

RESEARCH ARTICLE

## Degree of implementation of site management regulation (BNBC-93) in the construction site of Khulna city, Bangladesh

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### Abstract

The construction industry has a great impact on the economic growth of a country. Site management is an important issue to ensure efficient construction. Site management condition in construction industry in Bangladesh especially Khulna city still facing impediment as there is a deficiency of efficient implementation of Bangladesh National Building Code (BNBC) version 93. This study aims to identify the scenarios of site management practice according to BNBC-93 in the construction industry of Khulna city and identify the influencing factors for BNBC-93 adoption. The research has been carried out by a questionnaire survey where various stakeholders related to construction industry was participated. From the survey it was found that BNBC-93 rules on site management implementation rate are only 51% in Khulna city. According to this study, the main barriers to BNBC-93 rules adoption in construction site management are the lack of management support and negligence by relevant stakeholders. The lack of knowledge, behavior of workers and lack of law enforcement also act as significant barriers in this context. To increase the implementation of BNBC-93 rules on site management it is necessary to take action by the government agencies and increase awareness among all the stakeholders.

### Keywords

Construction; Site management; Regulation; Barriers; BNBC

Received: 18 March 2019; Accepted: 26 June 2019

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### 1. Introduction

One of the fastest and largest industry sector in Bangladesh is considered as building construction. During 1991-2006 periods it has been growing at 7.3 percent In terms of employment [1]. In recent year it has contributed 7.88% GDP to the national economy of Bangladesh [2, 3]. Total 2.024 million employees mounted in construction sector in 2008-2009. It will increase to 3.32 million by 2020 according to the current growth rate[1]. To accomplish controlled and focused result in the area where building or construction work is being

carried out, whether it is within, adjacent to or discrete from an existing working building must have to used site management practice [4]. To maintain all work on site and foundation for a successful project, it is required some planning and facilities that are only provided by efficient site management practice [5]. The construction industry is growing in every city of Bangladesh as well as Khulna city remarkably, but site management regulation has not implemented accordingly to be needed. When compared with other industries in Bangladesh it is found that the structural safety

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conditions, environmental protection and the injury records are in worst condition in construction site [6]. The specification of BNBC-93 is not strictly followed in terms of design, execution in construction, as well as requirements for safety of the worker because of inexpert personnel in construction and many building owners are unwilling to pursue service of a professional engineer [1].

Site management is an important part of any construction industry which include dealing, working, managing and organize all requirements of a construction site. Over the last few decades, a consciousness of the significance of quality site management has been developing in the construction industry. So every personnel related in the construction industry are needed to aware and understanding whole site management regulation in order to achieve the quality of construction[7]. The main function of a site management team is to organize, inform, coordinate, order, instruct and motivate others to undertake site activities [8]. However, there are several challenging engineering and management problems that occur on the construction site. For instance, identified five major problems that are management support, poor communication, poor information, lack of knowledge and negligence by the stakeholder [9, 10]. Weather conditions, altered drainage, discrepancies between planned and as actual grades, financing, and unforeseen construction requirements and other variables combine to make construction site management challenging[11, 12]. Due to improper or lack of site management practices, different levels of work accidents ranging from minor injuries to fatal accidents have occurred and also causes economic loss and environmental pollution. A review of the relevant literature reveals that the status of the industry (in regard to site management) in developing countries is not promising, which is apparent from the low level of awareness and the lack of knowledge about BNBC-93 regulation.

The review also found that the main factor hindering implementation of BNBC-93 regulation in the construction industry are management

support, negligence, behavior of worker, lack of knowledge and lack of law enforcement. It is necessary to present the real scenario of construction site management in Khulna city and take measure to overcome critical site management issues. Therefore, the aim of this study is to find the actual application rate of site management parameters during construction and identify the root causes for BNBC-93 adoption in construction sites of Khulna city, Bangladesh. This study also will able to find out the strength of BNBC-93 regulation for construction site management. If the real scenario comes to light, it will be easier for the authority to take effective necessary steps to improve the quality and standard of construction site management in Bangladesh. It is hoped that the outcomes of this study enrich knowledge about the current state of, driver of, and barriers to implement BNBC-93 regulation in Khulna City and form a significant base for future construction work within the country.

