Proposed Road Widening and Alternative Bypass Plan for Mirsharai Upazila Development Plan (MUDP)

Submitted To:
Ahmed Akhtaruzzaman
Senior Planner
Urban Development Directorate

Submitted By
Sk Nafiz Rahman
Rimu Mia
Purbasha Mallick
Faria Mahzabin Anika
Urban and Rural Planning Discipline,
Khulna University, Khulna-9208

Table of Contents

List of Maps

Chapter 1: Introduction

1.1 Preamble

Transportation problem is one of the major concerned factors for developing countries like Bangladesh. Specially in case of development plan, it is necessary to integrate the factors of transportation like trips and travel data that are interrelated directly with physical planning. But as transportation components like trip distribution, density and travel behavior is very flexible in nature than the rigid physical planning components like land use and service activities, modern planners always face challenges for integrating these two major fields of planning. This short time assignment on Mirsharai Upazila Developememt Plan has also faced that kind of challenges but found a way to interrelate the trip density with different structural density and service activities. The assignment has taken trip density and direction of trip origin as a major component for identifying the roads that needs to be widen. Also, the high-density areas have been analyzed to find out the service activity distribution of the areas. The analysis has been made through different primary and secondary data that are available for the Upazila. This assessment has been based on mainly transportation and land use data. As the behavioral data and origin destination data is available, it is possible to identify the trip density of the Upazila in different area. Also, the structure data is available which has been used to find out different structural density like residential, commercial and industrial density of the area. The road data has been used to evaluate the network condition of the Upazila. Primary data like household survey and also secondary data like land use and service activities has been used. In the last part of the assignment, the service activity of different regions has been identified. From this analysis a decision has been made that wither the high-density areas need that much service activities for the particular region or the less density areas need more service activities.

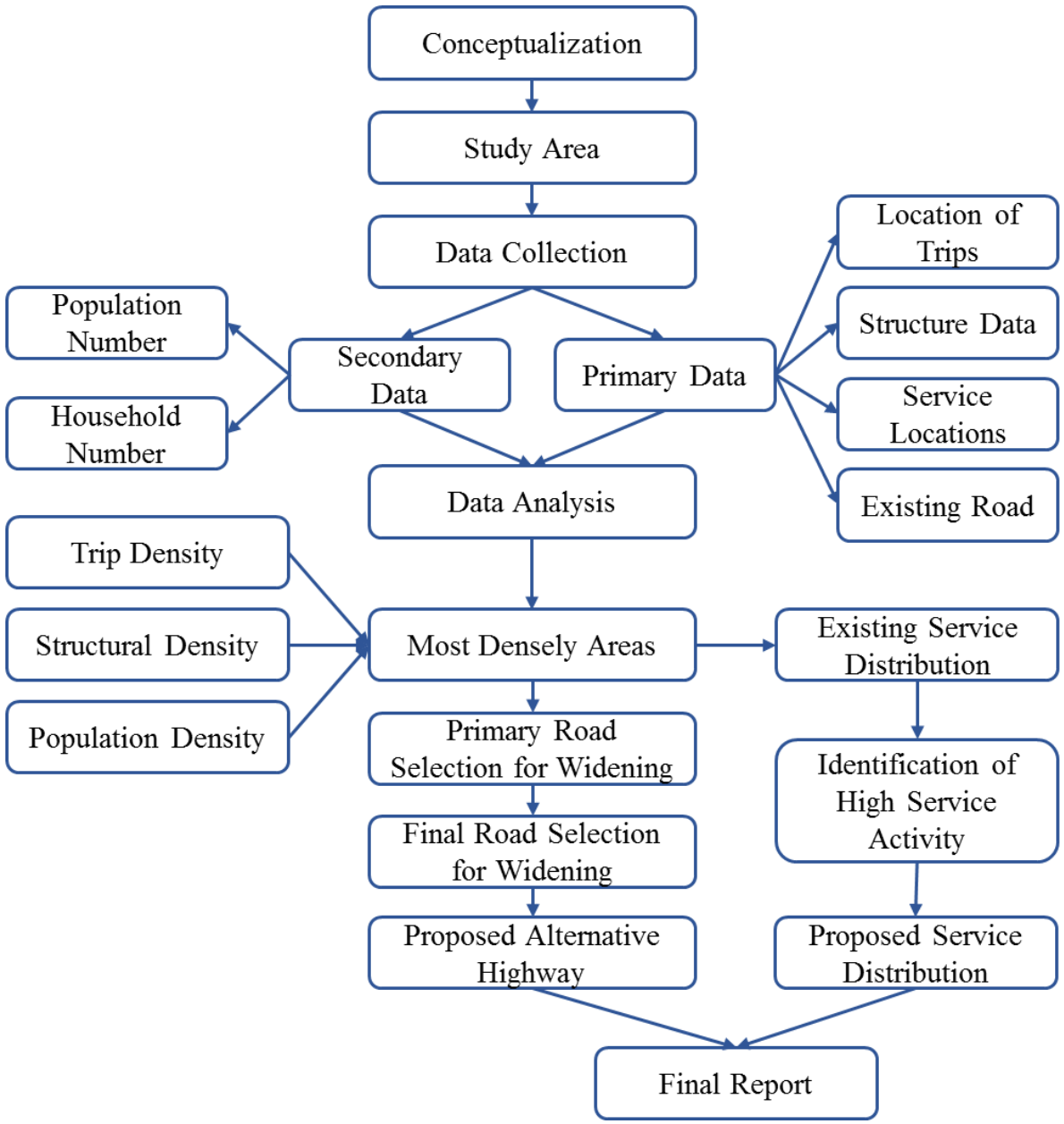
1.2 Objectives

- ⇒ To develop Density Map (Population Density, Household Density, Residential Density, Commercial Density, Industrial Density, Trip Density) of Mirsharai Upazila.
- ⇒ To propose the roads that need to be widen according to trip density.
- ⇒ To propose an alternative bypass and finding possible reason behind the proposal.
- ⇒ To identify the service activity level of different density areas.
- ⇒ To propose suitable distribution of different service activities.

Chapter 2: Methodology

2.1 Methodological Framework

This part of the report is illustrating the simultaneous pattern of activities that has been done to fulfill the objectives of this assignment. All the activities and their relations has been displayed with a framework below. From the next page, the basic introductory part and analytical tools has been described.



2.2 Study Area

Mirsharai Upazila is located at 22.7722°N, 91.5750°E with area of total 482.88 sq. km. It has total 16 unions. It is in the south-east part of Bangladesh in the Chattagram Devison. The Upazila is well known for its natural beauty.

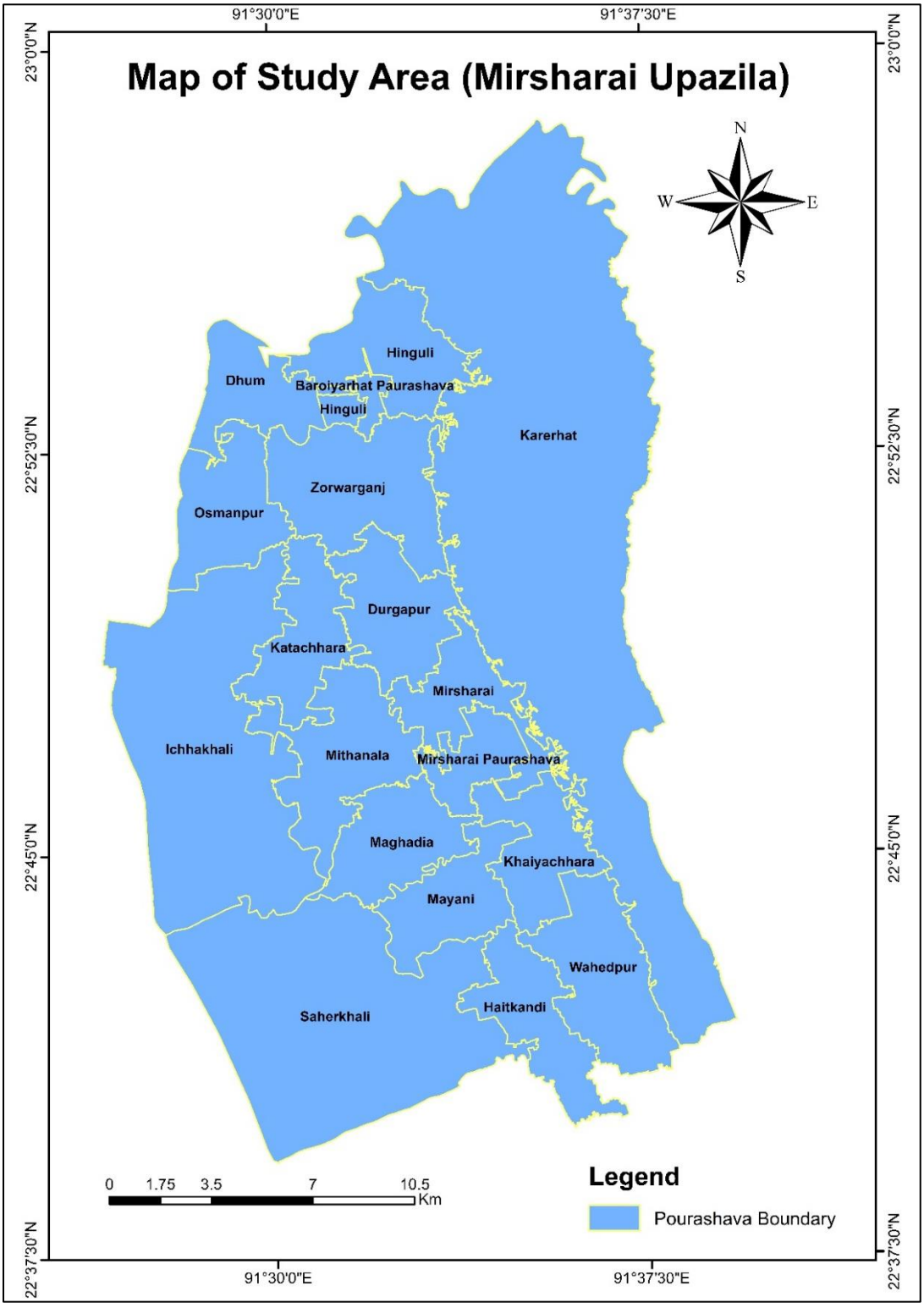


Figure 1 Study Area Map

2.3 Data Collection

There are mainly two kinds of data that has been used in this assessment. Those are:

1. Primary Data
2. Secondary Data

2.3.1 Primary Data Collection

The primary data has been collected by Survey Farm, a consulting agency that works with Urban Development Directorate in the Mirsharai Development Project. There are different kinds of data like household survey data, origin-destination data, traffic volume data, structural data and service location data. In this case, 470 household survey data and trip destination data has been used to develop the trip density map. Also, for other density maps like residential, commercial and industrial density map has also been made from this data. The service distribution has also been analyzed from primary data.

2.3.2 Secondary Data Collection

The secondary data like population and household data has been collected from BBS 2011. This data as been used to see the overall population and household condition of Mirsharai Upazila.

