Planning Assessment of Transport System: A Case from Nepal

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ABSTRACT

Purpose: *Road infrastructure is considered as "the infrastructure for infrastructure". Planning assessment of the transport system is done for assessing and planning the present road and transport infrastructures and facilities within the municipality and the surrounding local bodies. The research aims to analyse the planning of the transport system of Devchuli Municipality for recommending pragmatic solution of transport problems.*

Design/Methodology/Approach: *Devchuli Municipality is located in Nawalparasi East district of Gandaki Province in Nepal. Municipality is divided into 17 wards, covers 112.72 km2 area. Municipality is populated with different castes and religions with population of 49,637. It consists of 12025 households with population density of 440 persons per sq.km and 4.13 people per household. Data were collected using Official document, Key informant interview, Field Survey, and observation and analyzed using Content, Origin and Destination (OD) Survey, Road Inventory Survey, Classified Vehicle Count Survey, Public Transport and Services Study.*

Findings/Result: *Municipal Transport Master Plan (MTMP) started with the setup of Municipal Road Coordination Committee (MRCC) and the collection of demand and inventory of road within the municipality. Road inventory survey was done and the length of the roads collected is about 339.67 km (without SRN) From the sample data it is found that nearly 11% of the mode of transportation is shared by active road users hence footpath is proposed on the roads. Visionary city development and Indicative Development Potential Plan is studied with which the existing and potential market center/service centers (key growth centers) and the areas having various development potentials such as agro-based industries, high value cash crops and tourism.*

This study also formulated the road hierarchy for the various roads namely Class A, B, C and D. Class C and D basically deals with access while Class A and B basically deal with mobility and accessibility to higher services. Total cost for the required interventions proposed is calculated based on the rates of ToR for 5 years and was found to be approximately 794 million rupees.

Originality/Value: *It is action research. This study helps to develop a Visionary city development plan for Pragmatic solutions for issues of transport.*

Paper Type: *Ex-Post Facto Research*

Keywords: OD Survey, Financial gap, Existing Road Network, Condition of transport accessibility, MTMP

1. INTRODUCTION :

Rapid urbanization has led formation of rural areas to urban areas in short time. The presence of goods, services and facilities attracts people from rural areas to live in urban areas. While in past policy were made to encourage people to reside on their native area due to haphazard urbanization, recent study from economics and market theories supports dense population over urban areas based upon agglomeration and scale economies. Agglomeration economies are amplified by density and attenuated by distance. While in rural areas accessibility has been focused as major criteria in

transportation, urban areas need better mobility with accessibility (Mishra, Sah & Aithal, 2020: Aryal and Mishra, 2019) [1 &2].

Devchuli Municipality was, amongst them, established in March 10, 2017 (2073/11/27). It was formed by merging then existing Dibyapuri, Devchuli, Pragatinagar and Rajahar village development committees. Devchuli Municipality is located in Nawalparasi East district of Gandaki Province in Nepal. The municipality is located at 120 m to 1850 m altitude from mean sea level. Municipality is divided into 17 wards, covers 112.72 km2 area. Municipality is populated with different castes and religions with population of 49,637. Among them 26,480 (52.4%) are women and remaining 23,155 (47.6%) are men. It consists of 12025 households with population density of 440 persons per sq.km and 4.13 people per household (Devchuli profile, (2019) [3]).

After being designated as a municipal area, it will attract more population as socio-economic growth and other infrastructure development will gain pace. The municipality and its surrounding VDCs will see a rapid increase in housing, infrastructure and urban services demand. In this regard, under the coordination of the District Development Committee, Nawalparasi East and as per the decision of Infrastructure Development Division and its technical and Institutional support, is initiating the formulation of Municipal Transport Master Plan for assessing the present road and transport infrastructures and facilities within the municipality and the surrounding VDCs. So as to be presented as proper municipality or a city, it must have a very good mobility and accessibility by public and private means of transportation.

2. PROBLEM STATEMENT :

With a view to develop a robust transport infrastructure by providing pragmatic solution existing in the current transport system, It is essential to overcome this entire problem a systematic analysis is needed for the existing road network to identify the gap based on demand, land use plan, budgeting, service area and other facility area. So, the researcher is intended to conduct applied action research considering Devchuli Municipality as a case project. The outcome of research would be a guiding document for policy maker and transport planner as suggested based on study of Bandipur Inner Ring Road, Tanahu [4].

The study is highly significant to analyze mobility status of Municipality and access condition of public transport along with safety status and issue. It will be a guiding document for preparing indicative municipality development potential map and inventory map. It will be also significant for financial planning and Municipal Transport Master Plan (MTMP) preparation as the Municipality is under the process of developing its road network systematically.

3. OBJECTIVES :

The overall objective of this research is to provide the pragmatic solution of transport plan of Devchuli Municipality after analyzing the existing road network sufficiency.

4. LITERATURE REVIEW :

4.1 Road Planning in Nepal:

Planning at all levels in Nepal is made with the help of various guidelines availed by National Planning Commission (NPC), MoFALD/DoLIDAR. The Local Bodies (LBs) have extensive roles in local level development planning in general. Preparing district periodic plans and drawing annual plans from it are the responsibilities of the districts. The practice has been promoted and adopted by the local self-governance act and regulations bydefining14 steps procedure for local level planning [4 &5].

DDC being an umbrella institution for overall development activities of the district should request all the development institutions within the district to integrate the activities in line with DTMP. Summarized version of DTMP should be distributed to all the development offices in the district to help the line agencies to plan their future activities keeping in view of the future development of road network in the district. Similarly, summarized version of the DTMP is to be distributed to all the VDCs of the district, so that VDCs could plan to link its village and settlement level RTI and other development activities. Now with the increased resources available to each VDC from the central bock grant, each VDC are undertaking the RTI in unplanned and haphazard manner. Most of these transportation infrastructures are not in operational. VDCs are to make Village Transport Plan (VTP), so that each VDC could invest its resources in sensible manner (Khadka, (2016) [6]).

Department of Roads (DoR)as well as Department of Local Infrastructure Development and

Agricultural Roads (DoLIDAR) have constructed roads to meet global and local demands with rapid urbanization by addressing the issues of roads development through formulating effective road guidelines (NURS, (2015) [7]).
Basically, the planning at the municipality level urban roads is participatory and is based on bottom-up approach. Planning is made with the help of various guidelines availed by NPC, MoFALD, MoUD and others and periodic plans and annual plans are drawn in municipality. Municipality adopts the14 step plan procedure for local level planning (NURS, (2015) [7]).

4.2 District Level Planning Approach in India:

The grass-root level administrative unit of India is Palli (Village). While planning for district level developments in India, four major steps are conducted.

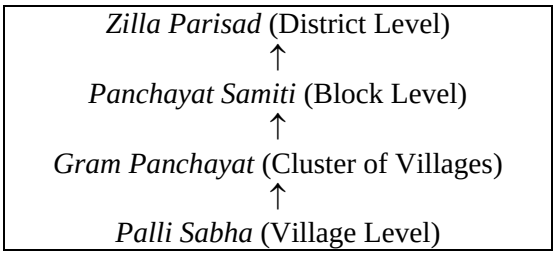


Fig. 1: District Level Planning Process in India (Donnges et al, (2004) [8]).

The Gram *Panchayat* Extension Officers train representatives of villages of his Gram *Panchayat* in the collection of data and preparation of Village Maps. They also conduct group discussions and interviews about various development sectors.
Data, information and demands are collected from every *Palli Sabha* (villages) and accumulated in Gram *Panchayat*. First, the collected demands are screened in cluster of villages. Then the screened demands are prioritized, ranked and implemented.
Projects, which are beyond the Gram *Panchayat* capacity, is sent to the *Panchay* at *Samiti*. Again, in *Panchayat Samiti*, the accumulated projects from various *Gram Panchayat* is screened and prioritized. At last, it is passed through the *Zilla Parisad* (Donnges et al (2004) [8]).
It is found that the local level planning process of Nepal is almost similar with the local level planning process of India. In both processes, Participatory and Bottom-Up Planning Approach is used.