## 2. About BNBC'93

Bangladesh National Building Code (BNBC) is a building code regulated by Government of the Peoples Republic of Bangladesh. BNBC was first published in 1993 and BNBC 93 has been used as a reference in this research. BNBC 93 consist of three volume which is divided into ten parts. Each part consists of a few chapters. However, volume 3, Part 7, Chapter 3 has been used in this study where title of the chapter is safety during construction. The relevant volume, part, chapter, and para has been shown in Table 1.

## 3. Study area

Khulna, the third largest city of Bangladesh, is located in the southern part of the country and is situated below the tropic of cancer, around the intersection of latitude 22.49N and longitude 89.34E. The area of Khulna city is 47 square km with a population of 1.5 million (corporation 2018). This study was performed at six selected areas of Khulna city such as KUET (Khulna University of Engineering and Technology), Fulbarigate, Boira,

Sonadanga, Nirala and New market. and the area has been represented in Fig. 1.

**Table 1.** Relevant segments of BNBC'93 of this study

Issue	Volume	Part	Chapter	Para	Page
1. First aid kit.	3	7	1	1.4.2	7-3
2. Telephone for emergency contact	3	7	1	1.4.2	7-3
3. Temporary construction	3	7	1	1.4.3	7-3
4. Plan, layout, design and specification of all temporary constructions	3	7	1	1.4.3	7-3
5. Adequate storage.	3	7	1	1.4.4	7-4
6. Protection from weather	3	7	1	1.4.4	7-4
7. Vehicle easy access and exit	3	7	1	1.4.5.2	7-4
8. Adequate yard lighting	3	7	1	1.4.5.2	7-4
9. Effective drainage plan	3	7	1	1.4.5.2	7-4
10. Fencing, barricades and signage	3	7	1	1.4.5.2	7-4
11. Layout of temporary services	3	7	1	1.4.5.2	7-4
12. Construction safety with emergency access	3	7	1	1.4.5.2	7-4
13. Free access from the street to fire hydrant.	3	7	1	1.4.5.3	7-5
14. Stairway	3	7	1	1.4.5.3	7-5
15. Ensuring slope stability	3	7	1	1.4.5.4	7-5
16. Installation of cranes and piling equipment.	3	7	1	1.4.5.4	7-5
17. Protection against ground water seepage.	3	7	1	1.4.5.4	7-5
18. Personnel protective equipment.	3	7			
19. Monitoring and controls during project.	3	7	3	3.2.1	7-30
20. Protection adjoining structures	3	7	1	1.7.1	7-8
21. The permission of the adjoining property owner.	3	7	1	1.7.2	7-8
22. Protective fence and railing	3	7	1	1.7.3	7-9
23. Adequate strength to resist wind pressure.	3	7	1	1.7.3	7-9
24. Protective frame and boarding	3	7	1	1.7.5	7-9
25. Precaution during construction	3	7	1	1.7.5	7-9
26. Permissions from authorities	3	7	1	1.7.6	7-10
27. Clear passage along the building site	3	7	1	1.7.6	7-10
28. Walkway keep well-lighted at night	3	7	1	1.7.8	7-10
29. Signs and emergency instructions.	3	7	1	1.7.8	7-10
30. Watchman.	3	7	1	1.7.9	7-10
31. Audible signal	3	7	1	1.7.9	7-10
32. Existing underground utility lines	3	7	1	1.8.1	7-11
33. Permission from the respective authorities before excavation	3	7	1	1.8.1	7-11
34. Housekeeping	3	7	2	2.1.4	7-14
35. Adequate sanitary facilities	3	7	3	3.2.3	7-30
36. Minimize dust-blow	3	7	1	1.8.3	7-11
37. Noisy activities	3	7	1	1.8.4	7-12
38. Good site practices	3	7	1	1.8.5	7-12

