

ACKNOWLEDGEMENT

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The Study Team

EXECUTIVE SUMMARY

Transportation is considered as the “Infrastructure for Infrastructure” and forms a basis for increasing the access as well as mobility in either as well as urban environment. Urbanization and its associated transportation infrastructure define the relationship between city and countryside, accessibility is one of the major components to improve access of the people to service and facilities through increased mobility.

Increased mobility results in better linkages with the market centers, tourism sector, agricultural production pocket area and help in generating numerous opportunities in the area. With transport sector interventions and planning based on accessibility as well as mobility considerations, Municipal Transport Master Plan (MTMP) for a Municipality offers long-term perspective for the planned development of the roads network in the district. Thus, MTMP of Bhirkot Municipality will support the probable investments in systematic transport system with appropriate guidelines and criteria for rational decision-making process.

Bhirkot Municipality located on Syangja District of Gandaki Province is one of the newly formed municipality announced on 1st Asoj 2072 by Council of Ministers of the Government of Nepal according to Article 80 of Local Self Governance Act 2055 BS. This Bhirkot municipality combines 9 wards which extends from Shankhpur Bhirkot Ward No. 1 in the north to Khatrikhola of Bhirkot Municipality Ward No. 4 in the south and from Bhurungkhola of Bhirkot Municipality Ward No. 3 in the east to the border of Kalikakot Parbat District of Bhirkot Municipality Ward No. 9 in the west. The state of Bhirkot was established between 1475 and 1500 BCE within the medieval Andhikhola civilization. In the history of Syangja, Nuwakot, Satahunkot, Gahraunkot, Bhirkot is considered to be an ancient historical fort and fortress. From Andhikhola to Paschim Khilung, a settlement was established by Jain Khan, and in the cool breeze near Bhirkot, houses, temples, and fortresses were built by the Thakuris.

Municipality road network is conceptualized by considering the functional hierarchy as arterial, sub-arterial and urban roads of various categories such as Class A, Class B, Class C and Class D. Based on technical study and bottom up participatory approach, three Class A roads with length 41.95 km roads and right of way of 14m; sixteen Class B roads with length 65.60 km and right of way of 12m; and Class C roads with total length of 78.14 km and RoW of 9m and the rest D class road have been proposed within the Municipality. After provision of all SRN and DRCN roads within the Municipality each road will be linked with any of the hierarchical road network. A network consists of several links and has their own importance. It is not possible to construct/maintain or upgrade all roads at a time due to various constraints as: time, resources and cost constraint. Thus, each link in a network needs to be prioritized and various intervention need to be taken based on the prioritization. The road network is prioritized separately for different class based on eight criteria, which includes Road Width, Surface type, link to higher road network, municipal special area, population served, and linkage to Indicative potential and Access to SAMT (Service center, Agriculture, Market, Tourism).

The first five-year financial plan is prepared based on the assumption that the second year budget will increase 10% from first year budget. And the further forecast is based on the assumption that about 20% of the total investment must be allocated to road network upgrading and maintenance. The perspective cost of road network is calculated based on the road will be developed full width at the end, i.e. Class A of 14m, Class B of 12m, Class C of 9m and Class D of 6m respectively. The five-year implementation plan is on the basis of budget allocation of 70% - 30% for

construction plus upgrading and maintenance respectively. And, even the construction & Upgrading budget is allocated in ratio of 40%-30%-20%-10% for Class A, B, C and D roads respectively. For the

Year	For Class "A" Roads (40 %)	For Class "B" Roads (30 %)	For Class "C" Roads (20 %)	For Class "D" Roads (10%)	Maintenance (30%)	Total Budget
2079/80	22,482,250	8,992,900	6,744,675	4,496,450	9,635,250	32,117,500
2080/81	25,518,578	10,207,431	7,655,573	5,103,716	10,936,533	36,455,112
2082/83	28,964,975	11,585,990	8,689,493	5,792,995	12,413,561	41,378,536
2083/84	32,876,824	13,150,730	9,863,047	6,575,365	14,090,067	46,966,891
2084/85	37,316,985	14,926,794	11,195,096	7,463,397	15,992,994	53,309,979
2085/86	42,356,810	16,942,724	12,707,043	8,471,362	18,152,918	60,509,728
Total	189,516,423	75,806,569	56,854,927	37,903,285	81,221,324	270,737,747

Preparation of implementation plan one intervention for each road was considered to be intervening. For example, if a road is earthen at present, it will first be upgraded to gravel road and then the next ranked road is provided with intervention and if the budget remains only then it will be upgraded to bituminous/metaled road. At short run all the Class A roads will be upgraded to two lane roads, whereas Class B, C and D roads to single lane roads. At the end of MTMP period all Class A roads will have at least one sort of intervention. A001 and A002 will be upgraded to Gravel. Similarly, five Class C roads will be provided with one level of intervention.

It has been recommended that the proper framework and policies for the implementation of the perspective plans is must and for this it is important to build the capacity of the Municipality and the local organizations and committees. Promotion of Non-motorized travel (walking and cycling) mode and efficient planning of public transportation routes is must. Preparation of MTMP is the first effort for the planned development of the municipal area. This is an opportunity for implementing a sustainable transport system in the Municipality. For effective MTMP, it need to be compatible with comprehensive town planning and land use policy.

ACRONYMS/ABBREVIATIONS

DDC	District Development Committee
DOLI	Department of Local Infrastructure Development
DTMP	District Transport Master Plan
GIS	Geographic Information System
GPS	Global Positioning System
Ha	Hectare
HH	Household
IDPM	Indicative Development Potential Map
Km.	Kilometer
MIM	Municipal Road Inventory Map
Min.	Minute
MoFAGA	Ministry of Federal Affairs and General Administration
MRCC	Municipal Road Coordination Committee
MTMP	Municipal Transport Master Plan
MTPP	Municipal Transport Perspective Plan
NMT	Non- Motorized Transport
O-D	Origin and Destination
PCU	Passenger Car Unit
PT	Public Transport
ROW	Right of Way
Sq. km	Square Kilometre
SRN	Strategic Road Network
ToR	Terms of Reference
VDCs	Village Development Committees
Municipal	Municipal

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CHAPTER ONE: INTRODUCTION

This chapter briefly explains the background and study area of the study along with the scopes and objectives associated with the preparation of Municipal Transport Master Plan.

1.1 Background:

Transport, which is simply, defined as movement of people and goods covering some geographical space to improve people's access to services. It not only increases the accessibility to the remote places, but also increases the mobility scenario, and hence results in better linkages with market centers/agricultural production pocket areas and other opportunities in the district as well as Municipality.

Transport facilities help in developing access with the -urban linkages. Road accessibility can reduce isolation, stimulate crop production and marketing activities, encourage public services and help to transfer technology. Road building has been seen to bring about notable enthusiasm and visible changes in life. Road infrastructure is considered as “the infrastructure for infrastructure”. However, in absence of notable criteria and rational guidelines, road construction is carried out in adverse manner resulting in haphazard use and wastage of limited resources.

Bhirkot Municipality located on Syangja District of Gandaki Province is one of the newly formed municipality announced on 1st Asoj 2072 by Council of Ministers of the Government of Nepal according to Article 80 Of Local Self Governance Act 2055 BS. This Bhirkot municipality combines 9 wards which extends from Shankhpur Bhirkot Ward No. 1 in the north to Khatrikhola of Bhirkot Municipality Ward No. 4 in the south and from Bhurungkhola of Bhirkot Municipality Ward No. 3 in the east to the border of Kalikakot Parbat District of Bhirkot Municipality Ward No. 9 in the west.

Municipal Transport Master Plan (MTMP) is primarily a reflection of existing transport infrastructure situation and future potential ones in consistent with the resources available in the Municipality. It offers long term perspective for the planned development of the roads network in the Municipality. The MTMP preparation strongly advocates meaningful participation of all key stakeholders of municipal roads in the planning process, which makes MTMP more acceptable and ensure ownership. A comprehensive Municipal Transport Master Plan (MTMP) is being developed in the Municipality to support investments in transport development with appropriate guideline and criteria for rational and transparent decision making process. MTMP becomes an authoritative document of the district to negotiate possible grant and loan assistance from donor agencies. Proper planning and sustainability are the key issues for development of municipal transport network.

1.2 Objectives

The prime objective of this study is the preparation of Municipal Transport Master Plan (MTMP). The planning approach is participatory and bottom-up from the settlement level. The specific objectives of the MTMP as indicated in ToR are mentioned below:

1. Prepare the Municipal road Inventory Map (MIM) of all road networks.
2. Identify the major road networks linking the municipality with the surrounding areas.

3. Analyze the present mobility and accessibility situation.
4. Identify and prioritize the interventions based on mobility and accessibility situation.
5. Develop scoring criteria and its approval from Municipality.
6. Preparation of Municipal Transport Perspective Plan for transport services and facilities
7. Preparation of physical and financial implementation plan of prioritized roads for the MTMP period.
8. Prepare a five years Municipal Transport Master Plan (MTMP).

1.3 Scope of work:

The scope of this work is summarized as:

a. Analysis of accessibility and mobility status of the municipality:

Carrying out various surveys to gain data on accessibility and mobility situation that includes their travel patterns, questionnaire surveys and origin-destination survey.

b. Assessment of public transportation condition.

Data on different public transportation routes and their operation characteristics, which operate within the municipal area and to other adjoining area is studied.

c. Assessment of safety status and issues:

Road safety status and issues is to be accessed. Possible interventions to make the roads safer are proposed and recommended.

d. Preparation of Municipality Inventory Map (MIM) of existing roads:

MIM linking to strategic road networks and all other roads is prepared. It has include the road names, total length and width, surface type, existing condition, Right of way, vehicular traffic and pedestrian traffic flow etc.

e. Collection of demands for New/Upgrading/Rehabilitation transport linkages from Wards/Settlements:

Data regarding the construction, maintenance or rehabilitation of roads according to the existing condition and demand from ward level meeting and actual condition of all the linkages from road inventory survey is noted.

f. Scoring criteria:

Scoring criteria to screen and prioritize all potential interventions for proper allocation of limited budget is developed and approved by the municipality.

g. Preparation of perspective plan of interventions of services and facilities: All the identified interventions is screened and rated on the basis of approved criteria and forwarded to Municipality council meetings and finally shown in GIS maps.

h. Preparation of realistic physical and Financial Implementation Plan of Prioritised Roads for the MTMP period:

Information on the resources required for construction/rehabilitation, necessary funding allocation for next five years and appropriate proportion to be spent on ongoing roads and new interventions proposed in next year from municipality is assessed.

i. Preparation of Municipal Transport Master Plan (MTMP):

MTMP is prepared with due consideration to existing and projected future situation. Base scenario of existing road and transport network based on O-D survey, projected transport infrastructure network and management plan is prepared.

j. Medium term and long term planning:

The scope of work demands a detailed work plan for five years period (short term). Forecast/estimate of the demand for medium term (10 years) and long term (20 years) is done and recommend a framework to guide future interventions and planning processes.

1.4 Study Area:

Bhirkot Municipality located in Western region of Nepal is located in Syangja district. There are total of 9 wards in Bhirkot Municipality spread over 78.23 sq.km. Its headquarter is located at Bayarghari which is at 730m above sea level. It is located at distance of 255.1 km West from Kathmandu and 54.3 Km from Pokhara. The total population of this municipality is 25583. The state of Bhirkot was established between 1475 and 1500 BCE within the medieval Andhikhola civilization. In the history of Syangja, Nuwakot, Satahunkot, Gahraunkot, Bhirkot is considered to be an ancient historical fort and fortress. From Andhikhola to Paschim Khilung, a settlement was established by Jain Khan, and in the cool breeze near Bhirkot, houses, temples, and fortresses were built by the Thakuris.

Established: 01-06-2072

Geographical location Total area: 78.23 sq. Km.

Distance from Kathmandu: 255.1 Km west.

Total Population: 25583

It is bounded by Biruwa Municipality and Putalibazar Municipality on the east, Parbat District on the west, Arjunchaupari Municipality and Putalibazar Municipality on the north and Waling Municipality on the south.

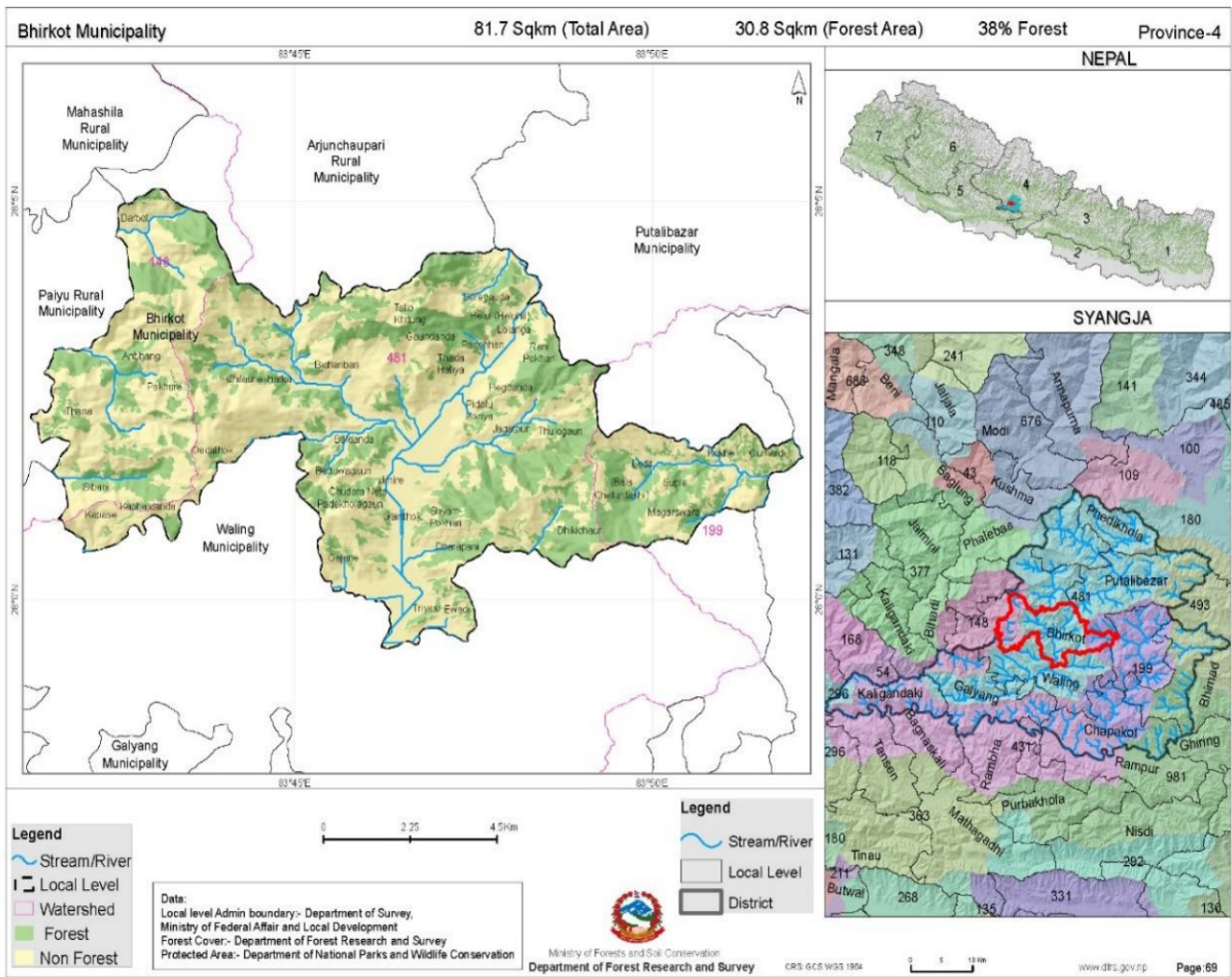


Figure 1 Bhirkot Municipality Map (study area)

1.5 Limitation of Study:

The limitation of the study are:

1. Lack of Comprehensive Town Development Plan, Proper Land Use Policy and Drainage Network Master Plan, which could have affect the future overall development pattern, and hence future development of these policy need to be based on the proposed MTMP.
2. Lack of VDC level Census data leads to calculate population growth rate based on 2001 and 2011 data.
3. Bottom - Up Participatory approach along with lack of proper financial policy for land acquisition leads some difficulty in MTMP planning process.

1.6 Organization of Report

This final report, which in the summarization report of all the work, both field and table work is summarized in eight chapters. Chapter one basically deals with introduction aspect, covering background, scope and objectives along with limitation. Chapter Two deals with the methodology adopted while data collection and data analysis process. Chapter Three covers the existing situation and scenario of the Municipality, which includes the socioeconomic, household and trip characteristics along with road services and facilities within the locality. It also covers how these factors are contributing in the development. Indicative Development Potential of the Municipality has been discussed in Chapter 4. Likewise, Chapter 5 deals with formulation of road hierarchy along with detail of various classes of roads. Chapter 6 deals with Prioritization criteria and prioritized road network. Implementing strategy and financial plan has been discussed on Chapter 7 and finally chapter 8 deals with the conclusion and summary aspects.

CHAPTER 2: METHODOLOGY

2.1 Approach:

MTMP will help to assist the planning of such roads to fulfill the stated objective. Better planning is incomplete without relevant quality data and quality data can only be acquired by use of properly selected survey methods. The chapter deals with the methodological framework adopted for data collection covering all used survey method, sampling techniques, quality and quantity of data along with data processing, analysis and presentation methodology.

