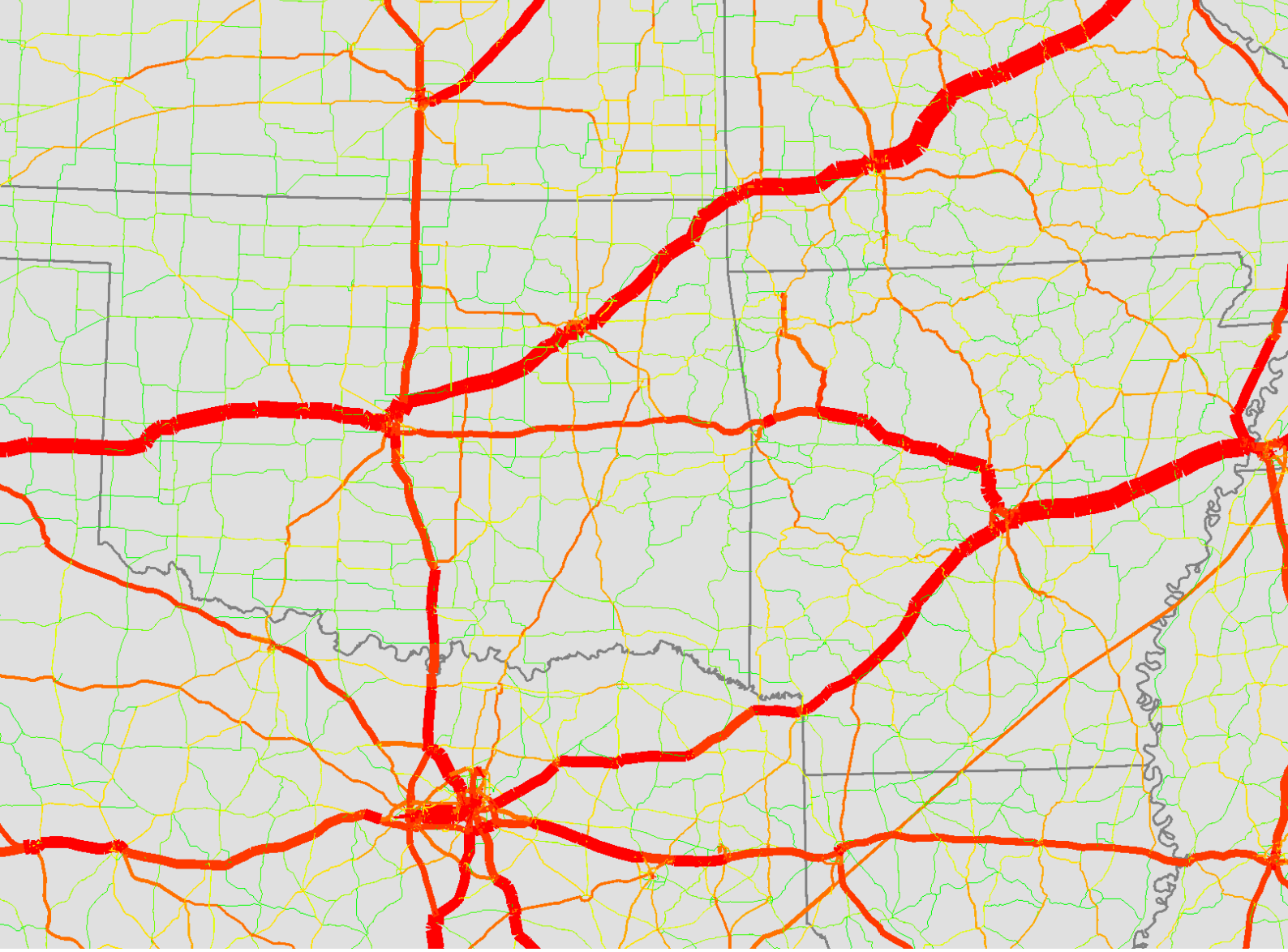


Figure 8.27: Pedestrian Flow across all Cordons



Chapter 9

Volume Capacity Analysis

Chapter 9: Volume Capacity Analysis

9.1 Software Used & Key Elements in Network Assignment

A number of specialized transport planning software packages are used to carry out network assignment. We have used TransCAD for conducting Network Assignment. These platforms provide robust modeling environments where planners can input travel demand data, define transportation networks, and run different assignment methods to forecast traffic conditions.

