

# A Case Study on the Issues in Quality Implementation for Municipality Registered MRT Designed Residential Buildings in Bhaktapur City of Nepal

Ajay Khadka

Assistant Professor, Department of Civil Engineering, Nepal Engineering College, Bhaktapur, Nepal

ajayk[at]nec.edu.np

**Abstract:** *This case study is focused to find the current practices of quality system in MRT residential building projects in Bhaktapur and to suggest possible measures to improve quality standard and also to recommend the implementation of effective Quality system in MRT residential building projects. A questionnaire survey and analysis was done to investigate the current quality system and to study the views, opinions and realization of contractors to have a system for quality. The study revealed that there are problems in quality implementation on studied issues to ensure effective quality management system in MRT residential building projects. Recommendations are made to improve quality management which includes: prepare working methodology prior to construction works, use quality control tools such as check lists/tally charts, submit manufactures' standard sample and certificate prior to get approval for using the materials in works so that discrepancies as per specification does not occur and carry out cube tests before executing RCC works. Further research and studies should be carried out by municipalities to guide the contractor and engineering firms in developing a TQM system and also develop information management system for a feedback mechanism to address quality issues.*

**Keywords:** MRT, TQM, QMS, Construction management, Bhaktapur

## 1. Introduction

The country has a long history of destructive earthquakes as the three earthquakes of similar size occurred in Kathmandu Valley in the 19th Century: in 1810, 1833, and 1866 AD [1]. The most recent earthquake that badly hit Nepal was the earthquake of 25 April 2015, also called Gorkha earthquake which was a moderate size earthquake (Moment Magnitude 7.6). Mostly the central part of Nepal was affected including the Kathmandu Valley. About 8,500 people were killed and more than 6,00,000 structures in Kathmandu and nearby cities were either damaged or destroyed [1].

Before Gorkha earthquake, building code and measurement by rule of thumb (MRT) guidelines were not properly followed by engineering firms and house owners and there was lack of proper supervision by municipality engineers for quality of construction works. After Gorkha earthquake, national building code was strictly enforced in all municipalities of Nepal. Municipalities enforced all engineering firms to follow MRT guidelines for the preparation of architectural and structural drawing for plinth area less than 1000 square feet and upto three storey's. Municipalities also enforced to carry out structural analysis for buildings having plinth area more than 1000 square feet and stories more than three. Soil test report was also made compulsory for buildings more than 1000 sq. ft. and storey more than three.

The construction firms need to get registered in municipality to design the building projects. The construction firms are selected based on their manpower capability and their experience. The construction firms are

assigned as A, B, C and D class building contractor based on their experience and manpower capability [2]. The Class A and B building contractor can construct buildings more than 1000 sq. ft. and more than 3 storey buildings. Class C building consultants can only design buildings having plinth area less than 1000 sq. ft. and up to three storeys as per MRT guidelines and national building code.

The municipalities first issue the completion certificate to house owners upon completion of the beam level and submission of form by the supervising registered engineer. Then the municipalities provide building completion certificate to house owners when they submit the filled form signed and supervised by registered engineering firm. Before Gorkha earthquake, the supervision was carried out by municipality engineers. After the enforcement of Building Code in municipalities after Gorkha earthquake, the full responsibility of supervision is under the registered consulting firms and engineers.

The construction sector is one of the most dynamic sectors in the Nepalese economy. About 60 percentage of the nation's development budget is spent through the use of contractors [3]. In the last two decade there has been considerable progress in the construction industry. The construction is a major sector and any productivity enhancement activity in this sector will have a positive impact in the overall improvement of the national economy [4].

During the construction of MRT buildings, it is observed that only architectural and structural drawings were followed. House owners and local contractors have not enough knowledge about earthquake safer buildings. House owners totally rely on contractors and there were

Volume 11 Issue 2, February 2022

[www.ijsr.net](http://www.ijsr.net)

Licensed Under Creative Commons Attribution CC BY

no enough supervision by engineering firms and house owners as well.

