

MATERIALS MANAGEMENT ON CONSTRUCTION SITES: A CASE STUDY OF CEMENT MANAGEMENT IN MAIDUGURI

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Abstract

This study is aimed at appraising materials management with emphasis on cement by selected contractors in Maiduguri. The aspects considered included materials acquisition, daily stores operation; calculation of required quantity of cement before purchase, selection of cement suppliers, cement delivery by suppliers, cement inspection on site, protection of cement from damage during storage, cement wastage during utilization on site and protection of cement from theft on site. Data relating to these materials management practices were collected using questionnaires from 85 randomly selected contractors. The collected data were analyzed using simple averages, mean, standard deviation, percentage and rating methods. From the results, it was concluded, generally, that the contractors maintain poor cement management practices. The consequence of this low performance is that contractors' profits are marginal and they devise sharp practices using poor quality and inadequate quantity of materials to execute jobs. These practices lead to project failures, early maintenance needs and cost overruns from the clients' stance. It is, however recommended that much can be done in order to achieve better project delivery in terms of cost, time and quality.

Keywords: *Materials, construction, site, cement, management.*

Introduction

Materials management is the scientific method of procuring, storing, safeguarding, transporting and utilizing materials on site in order to ensure economy and achieve waste minimization (Charlett, 1982). Materials management, from a scientific perspective, had been a 'Cinderella' activity in the construction industry, especially in Nigeria (Adeagbo and Kunya, 2003).

Materials are the lifeblood of many industries and it constitutes more than 50% of the total annual expenditure of a typical manufacturing industry (Fajemilua, 1997). In the

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construction industry, Adeagbo and Kunya (2003) noted that materials constitute a large percentage of the costs that go into the building production, claiming it occupies about 63% in relation to labour's contribution of 37% in a typical traditional building construction. The concept of materials management is geared towards providing the right materials in the right quantity and quality at the right place and time as well as minimizing waste levels and ensuring profit maximization. However, a study conducted by Adeagbo and Kunya (2003) revealed that construction professionals pay little attention to the value of materials on site, and they see waste as the inevitable consequences of the construction process.

Where poor materials management are exercised, some negative consequences include over-consumption of construction materials resulting from poor material accountability and record keeping; damage caused by mishandling, undue exposure to weather and vandalism; and excess materials after job is completed (Greenwood, 2004).

Justification

Today's construction industry demands prudence in all aspects of materials management, especially on cement. This is because contract acquisition is becoming increasingly competitive; hence the need for contractors to be more prudent in handling and utilization of materials. Several projects experience cost and time overruns in Nigeria due to several factors such as clients' behavior, contractors' faults, material price fluctuations, poor material management practices, etc (Achuenu and Kolawole 1988). Materials constitute more than 60% of the total cost of projects (Adeagbo and Kunya, 2003). Cement is one of the most expensive, easily stolen and unstable construction materials in Maiduguri today, owing to the fact that most of the cement used comes from Ashaka cement factory with its attendant high cost. The project sets out to appraise the general level of compliance of selected contractors in Maiduguri towards cement management practices. This is targeted to assess by how much compliance or otherwise this affects the general cost of projects and also provide a current assessment of cement management practices amongst contractors in Maiduguri. From Table 1, the compliance or otherwise to cement management is calculated as follows:

$$\text{Compliance} = \frac{4}{8} \times 100\% = 50\%$$

$$\text{Non Compliance} = \frac{4}{8} \times 100\% = 50\%$$

Total average score of contractors in terms of materials acquisition activities on sites, daily stores operation; calculation of required quantity of cement before purchase, selection of

cement suppliers, cement delivery by suppliers, cement inspection on site, protection of cement from damage during storage, cement wastage during site utilization and protection of cement from theft on site

$$= \frac{37.1 + 73.0 + 27.7 + 21.2 + 90.6 + 78.9 + 41.2 + 86.6}{8}$$

$$= 57.0\%$$

$$\text{Cumulative average performance} = \frac{57.0 + 50}{2} = 53.5\%$$

Determination of Compliance of Contractors in Maiduguri Towards Accepted Practices in Cement Management

Table 1- Summary of compliance of Contractors to materials management in Maiduguri

S/N	Factors considered	Acceptance	Rejection
1.	Qualification of officers in charge of daily stores operation – 37.1%		√
2.	Calculation of required quantity of cement before purchases – 73.0%	√	
3	Selection of cement suppliers by contractors – 27.7%		√
4	Delay in cement delivery by suppliers on site - 21.2%		√
5	Inspection of cement on arrival to site – 90.6%	√	
6	Minimization of cement damage during storage – 78.9%	√	
7	Minimization of cement wastage during utilization of cement on site – 41.2%		√

From the table 1 above, a marginal majority (57.0%) of the contractors show an average (50.0%) compliance to accepted practices on cement management. The cumulative average score of 53.5% indicates that the level of compliance is unacceptable, being only slightly above average.

Estimation of cement wastage in Maiduguri

Cost of 1 bag of cement = N2200.00

1 m³ of cement weighs 1443 kg

Wastage of cement from delivery to placement = 5 to 6 bags (5.5bags) for every 100bags = 5.5%.