4.3 Municipal Transport Master Plan of Devchuli Municipality:

MTMP started with the setup of Municipal Road Coordination Committee (MRCC) and the collection of demand and inventory of road within the municipality. Road inventory survey was done and length of the roads collected is about 302.14 km (without SRN) with almost all roads having earthen surface. From the sample data it is found that nearly 11% of the mode of transportation is shared by active road users hence footpath is proposed on the roads. Similarly, the average time to reach the nearest bus stop is about 10 minutes for this municipality and due to lack of proper public transportation; mobility mostly relies on private vehicles though nowadays public transport condition is increasing at a slow pace.
Visionary city development and Indicative Development Potential Plan is prepared basically showing the existing and potential market center/service centers (key growth centers) and the areas having various development potentials such as agro-based industries, high value cash crops and tourism.
This study also formulated the road hierarchy for the various roads namely Class A, B, C and D. Class C and D basically deals with access while Class A and B basically deal with mobility and accessibility to higher services. Total cost for the required interventions proposed is calculated based on the rates of ToR for 5 years and was found to be approximately 794 million rupees.
Due to the limitation of the municipality budget, the roads are ranked hierarchy wise based on the Demand priority of wards, Proposed road class, Total existing width, Population served, Road surface condition, Road density, Settlement density, Service provided by the road such as Recreational(R), Agricultural (A), Market(M) and Service centre (S) (RAMS), Access to poor and minor. And five-year implementation plan is prepared. This shows the budget required for the first five year is 794 million rupees (Devchuli Municipality, (2021) [9]).

4.4 Mobility and Safety Plan: Amravati Municipal Cooperation, India

Amaravati Municipal Cooperation, India has planned to develop the post urban planning and smart cities. Municipality has focused in major six key areas and urban transportation is one of the important keys in their plan.

Municipality is going to prepare GPS enabled map of the connectivity occurred in the municipality. If the roads are narrow for the buses and other vehicles, they are widening and constructed as per required design and after construction, kiosks will be kept at every bus-stop. The enhancement, usability and ownership of the connectivity is taken by municipality itself.

Bus fleet capacity will be increased and it will be supported by enhancing required infrastructure development.100% traffic light system will be installed (Amaravai Municipal, (2015) [10]).

5. RESEARCH GAP :

Planning is the key of implementation though we lack a perfect planning guidance for transport which is having the highest investment. So, the gap of guiding document will be covered through the study.

6. RESEARCH METHODOLOGY :

6.1 Study Area:

Devchuli municipality is located in Nawalparasi East district of Gandaki Province in Nepal. The municipality is located at 120 m to 1850 m altitude from mean sea level. Devchuli municipality was established on March 10, 2017 (2073/11/27). It was formed by merging then existing Dibyapuri, Devchuli, Pragatinagar and Rajahar village development committees. Municipality is divided into 17 wards, covers 112.72 km^2 area.

Devchuli Municipality has a warm and sub-tropical type of climate with deciduous forest type. Average rainfall of the area is about 2800 ml. Small streams are flowing from all the way from north to south of the municipality to meet at Narayani River. Chitawan National Park is in south side of Devchuli Municipality, Gaindakot Municipality lies on the East and Kawasoti Municipality and Hupsekot Rural Municipality on west. Similarly, Bulingtar Rural Municipality is in the Northern side of Devchuli Municipality.

The major rivers or water resources of this municipality are Lokaha, Narayani, Mukunde, Bagaha, Aanpchaur, Deusat, Baulaha, Kakardaha, Bhubya, Bharlangdi and Jharahi khola.

Municipality is populated with different castes and religions with population of 49,637. Among them 26,480 (52.4%) are women and remaining 23,155 (47.6%) are men. It consists of 12025 households with population density of 440 persons per sq.km and 4.13 people per household. The municipality is divided into 17 wards. Among them, the maximum nos. of population are in ward 17 with 6296 individuals & lowest in ward 8 with 1390 [3 & 9].

6.2 Population with Density and Household Structure:

Municipality is populated with different castes and religions with population of 49,637. Among them 26,480 (52.4%) are women and remaining 23,155 (47.6%) are men. It consists of 12025 households with population density of 440 persons per sq.km and 4.13 people per household. Density of ward 2 is highest with 2045 people living in per sq. km of land while density of ward 6 is lowest with 87 people living per square kilometer of land.

Out of total population of 49,637 in Municipality, 26,480 (52.4%) are women and remaining 23,155 (47.6%) are men. It consists of 12025 households with population density of 440 persons per sq.km and 4.13 people per household.

Ward 6 has the highest household size of 4.52 whereas ward 2 has the lowest household size with average size of 3.84 [3 & 9].

6.3 Education:

Nearly 27062 members of the municipality have completed or are perusing only school level education. About 4640 are enrolled or are having completed higher secondary (10+2), 1646 have bachelor's degree and only 875 have higher education with literacy rate is 74.2%, [3].

6.4 Employment pattern and income:

Among the members of the households in Municipality, 12025 households (46%) are involved in agriculture as their source of income, 4725 households (18%) from foreign remittance, 3720 (14%)

are employed in service sector, 3305 (13%) households have their own business or industry whereas 1559 (6%) households earn from daily based labour and 821 (3%) households have retirement funds as their source of income.
Most of the respondents with higher education are involved in service sector. Illiteracy is highest among unemployed people while school level education dominates all other occupation. A majority of the household have monthly family income of less than NRs. 30,000.

6.5 Land use pattern:

The land use distribution of Devchuli Municipality shows that 50 sq. km (46.2%) of the land area is covered by forest. About 5.77 sq. km (5%) of land is used for residential purpose and 34.5 sq. km (31%) for cultivation purpose. About 20.12 sq.km (1.9%) of land area is covered by grass and bush. 1.6 sq km area of land is sandy and barren whereas 0.13 sq. km is covered by streams and rivers. Remaining 0.58 sq. km of land is steep.

6.6 Methodological framework:

The research will adopt pragmatic philosophy of research along with a case study survey using abductive logical reasoning with a mixed method i.e., qualitative and quantitative. Longitudinal data will be collected from both primary and secondary source.
The study will be started with preliminary planning or desk study where basic background of municipality will be studied with help of secondary data including census data, GIS data. The study will get acceleration with formation of MRCC and inspection report. Various field surveys will be carried out with objective of collecting primary data on transportation network, trip characteristics and service facilities. Along with the primary data, demands for various transportation projects (construction/upgrading/maintenance) will be obtained from each ward. Also, potential areas/location for various facilities will also identified based on interaction with local people and MRCC. The scoring criteria for prioritizing road network will be identified based on key informant interview.

6.7. Data Collection:

6.7.1 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 will be 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 will also be carried out.
Following will be the primary data collection methods:

- Origin and Destination (OD) Survey
- Road Inventory Survey
- Classified Vehicle Count Survey
- Public Transport and Services Study

Origin and Destination (OD) Survey Household questionnaire method will be used to conduct OD survey which will give number of information reflecting, personal, household and trip making characteristics. This survey will also be helped to visualize the accessibility and mobility scenario of road network and to public transportation from the settlement/wards. As all the household will not be covered a realistic and statistically significant sample size will be calculated based on probabilistic method.
Road inventory survey will be conducted to collect data on its condition of road, road linkage, road safety status and issues that need to be highlight. It will be helped in field validation of base maps and also assist in the preparation of road inventory map, nomenclature and coding of the road linkages and proposed various interventions.
Classified vehicle count will be conducted so as to reflect the usage of various vehicles in the certain route, especially where maximum volume occurs. Twelve-hour count will be done at required location and the vehicles would be classified to different types and finally traffic volume will be converted to passenger car unit (PCU) to visualize the exact condition which is identified and collection is being done.
Public Transport and Services Study will be highlighted the services provided by public transportation and location of various services and facilities. It will be carried out by directly interviewing the route

operators.

6.7.2 Secondary Data Collection:

Secondary data will be collected from published and non-published official record, census and literature.

6.8. Data Analysis:

Data collected at field will be first entered at MS office tools (MS excel and word) and GIS database. All the complete and reliable sets of data will be transformed into useable information and the present scenario of municipality will be shown through graphs, figures and tables. Similarly, those which will be entered into GIS database provide various types of maps. Population and traffic will be forecasted for the MTMP.

6.9. Validity and Reliability of Research:

Validity of the research will be assured by the method of triangulation through key informant interview, observation with checklist and practice from various other published and practiced documents. Content, construct and criterion validity would be assured before concluding. Reliability of the data will be assured by equal foam method.

