

EVALUATION OF LOCAL ROAD CONSTRUCTION UNDER USER COMMITTEE AT POKHARA METROPOLITAN CITY, NEPAL

Manoj Baral¹, Buddhi Raj Joshi², Sandip Duwadi³, Khem Raj Joshi⁴

¹Managing Director/Consultant, Gradient Engineering Consultancy, Pokhara-07, Kaski, Nepal

²Lecturer, School of Engineering, Faculty of Science and Technology, Pokhara University, Pokhara-30, Kaski, Nepal

³Lecturer, Pokhara Engineering College, Pokhara, Kaski, Nepal

⁴Registrar, Nepal Engineering Council, Kathmandu, Nepal

Abstract: The evaluation of local road works constructed under the user's committee at Pokhara Metropolitan City is carried out to analyze the existing scenario of urban road construction, evaluate the construction of urban roads, and compare the design parameters in road construction with available design standards. To meet these objectives, primary and secondary data were collected. A questionnaire survey and focus group discussion were carried out to collect the primary data in the study, and secondary data were collected through project-related documents from the Pokhara Metropolitan City Office reports, websites, periodicals, and journal articles. A qualitative approach was applied to the research work.

A comparison checklist was prepared on the basis of the available design standards and on the basis of different sets of questionnaires prepared for the concerned stakeholders such as UC president, UC member, and Site engineers.

The data mentioned in this research are those which are obtained from field observations. The data represent the real situation of existing road construction patterns within Pokhara Metropolitan City. Orientation to user's committee members will be fruitful to achieve the quality and standards in the construction work through the UC approach.

Keywords: Road construction, user committee, local road, design standards, bylaws

1. INTRODUCTION

1.0 Background of the Study

The nationwide administrative restructuring as per the provision of a new constitution of the federal republic of Nepal 2072, local levels are empowered and are

being autonomous to decide and implement the programs by making their own acts and regulations without violating the main spirit of the constitution. Based on the constitution of Nepal, there are three levels of government: the federal government, provincial government, and local level government. Municipalities and rural municipalities are included in the local government system. There is a need of empower local governments through effective administrative system development and implementation of development-related activities. At present, the priority of the local government is for the construction /upgrading of the local infrastructure, including local roads. Road infrastructure is considered the backbone of the economic enhancement of the local people.

Local bodies have practiced a participatory approach for the upgrading as well as maintenance of local roads. Users' communities also invest some part of the estimated cost for the maintenance and upgrading of roads. Most of them have funded 60-80 % of the cost of estimate depending upon nature and locality.

Among the local level governments, Pokhara Metropolitan City is a body having the largest territory coverage with natural beauty. Before the declaration of Metropolitan City, it was included as a sub-metropolitan city and was limited only to the plain region of the valley. It had a wide road network with a black-topped surface. The surrounding VDCs are also included as additional wards after it is declared a metropolitan city, and these additional wards have a minimum network of road having earthen pavement. There are a large number of roads within the city to be upgraded for all weather standards, and there is also a wide range of scope for the maintenance of the existing condition of road.

Procurement thresholds have to be fulfilled to carry out maintenance and upgrading of roads through a

contract approach for the selection of contractors. As per the prevailing rules, 15 days for sealed quotation and 30 days' notice for bid invitation has to be published in a national daily newspaper. This process takes time for complete all processes to award the contract for the construction and maintenance of the road. Therefore, the quick execution of the work community approach is a suitable practice for the Metropolitan Office. If the work is carried out under a user committee has to be designed and implemented as per specification and design standards. It seems there is transparent expenditure of funds and no any misuse, but the standards should be followed for the achievement of quality structures and to meet the expected service to be delivered. The effectiveness of the post construction of the road constructed should be evaluated and analyzed according to the serviceability of the road (Bhatta, A., 2015). So this research is carried out to find the lack of design, construction, and implementation of user committee based construction practice for the better quality construction of another user committee projects in a metropolitan city.

1.1 Objectives of the study

The following are objectives of the study:

- Comparison of the road design and implementation parameters in road construction with available design standards for urban roads under user's committee.
- Assessments and evaluation of the existing construction scenario of urban road under user's Committee.

1.2 Statement of the Problem

This study aims to study the effectiveness of road construction by the road users committee at Pokhara Metropolitan City.

- Are the bylaws properly followed during construction?
- Are the design standards and procedures followed properly?
- Is the quality of road construction maintained properly?
- Is the safety measures considered?

2. LITERATURE REVIEW

2.0 Previous study on road evaluation

Evaluation of road projects is a systematic method for collecting, analyzing, and using information to answer questions about their effectiveness and efficiency. On the basis of this evaluation, project alternatives are categorized for their prioritization, acceptance, or rejection for implementation. Stakeholders from Public as well as in private sector stakeholders want to know whether the programs they are funding, implementing, voting for, receiving, or objecting to actually have the intended effect, and answering this question is the job of an evaluator. Evaluation must be based on some well-defined and tested criteria. These criteria shall give distinctions between alternatives, be simple for the evaluation, and shall cover the sustainability aspects. (Bhandari, Shahi, & Shrestha, 2014)

Different criteria are used for the evaluation of rural roads in the world. In Nepal, two types of criteria, population per unit cost, cultivated land per km, population multiplied by walking hours, the total population of poor and indigenous groups are used for new construction and cost per traffic unit, cost per km, and centrality index related to market canters are used for rehabilitation in the rural road sector (DoLIDAR, 2010). Similarly, achievement of goals, cost, economic viability, financial viability, technical viability, operational viability, operational cost, multimodal transfer, sustainability, environmental impact, resettlement impact, and social impact are used North South fast track, an important project to link the Kathmandu to the southern part studied by the Asian Development Bank (ADB, 2008). Dr. Chandra Shrestha proposed in his research, Cost-benefit criteria in developed areas and agricultural potential, interaction, accessibility, and environmental impact in the underdeveloped area and tested these criteria in one district of Nepal (Shrestha, 2003).

