TITLE: EVALUATION OF THE PERFORMANCE AND SUITABILITY FOR USE OF VARIOUS FLOORING MATERIALS IN STUDENTS' HOSTELS;

CASE STUDY OF THE HOSTELS IN THE UNIVERSITY OF NAIROBI (MAIN CAMPUS) AND KENYATTA UNIVERSITY.

BY

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DECLARATION

I, ORIYO SABIAN O.OKOTH, hereby declare that this project paper is my own original work and has not been submitted for the award of degree in any other university.

Signed_____.

SUPERVISOR'S DECLARATION

This project has been submitted for examination with my approval as the university supervisor.

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DEDICATION

This project paper is dedicated to you all my family members; Mom, and Dad; Brothers, Martin, David, Erastus and Damian, and all my Sisters for your continued and unwavering support, Mentally, Materially and Spiritually, that has enabled me attain a position in academic Space.

Thank You All, Long Lives and God Bless You All, Amen.

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ABSTRACT

In the consideration of the economic upheavals facing all sectors of the Kenyan economy, the public universities have equally been subjected to the negative repercussions of the above. This has made the universities financially handicapped to the extent that they cannot meet the maintenance requirements of the hostels.

The above has led to great neglect of the facilities and of particular interest being the floor finishes which are currently in a deplorable state. With the continuance of the statusquo, it therefore requires that the choice of initial materials to be used in the construction of these hostels be critically evaluated to find those, which would survive for 'eternity' without or with minimal possible maintenance requirements.

Given the problem of deplorable state of these finishes, the research has thus tried to establish various application options of 'maintenance free' materials finishes. These are basically those materials, which were studied and evaluated against their performance standards, extent of resistance to both natural wear and tear, and that as a result of unforeseeable user requirements at the design stage and age of such finishes.

For the various spaces or locations in a hall require different types of finishes due to differing functional requirements, the research thus recommends the best options of finishes to be used in each of these different locations. This is due to the fact that no single finish can successfully be used in all these locations, where all of them exist.

The research is consequently divided into Five Chapters. Chapter One is the Introduction and Problem Statement where the Problem is stated, Objectives, Hypothesis and the Limitations & Scope of the Study are described.

Chapter Two is Literature Review where the available literature pertaining to floor finishes are discussed. This has encompassed inter alia, The technical aspects of construction, Floor Defects and their causes and recommended adhesives for use with different types of finishing materials.

Chapter Three is the Methodology, which addresses the sampling techniques, population, samples and sample frame, Methods of Data collections and Instruments, and the Data analysis techniques employed. Chapter Four is the Results, which enumerates the results of the analysis.

Chapter Five is the Summary, Conclusions and Recommendations, in which the results in chapter four are discussed and summarized, conclusions made and Recommendations are made for the study. In this Chapter are also suggestions on areas for Further Research.

CHAPTER ONE

PROBLEM IDENTIFICATION AND STATEMENT

1.10 INTRODUCTION/BACKGROUND OF THE STUDY.

With the many varying types of floor finishes available, it will be appreciated that selection needs to be critically made where a number of them will be available and appear to suit the same environmental application.

Apart from the question of cost and personal preference with respect to colour and appearance, it's important to consider and compare the properties and performance of the individual products against the environmental and functional considerations. This is to ensure the best selection that is compatible with the above and that it would maintain this suitability for a very long time.

Realization that from time to time performance must give way to practicality and fitness for purpose is often an after-thought while it should be forethought. The general serviceability of floor finish depends as much on the method of cleaning and maintenance as upon the initial selection of the right type of flooring material viz a viz the functions to which the floor would be subjected to during its life span.

To achieve the required standard of performance of flooring materials, all the structures need some degree of maintenance unless the structure is designed for a short span; the purpose of maintenance being to ensure original or the currently acceptable condition of the materials are kept or maintained. This consequently would ensure that the materials perform as originally intended.

Consequently, where maintenance is lacking or limited, careful selection with respect to the functions needs to be taken into account to achieve such performance within the acceptable standards.

According to Oxley T.A (1983), it's estimated that a fifth of the total cost is spent on rectification of defects arising out of errors in design, execution (workmanship) and material components, many of which could have been avoided by correct specification, right detailing of construction, workmanship and fore-seeing or anticipation of possible changes in future user requirements.

