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Construction Management in Bangladesh: A Case Study of Low-Rise Buildings of Rangpur City Corporation

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Abstract- Construction projects have been managed since old ages, but recently, the great revolution in technology, and the significant changes in the construction industry, forced changes in the way projects are managed. The main aim of this research was to study the present situation of project management in rural areas of Rangpur, Bangladesh and to identify the problems in managing construction projects. For the study, six construction sites of Rangpur, Bangladesh were investigated and visited for six months. There were four residential buildings, one school building and one mosque, all of them being two storied. Data were collected by questioning to the worker, site engineer and owner, and also by self-observation and measurement. For our study, we chose 20 parameters that are crucial for any building construction work. All the data derived were categorized and presented by graph for better understanding. We found that all the raw materials used in the construction work conforms to the ASTM guideline. Dissimilarities with drawings were observed in almost all the sites. Least attention was given while storing aggregates, mixing concrete. Some good practices, like use of steel shuttering and scaffoldings, braced excavations, increased days of curing were observed to raise. Reluctance for sub-soil investigation was notable. However, more studies can be done on this topic taking buildings of various types along with tall and slender ones.

Keywords- Construction Management, Rangpur City Corporation, Construction Practice, Low-Rise Building, Bangladesh.

I. INTRODUCTION

Quality control is necessary term in construction industry as well as in civil engineering. Quality control in construction ensures compliance with minimum standards of materials and workmanship so that the work can be completed according to the design. Construction projects consist of many extremely complex procedures. Bangladesh being a developing country, development in construction practices has a significant role in the overall development progress of the country. So the construction in any country requires serious attention period of time with minimum cost. The process is corruption prone because the cost of material and workmanship is substantial in construction projects. Common malpractices includes manipulation in sampling of materials for testing, substitution of test samples, falsification of test reports, and false or selective reporting of field tests. As a result of poor monitoring of the buildings and all other structures, they may crack, tilt or collapse and cause loss of live and wealth. To improve the present situation of construction quality is important to conduct a detail

study of building construction. The specific objectives of the study are given below:

1. To assess the quality of construction including materials (steel, aggregates, cement, sand and others building materials) according to design specification.
2. To evaluate the ongoing construction procedures & compare them with standard.
3. To observe construction safety procedure & compare them with standard.

II. LITERATURE REVIEW

With progress in construction works in different varities of structure, there has been enormous studies on how to develop the construction practices, how to get improved structural performance using suitable materials along with the proper safety of the worker and others. For overall quality ensurance of constructions materials and management procedures in Bangladesh, there are guidelines provided by House and Building Research Institute (HBRI), named BNBC [1]. BNBC conforms to ASTM guidelines, which maintain its international standard. There are several studies that have been performed on various types of buildings in Bangladesh.

As early as in 1990, the study on construction practices on high rise buildings started [2]. Back then, poor practices, like- non-engineered building design, manual transportation of concrete, using only bamboos and wooden shutters were observed, even in high rise buildings. In 2012, a study on construction practices of several buildings of Sylhet city was performed [3]. It showed certain improvement in the situation, but pointed out some drawbacks- like lack of safety measures, poor material management, and supervision by inexperienced engineers. Another study on Khulna City Corporation was performed [4] later in 2019 where the researchers focused on evaluating 38 parameters from the sites and compared them with BNBC-93.

They found that lack of proper inspection, inexperience of engineers and workers and tight work schedule have a significant negative impact on proper site management. Most recently, again, the condition of some construction practices, like- Safety, Compliance with Building Code, Solution to accommodation problems; of high rise buildings all over the country were studied by questionnaire survey of professionals [5]. Extensive studies on construction safety are now a big concern as high-rise buildings are being constructed a lot recently. A study [6] based on questionnaire surveys addressed some safety issues and found out that indeed, safety is not considered at all, or at minimal level in construction works.