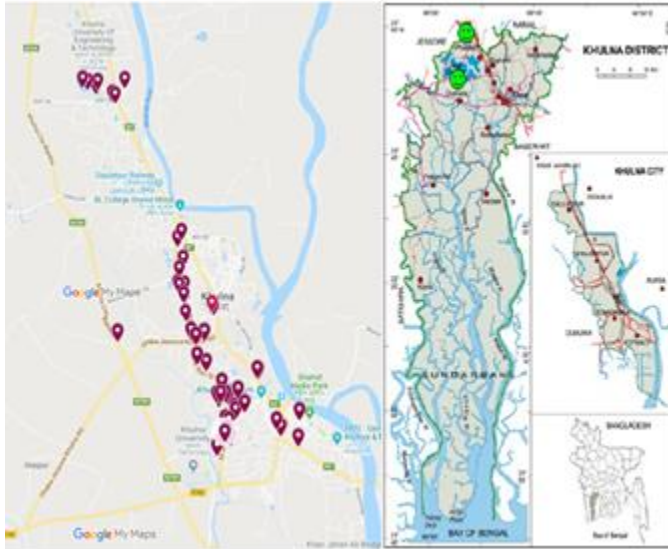


Fig. 1. Location of study areas in Khulna city area of Bangladesh.

#### 4. Research methodology

The study had been conducted through several phases namely literature review, review of existing laws, data collection and analysis, application of statistical tools for analysis of survey data. Then the influencing factors were identified, and finally this study provided some suggestions and recommendations. Fig. 2 represents the overall process of the study.

##### 4.1. Questionnaire design

In order to fulfill the objectives of the study, all around organized close-ended questionnaires were designed to assemble data from the respondents. These questions were ethical and feasible. The wordings were without bias and the questions provided multiple choice options which gave the respondents the opportunity to present their ideas by the way of selecting from the options provided. The sample questionnaire form that has been conducted can be seen in Fig. 3.

In most of the questions in the questionnaire survey, the contractor, engineers, project managers, and the workers were the respondents where they have provided their opinion according to their own

construction site to each statement. Two types of question such as Yes or No has been. If any respondent were choosing No option, then they also choose the option behind the reasons that found from background information collection. This study mainly focused on the construction site management part, according to BNBC -93(Volume 3, Part 7, Chapter 1, Page No 3-13) and assess whether the BNBC regulations implement or not. For this purpose 38 major issues of site management regulation was chosen from BNBC-93. Issues are related to first aid attendant, temporary construction, access for firefighting equipment vehicles, construction strategy and construction sequence, health, and safety environment, adjoining property, protective fences and railings, protection of utilities, use of road and footpath, notices and signs, watchman and auditory signal, protection of soil, aquifers, and water channels against pollution, protection from air and sound pollution, housekeeping, site security, use of personal protective equipment etc. 5 major barriers set on the questionnaire (lack of management support, Negligence, behavior of workers, lack of knowledge, lack of law enforcement) based on the literature review.

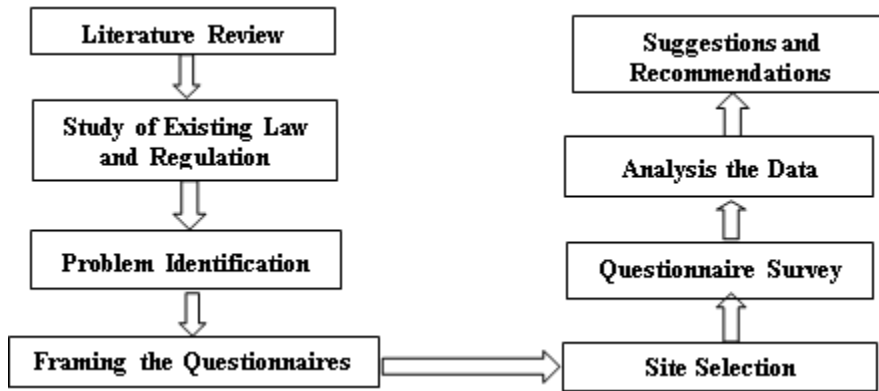


Fig. 2. Overall process of the study

**DEGREE OF IMPLEMENTATION OF SITE MANAGEMENT REGULATION (BNBC-93) IN THE CONSTRUCTION SITE OF KHIJUNA CITY.**

Dear sir/maam, we are students of Khulna University of Engineering & Technology. Our thesis is related to site management practice in construction industry. So we need some data related to your site. We will be very grateful if you provide us above mentioned topic related data.