9.1.1 Inputs Required for Assignment

The network assignment process relies on two key sets of input data.

- ✓ First, the Origin–Destination (OD) Matrix derived from the Trip Distribution stage, which defines how many trips are expected between different zones.
- ✓ Second, the road or transit network, which consists of links and nodes along with their attributes such as capacity, free-flow travel time, and cost. Together, these inputs represent both the demand for travel and the physical infrastructure through which this demand flows.

9.1.2 Outputs of Assignment

Once the assignment is carried out, several important outputs are generated. These include

- ✓ Link-wise traffic volumes, which show how many vehicles are expected to use each road segment. The results also provide link utilization indicators such as the volume-to-capacity (V/C) ratio, which helps assess congestion levels.
- ✓ In addition, outputs include average travel times and speeds across the network, as well as the identification of congested routes, which highlights critical bottlenecks and areas needing intervention.

Definition of Volume Capacity Ratio

The Volume–Capacity Ratio (V/C ratio) is a key performance indicator in transport planning and traffic engineering. It represents the relationship between the actual traffic volume on a road segment and the designed capacity of that road.

Traffic Volume is basically the demand and Road Capacity is the Supply. Traffic demand at a particular road section is first obtained through classified volume counts. All vehicle categories—cars, buses, trucks, motorcycles, rickshaws, etc.—are recorded and converted into vehicles per hour. To make these heterogeneous flows comparable, each category is further expressed in terms of Passenger Car Units (PCU) using standard PCU conversion factors. This step gives a consolidated measure of demand in PCU/hour for the observed location.

Road capacity is not a fixed figure; it varies with roadway typology, geometric design, and national standards. In Bangladesh, reference values are provided in the Road Capacity Manual (Table 8.1), which specifies the capacity of different road types in PCU/hour per lane. To ensure comparability with observed flows, the measured traffic volume (in PCU/hour per carriageway) is normalized on a per-lane basis.

Once both demand and capacity are expressed in the same unit (PCU/hour/lane), the Volume-to-Capacity (V/C) ratio can be derived mathematically,

$$\frac{V}{C} = \frac{Traffic\ Volume\ (PCU/hour/lane)}{Road\ Capacity\ (PCU/hour/lane)}$$

Interpretation

V/C < 0.5 → The road is underutilized, free-flow conditions.

0.5 ≤ V/C < 0.8 → Stable flow, minor delays possible during peak hours.

0.8 ≤ V/C < 1.0 → Near-capacity condition; congestion likely, delays frequent.

V/C ≥ 1.0 → Overcapacity; the demand exceeds the available road space, resulting in severe congestion and delays.

Passenger Car Unit (PCU) Definition

Passenger Car Unit (PCU) is a standard unit of measurement used in traffic engineering to express the impact of different types of vehicles on road capacity and traffic flow in terms of an equivalent number of passenger cars. Since vehicles vary in size, speed, and

maneuverability, the PCU provides a way to normalize their effect on the road by comparing them to a standard passenger car.

Purpose

- ✓ To convert mixed traffic flows (cars, buses, trucks, rickshaws, motorcycles, etc.) into a common unit.
- ✓ To analyze capacity, volume, and congestion in heterogeneous traffic conditions.
- ✓ To help planners design roads, intersections, and traffic control systems more effectively.

PCU Values (Typical Ranges)

Different vehicles are assigned PCU factors depending on their influence relative to a passenger car:

Passenger Car / Jeep / Van → 1.0 PCU (base unit)

Motorcycle / Scooter → 0.5 PCU

Auto-rickshaw / CNG → 1.2 PCU

Truck / Lorry (Heavy) → 3.0 PCU

Bus (Standard) → 2.5 PCU

Bicycle → 0.5 PCU

Cycle Rickshaw → 1.5 PCU

PCU for Our Study (in the Context of Bangladesh)

Table 9.1: PCU for Our Study (in the Context of Bangladesh)

Road Type	**PCU/Hour/Lane**
Regional Highway	1350
Upazila Road	1050
Union Road	750
Village Road	600
Local Road	500