2.4 Data Analysis

For data analysis, mainly the ArcMap 10.4.1 and QGIS 3.4 has been used. The whole analysis can be divided into two parts. These are:

1. Density Analysis
2. Service Area Analysis

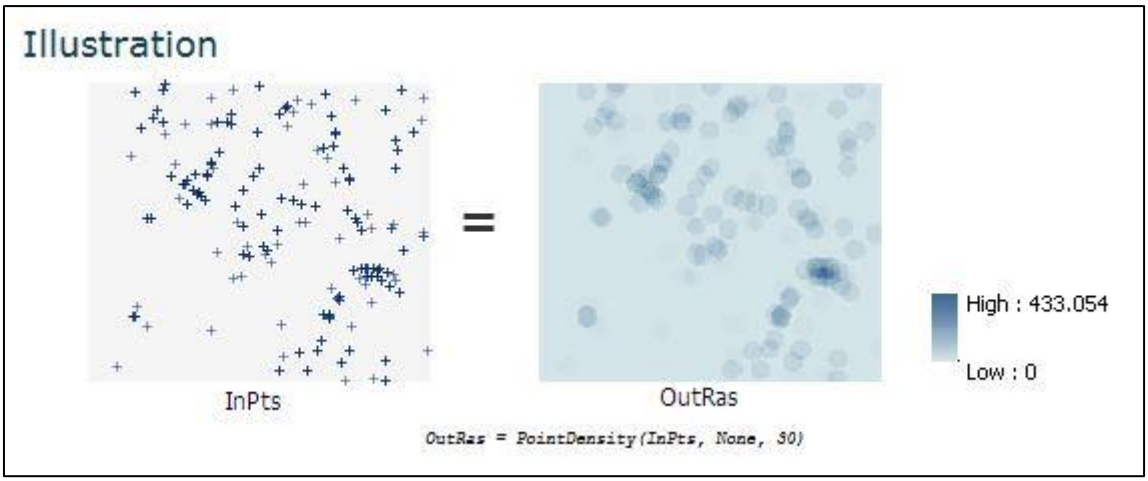
2.4.1 Density Analysis

There are mainly three kinds of density that has been used. Those are:

1. Point Density
2. Line Density
3. Kernel Density

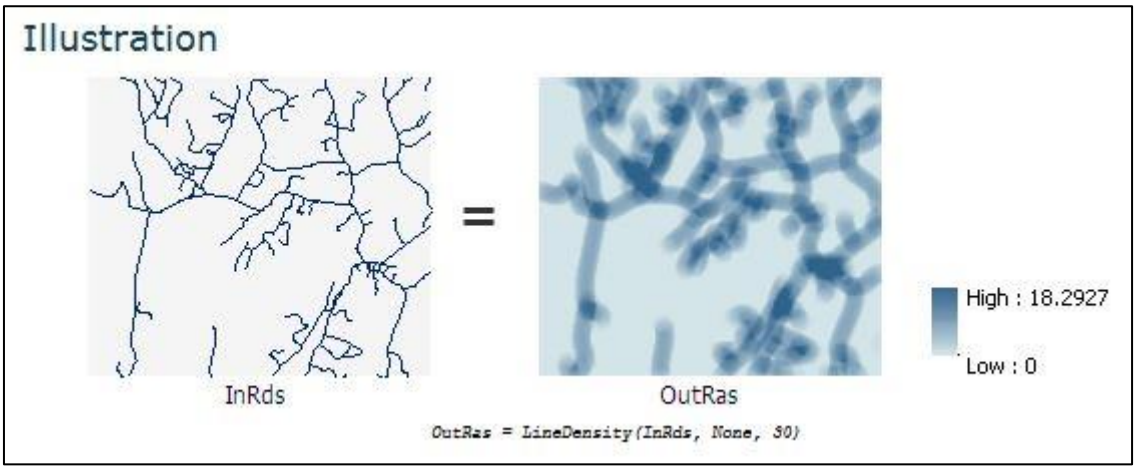
The ArcMap tools has been used to conduct this analysis. The process of these tools has been described from the next page.

Point Density: Calculates a magnitude-per-unit area from point features that fall within a neighborhood around each cell. In this case, the unit for this density is per sq. km. The tool has been used to find out different structural density of Mirsharai Upazila.



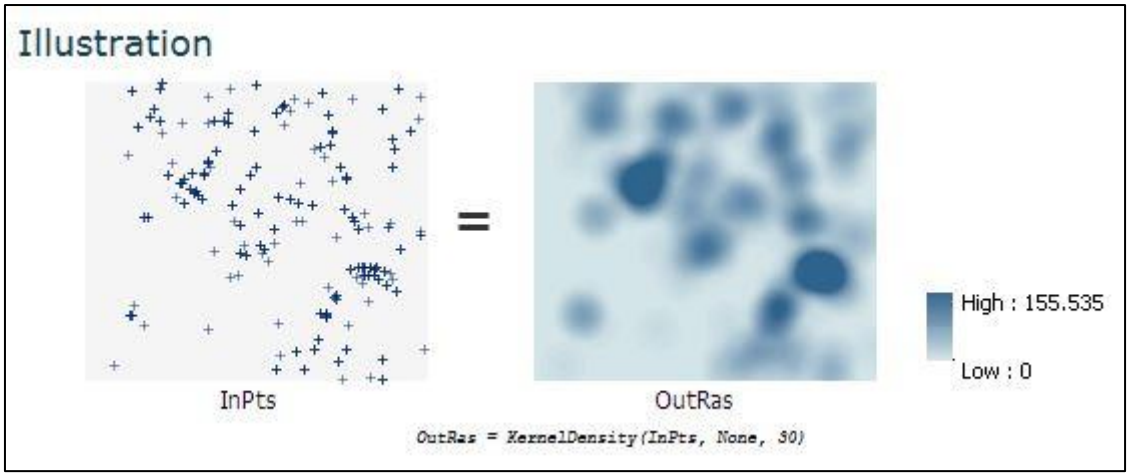
There is another tool that has been used in case of making the points which is **Feature to Point.** This tool has been used to convert the shapes into points.

Line Density: Calculates a magnitude-per-unit area from polyline features that fall within a radius around each cell. The unit for this density is per sq. km. This tool has been used to find out the trip density of Mirsharai Upazila.



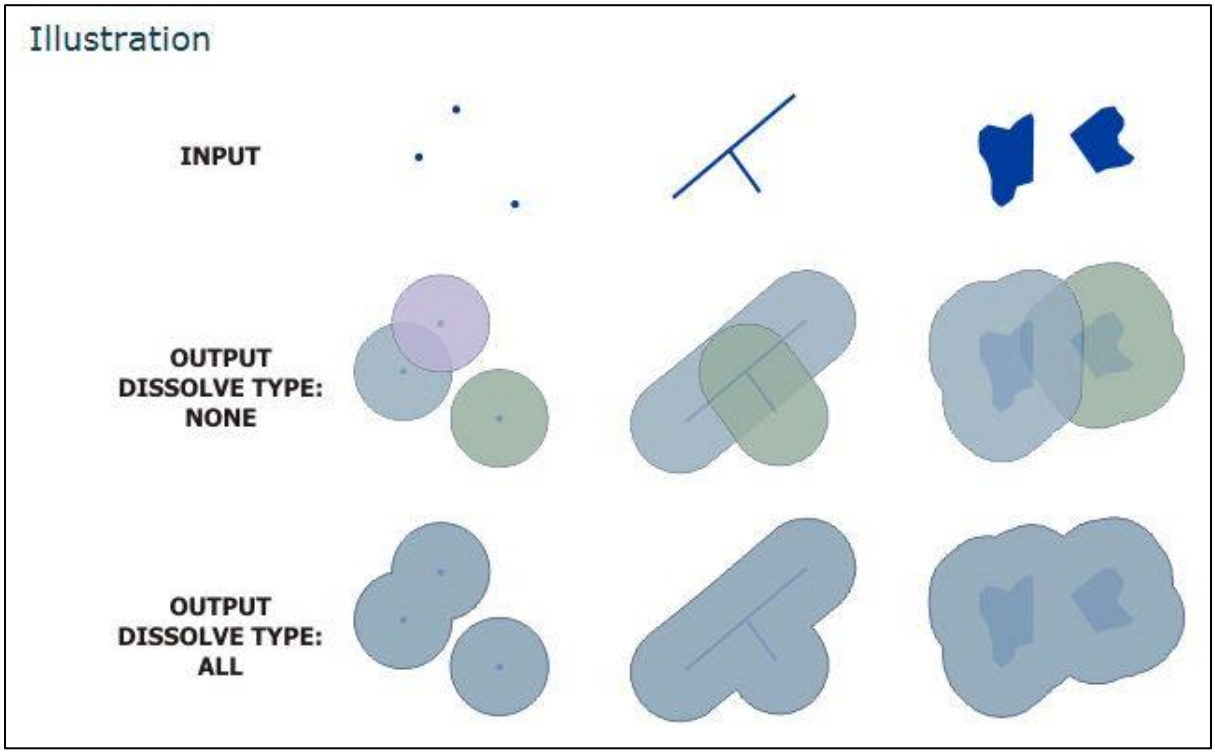
Another tool that has been used in case of line density is **Points to Paths**. This tool converts the points of each household trips in lines and make it trip lines.

Kernel Density: This is another density tool that has been used to identify the income wise household distribution of the household surveyed. Calculates a magnitude-per-unit area from point or polyline features using a kernel function to fit a smoothly tapered surface to each point or polyline.



2.4.2 Service Area Analysis

The service area has been analyzed by the **Buffer** tool. The buffer tool has been used to find out the different service concentration for high density area. The tool creates buffer polygons around input features to a specified distance.