2.1 By-laws

A by-law is a rule or law established by an organization or community to regulate itself, as allowed or provided for by some higher authority. The higher authority, generally a legislature or some other government body, establishes the degree of control that the by-laws may exercise. By-laws may be established by entities such as a business corporation, a neighborhood association, or depending on the jurisdiction, a municipality.

Municipal by-laws are the public regulatory laws that apply in a certain area. The main difference between a by-law and a law passed by a national/federal or regional/state body is that a by-law is made by a non-sovereign body, which derives its authority from another governing body, and can only be made on a limited range of matters. A local council or municipal government derives its power to pass laws through the law of the national or regional government, which specifies what things the town or city may regulate through by-laws. It is, therefore, a form of delegated legislation. Within its jurisdiction and specific to those areas mandated by the higher body, a municipal by-law is no different from any other law of the land, and can be enforced with penalties, challenged in court, and must comply with other laws of the land, such as the country's constitution. Municipal by-laws are often enforceable through the public justice system, and offenders can be charged with a criminal offense for breach of a by-law. Common by-laws include vehicle parking and stopping regulations, animal control, building and construction, licensing, noise, zoning and business regulation, and management of public recreational areas.

For this study purpose, the by-laws prepared by the Pokhara Metropolitan City Office will be followed. Also by-laws prepared by the Ministry of Urban Development, "New settlement, urban planning and building construction related basic bylaws, 2072"

- Right of the way
- Ground coverage
- Floor Area Ratio
- Set back
- 'Ka' class building
- 'Kha' class building
- 'Ga' class building
- 'Gha' class building

2.2 Design Criteria

Design criteria are the explicit goals that a project must achieve in order to be successful. In recommendation and feasibility reports, especially, the design and

decision criteria determine the document's final recommendation for action. Managers use these criteria as their basic tool in evaluating a project's potential for success and how well it fits into the goals of the organization. Experts need explicit design and decision criteria in order to evaluate recommended designs of devices and test procedures.

2.3 Quality Control

Quality control (QC) is a process by which entities review the quality of all factors involved in production. ISO 9000 defines quality control as a part of quality management focused on fulfilling quality requirements. This approach places an emphasis on three aspects (enshrined in standards such as ISO 9001).

- Elements such as controls, job management, defined and well-managed processes, performance and integrity criteria, and identification of records
- Competence, such as knowledge, skills, experience, and qualifications
- Soft elements, such as personnel, integrity, confidence, organizational culture, motivation, team spirit, and quality relationships.

Inspection is a major component of quality control, where physical products are examined visually (or end results of a service are analyzed). Product inspectors will be provided with lists and descriptions of unacceptable product defects such as cracks or surface blemishes for example. The quality of the outputs is at risk if any of these three aspects is deficient in any way.

2.4 Health and safety considerations

Occupational safety and health (OSH), or workplace health and safety (WHS), is a multidisciplinary field concerned with the safety, health, and welfare of people at work. These terms also refer to the goals of this field, so their use in the sense of this article was originally an abbreviation of occupational safety and health program/department etc.

The goals of occupational safety and health programs include fostering a safe and healthy work environment. OSH may also protect coworkers, family members,

employers, customers, and many others who might be affected by the workplace environment. In the United States, the term occupational health and safety is referred to as occupational health and occupational and non-occupational safety and includes safety for activities outside of work.

In common-law jurisdictions, employers have a common law duty to take reasonable care of the safety of their employees. Statute law may, in addition, impose other general duties, introduce specific duties, and create government bodies with powers to regulate workplace safety issues: details of this vary from jurisdiction to jurisdiction.

2.5 Issues in Urban Road Development

The major issues in our context regarding the development of urban roads are as follows:

- Allocation of space for all road users and services
- Development plans sellable to funding agencies for construction and upgrading
- Stakeholder coordination and consultation for developing a people-centric transport system
- Road maintenance organizations and finance
- Traffic management to improve the capacity, quality, and safety of urban transport systems
- Demand management for the maximization of social values from network use
- Promotion of certain modes for sustainability and safety concerns
- Infrastructure extension planning and appraisal
- Agreeing to a common plan by the local inhabitants, the business communities, and the government

2.6 Legal and Policy Framework of NURS

The relevant legal and policy provisions are as follows:

- Kathmandu valley development authority Act 2045
- The thirteenth plan (2070/71--2072/73) 2014
- Nepal Road Safety Action Plan (2013-2020) 2013
- Guidelines for work in Kathmandu Valley, 2007
- National transport policy 2002