Maintenance thus plays a very key and great role in effecting the performance of a facility and should therefore be considered critical right at the design stage such that the materials that require higher maintenance needs than can be met by the ultimate user requirements should be substituted with those which demand less frequency of maintenance.

From the aforesaid it's evident that with maintenance lacking the facility (here being floor finishes) would definitely deteriorate and eventually become obsolete thus impairing their performance. To guarantee the performance, there is therefore a need for proper selection of materials that will not deteriorate faster subject to the user requirements.

Fieldman, (1975), in his study also concluded that floors receive an estimated 90% wear and tear more than any other part of the building and they account for 40%of the overall cost of the building operations. This wear and tear eventually paralyses the effective performance of materials used as floor finishes.

1.20 PROBLEM STATEMENT:

"The universities have become adjuncts of the executive having been rendered intellectually servile and politically sterile and pliable; the universities ceased to have any strategic political value to the Government and were consequently subjected to the perpetual neglect and stagnation. It's no wonder that public universities are now characterized by filth, congestion and collapsed infrastructures easily noticeable from casual look into any of them..." Daily Nation, Monday November 17th 2003; page 9 col.1

Preliminary survey on the condition of the floor finishes in the students' halls of residence reveals great neglect and stagnation as there is a lot of deterioration and/or dilapidation of finishing materials.

According to Building Research Establishment, BRE, (1978), Building Defects are mainly caused by four factors viz;

- Faulty Design, or,
- Faulty execution, or,
- Faulty material components, and
- Unexpected user requirements.

Other than the above, defects also do occur due to natural wear and tear where the finishes are subjected to prolonged duration without attention.

The BRE (1989) Version also goes further to state that the failure of a building material or component is usually due to one of the following factors:

1. An inherent weakness in the material due to the faults in its manufacture
2. Poor design where the material has been used in a situation for which it is not intended.
3. The degradation of the material through the attack by an agent.

Further to these, Fieldman notes that floors receive an estimated 90% more wear and tear than any other building elements implying that in the event of any of the four aforementioned factors the floors will be more highly affected than any other building elements thus absolute care needs to be taken in executing any of the above four parameters.

With respect to the hostels of the University of Nairobi, studies carried out regarding their conditions have come up with the following findings;

(i) There is lack of maintenance of university's facilities majorly due to bureaucratic procedures involved in the Management of these facilities.

~Abdul R.O. (1993) "Nature of bureaucratic procedures involved in the maintenance and repairs of university facilities."

(ii) There are no laid down policies on maintenance of buildings (Hostels included) at the university despite the fact that such a policy is critical for effective maintenance.
~Chepkorir Susan (2002),
~Ndumbai F.M. (1996),

(iii) Inadequate finance, poor organization hierarchy and inadequate number of relevant personnel in the management have also contributed immensely to poor maintenance.
~Susan Chepkorir, (2002)

The above studies have considered the situation from the Managerial and Maintenance aspects, which they have found to be either limited or lacking. The condition of the finishes still continues to be poor hence the need to solve the problem in view of the above limitations. Given the studies have not dealt with the causes of action to be taken with regard to lack of or limited maintenance and management which have continued to persist to date, ***the study is therefore to develop a design criteria for a relatively "maintenance free" flooring finishes for University Students Hostels.***

For there has been either very limited or lack of proper maintenance of the facilities, (here considered the floor finishes) it's therefore most evident that deterioration and dilapidation could have occurred. However, the preliminary survey further shows that the extent of deterioration and/or dilapidation is not uniform across the board in all the hostels probably due to differences in age and performance resistance of the individual finishes to changing user needs.

Suitability for application in such environments would depend largely on the materials qualities to withstand such harsh treatments they are often subjected to for longer time.

The research study thus seeks to establish the materials whose performance standards are least impaired despite such limited maintenance they are exposed to. The suitability and hence the performance standards of the materials would be established by scrutinizing to what extent the material resists or succumbs to the factors outlined above (as unexpected user needs, Faulty execution, poor material selection…)

The materials established to meet the minimum performance standards for application in the current situation would form the basis for recommendation and selection for the future housing developments or extensions of the existing hostels. In addition to this the study proposes to further look into the technical aspects of constructing such finishes and their replacement in existing hostels should such a need arises. Thus the research study is eventually proposed to look into means and modes of designing or selection and specification of low maintenance floor finishing materials for university students' hostels.