Accepted avoidable waste level for cement = 2 to 3% (2.5%)

Therefore actual waste due to poor management = 5.5 – 2.5 = 3%

Cement content of frequently used nominal concrete mixes

For concrete 1:2:4 cement content for 1m³

= (1/7) x 1443 = 206.14kg

Cement wastage = 3% x 206.14kg = 6.1842kg

6.1842kg of cement cost = $N2200 \times \frac{6.1842}{50} = N272.10 / m^3 \text{ of cement}$

For concrete mix of 1:3:6 cement content for 1m³

= (1/10) x 1443kg = 144.3kg

Cement wastage cost = 3% of $\frac{144.3}{50} \times N2200 = N190.48 / m^3 \text{ of cement}$

For concrete mix of 1:1.5:3 cement content for 1m³

= (1/5.5) x 1443 = 262.36kg

Cement wastage cost = 3% of $\frac{262.36}{50} \times N2200 = N346.32 \text{ per } m^3 \text{ of cement.}$

Summary of Findings

- (1) Most contractors (89%) bypass the establishment of material/ store department in the head offices for sites in order to save operational costs. However, this practice introduces flaws such as connivance with cement suppliers to inflate cement prices. This action most usually forces the contractor to reduce the quality of the work by using inferior or reduced quantity of materials to achieve the same job. Thus, quality of work is affected and this may precipitate early maintenance of buildings.
- (2) Very few contractors (37.1%) make attempt to engage competent stores officers to oversee the daily complex work of keeping cement. The implication is that accurate inventory management becomes a very futile exercise. Thus, if the contractor notices excessive cost overrun, he may compromise quality. He may also delay the work to the detriment of the client.

- (3) Very few contractors (27.7%) engage qualified cement suppliers, thus leaving majority to be saddled with the issue of delay in cement delivery. This delay may affect construction work, especially timber members negatively. As a result, timber shuttering, formwork and roof works may split, warp, twist and cup which may threaten the structural integrity of the building. At a result, the client may suffer because of the ineffectiveness created by the cement suppliers.
- (4) Majority of contractors are not meticulous when it comes to cement utilization on site. Only about 41% have average mechanism in place to reduce wastage of cement by way of providing adequate supervision and incentives, for example during concrete work. There is about 5 bags wastage for every 100 bags of cement delivered to site for concrete work (Balami 2011). This occurs during cement delivery, storage, mixing and placement of cement concrete. Currently, with the price of cement averaging N2200.00 per bag, a contractor losses 6.184kg, 4.329kg and 7.871kg of cement for concrete 1:2:4, 1:3:6 and 1:1.5:3 respectively per meter cube of concrete. This implies that judging the current wastage level, contractors lose (ignoring unavoidable waste) from N190.48 to N346.32 of cement for every 1m³ of concrete work from delivery to placement of concrete for the mix ratios mentioned above. These amounts affect contractors profit very negatively and contractors may resort to sharp practices to achieve client' objectives with the attendant poor quality job, early maintenance problems and other failures.
- (5) Majority of the contractors (86.6%) have good mechanisms in place to safe-guard cement on the site. This is seen in the area of engaging security personnel, provision of fencing around the perimeter of the site, restriction of visitors to sites, searching of vehicles leaving the sites and keeping cement stores under lock and key. However, the contractors scored low (30.6%) in the area of provision of lighting at night. This encourages thieves to invade the sites at night. Whether materials are directly procured by clients or not, the contractor has the responsibility to protect them. This lapse on the contractors' part could breed litigation with the clients in which the project may suffer. Also, the contractors could avoid litigation by using sharp practices which will endanger the quality of the work. In either case, the clients suffer unduly.

Conclusions

Based on the findings of the study, the following conclusions can be drawn:

- (i) The most obvious finding to emerge from this study is that most contractors are ignorant of the importance of efficient and effective cement management practices on site. The contractors are just interested in their profit margin and not the quality of work.
- (ii) The research has shown that contractors have limited understanding of accurate inventory management. This shows their inability to conduct adequate stock control and coordinated material documentation leading to unaccounted material wastage and decreased productivity.
- (iii) The study also reveals that the contractors lack competent personnel to oversee cement utilization activities on site. Consequently, because of enormous wastage of cement, contractors will engage in sharp practices to maintain their profit while their clients get poor- quality job and early maintenance problem as well as other failures on the buildings.
- (iv) The relevance safe-guarding cement on site is clearly supported by the current findings. While the contractors provide security and fencing as the only means of safe-guarding cement, they are still not conscious of rudiments of material storage; e.g. to employ trained and competent personnel, to correctly locate stores on site, to determine the conditions of storage and the types of systems used in controlling stores materials—closed or open.

Recommendations

Based on the findings above, it is recommended as follows:

- i) Head offices should monitor site cement management practices effectively in order to discourage any sharp practice from the site operatives. This will ensure that the contractors finish jobs with expected profits not unduly affected. With this in place, clients objectives of finishing the work within stated time, cost and quality are not jeopardized.
- ii) Efforts must be made in order to train store officers in modern store-keeping best practices. This will ensure cement is not lost due to inefficiency. It will also ensure that adequate inventory management of cement on site. These practices will prevent undue claims from the contractors who exploit technically ignorant clients.

- iii) Cement suppliers must be selected based on competence as their present actions create undue quarrels between the contractors and clients. Suppliers must be made to sign the 'performance bond' with a reliable guarantor in case of default.
- iv) Adequate supervision and incentives given to site operative should be aimed at discouraging wastage of cement during concreting and other activities on site. This will reduce the level of contractors' losses, thereby protecting the clients to some extent.
- v) Security of cement on sites should be given adequate attention through provision of lighting in order to deter thieves at night. This is because the contractor is saddled with the responsibility of protecting whatever materials kept on his site. This should be done to protect the clients' investment.

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