This case study is aimed to analyze the opinions of the relevant target groups and the available data related to Quality in MRT designed buildings in Bhaktapur district so as to explore the issues in implementation of quality and to ensure the quality standard in MRT designed residential buildings. This study encompass the importance of quality planning, use of quality control tools, problems with quality implementation, quality record keeping and reporting in the construction phases of the building projects. The major issues and problems raised during the quality implementation was identified, reviewed and analyzed. Thus this study give the overall idea to engineering firms, contractor, house owners including municipalities, to initiate and implement quality assurance management plan and policies efficiently and effectively to construct the residential buildings.

## 2.Methodology

In this case study, qualitative approaches are used. Site visits and closed questionnaire were used for data collection. The questionnaire survey was conducted to get the factual information about the current issues in quality implementation for MRT designed residential buildings and to know the opinions of the relevant target groups to ensure the quality standard in MRT design buildings.

A structured questionnaire had been developed based on literature review and fieldwork. The questionnaire is composed of four sections to accomplish the aim of this case study; Quality Planning, Quality Process Control, Problems with Quality Implementation and Quality Recording, Data Analysis and Reporting. The sample of questionnaire is in the Annex.

Regarding the population and sample, the population includes 103 registered municipality engineering firms and 28 Class C contracting companies of Bhaktapur district. The sample population included 40 registered municipality engineering firms and 25 Class C Nepalese construction companies. Among a sample of 40 registered municipality engineering firms, responses of 26 engineering firms were obtained. Similarly, among a sample of 25 Class C contractors, responses of 20 construction companies were obtained. The sample population was selected randomly based on their work experience and popularity in local construction market.

Frequency distribution and percentage were obtained from the collected data and were used to describe the aspects of the data. MS-Excel software had been used for data analysis. Conclusions and recommendations were made based on the results of survey data analysis. The flow diagram of research methodology is shown in Figure 1.

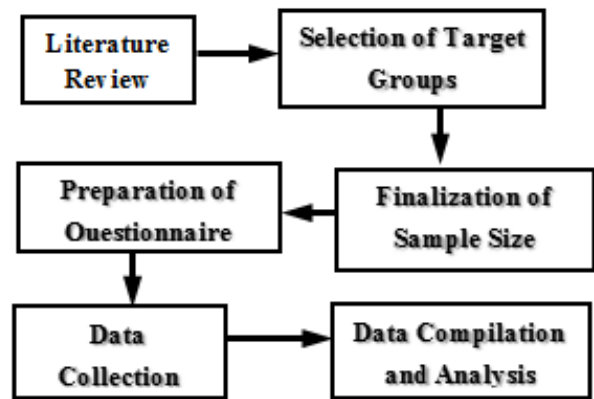


Figure 1: Research Methodology

## 3.Results and Discussion

The collected data are analyzed and presented in simple forms using charts, graphs and tables. Results and discussion under the four headings are presented here as; 1) Quality Planning, 2) Quality Process Control, 3) Problems with Quality Implementation, 4) Quality Recording, Data Analysis and Reporting.

### 3.1 Quality Planning

#### 3.1.1 Implementation of specification and MRT guidelines

Specification and MRT guidelines must be followed to maintain quality of construction works. This study reveals that the specification and MRT guidelines are followed occasionally. From questionnaire survey, 52% of the respondents (all participants) said that they occasionally follow specification and MRT guidelines (Figure 2).

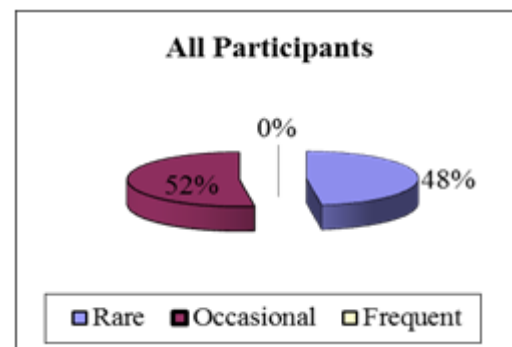


Figure 2: Implementation of specification and MRT guidelines

#### 3.1.2 Supervision of construction works

61% of the respondent said that the municipality registered construction firms had supervised frequently as per design approved by municipality. On the other hand, 26% expressed that the construction firms occasionally supervise as per design approved by municipality. The survey results show that there is frequent supervision of municipality approved drawings [Figure 3].