9.2 Model Output

Major Congestion Area's Vehicle Capacity Ratio (VCR) Statistics

Table 9.2: Major Congestion Area's Vehicle Capacity Ratio (VCR) Statistics

SL	1	2	3	4	5	6
Name	Meherpur Hospital Road	College Road	Meherpur-Chuadanga Road	Meherpur Main Road	Kustia-Meherpur Highway	Kahuli Road
Class	Secondary	Primary	Primary	Secondary	Primary	Secondary
Road Type	Regional Highway	Regional Highway	Regional Highway	Regional Highway	Regional Highway	Upazila Road
Speed	40	60	60	40	60	30
PCU	800	1350	1350	800	1350	1050
Capacity	1600	5785.7143	4242.8571	1600	5785.7143	2100
AB Flow	2746.5281	4795.9695	4600.4422	2239.2275	5556.9695	2607.3985
BA Flow	1286.1998	5358.2652	4916.6438	2580.0401	6265.5059	1839.1407
Total Flow	4032.728	10154.235	9517.086	4819.2676	11822.475	4446.5393
AB VCR	1.71658	0.828933	1.084279	1.399517	0.960464	1.241618
BA VCR	0.803875	0.92612	1.158805	1.612525	1.082927	0.875781
Max VCR	1.71658	0.92612	1.158805	1.612525	1.082927	1.241618
AB Speed	16.75864	56.04684	49.759021	25.131707	53.133934	22.055007
BA Speed	37.606088	54.217489	47.614332	19.313896	49.73279	27.590561