Chapter 3: Structural Density

3.1 Residential Density

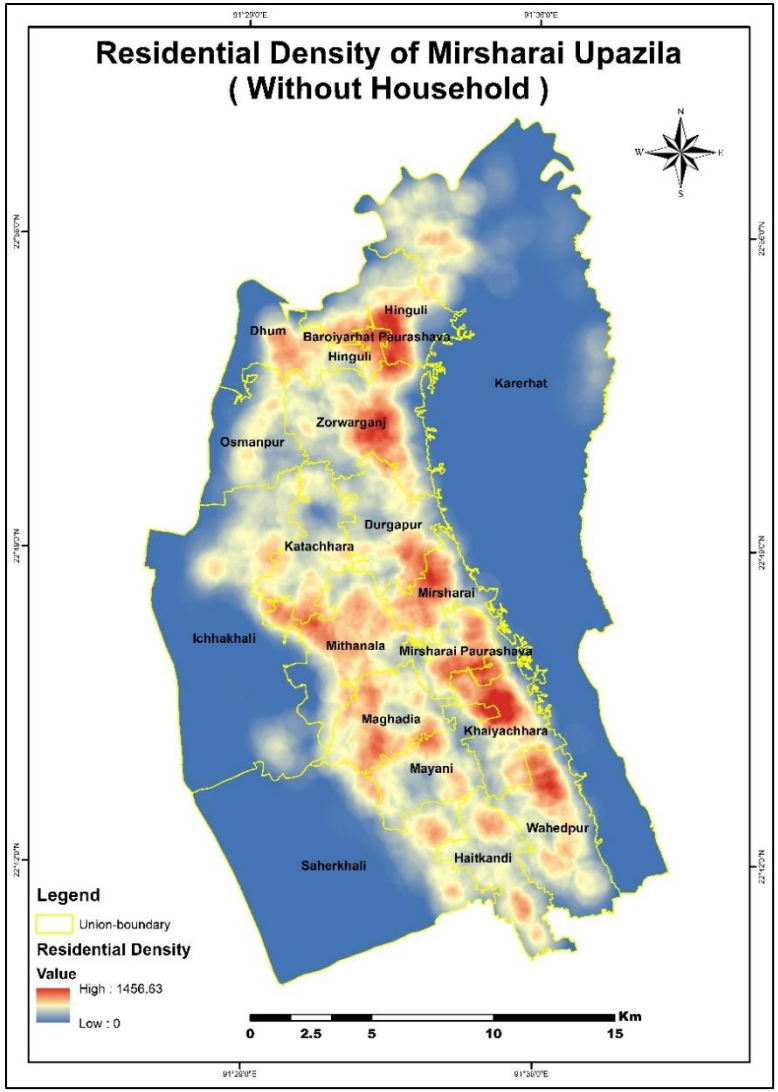


Figure 3 Residential Density of Mirsharai (With Household)

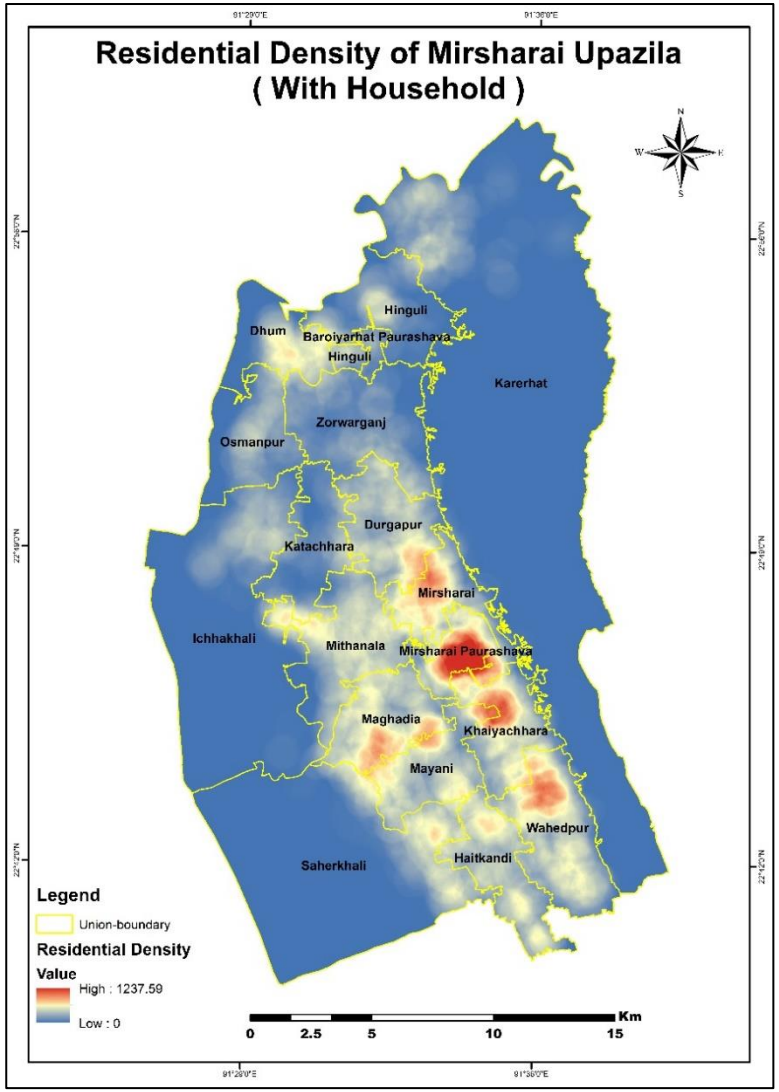


Figure 2 Residential Density of Mirsharai (Without Household)

The previous page is showing the residential density of Mirsharai Upazila. The first map is showing the residential density without households. From the map, it can be seen that without household, the residential density is mainly concentrated to several areas of the Upazila. But the household concentration is mainly in the Mirsharai Paurashave. This output is rather different from the BBS 2011 data. The below maps are showing the household concentration according to BBS 2011.

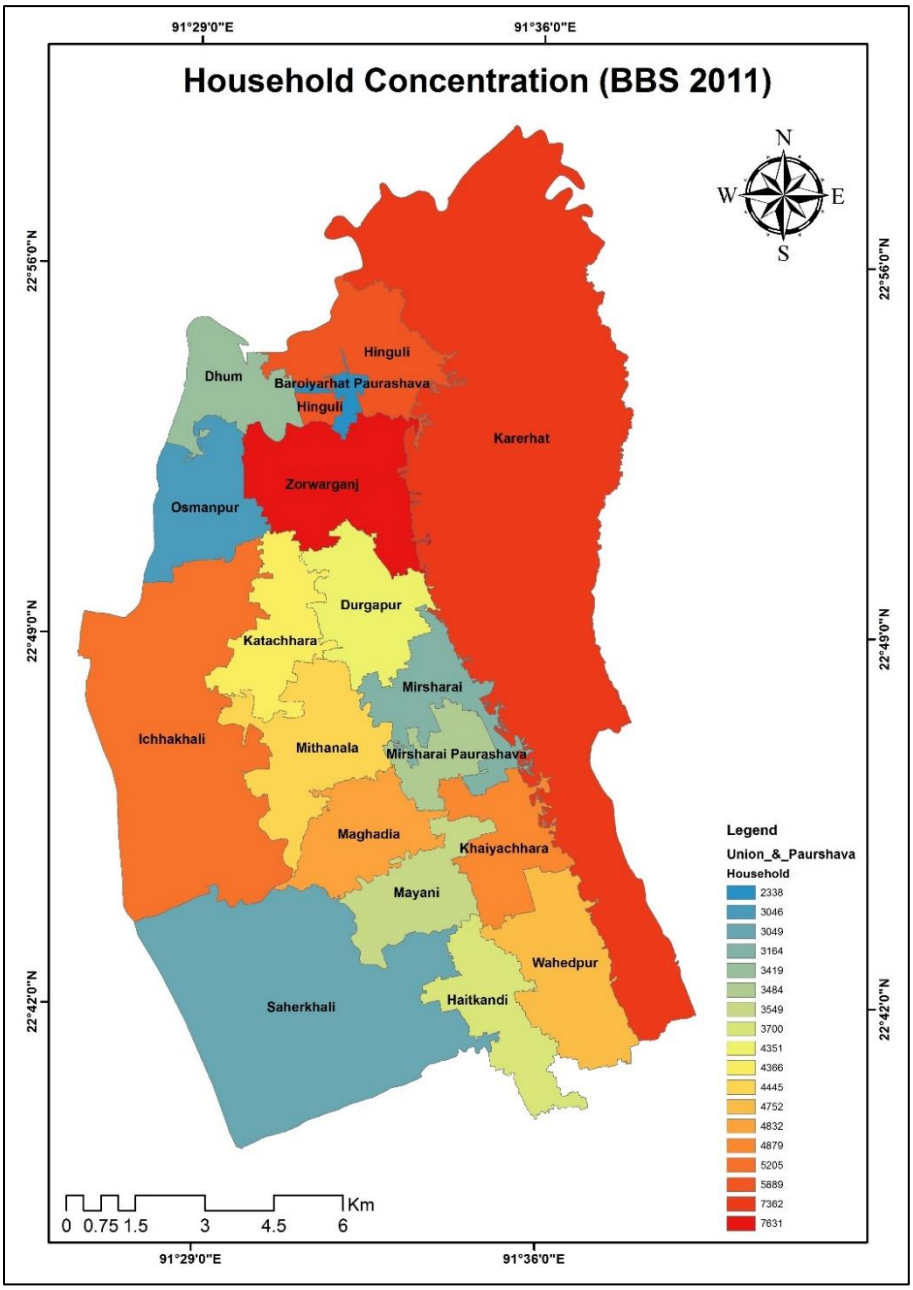


Figure 4 Household Concentration (BBS 2011)

From the map, it can be seen that the current household concentration is not same as BBS 2011. Now the household concentration has been transferred to Zorwarganj to Mirsharai. As a result, the BBS data can not be used directly for this assessment.