1.30 AIM/PURPOSE OF THE STUDY

The study's main aim is to explore into details the various floor defects, extent of deterioration and dilapidation and their influence on the performance of the floor finishes in the university halls of residence. Also to be investigated are the various activities of students e.g. cooking which might be an impetus to accelerated rates of deterioration. All these are done with a view to developing a critical framework for assessing or evaluating floor finishes, then use the frame work to identify appropriate materials for applications in students hostels; which are relatively "maintenance free" finishings.

The study is to identify possible materials for floor finishes and out of this develop a theoretical framework for assessing /evaluating and comparing all the possible floor finishing materials for enhancing their performance.

1.31 SPECIFIC OBJECTIVES

(1) To establish the most appropriate finishing materials for use in the students' hostels which as well are 'maintenance free' and develop a theoretical framework for the criteria of defects identification, diagnosis and solution.

(2) Explore the various floor finishes defects on the floor finishes of students hostels.

(3) To investigate the other causes of finishes deterioration other than the natural wear and tear, including the students' actions which are an impetus to finishes deterioration rate.

(4) To identify appropriate design criteria for floor finishes and develop a theoretical framework for assessing, evaluating and comparing such materials.

1.40 HYPOTHESIS

"THE JOINTLESS HARD WEARING FLOORINGS HAVE BETTER PERFORMANCE HENCE ARE MORE SUITABLE FOR USE IN STUDENTS' HOSTELS THAN JOINTED FLOORING"

1.50 SCOPE OF THE STUDY

The study is designed to cover two of the six public universities; Nairobi and Kenyatta universities. This is basically due to the time and financial limitations and constraints.
The specific areas to be studied in these universities are;

- Nairobi university-Main campus hostels;
- Kenyatta university- Nyayo 1-4, Rwenzori, Kilimambogo and Kilmanjaro hostels, among others.

1.60 SIGNIFICANCE AND JUSTIFICATION OF THE STUDY

Buildings are an expensive investment to the developer, whether an individual(s) or an organization or institution hence need to take some precautionary measures against factors which could lead to defects or dilapidation early enough probably at design stage.

There is therefore a strong need to establish the parameters to form the basis of selection of the materials and components best fit for a particular situation, condition and purpose. This, with regard to the university hostels, where there is no or limited amount of maintenance, there is therefore a need for careful selection of materials best suitable. i.e. relatively "maintenance free" materials (which will require least level of maintenance, but continue performing to some minimum acceptable standards).

1.70 LIMITATION OF THE STUDY.

Due to the financial and constraints the study will mainly cover two of the six public universities viz Nairobi and Kenyatta universities. The study was originally intended to include Jomo Kenyatta University of Agriculture and Technology, but due to the fact that the respondents, students, are out the university as at the time of data collection, it then set aside.

Despite the above constraints, the study would still try to conclude and give recommendations on the other remaining universities.

1.80 FRAME WORK OF VARIABLES FOR EVALUATING DEFECTS AND DETERIORATION IN FLOORING MATERIALS:

Considered under this heading are parameters to help in establishing the various defects and extent of dilapidation and deterioration of floor finishes and include the following;

(i) Floor screed hollowness, lifting and curling.

The observed effects depend somewhat upon the nature of the applied finish. In situ finishes may crack along the lines of bay joints in the screed and may be accompanied with cracking at the edges.

Tiled and sheet finishes may also crack or split at the same point, or may be indented at random points, particularly in heavily trafficked areas. The floor may sound hollow when tapped or walked on.

(ii) Wood block flooring lifting or Arching:

The act of pulling away from the sub base of the floor finishes in large strips due to poor adhesion. The defect may occur any time although the point of failure may vary i.e. the blocks may come away from the screed.

(iii) Clay tile flooring lifting or Arching:

The tiles lift over a large area by arching or along two or three rows by 'tenting up'. Before this they may show signs of hollowness when tapped, the final failure often occurring suddenly and with an appreciable noise as the tiles Part Company from the bedding, which is usually clean.