7. RESULTS AND DISCUSSION :

7.1 Existing Status:

The existing status of Devchuli has been analysed.

7.1.1 Municipality Inventory of Road Networks:

Road transport is major transport mode for movement in Devchuli Municipality and facilitated mainly through SRN. Built up area is quite middling so there is still probability for settlement expansion in the municipality. Vehicle ownership is satisfactory among the people of the municipality. Almost entire roads are earthen with intermediate carriageway. The vehicle composition shows that most of the vehicles that ply along the roads are motorbikes.

Road inventory survey was done and details of all the roads and cross structures were collected. Total length of all the roads is 370.79 km out of which 31.12 km is Strategic Road Network (SRN) while remaining 339.67 km are Municipal Roads. At present the road density of about 3.29 km per square km for the municipality. Similarly, the road density per thousand populations is nearly 7.47 km. Ward 11 has the maximum length of road (47.60 km) whereas ward 3 has the minimum road length (4.70 km). Road density per unit area is maximum in ward 6 whereas that is lowest at ward14. After the decision of MRCC and concerned members, the roads in Devchuli Municipality have been classified in to Class A (ROW 12m), Class B (ROW 10m), Class C (ROW 8m) & Class D (ROW 6m).

Among the municipal roads, 6.89 km are Class A roads, 64.52 km are Class B roads, 95.12 km are Class C roads whereas remaining 173.12 km are Class D roads. 101.93 km (27.49%) of roads in the municipality are Blacktop, 124.76 km (33.65%) are Gravel, 131.97 km (35.59%) are Earthen and the remaining 12.12 km (3.27%) are to be newly constructed. 20.43 km of SRN is Blacktop and remaining 10.69 km is Graveled. 5.53 km of Class A roads are Blacktop and 1.37 km is Earthen. 30.59 km of Class B roads are Blacktop, 14.94 km are Graveled, 19.24 km are Earthen whereas 11.91 km are to be newly constructed. 18.15 km of Class D roads are Blacktop, 62.39 km are Graveled, 92.37 km are Earthen and 0.21 km is to be newly constructed.

From the sample data it is found that nearly 11% of the mode of transportation is shared by active road users hence footpath is proposed on the roads. Similarly, the average time to reach the nearest bus stop is about 10 minutes for this municipality and due to lack of proper public transportation; mobility mostly relies on private vehicles though nowadays public transport condition is increasing at a slow pace. The majority of trips made are by public vehicles (47%) followed by motorcycles (24%) and then walking (11%).

Surface wise Composition according to Class of Roads (km)

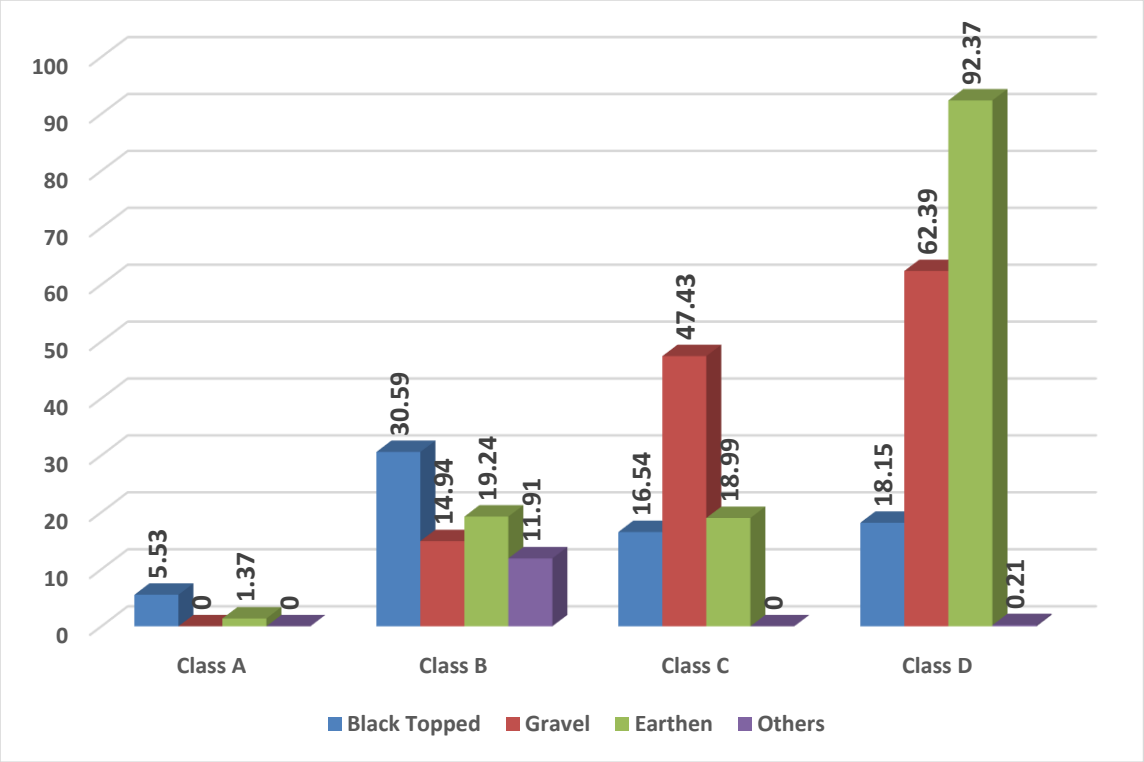


Fig. 2: Surface wise Composition according to Class of Roads.

7.1.2 Present Transportation Related Problems:

Questions were asked to local political representatives and officials of municipality to findout the problems even after the implementation of DTMP in this road. FGDs also gave several information about the problems such as the width of road is too narrow but high numbers of buses, car/taxis, bikes run from both sides, lack of footpath for pedestrian, only around 500m stone side drain is constructed in metaled section and dry earthen drain in graveled section without drain in earthen section with more than 2.5km road is dusty earthen condition, and lack of sufficient retaining structures. Furthermore, during interview and survey, it was found that road has sharp bends at in some sections without proper Krebs and lay byes in this road. Sometimes water tank of water supply system is also affected. There is not any particular bus park. It is so hard and expensive to transport vegetables and other products in the market. It is so inconvenient to go in hospital and other service areas. There are complaints about the roads from internal and external tourists. After interviewing Executive Officer and other officials of municipality, it was found that they are also facing different problems relating transportation sector such as issues of Right of Way (RoW), drainage and Setback and being difficult to pass buildingdrawings without any traffic sign and signals and any linkage b e t w e e n road, hotel business and tourismproperly.

Result showed that people, visitors and even municipality office are facing difficulties stillin present time and need improvements for getting easy access and passes for the vehicles. This result also shows the rational/needed and legitimate of MTMP to assess the implement ability of it.

7.2 Sufficiency of Existing Road Network:

The Sufficiency of existing road network is analyze using projection of population and projection of road traffic along with planning of road infrastructure to cater this traffic in short, medium and long term with preparation of Development potential map.

7.2.1 Projection of population:

The underlying assumption for the preparation of MTMP is that, the recently designated municipal area has a growing population and has also fulfilled the population criteria (one of many criteria to be a municipality) to be a municipality. As such the municipality is an urban area or an urbanizing area. One of the characteristics of an urban area is higher population densities and corresponding higher demand for services and facilities all of which directly demands proper transport infrastructure. 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.

In the present time the urban population is increasing in high rate although the proportion of it is very small. To forecast the population in the municipality for the preparation of MTMP the geometric method has been used considering the rapid urbanization of the area. For this the following formula is used:

$P_n = P (1+ IG/100)n$

Where, IG = geometric mean (%)

P = Present population

n = no. of decades.

Pn=population at the end of nth decade

By using this method, we found that the average growth rate of population in this municipality is on average 20.95% as shown in table 2 which indicates rapid urbanization. This may be due inter district migration and migration from other local bodies of Nawalparasi East. Based on this trend, the average projected population of this municipality on the year 2031 will be 62363.