III. METHODOLOGY

1. Site Selection

Due to time and property access limitations, six (6) Construction sites from Rangpur were choosen, four (04) of them were residentianl buildings which were under private funding, one (01) was School building and one (01) was Mosque. The school building and mosque were government funded projects. They all were two-storied and had isolated footing as foundation system. The project names are given below-

- Md. Rafiqul Islam, D/O- Md.Hashimuddin, Purbo Oviram, Rangpur sadar, Rangpur.
- Sree Chandro Sarker, D/O- Joges Chandro Sarker, Purbo Oviram, Rangpur
- Sree Moti Nirmola Rani Sarker, D/O- Nitai Sarker, Purbo Oviram, Rangpur Sadar, Rangpur.
- Purbo Oviram New Jame Moszid, 2 No Word Mohanogor Rangpur sadar, Rangpur.
- Md. Mohuber Mia, D/O- Ajiber Mia.Gila tary, Gonggachora, Rangpur.
- Andrahabho Adosho Guccogram Government Primary School, Rangpur.

2. Data Collection

For the collection of data, we went to the selected sites at different times during our study. As different sites were at various stages of construction, data of different parameters were taken at a time. We asked questions and sought clarifications from the Site Engineers, Contractors and Workers for credible data where it was necessary. Furthermore, being present at time of various important steps, like- Concrete batching, Casting, opening of Shuttering, we ensured that we are not just relying on others for information. We ourselves took measurements and notes. We also took some pictures using mobile phone camera to represent the sites better while analyzing and presenting. Also, where required, we saw

architectural and structural drawings and compared it with the work going on the site.

3. Data Analysis

For our study, the data taken was categorized into different parameters. The collected information from the sites were compared with the standard practices as stated by BNBC 2020 or by ASTM.The following 20 parameters were considered to get the scenario of construction management process.

1. Types of Building Studied
2. Types of Cement Used
3. Types of Fine Aggregates Used
4. Types of Coarse Aggregates Used
5. Reinforcement Used
6. Admixture Used
7. Storage of Raw Materials
8. Concrete batching
9. Water cement ratio
10. Test of concrete batches
11. Transportation of Mixed Concrete
12. Compaction of Concrete
13. Type of Formwork Used
14. Scaffolding Material
15. Age of Curing
16. Method of curing
17. Consistency of Construction with Architectural drawing
18. Consistency of Construction with Structural Drawing.
19. Soil Test
20. Precautions in excavation

IV. RESULT AND DISCUSSION

To analysis the survey data and interpret it, we use the graphical method for better understanding. All the data are interpreted by numerical value and with the help of Microsoft Excel, graphical representations are made.

1. Raw materials used and their storage system

100% of our studied building used PCC Cement for their RC or CC works. Other cement types, even OPC cement is not used. Also, they all used Sylhet safine

