Comparative Cost Analysis of Wall Cladding Materials

D. O. Mac-Barango
Department of Quantity Surveying,
Rivers State University of Science and Technology,
Port Harcourt, Nigeria.
Email: dumomacb@yahoo.com

Abstract
Wall is a principal component in building construction. Cost data statistics for pretender planning/investment appraisal analysis as it relates to alternative choice of cladding materials (sandcrete blocks, concrete blocks or timber) are seldom readily available. This research examines the cost relationships between sandcrete blocks and timber as alternative wall cladding materials. Using rates from synthesized bills of quantities, and the statistical tool of percentile, it establishes and compares cost profiles of the elemental components of buildings constructed in both materials. Research findings establish as follows: (i) Buildings constructed of timber are about 6% more expensive that those constructed in sandcrete clocks. Electrical component installation reveals a percentage cost of 6.8% and 5.9% respectively for block and timber claddings respectively. It is recommended that improvement be made to cost data compilation, on periodic basis for the both types of claddings.

Key words: *Cladding Materials; Sandcrete Blocks; Timber Panels; Innovations in Cladding Materials.*

INTRODUCTION

Wall is a principal component in building construction. Sandcrete block is the conventional and predominant material used as masonry wall cladding material in Nigeria and other countries in West African sub-region. (Agyei 2011, Nwogu and Ganiyu 2012, Abankwa 2012). There is however an array of problems which affect the utilization of sandcrete blocks as wall cladding material, ranging from the existence of paucity of cost data information to the selection of cost effective and alternative cladding materials that are eco friendly and sustainable. Ogbonyomi (1998) and Olateju (1999) cited in Olaoye and Izam (2004) have observed, increases in cost of cement as well as shortages in supply relative to its demand. According to Ajanlekoko (2001), the shortages in supply are responsible for the galloping cost of cement over the years.

Laryea (2012) has also observed inflationary trends and fluctuations in the prices of cement, a principal material used in the construction of sandcrete blocks. Avery (1983) and Smith et-al (1983) have posited that paucity of cost data information, affects cost forecasting adjustment for location variations and inflationary trends for broadly similar work or work with distinctly different characteristics. According to Atinuke (2010), paucity of cost data information affects cost data forecasting, adjustment for location differences. The occurrence of paucity of cost data information poses serious challenges to construction researchers and cost data management.

The pivotal role of wall as a principal component in building construction is also beginning to be better and appreciated in terms: of cement a principal material used for the construction of sandcrete blocks and the consequential impacts on the environmental. See, the elucidations of Indian Cement industry (2005), on the hazardous nature of the production process of cement on the environment.

Agenda 21 (2001), has noted that the physical environment and the construction sector are linked principally by the demands made by the latter on global natural resources, and this assumes huge environmental significance with the rapid growth in global, population and the attendant implications for natural resources. This is especially the case with housing and infrastructure, which are very resource intensive. The call and desire for sustainable construction is in realization of the construction industry's capacity to make a significant contribution to environmental sustainability because of the enormous demands it exerts on global resources. This coupled with the emergence and the utilization of eco friendly construction practices as observed by (future foundations 2002) and the emerging opportunities in innovation in materials and technologies for sustainable construction in developing countries as reiterated by Agenda 21 (2001), emphasizes an urgent need for the research to understand and establish the factors that promote/enhance or inhibit the use of various cladding materials in wall construction. This is achieved through a rigorous review and cost profile analysis of cladding materials which culminated in the revelations of some selection criteria and parameters for the construction of wall components, that are cost effective, adopting economic or as well as environmentally friendly and socially acceptable processes. Issues connected with the sustainability benefits of wood, low energy, low CO_2 emission and low life cycle cost are extensively dealt with in John et-al (2006). Issues bordering on the low usage of timber as well cladding are well articulated by (Okereke 2005 and Abankwa 2012). There is a relevant literature review which discusses the escalating cost of conventional building materials and the need for alternatives (Fawale et-al 2012).