Table 1: Population growth rate and base year population

Municipality	Population of Year		Growth Rate (%)	Remarks
	2011 AD	2022 AD		
Devchuli	42603	59400	39.43%	Avg. growth rate

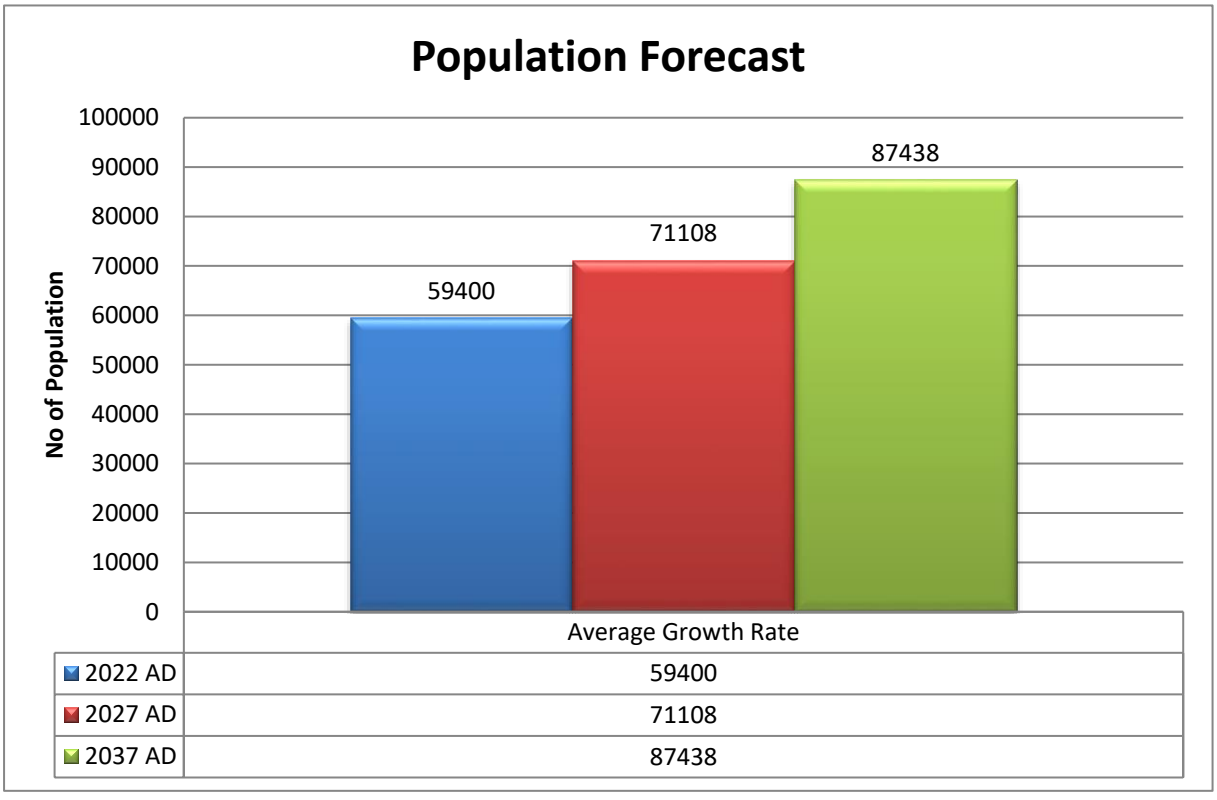


Fig. 3: Projected Populations for Devchuli Municipality

7.2.2 Projection of road traffic:

The transport infrastructure and facilities pave the path for the development of the area. Thus, the existing trend in the development of the economy and change in land use along with the planned development and land use are considered to plan the transport facilities requirements in the future. In the planning process of the transport infrastructures, projection of the traffic is the most crucial factor.

Traffic forecasting for planning projects determines the required number of lanes and road width to meet the future anticipated traffic demands.
In case of Devchuli municipality, there is no traffic data from past. Lack of proper city development plan and land use plan further restricts the use of complex models for reliable traffic forecast. Thus, the use of primary data collected during the study is used to forecast the traffic.

7.2.3 Indicative development potential:

For Devchuli municipality, the following areas have been proposed for the potential development area. For this the "Devchuli Municipality Profile 2076" has been used as a reference document.

Table 2. Indicative development potential plan of Devchuli based on Municipal By-Law

S.N.	Development Potential	Area
1	Institutional	Pragatinagar, Daldale
2	Agricultural area	Due to the fertile alluvial soil found throughout the terai region, almost all the land area of the municipality except covered by commercial, built up, steep hills and forest area are agricultural area.
3	Major Touristic & Religious	Devchuli Danda
		CG Sashwat Dham
		Tinkanya Mandir
		Munde Maharaj Mandir
		Mudhabaas Danda
		Narayani River Bank Areas
		Maharaja Mandir, Bhagawati Mandir, Ganesh Mandir, Kailash Mandir, Durga Mandir, Pashupati Shivalaya Mandir, Om Shanti Mandir, Nawadurga Mandir, Naagsthaan, Kalika Mandir, Radhakrishna Mandir, Sankat Mochan Shivalaya Mandir, Shenchen Chyamling Gumba, Jakhadimai Mandir, Rajahar Mosque, Abhishek Church, Dibya Dham, Banbatika Ganesh Mandir, Ganesh Panchayan Mandir, Nilopokhari Bhairav Kalika Mandir, Subhakamana Sewa Kendra, Nikhileshwor Siddhashram, Siddha Kalika Mandir, Satya Sai Kendra, Kumarwarti Mandir, Manihar Mandali Church, Devchuli Bauddha Vihar, JIbanko Roti Mandali Church, Pachaha Shivalaya, Yaha Bire Church, Ishworeshwor Ganesh Mandir, Uruyaani Dadailing Gumba, Namuna Basti Church, Yahureya Church, Bhoktadhari Mandir, Jhahare Saangkhaad Choda Dharke Li Gumba, Kulani Urgen Dhaddod Li Gumba
4	Commercial area	Keurini, Garduwa, Dibyapuri, Punarbas, Dumkauli, Sashwatdham, Aambas, Dhokan, Narayani Chowk, Devchuli, Kirtipur, Rambas, Mudhabas, Aanptari, Prithvinagar, Ganeshtole, Pragatimarga, Dharapani, Daldale, Dibyanagar, Gaidi, Rajahar
5	High density residential area	Daldale, Rajahar, Dumkauli, Keurini, Garduwa, Pragatinagar, Dharapani, Bishaltar, Rambas, Sitabas, Aanptari, Paranpur, Devchuli
6	Low density residential area	Barkot, Belswara, Bandipur, Nayanchhap, Dhokreghat, Kumsot, Tinghare

[11, 12&13]

7.2.4 Accessibility and mobility scenario:

Transportation system most often needs to trade-off between accessibility and mobility. Need of travel is a derived demand, not being end in itself but a means. Accessibility is the ease with which goods, services, people and opportunities can be reached. In the context of Devchuli municipality with core

market centers as epicenter of all goods, services and facilities, people lying on the peripheral regions need accessibility.

Mobility is efficient movement of goods and people. Mobility is more focused on trips and distance covered. Mobility values transportation as end rather than means, but still in outlying areas accessibility requires a lot of mobility, while central population need smaller trip lengths. While we provide space for active mode users and public transits as a means of enhancing accessibility, we are trading a part of road space from the mobility sector, and when we provide more road space for private vehicles to move efficiently we trade part of road space associated with accessibility.

Present scenario of Devchuli reflects the access to bus stop on an average about 10 minutes, Class "C" and "D" roads that are planned for public vehicle to ply are expected to reduce this time to within 5 minutes. People will have access to either Class "B" or Class "A" roads designed for more mobility within 10 minutes or 15 minutes on an average walking distance that are designed for greater mobility. Planning work has focused on reducing access directly to highways, subsequent developments are recommended for national authority to develop required infrastructures. The map showing the desire line has been appended in Appendix.

7.2.5 Transport infrastructure planning:

Land use and transport, developed road hierarchy, accessibility and mobility scenario are the policy level guidelines for development and planning of transport infrastructures.

Nearly 41% of household do not own any type of vehicle, whereas around 33% of people own motorcycle. Thus, from the perspective of sustainable transport also, we need to protect the peoples' utilization of motorcycle in planning works.

While 11% of the trips made as of today is on foot, the planning works has incorporated footpaths for pedestrians segregated from carriage-way width.