Personal name: MD. KAMRAN ISLAM Designation: Project Engineer Age: 60

Project Location: BESTAVI, KHULNA

Project Type: 5 STOREY RESIDENTIAL BUILDING

Please indicate your reaction (according to your own construction site) to each statement by ticking the appropriate cell.

Issues	If no please tick behind the reasons					On	Rate
	Yes	No	Manage	Need	Lack of		
1. First aid kit							
2. Telephone for emergency contact							
3. Temporary Construction:							
3.1. Workery shed, toilet, site office, site office, storage, storage, food, bridge, guard shed etc.							
3.2. Plans, layout, design and specification of all temporary constructions							
4. Adverse weather issues:							
4.1. Adequate protected storage for weather sensitive materials							
4.2. Protection for personnel from extreme hot/cold/contaminants							
5. Site layout issues:							
5.1. Easy access and exit, with proper parking of vehicle and equipment during construction							
5.2. Adequate yard lighting and lighting for night shifts							
5.3. Roads for vehicular movement with effective drainage plan							

10. Framing, formwork and rigging:							
11. Layout of temporary services (water, power, gas, sewerage, etc.)							
12. Construction safety with emergency access and evacuation and security measures:							
13. Free access from the street to the building/office/worker facility:							
14. Stairways (in all buildings over two stories high, at least one (stiffness))							
15. Framing, steel, stability with retaining structure before the main construction							
16. Installation and movement of heavy equipment like crane and jacking equipment							
17. Protection against ground water seepage							
18. Personal protective equipment							
19. Reporting on their monitoring and controls during project implementation							
20. Protection of all adjoining structures and public from damage							
21. The permission of the adjoining property owner							
22. Whether height of fence 2.4 m in							
23. Adequate strength to resist wind pressure							
24. Protection frame and securing around and over every street lamp, utility line, fire and police station, fire hydrant, catch basin and manhole							
25. Protection during construction to prevent scattering, erosion, settling or any other material from entering and blocking a sewer							
26. Permissions from relevant authorities for all work done							
27. One (1) meter clear passage along the building site							
28. Signs and Signs Issues:							
29. Signs and signs related to a construction, demolition or excavation are being used (night or day)							
30. Signs with caution signs, along with safety regulations and emergency instructions							
31. A watchman shall be employed to watch the ground/pit							
32. Audible signal use (trucks of concrete dump)							
33. Protection of Existing Drainage Systems and Utilities Issues:							
34. Ensure safety in site covering underground utility lines and drainage systems during excavation							
35. Written permission from the respective authorities before excavation/fitting in both sides							
36. Provide appropriate and adequate facilities for the temporary storage of all wastes before disposal							
37. provision of adequate sanitary facilities for the construction workforce							
38. Take all reasonable measures to minimize dust/soil/water splash from any site							
39. Heavy activities not carried out from 10:00am to 5:00pm in the morning							
40. Adequate machine maintenance and good site practices							


  
 MD. KAMRAN ISLAM  
 Project Engineer  
 112, Durgam Chandra Road  
 Dhaka 1213, Bangladesh

Fig. 3. Sample questionnaire form

#### 4.2. Data collection

The data was collected mainly from construction sites of different parts of Khulna city in order to get a general scenario of the construction sites of Khulna city. Around 100 sites were selected randomly from both developed areas and suburban areas. Two groups were classified to conduct the survey. Group-1 covered the workers and foremen. The other group, group-2 covered the employer's side which constituted site engineers, project managers, and contractors.

#### 4.3. Data analysis

The statistics have been analyzed via SPSS software program and MS Excel. The frequency, percent, valid percent and cumulative percent of that data were determined against 38 issues of site management. The one sample of data analysis shown in Table 2.

