Effects Of Faulty Construction On Building Maintenance

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ABSTRACT: The success of a building project depends on its performance, which is measured based on the cost of maintenance and the quality and standard of workmanship. Hence, the maintenance cost of a building during its functional life could outweigh the initial cost of a new building if maintenance has not been incorporated during the planning stage of the project. It is therefore of paramount importance to note that any decision made at the planning and construction stage of the project could have a substantial effect on the cost of maintenance. The paper seek to identify the defects caused by faulty construction on maintenance, a total of 115 structured questionnaire were randomly distributed to three (3) groups of respondents Builders, Architects and civil engineers eighty(80) were completed and returned. The severity index (SI) was used to rank the most severe defects on maintenance. While, the kruskal Wallis test, show that there were comparison and no significance difference in the opinion between the respondents. The results reveal according to the rank by the architects and builders that insufficient reinforcement bar concrete cover is the most severe defects while the civil engineers rank non-compliance with specification as the most severe defects. The study concludes that ensuring quality during construction process is dependent on teamwork and also the performance of contractor's should be monitored to avoid defects, mistake or spot inspection

Keywords: Maintenance cost, initial cost, constructions stage, faulty construction, building defects, functional life

1. INTRODUCTION

Construction is where our designs are put into practice and the owner starts paying. No matter how good the design is, it is only as good as what the construction stage of the processes makes it. In construction and engineering projects the nature and type of defects vary drastically, as at the point at which they become apparent; at one end of the scale minor defect can easily be corrected before the building is handed over to the client, while at the other extreme, significant defects may occur long after the original work has been completed and require extensive remedial works to fix. A report that was developed by the Building Maintenance Committee (in the UK) observed that about 20% of the average annual expenditure on repairs in a large number of buildings was abnormal and, in most cases, could be described as arising from defects. Defects can arise because work was not carried out in a good and workmanlike manner in accordance with good practice or a particular design, or because wrong materials have been used. Design plays a major role in determining the conditions of the building after completion, mainly in aspects of defects and maintenance (Ahmad, 2006). The researcher further explained that, indirectly, design influences the performance and physical characteristic of building and its durability to with stand against environmental condition, social interfaces such as graffiti and Vandalism. Alternatively the designer could be faulty, because a particular design is not working in the manner that it should. In the design and build scenario, the contractor would normally have primary liability for both types of failure although it may have consequential claims against its design. However in considering defects as a matter of principle, work may be defective even if it has been carried out with all due skill and care but it fails to meet a particular specification. Faulty construction is a problem for people working on a building, as well as for people who will enter the building after it is completed. When safety and building code are not followed, the result is an unsafe structure that can pose many dangers. In Nigeria architect can design an unsound building, contractor may cut cost that lead to poor construction. Issues like these can cause all or part of a building to experience total maintenance. Atkinson(2003) explained that managerial errors mostly accounts for more than 82% of all construction errors committed and that managerial errors have hidden or latent characteristics, suggesting that these error are not visible at construction stage and both clients and designer might have huge impact on such defect. Faulty construction practice cause massive loss of resources, there are many defects in construction that can be categorized under faulty construction practices, and any of this can lead to serious issues throughout the life of the building while contractor licensing and building code seek to eliminate faulty construction practice, it's not always possible to detect problems immediately, or ever, if the event that reveal the fault never transpire; Al-Hammadet. al. (1997) maintains that, provision of adequate structural design, hiring of qualified architects and building systems design professionals, and provision of sufficient details in construction drawings are some of the measures that could be employed to improve building maintenance. It is very common to see a higher incidence of faulty construction practice during period of very fast construction, inspectors are overworked, and building authorities are under constant pressure to issue permits and move the workload through their office. Faulty construction practice may not be intentional. It could be a design flaw that the architect didn't detect before passing down the blueprint for construction. Element of the design might not have been carried out precisely as depicted on the blueprint. A construction worker may accidentally assemble something wrongly. There may be undetectable flaw in the materials used. Inexperience, such as may be the case when clients choose to do their own construction which is a common practice in Nigeria may lead to faulty construction. In February 2011 it was reported that it could cost in excess of €15 billion just to replace all the faulty construction in homes across the united state. If the scenario is to be compared to Nigeria, we should be talking about trillion of naira because of multiple construction errors.