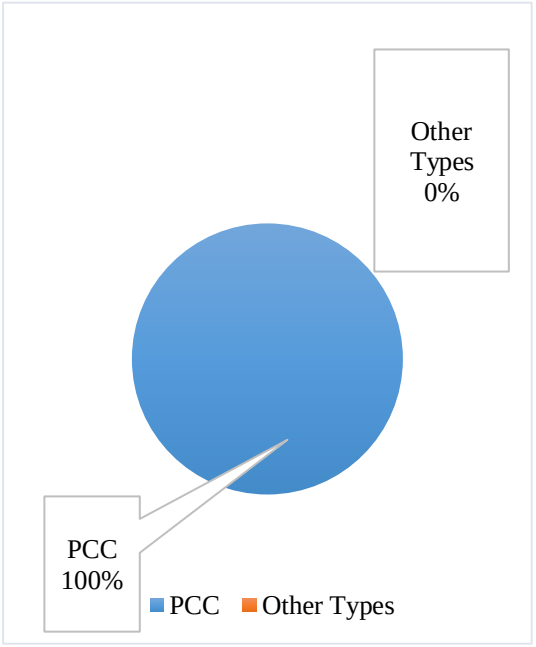

Fig.1 Type of cement Used

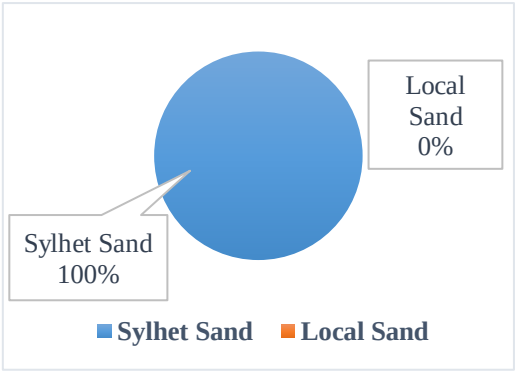

Fig.2: Types of fine aggregates used

aggregate for RC or CC works and brick chips as concrete course aggregate. None of them used chemical admixers. As for storing the materials, no proper methods were followed as suggested by BNBC. No wooden platforms were used, cements were not kept in air-tight rooms, and they didn't sought for permission before storing the materials on road side.