This research begins to contribute to this agenda through its findings, using as case studies, buildings in Port Harcourt situated in the Niger Delta region of Nigeria. The research highlights cost profile analysis of building components constructed in sandcrete block and timber as cladding materials, see (appendix for the detail design plans sections and facades) of the buildings, which are fundamentally load bearing walls. The research also offers results of early works, which provide background knowledge. See for example, Dayyau (1994), from study and review on block work and concrete in Nigerian housing constructions established that the combined cost of block work and concrete of a 3-bedroom flat had a 27% contribution to initial total cost. Yusuf (2004) from a study on cost profile of ground and first floor of a four flats two bedroom residential building established that the wall component had a 9% contribution to total cost. Ogundiran and Adereji's (2000) research on comparative cost analysis between sandcrete block wall and expanded polystyrene (EPS) material established that the wall and facial component of EPS has a lower value than the conventional sandcrete block recording 32% cost differential.

The structure of the paper is as follows: First its background gives an insight into previous studies on walls in housing construction. Second, it provides a review on the characteristics of wall, categorization of wall cladding constructions, selection criteria for cladding materials, sandcrete block walls, timber walls, innovations in cladding materials, the measurement and costing of cladding materials. The reviews provided the basis for probing and provided answers to pertinent issues like, are there differentials in the initial total cost of wall components constructed in timber and sandcrete blocks? What cladding material established a higher cost? What are the percentage contributions of wall component. Constructed in timber and sandcrete block cladding materials to initial total cost? What are the percentage contributions of various elements both for timber and sandcrete block cladding materials to their various initial total costs? Third, the paper summarizes the methodology adopted for the research. Finally the research draws conclusion, using results of early studies, the findings form reviews and case study as basis. It also offers recommendation.

INNOVATIONS AND ALTERNATIVE WALL CLADDING MATERIALS.

Ideally, the combination of all environmental economic and social factors give a description of a material, and thus help in decision-making process regarding the selection of the material suitable for building. (Abey Sundara et-al 2009, Bechio et-al 2009 cited in Adedeji 2011).

Advancement in materials innovations and technology however offers a broader spectrum of selection and choice of alternative materials. Based upon this guidance the paper offers further articulated views on the advantages, properties and indications which assist in the selection of alternative materials. (see, for example, (FAO, 2002) on the life cycle assessment of building and the advantages of wood over other synthetic materials. IKP (1999), cited in Townsend and Wagner (2002), for environmental indicators used for the assessment of the advantages of wood-based products (lingo-cellulosic raw materials bonded in organic binders for the production of mineral-bounded composite panels. Orisabinu (2007), cited in Adedeji (2011), for cement-bounded composite panels produced from palm kernel over conventional sandcrete blocks. (See, Fawale et-al 2012, on experimental evidences of the thermal, sound and energy efficiency as properties which influence strawbale as a cladding material for wall construction. (See, Smith 1992, and Neville 1995 on rice husk Ash (RHA) and pulverized Fuel Ash (PFA), and Sugar Baggase Ash (SCBA) as alternative to cement). The reviews of Homes (2003), Downton (2003) and Adedeji (2007) provide relevant headings for other properties: fire resistance, moisture pest resistance and low cost which influence the search and selection for alternative materials for wall claddings. Issues on thermal property, availability and ease of construction as the relative edges of strawbale over other conventional walling materials (sandcrete blocks), are extensively dealt with elsewhere. See Harvest homes 2004, cited in Fawale et-al 2013. The challenges which sandcrete block wall face overheated building interiors and the interrelated requirements are well articulated by (Nwogu and Ganiyu, 2012). There is need for further development in the conventional technologies used for building construction. See, for example articulation of Ghosh 2012, cited in Ogundiran and Adedeji 2012 on expanded polystyrene initiatives, and the inefficiency, resource wastefulness and limitations of conventional building materials. There is a skewed and concentrated emphasis towards laboratory testing of the structural and other properties of traditional materials which usually form the basis of research into alternative construction materials. There are however other economic attributes which also govern the assessment and selection process of alternative construction materials such as: utility cost and the potential consumers needs, transportation, future maintenance cost, sociological perspectives and the predispositions of the end users (Anibogu 1999). The derivable advantages of alternative materials from innovations notwithstanding, Fawale et-al (2012), posited that the choice of building construction materials is governed by the properties of the materials that are pertinent to what the builder has in mind.