### 5. Result and discussion

#### 5.1. Present scenario of adoption of BNBC-93 regulations

From the site survey it has been found that proper site management practices that has been regulated in BNBC'93 is below the satisfactory level in the construction site of Khulna city area. The current scenario has been represented in the Figs. 4-9.

Table 3 represent the degree of implantation of 38 nos. of BNBC-93 regulation on construction site management for instance first aid implementation rate is only 44%, telephone for emergency contact is used only 21% site etc. Overall, Fig. 10 shown the graphical representation of implementation status of the BNBC-93 regulation where 51% regulations have been adopted and 49 % regulations did not implemented.



**Fig. 4.** Lack of waste management system



**Fig. 5.** Unplanned location of site office



**Fig. 6.** No hoarding or barricade and safety sign provided



**Fig. 7.** No protection for street lamp, electric post



**Fig. 8.** The construction material placed on public road



**Fig. 9.** Not using of PPE

**Table 2.** Survey response for first aid kit

	Frequency	Percent	Valid Percent	Cumulative Percent
No	Management support	34	34.0	60.7
	Negligence	13	13.0	83.9
	Lack of knowledge	4	4.0	91.1
	Lack of law enforcement	4	4.0	98.2
	Others	1	1.0	100.0
	Total	56	56.0	100.0
Yes	44	44.0		
Total	100	100.0		

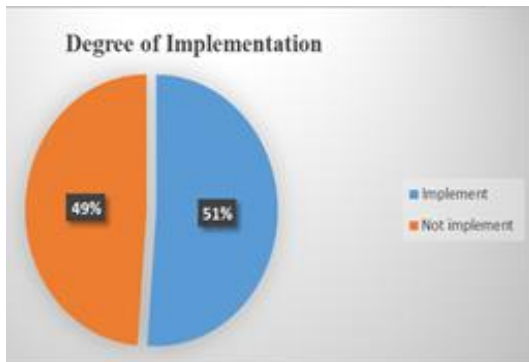
**Table 3.** Degree of implantation of various site management issues according to BNBC

Issues (major site management regulation)	Implement (%)	Not implement (%)	Total
1. First aid kit.	44	56	100
2. Telephone for emergency contact	21	79	100
3. Temporary construction	66	34	100
4. Plan, layout, design and specification of all temporary constructions	7	93	100
5. Adequate storage.	63	37	100
6. Protection from weather	5	95	100
7. Vehicle easy access and exit	56	44	100
8. Adequate yard lighting	85	15	100
9. Effective drainage plan	16	84	100
10. Fencing, barricades and signage	41	59	100
11. Layout of temporary services	5	95	100
12. Construction safety with emergency access	51	49	100
13. Free access from the street to fire hydrant.	72	28	100
14. Stairway	99	1	100
15. Ensuring slope stability	75	25	100
16. Installation of cranes and piling equipment.	36	64	100
17. Protection against ground water seepage.	82	18	100
18. Personnel protective equipment.	14	86	100
19. Monitoring and controls during project.	76	24	100
20. Protection adjoining structures	74	26	100
21. The permission of the adjoining property owner.	89	11	100
22. Protective fence and railing	25	75	100
23. Adequate strength to resist wind pressure.	28	72	100
24. Protective frame and boarding	22	78	100



**Table 3.** Cont'd

25. Precaution during construction	78	22	100
26. Permissions from authorities	92	8	100
27. Clear passage along the building site	38	62	100
28. Walkway keep well-lighted at night	85	15	100
29. Signs and emergency instructions.	21	79	100
30. Watchman.	85	15	100
31. Audible signal	7	93	100
32. Existing underground utility lines	67	33	100
33. Permission from the respective authorities before excavation	65	35	100
34. Housekeeping	55	45	100
35. Adequate sanitary facilities	75	25	100
36. Minimize dust-blow	8	92	100
37. Noisy activities	44	56	100
38. Good site practices	72	28	100
Cumulative (%)	1944	1856	
Total (%)	51.2	48.8	100

**Fig. 10.** Overall degree of adoption of BNBC'93 regulations

### 5.2. Barriers and their impact on BNBC'93 implementation

Table 4 represented the main obstacle for implementing BNBC-93 and their negative impact on each site management issues. The main impairment of first aid kit implementation is lack of management support where 60.7% of the management are not supporting the adoption of site management regulations that has been incorporated in BNBC'93. Similarly, the major obstacle for utilization of telephone for emergency contact is negligence of owners, contractors, engineers,

workers and other stakeholders and the magnitude is 49.4%. The rest of the survey results has been represented in the Table 4.