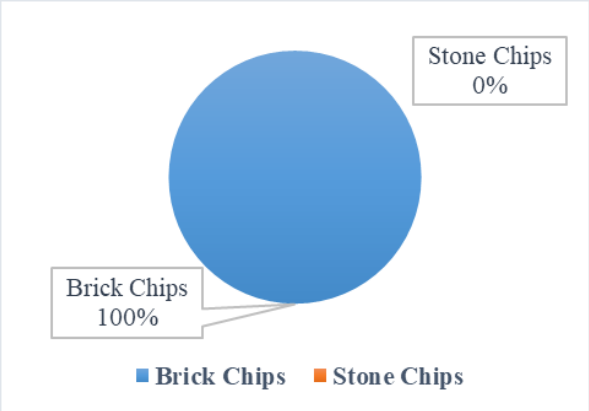

Fig.3: Types of coarse aggregates used

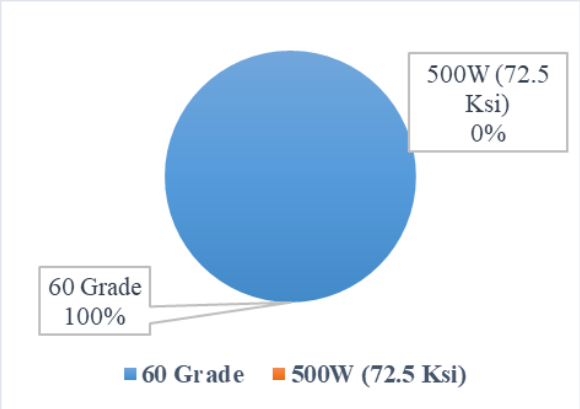

Fig.4 Types of Reinforcement Used

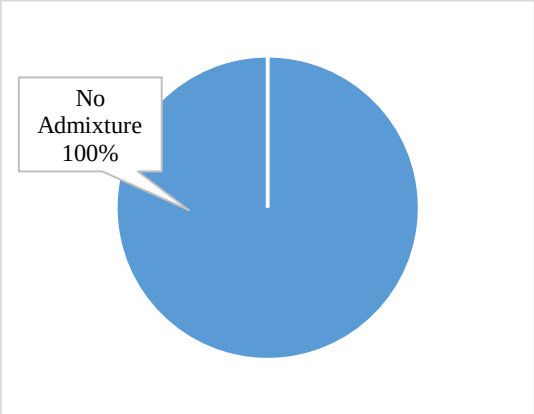

Fig.5 Type of Admixtures Used

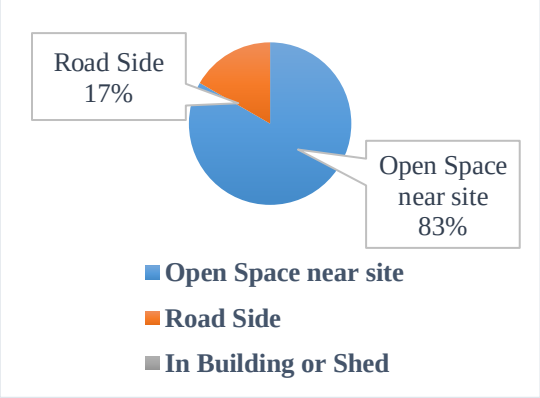

Fig.6 Storage of Raw Materials

2. Concrete Mixing and its placement

The government funded buildings (mosque & school, 33%) preferred to use ready mixed concrete for batching of concrete and used water-cement ratio of less than or equal to 0.4. Meanwhile, private funded (residential buildings, 67%) mixed the raw materials at site and used water-cement ratio of 0.4 to 0.5. Volumetric method were used for concrete mixed at site, rather than the weight basis one. Also, no construction site used a water cement ratio greater than 0.5 which would lead to an increase in porosity & reduction in strength. Only the government funded sites performed strength test & slump test of concrete, but the number of cylinders tested were inadequate. Transportation of mixed concrete were performed manually in all buildings, while concrete compaction were done by mechanical vibrators. Steel formwork and steel scaffoldings were used in government funded buildings while others used wooden shuttering and bamboos for scaffolding.