- The long-term development concept of the Kathmandu valley (2020), 2002
- Road Board Acts, 2001
- Local Self-Government Act, 1998
- Vehicles and Transport Management Regulations, 1996
- Study on the Kathmandu Valley Urban Road Development, 1993
- Public Road Act, 1993
- Vehicles and Transport Management Acts, 1990
- Town Development Act, 1987
- Ancient Monuments Preservation Acts, 1956

2.7 Technical aspects of urban road construction

Nepal Urban Road Standards (2071), in short called NURS-2071 (concept note), shall apply to all urban roads being constructed within the municipalities of Nepal. These standards may be relaxed by the Government of Nepal to meet special circumstances. The road network is the major urban infrastructure in terms of its required financial resources, land consumption, and land-use planning in urban areas. Furthermore, the aesthetic appearance of the city is mainly dependent on urban road patterns. The growth of the urban area is mainly guided by the urban road hierarchy and their alignment. In this context, growing urbanization in Nepal is a major challenge for urban planners as well as municipal authorities. Urban mobility and accessibility mainly depend on urban road network planning and their technical parameters. With the objective of achieving consistency in road design and construction, the Nepal Road Standard (NRS) was first introduced by the Department of Road in 1970 and was revised in 1988, 1994. However, these standards were applicable only for the design of strategic roads. Therefore, it became very essential to develop the 'Nepal Urban Road Standard'. The proposed 'Nepal Urban Road Standard' incorporates all the technical as well as planning aspects for urban roads. The classifications of urban roads, design criteria, elements of cross sections, and clearance are major parts of the road (NURS, 2012).

2.8 Classification of Urban Roads According to Nepal Urban Road Standards 2071 (Draft)

For the purpose of geometric design, urban roads are classified into five categories considering the function of the road and traffic level, which includes Path, Sadak, Marga, Galli, Padyatra Kshatra, and Cycle lane. The Nepal Urban Road Standards has mentioned strict design aspects for urban road geometry, as mentioned below. These parameters should be considered while planning the upgrading of the roads.

Table 1 : NURS and Carriageway Width

Category	Carriageway width (m)
Arterial and sub Arterial roads:	
a. Single lane	3.75
b. 2-lane without raised kerb	7.0
c. 2-lane lane with raised kerb	7.5
d. Multi-lane carriageway, width/lane	3.5
Collector streets:	
a. single lane	3.5
b. 2-lane lane without raised kerb	7.0
c. 2-lane lane with raised kerb	7.5
d. 3-lane with or without kerb	10.5/11.0
e. 4-lane with or without kerb	14.0
Local street, per lane	33.0

Table 2: Recommended Cambers

Surface type	Camber,%
WBM or gravel	2.5 to 3.0
Thin bituminous surfacing	2.0 to 2.5
High type bituminous surfacing or Cement concrete surface	1.7 to 2.0

2.9 Road Board Nepal: An Institution for Road Maintenance

The RBN works together with road agencies (RA), which actually implement road maintenance works. The Department of Roads (DOR) was identified as RA for the maintenance of a strategic road network (SRN). The maintenance of urban, district, and local roads is governed by the Department of Local Infrastructure Development and Agricultural Roads (DoLIDAR), which coordinates the district development committees (DDC) and municipalities (MC) recognized as the road agencies for local road network (LRN). On the other hand, the RBN has to report to and communicate with the GoN through the Ministry of Physical Planning and Works (MPPW). Twenty first-century public sector services, such as roads, cannot be managed in isolation. User participation is defined and other stakeholders are equally important, and their voices shall be heard. Transparency in the process of road maintenance management is of paramount importance. This can be enhanced through the efficient work of RBN as it constitutes representations from the government, private, and civil sectors for better effectiveness.

The RBN prepares a comprehensive integrated action plan based on annual road maintenance programs (ARMP) submitted by the RA. The RBN ensures the optimum utilization of scarce resources based on its prioritization methods. Priority is linked to traffic flow, terrain type, rehabilitation, reconstruction, and upgrading. Emergency maintenance is addressed through a predetermined reserve fund. A road not in a maintainable condition is not given priority for regular maintenance, as it has to be brought to the maintainable condition by rehabilitation or reconstruction first. The RBN decides the final allocation to the RAs. RBN has the authority to monitor, control, check, evaluate, and hold to release money to non-performing RA (RBN).

2.10 UNCDF Decentralized Financing and Development Program

The DFDP's goal was to reduce poverty. The means for reducing poverty have been taken as the development

of small-scale basic rural infrastructures and human resources.

Implementation Process: The study has mentioned the following models of implementation broadly, in principle, two types of implementation modalities prevail in Nepal's infrastructure construction sector. However, for the purpose of the study and from a practical point of view, the implementation process was grouped into three types. The financing strategy of the project can be evaluated based on multi-criteria evaluation based on the ranking of the road projects (Bhandari, S. B., Shahi, P. B., & Shrestha, R. N., 2014). The processes of the implementation modalities are as follows:

- I. Contractor-based
- II. Quasi contractor (or quasi UC)-based
- III. UC-based

Contractor-based implementation

The topical itself is self-explanatory that the implementing agency contracts out to the registered contractor for construction. The construction responsibility of the contract package will be on the contractor. Being a profit-making company, the contractor makes use of human and physical resources seeking maximum benefits.