2. Literature review

Faulty construction is one of the problems most public building is facing in Nigeria and this can be attributed to inexperience and inconsistency in the training of artisan. According to assaf etal (1995) faulty construction is one of the causes of early deterioration in building. (Piokeng, 2001)

stated that the common construction faults include inadequate compaction and failure to position reinforcement so that it has adequate concrete cover. (seeley,1987) however, observed that those faults will reduce the service life of the structure as a result of reinforcement rusting after the concrete has become strong and the cost of maintenance can be substantial. Sadi (1995) explained that such defects are substantial source of maintenance expenditure. Here in Nigeria and most developing countries the conditions under which building construction takes place are often far from ideal with the focus mainly being on speedy delivery.

2.2 Construction defect

A construction defect may include any problem that reduces the value of a home, condominium, or building. Construction defects can be the result of design error by the architect, the contractor's flaw, defective materials, improper use or installation of materials, lack of adherence to the blueprint by the contractor. However construction defect includes activities such as compaction and consolidation not done to the provided specification leading to subsidence(ground movement) and eventual early deterioration of foundation, structural defects resulting in cracks or collapse, defective or poor electrical wiring and/or lighting, defective plumbing installations, inadequate or faulty drainage system, inadequate ventilation, cooling or heating system, inadequate sound proofing and fire proofing suppression systems. (Ramson, 1981) stated that the diagnosis of building defects is essential to ensure that the cost of remedial work is not excessive but successful. Ramson (1981) however put the following factors to determine whether a problem constitutes a construction defects

- **i.** The buyers reasonable expectation
- **ii.** The builders compliance or non compliance with applicable building codes and construction standards
- **iii.** Whether the construction is in a workmanlike manner
- **iv.** Whether building materials and products used were suitable for their intended purposes
- **v.** Whether or not the plan of Architects and or engineers were followed

In order to determine the quality of ongoing construction work on a number of low rise traditional housing scheme the building research establishment organized a major research project in conjunction with the National building agency (1993) to identify the most frequent defects caused by faulty construction, however 35 most frequent defects were identified and listed based on the research work of Assaf, Al-hammed, Al-shilah 1995). But according to this research work, the similarities of the identified defects (Assaf, Al-hammed, Al-shilah 1995) and additions from literature survey are listed and explained succinctly below.

1) Inaccurate measurement

Inaccurate measurement is a serious problem contractors or builders face on a construction site, this problem may arise as a result of the designer under-measuring or over- measuring the exact size of a building component in a building plan. Assaf (1995) cites such instance where a contractor increases the water content in the mix which causes porous and results in corrosion of steel bars and cracking of the concrete structure. Such example is based on the mistake from the construction aspect while the designer also have a blame when he under-measure.

2) Movement or changes in the position of formwork

Concrete when first mixed is a fluid and therefore form any concrete member (R chudley and greeno, 2005). Assaf etal (1995) explained that any movement of the formwork which occurs between that the concrete set will cause cracks to appear in the structure. The results of these cracks is that they form an invisible water pocket in the concrete mass which when freeze will expose the concrete surface to corrosion of reinforcement

3) The use of damaged formwork

Some contractor or builders are so greedy that they use damaged planks for construction of their formwork or false work to save cost that will later put them in trouble, The results is that it affects the quality of the concrete by producing a honey comb like structure which allow moisture to penetrate the exposed steel bars, hence, the basic principle of formwork is to resist the imposed, dead and hydrostatic pressure.

4) Painting on unsuitable surface

According to BS 6150(painting of building) preparation of the surface to receive paint is of utmost importance since poor preparation is one of the chief causes of paint failure. The major purpose of paint is for surface protection and surface decoration but the purpose may be defeated when painting is being carried out on a wet surface or salty surface or even in a bad weather condition i.e. humid. These will results in the peeling of the paint, crazing, and chalking e.t.c

5) Vibration

It is generally noted that formwork should be strong than is traditional in order to withstand vibration, inability of the formwork to withstand vibration can results in a crack

6) Insufficient reinforcement bars concrete cover

The recommended standard for concrete cover is usually between 50-75mm depending on the building components. Inability of the contractors or builders to comply with the specification provided for concrete cover usually results in the rapid rate of reinforcement bar corrosion and cracks when exposed.

7) Improper construction of joints

Joints are lines of weakness which will leak unless carefully designed and constructed which should be simple in concept and easy to construct. Improper construction of joints usually occurs between a new and old concrete (cold joints) and if such Joints are not properly treated it will results in cracks and water penetration.