(iv) Thermoplastic and vinyl tiles lifting and edge deterioration:

The edges of individual tiles lift or the whole tile becomes loose. Sheet flooring's general loss of adhesion may be localized causing surface blistering or rippling or more generalized failure over large areas.

(v) PVC Flooring shrinkage:

Over a period of time, gaps appear at the joints of tiles or PVC flooring. In some cases the tiles may move under traffic causing very wide gaps to appear.

(vi) Granolithic floor dusting

This is a partial or complete disintegration of the floor finish resulting in fine light coloured dust. It may be cracked, sometimes deeply. It's as a result of abrasion of the surface on heavy traffic.

(vii) Floor coverings uneven wear and discolouration

A Djscernible wear pattern is generated on the floor finish where people are concentrated in a particular line of travel. It's normally noticeable in passageways and on corners of entrances. It's normally accompanied by a change of colour of the worn out area.

(viii) Floor Screed pitting

This is manifested by formation of holes on the floor screed or grano and terrazzo paving. Commonly caused by impact of heavy spiked objects.

(ix) The screed and paving slipperiness.

The surfaces of screed grano and terrazzo do become very slippery after usage for a long time without any maintenance especially when wet. The floor is slippery to provide resistant to people when they walk on it. A rating of 0.50 as measured by James' machine is normally considered sufficient and safe coefficient.

(ix) Economy

(Seely) states that floor finishings should have reasonable initial, maintenance and running costs, having regard to the class of the building and the particular location within the building. The use to which the building is going to be put justifies the costs of floor finishes to be used.

(xi) Appearance.

According to BRE and Seely, aesthetics is an important consideration for it usually psychological comfort and pride to the owners and users of the building. This in turn gives self-esteem and actualization to such people. It must however be decided as to whether emphasis is to be put on decorative appearance aspect or strictly functional requirements of the finishes. This is because no single finish would meet all these requirements.

The above factors, it should be noted, would further the basis of our mode of selection and evaluation of the performance and suitability to application of the various floor finishes subject to other factors as age, frequency of usage, user requirements and material components among other factors.

1.90 DEFINITION OF TERMS;

The definitions of terms as used for the purposes of this project include;

Jointless hard flooring; are seamless flooring laid in a continuous sheets or pavings.

Jointed floor finishes; are the finishes laid in tile form, i.e. various tiles jointed side by side to one another.

Performance standards; this is the yardstick for measuring how best a finish fulfills or meets its functional requirements.

Suitability for use/application; the appropriateness of application of particular flooring materials for given functions and conditions.

Maintenance free; these are the finishing materials that shall have survived for longer duration with no or limited maintenance accorded to them but still meet the minimum performance standards.

Defects; these are defaults which occur on the flooring materials.

Deterioration; this is the act of the flooring materials becoming worse in quality and condition

Dilapidation; this is the bad state of repair of the floor finishes.

1.91 ABBREVIATION CITED REFERENCES;

CFA Contract Flooring Association.

BRE Building Research Establishment.

EE Engineering Equipment.

CHAPTER TWO: LITERATURE REVIEW

2.10 INTRODUCTION

According to BRE, 1989, Buildings are generally considered to be durable commodities. Those buildings which have survived for long are of minor number compared to those which have perished, and those which have stayed long have been so due to constant care, and more importantly, constant repair they have been subjected to throughout their lives.

From the time construction process is finished, a building starts, albeit very slowly, to decay. This fact often, must be taken account of, and at least recognized in design, through the provision of finishes which are intended to protect more vulnerable components.

These finishes, often are recognized as having life shorter than that required of the building and it's acceptable that they will be renewed at regular intervals throughout the life of the building.

It further states that estimating the life of a building is often a complex and a difficult task, however, any discussions on the causes of deterioration must embrace the fact that in the expected life of a building, some items require to be replaced hence need to take into consideration the frequency and cost implication of such acts in the long run.

Many materials can be used as floor finishes subject to various factors as, initial cost, materials available, running costs, background to which its applied and the ease of application (Fullerton, 1968). Even with this, to guarantee performance, maintenance has to be carried out throughout the life of the building.

In constructions, being expensive ventures, funds are usually limited, thus there is need for houses to be designed to minimize future running costs i.e. the aim should always be to minimize the total costs both in terms of the initial and the running costs. Thus houses should be robust without unnecessarily being expensive.