Quasi contractor or quasi-UC-based implementation

In this case, the User Committee (UC) is involved in principle and not the contractor. However, only a few officials from the UC are involved in the construction purpose. These officials' working modality will not be considerably different from that of the contractor.

UC-based implementation

This is a perfect user committee (UC)-based approach. In this all users are required to be involved in one or more of the construction process. The amount agreed with the DDC becomes the working capital of the UC, and the responsibility of construction also lies with the UC. An individual participates as per the rules and regulations of the UC. Full labor contribution, partially

paid labor contribution, and fully paid labor input will be from individual users.

Comparison of strengths and weaknesses

The study made comparisons among all the three implementation processes discussed in the previous sections, and their strengths and weaknesses based on the matrix spelled out the specific strengths and weaknesses (Sharma, 2003). The delay can be found from the contractor perspective if the timely decision on construction supervision and administrative work commenced (Akomah, B., & Jackson, E., 2016).

3. RESEARCH METHODOLOGY

This study is based on both primary and secondary data. Primary data will be collected through a field survey. Data such as road design, cost estimates, bill of quantity, running bills, final bills, and work completion reports were collected for study and field verification as well and testing has been done in fields.

Suitable indicators and parameters for the study purposes were formulated, and a comparative analysis of the acquired data has been done in this study. Similarly, a suitable questionnaire survey regarding health and safety management was prepared and conducted during the field visits.

The degree of effective implementation for each performance indicator obtained was multiplied with a certain coefficient. The weighted degree of all the individual evaluated criteria was summed up to get the overall degree of effectiveness of the implementation of road construction work.

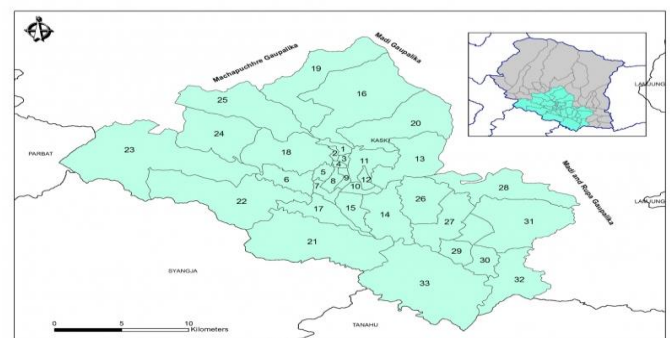


Figure: Study Area-Pokhara Metropolitan City

3.1 Sampling

The sampling of the roads was conducted as per the use, length, serviceability, area covered, and beneficiary population. The total number of wards was randomly clustered and the sample of roads was taken using the convenience method of sampling within the selected wards having more quality issues publicly.

3.2 Data Collection

The primary data were collected through field verification and secondary data through project document analysis. In field verification, technical, health, and safety parameters as per the approved specification will be checked.

3.2.1 Primary Data Collection

Primary data were collected through field visits using the prepared questionnaire and verification of the implementation in the field.

3.2.2 Secondary Data Collection

Secondary data were collected through documents from the Metropolitan City Office and related publications. Similarly, the secondary data were collected through different project documents, reports, journals, and books, which are listed below:

- DOR Norms and Specifications
- DOLIDAR Norms and Specifications
- Nepal Road Standard 2070
- Quality control handbook for rural road construction and maintenance (Volume II)
- Municipal Acts and regulations
- Sub-Project Documentation Reports from the Metropolitan City Planning section

3.3 Data Analysis

The outcome of data collected from the field visits and questionnaire surveys were analyzed based on the formulation of different evaluation criteria. Finally, the end conclusions were drawn with certain engineering significance. Different parameters that were chosen from:

- Survey and design

- Procurements documents
- Quality of works
- Work progress
- Financial management
- Monitoring, evaluation, and reporting
- Communication and transparency
- Environmental safeguard compliance
- Details of selected roads for the study (Table 17)

3.4 Statistical Analysis

Various statistical methods were used to meet the objectives of the study. The obtained data were analyzed with the statistical tool as correlation, table, charts, and diagrams. The analysis was carried out using the powerful Excel and SPSS software. Regression analysis was conducted to establish the relationship between the different evaluated criteria using method of least square.

4. RESULT AND DISCUSSION

The collected Secondary data from the Metropolitan Office were collected after the sample selection process. The data obtained were analyzed as per the objective of the study on the basis of the parameters taken for evaluation. The documents which are available from the planning section of the Metropolitan Office are thoroughly studied. During the study, the collected information was not well documented as per requirement, such as design, drawing, and quality assurance documents.

The data analysis and evaluation was done on the basis of the comparison checklist of available design standards and on the basis of different sets of questionnaires prepared for the concerned stakeholders such as UC president, UC member, and site engineer. The data from the questionnaire survey were analyzed and evaluated on the basis of ranking i.e. certain rank standards were fixed having given rank accordingly.

4.1 Field observation data on design parameters and analysis

The design and other parameters were measured from the field and compared with the design standard as per

Government Standards and tabulated in the following tables.