8) Early or premature formwork removal

With modern pressure for speed and economy in construction, there is a tendency to remove the formwork before the concrete has attained sufficient strength. When this occurs, the concrete often cracks, sometimes severely (Auwai, 2008). According to Assaf etal (1997) this can cause permanent deflection and cracking of the structure which will

allow moisture to reach the steel and cause continuous corrosion and cracking of the building elements

9) Poor soil compaction

Poor soil compaction is a serious problem that can cause settlement when backfilling it required for the backfilling to be compacted at each layers usually at every 150mm. most contractors backfill the soil in one layer rather than several layers, therefore, they only compact the top layer. Since, the bottom soil is not well compacted or not even compacted, it will settle at a later stage and cause settlement in the building which can results in a continuous cracking of wall and foundation failure.

10) Inadequate provision for water proofing and drainage

Most contractor usually construct building component without taking cognizance with the joints which is usually the critical points. This usually results in water seepage via the roof or walls and down to other part of the building since roof drainage was also not part of the construction

11) Inadequate curing procedures

Curing is usually needed in concrete to reduce water loss especially in hot climate (most especially the northern Nigeria), hence, failure to cure concrete will results in a weak concrete and a spontaneous development of cracks on the surface. Assaf etal (1995) maintains that even if the contractor wants to cure the concrete, they use salty water which will allow the salt to penetrate the concrete elements and cause corrosion of steel bars or loss of adhesion.

12) Not complying with specification

Contractors tend to do things their own way and few of them follow the construction specification. As a result all the effort spent during the design stage is ignored. Such problem will increase the maintenance work required during the operation of the building depending on the contractor's experience

13). Using block work as formwork

This may not be a popular practice in a developed countries but it is a habit in some developing countries such as Nigeria. It involves the use of block to serve the purpose of a formwork. When constructing a foundation, at the stage where the short column is covered with formwork before being cast; instead a block is place at both adjacent sides to serve as a formwork. This results in a bulky product of concrete and an early loss of moisture through the environment of the block. The columns will certainly fail to serve the purpose of which it was meant for. However, after plastering the column an eventual longitudinal crack or transverse will be a cause for maintenance.

14). Uneven mixture of aggregates

This also occurs when the ratio of aggregate to cement in a head pan is different, not uniform e.g. the aggregate in a head pan may be heaped while that of the cement may be compressed. These can affect the workability of the concrete and produce a result such as cracks later. This problem is unknown by most contractors.

15). Using unwashed aggregate for construction

Most especially gravel. Gravel contains some large amount of clay and sand which is always advisable to wash and sieve before usage. But most contractor make the mistake of using it without washing it to sieve away the clay and the sand particles but a well experienced contractor will reduce the ratio of sand to aggregate to accommodate the percentage of sand contents in the mix ratio. Using the aggregate without washing it can result in a weak concrete and a substantial cost of maintenance that is if the concrete is still durable

16). Insufficient mortar for block work

Some mason are well experienced technically that they do not need chips (spacer) when carrying out bonding, they already know the exact thickness of mortar using their eye as a gauge when pouring the mortar. But some inexperienced one may vary the thickness from one block to the other which can result in imbalance or instability among the blocks setting. It is however advisable for contractor to carry out full inspection during bonding than 'spot inspection" to avoid a bad construction work.

17). Improper soil analysis

One of the steps in building projects is to perform soil analysis to help the builder to know the right strategy to use in preparing the land prior to construction. Soil not properly analyzed and not developed properly can have damaging effect on the structure. An example of this is building a house on an expansive soil, a type of soil that swells when it get wet and shrinks upon drying. In order to prevent damages to the structures built upon expansive soil, a building would be able to withstand the changes in soil consistency. Builders who unknowingly build upon expansive soil can experience crack throughout the structure and the outside pavement.

18). Defective material

Using defective materials can be the cause of many construction defects on structure an example could be a building built with defective roofing materials that allow water to leak into the structure. The result could be a number of defects such as the wood rotting, mold an building for mildew and, moisture stains on the walls and ceiling before construction, a builder should thoroughly inspect building for defects Making sure materials is up to current code and is a quality materials

2.3. Defects caused by contractor administration and staff

1). **Poor communication with the design firm**

This is a major concern in a construction project. The problem of who leads a construction project (usually between the builders and the architects) can results in a gap in communication between the professionals especially among Nigerian architects and builders. And also the frequent recruitment of workers on construction site can make it difficult for the workers to know whom to report to which can results in the worker performing the job based on their own understanding.

2). Hiring incompetent supervisors

You can imagine the problem incompetency can cause a construction project. Basically from experience, most site workers tend to test the intelligence of the so call supervisor and if found wanting in any technical aspect he will be deemed to lose an absolute control on the workers. According

to assaf (1995) the contractor is the main controller of the construction quality. Hiring a qualified supervisor or contractor will help in reducing defects during construction.