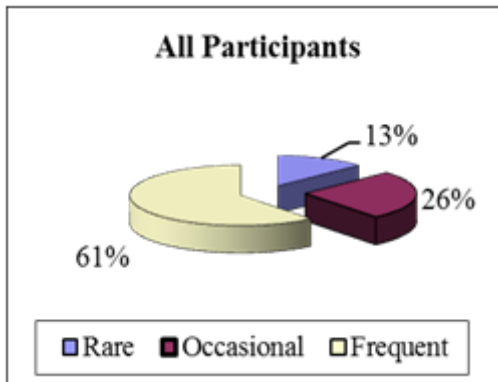


Figure 3: Supervision of construction works

### 3.1.3 Technical meetings to resolve quality issues

The majority of the respondents, 61% agree that technical meetings are held occasionally to discuss quality issues. On the other hand, only 17% meet frequently and 22% meet rarely to discuss technical quality issues. The details are shown in Figure 4.

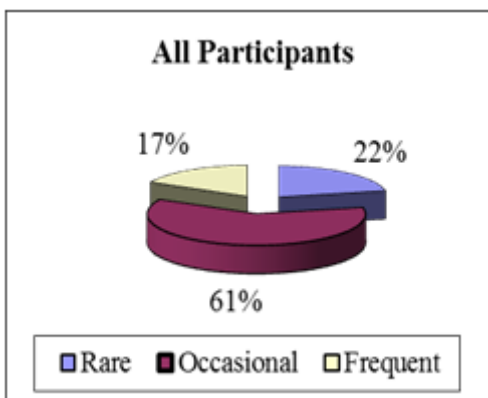


Figure 4: Technical meetings to resolve quality issues

### 3.1.4 Use of improved construction method by contractor

80% of the respondent expressed that contractors do not make any attempt to introduce improved construction methods to speed up the progress, reduce costs and/or improve quality. The details are shown in Figure 5.

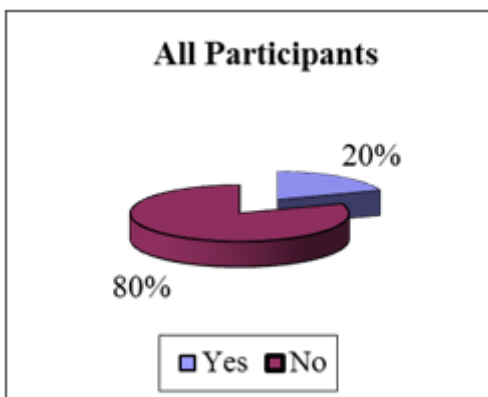


Figure 5: Use of improved construction method by contractor

Specification and MRT guidelines must be followed to maintain quality of construction works. The study reveals that the specification and MRT guidelines are followed occasionally. The survey results show that there is frequent supervision of municipality approved drawings by municipality registered engineers. The technical meetings are held occasionally between consulting engineering firms and contractors to resolve the quality issues that arise during execution of works. Contractors do not make any attempt to introduce improved construction methods to speed up the progress, reduce costs and/or improve quality.

## 3.2 Quality Process Control

### 3.2.1 Use of Checklists/Tally Charts for Quality Control

The survey results show that 89% respondents don't use check lists/tally charts for quality control which indicates that the level of use of check lists/tally charts is poor as depicted in Figure 6.

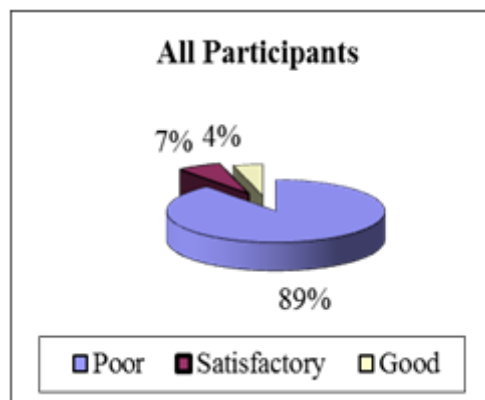


Figure 6: Use of checklists/ tally for quality Control

### 3.2.2 Submission of manufactures' standard sample and certificate

Only 11 % respondent said that the level of submission of manufactures' standard sample and certificate prior to get approval to use the materials in works was good, whereas 67% said that they don't submit standard samples and certificates. The remaining 22 % told that the level of submission of standard samples and certificate was satisfactory. The details are shown in Figure 7.