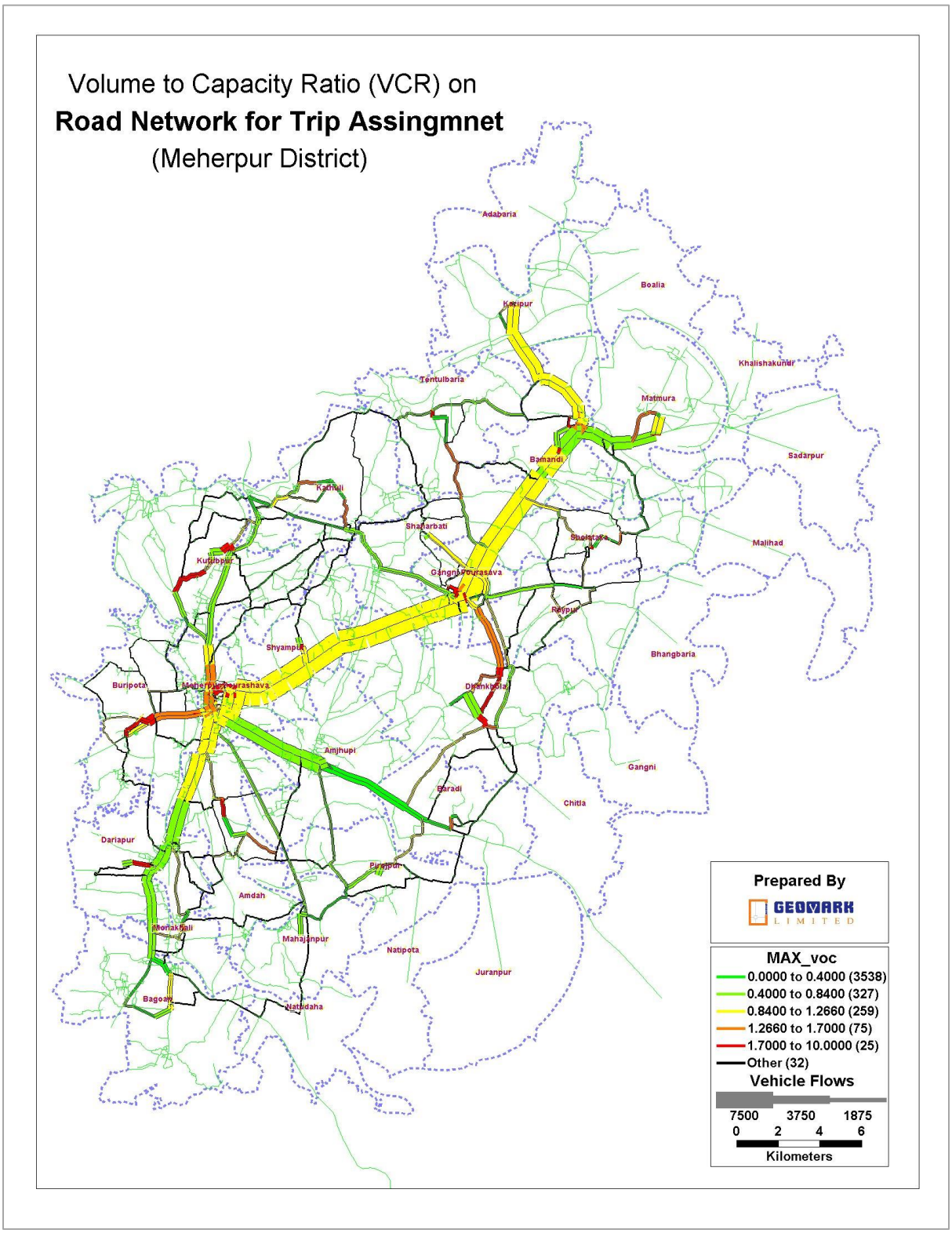


Figure: 9.1 Volume Capacity Ratio (Road Network for Trip Assignment)

Chapter 10

Discussion, Recommendation and Concluding Remark

Chapter 10: Discussion, Recommendation and Concluding Remark

The analysis of trip production versus trip attraction across all unions and municipalities reveals that Meherpur Municipality, Gangni Municipality, and Bamundi Union function as the primary hubs of attraction within the study area. In each of these zones, trip attraction significantly exceeds trip production, reflecting their roles as dominant centers for employment, education, trade, and essential services. Meherpur Municipality emerges as the strongest magnet, drawing the highest number of trips and underscoring its position as the district's administrative and economic core. Gangni Municipality similarly attracts substantial inflows from surrounding unions, highlighting its importance as a secondary urban hub. Bamundi Union, though smaller in scale, also records higher attraction than production, pointing to its significance as a service and activity center. Together, these three hubs define the spatial hierarchy of mobility in the region, with municipalities and service-rich centers shaping the direction of inter-zonal travel and concentrating the bulk of daily movement.

10.1 Recommendations

10.1.1 Policy Recommendations Based on Modal Choice

Strengthen Para-Transit Modes

Since rickshaw/van and easy bike/auto dominate travel across all occupational groups, policies should focus on organizing, regulating, and improving safety standards for these modes rather than ignoring them. Creating designated stands, proper fare systems, and traffic management will enhance their efficiency.

Introduce Affordable Public Transport

The very low usage of buses indicates either a lack of services or accessibility issues. Introducing affordable, frequent, and reliable small- or medium-bus services could reduce overdependence on para-transit, especially for students, employees, and long-distance commuters.

Promote Non-Motorized Transport (NMT)

Walking and cycling have very low shares despite being sustainable. Developing safe pedestrian pathways and cycle-friendly infrastructure can encourage short-distance travel without adding to congestion.

Occupational-Specific Support

For students, subsidized transport schemes (school vans or student passes) can reduce their heavy dependence on informal modes. For farmers and laborers, ensuring reliable access to local markets through affordable transport can directly support livelihoods. For employees and business groups, structured transport connectivity between residential and commercial areas will reduce travel stress.

Integrated Transport Planning

Municipal authorities should adopt an integrated urban transport plan that connects para-transit, public buses, and NMT modes, ensuring accessibility for all groups while reducing congestion and environmental impacts.

10.1.2 Policy Recommendations on Travel Modes by Occupation

The analysis of travel mode by occupational group shows that rickshaw/van and easy bike/auto dominate everyday mobility across all categories. These modes are cheap, flexible, and accessible, which explains their universal use. But their dominance also signals a structural gap: people use them not because they always prefer them, but because formal transport alternatives are limited or poorly connected.

Recognize and Formalize Para-Transit

Since rickshaws, vans, and easy bikes are the backbone of daily mobility for workers, students, and households, policy must move away from treating them as “temporary” or “informal.” Instead:

- ✓ Register and regulate these vehicles to improve safety and service quality.
- ✓ Create designated stands and stops near markets, schools, and offices.
- ✓ Introduce simple fare guidelines to prevent price exploitation.

Strengthen Rural and Semi-Urban Access

- ✓ Agriculture, farming, and labor households show clear dependence on short-haul para-transit. This indicates that local connectivity is more important than long-distance commuting for them.
- ✓ Improve village-to-market roads so that rickshaws and easy bikes can run year-round.
- ✓ Provide charging facilities for easy bikes in rural growth centers to reduce energy costs.

Provide Safer, Cheaper Options for Students and Housewives

- ✓ Students and housewives rely most heavily on these informal modes, often for short, repetitive trips.
- ✓ Ensure school transport safety by regulating rickshaw/auto operations around schools.
- ✓ Support affordable "student passes" or subsidies for short-distance modes.
- ✓ Develop women-friendly transport policies (safe waiting areas, lighting, trained drivers) for housewives' local trips.