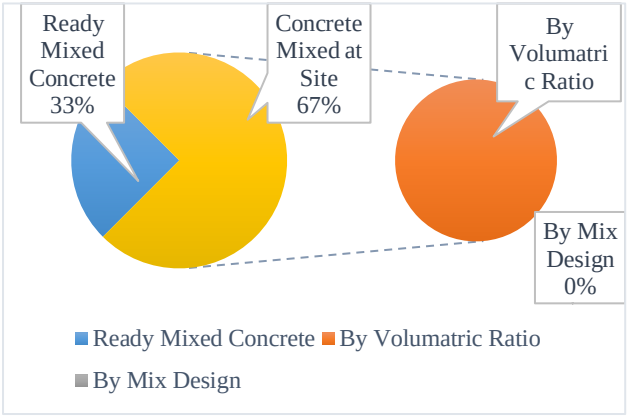

Fig.7: Concrete Batching

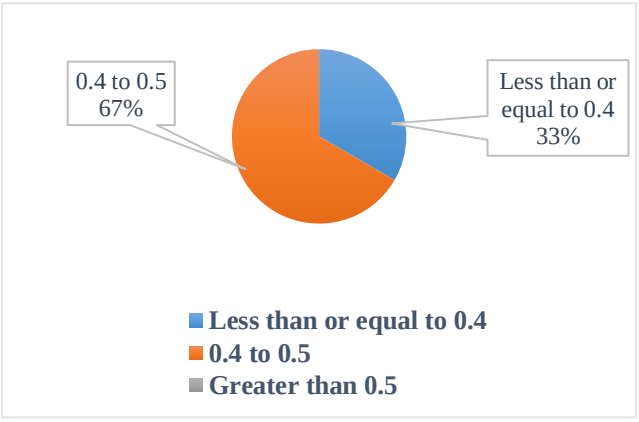

Fig. 8 Water-Cement Ratio

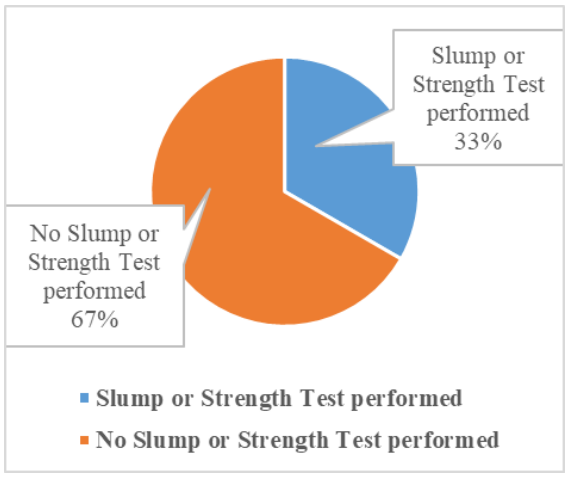

Fig. 9 Test of Concrete

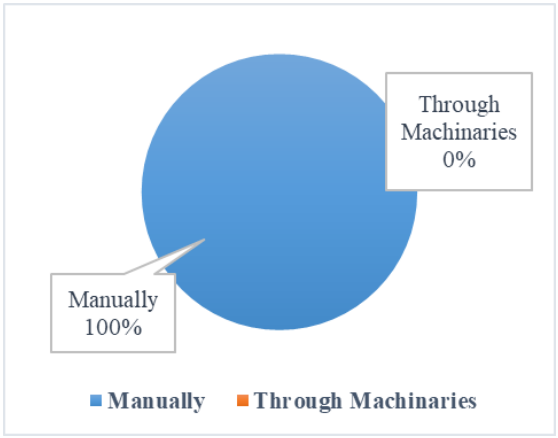

Fig.10 Transportation of Concrete

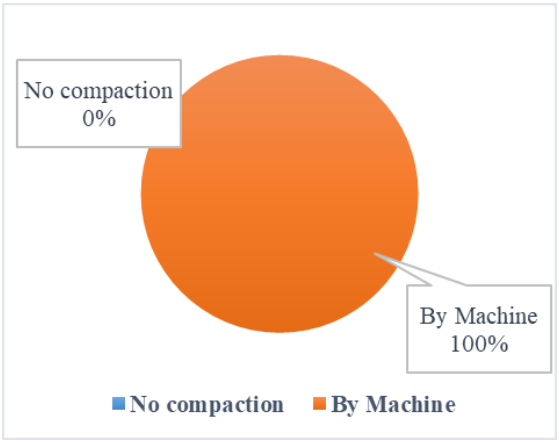

Fig.11 Compaction of concrete

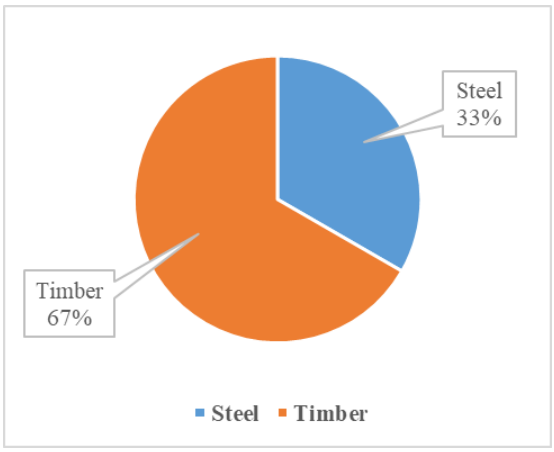

Fig. 12: Types of Formwork Used

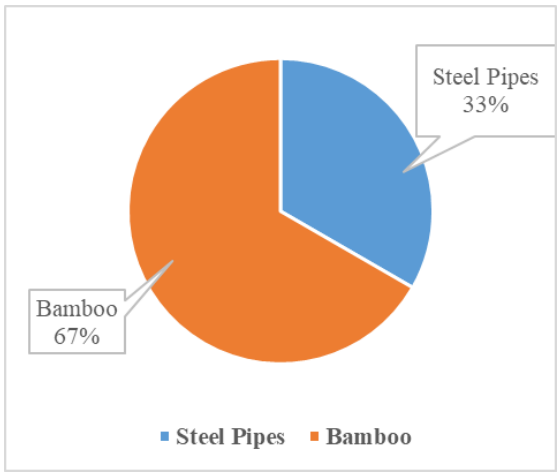

Fig.13 Scaffolding Material

3. Curing of Concrete

All columns in all sites were cured by spraying water on wet gunny bags and all the slabs of all sites were cured by ponding method. However, curing of column was not up to mark as due to excessive heat of summer, the gunny bags were seen to dry up. However, curing of columns were done for maximum of 7 days while slabs were cured for at least 21 days.