2.1.1 CAUSES OF DETERIORATION

The unexpected occurrence of building defects, according to BRE, 1989, could be attributed to either one or a combination of the following:

(i) The inappropriate use of a component or material.
(ii) The use of a material adjacent to or in combination with another that adversely affects it.
(iii) Lack of knowledge by the designer regarding the potential deterioration of a material.
(iv) The building being subjected to forces or agents not considered in the design.
(v) Inaccurate information from the manufacturers.
(vi) Poor manufacturing quality.
(vii) Poor workmanship.
(viii) The failure to carry out necessary routine maintenance at the appropriate time.

2.1.2 THE FLOOR SUBSTRATES

A substrate is an unfinished floor, laid as a base for finished floor. The principle materials used for sub-floors are concrete and timber; timber/wood sub floors should have good stiffness, adequate nail holding capacity and surface characteristics which facilitate the application of finishes.

Grade levels:

Any floor which is in direct contact with the earth and below the surrounding ground level is classified as "Below Grade". A special care should be taken to waterproof such a floor and alkali resistant adhesives should be used in the case of floorings requiring the use of adhesives.

Floors laid on the ground over well-drained gravel base are classified as "on grade" and can take any form of finish. Whereas in "below grade" level floors, there is a decay potential for carpets, wood, cork linoleum and paper backed goods; asphalt, vinyl asbestos, rubber and homogeneous vinyl are suitable for application in such situations.

Floors not in contact with earth are "above grade" and have no moisture problems thus can take any floor finish.

2.13 THE PERFORMANCE STANDARDS OF FLOORS

The performance standards are usually negatively affected by deterioration and defects on finishes materials or components of a building. Thus the suitability of any material or component is a function of the level of performance standards maintained by such materials or components.
These standards are used to evaluate the various characteristics of flooring which are in turn used to select the type of floor finish to be used for a particular application, CFA, 1980.

To ensure that floors conform to certain minimum performance standards, the following guidelines have been cited by various authors viz:

(i) **Structure** The floor substrates must be structurally sound, wind and weather tight. The construction of such structures should be done of durable materials which require low levels of maintenance.

To further the above structural stability and soundness, the finishes applied to it must have **characteristics** as to protect the substrate from dilapidation, CFA, 1980 and **such floor finish qualities to be included consideration are:**

(ii) Durability

The material should have a reasonable life to avoid premature replacement with resistant extra cost and inconvenience. Durability is how well a finish/material resists wear.

(iii) Economy

BRE, 1989, says the materials or components should be of reasonable costs both initial, maintenance and running costs and giving regard to the class of building and the particular location inside the building. The use to which a building is going to be put justifies the costs of finishes to be applied.

(iv) Resistance to wear

This includes resistance to indentation, where the floor has to withstand heavy furniture, fittings or equipment and resistance to abrasion in buildings subject to heavy traffic from pedestrians and movable equipment.

(v) Ease of cleaning

This is of increasing importance in many classes of buildings as the labour intensive cleaning costs continue to rise at a disproportional rate.

(vi) Warmth and underfoot comfort

Under foot warmth is an important consideration in finishes selection. The quality of under foot comfort is a measure of the capacity of a flooring to absorb impact noise associated with walking

Table 2.10 Comfort ratings of various finishes.

	Comfort ratings		
Carpet	Excellent	Homogeneous vinyl	Good
Cork	Very good	Vinyl cork	Good to fair
Linoleum	Good	Wood	Poor
Rubber	Good	Concrete & Terrazzo	V. Poor

(Source; Barkley, Floors Selection and maintenance pp.20)

(vii) Non-slip qualities

This is particularly important in areas as bathrooms where the floors can become damp and hence slippery.

(viii) Appearance

This considers the aesthetic nature of the floor finishes. The decorative nature of a finish brings psychological comfort and pride to the owners or occupants of a building. It must be decided as to whether emphasis is to be placed on decorative appearance and comfort or strictly on the functional requirements of the finishes. This is because no single finish will meet all these requirements.

This chapter is thus discussed under three sub-headings namely; 'Floor finishes and their constructional techniques,' 'The flooring defects' and 'Floor Adhesives'. The first discusses the various techniques of construction, properties, maintenance and places of application or usage of

the various floor finishes. It also gives the various British, BS Standards and British codes of practice, CP discussing such finishes.