Expand and Integrate Formal Transport Gradually

- ✓ The weak presence of buses and larger vehicles shows that formal systems are failing to capture demand. But introducing heavy systems all at once risks low use.
- ✓ Start with small-capacity feeder buses that connect neighborhoods to para-transit hubs.
- ✓ Integrate ticketing and scheduling so passengers can easily switch between rickshaw/auto and buses.
- ✓ Over time, scale up bus routes in denser corridors where dependence on para-transit is pushing up congestion.

Cross-Cutting Improvements

- ✓ Traffic Management: Create separate lanes or priority spaces for rickshaws and autos in busy centers.
- ✓ Environmental Regulation: Encourage replacement of polluting three-wheelers with battery-operated or CNG models.
- ✓ Equity Measures: Recognize that retired, unemployed, and low-income groups still rely on these cheap modes; policies should avoid banning them outright.

10.1.3 Policy Recommendations Based on Trip Generation (2025)

Tier 1: Major Trip Producers

Kazipur (43,148), Meherpur Pourashava (37,951), Matmura (37,409), Kutubpur (36,847)

- ✓ Build a public transport backbone (bus corridors, terminals, route rationalization).
- ✓ Upgrade arterial intersections and deploy signal coordination to handle high volumes.
- ✓ Apply land-use controls to avoid uncontrolled sprawl.
- ✓ Ensure pedestrian safety (zebra crossings, overpasses) in congested corridors.

Tier 2: Strong Secondary Producers

- ✓ Buripota (33,371), Amjhupi (29,045), Bagoan (28,499), Gangni Pourashava (27,291), Bamandi (26,516)
- ✓ Gangni Pourashava: With a high trip rate (0.88 trips/person/day), it functions as a dense urban node. Prioritize bus feeder services, NMT lanes, and intersection redesign.
- ✓ Bamandi: With 0.87 trips/person/day, it is a high-intensity, mid-volume zone. Focus on short-haul transit (rickshaws, minibuses) and safe NMT facilities, as residents make frequent local trips.
- ✓ For the group as a whole:
    - Strengthen collector roads linking them to Tier 1 hubs.
    - Provide paratransit hubs (CNG/rickshaw stands) at junctions.
    - Monitor growth, as some may transition into Tier 1 in the future.

Tier 3: Medium Generators

- ✓ Shaharabati (26,014), Dhankhola (27,546), Amdah (24,663), Sholatoka (20,153)
- ✓ Shaharabati: Highest trip rate (0.98). Build pedestrian and cycle infrastructure to handle short, frequent trips.
- ✓ Dhankhola: Lowest rate (0.60). Intervene with affordable public transport and improved access to jobs/services.
- ✓ Others: Provide rural bus shelters, school transport programs, and small transit hubs to support daily mobility.

Tier 4: Low Producers

- ✓ Shyampur (16,399), Baradi (17,367), Pirojpur (16,640), Mahajanpur (15,843), Dariapur (15,826), Monakhali (19,329)
- ✓ Focus on basic road maintenance and all-weather connectivity.
- ✓ Support low-cost demand-responsive services (CNG, shared vans, minibuses).
- ✓ Place emphasis on social equity, ensuring access to education, health, and markets rather than capacity expansion.

Cross-Cutting Strategies

- ✓ Urban Mobility Packages: Bus lanes + NMT infrastructure in Gangni Pourashava, Bamandi, and Shaharabati to manage intense trip-making.
- ✓ Corridor Development: Strengthen radial corridors linking Buripota, Amjhupi, and Bagoan with Meherpur Pourashava.
- ✓ Rural Access: Keep smaller zones well connected but avoid over-investment — scale interventions to actual demand.
- ✓ Monitoring & Transition: Track growth in Gangni and Bamandi; their combination of high trip rates and steady volumes makes them likely candidates to join the Tier 1 group within the next planning horizon.

10.1.4 Policy Recommendations from the Inter-Zonal Analysis

The trip distribution results confirm a hierarchical structure of mobility in Meherpur District, with Meherpur Municipality as the dominant hub, Gangni Municipality as a strong secondary center, and Bamundi Union emerging as a key local producer with outward links. Policies need to reflect this hierarchy rather than treating all zones as equal.