3.) Hiring incompetent unqualified workers or workforce
The major uniqueness of a project to the client and the end users is quality. In project management the uniqueness of every project has to do with the end product such as quality. The kind of worker employed to work on a project must be experienced and technically sound to help achieve the total quality of a building because if the building product is bad or defective it is mostly affected by the site engineer and the workforce. If the supervision is adequate but the implementation of TQM is not, defects will increase during the operation.

4). Inability to interpret drawing
This is also one of the substantial problems in most construction site. You discover that the supervisor or contractor cannot interpret a drawing to the workers on site due to his poor technical background. With such, deficiencies are incorporated for the client to inherit.

5). Speedy completion of work
Corruption, impatient and greediness most times can be traced to the reasons why jobs are carried out as quick as possible not considering the consequences. You discover that a contractor has 2-3 ongoing projects at a time with each having a set target for completion. The contractor will be in a hurry to quickly complete the job and handover to the client, this practice encourage bad jobs and bad materials usage for projects

6). To Bad workmanship
There will usually be a bad job when the person supervising the project is inexperienced and technically unsound to understand the rudiments of construction methodology

7). Not compliance with specification
A very good construction project has a laid down procedures that should be followed to avoid erroneous mistake during construction. Such specifications provided by the designer to the contractor specify the methods and types of workmanship to be employed during construction but some contractor will rather prefer to use their own experience instead of the specification provided.

8). Nonchalant attitude towards building regulations
It is quite alarming and appalling that Nigeria is yet to have a workable national building regulation except the one that have been approved by the state government. This has contributed to the nonchalant attitude of contractors towards building regulation; they use their discretion and construct a building that is not in conformity with the building regulations. It was even observed by the building collapse guide in Nigeria (BCG) that most bad workmanship in Nigeria is a result of non-workable building regulations which create an avenue for non adherence to building regulations.

3. Research methodology

By observing the research title from various perceptions, and to avoid any likely controversies and discrepancies in the collected data; architects, builders and civil engineers were the only professionals selected for this study. Other professionals were not included in this study. For this study, the sampling size consists of 35 builders, 20 architects and 25 civil engineers. Questionnaire was used to collect data of the study. The questionnaire was divided into 2(two) parts. The first part (part) requested the background information of the respondents while the second parts of the questionnaire (Part) focuses on the defects caused by faulty construction.

3.1 Data analysis

Severity index
The data collected were analyzed using inferential statistics. To measure the data obtained from the respondents, the questionnaire data was analyzed using the severity index formula. The severity index formula is to determine the ranking parameters for each answer to the question and check the weight of each item. For every question there are four (4) parameters that should be used by the respondent as options to answer the questionnaire. The four options given are Does not affects, strongly affects, moderately affects and slightly affects. Each factor has a severity index which can be calculated as follows (Assaf, 1995). A four scale point was used in solving the question provided. The important index could be obtained for each factor as follows (Assaf 1995)

$$\text{Severity index (IS)} = \frac{\sum (a_1 x_1)}{3 \sum x_1} \times 100\% \qquad (1)$$

Where ai = constant expressing the weight given in ith response, I = 1,2,3,4 where a1= 0 is equivalent to Does not affect response, a2= 1 is equivalent to slightly affects response, a3= 2 is equivalent to moderately affects response, a4= 3 is equivalent to strongly affects response, Xi = the variable expressing the degree of importance, x_1 = the frequency of does not affects response, x_2 = the frequency of moderately affects response, x_3 = the frequency of slightly affects response, x_4 = the frequency of strongly affect.

3.2 kruskal Wallis test

Kruskal Wallis (KW) is a statistical test that is used to compare the ranks means between two or more samples. The test is used to determine if there is any form of significance difference in the point of view between the architects, builders and civil engineers on the defects caused by faulty construction. The results of the kruskal Wallis test is shown in table 6.0. The kruskal walls k-statistical test is as follows:

$$\frac{K= 12}{N\,(n+1)} \qquad \frac{\sum R^2}{nj} - 3(n+1) \qquad (2)$$

Where: K= kruskal Wallis k- statistic
Nj= number of items in sample j
Rj =sum of the ranks of the items in sample j
K= number of samples
N= n1+n2+……..+nk the total number of observations in the entire sample

Discussion of results
A total of one hundred and fifteen (115) questionnaires were administered, eighty (80) questionnaires were retrieved. Table below Shows the characteristics details of the respondents