With projection of population at present growth rate of 20.95%, population would rise above 63,000 in 10 years which will certainly grow in economic size and have better income scenario. People will aspire to have private vehicles of their own to increase mobility, requiring greater road space width which will be provisioned by class A and class B roads but the aim of sustainable transport and accessibility policy will be to check private ownership of vehicles under control.

Class A and Class B road would have provision of bus-bay to facilitate public transit riders. Green belts would be developed for aesthetic purpose and noise reduction purpose as well as segregation of pedestrians from road traffic. Road side furniture would be installed as deemed necessary.

7.2.6 Short term Municipality Transport Master Plan (Five years):

The short term municipality transport master plan has been developed to guide the municipal investments on road infrastructure through 2022-2026. This short term plan will mainly focus on the demand by the people and for the accessibility of the people in the first step. The plan will advance the municipality towards the medium and long term plan as outlined in the later topics.

Short term planning elements generally known as transportation system management (TSM) are basically meant for efficient use of existing and proposed infrastructure. Short term MTMP refers to maintenance and upgrading of the existing road networks to the proposed standards to support the present and future (5 years) transport demand paving the demand for the implementation of medium term and long term plan. It also includes construction of new road linkages which are necessary to support the current road network and the envisaged road network for the future. The interventions are applied to the road sections based on their priorities (based on the developed scoring criteria) and the annual budget. The transport infrastructure envisaged at the end of five years plan is for the development and maintenance of access road linkages and collector roads that maintains a road hierarchy (as formulated above) and justifies the construction and development of higher hierarchy roads in the medium and long term (in short term if justified).

As such, short term plan focuses on the accessibility of all the settlements, moving towards mobility to increase the access to wider services, thus paving the way for development of proper sustainable public transport services within and around the municipality. The strategy and investment plans for short term municipality transport master plan is elaborated in the next section.

7.2.7 Medium term Municipality Transport Master Plan (Ten years):

The development of the road network in medium term plan includes opening of the track and clearing the right of way (ROW) along the Class B roads. The period of short term plan controls the encroachment and urban sprawl growth along the ROW of the Class B roads.

Medium term and long term municipality transport plan gives the layout for the development of higher hierarchy road corridors with higher mobility and limited direct access. During the short term (first five years) development of local access roads and collector roads develops the concept and culture of wide roads among the locals. This facilitates in creating the demand for expansion of the roads to their designated class width during the medium term (five to ten years). Medium term plan continues the development and maintenance of the access roads and, expansion and maintenance of collector roads to their respective standard layout. Class "B" roads will also be constructed and expanded during the medium term plan depending upon the necessity/demand of road hierarchy.

All the roads of Class "C" will be constructed and maintained at their designated standard layout at the end of medium term plan. Class "B" and Class "A" roads will also be constructed wide enough to address the demand generated during this period. Few Class "B" roads will be constructed to their full width with designated pedestrian paths and cycle tracks. For other Class "B" roads, the medium term time period will allow opening of the track by shifting the existing structures and stopping further construction of other structures within the designated ROW.

7.2.8 Long term Municipality Transport Master Plan (Twenty years):

The development of Class A roads is necessary in the long run of the municipality for the structured development of the road network hierarchy and thus the proper development of the trips and the municipality as a whole. The period of short term and medium term plan controls the encroachment and urban sprawl growth along the ROW of the Class "A" roads.

Long term municipality transport master plan envisages the development of the roads of all hierarchy within the municipality as depicted by the perspective plan whose demand is set out by the indicative potential development of the municipality.

Short term period (first five years) identifies the higher hierarchy roads necessary for the municipality in the long run and set necessary bylaws. It also implements those higher hierarchy roads in the policy level by controlling the development of other structures within the proposed ROW and shifting of the existing structure away. It will facilitate clearing of the ROW and track opening during the medium term time period (five to ten years). During medium term plan, these roads will be developed to certain level as per the existing demand.

This time period (first ten years) is critical in developing proper implementation policies, tools and plans for the construction and implementation of the standards of these roads in the long term time period of ten to twenty years. Plans to integrate other service facilities such as electricity, drainage and drinking water pipes should be developed during this period. Other plans such as land use plan, city development plan (if not developed), drainage network master plan should be developed in compliance with the municipality transport master plan. Depending upon these plans, MTMP may also be revised. During the long term plan of ten years to twenty years, the higher hierarchy roads will be constructed in full phase.

7.3 Ranking the Values Based on Mean:

7.3.1 Pragmatic Solution of Transport Plan:

This study also formulates the road hierarchy for the various roads. After going through large number of literatures, the study has proposed four level hierarchy roads namely Class A, B, C and D. Class C and D basically deals with access while Class A and B basically deals with mobility and accessibility to higher services.

Table 3: Criterion of Road hierarchy

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	Connection between Class A and C roads; and also Provide alternative connection routes between Class A	Connects higher order roads and 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 lay bays	Segregated NMT facilities and Bus lay bays	Segregated NMT facilities	Local NMT movement
	Complete access to public transport	High access to public transport	Limited access to public transport	
Maintenance Responsibility	Municipality	Municipality	Municipality & Local people	Local people
Speed (Kmph)	60-80	50-60	40-50	30-40
Capacity (PCU/hr)	2400-3600	1500-2400	800-1500	Less than 800
Access Control	Full Control	Partial Control	No	No
Public transport services	Mass Transit facilities	Mass Transit, Local Public transport	Limited access to public transport	No public transportation
Right of Way	Minimum 30m	20-29	10-19	6*-10

** The roads fulfilling the minimum width of road criteria set by the municipality*

7.3.2 Class 'A' road:

All major roads which connect major Growth Centers (market, tourism Centre, industry, etc.) or several Wards with high network coverage, connected directly or through the National Strategic Road Network or district road falls on the road class A. ROW for Class A road is 14m with total carriageway of 14m having shoulder 1.5m each on both sides. Sidewalks for pedestrians are adopted 2m each on both sides with drains flowing below them. Setback of 2m is adopted.

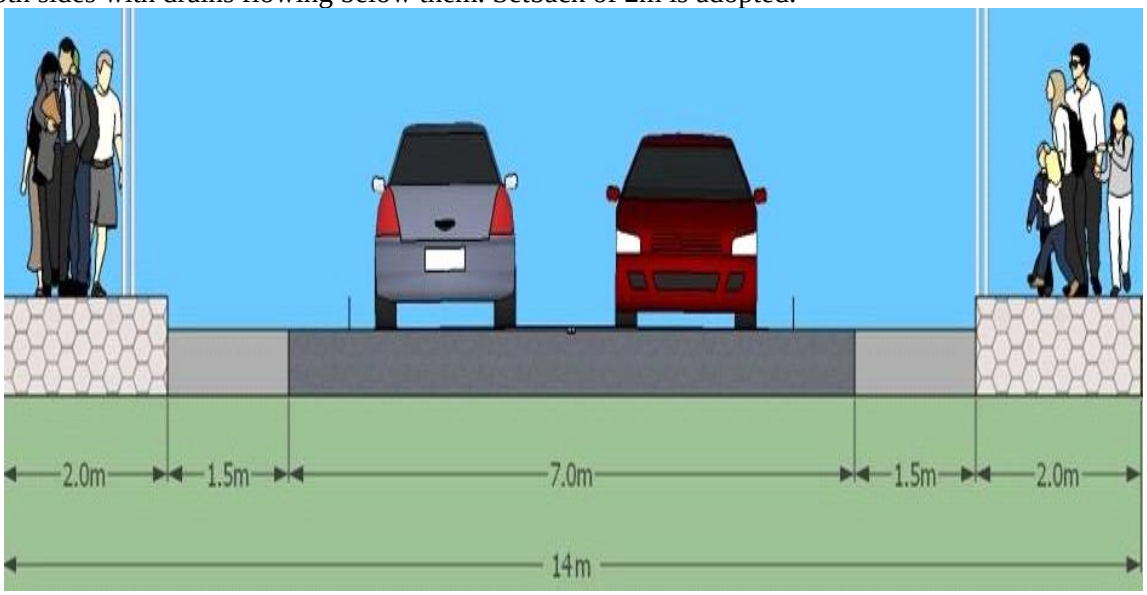


Fig. 4: Typical Cross section of A Class Road

7.3.3 Class 'B' road:

All roads which connect to a major road network and other roads of similar hierarchy with a road connecting major Growth Centre of the same or neighboring wards which provide access between Class A and class C road falls on the category of Class B. For Devchuli Municipality, ROW of Class B is adopted 10m with immediate carriageway of 7m with extra 0.5m shoulder each on both sides. Walking pavements are provided on both side of width 1m on both sides with drain flowing below them. Setback of 1.5m is adopted.