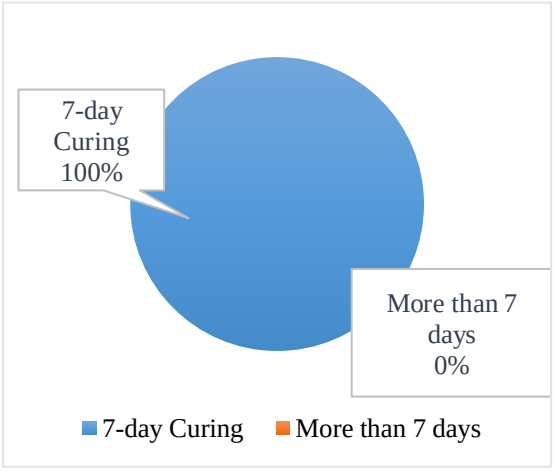

Fig.14Curing Period of Column

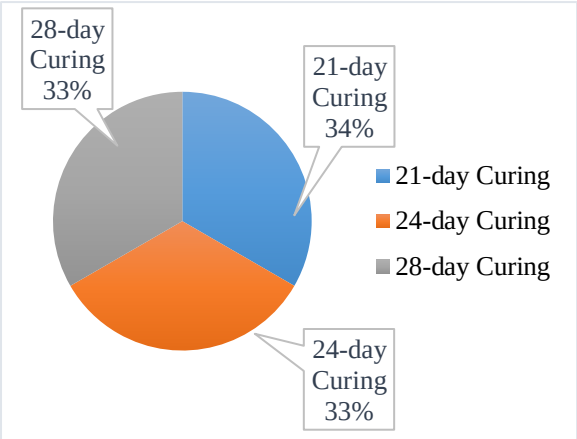

Fig.15Curing Period of Slab

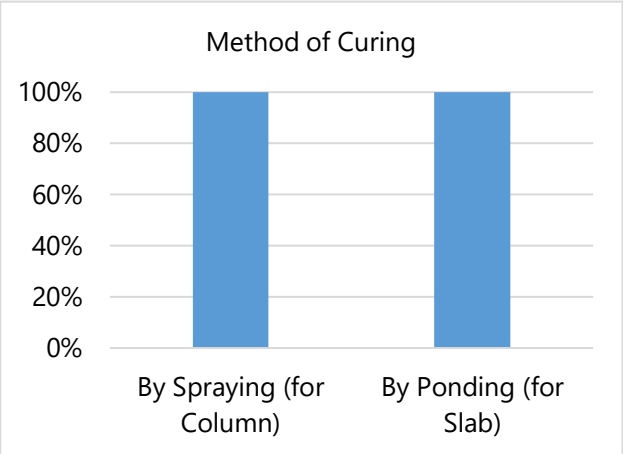

Fig.16 Method of curing for Column and Slab

4. Sub-soil Investigation and Protection of excavations

Only the authorities of the school building performed sub-soil investigation. Others designed their foundation based on judgement and previous experience. Also, there were not enough protective measures taken for excavation, but it can be justified as the excavation depths were low.

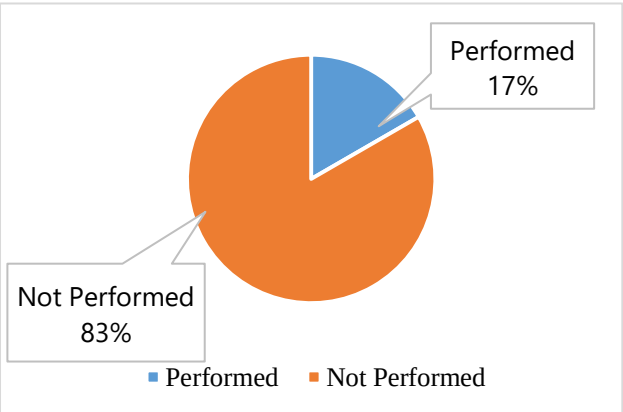

Fig.17 Soil Test

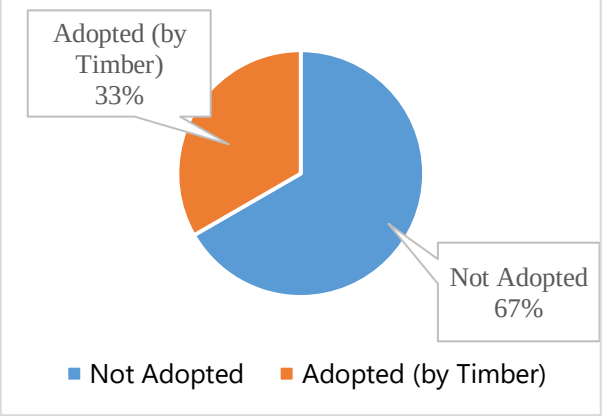

Fig. 18 Protection in excavations

5. Consistency with Structural and Architectural Drawing

When the constructions were compared with their respective architectural drawings, it was found that, the residential buildings extended one or two balconies beyond the limit but the other two complied with the drawings. However, no major changes were made in any sites. There were found large amount of discrepancies in site work and structural drawing. Lap length and development lengths were found to be inadequate at all sites.