Municipality Transport Master Plan has been prepared using participatory bottom-up approach and differs from conventional practices of top down approach. Techno Political interface has been incorporated in the planning process, where active participation from representatives of political parties, line agencies, and Municipality officials is crucial. The Municipality Road Coordination Committee (MRCC) has been constituted as authorized legislative body of Municipality.

2.2 Methodological Framework:

The study starts with preliminary planning or desk study where basic background of municipality is studied with help of secondary data including census data, GIS data. The study got acceleration with formation of MRCC and inspection report. Various field surveys were carried out with objective of collecting primary data on transportation network, trip characteristics and service facilities. Along with the primary data, demand for various transportation project (construction/upgrading/maintenance) were obtained from each wards. Also, potential areas/location for various facilities were also identified based on interaction with local people and MRCC. The scoring criteria for prioritizing road network were identified based on ToR and were approved by municipality. Then, the hierarchy of road were purposed and perspective plan of various intervention were purposed and were analysed based on available fund and finally physical and financial implementation plan of prioritized roads for MTMP period. After analysis, the study will come up with potential roads, that need immediate intervention and roads that need to be given consideration for effective future planning.

All the above mentioned strategy adopted for data collection, processing and analysis is summarized in the following chart.

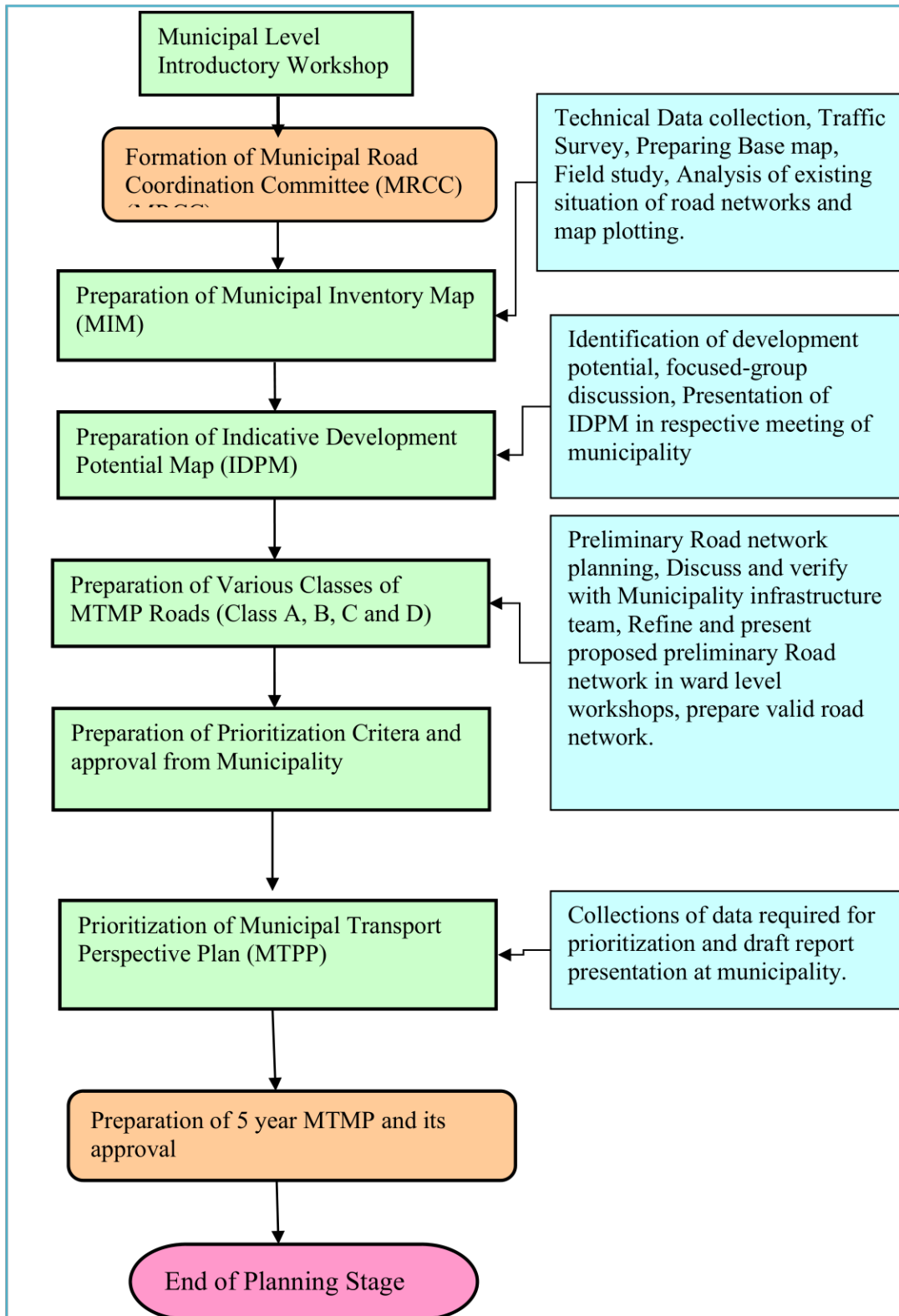


Figure 2 Methodological framework for planning MTMP

2.3 Secondary Data Collection

Any sorts of data that were collected from secondary sources are called secondary data. These data were collected from annual report published by district level offices and consultation with various

concerned stakeholders. The information about demographic data of Municipality, various maps showing service centers, transport infrastructure inventory, past plans and sector study reports, sector standards and policy targets were collected from the secondary sources, which includes Bureau of Statistics, Survey Department, Local NGOs, line agencies, DCC, Municipality etc. Digitized topographic maps, administrative map of Municipality, strategic road network map prepared by DoR, etc. were some other secondary data that were used during the study.

2.4 Primary Data Collection:

Primary information on present household and trip characteristics, traffic characteristics, existing accessibility and mobility level of settlements, prioritized road network required for each wards are obtained via various reliable methods. Tracking of the existing road network along with detail information of its width, surface type and possible intervention required for the effectiveness of services is also carried out. Following primary data collection are adopted for data collection methods.

Road inventory survey was conducted to collect data on its condition of road, road linkage, road safety status and issues that need to be highlight. It helps in field validation of base maps and also assists in preparation of road inventory map, nomenclature and coding of the road linkages and to propose various interventions.

Road Demand survey comprised of interaction session with the members of ward elected body followed by asking them to fill up demand survey form, which includes demand of new facility or interventions to improve existing roads based on priority.

Household questionnaire method of Origin and Destination study was conducted in all wards of Bhirkot Municipality, to collect data on socio-economic status, HH characteristics and trip making characteristics. The socio-economic details include monthly income, occupation and educational status and vehicle ownership level. Trip characteristics include origin & destination of trip, trip purpose and mode, trip time and accessibility to nearest bus stop.

2.5 Application of GIS for Preparation of Maps:

GIS software has been used for the preparation of different maps and database of the municipal roads and other details. GIS maps prepared for Municipal Transport Master Plan (MTMP) can be summarized in the following points.

a. Preparation of map

Shape files for Ward Boundary, Municipal/ Municipal, District Boundary and Development Region Boundary was obtained from Department of Survey. Ward Boundary of each Municipality were also generated in similar manner. Satellite image of the respective Municipality was obtained using Image Capture Software and Google Earth. A ".kml" file was used to obtain an enclosed area for image capture using Google Earth. The image was captured in spatial reference of WGS 1984. After the image was captured, layers for land use, road, buildings, etc. were digitized. Then, WGS 1984 was transformed into Modified Universal Transverse Mercator (MUTM) in three regions namely MUTM 81, MUTM 84 and MUTM 87.

b. Cartography

After field verified data was entered then map preparation was done. All the maps are prepared in Arc GIS version 10.5. MUTM 84 was used as projected coordinate system. All maps are prepared in a scale in the multiple of 1:25000. Symbols for Road classes have been used as described in Terms of Reference (ToR) provided by MoFAGA. Other symbols are standard and are used so that the whole map expresses what it is intended to.

2.6 Preparation of Visionary City Development and Indicative Development Potential Map (IDPM)

IDPM is basically the indication of the existing and potential market/service centers and high value cash crops, agro-based industries and tourism based areas. Similarly, visionary city development plan also governs how the city is planned to be developed in future and is based on the present and foresight vision of the Municipality. Visionary City development plan is also discussed in front of MRCC and Municipality and the idea of MRCC and Municipality is incorporated in the preparation of IDPM and Visionary City Development Plan.

2.7 Scoring Criteria for Prioritization

A network consists of several links. It is not possible to construct all roads at a time due to resource and time constraint. Therefore, each link in a network needs to be prioritized. After developing a municipal level network, the cost estimate of the road is prepared. Existing population within the zone of influence, present road demand, future potential route, accessibility situation, land use pattern, environmental and social safeguard, proximity to the market/service centers, religious and tourism places were taken as the indicators for prioritization. The scoring criteria is finalized after rigorous study and set in front of Municipality and MRCC for its approval and had been approved with little bit of modification.

CHAPTER THREE: MUNICIPALITY PROFILE

The chapter deals with the present condition and scenario of the Municipality Socio-economic, trip, land use and road network characteristics within the Municipality. The basic data source of the analysis is the collected primary data.

3.1 Population Status;

Present and projected Socio-economic and demographic status play a vital role in shaping the cities. Population, household structure and their characteristics are some of the major pillar for better understanding of the locality. Population of Bhirkot Municipality 25583 where 10984 are male and 14,599 are female with sex ratio of 75.24. The household size is 6083HH (Census 2011) with average HH size of 4.21 in an area of 78.23 Sq. Km. (Department of Survey). The population density of Bhirkot Municipality is 490 people per sq. km. The ward specific population and population density (to the nearest whole number) is summarized in Table 1.

Table 1 Population status in the Municipality

WARD NO.	POPULATION	AREA(SQ KM)	POPULATION DENSITY
1	3649	9.66	378
2	2949	6.02	490
3	3546	9.99	355
4	1382	4.66	297
5	3130	7.68	408
6	2114	6.5	326
7	2210	7.19	308
8	3666	17.2	214
9	2937	9.33	315
TOTAL:	25583	78.23	

Based on Table 1, we can clearly see population density lies in the range of just 214 person per sq.km. to 490 person per sq.km. Less population density is witnessed in Ward 8 having area of 17.2 sq.km, whereas highest population and population density is witnessed in the ward 2 with area of just 6.02 sq.km.

3.2 Socio-economic and Demographic Status

Based on HH data observed in field, the population have been categorized based on gender, educational status, caste have been summed up as below.

The status of the Municipality is governed to large extent by the educational and occupational status. Higher the educational level of the residents, high will be the level of development. Based on HH survey, Almost 50% of people have completed or are perusing school level education.

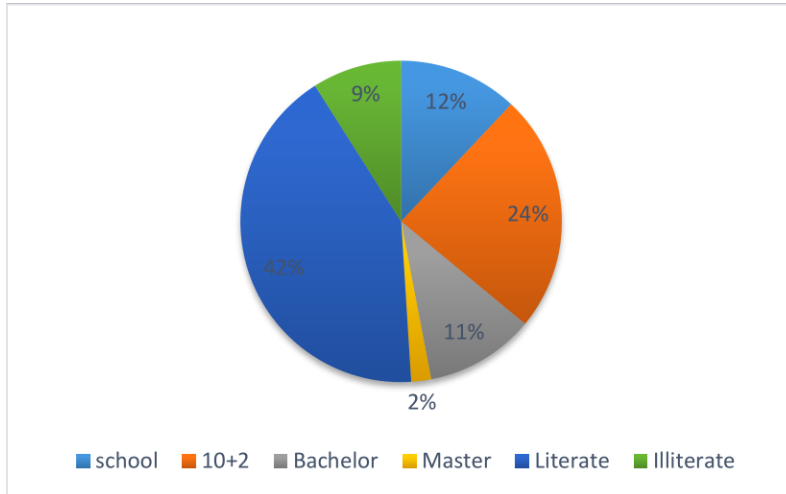


Figure 3 Education status in percentage

This Municipality is inhabited by people of different castes. People from all over the nation are settled in this Municipality and there is also hodgepodge in the employment criteria too as shown by the below mentioned figure in terms of percentage in which Agriculture (53%) takes the major share followed by students while unemployed being the least.

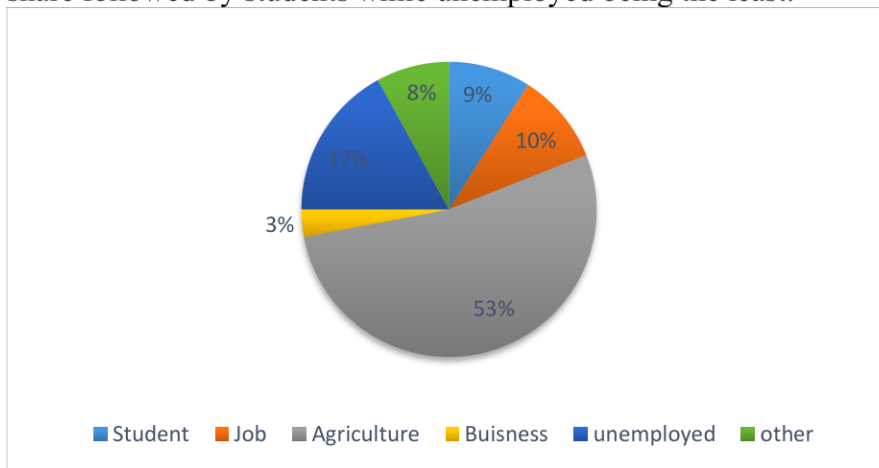


Figure 4 Occupational Status in percentage

3.3 Household Characteristics:

Household is defined as those who dwell under the same roof and compose a family, i.e. in simple words it's can be termed as family (Merriam Webster Dictionary). Any journey undertaken by any mode/means of transport having a definite origin and destination and having some sort of purpose is called trip. Trip characteristics differs from locality to locality and even household to household.

3.3.1 Income and Vehicle ownership

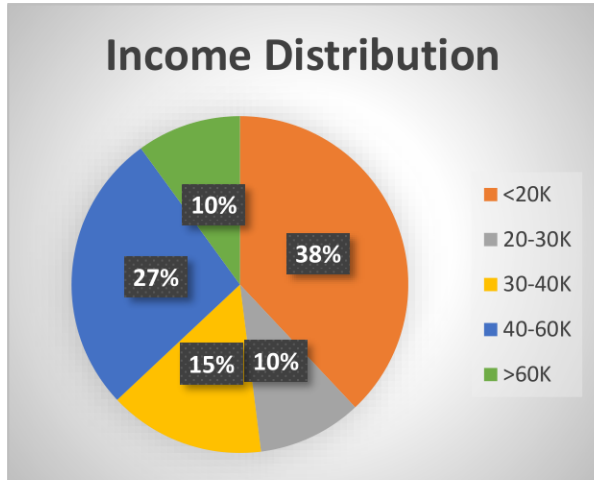


Figure 5: Income distribution in percentage

Annual or monthly earning of each household has significant role in the trip characteristics and finally on the overall planning aspects of the locality. Higher the income, people tends to live luxurious life i.e. tends to have their own vehicle and so on. The income characteristics are aggregated in household level, which revealed that majority of them (38%) are at low income status (monthly income less than NRs. 20,000) and few of them (27%) have income level more than 40,000. Income level also affect vehicle ownership. Most of the people with HH income less than 20,000 own cycle and as income increases ownership of motorbike increases.

Vehicle ownership has a great role in trip making. Higher the number of personalized vehicles, higher will be the number of shopping and social/recreational trips. Motor-Cycle ownership proportion was found to be too high. Based on sample data, it was found that almost half HH has just Motorcycle only. Around one third household owned other type of Vehicle (1 Auto and 1 tractor). This proportion is expected to rise in future as income level increases. The vehicle ownership level of sampled HH is summed up in chart 4.

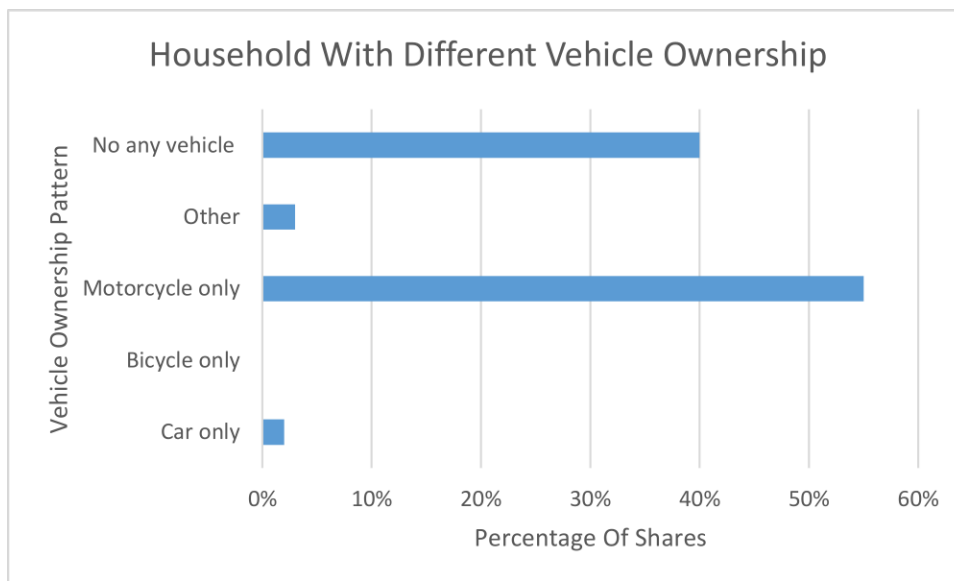


Figure 6 Household with different vehicle population

3.4 Trip Characteristics:

Any journey undertaken by any mode/means of transport having a definite origin and destination and having some sort of purpose is called trip. Various characteristics are used to define trips; such as trip purpose, trip mode, trip time and so on. Trip characteristics differs from locality to locality and even household to household.