Among the selected 10 roads, five roads are of rigid pavement and five roads are of flexible pavement. The comparison checklists were presented based on the above information and data analysis. It was found that road construction did not comply with the available design and construction standards. In most of the roads, there were no sufficient curve radius and sight distance considerations. There is no footpath construction provision in design and also in construction with non-uniform road width. There is a smooth pavement profile with street-lights provision. On rigid pavement road construction, there is side drain construction at some portion of the road alignment, while on flexible pavement construction, almost of the road alignment contains the side drain provision and construction. There is a lack of noticeable numbers of cross drainage structures along the alignment. The width of the road is not uniform and alignment is zigzag, which indicates that the construction of the road is not professional and lacks engineering.

4.2 Questionnaire survey data and analysis

User road construction is directly linked to community people and people's representative management and construction approach. Therefore, a questionnaire survey was conducted for UC chairman, UC members, and site engineers regarding project selection, financial management, cost sharing, feasibility of the project, repair and maintenance approach, project management, public participation, political interference, gender participation, problem-solving approaches, design, construction, implementation, quality control, quality monitoring, and other related informations. The details of the information and analysis are presented in the tabulated form below of all roads constructed by UC.

There is a problem in the decision, execution, construction, and maintenance of urban road construction through the user's committee. The cost sharing portion of the project was not well known during the feasibility and design phase but needed to

know about it during the final approval. Project selection and implementation guidelines were not established, and the decisions were made based on the jurisdiction of the chief and executive of the PMC. Due to a lack of collection of participatory funds and lack of road construction experiences, UC used to appoint hidden contractors, and it was not seen whether the contractor had experienced in road construction or not. The contractor accepted the work below the estimated cost and waived the participatory part at least. All UC members contributed their efforts to quality and cost control but faced problems during meeting conduction. Detail drawings and specifications were not found included in the contract agreement. Work was accomplished based only on brief specifications mentioned on the estimated sheet. There is no construction manual, safety manual, and quality control plan was incorporated within the agreement paper. PMC collects maintenance deposit amount, but no maintenance work is done from the collected amount.

It was found that the design manual and selection guidelines were not developed in the PMC. Design, drawings, and specifications were not prepared project wise but available in typical format. Municipality enjoyed in selecting participatory projects because there was no value added tax, overhead, and contingencies in the estimate, which reduced significant amount of total project cost in comparison to the project implemented through the contractor. There was no provision of DLP and maintenance provision in the contract document. The perception of the contractor during construction indicates that the project must be handed over before the project completion to save extra expenses, but there is no clear idea regarding this. From the above findings, it is very important to develop procedures or models for participatory approaches to urban road construction and maintenance work in order to mobilize the User Committee in an effective way for quality construction. The details of the data analysis are presented in the following tables:

Table 3: Name and Adress of Road: Suryodaya Tole Road, PMC-14
Length: 295m, Width=5.1m, Pavement Type= Flexible

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	2.50%	2.5	As per standard
2	Curve Radius	Min.20 m (no super elevation) and 10 m general	N/A	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	0.5	As per standard
6	Cross Drainage	Max. 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.50	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 4: Deurali Pakho Archalthar, PMC-31
Length: 652m, Width=5.7m, Pavement Type= Flexible

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	2.5	2.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	0.5	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	N/A	Not as per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

**Table 5: Name and Adress of Road: Phursekhola Chhorepatan Road PMC-17
Length: 800m, Width=6m, Pavement Type= Flexible**

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	2.5	2.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	0.5	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

**Table 6: Bindhabasini Barpatan Road PMC-02
Length: 497m, Width=4.8m, Pavement Type= Flexible**

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	2.5	2.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	1 m	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 7: Alakapur Marga PMC-15
Length: 270m, Width=5m, Pavement Type= Flexible

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	2.5	2.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 8: Nagbeli Shrijanshil Marga PMC-15
Length: 170m, Width=6m, Pavement Type= Rigid

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	1.5 to 2.0	1.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 9: Saraswati Marga PMC-15
Length: 308m, Width=4.9m, Pavement Type= Rigid

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	1.5 to 2.0	1.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 10: Janakalyan Tole Nagdhunga Marga PMC-09
Length: 236m, Width=4.5m, Pavement Type= Rigid

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	1.5 to 2.0	1.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 11: Chautari Marga PMC-15
Length: 388m, Width=6m, Pavement Type= Rigid

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	1.5 to 2.0	1.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	Available	As per standard
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 12: Baikuntha Marga PMC-16
Length: 217m, Width=5m, Pavement Type= Rigid

S/N	Design Parameters	NRS Standard	Observed	Comparative Result
1	Camber Slope, % for bituminous	1.5 to 2.0	1.5	As per standard
2	Curve Radius	Min. 20 m for no super elevation and 10 m	Not Sufficient	Not as per standard
3	Sight Distance	Min. 20 m	N/A	Not as per standard
4	Longitudinal Drainage facility	Yes	Available	As per standard
5	Drainage Profile, %	Min 0.5 % grade	Available	As per standard
6	Cross Drainage	Max to 500 m length	N/A	Not necessary
7	Street Light	Min 9 m height and 0.4 lux	Available	As per standard
8	Traffic signs and symbol	Min 2 m ht. outside	N/A	Not as per standard
9	Pavement profile	Smooth	Smooth	As per standard
10	Minimum Longitudinal Gradient, %	0.5	0.5	As per standard
11	Foot Path	Min. 1.5 m	N/A	Not as per standard
12	Shoulder	Min 0.5 m - 0.75 m	N/A	Not as per standard
13	Cycle Lane	lane width 1.2 m	N/A	Not as per standard