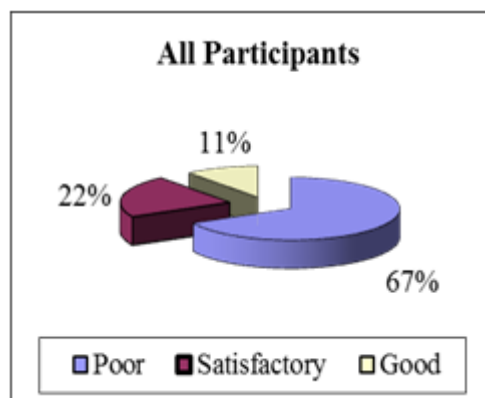


Figure 7: Submission of manufacturers, standard sample and certificate

**3.3 Problems with Quality Implementation**

Table 1 represents the major problems with current quality implementation in MRT residential buildings. The results

show that the majority of respondents (65%) agree that there is lack of properly qualified engineering firms in total quality management (TQM).

**Table 1: Problems with Quality Implementation**

S.N.	Problem	Agree %	Intermediately Agree %	Disagree %
1	There is lack of engineering firms properly qualified in total quality management (TQM)	65	26	9
2	The house owners do not control the over used materials (more than specification) thinking more materials make their structure more stronger	80	20	0
3	There is a shortage of studies from municipalities to help guide the contractor in developing a TQM system	100	0	0
4	There is no feedback system from house owner and engineering firms	63	20	17
5	There are more material wastages and re-works due to failure of proper use of specification during construction works	78	18	4

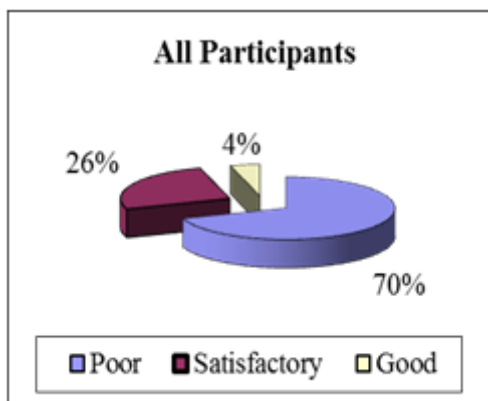
Table 1 shows that there is lack of engineering firms properly qualified in total quality management (TQM).The current problem of quality implementation is due to the misconception of house owners that over use of materials make their structure more stronger and do not control the over used materials (more than specification). There is shortage of studies from municipalities to help guide the contractor in developing a TQM system. There is less feedback system from house owner and engineering firms regarding quality implementation in construction sites. There are more material wastages and re-works due to failure of proper use of specification during construction works.

1. Only frequent supervision by consulting engineers is not enough. Specification and MRT guidelines must be followed and enforced strictly by concerned authority (municipalities).
2. The concerned authority should encourage contractors to use quality control tools such as check lists/tally charts, which is very essential for maintaining quality in RCC construction works.
3. Municipalities should be focused to guide the contractor and engineering firms in developing a TQM system and also develop a feedback mechanism related to quality issues.
4. Municipalities should develop the Information management system (IMS) for contractors and engineering firms to address quality issues.

**3.4 Quality Recording, Data Analysis and Reporting**

**3.4.1 Level of reporting system of contractor in terms of Quality issues**

Survey results show that the level of reporting system in terms of quality issues is poor. The details are shown in Figure 8.