7.3.4 Class 'C' road

All roads which provide connection to higher order roads with all agricultural roads which connect a farm with a mini-market Centre or an agro-based production Centre and means for mobility of local trips are understood as road Class C. For Devchuli Municipality, ROW of Class C is adopted 8m with immediate carriageway of 5.5m. Walking pavements are provided on both side of width 1.2m each on both sides with drain flowing below them. Setback of 1.5m is adopted.

7.3.5 Class 'D' road:

All roads which provide connection to higher order roads with individual household for mobility of local trips are understood as road Class D. For Devchuli Municipality, ROW of Class D is adopted 6m with immediate carriageway of 3.8m with extra 0.5m shoulder each on both sides. Walking pavements are provided on one side of width 1.2m with drain flowing below it. Setback of 1m is adopted.

7.3.6 Ring road Concept:

The concept of ring road has been finalized in Devchuli. The ring road will cover every ward of Devchuli Municipality. For Devchuli Municipality, ROW of ring road is adopted the same as Class B roads are adopted having ROW 10m with immediate carriageway of 7m with extra 0.5m shoulder each on both sides. Walking pavements are provided on both side of width 1m on both sides with drain flowing below them. Setback of 1.5m is adopted.

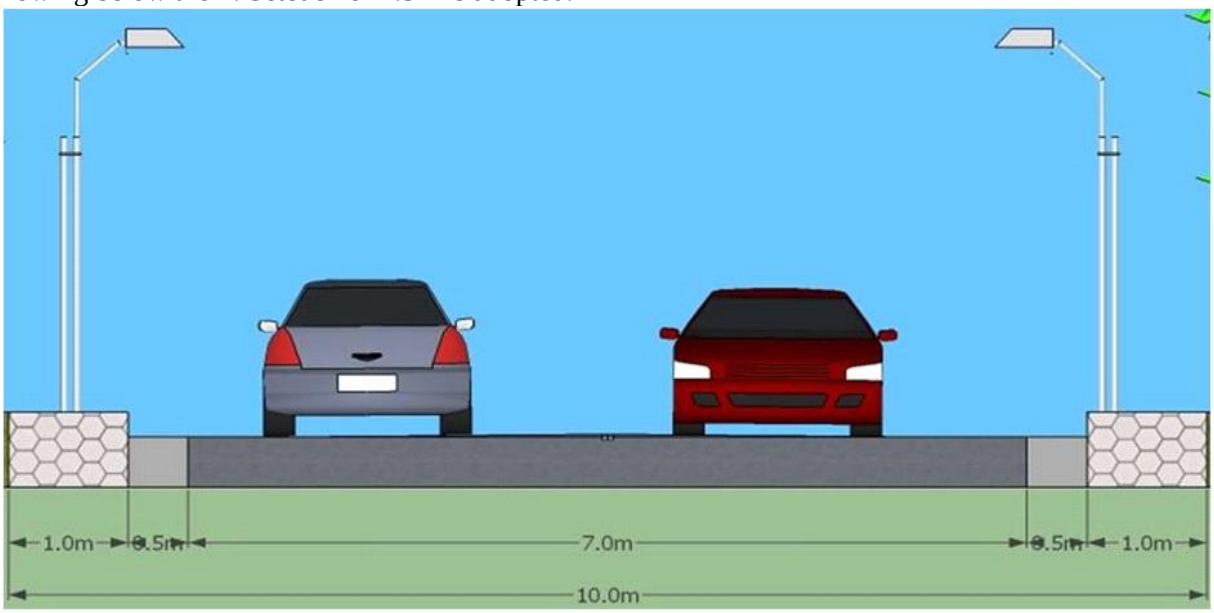


Fig. 5: Typical cross section of Ring Road

7.3.7 Strategic Framework:

The framework adopted during the entire planning and how it is compatible with long term vision of transportation planning and economic-social development is described in the underlying headings.

7.3.8 Hierarchy of road:

In any urban area, provision of proper hierarchy of roads at proper spacing helps to reduce traffic congestions and increase the mobility along the roads. A well-formed road hierarchy and its network of roads will reduce overall impact of traffic on the land use and at the same time guide the planned change of the land use. Thus, a proper hierarchy of road networks should be provided at proper spacing so that their purpose and functions can be justified.

Hierarchy should be maintained according to the major SRN road (national highway, feeder road) that passes through the municipality or is closest to the municipal area. Urban/municipal roads that open into these SRN should be have proper ROW and spacing so that the traffic that enters the SRN is justified and the purpose of the road is also preserved. The NRS (2070) [11, 12 &13] gives the provision of parallel service (frontage roads) at the spacing of at least 750 meters. Larger spacing creates bottlenecks while closer spacing may be unnecessary.

A well-formed network of Class "A" and "B" roads creates blocks of 1 sq. km. to 2 sq. km. in the urban area and bigger blocks in the sub-urban areas. The hierarchy also provides well connected pedestrian way.

7.3.9 Urban roads:

Urban roads are used by all sorts of users including pedestrians, cyclists, motorists and pubic vehicles. Their speed of travel varies significantly. Pedestrians and cyclists move slowly while other motorized vehicles travel at greater speed. Sharing of common roadway by all these users is very unsafe and unpleasant, especially for the active users. Their volume is also very significant and thus cannot be ignored. Thus, proper road infrastructure should be provided to ensure their safety by segregated pedestrian facilities and bicycle tracks.

7.3.10 Public transport:

Public transport is a means for enhancing mobility of local people. High proportion of active transport users justifies the necessity of public transport to increase their mobility and thus access to wider services and facilities within the perceived travel time budget. Proper structured public transport routes are vital for sustainable transport development. The existing economy and travel pattern may not sustain on its own. Development of proper roads to facilitate access and (through access) mobility to various services and facilities will create more trips and thus demand. Strategic development of such roads will not only create demand for public transport (greater mobility) but also develop proper road network where public transport vehicles can fly.

As the demand increases, before well-structured and formal transport is justified economically, the local government should introduce city buses. City buses are government run public vehicles. Their sole purpose is to provide greater mobility to the local people even when the demand is not economically justified. Such provision adds fuel to the overall development of the local economy. It also captures the potential public transport users and retains those users. This is a “pull factor” to increase public transport users in the future and creates an environment to introduce formal public transport services.

7.3.11 Principal guideline of road planning:

Change in land use and transport are cause and effect of each other, as depicted by the land use cycle in previous chapter. Thus, current land use and the predicted/planned change in land use in the future is the basic guideline for transport planning. Development of compact settlements and corresponding development scenario has been considered for road planning. The municipality is urbanizing area whose population is expected to rise in the coming years. As the population is added, the settlements grow both horizontally and vertically. Horizontal expansion increases the built-up area while vertical expansion increases the population density. With higher road densities, the required width of the transport facilities also increases locally and along the major roads. Increase in built up area demands bigger network of local and collector roads which ultimately demand wider roads of higher hierarchy.

7.3.12 Hierarchy of settlement:

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 center and local market centers. Promotion of bi-nuclear or multi-nuclear city is necessary for even development of the settlements within the municipality. These bring many services and facilities closer to the demand and reduce the need to travel to the main market center.

7.3.13 Introduction of basic road and road side infrastructure:

There is a need to redefine the term “road way” among the local people who perceive only paved road surface for motorized vehicles as proper road way. Although, the proportion of active transport users is very high, the road infrastructure necessary to support these users do not fit within the defined road by the locals. Such perception and construction of road infrastructure accordingly will lead to high rate of motorization which creates problem to manage the generated traffic, pollution and other externalities.

In the present context, with very high active users, proper networks of pedestrian way and cycle tracks should fit in the basic road width. It should be planned and implemented as basic road side infrastructure. Similarly, the landscaping of the road sections with proper greenbelt increases the greenery in the city, provides shade to the active users, segregate different users and a pleasant travelling environment for all the users.