CLADDING MATERIALS FOR WALL CONSTRUCTION

Wall, is one of the components in building construction. Walls are any continuous vertical members, whose length and height are both much larger than the thickness (UNESCO 2008). Walls as illustrated by UNESCO 2008, can be classified according to load bearing and non load bearing. Load bearing walls support the weight of the roof and any upper floors. In non load bearing walls, the cladding materials are attached to a frame work and the cladding sheets/panels do not support the structure of the building. Walls are further classified according to the materials used for their construction. The common types are sandcrete blocks, concrete blocks bricks, reinforced concrete, stones and timber. The characteristics and properties of materials influence, the selection of cladding materials for wall construction. These properties are discussed in Mitchell's Series 1977. The primary function of walls are to resist rain penetration, resist wind pressure, give required degree of thermal and sound insulation that suits the type, provide sufficient opening for natural daylight ventilation and aesthetically pleasant (UNESCO 2008). Seeley (1995)'s headings are good examples of functional requirements of walls: Division of spaces into convenient size, keep out dust and rain, provide shade, coolness, privacy, shelter and protection and in certain cases provide support for upper floors and roof, structurally load bearing and provide spaces for windows and doors. Other variables, aside the physical and chemical properties influence the selection of cladding materials for wall construction. Adedeji (2011)'s headings form an excellent basis for these variables: Design criteria, purpose of the building, the location of the building (climate and geographical), the time factor in construction the availability of the materials, innovations and the cost effectiveness. See also Rowley 1999)'s postulation, on the building fabric; interior, indoor space and external environment and Ashbel (2000)'s comment on the influence of the thermal environment on architectural expression. Seeley's (1995) headings form an excellent basis for a review of what constitutes a good choice for wall cladding materials: strength, resistance to dampness, insulation, sound insulation, fire resistance, internal fire spread, compartmentalization, external fire spread and stairways. Also Evert (1978), Nwokoye (1987), Ground (1988) and Jagboro (1992) as cited in Mac-Barango (2003), offers a good basis for discussion on the considerations of the variables of serviceability, safety and aesthesis and economics and how they influence the choice of material. The consideration in innovation, technology advancement and cost economics are other potent factors which can influence the choice of alternative materials for wall cladding. See (Mac-Barango 2006). Issues bordering on condensation risk on wall panels are extensively reviewed and articulated in (Nwankwo 1999).

SANDCRETE BLOCK WALL

Sandcrete blocks are the predominant wall cladding materials in Nigeria (Mac-Barango 2011). Sandcrete blocks are made from a mixture of sand, cement and water (Oyekan, 2007). In order to achieve the functional requirements of sandcrete blocks, the size of sandcrete blocks, the specification and quality, loading systems of the building and the construction details become relevant factors. Standard organization of Nigeria SON (2004) documentation provides good headings, both for the manufacture and use of sandcrete blocks in Nigeria. BS 4729, cited in Jackson (1991), on dimensional classification of sandcrete block, offers a relevant example of how sizes of block influence the attainment of functional requirement. The loading system (load bearing or non loading bearing), walling are determinants of what size (thickness) of sandcrete wall, will be adopted (Seeley 1995). Issues of functional requirements of sandcrete blocks as they relate to quality are dealt with in (Mac-Barango 2011). Admixtures, such as sugar and sawdust can cause variations in compressive strength and setting time of sandcrete blocks (See, Ashworth 1980), and paramaswam (1979) cited in Oyekan 2007). The quality of sandcrete block wall construction starts with the manufacturing process. A step by step process approach is as articulated by (Oyekan, 2007). Fire resistance, thermal conductivity, sound resistance and absorption aesthetics are also issues of functional requirement. The Nigerian industrial standard, NIS (2007), prescribes requisite minimum standards which sandcrete blocks used for wall construction are to meet. Abdullahi 2005 cited in Anosike and Oyebade (2011)'s articulation identifies consistency in production methods and properties as quality determinants of sandcrete blocks. Variations and inconsistency in quality leads to substandard blocks and development of cracks.

SANDCRETE BLOCK WALL CONSTRUCTION

Blocks are laid in some acceptable bonding patterns with mortar for the construction of walls. Seeley (1995) and Mac-Barango (2003), offer a detail explanation of the physical and mental efforts exerted towards block work construction process. Basic tools are used in the construction process of block work. These tools with usage by mason and labours ensure that essentials as pointing, neatness of joints, perpendicularity and horizontally of block work courses are maintained (Watson 1986). The essence of bedding and jointing and bounding blocks in mortar is to give maximum strength and adequate distribution of loads over the wall. (Seeley, 1995). UNESCO (2008), summaries and articulates the method of constructing a wall with sandcrete block. This involves a step by step approach, which commences with the formation of corners or end coarse used as reference lines to construct the straight lines of walls that are bonded with mortar. The blocks are arranged in regular patterns.