Table 13: Design Standard Analysis

S/N	Parameter	Frequency
1	Camber for pavement	Camber was found satisfactory level at most of the roads
2	Curve Radius	During field observation the radius of the curve was not found minimum 20 m and 10 m for 10 % superelevation on road
3	Sight Distance	Minimum sight distance i.e. 20 m was also not found in roads due to having no lateral clearance along the alignment
4	Longitudinal Drainage facility	Longitudinal drainage facility was found during field visit rather than in some rigid pavement roads.
5	Drainage Profile	Drainage profile was found maintained in most of the roads.
6	Cross Drainage	Cross drainage was found in some roads where necessary and somewhere either necessary but not found
7	Street Light	Street light was found in all most roads except Deurali Pakho road
8	Traffic signs and symbol	No any traffic signs and symbol was found in all the roads rather than road longitudinal lining at both side and kerb painting
9	Pavement profile	The profile of the pavement was found smooth
10	Longitudinal Gradient	Minimum longitudinal gradient of road was found maintained
11	Foot Path	Foot path was found only in Bindhabasini Barpatan road but width was not enough and not found in all length
12	Shoulder	Shoulder was not found in any roads during the field visit
13	Cycle Lane	Cycle lane was not found in any roads during field visit

Table 14: Questionnaire Data Analysis for UC Chairman:

S/N	Parameter	Number	Result and Discussion
1	Mass Meeting	10	100 % replied that UC is formed by mass meeting
2	Women Participation in UC	10	60% replied that they were aware of the composition and minimum participation of women and 40 % answered they do not know.
3	Political Interference for UC formation	10	90% replied that there is no political interference and 10 % answered that there is political interference during UC formation.
4	Problems Prefeasibility	10	100 % replied that there was no problem during prefeasibility
5	Lacking in Participatory road	10	30% replied that there is financial lacking, other 30 % answered that there is lacking in awareness of people, next 30 % said that lacking on capacity building of officials and 10 % responded that there is legal lacking.
6	Weakness	10	30% replied that there is less skill in work experience, other 30 % responded that there is less professionalism, next 30 % answered that there is less technical control and 10 % said that there is bargaining in cost sharing.
7	Further Problems	10	30% replied that there is unclarity on legal aspect, other 30 % responded that there is domination in technical aspect and 40 % answered that there is less quality concern.
8	Aware PMC Approval	10	100 % replied that they were aware of PMC approval process
9	Consult Contractor	100	60% replied that they consulted contractor and 40 % answered they did not consult
10	Situation User Model	10	60% replied that the situation is medium and 40 % answered the situation is high
11	Problem on Approach	10	30 % replied less professionalism of UC as a problem. Similarly another 30 % answered bargaining of cost sharing for the construction and remaining 40 % responded less technical control

Table 15: Questionnaire Data Analysis for UC Members:

S/N	Parameter	Number	Result and Discussion
1	Who Generated Idea about project	20	50 % responded as UC and 50 % answered ward chairman
2	Prioritization Criteria of Project	20	25 % replied Number of users , 25 % replied Cost Sharing, 25 % replied Budget Available and rest 25 % answered People's pressure on demand
3	Ranking for Project Selection	20	50 % replied financial, 25 % replied social and 25 % replied technical
4	Feasibility Report Before Selection	20	100 % replied that there was no feasibility report prepared
5	What Should Be Cost Sharing UC	20	75% replied it should be 30 % and next 25 % answered as 50 %
6	Who Manage Material Management	20	50% replied staff designated by UC and 50 % answered other member of UC
7	Impact Of Construction By UC	20	50% responded as UC's Participation, 25 % said that saving time for procurement delay and 25 % answered as 15 % saving on overhead cost and 13 % VAT.
8	Times Site Supervised By Engineers	20	Equally responded as two and three
9	Payment on Scheduled Time	20	50% replied Satisfactory, 25 % responded as delayed and 25 % answered no delay
10	Was Time Extended For Project	20	75 % answered no time extended and 25 % answered time was extended
11	Public Hearing Monitoring By UC	20	50 % replied only Audit Conducted & 50 % answered both conducted
12	Monitoring Evaluation By PMC	20	50 % replied PMC Monitoring, 25 % answered no idea on M/E and 25 % responded as not effective policy of M/E
13	Was Maintenance Fund Allocated	20	100 % answered yes allocated
14	Deposit for water connection repair	20	100 % replied yes to be deposited
15	Project Selection Criteria By PMC	20	100 % responded not developed
16	Project Construction Manual by PMC	20	100 % said that not developed
17	Possibility of Project duplication	20	100 % replied no possibility
18	Project Selection Committee at PMC	20	100 % responded positive at PMC
19	Project Bank By feasibility Report	20	100 % answered as no project bank
20	All Construction Was Managed By UC	20	100 % replied yes UC managed
21	You aware of UC method at PMC	20	75 % replied as yes they were aware and 25 % answered they are not
22	You were aware Quality Control in Construction	20	75 % replied as yes they were aware and 25 % answered they are not
23	Was Mass Meeting During Project Planning	20	100 % responded yes
24	Did you completed project on time	20	75 % replied as yes and 25% not at time