Proper lay-bys are necessary elements for proper public transport system. Bus stops should have proper sheltering furniture, seating benches, lighting system, trash boxes, information boards and displays of routes and schedule of buses and proper connected pedestrian ways and zebra crossings [14].

7.3.14 Urban road discipline:

Obeying of proper discipline and enforcement of it is equally important as the provision of the urban road infrastructure itself. Proper discipline not only makes the use of the facility efficient; it also creates a sense of comfort and safety. Segregation of the pedestrian way and cycle track from the main carriageway enforces certain level of discipline among the users. Provision of proper NMT crossing facilities and control of jay walkers is necessary to maintain proper flow of traffic in the Main Street and safety.

7.3.15 Integrated service planning:

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 investments in the individual infrastructure and the damage to other infrastructure during maintenance and/or expansion.

7.3.16 Development phase of roads:

The proposed roads cannot be directly implemented at a glance. Proper phases of development of roads of all hierarchy should be envisaged and planned. The first phase is simply the formulation of necessary hierarchy and identification of road sections that serves/ can serve as different hierarchy roads. During this phase, bylaws as demanded by the formulated road hierarchy along the identified roads should be enforced. The next phase is to develop necessary policy and implementation plan for expansion and construction of the road. The phases of construction total road width should also be worked out as development of full road width as demanded by the respective road hierarchy may not be possible. As such, implementation of road hierarchy starts from roads in lowest hierarchy and stage wise expansion of the roads according to the demand and necessity of wider roads and facilities to the higher hierarchy roads.

7.3.17 Grass root institutions:

The grass root institutions/committees should be empowered with the provision of local technicians in such institutions. Such institutions include consumers' groups, ward level committees, MRCC and others.

7.3.18 Prospective 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. Roads of Class "C" will also be widened to its functional width providing proper cycle tracks and pedestrian ways were permitted by the available road space. 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.

Year five to ten will then implement the higher hierarchy roads in stages of clearing of the required ROW road space and construction of necessary infrastructure. 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 then to Class "A"). Other implementation strategies should also be developed and finalized at the end of this period. The road network developed during this period shall complete construction of Class "C" roads. This will demand higher class roads to support the local road networks. 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.

7.4 Financial institution and Capital Investment Plan:

To determine how much of the proposed work can be carried out in the 5-year MTMP period, it is necessary to estimate the budget available in this period. This is done by estimating the amount of money available from different sources based on the actual amounts of the current or last financial year, assuming certain growth rates for each funding source.

It is recommended that the planning section of municipality should incorporate funding source from different line agencies as well as NGOs, INGOs, people's contribution fund for proper management, infrastructure development and maintenance of road within the municipality.

7.4.1 Five year budget expenditure:

One of the final outcomes of this study is to provide annual budget expenditure for proposed intervention (new construction, upgrading, maintenance and rehabilitation).

For the allocation of yearly budget, the total cost required for twenty years is first calculated and this amount is distributed to twenty years assuming that budget spending capacity of municipality is expected to grow at the rate of 10% per year. Total budget required for the 5 years was found to be approximately NRs. 794 millions.

The estimate of budget required for the five years is prepared based on the assumption that the Class A road is to be made two lanes, Class B road is to be made intermediate lane and Class C road is to be made single lane and lane considered are assumed to be metaled. Due to limitation of budget, the roads are assumed to have simple cross drainage structures within this period whereas cross drainage structures such as Bridges are not included in this budget and expected to be completed within this time period by external sources. For approximate costing, the construction rate of road appurtenances is assumed to be equal to that of gravelling cost and for short term the minimum width of 2m is assumed if existing road width doesn't exist.

MTMP mainly deals with Class A, B and C roads, and it may find that Class D roads are not given any consideration. Interventions on those roads need to be incorporated in annual budget plan. Intervention that needs can't be completed in predetermined 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 is 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.

Total budget is first broken down to 70% for road construction and 30% for maintenance. Of the total budget available for construction of roads, 40% is allocated for construction of class A roads, 30% is allocated for Class B and remaining 30% is allocated to Class C and D roads.

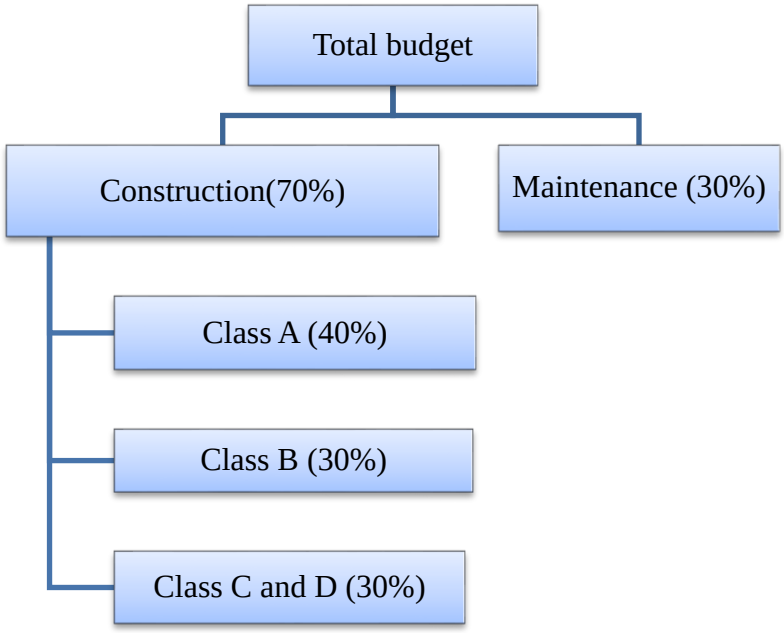
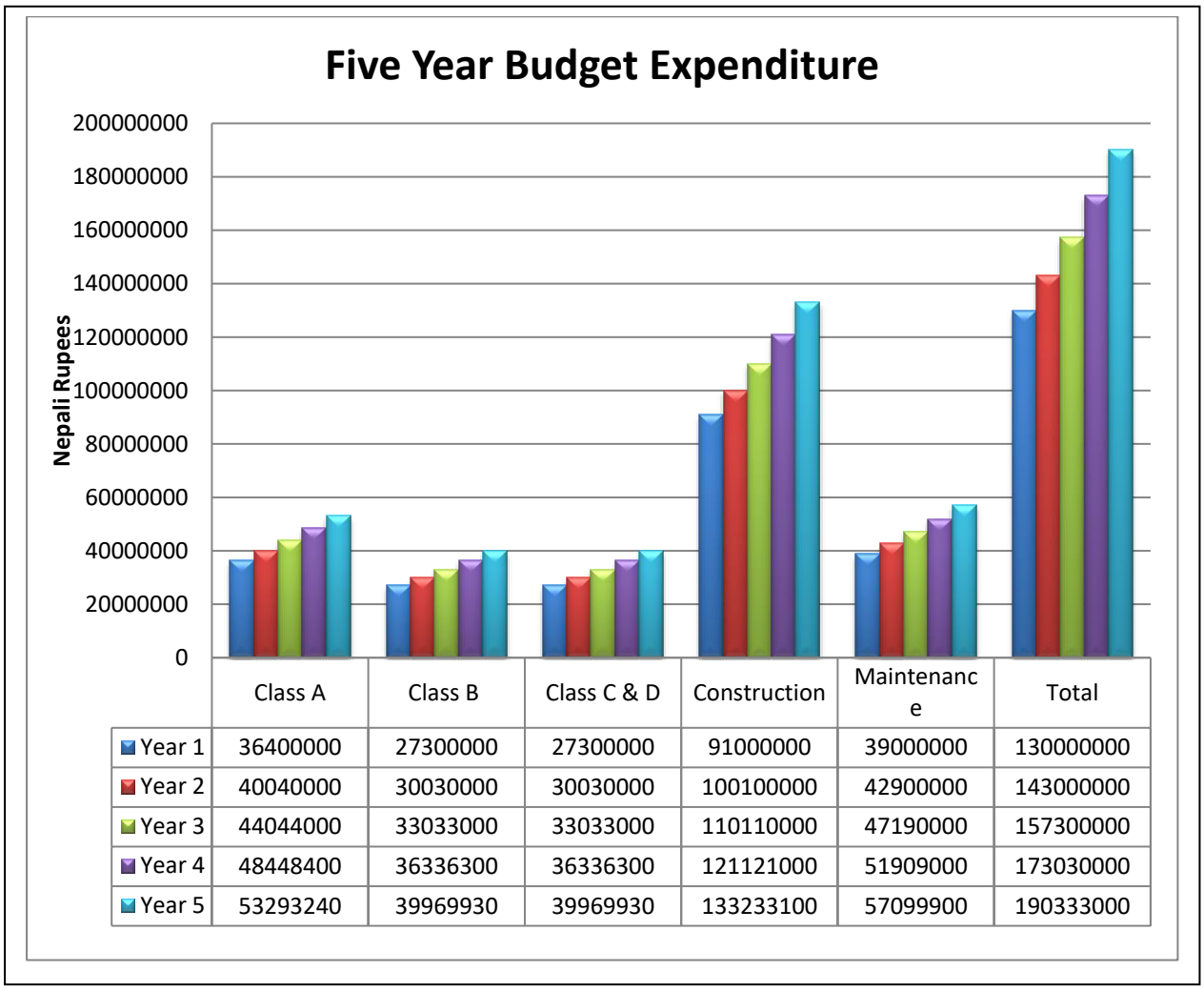