TIMBER AS A CONSTRUCTIONAL MATERIAL

Timber is wood that is cut for use in building. Timber is used in the production of wall, floor roof and joinery generally (Emitt 2005). The functional requirement of timber walls are: fire safety, resistance to the passage of sound, insulation and aesthetics (Cheng, 2000). The building regulations for England and Wales and the building standards for Scotland provide the functional requirements of timber in terms of fire resistance (TF 2000 project). Timber, as a building material has advantages, which are spelt out in Gregory 1984, Nolan and Whitelaw 1990,cited in Adedeji and Ogunsote (2004). Botanically trees are grouped into two classifications: Hardwoods or Softwoods. (Seeley 1995). The size and shape of their leaves, are further distinguishing characteristics. Emit and Gorse (2005), provide a description of the internal structure and arrangement of timber cells. The conversion of wood to timber consist of an array of processes, Seeley (1995) provides the relevant headings: fuelling of trees, cutting trees trucks into logs, scantlings into smaller units and into further smaller units of boards and seasoning. According to Seeley (1995), seasonings consist of drying out the free water content from the cell walls. Air seasoning and Kiln seasoning are two principal methods. The seasoning of timber checks defects which affects the strength. The principal defects are identified as physical, fungal attacks. The various heading that fall under these two major types of defects are listed and described by Seeley (1995). The preservative treatment of timber eliminates or minimizes these defects (Abankwa 2005). Seeley (1995), outlines the principal protective liquids, and reveals further the preservation methods, the potency and efficiency of pressure method over non pressure methods. Abankwa (2005), provides a relevant example of pressure impregnation as executed by wood Dapul treatment company limited, Ghana. Ansell (2013) presents further articulated literature on impregnation coating process and performance of timber, using nano based materials. Seeley (1995), gives a detailed description of the constructional details of wall cladding materials in timber. The cladding materials are fixed to timber frame members and components through some jointing techniques. The vertical components are the studies which are nailed with simple butt joints to top and bottom rails. Noggins are horizontal members inserted between bracing with wood based materials provide extra rigidity of the frame. Sheathing board nailed to the timber studwork is used as the covering material.

THE MEASUREMENT AND COSTING OF CLADDING MATERIALS FOR WALL CONSTRUCTION

Cartlidge (2009) provides relevant headings for the measurement and costing of building elements, wall cladding materials inclusive: Taking-off of quantities from design drawings, the preparation of bills of quantities, and the conversion of the estimates to a tender sum. Measurement and costing provides a good basis for analysis of alternatives for construction methods, equipment and materials (Bledsoe 2002). Standardized measurement rules and conventions provide a uniform basis for the evaluation and analysis of alternatives materials. These issues are well articulated by the RICS (2007), for building works in the United Kingdom (UK), the standard method of measurement SMM 7 (1988) and the Building and Engineering Standard Method of Measurement BESMM (2003) in Nigeria. The derived quantities from the application of the rules of the standard method of measurement are converted into an estimate. There is an excellent guidance for undertaking an Estimating Process in MC Caffer and Baldwin (1984) Akintoye (2000) and Bledsoe 2002. Cartlidge (2009) and Laryea et-al (2012), provide relevant guidelines for derivation of a final estimate. Geddes (1996) and Holroyd (2000), have emphasized that cost estimates must be as accurate as possible; observing further that