**Figure 8:** Level of reporting system in terms of Quality issues

**4. Conclusion**

The following conclusions were drawn from the results;

**References**

- [1] Intechopen.com/chapters/67102:Impact of the 2015 Gorkha earthquake by Shiva Subedi and Meen Bahadur Poudyal Chhetri
- [2] DUDBC, 1994.Nepal National Building Code NBC 205:1994 Mandatory Rule of Thumb for Reinforced Concrete Buildings Without Masonry Infill, Kathmandu, Nepal: Department of Urban Development and Building Construction (DUDBC).
- [3] As mentioned by CBA, 2055(1999), “construction entrepreneur” means a firm or company registered under the prevailing law with an object to carry out construction business”. The classification of construction entrepreneur as per clause 10 sub-rule (1), had classified the construction entrepreneur as Class A, Class B, Class C and Class D according to in Construction Business Rule CBR, 2056(2000A.D) Schedule10, Schedule-11, Schedule-12 and Schedule-13 respectively.
- [4] DUDBC, 2012.Nepal National Building Code Draft Final NBC 205:2012 Ready to Use Guidelines for Detailing of Low Rise Reinforced Concrete Buildings Without Masonry Infill, Kathmandu, Nepal: Department of Urban Development and Building Construction (DUDBC).

## Author Profile



**Ajay Khadka** is Assistant Professor at Department of Civil Engineering, Nepal Engineering College. Currently he is working as a Head of Department in Department of Civil Engineering. He holds M. Sc in Construction Management, Pokhara University. He has been in the teaching field since last 13 years. Her research interest includes Total Quality Management in construction projects.

## Annex

### 1. Quality Planning

1.1 Do the contractor follow specification and MRT guidelines?

a. Rare                       b. Occasional                       c. Frequent

1.2 Had the consultant checked the construction works as per design approved by municipality?

a. Rare                       b. Occasional                       c. Frequent

1.3 Did there is any training programs for effective use of Building code, organized at regular intervals?

a. Yes     b. No

1.4 Did there is any quality awards and recognition to the person and company involved in quality works?

a. Yes     b. No

1.5 Did the Consultant and Contractor arrange the technical meetings to resolve the quality issues arise during execution of work effectively?

a. Rare                       b. Occasional                       c. Frequent

1.6 Did the Contractor make any attempt to introduce improved construction methods to speed progress, reduce costs and/or improve quality?

(i) Yes                       (ii) No

(iii) If yes, what was the performance level?

a. Poor                       b. Satisfactory                       c. Good

### 2. Quality Process Control

2.1 Do the contractor submit the working methodology for each item of works prior to precede the construction works?

(i) Yes                       (ii) No

(iii) If yes, what was the performance level?

a. Poor                       b. Satisfactory                       c. Good

2.2 What was the level of the use checklists/tally charts for quality control works?

- a. Poor                       b. Satisfactory                       c. Good

2.3 Do the contractor submit manufactures' standard sample and certificate prior to get approval to use the materials in works?

- a. Poor                       b. Satisfactory                       c. Good

2.4 Do the contractor carry out cube tests before executing RCC Works?

- a. Poor                       b. Satisfactory                       c. Good

**3. Problems with Quality Implementation**

1	Agree			
2	Intermediately Agree			
3	Disagree			
	Problem	1	2	3
1.	There is lack of engineering firms properly qualified in total quality management (TQM)			
2.	The house owners do not control the over used materials (more than specification) thinking more materials make their structure more stronger			
3.	There is a shortage of studies from municipalities to help guide the contractor in developing a TQM system			
4.	There is no feedback system from house owner and engineering firms			
5.	There are more material wastages and re-works due to failure of proper use of specification during construction works			

**4. Quality Recording, Data Analysis and Reporting**

4.1 Did the contractor passed forward the certified test reports to the Consultant in time?

- a. Errors & irregular                       b. Satisfactory & regular

4.2 Are registers maintained for cube tests?

- a. Yes                       b. No

4.3 Did there is analysis of the recorded quality data?

- (i) Yes                       (ii) No

(iii) If yes, did the analysis of the recorded quality data used to amend the specification of work or just record keeping?

- a. Improvement of Quality Plan
- b. Record Keeping
- c. Both



4.4 What was the level of reporting system of contractor during the execution of construction work in terms of Quality issues?

- a. Poor                       b. Satisfactory                       c. Good

4.5 What was the level of reporting system of engineering firms during the execution of construction work in terms of Quality issues?

- a. Poor                       b. Satisfactory                       c. Good

4.6 Did there is Technical Audit?

- (i) Yes                       (ii) No

(iii) If yes, what was the impact of this in work in terms of quality?

- a. Poor                       b. Satisfactory                       c. Good