### 5.3. Overall barriers impact on site management

Fig. 11 represented among the six barriers, lack of management support around 34.9% and negligence (by contractors, Engineers, Owners, Workers and other stakeholders) around 34.6% are the main impediments of site management. Behaviors of workers, lack of knowledge and lack of knowledge also have a great negative impact on BNBC'93 rules adoption in site management. Other barriers like lack of inspection, lack of training, tight schedule also have a good impact.

## 6. Conclusion and recommendations

This research upholds the real scenario of site management practice according to BNBC-93 and the principle impediment and their negative impact on the adoption of site management regulations that have been regulated in the BNBC-93. The data were collected from various stakeholders for instance Engineers, Contractors, Workers, Owners, and Architects through a questionnaire survey.

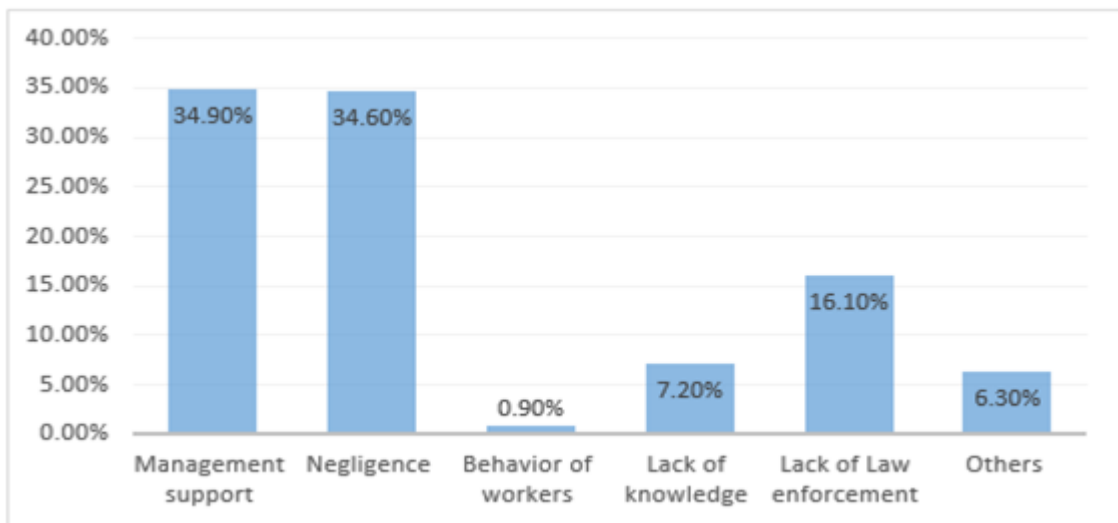


**Table 4.** Root causes and their negative impact on BNBC-93 adoption

No	Issues	Management Support (%)	Negligence (%)	Behavior of Worker (%)	Lack of Knowledge (%)	Lack of law Enforcement (%)	Others (%)
1	First aid kit	60.7	23.2	0	7.1	7.2	1.8
2	Telephone for emergency contact	46.8	49.4	0	0	1.3	2.5
3	Temporary construction	79.4	14.7	0	0	5.9	0
4	Plan, layout, design and specification of all temporary constructions	45.2	35.5	0	6.5	11.7	1.1
5	Adequate storage	67.7	18.9	0	0	2.7	10.8
6	Protection from weather	34.7	50.5	2.1	7.4	1.1	4.2
7	Vehicle easy access and exit	72.7	9.1	0	4.5	11.4	2.3
8	Adequate yard lighting	20	60	0	0	13.3	6.7
9	Effective drainage plan	34.5	8.3	0	35.7	15.5	6
10	Fencing, barricades and signage	15.3	32.2	0	5.1	32.2	15.2
11	Layout of temporary services	38.9	41.1	0	13.7	5.3	1
12	Construction safety with emergency access	30.6	34.6	0	10.2	20.5	4.1
13	Free access from the street to fire hydrant.	57.2	10.7	0	3.6	21.4	7.1
14	Stairway	100	0	0	0	0	0
15	Ensuring slope stability	12	44	0	4	28	12
16	Installation of cranes and piling equipment	92.1	6.3	0	0	1.6	0
17	Protection against ground water seepage.	38.3	33.3	0	5.6	5.6	16.7
18	Personnel protective equipment	52	12.8	17.4	2.3	10.5	0
19	Monitoring and controls during project	20.8	66.7	0	0	4.2	8.3
20	Protection adjoining structures	3.8	57.7	0	0	38.5	0
21	Permission of the adjoining owner	0	45.5	0	0	54.5	0
22	Protective fence and railing	10.7	42.6	0	37.3	6.7	2.7
23	Adequate strength to resist wind pressure	30.5	51.4	0	12.5	2.8	2.8
24	Protective frame and boarding	14.1	51.3	0	7.7	25.6	1.3
25	Precaution during construction	27.3	68.2	4.5	0	0	0

**Table 4.** Cont'd

26	Permissions from authorities	37.5	0	0	0	50	12.5
27	Clear passage along the building site	9.7	11.3	0	9.7	66.1	3.2