understanding the basic types of estimates, the purpose of the estimates, the sources of data and the level of details of the drawings are requisite factors towards the determination of the final estimate. Obtaining cost data information is an important process in the comparison of cost of different projects or construction components. Ashworth's (1980) headings form an excellent basis for discussion on the various forms of cost data information. Catalogues of vendors, periodicals of construction cost data and indices, manuals for estimating guides and digest of actual project cost. The factors which influence the specific mode of collection and the limitations sources of cost information are also highlighted. Hendrickson (2008) and Atinuke (2010) have revealed the usefulness and applicability of cost data information for management decision making. The detailed procedures to be adopted are well articulated by Aqua Group (2007), which include establishing a budget, producing approximate (preliminary estimates), element unit quantities estimates, approximate quantities estimates and accurate quantities estimates, cost plan, development of the cost plan and life cycle costing.
The bill of quantities is a readily used cost data information technique for the comparison of timber and sandcrete blocks as wall cladding materials in the research location. The relative accuracy and details of its content, the analytic processes involved in its production and its usage as uniform basis of tender are issues that are well articulated by JUPP (1984), Cartlidge (2009) and Aqua Group (2007). The above advantages notwithstanding, cost estimates derived from bills of quantities have inherent limitations. (Robertson 1973, Middleton et-al 1982 and Musa et-al 2011. The bill of quantities in its traditional form has little function beyond its contractual purpose and is usually a hypothetical construct and not necessarily a fully accurate description of reality (Higgin and Joseph, cited in Smith 1982). Adrian (1982), however postulated that the observed limitations are not peculiar to BOQ as a cost estimating technique and submits that no procedure or mathematical technique is without its flaw or is able to guarantee perfect estimates. The BOQ does provide a basis for cost data information without prejudices, to the opinions as it relates to accuracy levels of its cost data information. The Royal institute of chartered surveyors RICS (1990), working committee on cost information and data services emphasized the need for more research that defines the cost/price relationships in construction.

RESEARCH METHODOLOGY

The research discusses the cost and selection between wall cladding materials of sandcrete blocks and timber, the essence is to appraise the tender price which the client will have to pay for the alternative materials. Wilson's (1982), research on selection and the evaluation of possible design alternatives offers a relevant insight to micro cost based research technique. Smith 1982, Middleton et-al (1982) postulated that the adoption and usage of bill of quantities as cost tools is however limited. Middleton et-al (1982) have observed that the bill of quantities as a document contains mass information which is swallowed up in the processing to satisfy its primary function, the resultant document whilst constraining all, reveals nothing. Smith 1982, concludes that the bill of quantities in its traditional form has little function beyond its contractual purposes. Redesigned documentation techniques could be set up, which would be of greater direct and immediate use. The statistical tool of percentile was considered appropriate because of its capability, in establishing reasonable results for proportions when comparisons are made between various entities. Cost data information is relevant to the delivery of quantity surveying services (Morrison 1984 and Matipa et-al 2008 cited in Atinuke 2010). The research adopts a case study approach, comparing costs, between sandcrete block and timber as wall cladding materials. This involved the design, preparation of bills of quantities and the analysis of the data from the various summary of cost, obtained from both wall cladding types. Using designs of residential buildings having same gross floor area, the research examines the effect changes in wall cladding material have on the overall building cost as well as elements costs. The data for the research was generated from the design, measurement and the costing of the two design types (sandcrete block and timber cladding walls). Bills of quantities were prepared from designs of building constructed of the two wall types. See appendices, for the designs and constructional details in figs (2, 3 and 4) the buildings used as basis for the preparation of BOQ. The results are for only initial costs of the two cladding materials; analysis on cost-in use (the ultimate cost) is beyond the cost scope of this research. The total cost is exclusive of preliminaries. Using the rates obtained from the synthesized bills of quantities, prices by professional quantity surveying firms in Port Harcourt metropolis (situate in the Niger Delta region of Nigeria), the research analyzed the impact of two types of cladding materials and their cost implications (both the overall as well as elemental or component initial costs). The research also established the unit cost per square metre of gross floor area, from the overall building cost as well as the elemental costs. The measures and procedures taken to enhance the reliability of cost are that, same standard method of measurements were adopted and applied for the derivation of quantities from the designs of the two wall cladding types). The rates used for the analysis are the mean values from the totals. The relative abundance and the potentials of timber as a building material informed its choice for the research. The choice of sandcrete blocks is derived on its commonality in usage as a building material in the research location and Nigeria. The studies, of Mac-Barango (2012), Adegbehingbe (2012) and Achuenu (2012) form a good basis for the computational technique – the statistical tool of percentile adopted for this research. Graphs in forms of chart indicated the trend in overall costs as well as the elemental costs for both buildings constructed in the different cladding materials. The empirical validity of the research findings are based on some assumptions and limitations. Both designs have same floor area; this is to allow cost comparisons of both cladding materials to be carried out on a uniform basis. The specifications, as contained in the bills of quantities and on the drawing formed the basis for the synthesized rates. The comparisons are for only initial construction costs for both wall cladding materials. The finishing cost element includes (rendering and painting) for sandcrete block wall and smothering treating and polishing in the case of timber wall cladding. Olusola and Ikpo's (2000) articulations on the hierarchical definition of total reveals that life cycle cost / total cost is a discounted lump sum at a given time and that the hierarchical division of cost are often classified as initial cost (that is costs up to the defects liability period) and running cost. This research draws from the hierarchical division and its limitations to initial costs. See table 1 below, for the comparisons of various cost parameters of the wall cladding materials.