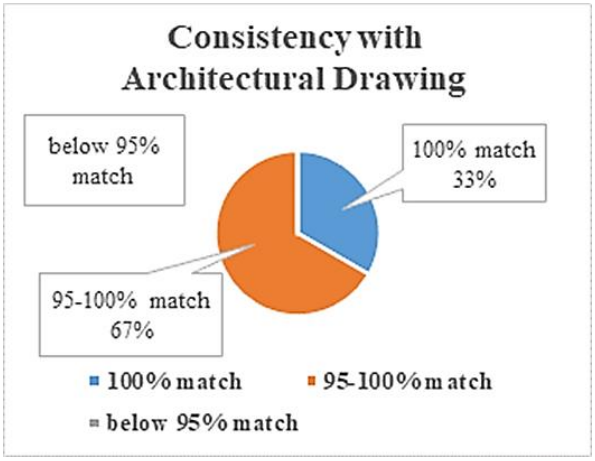

Fig. 19 Consistency with Architectural Drawing

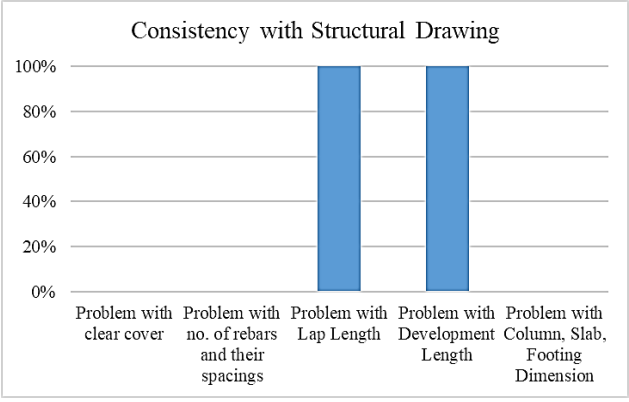

Chart -20: Consistency with Structural Drawing

Figure.1Curing of Concrete

Figure.2Storing of Stone Chips

Figure.3Protection of Excavations

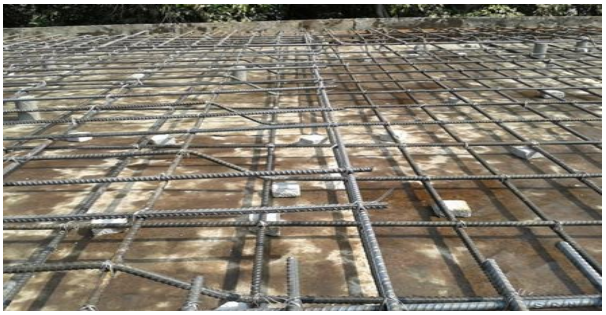

Figure. 4Rebar Spacing

V. CONCLUSION

The followings are the principal conclusions drawn from the study:

1. All of the building materials conform to the ASTM specifications.
2. Most of the buildings followed architectural specifications but failed to comply with the structural drawings in important structural elements, like- Columns and joints of beam, column and slab.
3. Most of the building construction sites are not interested to make tests out of their concrete batches to ensure quality of structural members.
4. The materials were stored in improper manner and in unplanned places without prior approval from authority.
5. The good practices are being implemented mostly on the government projects but is getting neglected on residential or private projects.
6. Reluctance to perform soil test has been observed in majority of the buildings.

Recommendation forFuture Studies

1. This research was conducted on a limited number of buildings for time restriction. It is recommended that future researches expand the study for more buildings.
2. This research was conducted on residential, school and mosque building due to access restriction. Future researchers can expand it by taking various categories of buildings, like- Industrial or commercial ones.
3. The building studied were all of two storied. More mid-rise and high-rise building of same category can be studied and compared with our result.
4. Other City Corporations of Bangladesh can be studied for similar types of buildings and can be compared.

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