3.4.1 Trip Purpose and Mode:

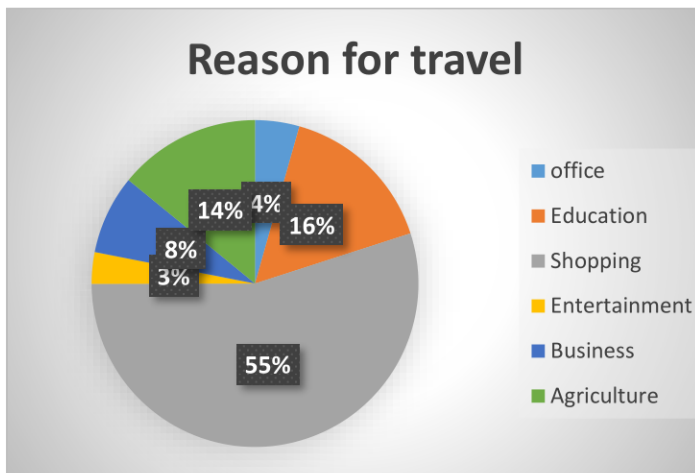


Figure 7 Reason for travel in percentage

Trips are undertaken for various purpose, some trips are compulsory which involves trips made for educational and work purpose, whereas trips made for shopping or recreational might be regarded as optional trips, which can be managed. Based on the respondents, shopping trips covers around half, education covers one third of total trips and other type of trips just contribute one fifth of trips. (Refer Chart 5). Summarizing, just more than half trips are compulsory trips, whose timing can't be alter. These trips are basically done during morning or evening peak time, whereas timing of other trips can differs.

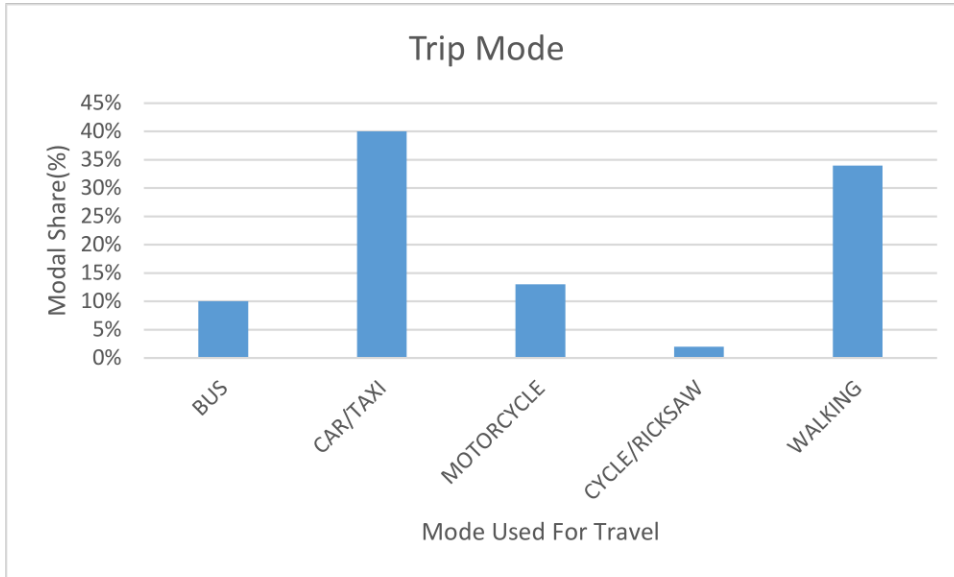


Figure 8 Mode used for travel in percentage

Different means of transport are used for different trips. Based on sample, walking, public transport (PT) like Buses and Taxi and Motor-Cycle were found to be the most dominant modes as highlighted in Chart. In the Hill terrain the only use of non-motorized travel (NMT) mode includes walking and there is negligible proportion of usage of cycling, rickshaw, cart,

Active mode transport are essential mode of sustainable transportation system, as they provide access to all economic level of people along with reducing demand on motorized vehicle, reducing energy consumption and increasing average life expectancy. There is variation in abundant mode of each ward as highlighted in Table 2.

Table 2 Ward Specific Dominant Trip Purpose and Trip Mode.

Ward	Trip Purpose				Trip Mode			
	First Priority		Second Priority		First Priority		Second Priority	
	Purpose	%Share	Purpose	%Share	Purpose	%Share	Purpose	%Share
1	Shopping	56	Education	32	Walking	88	Motorcycle	8
2	Shopping	50	Education	7	Walking	50	Car/Taxi	29
3	Shopping	54	Education	7	Bus	37	Motorcycle	34
4	Shopping	60	Education	14	Car/Taxi	67	Bus	17
5	Shopping	39	Education	21	Walking	41	Car/taxi	33
6	Shopping	55	Education	18	Car/Taxi	64	Motorcycle	26
7	Shopping	100	Education	0	Bus	67	Walking	33.33
8	Shopping	44	Education	15	Walking	52	Car/Taxi	48
9	Shopping	62	Education	25	Car/Taxi	74	Bus	15

Detail analysis reveals that shopping trips, share about 40 to 60% followed by education trips, which accounts for 10 to 35% of total trips made in each wards. Walking is most used mode for trip in 1, 2, 5 and 8 wards. Public transportation mode like Bus and Taxi doesn't lies within top two mode in Ward 1 and thus these wards need to take some step towards building proper and adequate public transport network. Agricultural trips are undertaken by walking, whereas education trips via public transport and walking. Bike carries a significant proportion for social and business trips. Walking is the predominant mode in shopping and recreational trips (Ref. fig 8 and 9).

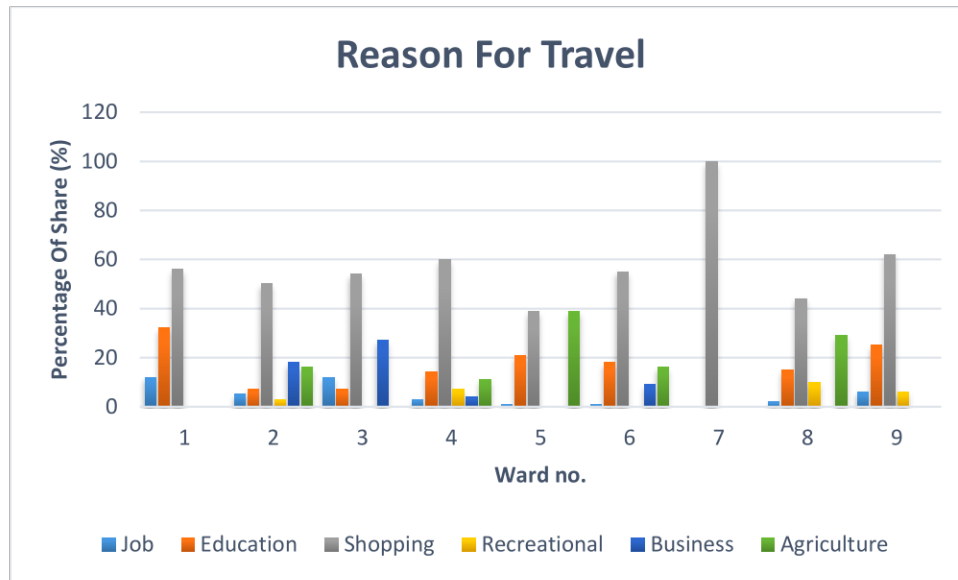


Figure 9 Ward wise reason for travel in percentage

Trips are undertaken for various purpose, some trips are compulsory which involves trips made for educational and work purpose, whereas trips made for shopping or recreational might be regarded as optional trips, which can be managed. Based on the respondents, shopping trips covers around half, education covers one third of total trips and other type of trips just contribute one fifth of trips. Summarizing, more than half trips are not compulsory trips, whose timing can be alter. The trips like educational and job purposes are basically done during morning or evening peak time, whereas timing of other trips can differs.

3.4.2 Origin and Destination Study:

Trip, simply called journey is the process of going from one place to another with some purpose. Thus, trip is characterized by origin (starting point) and destination (ending point). To be more precise, trip are characterized by trip production and trip attraction. Home end is always trip production and the location which attract the produced trips for various causes (job, shopping, and entertainment) are attraction end of trips. Most of the trips are home based trips with different destination. Trip chaining, going at various destination points in the form of chain in a single day, was rarely found in the study area.

A *Desire path*, also known as a desire line usually represents the shortest or most easily navigated route between an origin and destination. It is use as a basic of importance, thicker the line, higher with be the importance of the route. In urban planning, the concept of desire paths can be used to analyse traffic patterns in any mode and route of travel. Similarly, *O-D matrix* summarized the total trip originating from a ward and terminating to a ward. Trips are produced from each wards and are attracted to various wards within the municipality or outside municipality.

Bagrebajar, Baljyoti school, Bayarghari, Bayarghari Sapange, Dadakot Tol, Dathum Secondary School, Deurali, Health Post , Helu, Janasewa School, Maidan, Mandush, Pakan Dhalkebar , Raniraha School, Waling are some of the usual destination.

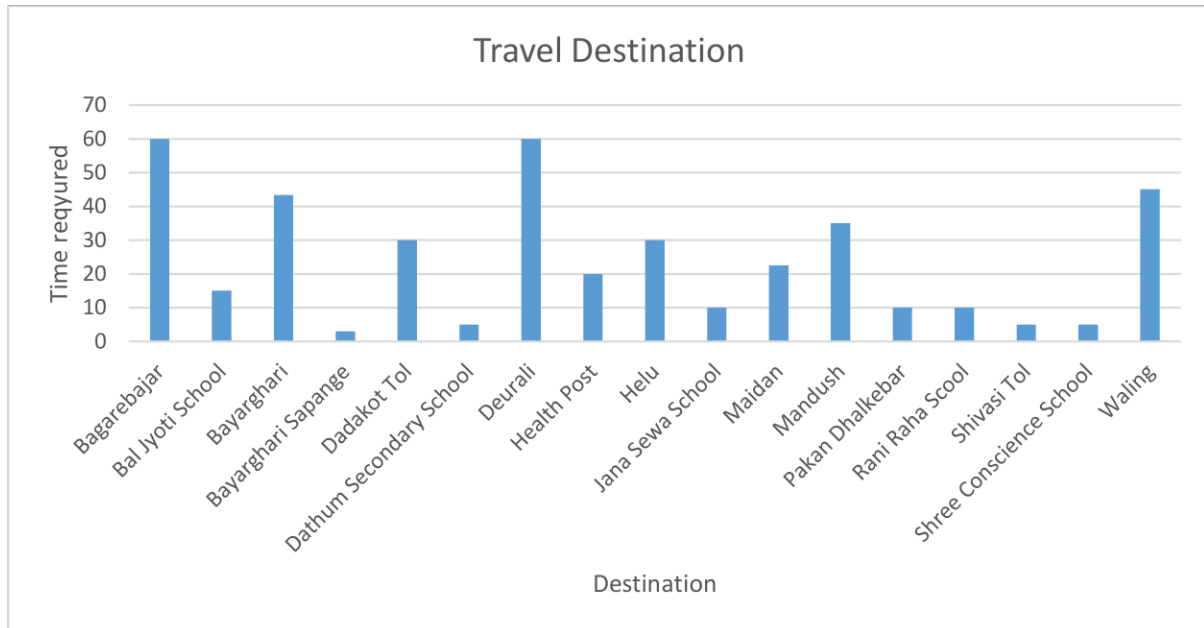


Figure 10 Frequent Travel Destination

There are five major destination as highlighted in , which accounts more than 90% of the total trips as highlighted in Table 2 and Figure 10 below.

Table 3 Destination and trip purposes in percentage

Destination	Trip Purpose						Total Trips	Share (%)
	W	E	S	R	B	A		
Bayarghari	23	27	95	3	10	12	170	79
Waling	0	7	13	1	0	0	21	9
Pakan Dholkebar	0	2	0	0	0	3	5	4
Dadakot Tol	0	0	5	1	0	0	6	3
Maidan	0	5	0	0	0	0	5	2

W= Work, E= Education, S= Shopping, R= Recreation/Social, B= Business, A= Agricultural

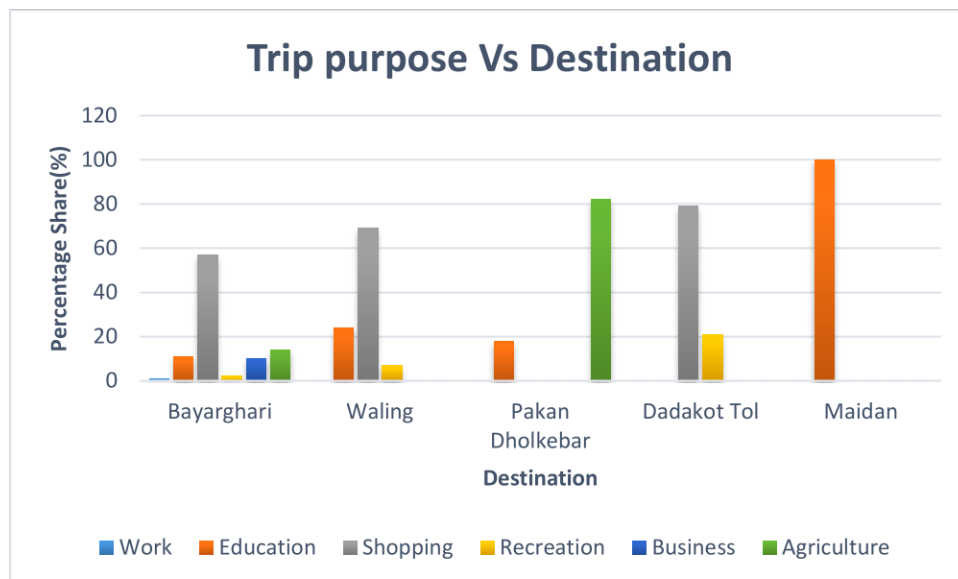


Figure 11 Trip purposes in major destinations

Bayarghari attract about 79% of total trips, contributing share of education and shopping trips. Waling and Pakan Dholkebar occupy the second and third spot in the list of major destination. Waling and Dadakot Tol is famous for shopping followed by school whereas Maidan trip generation accounts for Education only. Pakan Dholkebar have major trip purpose as Agriculture.

3.5 Accessibility and Mobility Scenario:

Accessibility refers to the ability to reach desired goods, services, activities and destinations. Provision of small trail roads, provision of public transportation and proper road network with last mile connectivity help to ensure accessibility. Though walking is dominant mode, better accessibility and mobility is achieved via public transportation network and their frequency. Average time required to reach the bus stop is one of the criteria to set up priority for public transportation improvement, which is summed up in Table 4. Ward 4 and 6 has poor public transportation network as the average time to reach the stop is more than 15 minute.

Table 4 Ward specific time to reach the nearest destination

Ward	Average time to bus stop (Minute)	Maximum Time (Minute)	Minimum Time (Minute)	Standard Deviation (Minute)
1	3	10	1	3.5
2	11.5	30	1	12
3	4	10	2	3
4	17	45	1	15
5	3	7	1	2.5

6	16	30	5	13
7	5	5	5	0
8	9	15	5	5
9	3	5	1	2

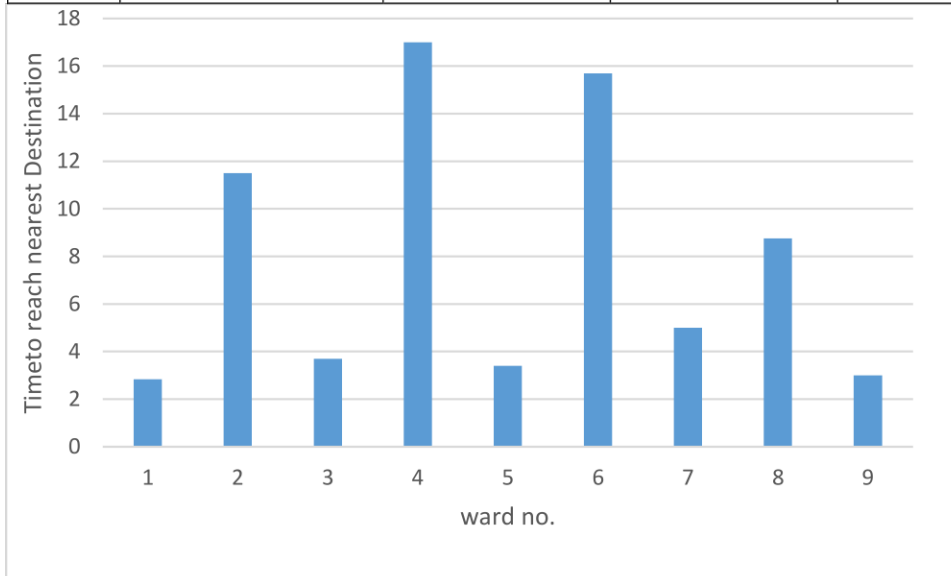


Figure 12 Ward wise time to reach nearest destination

3.6 Road and Traffic Scenario:

As elsewhere in Nepal, road transportation is the dominant and only mode of movement in this area also. Also, the road network is poor and hence there is lack of reliable and systematic public transportation.