3.3 Commercial and Industrial Density

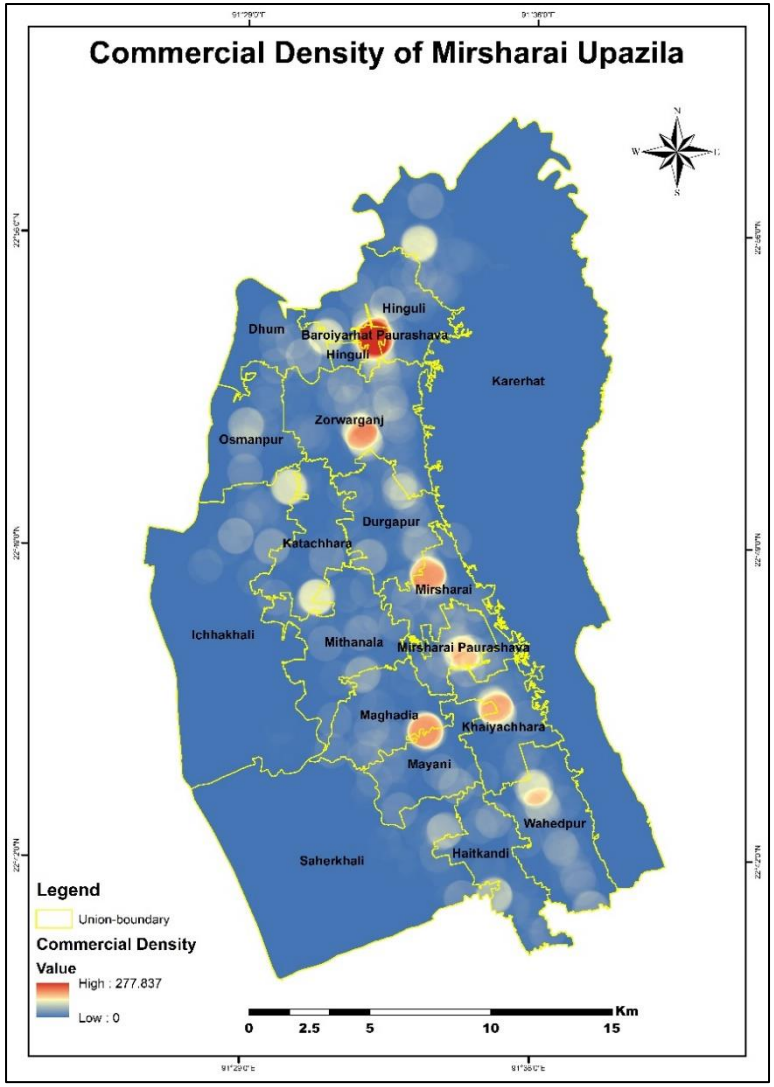


Figure 6 Commercial Density of Mirsharai Upazila

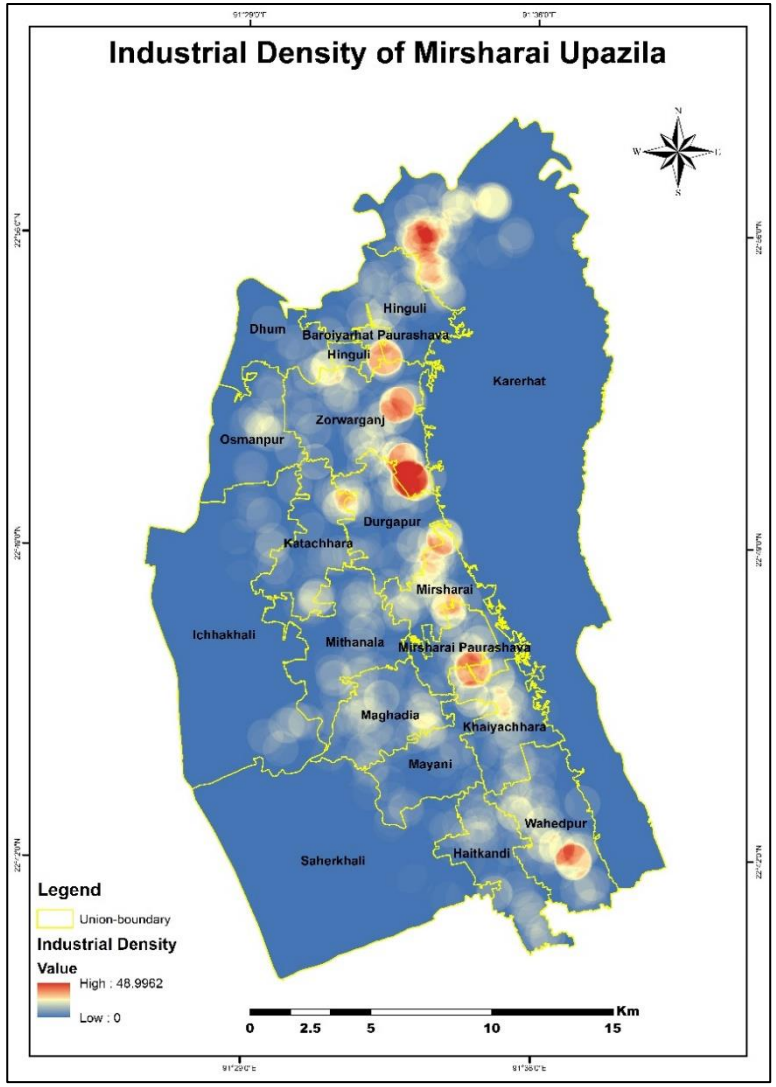


Figure 5 Industrial Desnity Map of Mirsharai Upazila

The previous two maps are showing the commercial and industrial density of Mirsharai Upazila. From the map, it can be seen that Baroyarir Hat is the main commercial concentration of the area. But in case of industrial density, the Zorwarganj Bazar is the main concentration point. This analysis is very useful to find out the trip generation of the area that is mainly the residential density. Also, the trip attraction area which is mainly commercial and industrial density can be found throughout the map.

Chapter 4: Trip Density and Road Selection

4.1 Location of Household and Trip Lines

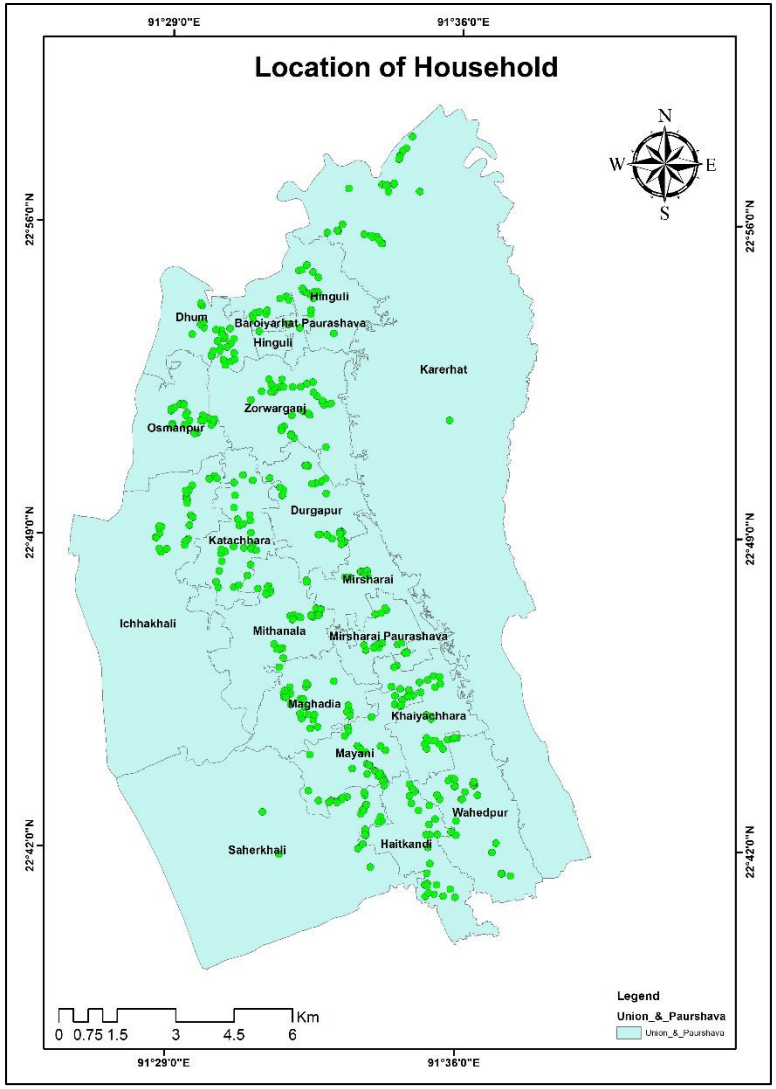


Figure 8 Location of Households

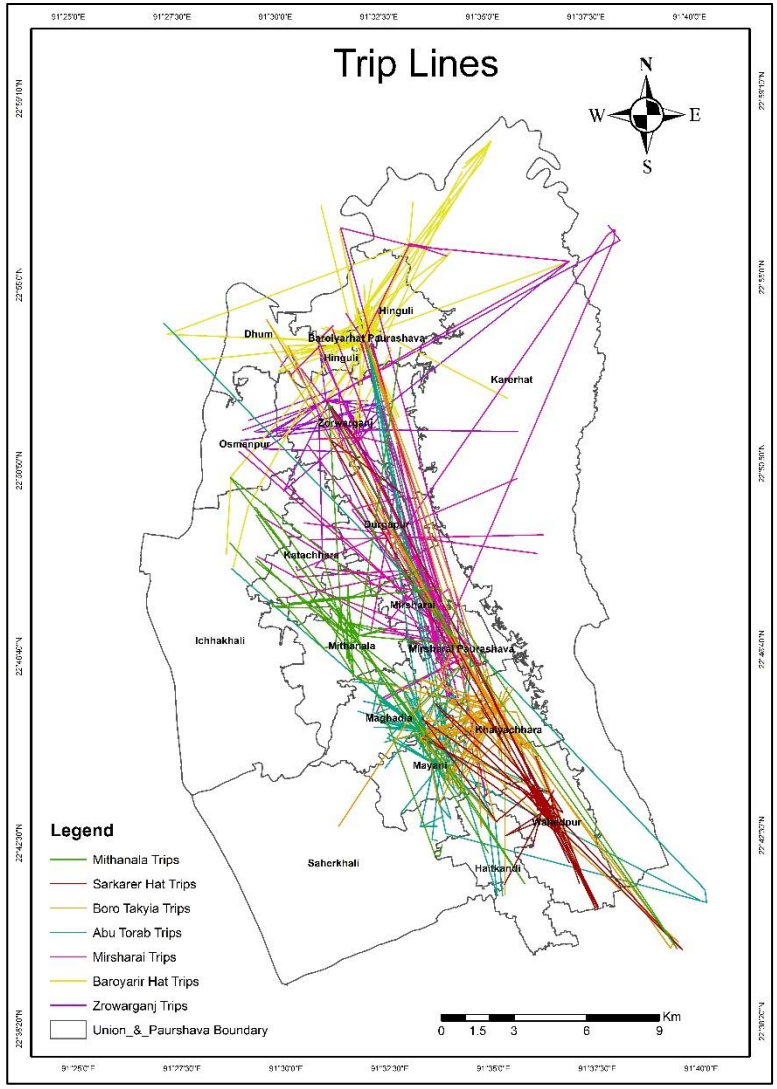


Figure 7 Trip Lines Map

The previous map is showing the household location that had been surveyed. From this socio-economic survey, the location of trips for each household can be found. The location of trips is then used to connect the household with lines. These lines are representing the trip lines for each household. This trip lines are then used to find out the trip density of Mirsharai Upazila.

4.2 Trip Density

The below map is showing the trip density that has been found from the trip lines. The Line Density Tool has been used to calculate the trip density for the whole Upazila.