PRESENTATION, ANALYSIS AND DISCUSSION OF RESULTS

Table 1: Comparison of initial cost parameters: of wall cladding materials constructed in sandcrete block and timber using mean values of rates obtained from synthesized (BOQ).

S/NO	BUILDING ELEMENT	TOTAL COST OF CLADDING MATERIALS		COST/M2 OF GROSS FLOOR OF ELEMENTS		ELEMENTAL COST EXPRESSED AS A % OF TOTAL COST	
		BLOCK WALL COST	TIMBER WALL COST	BLOCK WALL	TIMBER WALL	BLOCK WALL CLADDING	TIMBER WALL CLADDING
1	Sub-structure	1, 105,754.22	1,072,420.88	10,238.47	9,929.82	30.30	29,00
2	Walls	639,789.86	705,316.29	5,923.98	6,530.71	17-60	19.10

3	Roofing	895,647.15	893,917.69	8,293.03	8,277.01	24.60	24.20
4	Electrical Installations	251,088.65	219,914.82	2,324.89	2,036.25	6.90	6.00
5	Sanitary Installations	196,854.24	189,358.13	1,822.72	1,753.32	5.40	5.20
6	Doors	91,229.59	141,738.53	844.71	1,312.39	2.50	3.90
7	Windows	187,965.31	200.094.07	1,740.42	1,852.72	5.20	5.40
8	Finishing	281,472.38	273,738.82	2,606.23	2,534.62	7.80	7.40
	Total Cost/Unit	**N3, 649,801.40**	**N 3,703,499.53**	**-**	**-**		
	Cost / Sq.m	**33,794.46**	**34,291.66**	**33,794.50**	**34,226.85**		

DISCUSSION OF FINDINGS

The comparison between the two wall cladding materials established the following results. (a) The overall building designed in timber cladding material established the sum of N3,703,499.53, whilst the design in sandcrete block wall established the sum of N3,649,801.40. (b) The timber and sandcrete block cladding materials recorded cost per square metre of N34,291.66 and N33,794.50 respectively. (c) The wall cladding material in timber recorded an higher overall cost than that of the sandcrete block. (d) The overall cost differential between timber and sandcrete block cladding materials is about 6%. (e) The cost differential in wall component constructed in timber and sandcrete block cladding materials is about 9%. Timber cladding material had a cost value of N705,316.29, whilst the sandcrete block had a lower cost value of N639,789.86. (f) The elemental cost of wall constructed in timber cladding material expressed as a % of total cost is 19%, whilst that of sandcrete block cladding material is 18%. (g) The elemental cost differences between wall cladding materials constructed in timber and sandcrete block expressed in percentages established values that were between (0.20-1.50); however the percentage contributions to total cost of the various elements (substructure, wall roofing, electrical installations, sanitary installations, doors, windows and finishings), as presented in table 1 is between (3.90 to 5.20)% and (2.50 to 3.30)% for wall cladding materials in timber and sandcrete block respectively.

Descriptive Analysis: see figure 1 below, indicates the cost trends/pattern between the various elements of the designs of the two different wall cladding materials (timber and sandcrete block); this is in resonance with the presentations in table 1, both in terms of monetary and percentage values of components. The percentage contribution of the wall component, to the initial total cost in both cladding (timber and sandcrete block as established in the research would seem relatively on the high side when compared with the results of other previous similar works. Yusuf's (2004) work on cost profile of residential buildings and Mac-Barango's (2006) research on an analysis of material and labour contents of 4 bedroom bungalow established that the percentage contributions to wall component constructed in sandcrete block to total cost were 9% and 7.49% respectively. The relative high cost of the wall component of this research when expressed as a percentage of total cost could be explained by some factor, the inclusion of the concrete works and its associated reinforcement bars and formwork under the wall component.