3.6.1 Road inventory

Road inventory was collected manually and total length of the roads surveyed was 295.01 Km. This municipality constitutes of 36.86Km of Blacktop road , 0.25km of Bridge in total, 218.46Km of Earthen roads, 27.87Km of Gravel , 6.37Km of newly constructed roads ,3.98 Km of RCC road and 0.006 km of Rock soiling .Ward no 1 has 16.87Km of Blacktop road , 0.05km of Bridge, 8.45Km of Earthen road , 5.67Km of Gravel and 1.15Km of RCC. Various types of road surface exist but the majority of surfaces are Earthen in almost each ward as illustrated in Table 5. More percentage of earthen road compared to even bituminous road is not a positive aspect of the municipality. Carriageway width was found less than single lane) to just more than 2 lane (m). The total width of the road, including shoulder, side slope and drainage structure was found to be within range of 3.75 m. Based on inventory, it was found that, most of the roads are of width m. Many of the roads requires immediate attention and need to be maintained and some earthen road need to be updated to gravel and some gravel roads need to be updated to bituminous road based on the present need and traffic volume. Further, the road infrastructure lack proper furniture such as traffic sign, separate footpaths, proper side rails, shoulder, and zebra crossings and so on.

Table 5 Ward level status of different types of roads

Ward no	Blacktop	Bridge	Earthern	Gravel	New	RCC	Rock Soling	Grand Total
1	16.87	0.05	8.45	5.67		1.15		32.19
2	4.71		13.26	8.71	3.57	0.20		30.13
3	0.17		40.74	0.13		0.03		41.06
4	4.88		18.07	0.12	2.80	0.37	0.06	26.30
5	5.28		27.74			0.08		33.10
6	2.20	0.10	25.70	0.74		0.74		29.47
7	1.37	0.11	16.05	8.38		0.29		26.21
8	1.39		31.74	4.13		1.12		38.37
9			37.85					37.85
Grand Total	36.86	0.25	218.46	27.87	6.37	3.98	0.06	295.01

Table 6 Length based on road width

Ward	New	0-4m	>4m	Grand
1		17.26		17.26
2	3.57	17.46		21.03
3		20.78	3.91	24.69
4	2.8	11.85		14.65
5		19.78		19.78
6		14.66		14.66
7		20.18		20.18
8		30.16		30.16
9		25.19		25.19
Grand	6.37	177.32	3.91	187.6

3.7 Road Demand:

Demand form was asked to be filled up by each ward for the priority of road demanded. They were asked to rank top five road in their wards or vicinity so as to ensure betterment of the ward. Most

of the roads were demanded for periodic maintenance and upgrading as summarized in table below and form of maps in ANNEX A

Table 7 Description of name of roads of different wards

SN	Name of Road	Existing Width(m)	Road Type	Proposed Category	Priority
Ward 1					
1	Bayerghari-Healthpost-Kega	3.75	Upgrading		1
2	Bayerghari- Bagarebajar-Parbat	3.75	Upgrading		2
3	Dharshing-Hegdanda-Ranipokhari	3.75	Upgrading		3
4	Dharshing-Jagatpur-Banethok-Biruwa	3.75	Upgrading		4
5	Rimidanda- Bhaluwadanda-Arlechikhola	3.75	Upgrading		5
Ward 2					
1	Thulogaun- Jogithum – Kegha	3.75	Upgrading		1
2	Jogkhola- Wasek – Dandakot	3.75	Upgrading		2
3	Krishi sewa Kendra-Bharthan-Dhabung thati- Banthok	3.75	Upgrading		3
4	Dhurbadeurali-Bharthok-Dandakot-Kalidanda	3.75	Upgrading		4
5	Fohor Byawasthapan - Andhikhola to khel	3.75	New		5
Ward 3					
1	Banethok-Bhaterpata-Magarswara-Riyale -Riju	3.75	Upgrading		1
2	Banethok-Leda-Suple-Riju-Rijukhola - Malmul	3.75	Upgrading		2
3	Madi-Ranidanda-Ojadi-Ramthe- Samadi	3.75	Upgrading		3
4	Deurali-Khoke-Rojikhola-Dovan-Malmul	3.75	Upgrading		4
5	Deurali-Mulka-olyandi	3.75	Upgrading		5
Ward 4					
1	Changchangdi-Dhabungthati-Biruwa	3.75	Upgrading		1
2	Odare - Hatiya – Bayarghari	3.75	Upgrading		2
3	Chhangchhangdi - Andhikhola pul	3.75	New+Upgrading		3
4	Gairathok-Rangthan-Chamdanda-jharunkhola-Dhahathum	3.75	Upgrading		4

SN	Name of Road	Existing Width(m)	Road Type	Proposed Category	Priority
Ward 5					
1	Dhalkebhar-Bhanjyang- Maidan	5.5	Upgrading		1
2	Chhatiban- Chaupani - Gadibhanjang-Maidan	3.75	Upgrading		2
3	Bagarebajar-Balebajar- Mahapur- Maidan	3.75	Upgrading		3
4	Kuwapani-Jimire - Archale-Banjang	3.75	Upgrading		4
5	Kaine-Toridanda-Archale-Mandanda-Bhanjang	3.75	Upgrading		5
Ward 6					
1	Ekbar-Simalchaur-Aamdanda-Tesede	3.75	Upgrading		1
2	Nayachaupari-Phokshing-Cheurikharka	3.75	Upgrading		2
3	Patpati-Sundarchaur-Teshedi	3.75	Upgrading		3
4	Nayachaupari-Cheknechaur-Dhobadi	3.75	Upgrading		4
5	Diphedi – Phokshing	3.75	Upgrading		5
Ward 7					
1	Kalika campus - Tilahar - Khilunga - Arjunchaupari Ga. Pa.	3.75	Upgrading		1
2	Mulpani - Panchhang - Pasindanda - Koldanda	4	Upgrading		2
3	Pasindanda - Gandanda - Khilung kalika mandir – cheurikharka	3.75	Upgrading		3
4	Satipola – Cheurikharka	4	Upgrading		4
5	Losunga - Panchhang - wada karyalaya	3.75	Upgrading		5
Ward 8					
1	Dhapukphedi-Dhapuka-sanobhnjang-Ripukhola-Jogithum-Sirukharka	4.5	Upgrading		1
2	Bagarebajar-Godikholagau-Thadokhoriy-Thulibhnajng-Jyamire	3.75	Upgrading		2
3	Mohandanda-Pakhere-Okhadi	3.75	Upgrading		3
4	Dhapukphedi-Khorbar-Bicharbari-Cheurikharka	3.75	Upgrading		4

SN	Name of Road	Existing Width(m)	Road Type	Proposed Category	Priority
5	Sanobhanjang-Deguwa-Narayangiri Baba mandir	3.75	Upgrading		5
Ward 9					
1	Thulibhanjng-Tharukdanda-Pipaldanda-Saundi	3.75	Upgrading		1
2	Maidan-Sirkot-Pipaldanda	3.75	Upgrading		2
3	Taruk-Charan-Junelidanda-Kavre	3.75	Upgrading		3
4	Dandathok - Gadaregufa-Thulibhanjng- thamdanda	3.75	Upgrading		4
5	Angbhnag-swamidanda-Narayangiri-Dhapung	3.75	Upgrading		5
1	Thulogaun- Jogithum – Kegha	3.75	Upgrading		1
2	Jogkhola- Wasek – Dandakot	3.75	Upgrading		2
3	Krishi sewa Kendra-Bharthan-Dhabung thati- Banthok	3.75	Upgrading		3
4	Dhurbadeurali-Bharthok-Dandakot-Kalidanda	3.75	Upgrading		4
5	Fohor Byawasthapan kendra - Andhikhola corridor hudai Khel Maidan	3.75	New+Upgrading		5

3.8 Land Use Pattern

Land use pattern affect transportation planning to large extent. Future development of the locality is largely dependent on the present land use pattern and possibility of development. The land use distribution of Bhirkot Municipality shows that it is mostly used as the forest followed by Cultivated land to the second most Thus the area of KI Singh has both agricultural areas as well as built-up areas in respective suburbs and nearby of the road. Though, small stream seems to passing across the different wards, due to less significant area, the proportion of water bodies is quite negligible within the Municipality. This is shown as below in the form of figure as well as shown in the form of Map as in ANNEX A. The landuse is taken from survey department data 1990.

Table 8 Land use pattern of Bhirkot Municipality

SN	Present Land Use	Area SQKM	Percentage(%)
1	Cultivation	44.72	57.02
2	Commercial area	0.01	0.02
3	Cultural and archaeological	0.00	0.00
4	Forest	28.71	36.61
5	Riverine and lakes	1.87	2.39
6	Industrial	0.00	0.00
7	Others	0.68	0.87
8	Public use	1.41	1.80
9	Residentials	1.01	1.29
	Total	78.42	

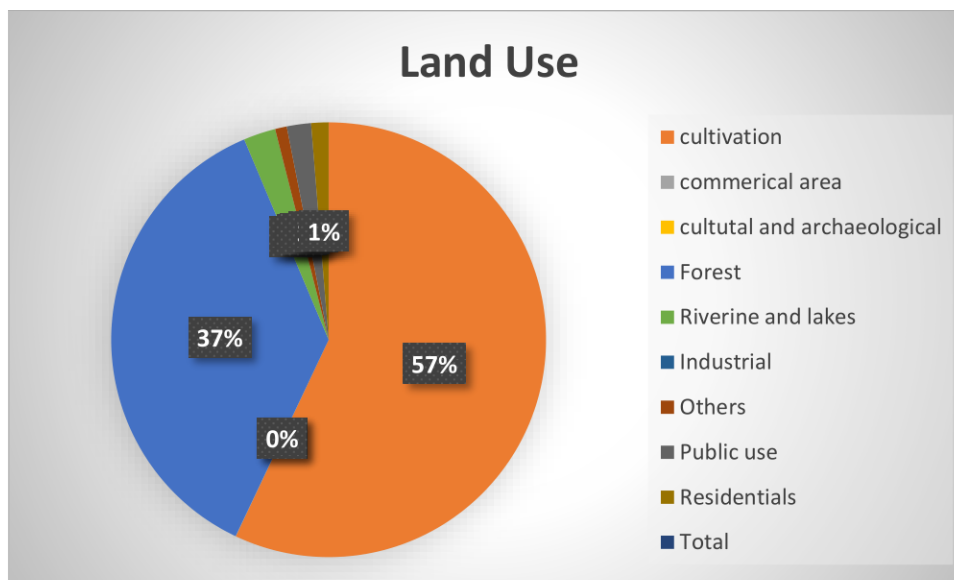


Figure 13 Land use proportion within the Municipality

3.9 Road Safety Status:

Road accident is one of the critical issue in Nepal and they are the seen most critical issue. They are not addressed properly. Significant traffic and pedestrian volume, improper and inadequately maintained road condition, lack of traffic control measures are further accelerating the road safety status within the Municipality. There is not any provision of separate footpath for pedestrian within the Municipality and hence, pedestrian is forced to share the same road space with other vehicle. Sharp curves and gradient exists within the roads and they need to be maintained.

Almost all surfaces of road are earthen with few exceptions of bituminous and concrete pavement. The roads with bituminous pavement are well constructed considering parameters such as width, gradient, crossing structures etc. and delineator guard posts are provided on bridges and culverts. Traffic signs even on the bituminous roads are missing. The geometric features of fair-weather road (Earthen) in the municipality are unacceptable in terms of gradient, width, radius, crossings

etc. without any consideration for traffic safety i.e. non engineered roads. Landslides on the road are too often. The debris such as tree trunks, stones, soils etc. due to landslide are not removed thus may present as hazard and cause accidents. The roads on market are constructed with bituminous surface in full width without footpath (No separation of pedestrians and Traffic) and open drains. The setbacks on buildings of marketplace are not provided which may reduce visibility of traffic.

3.9.1 Parking and other facilities

Separate area for parkings is not allotted hence roadside parking is common. The jeeps use roadside parkings to collect passengers. Even though land has been allocated for buspark due to lack of infrastructures and access road the buspark is not in use currently. The shoulders on Siddhartha highway have been used as footpath in marketplace but the inner core of Bayerghari lacks any footpath related structures. Bus-Stops (Pratikshyalaya) has been constructed in adequate number in the municipality which has been positive aspect of public transportation.



Roadside Parking

3.10 Public transportation Scenario Bhirkot Municipality

Bhirkot is connected by Siddhartha Highway(H10) to Strategic Road thus serves as major route of Intracity Public Transport to cities such as Putalibazaar, Waling, Pokhara and Butwal. Bayerghari is the major market center of this municipality with major services such as municipality office, vendor, shops, medicals and other facilities. The means of intracity transport includes Bus, Minibus, Truck etc. for transportation of goods and people. Some Bus routes such as Deurali-Bayerghari-Butwal (Ward no 3) are operated during fair weather (Except Rainy Season) with 1 bus per 2 days. Intercity Public Transportation scenario of Bhirkot municipality is minimum to almost nonexistent with very limited routes and options for travel. The routes of public transportation are such that it connects different ward center to Bayerghari with 1-2 Jeep (Bolero) per day with departure during morning hours from ward centres and return on evening hours. The operation of Buses is not possible in current condition due to issues such as High Gradient, Earthen Surface, Insufficient width and turning radius, etc. Hence the jeeps are the best means of public transportation in current condition. For transportation within the marketplace of Bayerghari some Autorickshaw are also being used. The following are the routes of Jeeps currently:

- Ward no 1: Not Necessary (Adjacent to Siddhartha Highway and main Marketplace)
- Ward no 2: Bayerghari -Jogkhola-Dhurbadeurali-Kega
- Ward no 3: Deurali-Bayerghari
- Ward no 4: Bayerghari-Changchangdi-Dabungthati
- Ward no 5: Bayerghari-Bagarebazaar-Maidan
- Ward no 6: Bayerghari-Simalchaur-Aamdada-Tisedi
- Ward no 7:
- Ward no 8: Bayerghari-Dhapukfedi-Dhapuk-Sanibhanjyang-Jogithum-Sirukharka
- Ward no 9: Bayerghari-Bagarebazaar-Mohandada-Thulibhanjyang-Tarukdada-Saundhi (from Ward no 8) and Bayerghari-Bagarebazaar-Maidan-Sirkot-Pipaldada (from Ward no 5)

CHAPTER 4: VISIONARY CITY DEVELOPMENT PLAN

The development of the Municipality is basically depended on the features of the individual wards and the vision of the Municipality. This chapter basically covers the indicative development potential and visionary city development plan of the Municipality.

4.1 Bhirkot Municipality Wards Features

4.1.1 Ward 1

With the population of 4079 the ward is facilized with the main market area as Bagarebajar. Bagarebajar is the major center for all wards for the shopping, Banking and other officials works. The wards consist of Banks, Saving and Credit offices, Private Schools, Adharbhut schools Water supply Facilities. The road networks of this wards should maintain proper grading, surface condition, width so that the school buses and other publics vehicles can easily reach the destination in time. During the rainy seasons pot holes and slippery road conditions makes the movement more crucial. The ward consists of bus parks with improper infrastructures. The wards consist of masjid, temples as the religious places. The ward consists of Bhirkot Municipality Hospital, this also increase the trip generation of the other wards .



4.1.2 Ward 2

With the population of 3756, ward consist of Dahathum police station, District agricultural research center, Banks and credit and Saving offices which will generate the trips. Within the wards no other public vehicles are available for the public. The educational privilege of this ward is quite good it consists of secondary schools, pre primary schools with proper infrastructures. The Bolero available for the movements of the peoples and goods cannot meet the demand of the generated trip demands as seen in the pictures high chance of road accidents. Post office services is also available in this ward. The ward is rich in agricultural productions of fruits, meats. For the proper



markets of the agricultural products the road networks should be constructed with proper road ancillaries and infrastructures.

4.1.3 Ward 3

With the population of 4625, ward consist of 7 schools ,1 health post. Mulka Baraha Temple as the major religious palace, road connectivity is poor to reach the temple. The ward is reach in major fruits like orange and the products are not getting proper markets due to lack of proper road networks.



4.1.4 Ward 4

With the population of 1748, the ward consist of Changchandi chayachettra (Siva Temple) as the major tourist and religious area, Bhirkot park ,Dhabung kalikot temple .and the dumping site near the Adhikhola corridor . Jante Dhunga is major place for tourist destination place.The educational previllage of this ward is not soo good lacks the proper infrstructures .The wards also facilates the drinking water supply .



4.1.5 Ward 5

With the population of 4168, Sworek maidan is major trip generation and tourist destination palace, the palace is famous for paragliding. The ward is facilized with one health post which is in the completion stage which will provide the primary treatment only .The educational privilege of this ward is poor .Due to the poor transportation facilities and poor road networks ,it is effecting the sound and economic growth of the wards so the road networks should be timely maintain and proper and proper scheduled public transportation facility should be provided by the concern authority which will finally create the employment and tourism development will be in rapid way ,finally leads the sound and economic development of ward .