Fig. 6: Budget Allocation

From fund available for construction of A, B, C roads, each year for the next five years from preparation of MTMP, Rs.1,000,000.00 shall be allocated for study and advocacy of development of road corridor through major road class for clearance of right of way from maintenance fund.



	Class A	Class B	Class C & D	Construction	Maintenance	Total
Year 1	36400000	27300000	27300000	91000000	39000000	130000000
Year 2	40040000	30030000	30030000	100100000	42900000	143000000
Year 3	44044000	33033000	33033000	110110000	47190000	157300000
Year 4	48448400	36336300	36336300	121121000	51909000	173030000
Year 5	53293240	39969930	39969930	133233100	57099900	190333000

Fig. 7: Five Year MTMP Budget

Total budget of Devchuli Municipality for the fiscal year 2078/79 is NRs. 62,27,78,000.00 among which 41.75% i.e., NRs. 26,00,09,815.00 has been allocated for infrastructure development. Taking into consideration that half of the infrastructure budget will be allotted for road and allied structure, we have prepared a five-year budget as presented in chart below. Which are done for ideal condition that is other things remain constant. If there is a problem in time overrun price escalation due to various cause then re-planning of re-estimate as per suggestion of technical person should be done.

7.4.2 Scoring and 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 and various interventions need to be taken based on the prioritization. After developing a municipal level road network, the cost estimate of the road is prepared and benefit of each link in the network is assessed. There might be various criteria of prioritization, which may differ from place to place. The basic criteria that is used for prioritization includes existing population within the zone of influence, present road demand, future potential route, accessibility situation, land use pattern, proximity to the market/service centres, religious and tourism places, existing road width and surface type. These criteria are given various weight age and weight age average of all the criteria is summed up to come with a priority of intervention. All type of intervention is provided with same scoring criteria. The finalized scoring criterion based on rigorous study is set in front of municipality and MRCC for its approval.

Each road link is allocated the number of points corresponding to the fulfilment of the particular criteria. The weighted average of score that each intervention receives leads to a ranking/prioritization of the intervention options. Short description of the indicators used is given below and detail discussion is given in Appendix of the report.

- Demand priority of wards indicates higher the priority order of the road by ward, higher the weight age the road gains.
- Proposed road class: higher the road class, higher number of people it serves and it should get more priority.
- Total existing width: the road with more width should get higher priority because it indicates the necessity of road and the people's dedication for wide roads.
- Population served: the main purpose of the road is to serve people and more a road serves for population it should be given high priority.
- Road surface condition: from the point of view of accessibility to mobility, more priority should be given to road of poor surface condition to upgrade to higher condition.
- Road density: it may be defined in two ways. In one way it is the length of road per unit area of the settlement and in another way, it indicates the length of road per 1000 population it serves.
- Settlement density: higher the settlement density, higher will be the road users and hence such area should be given more priority.
- Service provided by the road such as Recreational(R), Agricultural (A), Market (M) and Service centre (S) (RAMS): if a road provides more service than another then this road should be given higher priority.
- Access to poor and minor: if a road serves for poor and marginalized people then it should be given higher priority.

7.4.3 Strategic Implementation: Mid period review:

In light of present context without proper land use and city development plans of the municipality, the formulated municipal transport plan for five years and long-term perspective plan cannot be complete. Comprehensive drainage plan and layout also guides the placement of cross drainage structures along the roads. Therefore, a mid-period review is necessary. This review follows the formulation of comprehensive city development plan and land use plan. These plans will bolster the transport master plan and also suggest necessary deviations and revisions. The surveys conducted to prepare this MTMP are baseline survey for future planning. In reference to these surveys, the mid period review will track the changes and its effect on the formulated five-year plan and long-term perspective plan. Based on the recommendations of land use and city development plan, and the changes during the first two years in the road infrastructure and road traffic the mid period review will guide MTMP in the later stages.

The next MTMP will be prepared in the sixth year which will create a void in continuity of transport infrastructure development during the sixth year. The mid period year shall also formulate implementation and investment plan for that period which will be carried over the next MTMP.

7.4.4 Yearly maintenance plan:

According to the yearly progress of transport infrastructure development and construction, yearly maintenance plan should be prepared. This maintenance plan addresses the recurrent maintenance, specific maintenance and emergency maintenance requirements of the municipal roads.

7.4.5 Stages of development of roads:

Visualization of stages of development of roads is very important aspect of long term municipality transport master plan (perspective plan). Current land use and road side development may not allow immediate implementation of wider roads. These restrictions should be addressed in various stages. The stages can be visualized in reference to various variables.

The prime stage is the formulation of policy and plans. This stage formulates the hierarchy and their geometric and physical characteristics, purpose and functions along with necessary ROW. With the formulation of road hierarchy, road bylaws will be enforced. It should be followed by formulation of proper implementation strategies for/and use of various tools for land acquisition and compensation, method and stages of construction of roads and road side infrastructures and enforcement of road discipline and right of users. Development of such policies will support continuous development of the roads. The next stage is to clear the total right of way so that other infrastructures integrated with road can be developed. Until the end of clearing of proper right of way, the policies should be strong and well-informed. This will mark the entry to the next stage which is construction of full phase of all hierarchy roads.

Construction of higher hierarchy roads should be done in stages according to the necessity as guided by the developed lower hierarchy roads and corresponding demand of higher hierarchy roads they

generate. The first stage should connect the pedestrian path and cycle tracks along with double lane carriageway for all higher hierarchy roads. The development of Class "A" roads should follow construction of road space to the standard of Class "C" then gradually expanding to Class "B" and finally to Class "A". Class "B" roads should also follow the same development stages. Construction of well-connected pedestrian way, cycle tracks and green belt along the edges of the ROW restricts any possible encroachment of the road space.

8. CONCLUSION :

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 has been prepared. Detail implementation strategy and budged expenditure plans have been prepared. The inventory shows that majority of roads are narrow and needs maintenance and upgrading. This is in line with the demand by the wards. The accessibility of roads has addressed most of the settlements but their mobility is very low. Access to facilities is hindered due to lack of reliable and safe public transport services within the municipality. Introduction of proper city buses and public transport is pertinent to fuel the development process at earliest.

The study has formulated hierarchy of roads which is necessary for long term rapid development of the municipality area. The report presents the necessary functions of the roads and their characteristics. Possible cross sections are also recommended. The study has shown high proportion of active road users which have been addressed thorough provision of pedestrian facilities and bicycle tracks is all roads except access roads. This is necessary to be implemented as the developed cities are having trouble to address the demand of active mode user friendly urban road infrastructures, Devchuli Municipality has the opportunity to sustain the road users and create a sustainable and well-planned urban road network and infrastructure. 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.

This study, being first of its type for this municipality, should be revised and integrated with other plans that will be developed in coming years. Periodic review and update of the plans is necessary according to the change in land use and traffic that occurs in the future. A mid period review in the third year and five yearly MTMP should be prepared every five years.

9. ACKNOWLEDGEMENT :

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