This relative high cost not withstanding they do serve as a basis for probe and guide for comparison between various cladding materials for wall construction, with necessary adjustments.

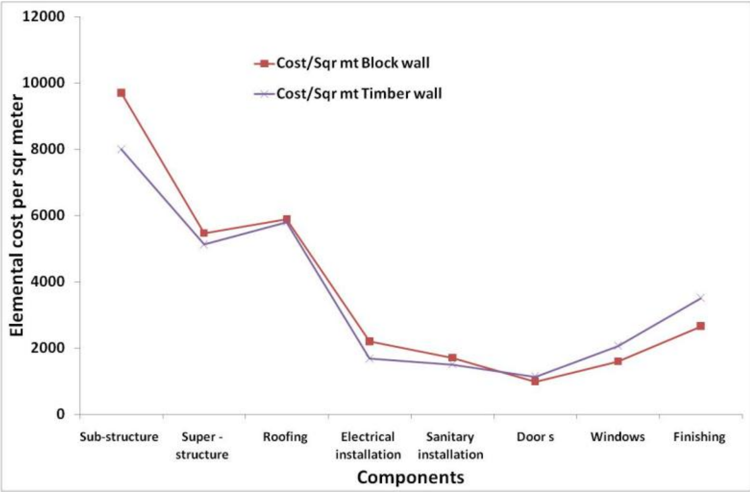

Figure 1: Cost trends and pattern between Timber and Sandcrete Block cladding materials.

CONCLUSION

The research concludes that differences exist between the initial total costs of timber and sandcrete block as wall cladding materials for residential buildings. Buildings constructed of timber recorded higher cost; leading to a cost differential of 6%. There also exists cost differentials in the elemental components of the buildings constructed with the two types of wall cladding; timber wall recorded a cost about 9% higher than that of sandcrete block. The elemental costs differentials is between (0.20 to 1.50) expressed as a % of total cost depending on the component involved. Admittedly it would seem in appropriate to overgeneralize the outcome of the cost comparison. This is principally due to the impact location/climatic conditions could have on whole life costing when these materials are used for construction, nevertheless, they do serve as relevant basis for exploration between the alternative cladding materials. The research recommends further exploratory studies on alternative innovative cladding materials using functional, environmental and cost economics as relevant ranking parameters.

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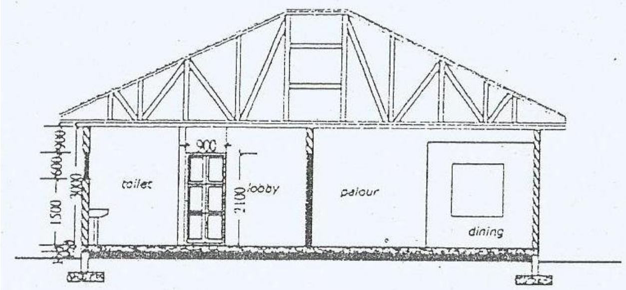
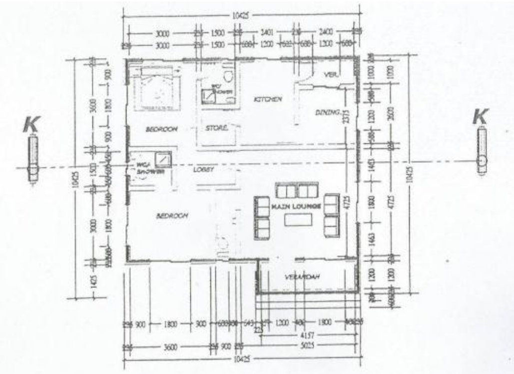
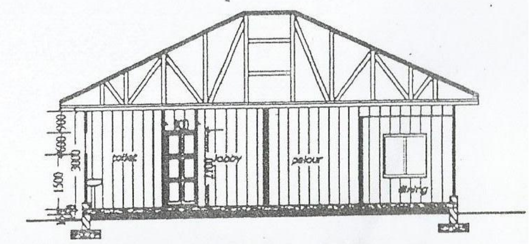
APPENDIX



SECTION A-A FOR BLOCK WALL



GROUND FLOOR PLAN FOR TIMBER WALL



SECTION A-A FOR TIMBER WALL