4.1.6 Ward 6

The population of the ward is 2977.The educational previlage of the ward is very poor. Only one primary health post is currently available which provides the basic treatments only. Bolero provides the transportation facilities. The road condition around the dobato xekne bato is very `crucial,during the rainy seasons the vechicular movility gets affected so unsound movements of vechiles may arise the road crashes .The road networks lacks proper infrastructures .



4.1.7 Ward 7

With the population of 2813 ,It consist of primary to secondary school ,religious and cultural temple khilung kalika temple ,gupteshowr temples and gufa .one health post is available which is providing the basic treatment facilities .



4.1.8 Ward 8

With 4550 population of this ward,Tamulek as the trekking route ,Dhapukfedi as the main market area for the peoples , Okhatipani is famous for homestay .The educational privilege of the ward is very poor .

4.1.9 ward 9



With the population of 3252, the consist of preprimary and secondary school ,one health post which provides the basic treatment.Police station is also providing services in this ward .Sirkot is the major market area of ward .The Narayangiri baba mandir is the famous religious area of this ward .Gadare gufa is the tourist attracting center of this ward .Chamthung is famous for paragliding .



4.2 Indicative Development Plan:

Indicative Development Potential (IDP) is basically the indication of the existing and potential market center/service centers (key growth centers) and the areas having various development potentials such as agro-based industries, high yield agricultural area and tourism. Thus, IDP shows high value cash crops, tourism area, and area of service centers such as hospital, post office, telecommunication, school, campus, bus parks, security offices and large settlements, important historic and religious places.

The portions besides bazar areas (Ward 5) are highly dependent in agriculture as soil is fertile and most of the areas are vacant with less human settlements.

Educational sector is not distributed equally. Most places consist of “Primary” only out of which many are in non-operating conditions. Also, the Municipality is not equipped with medical facilities except that of various health posts. People have to come Waling bazar for treatment. So, either new hospitals need to be established or the recent Hospital located at the the Municipality should be upgraded to the hospital. These facilities can be upgraded for betterment of the services and thus, it can be upgraded as the major medical centre of the entire Municipality. The main potential of socio-economic development of Bhirkot Municipality is Agriculture and animal husbandry.

Tourism:

Tourism can be major aspect of development. Bhirkot Municipality is blessed with Natural beauties and can be capitalized for further betterment of municipality. The municipality consists of many tourist spots which municipality plans to bring in wider picture. Most of the tourism Potential location lacks proper advertisement and municipality is planning to provide sufficient help for the promotion of tourism sector in the area. Major tourism area are Gadare cave, Okhatipani homestay, chamthubg paragliding, Changchandi Shiva mandir, Sworek Maidan. With the increase in tourism industry other service sectors are likely to get benefit which are directly or indirectly linked to this sector.

Agriculture:

Being an agriculture dependent municipality, proper marketing of the product can be beneficial for uplifting of living standard of citizen. Municipality focuses on bring positive development towards agriculture by modernizing agricultural tools and using more scientific methods for farming. Similarly, Livestock farming is also one of the important aspect of livelihood. Proper knowledge and training is being Planned to provide by the municipality on improvement of livestock farming. Goat and chicken farming are main livestock activities within the area. Planning and construction of new route with parking facilities are being done for providing services to the local people for the improvement of their working condition and to provide minimum support required to make their hard work worthy.

4.3 Visionary City Development Plan

Visionary city development plan ensures safe, responsible, sustainable development of city. According to Kevin Lynch’s “A Theory of Good City Form” (Cambridge, MA, MIT Press, 1981), several basic concepts underlie urban and regional economic analysis. First, cities cannot grow if their residents simply provide services for one another. The city must create products which can be sold to an external purchaser, bringing in money which can be reinvested in new production facilities and raw materials. This “economic base” of production for external markets is crucial. Without it, the economic engine of the city grinds to a halt. Once the economic base is established, an elaborate internal market can evolve. This market includes the production of goods and services for businesses and residents within the city. Obviously, a large part of the city’s physical plant is devoted to facilities for internal transactions: retail stores, restaurants, and local professional services such as home stay for tourists, and so on. Modern cities are increasingly engaged in competition for economic resources such as industrial plants, high-technology firms, development of tourism centres, government facilities etc. Various potential areas of development and future oriented planning of Municipality, were discussed and finalized with Municipality and is summarized in the following subheading.

4.3.1 Tourism Area

Bhirkot Municipality can also attract local as well as outsider based on its tourism perspective. The tourism can be categorized as natural, historical as well as religious and it must be protected for betterment of Municipality. Major tourism area are Gadare cave, Okhatipani homestay, chamthubg paragliding, Changchandi Shiva mandir, Sworek Maidan.

4.3.2 Future Settlement Area

As the population of the Municipality is trending to increase rapidly and also being located at the Syangja district, there is possibility of high increase in population. Also the special places within Bhirkot Municipality is also expected to go with high urbanization.

4.3.3 Agricultural Area

Fertile land is the most important resource of this area. Bhirkot Municipality has made provisions for irrigation from small projects and villagers themselves prepare earthen canals. They produce fruits, ginger, walnut and other seasonal fruits and vegetables. As majority of the area is covered with forest. If processed and marketed, forest resources can change the life of the village. People use raw materials to make houses. Proper commercialization of the agricultural products within this Municipality will serves to enhance the economic status of people within the Municipality as well as the economic profile of Municipality. Along with them, Fishery & Poultry could be the major source for income via butchery.

4.4 Population projection

The population and population density of the municipality is expected to grow rapidly after designation as a municipality. Higher migration rate is witnessed in desire for better economic opportunities, desire for better living or housing conditions, movement for reasons of health, education, or retirement etc. For sustainable supply of transport infrastructure, it is pertinent to forecast the population in the future so that the infrastructures can be planned and constructed accordingly. Population forecast is considered simpler for areas showing stability in the size of their populations for several decades, change in the economic and social conditions; whereas it becomes an extremely difficult and complex for areas having sharp fluctuations in the direction or rate of population change. Geometric growth factor method is used for population projection.

Census data were used to calculate the growth rate of each VDC's (before municipality formulation), along with year (2015) population by the use of average growth method.

Table 9 Population forecast

Ward no.	Population (2011)	Population (2019)	% Change	2020	2030	2040
1	3649	4079	12	4133	4670	5208
2	2949	3756	27	3857	4866	5874
3	3546	4625	30	4760	6109	7457
4	1382	1748	26	1794	2251	2709
5	3130	4168	33	4298	5595	6893
6	2114	2977	41	3085	4164	5242
7	2210	2813	27	2888	4661	3291
8	3666	4550	24	4661	5766	3685
9	2937	3252	11	4396	6871	4079
TOTAL	25583	31968		32766	40747	48729

This table shows the increase in population in almost every ward with maximum of 41% in ward 6 followed by ward 5 (33%) and ward 3 (30%). The population are calculated on basic assumption if population goes on increasing at the present rate, i.e. at average growth rate, which reflects the minimum possible population growth rate.

CHAPTER 5: ROAD HIERARCHY DEVELOPMENT

5.1 Road Hierarchy:

Road network serve for direct access to the particular land-use by the provision of pedestrian footpaths, bicycle tracks, bus and vehicle routes and cater through traffic that is not related to immediate land uses. Functional provisions of passenger and goods movement mainly define the hierarchy of roads and their classification. On the basis of this concept, roads are classified as per their function. Road class is related to the technical standard and functional requirements. Therefore, road classification should be based on its functional hierarchy. It is important to distinguish roads in different class or type based on various criteria. A road hierarchy is a means of defining each roadway in terms of its function such that appropriate objectives for that roadway can be set and appropriate design criteria can be implemented. It is an important instrument of road network and land use planning.

There are restrictions of direct linkage between various kinds of road-hierarchy. In other words, direct connections between certain types of road links should be reduced, for example residential streets and arterial roads. Connections between similar order streets should be made (e.g. arterial to arterial) or between street types that are separated by one level in the hierarchy (e.g. arterial to highway and collector to arterial.). This conceptual framework can be seen from Figure 9 and 10, These hierarchical distinctions of road types becomes more clear when considering the recommended design specifications for the number of through lanes, design speed, intersection spacing and driveway access.

A well-formed road hierarchy increases the performance and efficiency of the particular type of road as well as of the entire road network. Furthermore, it reduces overall impact of traffic by concentrating longer distance flow onto routes in less sensitive locations, ensuring land uses and activities that are incompatible with traffic flow are restricted from routes where traffic movement should predominate and preserving areas where through traffic is discouraged.

5.1.1 Formulation of Road Hierarchy

Roads under jurisdiction of Municipal authority are referred as urban roads. The classification practices of urban roads basically are guided by the functional hierarchy of roads. Municipality has a complete road network hierarchy consisting of National Highways, Feeder Roads, District Roads and Urban Roads of all four classes. The concept of road hierarchy assist in planning of overall road network and its transport services. Different hierarchy of road has different effect in surrounding areas and other roadways. Hierarchy of roads enable urban design principles such as accessibility, connectivity, efficiency, amenity and safety. Further, it also identifies treatments such as

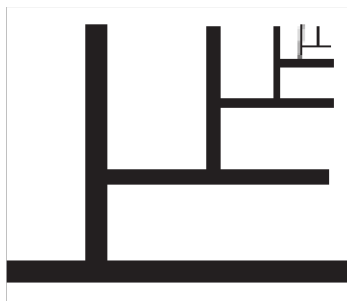


Figure 14 Road Network Hierarchy

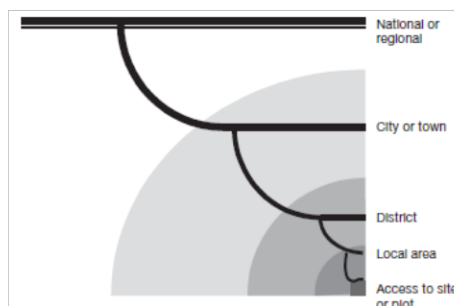


Figure 15 Urban Road Hierarchy

barriers, buffers and landscaping to preserve amenity for adjacent land uses. Thus, a proper plan should accommodate all users of the urban streets in planning, designing and construction of the road infrastructure and furniture. Municipality road network can be conceptualized by considering the functional hierarchy as arterial, sub-arterial and urban roads of various categories such as Class A, Class B, Class C and Class D.

Table 10 Proposed width for various types of roads within urban area

City	Criteria	Expressway	Arterial	Sub arterial	Collector	Local
Sub city	10,000 -40,000	-	-	30m	20m	10m
City	40,000 -100,000	-	50m	30m	20m	10m
Sub Metro City	100,000 - 300,000	50m	30m	20m	10m	10m

Source: Planning Norms and Standard 2015, GoN, DUDBC

The various standard documents on Nepal, which includes Nepal Road Standard (NRS 2070), Nepal Road Standard (NRRS 2071) and Nepal Urban Road Standard 2068 Draft suggest the need of footpath and the total right of way is adopted as per ToR provided by MoFAGA and is as follows:

Table 11 Classification of Municipal Roads

Road Type	Road Class	Right of way (RoW)
Main Collector Road	Class A	14 m
Other Collector Road	Class B	11 m
Tole Road	Class C	8 m
Other Road	Class D	6 m

5.2 High Hierarchical Road Network

Road are classified based on its importance and its area served. Basically, higher hierarchical road network within the Municipality comprises of Strategic Road Network (National Highway and Feeder Roads) and then the local road network, consisting of District Road Core Network (DRCN).

Table 12 Ward wise National Highway and District Roads

Road code	Wards									Grand Total
	1	2	3	4	5	6	7	8	9	
39DR006									2.41	2.41
39DR011	0.55							3.75	3.18	7.48
39DR012	0.58				3.74	1.53				5.84
39DR013		7.88	4.03	0.98						12.90
39DR017	0.48						2.61			3.09
39DR020			1.24							1.24
H10	5.24	1.52		2.85						9.61
Grand Total	6.85	9.09	5.28	3.83	3.74	1.53	2.61	3.75	5.58	42.56

5.2.1 Strategic Road Network (SRN)

There is a Strategic Road Network within the Municipality. The total Right of way of these roads is 50m. The total length of the roads is 35.03Km.

Table 13 List of SRN Roads within the Municipality

Road Code	1	2	3	4	5	6	7	8	9	Grand Total
Siddhartha Highway(H10)	5.24	1.52		2.85						9.61
Grand Total	5.24	1.52		2.85						9.61

5.2.2 District Road Core Network (DRCN)

Based on District Transport Master Plan (DTMP) report prepared by Department of Local Infrastructure (DoLI) there are five DRCN roads within the Municipality which passes through various wards and are of total right of way of 30m as approved by District Development Committee and District Road Coordination Committee. These roads are summarized as below

Table 14 List of DRCN Roads within municipality

Road Code	1	2	3	4	5	6	7	8	9	Grand Total
39DR006 Chamthung Pipaldanda -									2.41	2.41
39DR011 Bagarebajar- Jyamire	0.55							3.7 5	3.18	7.48
39DR012 Balmata-Pakan- Amale	0.58				3.74	1.53				5.84
39DR013 Siddhartha Rajmarga Deurali -		7.88	4.03	0.98						12.9
39DR017 Siddhartha Rajmarga Sisnepani -	0.48							2.6 1		3.09
39DR020 Dhanubanse Bhimalswara -			1.24							1.24
Grand Total	1.61	7.88	5.27	0.98	3.74	1.53	-	6.3 6	5.59	32.96

Table 15 Types of District Road surfaces

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Chamthung Pipaldanda -	39DR006	2.41				
Bagarebajar- jyamire	39DR011	4.06	1.41	1.39	0.08	
Siddhartha Rajmarga - Swarek kot	39DR012	3.18	0.55	2.00		
Siddhartha Rajmarga - Deurali	39DR013	7.92	4.13	0.53	0.07	
Siddhartha Rajmarga Sisnepani -	39DR017		2.51	0.48		
Dhanubanse, Waling - Bhimalswara, waling	39DR020	1.24				

5.3 Municipal Roads

Different road serves different function, some basically serves the function of access and some serves function of high quality mobility. Hence formulation of Road Hierarchy is must to ensure effective and efficient transportation planning process. This study also formulate four level road hierarchy namely Class A, B, C and D as described in Chapter IV. The function of Class C and D is basically to provide access, while Class A and B provides mobility and accessibility to higher services.

Class ‘A’ roads connect one or more major growth centres or has direct linkage to National Strategic Road Network or district road and thus has high network coverage. **Class ‘B’** roads connects major road network and other roads of similar hierarchy with either major growth centre or provide access between Class A and class C road. **Class ‘C’** roads provides connection to higher order roads or with agricultural roads which connect a farm with a mini-market centre or an agro based production centre. **Class ‘D’** roads are all other minor roads, with width above minimum standard of municipality which provides access to a tole and property.

There is fundamental difference between various class of roads and have been summed up in the form of table 16 as:

Table 16 Comparison of various hierarchy of roads

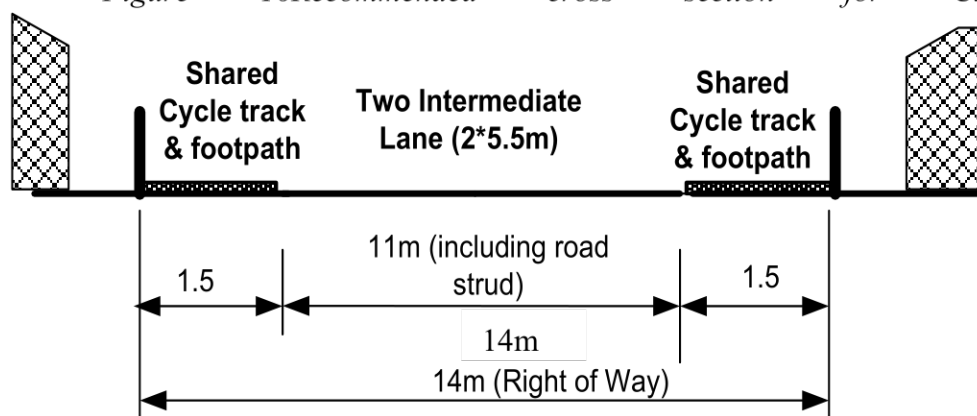
Criteria	Class A	Class B	Class C	Class D
Purpose	Mobility	Mobility and control access	Access and mobility	Access
Function	Through and long distance movement	Connect Class A and C; provide alternative connection routes between Class A	Connects higher order roads & mobility to local trips.	Connect local trips to higher level roads.
	High network coverage	Support through movement of traffic	Access to property	direct access to property
	Segregated NMT facilities and Bus laybys	Segregated NMT facilities and Bus laybys	Segregated NMT facilities	Local NMT movement
Maintenance Responsibility	Municipality	Municipality	Municipality & Community	Community
Design Speed (Kmph)	40	30	20	20
Radius (m)	30	20	15	15
Minimum RoW (m)	14	12	10	8
Setback distance (m)	2	2	1.5	1.5

Criteria	Class A	Class B	Class C	Class D
Access Control	Applicable based on locality	Not Applicable	Not Applicable	Not Applicable
Public transport services	Public Transportation	Local transport Public	Small form of public transport	No public transportation

5.3.1 Class A Roads

Class A roads serve as the major collector roads. These roads start either from the Arterial or Sub-Arterial road. These roads are of relatively long distance which connect big market or settlement areas or two or more wards centers within the Municipality. They provides linkage to SRN & DRCN roads as well as to the nearby Municipality.