The second sub-heading discusses the various floor defects of different finishes; their symptoms and cure. These are to lay the basis of diagnosing the various floor defects and appropriate application of such finishes in the field. The third sub topic hence deals with the various recommended floor adhesives for fixing different types of finishes.

2.20 FLOOR FINISHES AND THEIR CONSTRUCTION TECHNIQUES

It's highly imparable that throughout the building the same type of floor finish could be used. It's for example necessary to give individual consideration to such areas as the living rooms, the wet areas (WC, SH, Bath Tubs and WHB), common rooms and offices. The service conditions will vary greatly in such areas and it's therefore absolutely necessary to treat each section on its characteristics and merits, BRE, 1989.

The selection and suitability of given floor finishes should thus focus onto the above mentioned functional and performance standards weighed against each material's demerits and merits of application in a particular section or area of the building.

According to EFE, 1965, floor finishes can thus be broadly divided into five (5) groups as:

(i) Resilient – including Linoleum Rubber, Asphalt Cork Vinyl and Vinyl asbestos.

(ii) Carpets- which are categorized according to the fibre used as wool, nylon acrylic.

(iii) Wood flooring – categorized as strip, block or boarding

(iv) Masonry flooring including ceramic tiles, terrazzo, slate tiles concrete screed, magnesite, granite and bricks.

(v) Formed-in Place floorings as mastic and resinous toppings based on a combination of certain chemicals as the epoxides, polyesters and silicon.

2.2.1. RESILIENT FINISHES

2.2.11 POLYVINYL CHLORIDE TILES AND SHEETS

(a) Type and general description

These are based on plasticized PVC fillers, pigments etc. and can be obtained in a wide variety of colours, both plain and marbled. Glossy and matt finishes are available.

Common sizes are 225mm x 225mm or 300mm x 300mm with the thickness varying from 2mm – 3mm. Sheets are usually manufactured in widths varying from 0.80M to 1.80M; in rolls up to 30M long, with the thickness of same range as tiles.

(b) Properties

PVC tiles and sheeting materials are warm to the tread, resilient and very flexible. The material is hard wearing and resistant to acids, alkalis, solvents, grease, but reagents of staining or oxidizing nature may cause changes to certain colours.

The resistance to scratches and the like is fair, but permanent markings do occur if such items as burning cigarette ends are left in contact with the floor.

(c) Laying precautions

Both the PVC tiles and sheets are laid on smooth concrete sub-floors, using rubber or resin based solvents adhesives. The concrete sub-base should be very smooth given such materials are very thin and consequently will reproduce the irregularities in the screed.

Ground concrete should be fitted with DPC with the concrete surfaces finished with wood floats, leaving a slightly roughened surface.

Timber sub-bases should be either covered with ply wood or hard board to provide a level surface for final finish.

(d) Maintenance

The floor should not be washed until 7 – 10 days old. Thereafter maintenance should be carried out by washing with a non-alkaline soap or soap less detergent and warm water (max. 60^0C followed by polishing with approved wax polish of the paste emulsion types.

(e) Types of uses (Areas)

Entrance halls, officers, corridors, small kitchens, clinics, laboratories and cloak rooms.

(f) Relevant British standards

BS. 3261- Flexible PVC Flooring.

2.2.12 RUBBER FLOORING

(a) Type and general description

The following types of rubber flooring are in use:

(i) Sheet rubber: In rolls 2mm – 6mm thick, 1.0 – 2.0m wide and 10.0m long.

(ii) Sponge back rubber: in rolls of 2mm – 3mm thick on a sponge base 3mm thick.

(iii) Separate tiles: 3mm – 12mm thick: tiles are also available in studded surfaces to reduce danger of slipping.

(iv) In laid tiles: vulcanized to a sheet rubber base 5 – 6 mm thick.

(b) Properties

It's resilient, warm and has non-slip surface when dry, especially the ribbed or studded type, but rather slippery when dry for smooth rubber type.

It resists moderately abrasion and vibration and is good electrical insulator, special anti-static grades (in black only) are available for use in hospitals.

Tiles are usually in sizes of 500 x 500mm or 1000 x 1000mm with thickness varying from 1930 x 9150mm to 1400 x 1000mm sheet rolls with thickness of 2mm to 6mm.