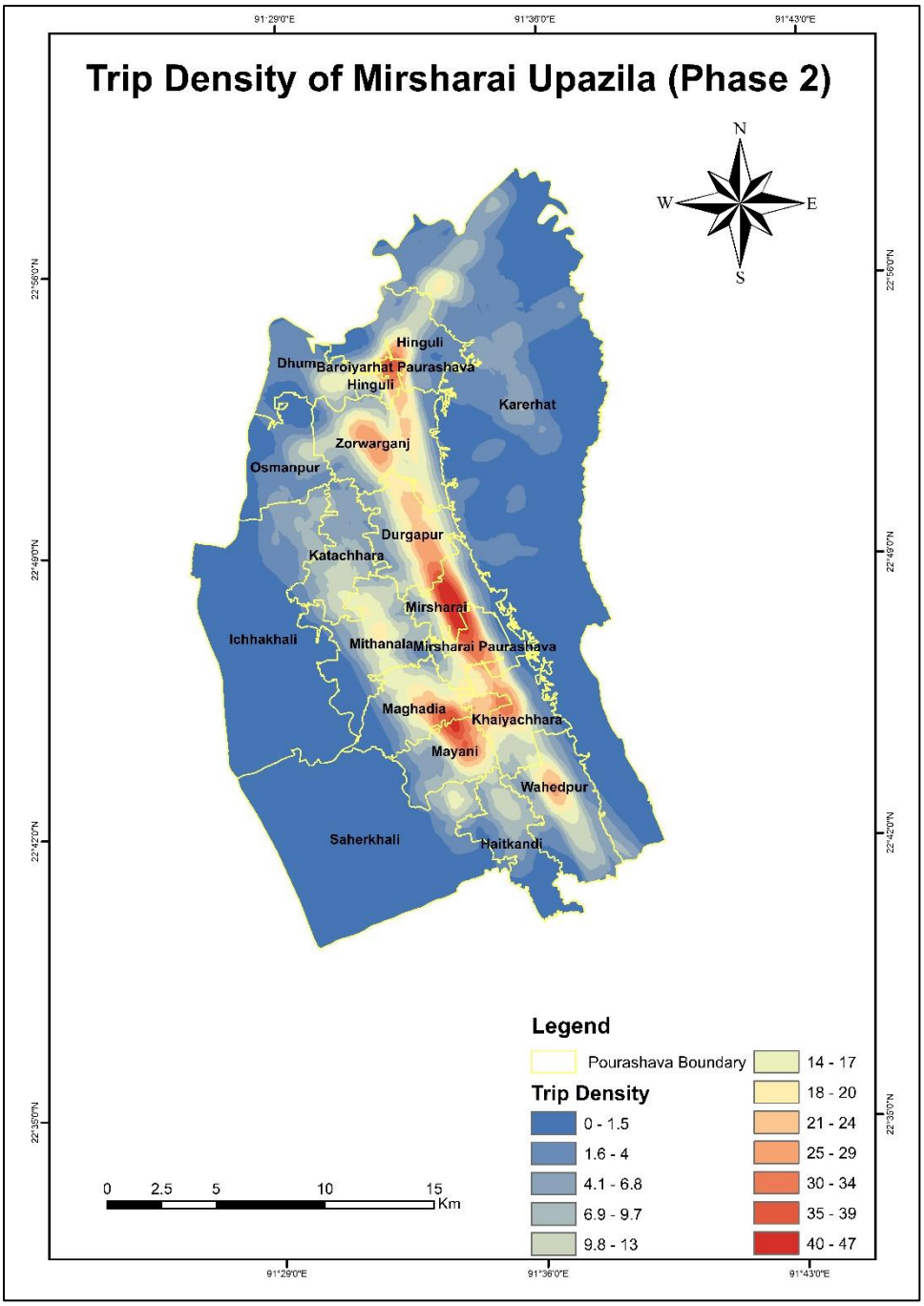
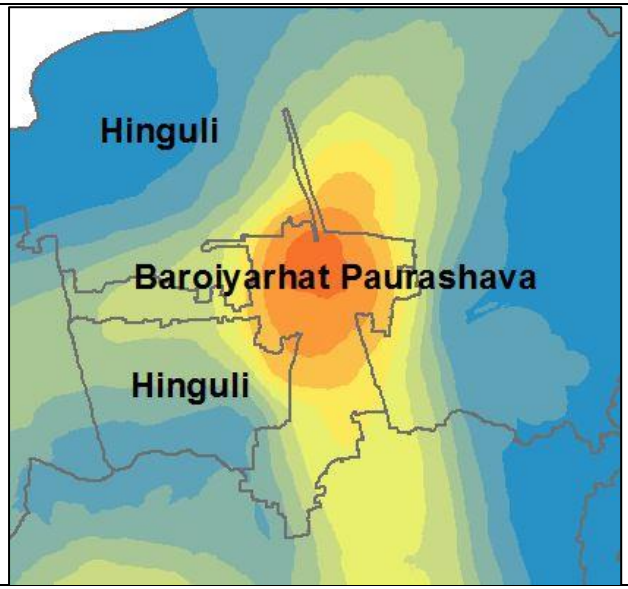
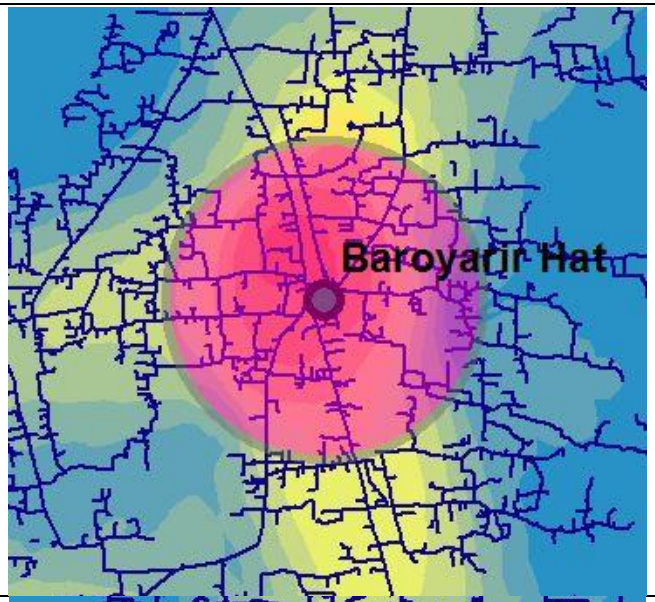
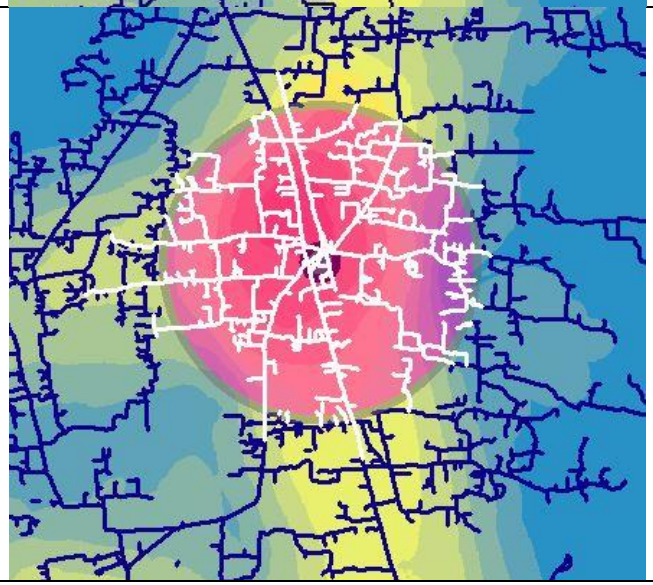


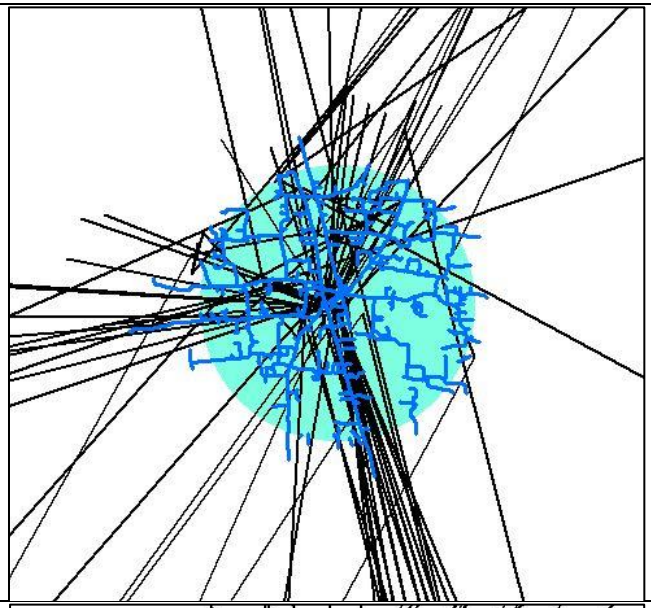
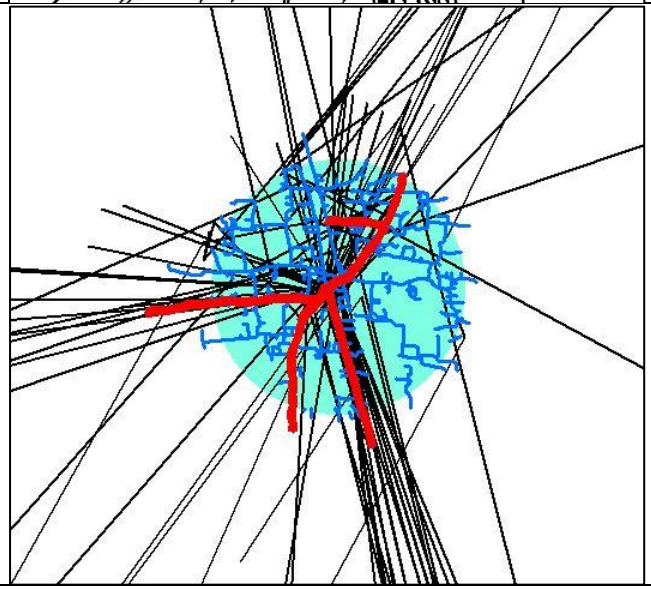
Figure 9 Trip Density Map

4.3 Road Selection

From the previous map, 7 locations that has been selected which has the most trip density which are Baroyarir Hat, Zorwarganj Bazar, Mirsharai Bazar, Abu Torab Bazar, Mithanala Bazar, Boro Takyia Bazar and Sorkarer Hat. So, these areas are the main focus of this assignment for widening the road and also propose an alternative bypass road for too much pressured Dhaka-Chittagong Highway. The primary selection of the road has been conducted through selecting the roads that are into the high trip density areas. Then the trip line direction has been used to identify the most used road of that area. This procedure has been used for all the high trip density areas. The whole procedure of selecting the high trip density road has been illustrate below for Baroyarir Hat. The other areas have been shown in the appendix part of the report.

ArcMap Illustration	Procedure
	The first process had already been described. The main trip density areas have been found. In this case, for illustration the Baroyarir Hat Paurasshave has been used. With a high density of commercial density and trip density, Baroyarir Hat has become one of the most importan place in the Mirsharai Upazila. As it is mainly situated on the Dhaka-Chittagong Highway, the trip concentration is high. But for controlling this high density, a proper road selection method is needed which has been illustrate in the next procedure.

	In the second step of the road selection, a polygon has been taken which is mainly representing the highest trip density area. This is the main trip concertation area of Baroyarir Hat.
	In the next step, the primary selection of the road has been conducted. The roads that are mainly in the most trip concentrated areas has been selected for in the first step. In the next step, the trip lines are being used to select the roads more specifically.

	In this part of road selection, the trip lines are being used to find out the direction form which the most trips are occurring. Form this observation, the roads that are in the most trip occurring direction has been selected. In case of Baroyarir hat, the most trips are occurring from the north-east, west and south part of the area.
	In the last step, the roads that are including the most trips are selected. In case of Baroyarir hat, 4 roads are being selected which are the main trip concentrated road of the area. The red lines are showing the final selected roads.

4.4 Final Selected Road for Widening

The previous procedure has been used to find out the high trip concentrated roads for each high trip density areas. As a result, the roads that needs to be widen can be found in the for the whole Upazila. The final roads selected for widening are shown in the below map.