Figure 16 Recommended cross section for Class A roads



Three Class A roads have been proposed so as to support the Indicative development potential as well as interconnectivity. Based on technical study and bottom up participatory approach, following Class A roads with right of way of 14m has been approved.

Table 17 List of Class A roads

Road Code	Proposed Road Network Name	Length(km)	Ward pass
A001	Andhikhola corridor	8.524	7,6,5
A002	Kalika Campus -Sirukharka	24.92	7,6,8
A003	Pipal Danda-Dhapung	8.505	9

Table 18 Class A length of roads ward-wise

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Andhikhola Corridor	A001					3.353	1.088	4.082		
Kalika campus-Jogithum-Sirukharka	A002						2.921	7.47	14.53	
Pipal Danda - Dhapung	A003									8.505

Table 19 Surface type of class A roads

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Andhikhola corridor	A001	2.46	2.45	3.57		
Kalika campus - Jogithum-Sirukharka	A002	19.92	4.59	0.30	0.07	
Pipal Danda - Dhapung	A003	8.51				

Andhikhola corridor (A001)

This road is corridor to Andhikhola which divides the municipality into almost two halves, and passes through ward 5,6,7. This road supports the extension of corridor from Waling municipality and Putalibazaar Municipality. Furthermore it also connects 39DR017.

Kalika campus -Jogithum-Sirukharka(A002)

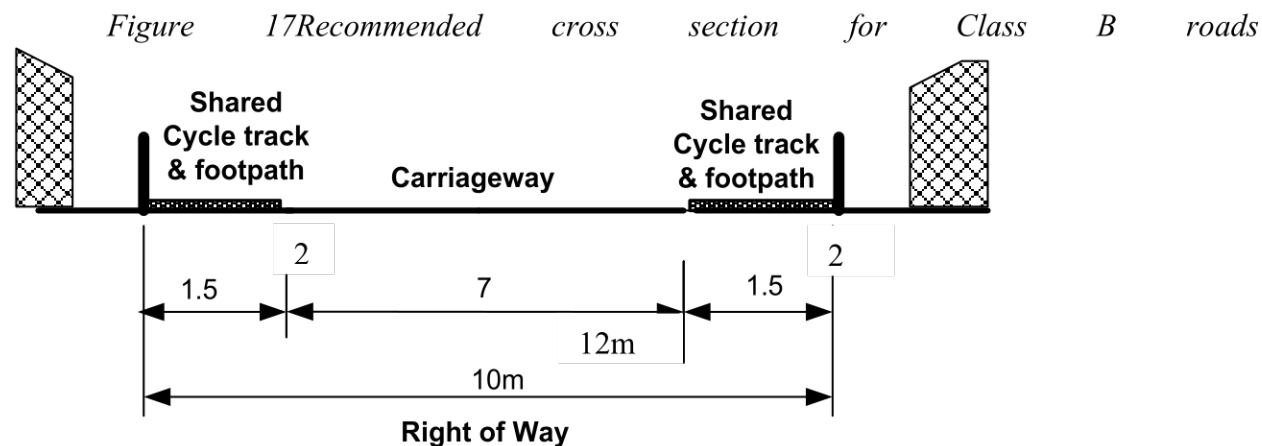
This Road originates from 39DR017 and connects three wards of Bhirkot to Parbat district. It connects agricultural pocket area, tourism area namely khilung kalika and residential area to market of Helu. This road passes through wards 6,7,8.

Pipal Danda - Dhapung(A003)

This road connects Pipaldada(Sirkot) to Thulibhanjyang. Landmarks such as Narayangiribaba Mandir lie in this Road. This road also connects Waling Municipality to ward no 9 of Bhirkot Municipality.

5.3.2 Class B Roads

These roads serves as a second level of road with total right of way more than 12m and can be considered as Feeder roads of Municipality. These roads connects major road network and other roads of similar hierarchy with either major growth center or provide access between Class A and class C road. Mobility is the main concern for these roads and it need to be equipped with at least facilities for non-motorized travel. The typical cross section for Class B roads is as:



Class B roads have been proposed so as to support the Indicative development potential as well as interconnectivity to Class A roads and DRCN roads. Based on technical study and bottom up participatory approach, Class B roads with ROW 10m as follows:

Table 20 List of Class B roads

Road Code	Proposed Road Network Name	Length(km)	Ward pass
B001	Simle gaun-pipaldanda	9.92	5,8,9
B002	Pipal danda - Karadi	5.81	9
B003	Taruk - sanobhanjyang	4.94	8
B004	Mulpani - Dhapukphedi	10.12	7,6,8
B005	Bagarebazaar - Dhapukphedi	2.63	6
B006	Dhada - Tilahar	2.47	7
B007	Chhangchhangdi- Buspark	4.08	4,2,1
B008	Bayerghari-kegha	5.39	1
B009	Hatiya chowk - Dhabungthati	4.78	4
B010	Dandakot - Kalleri	3.31	2
B011	Banethok - Gokes	12.15	3

Table 21 Class B length of roads ward-wise

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Simle gaun- pipaldanda	B001					8.47				1.45
Pipal danda - Karadi	B002									5.81
Taruk - sanobhanjyang	B003								4.94	
Mulpani - Dhapukphedi	B004						7.22	2.90		
Bagarebazaar - Dhapukphedi	B005						2.63			
Dhada - Tilahar	B006							2.47		
Chhangchhangdi- Buspark	B007		1.99		2.09					
Bayerghari- kegha	B008	5.39								
Hatiya chowk - Dhabungthati	B009				4.78					
Dandakot - Kalleri	B010		2.52	0.79						
Banethok - Gokes	B011			12.15						

Table 22 Surface type of class B roads

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Simle gaun-pipaldanda	B001	9.92				
Pipal danda - Karadi	B002	5.81				
Taruk sanobhanjyang	B003	4.94				
Mulpani Dhapukphedi	B004	8.80		0.86	0.47	
Bagarebazaar Dhapukphedi	B005	0.38	0.12	2.13		
Dhada - Tilahar	B006	2.47				
Chhangchhangdi-Buspark	B007					4.51
Bayerghari-kegha	B008	0.57		3.85	0.97	
Hatiya chowk - Dhabungthati	B009	2.68		2.04		
Dandakot Kalleri	B010	0.79	2.01			0.41
Banethok - Gokes	B011	12.15				

Simle gaun-pipaldanda(B001)

This road passes through wards 5 and 9. It connects Maidan(paragliding destination) and Sirkot(Market Centre of Ward no 9) to proposed Andhikhola Corridor.

Pipal danda – Karadi(B002)

This Road connects Bhirkot ward no 9 to parbat District and backwarded regions of ward no 9.

Taruk – sanobhanjyang(B003)

This Road connects 39DR011 to proposed A001 Roads. Lying along the alignment are Homestays, Residential areas and agricultural pocket areas. This road passes through ward 8.

Mulpani – Dhapukphedi(B004)

This road connects two points an proposed A class road A001 and serves 3 wards 6,7 &8. Services such as Health post, Ward 7 office lie in this road.

Bagarebazaar – Dhapukphedi(B005)

This Road connects 39DR011 and 39DR012 with market centre (Dhapukphedi) of ward no 8.

Dhada – Tilahar(B006)

This Road connects 39DR017 with proposed A class road A001

Chhangchhangdi- Buspark(B007)

This road is corridor to Andhikhola and runs parallel to Siddhartha highway. It may serve as bypass to siddhartha highway in near future. It consists of infrastructures such as waste management site and buspark among many others.

Bayerghari-kegha(B008)

This road connects marketcentre Bayerghari to agricultural pocket Kegha and also putalibazaar municipality.

Hatiya chowk - Dhabunghathi(B009)

This road connects different places of ward no 4 to siddhartha highway and also provides alternative access to ward no 3(backwarded ward)

Dandakot – Kalleri (B010)

This Road connects 39DR013 to another DR in Waling Municipality .

Banethok – Gokes(B011)

This road originates from 39DR013 and traverse various places of ward no 3 and connects Bhirkot with Putalibazaar municipality and Biruwa Rural Municipality

5.3.3 Class C Roads

Class C roads basically serves the function of access to greater extent and mobility to some extent. These are third hierarchy of roads and these provide access to Class D roads. The right of way for these are recommended to be more than 8m wider roads. Class C roads are residential street and they provide access to the private property and small industrial or public place. These roads provides connection to higher order roads or with agricultural roads which connect a farm with a mini-market centre or an agro-based production centre. These roads serve mainly for small/light vehicular movement for low volume intensity.

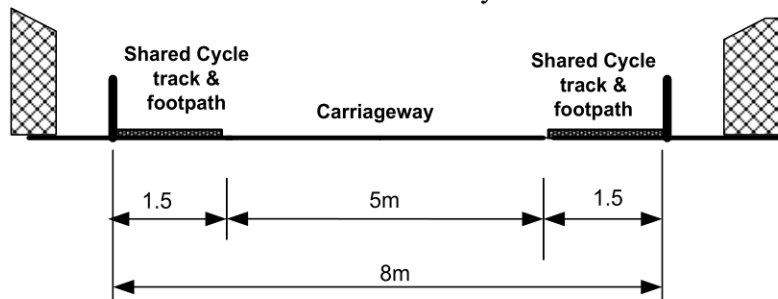


Figure 18 Recommended cross section for Class C roads

Twenty- Seven Class C roads of 78.14 km length is approved based on both technical study, on site feasibility as well as Bottom Up approach and been listed as follows:

Table 23 List of Class C roads

Road Code	Proposed Road Network Name	Length(km)	Ward pass
C001	Chhatiban- Chaupani	0.87	5
C002	Kaine-Bhanjyang	2.29	5
C003	Kuwapani-Banjang	1.48	5
C004	Pakan - Tiharneta school road	1.36	5
C005	Tilaharneta - Thalekharka	2.54	5
C006	Bagarebajar- Maidan	5.97	5,8
C007	Rip - Mohandanda	2.01	5,8
C008	Sirkot - Mohandanda	5.34	8,9
C009	Taruk-Kavre	3.15	9
C010	Sanobhanjang - Anbhang	3.56	8,9
C011	Dhadabari -Cheknechaur	0.99	6
C012	Ekba- Satipola	5.31	7,6
C013	Nagarpalika sadak	0.17	1
C014	Dharshing- Jagatpur	2.87	1
C015	Jagatpur - Banthok	4.65	1
C016	Thulogaun - Kegha	2.84	1
C017	Rimidan-Arlechikhola	1.67	1
C018	Khadi khola - Bharthan	3.47	1,2
C019	Bharthan - Jantedhunga	2.70	2,4
C020	Changchangdi-Biruwa	5.60	4
C021	Jogkhola - Dandakot	2.46	2
C022	Deurali-olyandi	1.28	3
C023	Banethok- Malmul	6.18	3
C024	Deurali-Malmul	3.08	3
C025	Musaha -Anpbotchautara	2.30	3
C026	Odare - Bayarghari	3.45	1,2,4
C027	99chowk - Buspark	0.55	

Table 24 Length of class C roads Ward-wise

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Chhatiban- Chaupani	C001					0.87				
Kaine- Bhanjyang	C002					2.29				
Kuwapani- Banjang	C003					1.48				
Pakan - Tiharneta school road	C004					1.36				
Tilaharneta - Thalekharka	C005					2.54				

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Bagarebajar-Maidan	C006					5.97				
Rip Mohandanda -	C007					0.76			1.25	
Sirkot Mohandanda -	C008								0.89	4.45
Taruk-Kavre	C009									3.15
Sanobhanjang - Anbhang	C010								2.57	0.99
Dhadabari - Cheknechaur	C011						0.99			
Ekba- Satipola	C012						4.03	1.28		
Nagarpalika sadak	C013	0.17								
Dharshing-Jagatpur	C014	2.85						0.02		
Jagatpur Banthok -	C015	4.58		0.07						
Thulogaun - Kegha	C016	2.84								
Rimidan-Arlechikhola	C017	1.67								
Khadi khola - Bharthan	C018	0.53	2.93							
Bharthan - Jantedhunga	C019		1.67		1.03					
Changchangdi -Biruwa	C020				5.60					
Jogkhola Dandakot -	C021		2.46							
Deurali-olyandi	C022			1.28						
Banethok-Malmul	C023			6.18						
Deurali-Malmul	C024			3.08						
Musaha - Anpbotchautara	C025			2.30						
Odare Bayarghari -	C026		1.67		1.78					

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
99chowk - Buspark	C027	0.554								

Table 25 Surface type of class C roads

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Chhatiban-Chaupani	C001	0.87				
Kaine-Bhanjyang	C002	2.29				
Kuwapani-Banjang	C003	1.48				
Pakan - Tiharneta school road	C004	1.28			0.08	
Tilaharneta - Thalekharka	C005	2.54				
Bagarebajar-Maidan	C006	5.97				
Rip - Mohandanda	C007	2.01				
Sirkot - Mohandanda	C008	5.34				
Taruk-Kavre	C009	3.15				
Sanobhanjyang - Anbhang	C010	3.56				
Dhadabari - Cheknechaur	C011		0.99			
Ekba-Satipola	C012	5.32				
Nagarpalika sadak	C013			0.17		
Dharshing-Jagatpur	C014	1.41		1.33	0.13	
Jagatpur - Banthok	C015	1.18		3.40	0.07	

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Thulogaun - Kegha	C016		2.84			
Rimidan-Arlechikhola	C017	1.21		0.47		
Khadi khola - Bharthan	C018	2.52		0.95		
Bharthan - Jantedhunga	C019	2.70				
Changchang di-Biruwa	C020	5.60				
Jogkhola - Dandakot	C021	2.46				
Deurali-olyandi	C022	1.28				
Banethok-Malmul	C023	6.15			0.03	
Deurali-Malmul	C024	3.08				
Musaha - Anpbotchaut ara	C025	2.30				
Odare - Bayarghari	C026	1.55			0.25	2.48
99chowk - Buspark	C027		0.55			

5.3.4 Class D Roads

Class 'D' roads are all other minor roads which gives access to public property. All other roads that fulfil the minimum requirement set by the Municipality and that doesn't fall under above classes, automatically falls under Class D roads. The cross section can be decided from local level with approval from MRCC, but ensuring all road users are given sufficient rights of sharing the roadway. The community level participation is must for completion of these roads. The Municipality-community share can go from 40% - 60% to 60% - 40% for effectiveness of construction and maintaining the roads. This criteria of investment from local sector depend on Municipality policy.

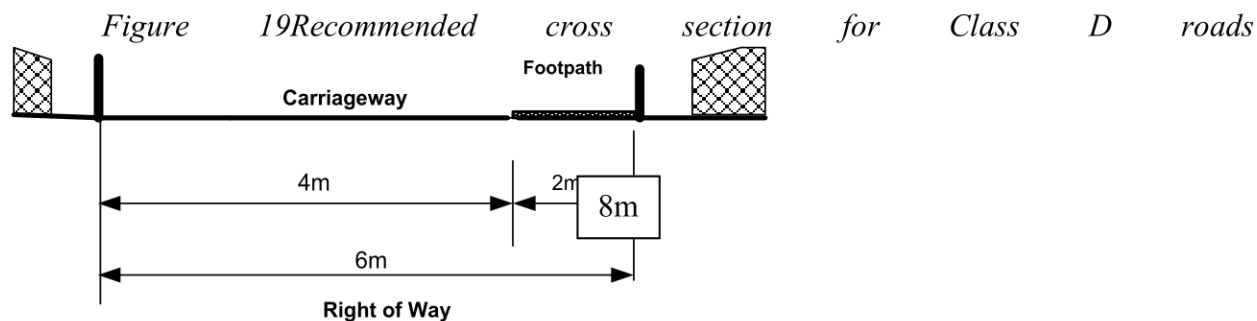


Table 26 List of Class D roads

Road	Proposed Road Network Name	Length(km)	Ward Pass
D001	Chappani - Chudara neta	0.74	5
D002	Swarekot Sadak	0.13	5
D003	Pakana Ramkrishana mandir-	0.49	5
D004	Sirindanda - Ujelidanda	0.93	5
D005	Sirkot sadak	1.26	9
D006	Angbhang - jyamire	1.93	9
D007	Dandathok - thamdanda	4.89	5
D008	Ripukhola - Kshetri danda	1.57	8
D009	Sirukharka - dansin	0.42	9
D010	Naulikharka -Tiure	1.57	8,9
D011	Dhapukfedi - Taruk	1.61	8
D012	Mohandanda - chilaune kharka	1.27	8
D013	Dhapukphedi - Salikos	1.29	8
D014	Majhkharka sadak	2.00	8
D015	Ujelidanda - Godikholagaun	0.21	8
D016	Bhagyodaya school road	0.87	8
D017	Mulpani - Ekbar	0.17	6
D018	Nayachaupari-cheknechaur-	0.97	6
D019	Nayachaupari-Dhanthan	1.57	6
D020	Dhanthan - Phoksing -	2.20	6
D021	Tallo khilung - khirmire	2.16	6,7
D022	Khilunga - Arjunchaupari	0.39	7
D023	Pasindanda - Khilung kalika	2.46	6,7
D024	Thahachowk -Odare	1.41	7
D025	Dhada- Gupteswor Mahadev	0.30	7
D026	Rotepani Tinkuwa - Mulpani	2.86	7
D027	Bhirkohospital road	0.38	1
D028	Kegha sadak	2.90	1
D029	Pidalu khoriya sadak	0.73	1
D030	Dharshing-Jagatpur	1.12	1
D031	Dahathum Healthpost road	0.17	1