(c) Laying precautions

Rubber floorings must be laid by a specialist contractor. The sub-base must be absolutely smooth, rigid, clean, dry and free from dust or any extraneous matter. An expansion joint must me made at any variation of sub-base.

Wooden base sometimes requires new, even base of plywood. They should be laid on DPM (for ground slabs) and purchased with bonding surface prepared for laying i.e. sanded by manufacturer.

(d) Maintenance

Should consist of regular cleaning/washing with mild non-alkaline soap. Only those polishes recommended by the manufacturer should be used. Persistent scrubbing and lavish use of water is injurious to such tiles.

(e) Typical uses

Public buildings, corridors, offices, banks, cinemas, hospital wards, clinics and schools. Not recommended for situations with grease, fats, oils, and excessive heat as in kitchens and laboratories.

(f) Relevant British standards

British code of practice, CP 203; sheet and tile flooring (cork, linoleum and rubber).

2.2.13 THEMOPLASTIC AND VINYL ASBESTOS TILES

(a) Types and general description

These consist of asbestos fibre, mineral fillers and a thermoplastic binder. In general, the darker colours have pitch base while the lighter coloured have coumarone resin base. The sizes generally are 225 x 225mm with 2 or 5mm thickness.

They are available in plain or marbled colours, with a matt finish.

(b) Properties

Are available in wide range of colours, hardwearing and reasonably warm. Are also resistant to water, alkalis and dilute acids, but are softened by oils, greases and solvent.

Can be laid over heated sub-floors provided the temperatures do not exceed 27°

(c) Laying precautions

They are laid on cement – sand screed, using bitumen adhesive of either the solvent or emulsion types, but manufacturer's instructions must be sought. On timber floors, an underlay is necessary which can consist of sand – cement screed (suitably reinforced with expanded metal), an approved grade of hard asphalt or rubber – latex cement composition.

(d) Maintenance

Should not be washed until its two (2) weeks old.

Should be washed with non-alkaline soap or soapless detergent and warm water (not exceeding 60^0C followed by lightly polishing with an approved wax emulsion polish applied sparingly to avoid material build up. Follow strictly manufacturer's instructions/ advice.

(e) Typical uses

Entrance halls, cloakrooms, offices, corridors (not kitchens).

(f) Relevant B.S.

BS. 2592: thermoplastic flooring tiles sometimes referred to as "Asphalt tiles".

2.2.14 CORK TILES

(a) Types and general description

Are made from selected quality granulated cork, thoroughly cleaned and prepared by heating under pressure without any binding agents. The quality of cork is related to its density.
The blocks formed from the above process are sliced into tiles 300 x 300mm and 6mm thick.
Cork skirting, stair treads and special trench covers with cork facings can also be obtained.

(b) Properties

Cork tiles are resilient, warm and silent under foot traffic, gives a relatively non-slippery surface even when polished. They are dustless, durable and resistant moderate abrasion and vibration. They are also resistant to damage from acids and most chemicals.

(c) Laying precautions

A good sub-floor must be dry clean, rigid smooth and even. Frequently a felt underlay is used which must be fixed to a base with adhesives.

The tiles are normally fixed to cement – sand screed by adhesives of bitumen or resin emulsion; each tile being held by a hardened steel pin. To enable nails be used on a concrete sub-floor, a screed bed should laid of foamed slag concrete (1:2:4) with slag aggregates. After laying the tiles should be smoothened and cleaned using 2 grades of abrasive paper, thoroughly swept, treated with wax filled or approved plastic sealant.

They should always be protected against rising dampness, penetrating oils and fats.

(d) Maintenance

Should involve sweeping and wax polishing at regular intervals. Excessive water must not be allowed to remain on the surface.

(e) Typical uses

Hospitals, offices, corridors and domestic rooms but not in bathrooms and kitchen.

(f) Relevant British Standards

BS. 877 – Foamed blast furnace slag for concrete aggregates.

BS. Code of practice, CP 203 sheet and tile flooring.