28	Walkway keep well-lighted at night	20	53.4	0	0	13.3	13.3
29	Signs and emergency instructions	16.4	24.1	0	19	36.7	3.8
30	Watchman	53.4	33.3	0	0	13.3	0
31	Audible signal	50.5	12.9	0	31.2	4.3	1.1
32	Existing underground utility lines	6.1	24.2	0	18.2	15.2	36.3
33	Permission from the respective authorities before excavation	0	20	2.9	11.4	45.7	20
34	Housekeeping	33.4	55.6	4.4	0	2.4	4.4
35	Adequate sanitary facilities	60	28	4	0	0	8
36	Minimize dust-blow	14.1	67.4	0	12	4.3	2.2
37	Noisy activities	3.6	55.4	0	7.1	26.8	7.1
38	God site practices	10.7	60.8	0	0	7.1	21.4



**Fig. 11.** Overall impact of major six impediment on site management in Khulna city

Major 38 nos. of site management regulations and 6 nos. of barriers were selected that has negative impact on BNBC-93 rules adoption in site management. In general, the site management related issues at present winning in the construction sites did not reflected a persuading and acceptable picture. This study identified that implementation rate of BNBC-93 rules on site management only

49%. Among the barriers "lack of management support and negligence (by contractors, Engineers, Owners, Workers and other stakeholders)" are the main affecting impediments. On the other hand, "behaviors of workers and lack of knowledge" also have a significant negative impact on BNBC-93 rules adoption for managing site. From the survey it also been found that "lack of inspection, lack of

training and tight schedule" have a significant negative impact on proper site management. From this research, it has been found that some site management issues like Earth Control Measure (ECM) and provision of washing bay can be added in the BNBC-93 code for better construction site management. This study was conducted in 100 construction sites located in Khulna city area of Bangladesh. However, more construction site need to be surveyed to find out the more accurate scenario of Khulna city. In addition, this survey was conducted with major 38 nos. of site management regulations and 6 major barriers that had been cited in the BNBC-93. However, in order to get more comprehensive results, more regulations and barrier can be incorporated in future study to get a more realistic result. Finally, it can be strongly recommended that the degree of implementation of site management regulation will increase if technology based site management such as Building Information Modeling (BIM) is implement in the construction site of Khulna city area of Bangladesh.

### Acknowledgments

The authors would like to thanks all participants who have helped by providing their valuable time and opinion during the survey.

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