Table 16: Questionnaire Data Analysis for Site Engineer:

S/N	Parameter	Number	Result and Discussion
1	Experienced UC Approach of Road Construction	6	33.33 % replied there is Public Pressure, 33.33 % answered Cost Minimization and 33.33 % responded Bargaining in Cost Sharing
2	Strength of Road construction Through UC TCQ	6	33.33 % replied Easy in agreement, 33.33 % answered Less Time for Procurement and 33.33 % responded ownership by users
3	Weakness of Road construction Through UC TCQ	6	33.33 % replied Less skill in work experience, 33.33 % answered Less Professionalism of UC and 33.33 % Less Technical Control
4	Were You Noticed On Work Schedule	6	50 % replied they were noticed and 50 % answered no
5	Considered all element At Survey Estimate	6	100 % are aware about survey estimate
6	Have Project Basket of Feasible Projects	6	100 % are not aware about basket of feasibility projects
7	Project Design and Estimate Criteria of UC	6	100 % replied that project was not designed and estimated as per UC
8	Thumb Rule Quick Estimation	6	100 % replied that project was not utilized the thumb rule quick estimation
9	Planning Duplication To DOR	6	100 % replied there is no planning duplication to DOR
10	How considered Budget Ceiling of Project	6	100 % replied estimate based budget
11	Do You Have Committee for Project Selection	6	100 % replied there is the existence of Committee for project selection
12	Was there QA/QC in Contract	6	100 % are aware about QA/QC of contract
13	Was There Hidden Contractor	6	100 % are aware about the contractor
14	Is Monitoring Schedule in agreement document	6	100 % replied that there is no monitoring scheduling in agreement documents
15	Who frequently visited site	6	66.7 % replied UC's executive member & 33 % replied users
16	Was maintenance fund Managed by UC or PMC	6	100 % are aware about maintenance fund
17	Was criteria for fixing cost sharing	6	100 % are aware about cost sharing project
18	Was proper documentation for completion project	6	100 % are not well known about documentation
19	Was there equally project distributed for wards	6	100 % do not agreed on the distribution
20	Compliance Checking before approving Project	6	100 % are not aware about compliance checking
21	Missing points in question	6	100 % replied no possibility

Table 17: Details of Sample Roads

S/N	Name of Road	Length (m)	Width (m)	Pavement Type	Ward No	Estimated Cost, NPR		Expenditure, NPR	
						Municipality	UC	Municipality	UC
1	Suryodaya Tole Bato	295	5.1	Flexible	14	980000	420000	1400000	420000
2	Deurali Pakho Archalthar	652	5.7	Flexible	31	5000000	5803685	5882325	882325
3	Furse Khola tallo Bealghari chhorepatan	800	6.0	Flexible	17	8838160	9820190	9820190	982020
4	Bindabasini barpatan Archalbot	497	4.8	Flexible	2	7000000	7997164	8000000	7000000
5	Alakapur marga	270	5.0	Flexible	15	1050000	1503090	1500000	450000
6	Nagabeli Shrijanshil Marga	170	6.0	Rigid	15	1400000	2006255	2000000	600000
7	Saraswati Marga	308	4.7	Rigid	15	1050000	1510802	1500000	450000
8	Janakalyan Tole Nagdhunga Marga	236	4.5	Rigid	9	1635587	2043237	2043237	408650
9	Chautari Marga	388	6.0	Rigid	15	1400000	2004936	2000000	600000
10	Baikuntha Marga	217	4.7	Rigid	16	1400000	2106920	2000000	600000

5. CONCLUSION

Five flexible pavements and five rigid pavements roads constructed under the user’s committee at Pokhara Metropolitan City were selected for the research work. Based on the results and discussions, the following conclusions have been found.

For Road Geometry

Almost all of the design parameters did not comply with the design standard set by the Government of Nepal. The geometry of the road could be maintained only if the survey design was carried out before the agreement of the work with UC. The payment of the Work should be done after all the necessary compliance tests, including field density, for flexible pavement and compressive strength for rigid pavement. A quality control plan should be prepared and incorporated into the agreement document. The

surface visibility of the road does not represent that it is properly constructed according to the design standards. The width of the constructed road was not uniform along the alignment, so it is necessary to provide a uniform road width throughout the alignment.

Road Project Identification

There are 33 wards in Pokhara Metropolitan City with many local roads and need to upgrade and maintain as per people's demand. Major roads were selected and identified by users and elected representatives. While selecting the project, the cost of the project and people’s demand are the major governing factors. Due to such consideration, technical consideration, degree of maintenance provision, and real beneficiaries were least considered. For improved access, a sustainable repair and maintenance plan must be adopted. During selection, the projects major focus goes on financial freedom compared to technical and social issues.

There is the Developing a computer-aided methodology for district road network planning and prioritization in Nepal, but it has not been widely adopted during the planning of project selection. Therefore, engineering considerations have been implemented during project selection.

Feasibility study

The current stage of project preparation is feasible but not seriously following the requisite process. Most of the road projects were estimated without a feasibility study for construction. It is necessary to adopt a feasibility study during project selection and implementation. For the feasibility of road projects, there is a system of improving the process of achieving strategic objectives, but in local areas, it has not been widely used for effective project execution.