Road	Proposed Road Network Name	Length(km)	Ward Pass
D032	Muktinath bank bata buspark	0.56	
D033	Garima Bikasbank road	0.11	1,2
D034	Ganesh tole bata Buddha school	0.21	2
D035	Ganesh tole sadak	0.25	2
D036	Krishi sewa kendra-Bharthan	0.95	2
D037	Shree Purna Durga Bhawani	3.28	1,2
D038	Dharun khola chowk -	0.46	2
D039	Gairathok-Dhahathum	1.55	4
D040	Sakhure chowk - dabhungthati	1.04	4
D041	Chhangchhyandi shiva mandir	0.25	4
D042	Masyankot danda sadak	0.63	4
D043	Dabhunthati - Badahabari	1.93	4
D044	Dabhungthati - Baddanda	1.74	
D045	Bhaterpata - Singarkotchowk	1.84	3
D046	Jogkhola - Dandakot	3.05	2
D047	Jogidanda-Kalidanda	1.46	2
D048	Banethok - kalleri	2.25	2,3
D049	Rayale -Bhumalswara	1.94	3
D050	Rayale chowk - Majhkot,	1.18	3
D051	Riju - Dobata	0.63	3
D052	Gumardi - Thakurigaun	1.51	3

Table 27 Length of class D roads Ward-wise

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
chappani chudara neta -	D001					0.74				
Swarekot sadak	D002					0.13				
Pakana Ramkrishana Mandir- Purba Andhikhola	D003					0.49				
Sirindanda Ujelidanda -	D004					0.93				
Sirkot sadak	D005									1.26
Angbhang jyamire -	D006									1.93

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Dandathok thamdanda -	D007								0.13	4.76
Ripukhola Kshetri danda -	D008								1.57	
Sirukharka dansin -	D009								0.42	
Naulikharka Tiure -	D010								1.57	
Dhapukfedi Taruk -	D011								1.61	
Mohandanda chilaune kharka -	D012								1.27	
Dhapukphedi Salikos -	D013								1.29	
Majhkharka sadak	D014								2.00	
Ujelidanda Godikholagaun -	D015								0.21	
Bhagyodaya school road	D016								0.87	
Mulpani - Ekbar	D017						0.17			
Nayachaupari-cheknechaur-	D018						0.97			
Nayachaupari-Dhanthan	D019						1.56			
Dhanthan Phoksing Chiurikhara -	D020						2.20			
Tallo khilung khirmire -	D021						2.16			
Khilunga Arjunchaupari -	D022							0.39		
Pasindanda Khilung kalika mandir -	D023						2.02	0.44		
Thahachowk Odare -	D024							1.41		
Dhada-Gupteswor Mahadev temple	D025							0.30		

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Rotepani Tinkuwa - Mulpani	D026							2.86		
Bhirkothospital road	D027	0.38								
Kegha sadak	D028	2.90								
Pidalu khoriya sadak	D029	0.73								
Dharshing- Jagatpur	D030	1.12								
Dahathum Healthpost road	D031	0.17								
Muktinath bank bata buspark jane bata	D032	0.56								
Garima Bikasbank road	D033	0.11								
Ganesh tole bata Buddha school sadak	D034		0.21							
Ganesh tole sadak	D035		0.25							
Krishi sewa kendra-Bharthan	D036		0.95							
Shree Purna Durga Bhawani School,Dandakot - Nalsingh	D037	1.38	1.91							
Dharun khola chowk - Chamdanda kalika mandir sadak	D038		0.46							
Gairathok- Dhahathum	D039				1.6					
Sakhure chowk - dabhungthati	D040				1.0					
Chhangchhyandi shiva mandir sadak	D041				0.2					
Masyankot danda sadak	D042				0.6					

Road Name	Road Code	Length of Roads in each Ward (km)								
		1	2	3	4	5	6	7	8	9
Dabhunthati - Badahabari	D043				1.9					
Dabhungthati - Baddanda	D044				1.7					
Bhaterpata - Singarkotchowk	D045			1.8						
Jogkhola - Dandakot	D046		3.05							
Jogidanda- Kalidanda	D047		1.46							
Banethok - kalleri	D048			2.25						
Rayale - Bhumalswara	D049			1.94						
Rayale chowk - Majhkot, Walling	D050			1.18						
Riju - Dobata	D051			0.63						
Gumardi - Thakurigaun	D052			1.51						

Table 28 Surface type of class D roads

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Chappani - Chudara neta	D001	0.74				
Swarekot sadak	D002	0.13				
Pakana Ramkrishana Mandir- Purba Andhikhola	D003	0.49				
Sirindanda - Ujelidanda	D004	0.93				
Sirkot sadak	D005	1.26				
Angbhang - Jyamire	D006	1.93				
Dandathok - Thamdanda	D007	4.89				
Ripukhola - Kshetri danda	D008	1.57				
Sirukharka - dansin	D009	0.42				

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Naulikharka -Tiure	D010	1.57				
Dhapukfedi - Taruk	D011	1.61				
Mohandanda - chilaune kharka	D012	1.26				
Dhapukphedi - Salikos	D013	1.29				
Majhkharka sadak	D014		2.00			
Ujelidanda - Godikhola gaun	D015	0.11			0.10	
Bhagyodaya school road	D016				0.87	
Mulpani - Ekbar	D017		0.17			
Nayachaupari- cheknechaur-	D018	0.43			0.54	
Nayachaupari- Dhanthan	D019	1.56				
Dhanthan - Phoksing - Chiurikhara	D020	2.20				
Tallo khilung - khirmire	D021	2.16				
Khilunga - Arjunchaupari	D022	0.39				
Pasindanda - Khilung kalika mandir	D023	2.45				
Thahachowk -Odare	D024	1.41				
Dhada- Gupteswor Mahadev temple	D025	0.30				
Rotepani Tinkuwa - Mulpani	D026	2.86				
Bhirkothospital road	D027		0.38			
Kegha sadak	D028	2.90				
Pidalu khoriya sadak	D029	0.73				
Dharshing-Jagatpur	D030			1.12		
Dahathum Healthpost road	D031			0.17		
Muktinath bank bata buspark jane bata	D032			0.56		
Garima Bikasbank road	D033			0.11		

Road Name	Road Code	Type of Roads in km				
		Earthen	Gravel	Bituminous	Cement Concrete	Newly Constructed
Ganesh tole bata Buddha school sadak	D034			0.21		
Ganesh tole sadak	D035			0.25		
Krishi sewa kendra- Bharthan	D036			0.95		
Shree Purna Durga Bhawani School,Dandakot - Nalsingh	D037		3.14		0.14	
Dharun khola chowk -Chamdanda kalika mandir sadak	D038			0.46		
Gairathok- Dhahathum	D039	1.55				
Sakhure chowk - dabhungthati	D040	0.91	0.12			
Chhangchhyandi shiva mandir sadak	D041	0.12			0.12	
Masyankot danda sadak	D042	0.63				
Dabhunthati - Badahabari	D043	1.93				
Dabhungthati - Baddanda	D044	1.74				
Bhaterpata - Singarkotchowk	D045	1.84				
Jogkhola - Dandakot	D046					3.05
Jogidanda- Kalidanda	D047		0.94			0.52
Banethok - kalleri	D048	2.25				
Rayale - Bhumalswara	D049	1.94				
Rayale chowk - Majhkot, Walling	D050	1.18				
Riju - Dobata	D051	0.63				
Gumardi - Thakurigaun	D052	1.51				

5.4 Ward Specific Hierarchy of Road

Various hierarchy of road have different functions and characteristics. Based on equity atleast each ward need to be connected by higher hierarchical road network. AS highlight in the table below, all the wards are touch by DRCN roads. Later each wards are touched by either of Class A, B or C roads.

Table 29 Ward specific hierarchy of road network

Ward	A	B	C	DRCN	SRN	D	Grand Total
1	0	5.39	13.2	1.06	5.25	7.33	32.23
2	0	4.51	8.74	7.62	1.52	8.29	30.68
3	0	12.94	12.91	5.29	0	9.34	40.48
4	0	6.87	8.4	0.98	2.85	7.14	26.24
5	3.35	8.47	15.28	3.74	0	2.28	33.12
6	4.01	9.85	5.02	1.55	0	9.08	29.51
7	11.55	5.38	1.3	2.61	0	5.39	26.23
8	14.53	4.94	4.71	3.75	0	10.93	38.86
9	8.51	7.26	8.59	5.59	0	7.95	37.9
Grand Total	41.95	65.61	78.15	32.19	9.62	67.73	295.25

Table below shows the road density per sq km and road density per 1000 population.

Table 30 Road density

Ward	Total Population	Area (sq km)	Road(KM)	Population Density	Road Density per sq. km	Road Density Per 1000 Population
1	3649	9.66	32.23	377.74	3.34	8.83
2	2949	6.02	30.68	489.87	5.10	10.40
3	3546	9.99	40.48	354.95	4.05	11.42
4	1382	4.66	26.24	296.57	5.63	18.99
5	3130	7.68	33.12	407.55	4.31	10.58
6	2114	6.5	29.51	325.23	4.54	13.96
7	2210	7.19	26.23	307.37	3.65	11.87
8	3666	17.2	38.86	213.14	2.26	10.60
9	2937	9.33	37.9	314.79	4.06	12.90
TOTAL	25583	78.23	295.25	3087.22	36.94	11.54

Table 31 Overall Type of Road Surface in Km

Road class	Blacktop	Bridge	Earthen	Gravel	New	RCC	Rock Soling
NH (Siddhartha Highway)	9.61						
District roads	39DR006			2.41			
	39DR011	1.39		4.06	1.96		0.08
	39DR012	1.99	0.14	3.17	0.53		
	39DR013	0.53		8.18	4.12		0.07
	39DR017	0.48	0.11		2.50		
	39DR020				1.24		
Municipality roads	22.87		200.56	18.76	6.37	3.84	0.06

Table 32 Identification of culvert/bridges in categories of road

S.N.	Object Id	Name of Object	Category
1	2	Bridge	39DR012
2	3	Bridge	39DR017
3	4	Bridge	39DR012
4	9	Bridge	39DR012
5	20	Bridge	39DR013
6	14	Bridge	H10
7	15	Bridge	H10
8	17	Bridge	C025
9	18	Bridge	C024
10	19	Bridge	B011
11	23	Bridge	A001
12	34	Bridge	A002
13	42	Bridge	B004
14	6	Culvert	D011
15	7	Culvert	D013
16	8	Culvert	A002
17	11	Culvert	A002
18	12	Culvert	D008
19	13	Culvert	D013
20	21	Culvert	A001
21	22	Culvert	39DR017
22	24	Culvert	C018
23	25	Culvert	B008
24	26	Culvert	C018
25	27	Culvert	D037
26	28	Culvert	C023
27	29	Culvert	D046
28	30	Culvert	C007
29	31	Culvert	D046
30	32	Culvert	D046
31	33	Culvert	D046
32	35	Culvert	A002
33	36	Culvert	B003
34	37	Culvert	B003
35	38	Culvert	B003
36	39	Culvert	B003
37	40	Culvert	B003
38	41	Culvert	A002

CHAPTER 6: PRIORITIZATION CRITERIA

6.1 Concept of Prioritization

Each roads are of importance in some aspect, some serve large population, whereas some serve the purpose of access, while some link the ward with market or service facilities and some link acts as connectors between two wards or Municipality. It is not possible to construct/maintain or upgrade all roads at a time due to various constraints as: time, resources and cost constraint. Looking at the importance of road, some road need intervention immediately and some can be done later on. Thus, each link in a network needs to be prioritized and various intervention need to be taken based on the prioritization. In simple words, rank of each road network need to be assessed based on its importance and the intervention is taken based on the rank. The scoring criteria and their weightage/score remains the same for all road links as well as for all type of intervention.

6.2 Weightage Scoring Criteria

After rigorous study (literature around the world and past experience) and ToR, following prioritization criteria is published. Eight ranking/prioritization indicator is proposed as prioritization indicator, which includes following:

Table 33 Proposed Scoring Criteria with score for prioritization

S.N	Scoring Criteria	Scoring Unit	Score
1	Demand Priority of wards		10
2	Total existing width	Meter	10
3	Population served		20
4	Road network benefit (access to service centers , recreational center, agricultural center and market)		30
5	Link to future development potential sites		10
6	Link to other road network (SRN, District roads, Airport)		10
7	Road Surface		10

A. Demand priority of wards:

It is the one of the major criteria for prioritization. Each ward has provided intervention in prioritized order during filling demand form from priority order one to five. These priority is based on actual present ward resident need, i.e. the intervention which is at number 1 priority need to be done first. Higher the priority of intervention, it should get highest score. If certain intervention got highest priority i.e. number 1 priority in certain ward level, then it need to get full marks. Road with first priority will get full marks and the score will reduced by 20 % for each lower level priority; i.e. second priority road will get 80% score. Lowest priority (5th priority) link intervention

will get twenty percent of total score. And all other roads will get 10% of the total score. The road link with different priority from different wards will get the average score

B. Existing Width of Road:

Existing width is also the next governing factor for prioritization. The present width of the road is the indicator of the importance. The road which is wider among many roads within the Municipality carries slight more importance than other roads. Thus, widest road is given highest priority and thus full score. As the new proposed road doesn't have width at present day giving them Zero score will not be realistic and thus new proposed road is given 25% of the total score. Road width within zero and maximum width is given score based on relative scoring. The score for road with variable width will be based on weightage width.

C. Population Served

Population coverage by the road linkage is one of the important indicator of prioritization. Higher the population served by the road, higher will be its necessity or importance and it need to be constructed/upgraded/maintained first. Thus, high score is assigned for the road link serving high population and all other score is based on the relative marking wt. Now the question arises which population can be considered as high population and thus relative score is provided. Among all roads within the Municipality, road serving maximum population is given full marks and the other roads are provided score accordingly. Thus, the score for road based on population served lies within zero to full score.

D. Road Network Benefit (RAMS)

It is one of the main governing prioritization indicator. The road link may provide access to recreational (picnic spot, historical place, park, cinema hall, playground), agricultural land, market center and service center (schools, health post, governmental offices, etc.). A single road link can serve just a single function to all above four function. Simply more the services road link offers more will be the importance of the road link/network. The proposed road intervention which serve all four facilities is regarded as the major intervention which need immediate attention and thus it is provided with highest full marks. If the road link only serve any three function/purpose, the score is reduced to 80% of the total final marks. Similarly, link serving any of the two function is provided with 60% and the road which serve only a single function is provided with 40%.

E. Future Potential Development

It is one of the main governing prioritization indicator. Higher the future potential development, higher will be its necessity or importance and it need to be constructed/upgraded/maintained first. Thus, high score is assigned for the higher potential road and all other score is based on the relative marking wt. Among all roads within the Municipality, road serving maximum potential development is given full marks and the other roads are provided score accordingly. Thus, the score for road based future potential lies within zero to full score.

F. Link to other road network

It is one of the main governing prioritization indicator. The proposed road intervention which join SRN, Feeder road, District road is regarded as the major intervention which need immediate attention and thus it is provided with highest full marks. If the road link only serve any two function/purpose, the score is reduced to 80% of the total final marks. Similarly, link serving any of the one function is provided with 60% and the road which serve from class a road is provided with 40%.

G. Existing Road Surface

Road surface type also governs the scoring and prioritization of the road. There are two principle behind which type of road to prioritize first, one principle says the objective need to be access first, i.e. first make the road motor-able so that it can be operated in all for all weather road. Another approach says the road importance is dependent on surface type, the road which is bituminous at presents has great importance and need to be maintained first compared to upgrading earthen road. Both aspect has significant impact on overall prioritization. Basically, road which has bituminous or metaled road surface serve large population and has significant width and thus it will get high marks in those criteria. Hence, this study give highest priority to earthen surface as we are mainly concern with accessibility first. Earthen surface road acquire full marks, gravel road surface acquire 80% of total and bituminous/metaled road gets 60% of total score. If a single road have different surface at different section, then the weightage average based on length is taken and score is provided accordingly.