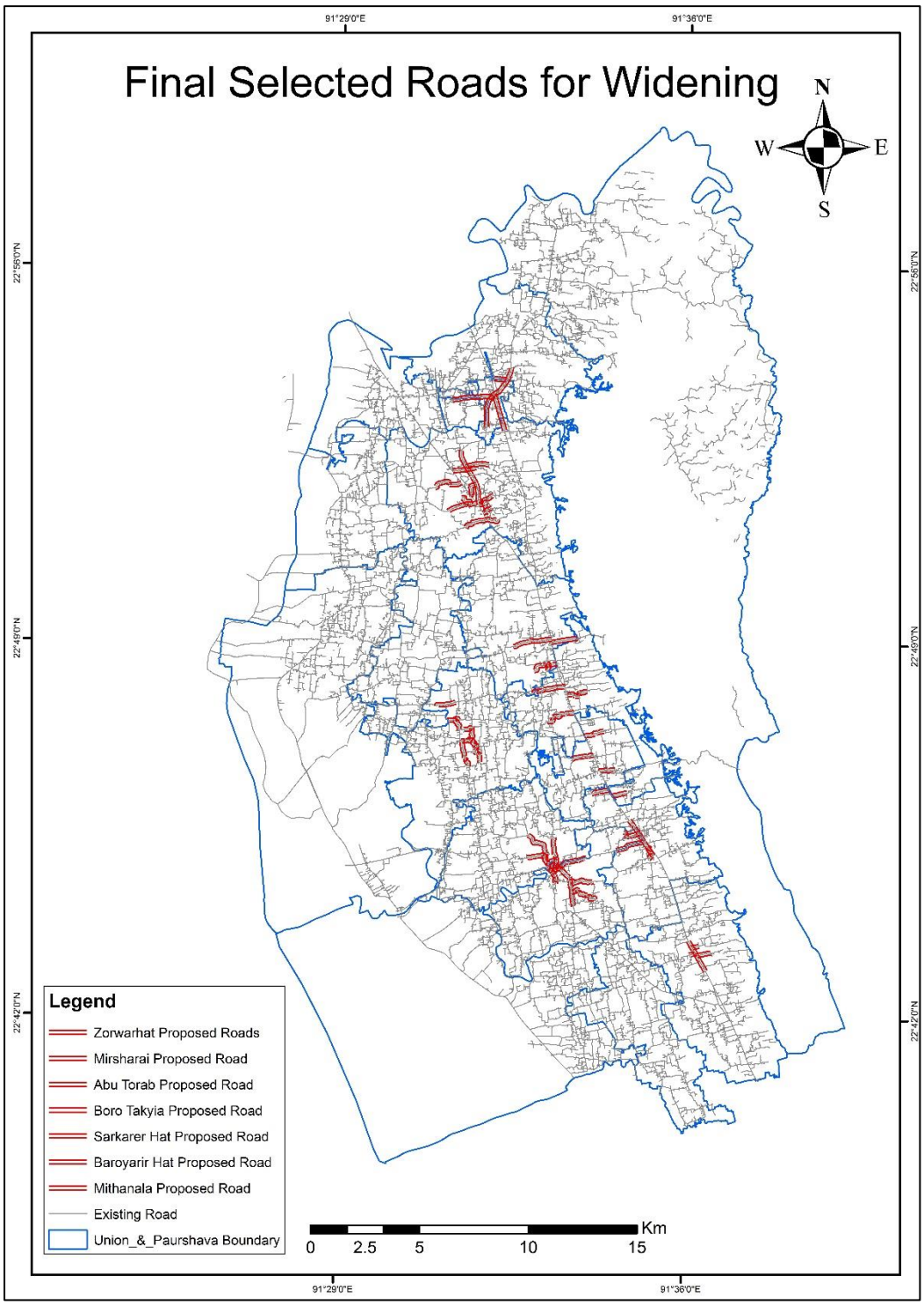


Figure 10 Final Selected Roads for Widening

Chapter 5: Proposed Bypass for Dhaka-Chittagong Highway

5.1 Liking Selected Roads

From the previous chapter, the roads that need to be widen for its high trip concentration can be found. But the map is showing that the roads that needs to be widening has no link with each other. For widening the roads, a method that can be used which is mainly based on buffer. From the previous chapter, area of the most trip density can be found. These areas have been buffered for multiple times until all the areas are being intersected with each other. The roads that are in the intersection points are the roads that are sharing the trips for each trip density area. That means these intersection roads are the main link road between each trip density areas.

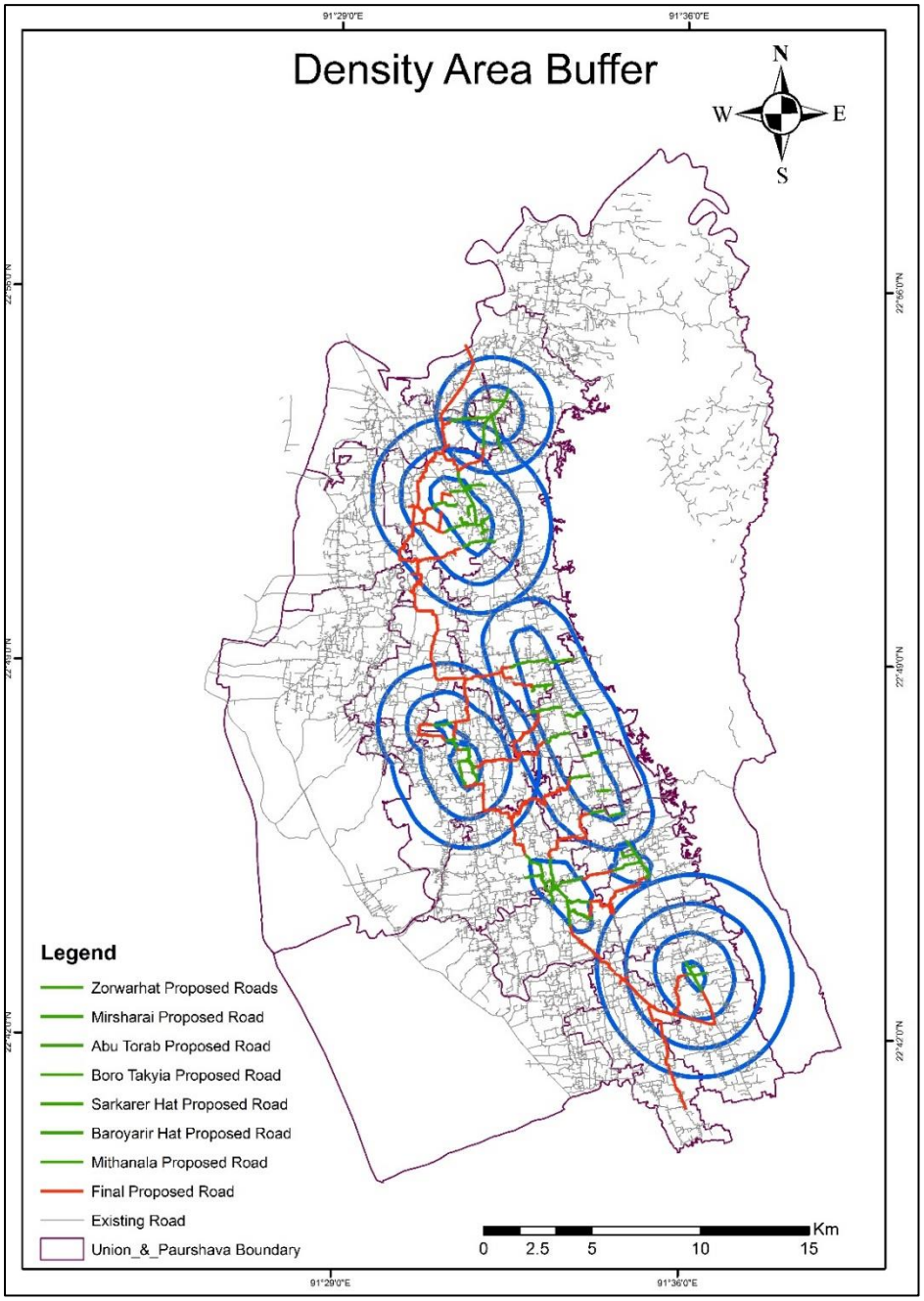


Figure 11 Density Area Buffer Map

From the previous buffer selection, the link road can be found which has been shown in the below map.

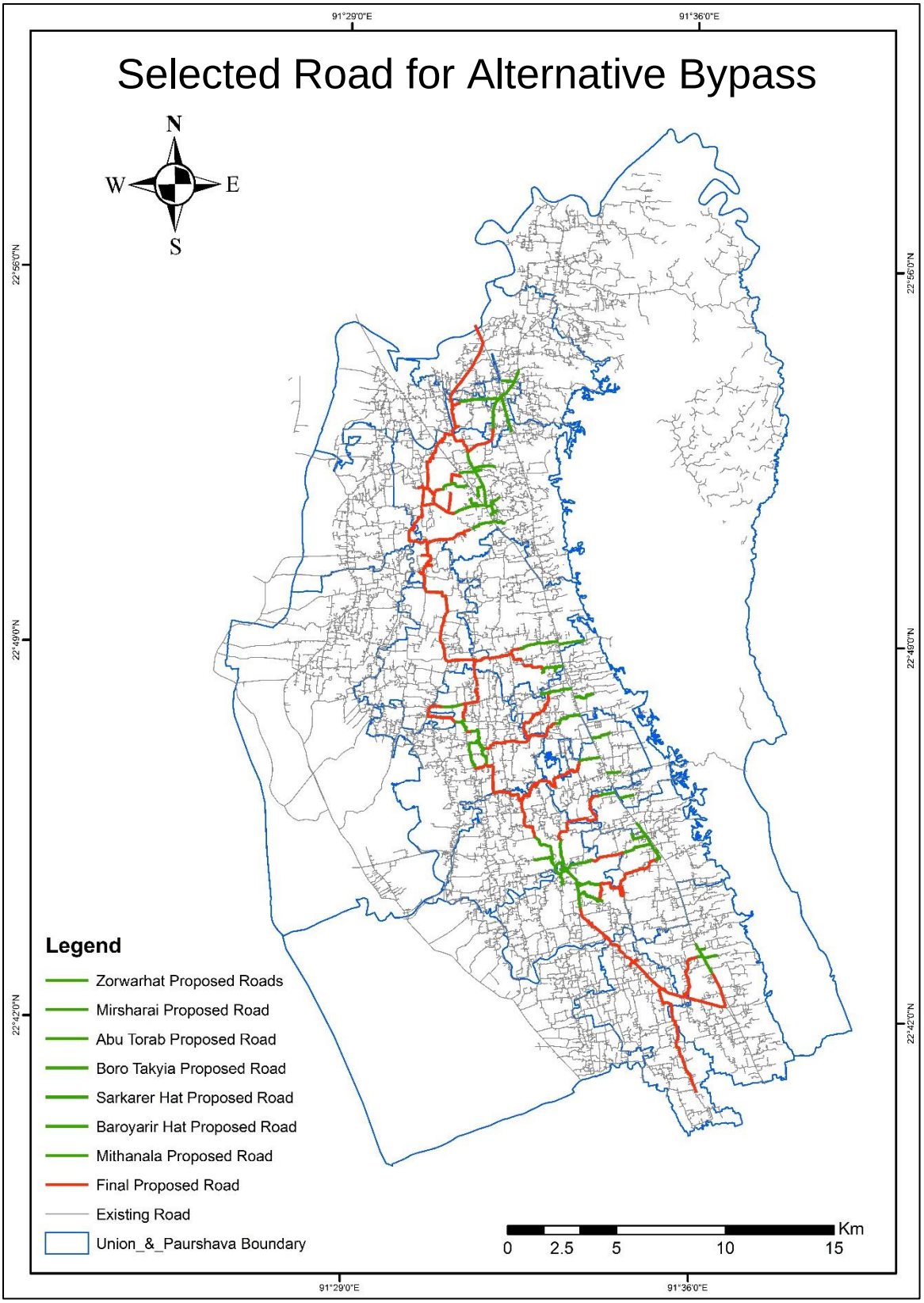


Figure 12 Selected Road for Alternative Bypass

5.2 Reason for Proposing Alternative Bypass

From the density map it can be seen that, the most trip density areas are mainly on the Dhaka-Chittagong highway. Also, some basic reasons for proposing an alternative bypass can be point out.