Strengthen the Municipal Core (Meherpur Municipality, TAZ 15)

- ✓ Meherpur attracts the highest number of inter-zonal trips, confirming its role as the administrative, commercial, and educational hub.
- ✓ Expand public transport corridors and terminals in and around the municipality to absorb heavy inflows.
- ✓ Upgrade radial road connections linking surrounding unions to Meherpur, ensuring smoother inter-zonal commuting.

- ✓ Provide multi-modal integration points (bus, rickshaw, easy-bike stands) to handle first- and last-mile connections.

Support Secondary Growth in Gangni Municipality (TAZ 7)

- ✓ Gangni demonstrates significant attraction from multiple origins, functioning as a secondary trade and service hub.
- ✓ Strengthen intra-municipal circulation (junction improvements, feeder services) to accommodate high incoming flows.
- ✓ Encourage economic decentralization by investing in administrative offices, training centers, and retail clusters in Gangni to reduce pressure on Meherpur.
- ✓ Develop public transport links between Gangni and Meherpur to facilitate structured commuting rather than unregulated para-transit dominance.

Enhance Bamundi Union's Role as a Local Production Zone (TAZ 3)

- ✓ Bamundi produces high intra-zonal trips while also sending strong flows outward, particularly toward Meherpur and Gangni.
- ✓ Improve feeder roads and rural connectivity to ensure reliable access for outward trips.
- ✓ Provide paratransit hubs and staging points in Bamundi to organize its outward flows more efficiently.
- ✓ Promote local service development (markets, small clinics, training centers) within Bamundi to balance production with in-zone service provision, reducing excessive dependency on municipal cores.

Manage Intra-Zonal Dominance

- ✓ The strong diagonal values in the trip matrix show that most daily trips are still internal to each zone.

- ✓ Prioritize neighborhood-level mobility (walking, cycling, rickshaw infrastructure) to make these local trips safer and more efficient.
- ✓ Apply traffic calming and safety measures in local centers where intra-zonal trips concentrate, such as bazaars and schools.

Integrate the Hierarchy into District Planning

- ✓ Recognize Meherpur Municipality as the central magnet, Gangni as a secondary hub, and Bamundi as a production-oriented feeder.
- ✓ Apply a polycentric planning approach: develop Gangni and Bamundi as complementary centers to relieve pressure on Meherpur, while maintaining strong inter-zonal connectivity.
- ✓ Introduce zoning and investment incentives that match this hierarchy—for instance, siting regional services in Meherpur, secondary services in Gangni, and agro-support infrastructure in Bamundi.

In brief,

Meherpur Municipality → needs high-capacity transport and multi-modal hubs.

Gangni Municipality → deserves investment as a secondary growth pole.

Bamundi Union → requires feeder connectivity and local service strengthening to support its strong outward flows.

10.2 Concluding Remark

The analysis reveals that mobility in the study area is overwhelmingly dependent on rickshaw/van and easy bike/auto, reflecting the dominance of informal, short-distance modes across all occupational categories. While these modes play a vital role in sustaining daily travel needs, the lack of formal, structured public transport limits long-distance mobility and creates pressure on para-transit systems. Future transport planning should therefore strike a balance: strengthening the efficiency of existing informal modes while gradually introducing structured, affordable public services and improving walking and cycling facilities. Such an approach will not only address current mobility demands but also support sustainable and inclusive transport development for the community.

The combined findings from modal choice, occupational travel behavior, trip generation, and inter-zonal distribution point to a transport system that is still dominated by informal, short-distance modes, with formal public transport playing only a marginal role. This reality underscores the need for a pragmatic, staged approach: strengthen and regulate para-transit in the short term, expand affordable and reliable public transport in the medium term, and integrate both with non-motorized facilities for long-term sustainability. At the spatial level, planning must acknowledge the district's clear mobility hierarchy, where Meherpur

Municipality functions as the central hub, Gangni Municipality acts as a strong secondary pole, and Bamundi Union emerges as a vital production-oriented feeder. Ensuring connectivity between these centers while safeguarding accessibility for smaller rural zones will not only balance demand but also promote equitable and inclusive growth. Ultimately, transport policy in Meherpur must strike a careful balance between managing intensity in high trip-rate areas, expanding capacity in high-volume zones, and protecting accessibility in low-demand settlements—thereby building a resilient, people-centered mobility framework for the district's future.