Project Approval:

Financial weightage was given in priority to select projects based on budget availability, project cost, and willingness to share cost by UC were the prime considered factors. Project implementation through a participatory approach is a cost-effective approach that reduces the cost of at least 15% contractor's overhead, 13% value added tax, 5% contingency, and cost sharing figure by UC. Generally, in an average 50% cost, is reduced by the participatory approach as compared to projects implemented through tender processes. Technical factors to be considered for the utility duct, including underneath infrastructure, sewer and water supply pipes, electricity cables, telephone cables, and traffic flow were found considered the least priority.

Project Implementation:

Each user committee involved a contractor to manage and implement the project construction. This scenario is far away from the real meaning of participation, which is not legal as well. The supervision frequency to be made by PMC technicians was found as per asked by the UC. There is a lack of an exact approach adopted for the scheduling of the project for the effective management of road project construction. No quality assurance and quality control plans were prepared and

implemented by PMC management. Most of the UC members were unknown about the specification, bill of quantity, and work schedule of the road project. Therefore, it is necessary to provide basic knowledge training to UC members for different phases of road construction.

Monitoring, evaluation, controlling, and auditing

There is No particular M/E action was found to be implemented in the road projects constructed by UC. Financial and technical auditing has not been conducted for UC-based constructed projects.

Project Completion

Most of the projects were found completed on scheduled time and duration it is because there is less finishing work on the geometry of the road constructed based on the available standards. The results of the questionnaire response indicate that the quality control mechanism for the user's committee executed road was not developed and implemented. The payment work completed did not comply with the compliance test of work. Supervision of works was not done on a regular basis i.e. only on the demand of the UC. The existing scenario of urban road construction through a user's committee is not found excellent. The design and drawings were not prepared before the execution of the project. There is a need for clear guidelines for project execution, including orientation to the contractor before the real execution of road works.

REFERENCES

1. ADB. (2008). *North South Fast Track Project Final Report Feasibility Studies and Preliminary Studies Design Volume 1*. Kathmandu: Asian Development Bank.
2. ADB. (2009). *Performance Evaluation Report : Lao People's Democratic Republic : Rural Access Roads Project*. Lao: Asian Development Bank.
3. Akomah, B. & Jackson, E. (2016). "Contractors's Perception of Factors Contributing to Road Project Delay,". *International Journal of*

Construction Engineering and Management, vol. 5, no. 3, pp. 79–85.

4. Bhandari, S. B., Shahi, P. B., & Shrestha, R. N. (2014). Multi-criteria Evaluation for Ranking Rural Road Projects: Case Study of Nepal. *IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE)*, 53-65
5. Bhatta, A. (2015). Post-Construction Effectiveness of Kathmandu-Naubise Alternative Road. *Journal of Advanced College of Engineering and Management*, Vol. 1
6. Chong, & Leong. (2016). Contractor's perception of factors contributing to road project delay . *International Journal of Construction Engineering & Management*, DOI: 10.5923/j.ijcem.20160503.02, pp 79-85
7. DoLIDAR. (2010). *Interim Guidelines for District Transport Master Plan Preparation*. Ministry of Local Development, Department of Local Infrastructure Development and Agricultural Roads
8. Donnges, C., Edmonds, G. & Johannessen, B. (2007). *Rural Road Maintenance - Sustaining Benefits of Improved Access*. Bangkok: International Labour Organization
9. DoR. (2014). *Pavement design guidelines (flexible pavement)*. Kathmandu : Government of Nepal, Ministry of Physical Infrastructure and Transport
10. DoR. (2073). *Standard Specifications for Road and Bridge Works*. Kathmandu: Government of Nepal, Ministry of Physical Infrastructure and Transport
11. GoN. (2007). *Initial Environmental Examination of Dhalkebar–Janakpur–Bhitthamod Road Upgrading Project* . Kathmandu : Government of Nepal, Ministry of Physical Planning and Works, Department of Road

12. GoN. (2007). *The Public Procurement Act 2063(2007)*. Kathmandu: Government of Nepal

13. ILO. (2008). *Maintenance of community built roads- A review of community maintenance on rural roads built under the Kecamatan Development Programme (KDP) in NAD Province, Indonesia* . International Labor Organization
14. PMC. (2018). *Necessary rules related to the bylaws*. Pokhara: Pokhara Metropolitan Office
15. Shrestha, C. B. (2003). Developing a computer-aided methodology for district road network planning and prioritization in Nepal. *International Journal of Transport Management*, 157-174

BIBLIOGRAPHY

1. DoR. (2014). *Pavement Design Guidelines (Flexible Pavement)*. Kathmandu : Government of Nepal, Ministry of Physical Infrastructure and Transport
2. DoR. (2073). *Standard Specifications for Road and Bridge Works*. Kathmandu: Government of Nepal, Ministry of Physical Infrastructure and Transport
3. GoN. (2007). *The Public Procurement Act, 2063(2007)*. Kathmandu: Government of Nepal
4. PMC. (2018). *Infrastructure Development and Management Acts -2075*. Pokhara : Pokhara Metropolitan Office
5. PMC. (2018). *Necessary Rules related to the Bylaws*. Pokhara: Pokhara Metropolitan Office