1. The highway is mainly used for heavy vehicles like Bus and Truck. As a result, it is risky for local people to use this highway rapidly for day to day trips.
2. The major trip density areas that are Borayarir hat, Mirsharai bazar, Boro Takyia Bazar and Sarkerer Hat is right over the highway. These high trip density areas are slowing down the long travel vehicles that are coming from Dhaka or Chittagong.
3. People don't want to use highways for some particular trips like school trips.

5.3 Possible Challenge of New Alternative Bypass

The main impact or challenges of new alternative bypass is number of structure and water bodies that needs to be demolished. As the proposed road will be 60ft wide with 20ft right of way, the number of different type of structures that need to be demolished are shown in the below table.

Structure Type	Number
Administrative	3
Commercial	36
Community Service	21
Education and Research	10
Industrial	11
Health Service	4
Residential	1110
Service Activity	1

These are the number of structures that need to be demolished or removed for the construction of the proposed road. Also 268 water bodies are on the way of constructing the proposed road.

5.4 Proposed Alternative Highway

From the previous map, the idea of a new alternative highway can be found. Linking the roads has given us the roads that are mainly need to be followed to propose an alternative highway. From the previous map, the alternative highway can be proposed which is illustrated in the below map.

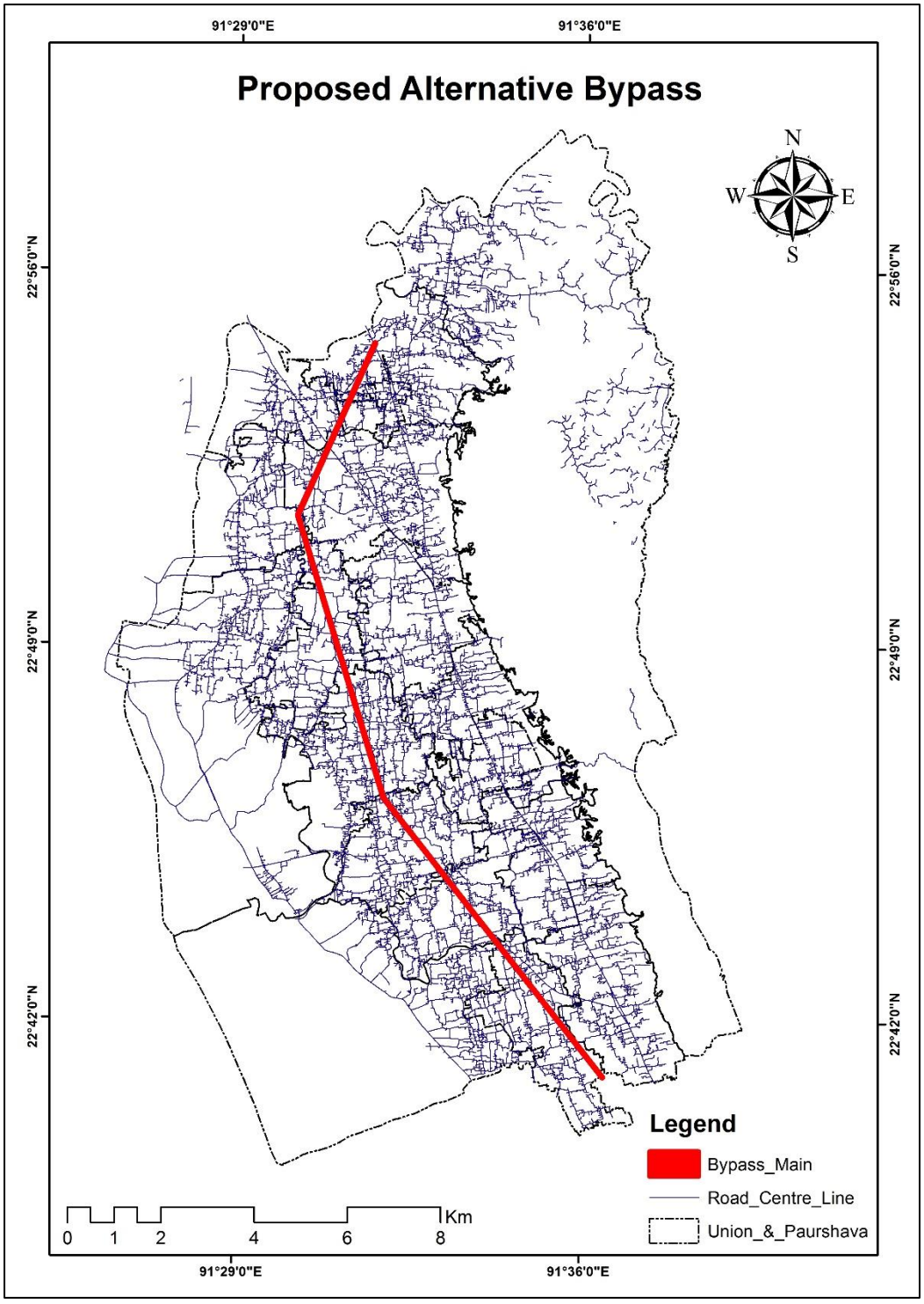


Figure 13 Proposed Alternative Bypass

5.5 Final Proposed Road Network

After the selection of main road that is linking all the high trip density areas, it is necessary to expand the main road in the left and right side. This expansion has been done by the trip density buffer areas that had been shown before. This expansion can illustrate the whole new road network scenario that will serve the whole Upazila and also keep the trip circulation in control.