6.3 Prioritized Road Network

The road intervention is based on the budget available as well as the importance of the road and based on above prioritization criteria all roads have been prioritized and then the MTMP plan had been proposed based on the prioritized road network. The prioritized score for various roads have been summed up in the form of table as:

Table 34 Prioritized Major Municipal Road Network

Road Code	Width	Surface Type	Ward Demand	High Hierarchy Road	IDP	Populati on Served	SAMT	Total Score	Priority
	Score	Score				Score			
CLASS A ROADS									
A001	10.0	8	8	9	10	20	22.5	87.5	2
A002	10.0	8	10	8	7.5	20	30	93.5	1
A003	9.5	8	10	9	7.5	10	15	69.0	3
CLASS B ROADS									
B001	10.0	6	8	9	10	20	9	78.0	2
B002	9.5	10	10	8	5	10	8	67.5	5
B003	9.5	8	6	8	5	10	8	61.5	7
B004	9.5	8	8	6	5	20	6	64.0	6
B005	9.1	8	0	8	5	10	8	40.1	10

Road Code	Width	Surface Type	Ward Demand	High Hierarchy Road	IDP	Populati on Served	SAMT	Total Score	Priority
	Score	Score				Score			
B006	9.1	10	0	8	5	10	8	42.1	9
B007	9.1	10	6	10	10	20	10	87.6	1
B008	9.5	8	10	10	5	10	10	75.0	3
B009	9.1	8	10	10	7.5	10	10	69.6	4
B010	9.1	10	4	8	5	10	8	46.1	8
B011	9.1	10	10	8	7.5	10	8	69.6	4
CLASS C ROADS									
C001	8.2	10	8	6	5	10	10	47.2	17
C002	8.2	10	2	6	5	10	10	41.2	23
C003	8.6	10	4	8	5	10	10	45.6	21
C004	8.6	8	0	8	5	10	8	47.1	18
C005	8.2	10	0	8	5	10	10	48.7	16
C006	10.0	10	6	8	10	15	10	81.5	1
C007	8.2	10	0	0	5	15	10	45.7	20
C008	8.6	8	6	8	5	15	8	65.6	5
C009	8.6	10	6	5	5	10	10	52.1	14
C010	8.6	8	2	5	5	15	8	43.6	22
C011	9.1	10	0	5	5	10	10	46.6	19
C012	9.1	8	10	5	5	15	8	52.1	14
C013	9.1	6	0	10	10	10	6	52.6	13
C014	9.1	8	6	10	5	10	8	63.1	6
C015	8.6	8	4	8	5	10	8	43.6	22
C016	9.5	8	10	5	5	10	8	55.0	11
C017	8.2	8	2	10	5	10	8	50.7	15
C018	8.6	10	0	8	5	15	10	54.1	12
C019	8.6	10	0	8	5	15	10	54.1	12
C020	8.6	8	10	10	5	10	8	74.1	3
C021	8.6	10	8	8	5	10	10	57.1	10
C022	8.6	8	2	8	5	10	8	71.6	4
C023	8.6	10	8	5	5	10	10	61.6	7
C024	8.6	10	4	8	5	10	10	60.6	8
C025	8.6	10	0	5	5	10	10	46.1	18
C026	8.6	10	8	10	5	20	10	76.6	2
C027	9.5	6	0	10	10	10	6	60.5	9

CHAPTER 7: MUNICIPAL TRANSPORT MASTER PLAN

This chapter deals with the strategic framework associated with municipal transport master plan. Alongside, it also covers perspective plan and implementing strategies necessary to achieve the plan followed by budget expenditure plan.

7.1 Perspective Plan of Municipal Road Network

Perspective plan of Municipal road network includes the maintenance of the access and collector roads and development of higher hierarchy road corridors supporting mobility of the roads. First five years should focus on development of existing access roads and their maintenance. It also incorporates construction of new road linkages to provide basic access to the settlements. During this period formulated road hierarchy will be implemented in terms of policy and enforcement of bylaws. Within 2 years other complementary plans of land use and city development will be developed. In the third year, the MTMP and its perspective plan should be revised in coordination with the other plans formulated and changes captured during this period.

Medium term planning will implement the higher hierarchy roads in stages of clearing of the required ROW and infrastructure facilitation. Proper development stages of roads should be planned (construction of Class “A” roads to the standards of Class “C”, then gradually upgrading to Class “B” and to Class “A”). Other implementation strategies should be developed and finalized at the end of this period. The road network developed during this period shall complete construction of Class “C” roads. Gradual upgrading of the higher hierarchy road networks during year ten to twenty will be justified by the traffic generated and level of mobility demanded to support the emerging economy. Land development and management should go parallel with clearance of Row of higher classes of road. Road corridor development project should be introduced for acquisition of land required to clear Row for various classes of road.

7.2 Financial Institutions and Capital Investment Plan

The construction work in each year depends on the probable budget. Firstly, the total budget for the current or last financial year needs to be determined. Firstly, the municipal Annual Budget Book is studied for revenues sources as well as expenditure plan on road. Planning of the investment is essential to support local government in developing good and best practice in construction, upgrading, overall asset management and especially operation and maintenance the road project. The grass root level involvement in the development of the road sector helps to create an informed and responsible citizen in the society. Thus, it is important to have local people’s participation in the construction works of the local access roads. A majority (if not all) the local access roads should be constructed by the local people in coordination with the Municipality. People’s participation can be achieved in plantation alongside of the roads, cleaning of the road area and other activities.

Municipality has the responsibility of preparing the necessary framework and implementing policies and strategies for the planned development of the municipal roads and thus the Municipality as a whole. Major share of the municipal budget should be used to maintain the roads and construction of wider roads to meet the planned class and ROW. The annual program should address the local need and the need of emergency and specific maintenance.

Municipality has a major role in developing the roads. It has the responsibility of preparing the necessary framework and implementing policies and strategies for the planned development of the municipal roads and thus the Municipality as a whole. Major share of the municipal budget should be used to maintain the roads and construction of wider roads to meet the planned class and ROW.

The annual program should address the local need and the need of emergency and specific maintenance. Specific roads should be constructed as a whole and not in parts for longer period of time. Other institutions are district and division line agencies such as DoR, DoLI. These institutions are responsible for the development of road corridors that are important to the district or a larger area as a whole. Their contribution may or may not invest in the roads within the Municipality, but wider roads of the Municipality that extends to the boundary to other VDC/districts may draw investment beyond the municipal boundary. This will ultimately help in the development of the local municipal market center.

7.3 Five Year Budget Expenditure

Provision of annual budget expenditure for proposed intervention (new construction, upgrading, maintenance and rehabilitation) is one of the final outcome of the study. The budget plan is based on realistic approach and takes consideration of annual allocated budget of Municipality. Intervention that can't be completed in preceding year should be the next priority in coming year. If a certain road, which was targeted to complete in first year could not be finished in first year, need to be given first priority in next year expenditure plan. If there occurs deficit in annual expenditure, Municipality need to incorporate that particular heading in next year at any cost. They can look for grant, assistance from district or even central level or they can incorporate them by shifting budget from less importance item/heading. Budgeting of roads has been divided according to interventions:

- i. Construction and upgrading (70%)
- ii. Maintenance (30%)

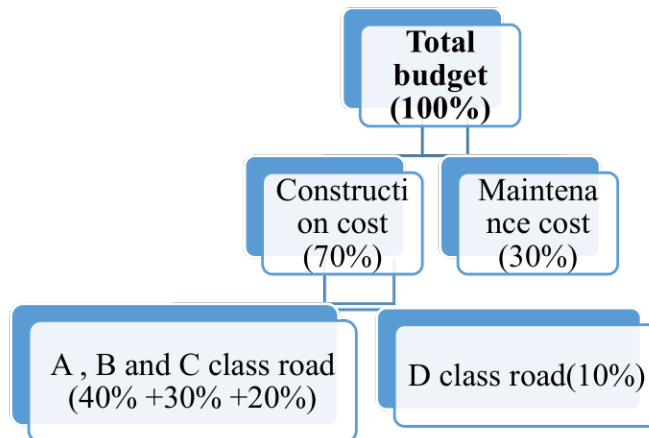


Figure 20 Expenditure Breakdown based on to MTMP Guidelines "A" Annex 5.

Budgeting of municipal road has been calculated based on present budget and certain growth rate. The capacity enhancement of the Municipality is assumed by 10% increment each year. Maintenance cost has been allocated 30% of fund available for municipal road. Yearly maintenance plans according to need based assessment of required maintenance has to be prepared and cost allocation needs to be done through this plan. In absence of specific fund granted for special project, all other fund available to Municipality for construction of road should come through one window system collected in under single basket and allocated to the roads based on ranking of roads.

Table 35 Budget Allocation for Upgrading and Maintenance

Year	Budget	Road infrastructure Budget	For Class "A" Roads (40 %)	For Class "B" Roads (30 %)	For Class "C" Roads (20 %)	For Class "D" Roads (10%)	Total for Construction & Upgrading- 70%	Maintenance (30%)
2079/80	160,587,502	32,117,500	22,482,250	8,992,900	6,744,675	4,496,450	2,248,225	9,635,250
2080/81	182,275,558	36,455,112	25,518,578	10,207,431	7,655,573	5,103,716	2,551,858	10,936,533
2082/83	206,892,682	41,378,536	28,964,975	11,585,990	8,689,493	5,792,995	2,896,498	12,413,561
2083/84	234,834,457	46,966,891	32,876,824	13,150,730	9,863,047	6,575,365	3,287,682	14,090,067
2084/85	266,549,894	53,309,979	37,316,985	14,926,794	11,195,096	7,463,397	3,731,699	15,992,994
2085/86	302,548,641	60,509,728	42,356,810	16,942,724	12,707,043	8,471,362	4,235,681	18,152,918
Total	1,353,688,735	270,737,747	189,516,423	75,806,569	56,854,927	37,903,285	18,951,642	81,221,324

The cost of construction and upgrading of road of class "D" is subjected to 10% of total cost of construction and upgrading. Class A road owes 40%, Class B 30% and Class C 20% according to MTMP Guidelines "A" annex 5.

This budget need to be increased to provide intervention to all road network, if it is to be designed to desired level of full Right of way and hence they are constructed to acceptable level in next five years and is dealt in next subheading.

7.5 Five Year Implementation Plan

Provision of annual budget expenditure for proposed intervention (new construction, upgrading, maintenance and rehabilitation) is one of the final outcome of the study. The budget plan is based on realistic approach and takes consideration of annual allocated budget of Municipality. Intervention that can't be completed in preceding year should be the next priority in coming year. If a certain road, which was targeted to complete in first year could not be finished in first year, need to be given first priority in next year expenditure plan.

For the preparation of implementation plan one intervention for each road was considered to be intervening. However, if budget remains, then it shall be used for the preparation of second level of interventions considering the same priority. For example, if a road is earthen at present, it will first be upgraded to gravel road and then the next ranked road is provided with intervention and if the budget remains only then it will be upgraded to bituminous/metaled road. At short run all the Class A and B roads will be upgraded to two lane roads, whereas Class C and D roads to single lane roads

For track opening and gravelling full length (Row) was used for intervening. In case of blacktopping within MTMP period (i.e. 5 years) **Single lane for Class A, single lane Gravel for Class B, C and Class D roads** has been taken under considerations. The difference of Row and existing width was taken for determining the cost for widening. In each of these calculations, the rate given in guideline was for single lane and the necessary multiplication was made for respective number of lanes. Drainage calculation was made for both side drains as well as cross drains. Cross drain was considered at every 1000 meter intervals. Most often double side drain was considered within the city area.

Based on the budget projection of the Municipality for next five year and budget allocation for various class of roads and surface type, the implementation strategy for the major hierarchical road network has been proposed.

CHAPTER 8: CONCLUSION

8.1 Conclusion

Municipal Transport Master Plan has been prepared for Bhirkot Municipality. A series surveys for data collection, series of different level interaction with the locals and various authorities was conducted. The study has identified all the roads of the Municipality, their status and interventions required. The map of IDPM, MIM, MTPP and other maps are prepared.

The study has formulated hierarchy of roads which is necessary for long term rapid development of the Municipality area. The study has shown increased trend of motorized vehicle. This is necessary to be implemented as the developed cities are have trouble to address the demand of active mode user friendly urban road infrastructures. As the implementation strategy suggests, the Municipality needs to develop proper framework and policies for the implementation of the perspective plans, built the capacity of the Municipality and the local organizations and committees and proper stages of development of the roads.

Transport and land use along with nodal development cannot be disintegrated. Preparation of municipal transport master plan is the first step in the planned development of the municipal area. MTMP alone cannot circumscribe the potential development of the municipal area. Comprehensive city development plan, land use plan, drainage master plan, etc. are some other plans that needs to be prepared and integrated with municipal transport master plan. For future nodal development and transport development, land use master plan and comprehensive city development plan should also be prepared. MTMP should then be revised based on those plans.

The Municipality is linked with high network of DRCN but proper materialization of the planned road network seems missing. Most of the roads are not of adequate width and hence they need to be upgraded.

8.2 Recommendation

- Unplanned urbanization has rendered many cities unlivable because of the growing pollution and lack of green/open spaces. Road space is most frequently used public space. **Provision of green belt** along the urban roads creates safer and pleasant walking spaces, and acts as median to separate motorists from each other and from the NMT users.
- **Proper structured public transport routes** are vital for sustainable transport development. As the demand increases, before well-structured and formal transport is justified economically, the local government should introduce City Bus to ply at least within the Municipality.
- **A proper hierarchy of settlement** should be developed to segregate the commercial and business centers from settlement areas and industrial area. A hierarchy of the market centers should be developed as main market
- Better provision of **Road and road side infrastructure** is must for effectiveness of planning. Due to very high active users, proper networks of pedestrian way and cycle tracks should fit in the basic road width. Proper bus lay byes are necessary elements for proper public transport system. Adequate lighting system along with proper connected pedestrian ways and zebra crossings is another major road infrastructure.
- Increase private motorized vehicle ownership will have witnessed the need of parking, so **Proper Parking Management** is must. Similarly, parking at the major destinations such as business and market centers, industrial and commercial areas should be managed by the private sector.
- **Integrated service planning** is a very important factor for damage minimization during construction and expansion of various facilities. As the road follows, settlement also

expands which demands other facilities such as electricity, drainage and drinking water. All these facilities are provided along with road infrastructure, mostly within the ROW of road. Proper integration of these services with road planning is necessary to minimize multiple investment in the individual infrastructure and the damage to other infrastructure during maintenance and/or expansion.

- The proposed roads cannot be directly implemented at a glance. **Proper phases of development** of roads of all hierarchy should be envisaged and planned.
- **Land acquisition** should go parallel with development phase of roads and possibly concept of land pooling can be adopted for land acquisition.
- **Proper Land Use Plan and Comprehensive city development plan** is must for better effectiveness of this MTMP and these three need to be correlated with each other.
- It is recommended to adopt **Labor based Environmental friendly and Participatory (LEP)** approach popularly known as Green Roads construction method. Green Road approach aims at reducing scarring by minimizing the amount of cut necessary and by balancing the amount of material cut with the amount of fill required.
- Revised Scoring criteria and Mid Period Review is must to ensure the MTMP is in accordance with the future developed polices on Land Use and Comprehensive City Development Plan.

GLOSSARY:

Accessibility: Ability to reach opportunities/facilities that is beneficial and not the movement.

Base map: A map depicting background reference information such as landforms, roads, landmarks, and political boundaries, onto which other thematic information is placed. A base map is used for locational reference and often includes a geodetic control network as part of its structure.

Capacity: The maximum number of vehicles that can pass over a given section of a lane or roadway in one direction (or in both directions for a two-lane or three-lane highway) during conditions.

Collector road: These roads provide both access and movement within residential, commercial and industrial areas. They are typically discontinuous between residential areas, so as to avoid traffic infiltration through neighborhoods. Lower density developments and community land uses such as schools and convenience retail are often located on collector streets.

Destination: Location where trips are attracted or ended.

Emergency maintenance: Maintenance works that are to be carried out due to unexpected and sudden blockage of roads that stop vehicular movement due to natural disaster

Household: Those who dwell under the same roof, compose a family and eat at the same kitchen

Land Use: Land use highlight on what purpose the land is being used

Local road: These roads provide direct property access in residential, industrial, commercial and downtown areas. With local streets connecting primarily to collector roads, travel distances are short, speeds are relatively low and volumes are modest, as their primary function of accommodating traffic from adjacent lands.

Maintenance: The process of preserving the original condition or function of an asset

Mobility: Efficient and effective movement of people and goods

MTMP: The MTMP is a strategic planning document designed to identify and address the Municipality's needs to the year 2020 and beyond. The MTMP is the document that identify, classify and prioritize the municipal roads; identify possible sources of funds and materials for the construction of the prioritized roads according to their respective standards and scientific mobilization of the available resource.

Network: Set of nodes and connecting links that represent transportation facilities in an area.

New construction: The work of building

Origin: The location of the beginning of a trip or the zone in which a trip begins.

Passenger Car Unit (PCU): Factor used to convert various type of vehicle to car equivalent in context of heterogeneous traffic

Periodic maintenance: Maintenance works to be carried out in intervals of years and of large-scale.

Public Transport: Shared passenger transport service which is available for use by the general public

Recurrent maintenance: Small maintenance works not falling under routine maintenance that are carried out a few times a year in all roads to repair minor damage resulting from traffic and rainfall

Right of Way: A general term denoting land, property of interest therein, usually in a strip, acquired for or devoted to transportation purposes

Routine maintenance: Small maintenance works that are to be carried out in all the seasons on all roads on a regular basis

Specific maintenance: Spot treatments and repairs that do not occur every year or in every road, and which are very specific in nature and location.

Traffic Volume: Number of vehicle passed through the considered section per unit time

Trip: A one-direction movement which begins at the origin at the start time, ends at the destination at the arrival time, and is conducted for a specific purpose.

Upgrading: The process of addition or change that makes something better than it was before

Usable area: The area that can be used for human construction. It includes cultivated and built up area. Environment sensitive area and barren lands are not usable area.

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**ANNEX A:
MAPS**

**ANNEX B
PHOTOGRAPHS**