Table 1: Response of questionnaire administered

Questionnaire	No	Percent
Total administered	115	115
Total returned	80	80
Not returned	35	35

The result from the table1 show the percentage of questionnaire administered and the percentage returned and completed

Table 2: Qualification of respondents

Qualification	Frequency	Percentage	Cumulative percent
OND	-	-	-
HND	24	30.00	30.00
BSC	26	32.50	62.50
MSC/MPM	30	37.50	100.00
PHD	-	-	
Total	80	100.00	

Table 2.0 shows that 30.00% are HND holders, 32.50% BSC holders, 37.50% MSC holders. This shows that MSC holder is the highest respondent.

Table 3.0 Demography of respondent

Professions	Frequency	Percent	Cumulative percent
Architects	20	25.00	25.00
Builders	35	43.75	68.75
Civil Engineer	25	31.25	100.00
Total	80	100.00	

Table 3.0 shows that 25.00% are architects, 43.75% are builders while 31.25% are civil engineers. This shows that the builders are the highest respondents.

Table 4.0 Severity indexes of defects caused by faulty construction on buildings maintenance

Table 4.0 presents the severity index and the ranking of the defects grouped as faulty construction.

No.	Defects	Architect	Rank	Builder	Rank	Civil engineer	Rank
1	Inaccurate measurement	69.52	10	83.33	5	77.11	11
2	Movement of formwork	62.86	13	65.00	10	68.87	12
3	Painting on unsuitable surface	84.77	4	95.00	2	73.32	9
4	Damaged formwork	69.53	10	73.33	7	66.67	13
5	Vibration	77.14	7	50.00	13	64.44	17
6	Inadequate provision for under proofing and drainage	66.67	12	81.67	6	86.44	3
7	Insufficient reinforcement bar concrete cover	100.00	1	100.00	1	86.67	2
8	Improper construction of joints	78.09	6	56.67	12	66.66	14
9	Premature formwork removal	95.24	2	86.67	4	86.44	3
10	Poor soil compaction	84.76	4	56.67	12	66.66	14
11	Inadequate curing procedures	71.43	9	73.33	7	82.22	5
12	Not complying with specification	71.43	9	66.67	9	65.14	15
13	Using block work as formwork	62.86	13	90.00	3	73.33	8
14	Uneven mixture of aggregate	55.00	18	86.67	4	75.00	7
15	Using unwashed aggregate for construction	62.85	14	65.00	10	84.64	21
16	Insufficient mortar for block work	71.43	9	40.96	16	65.00	16
17	Improper soil analysis	78.09	6	41.90	14	72.73	10
18	Defective materials	90.00	3	60.00	11	51.51	22
	Defects caused by contractors administration and staff						
19	Poor communication with design firm	60.00	15	71.67	8	48.48	23

20	Incompetent workforce	38.10	19	40.00	17	75.75	6
21	Lack of proper supervision of work	38.09	20	40.00	17	51.51	22
22	Non compliance with specification	57.14	16	86.67	4	90.91	1
23	Inability to interprets drawing	71.43	9	68.67	9	72.73	10
24	Hiring incompetents supervisor	66.66	12	66.67	9	42.42	24
25	Speedy completion of work	76.19	8	90.00	3	84.85	4
26	Inexperienced workmen and lack of motivation	83.81	5	90.00	3	84.85	4
27	Bad workmanship	67.63	11	40.00	17	63.63	18
28	Non challant attitudes towards building regulation	56.19	17	34.67	18	57.58	17
29	Poor technical background	60.00	15	41.67	15	57.15	20

Source: field survey 2013. Note: 75 -100 most severe defects, 50 -75 moderately severe defects, 25 -50 slightly severe defects, 0 - 25 Non severe defects

Table 4.0 shows the severity index of the defects caused by faulty construction on building maintenance as ranked by the architects, builders and civil engineers. Referring to the architects 10 defects was ranked the most severe, 17 as moderately severe and 2 as slightly severe defects on building maintenance, however according to the builders 10 defects was ranked the most severe, 11 as moderately severe and 7 defects as slightly severe defects. 9 most severe defects, 18 moderately severe defects and 2 slightly severe defects were ranked by the civil engineers. Based on the table 4.0, it can be seen that the architects and the builders have the basic knowledge about the defects that are caused by faulty construction.