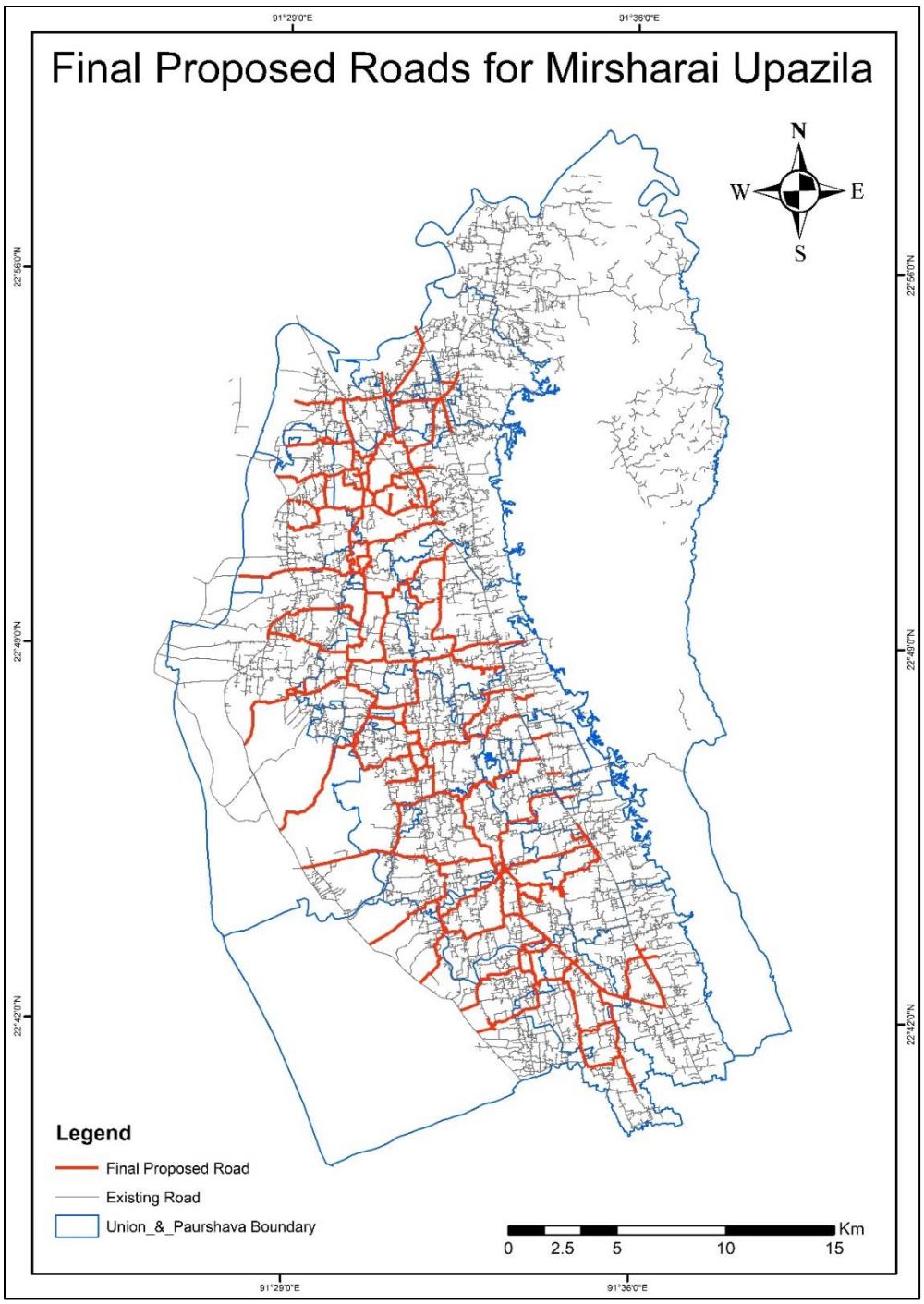


Figure 14 Final Proposed Roads for Mirsharai Upazila

Chapter 5: Service Activity Analysis

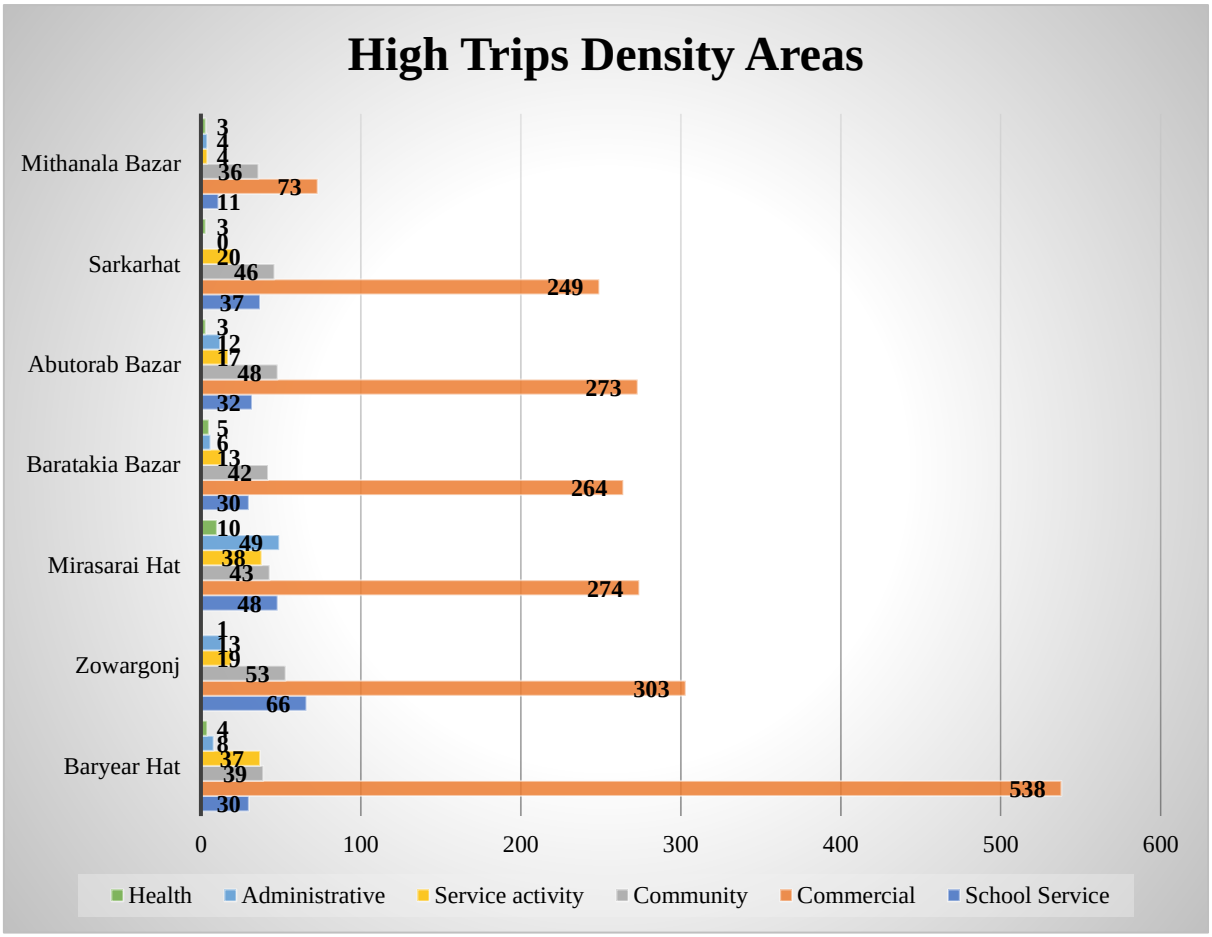
5.1 Existing Service Distribution

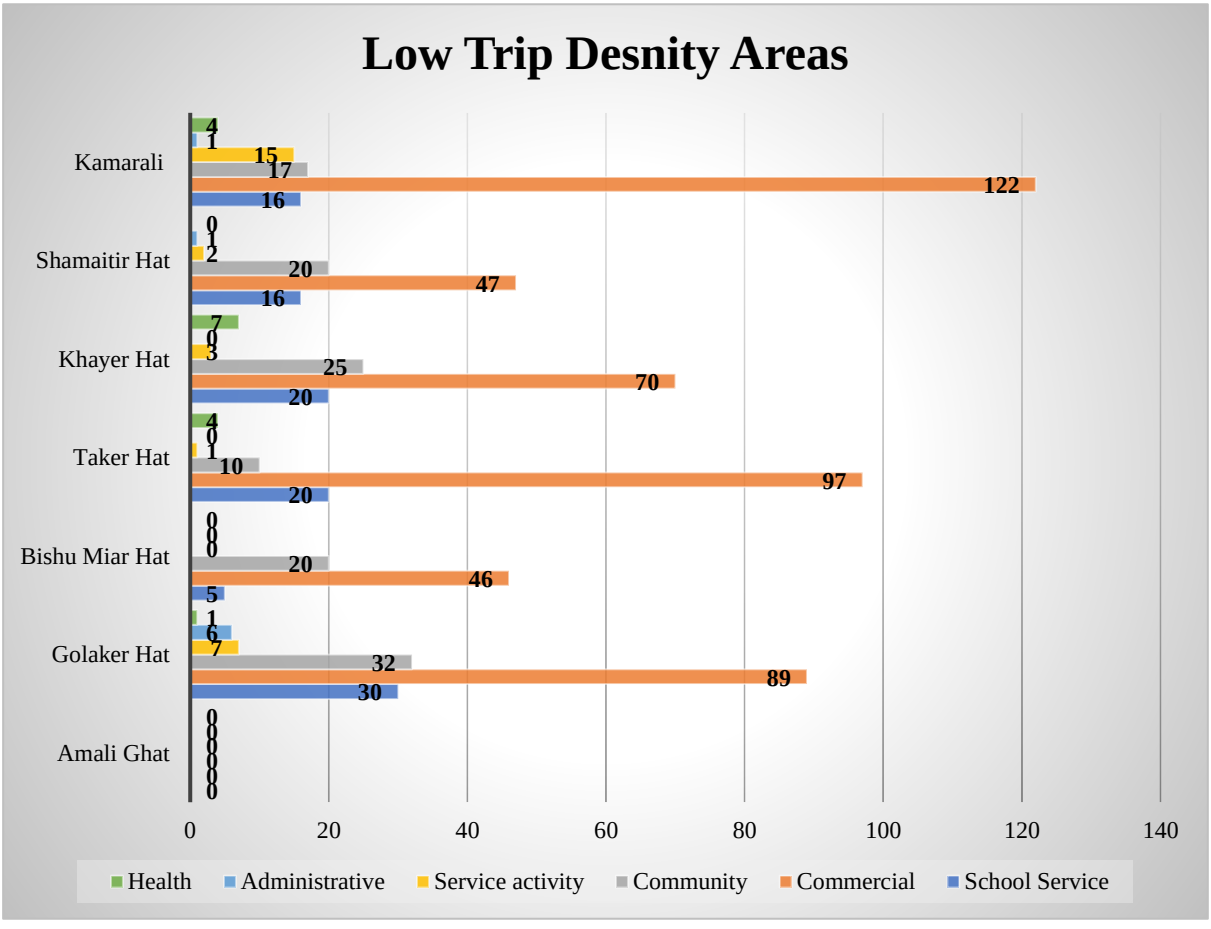
In this part of the report, different services and their condition of distribution have been explored. In this case, the main service activity that has been considered are administrative services, commercial services, community services, education and health services. As the households are the main unit that are using these services, in the first place of analysis, the number of households that have the availability of these services have been identified. In the below table, the percentage of households that are under these service areas have been shown.

Services	Number of Residents	Percentage of Residents (%)
Administrative	84574	57.4
Commercial	144479	98.1
Community	143910	97.7
Education	141151	95.8
Health	75161	51.0

From the table, it can be seen that the health and administrative services are the main lacking of Mirsharai Upazila. But this is an overall scenario. It has been extracted mainly from locational data. 1km area has been considered for service area for each service activities. Then the residential structure that are under these service areas has been identified. This is a very rigid method. Also, as the trip density is available for the whole Upazila, it is much more efficient to analyze the existing condition of high trip density areas and low trip density areas.

For this purpose, the high trip density areas like Baroyarir hat, Zorwargonj, Mirsharai hat, Borotakyia bazar, Abutorab bazar, Sarkarer hat, Mithanala bazar are being used to identify the service distribution of these areas. The primary assumption is that these areas are having too much services rather than other areas that have low trip density. These high service concentrations are causing the high trip density and traffic congestion in that areas. From this analysis, the services that are too much in these high trip density areas can be identified. In the next page, the high trip density area services and low trip density are services have been shown.


High Trips Density Areas
Mithanala Bazar
3
4
4
36
73
11
Sarkarhat
3
0
20
46
249
37
Abutorab Bazar
3
12
17
48
273
32
Baratakia Bazar
5
6
13
42
264
30
Mirasarai Hat
10
49
38
43
274
48
Zowargonj
1
13
19
53
303
66
Baryear Hat
4
8
37
39
538
30
0
100
200
300
400
500
600
Health
Administrative
Service activity
Community
Commercial
School Service


Low Trip Desnity Areas
Kamarali
4
1
15
17
122
16
Shamaitir Hat
0
1
2
20
47
16
Khayer Hat
7
0
3
25
70
20
Taker Hat
4
0
1
10
97
20
Bishu Miar Hat
0
0
0
20
46
5
Golaker Hat
1
6
7
32
89
30
Amali Ghat
0
0
0
0
0
0
0
20
40
60
80
100
120
140
Health
Administrative
Service activity
Community
Commercial
School Service

From the charts, it can be seen that the Baroyarir hat has too much commercial services rather than other high trip density areas. Also, in case of low trip density areas, it can be seen that their commercial service concertation is not even close to Baroyarir hat. There is an outlier that has low service concentration for commercial activity which is Mithanala bazar. But the other services are high concentrated which makes Mithanal bazar, a high concentrated trip density area. For the low trip density areas, the result is the opposite and, in some case, there is no services in some rural market like in Amalis ghat.

5.2 Service Area Distribution

For distributing the services, the main focus is to distribute the services equally among the high trip density and low trip density areas. From the existing service distribution chart, it can be seen that the main service that is dominating this Upazila is commercial services. As a result, in this assignment, the commercial services have been distributed equally for controlling the trip density. From the data it can be seen that the lowest high trip density that can be considered is Sarkarer hat. There are around 250 commercial services in this area which is making it a medium trip density area. But the other high trip density areas are similar with Sarkarer hat except Baroyarir hat. So, it is important to lower the commercial activities of Baroyarir hat close to 250.

In the low-density areas, the main target is to attract the trips in these areas. From the charts, it can be seen that Kamarali has a considerable number of commercial activities but still not attracting enough trips for making it a medium trip density area. As a result, it is important to raise the commercial services around 200 to make a balance for trip density. Possible solution is to distribute the high commercial services to these low trip density areas.

Chapter 6: Conclusions

From the introduction of this assignment, the main target is to identify different structural density and trip density of Mirsahrai Upazila to find out the roads that need to be widen. Also, one of the major findings of this assignment is that the Dhaka-Chittagong highway is having a massive pressure in case of trip density which is hampering the traffic flow of the highway. As a result, one of the major targets of this report is to identify and propose an alternative bypass road which will ease up the pressure for Dhaka-Chittagong highway. Also, in the last part of the report the service area analysis has been conducted to find out the current service distribution for high and low trip density areas. From this finding, a more balanced service concentration has been proposed for Mirsharai Upazila. So, the main findings are:

- ✓ Residential, Commercial and Industrial density to find out the major trip generation and attraction areas of Mirsharai Upazila.
- ✓ Compared BBS 2011 data and existing data to find out major changes.
- ✓ Trip density and high trip density areas of Mirsharai Upazila.
- ✓ Identified road to be widen for controlling the trip density of Mirsharai Upazila.
- ✓ Proposed alternative bypass for Mirsharia Upazila.
- ✓ Current and balanced service distribution of Mirhsarai Upazila.

From the findings, it can be seen that the assignment is fulfilling all of its objectives that had been described in the first chapter.