Table 5.0 Results of kruskal Wallis test

Defects	Kruskal Wallis	$T_{tab}(\chi)$	df	Asymp. sig	Decision
Faulty construction defects	0.097	5.991	2	0.953	Accept H_o

DF: degree of freedom
The agreement is significant at level of significant 0.05

Referring to table 6.0, the kruskal Wallis test, KW(H) is 0.097, H(2)=0.097, P>0.05 which indicates that there is no significance difference in the views of (Architects, Builders and civil engineers) regarding the response to all field. At 0.05 level of significance, t_{cal}=0.097 and **$T_{tab}(\chi)$ is** 5.991 therefore accept the null hypothesis (Ho) and reject the alternative hypothesis (H1). This is an indication that both the architects, builders and civil engineers all have the same views regarding the defects caused by faulty construction and contractor's administration and staff.

4. Discussion of findings

Perceived roles of project participants in ensuring quality of construction projects control on faulty construction and minimal cost of maintenance reveals that majority of the responsibilities lies between the architects, builders and civil engineers. Their responsibilities are closely related that each one rely on each other to achieve results, these responsibilities should not only be confined on the architects, builders and civil engineers but also from the client to the contractors, consultant and manufacturer's of building materials, all must work together to avoid the issue of faulty construction and unnecessary expenditure on building maintenance. The study reveals according to the respondent's (architects, builders and civil engineers) that speedy completion of work and inexperienced workmen are the most severe defects caused by the contractor's administration and staffs; according to assaf etal(1996) observed that the condition under which construction takes place are often far from ideal and coupled with emphasis on speedy completion of work. In the opinion of graham (1979) quality and cost performances should be monitored and advice should be given to the management staff when all these factors fall short of agreed acceptable standard. Also of the faulty construction defects insufficient reinforcement bar concrete cover was ranked the most severe defect by the respondents. However, through the finding of this research a total number of 29 possible defects were identified as shown in table 4.0. These defects were grouped into 2(two) categories. About 10 defects (34.48%) were ranked as the most severe, 17(58.62%) as moderately severe defects, 2(6.89%) as slightly severe defects by the architects. Also according to the builders 10 defects (34.48%) was ranked the most severe defects, 11(37.93%) as moderately severe and 7(24.14%) as slightly severe defects. More so, according to the civil engineers 9(31.03%) defects were ranked as most severe, 19(62.07) as moderately severe and 2(6.89%) as slightly severe defects. The study however, include an hypothesis to compare the views of the respondents on the defects identified by this study, hence the finding reveals that (based on kruskal Wallis test) that there is no significance difference in the views of the architects, builders and civil engineers on the defects identified I.e. H(2) =0.097 P>0.05 which strongly indicates that the respondent have the same views or opinion on the defects caused by faulty construction, hence resulted in the acceptance of Ho and the rejection of H1. Therefore, the similarity in opinion of the respondent reflects their involvement in the construction stage of a project. The research finding of this research work is similar to that of sadi assaf, al-hammad, Al-shilah (1996) and 1995 research work.

5. Summary of findings

From the finding, the study reveals that the 3(three) respondents agreed that out of a total of 29 defects identified, the top most severe defects on maintenance are summarized below:

- **I.** Insufficient reinforcement concrete cover
- **II.** Premature formwork removal

III. Speedy completion of work
IV. Inexperienced workmen and lack of motivation

6. Conclusion

From the above findings, the study concludes that ensuring defects free construction, the construction process is dependent on teamwork rather than personal competitiveness which will enhance a quality building and minimal cost of maintenance in the future. According to assaf etal(1995) quality assurance QA/QC should be implemented during the design and construction stage to avoid defects and mistake, hence quality of building should not be limited only to a particular person but the responsibilities of all parties involved in construction. Also, the performance of contractors on a project should be monitored to avoid spot inspection" due to is busy schedule in supervising other construction projects, these contributes to the speedy completion of work which usually have a serious effects on the building and maintenance. On the contractor's experienced workmen should be deployed to work on construction site to avoid abuse of standard and a substantial loss of resources through future maintenance. Finally, contractor should endeavor to always comply with the specification to avoid cases where concrete cover will be inadequate or insufficient.

7.0. Recommendations

The following recommendations are made based on the perception of the results of the study.
I. To avoid the issue of faulty construction and its effects on building maintenance all the stakeholders must work as a team in other to achieve the project results.
II. Contractors must endeavor to comply with the specifications provided by the designers to avoid defects
III. Clients and consultants should stop the notion of selecting a contractor based on his speed of delivery because this decision mostly contributes to bad quality jobs and numerous defects which may be too expensive to prevent.

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