2.2.15 LIONLEUM

(A) Type and general description

This is a fibrous and granular composition consisting generally of cork, drying oils, backed on a Hessian/jute cloth. There are two types viz

- **Standard linoleum** – This is manufactured from oxidized drying oils, organic and mineral fillers and pigments.
- **Toughened linoleum** – this is manufactured form modified oxidized drying oils, organic and mineral fillers and pigments. Tiles are on bitumen saturated felt base and are of size 300 x 300mm. Are also available in sheet form.

(b) Properties

It has good wearing qualities, not particularly slippery unless highly polished. It also has a reputation of toughness, and ease in maintenance.

Have excellent dimensional stability, resistance to wear and aging with good resistance to dilute acids and alkalis.

(c) Laying precautions

The sub-floor should be sound and even; any cracks filled before laying. Such surfaces should be dry, free of dust and clean especially where its to be laid with an adhesive.

Where no adhesive is used place the tiles on a paper underlay. DPM should be incorporated where damp is anticipated.

(d) Maintenance

May be kept clean by sparing use of mild soap and water; alkaline soaps should not be used. Further, scrubbing and frequent use of water is injurious. Wax polish and scaling should be used for a good surface.

Regular use of plastic resin – based emulsions improve resistance to water and dirt. Surface sealers require regular renewals at intervals specified by manufacturers.

(e) Typical uses

Domestic and public buildings with pedestrian traffic, schools, laboratories, control rooms and light industrial buildings.

(f) Repair

The only repair is to cut the damaged section and replace with new material

2.2.20 HARD WOOD STRIP OR BOARD FLOORING

(a) Types and general description.

Strip is a term applied to toughness and grooved flooring in narrow widths not exceeding 100mm. If over this width then is called "board' flooring. Hard wood strip is normally laid in widths varying from 50mm to 100mm and 12mm to 18mm thick. Hard wood board flooring is usually laid in width ranging 137.5 – 175mm and 25 – 37.5mm in thickness.

(b) Properties

It's hard wearing, warm, clean and safe but is unsuitable for use in wet areas one to its tendency to warp and lift.

(c) Laying precautions

It's usually secretly nailed in addition to being tongued a grooved. Where the strips are laid on bearers, the concrete screed should be brought up to finish with the top of the grounds and a waterproof membrane applied there on by laying the strips.

To avoid floor lifting, expansion joints should be laid round the edge of the flooring. When laying boards, the heading joint should be tongued. If the strips are nicely to be in contact with the concrete, then faces should be painted in bituminous paint.

(d) Maintenance

Sanding and wax polishing is the normal way of floor treatment, though to reduce maintenance costs, special fillers or sealers are applied to the surface.

(e) Typical uses

Offices, corridors, light machine stops, food factories, laboratories, packing dispatch and recreational areas.

(f) Repair

This is done by taking out and renewing the boards/ strips than subsequently sanding and waxing to match the existing boards.

(g) Relevant British standards

BS 881, 1589 nomenclature of commercial timbers including sources of supply.

CP 201 time flooring.

2.2.22 WOOD BLOCK FLOORING

(a) Type and general description

Wood block flooring should be made form a dense, closely – grained wood. Quarter sawn materials have, however, a lower ratio if expansion and contraction and thus is used liable to movements. Normal sizes are 225 – 300mm long, 75mm wide and 12mm or 18mm thick.

(b) Properties

The wood blocks are hardwearing warm, clean and easy to maintain.

(c) Laying procedure

They should be laid on a smooth, solid concrete base on which is brushed a coat of creosote tar before laying. Blocks are set in mastic or bitumen. The mastic should consistently remain plastic yet remain in adhesiveness and never sets brittle or hard.

Expansion joints should be allowed as in strip flooring to avoid lifting.

(d) Maintenance, repair and uses

Maintenance as described in strip flooring above.

(e) Relevant British Standards

BS. 881, 589 nomenclature of commercial timbers including sources of supply; BS. 1187 wood blocks for floors; CP, 210 timber flooring.

2.2.23 WOOD END-GRAIN BLOCK FLOORING

(a) Type and general description

These are two types namely; heavy duty and light duty depending on the thickness which ranges from 65 – 150mm and 255 x 75mm plan area. For heavy-duty work, soft blocks are cut so that they are laid with end grains vertically. 25mm cube blocks are used for decorative purposes.

(b) Properties

Are quiet, warm and non-slippery. They resist severe abrasion and heavy impact loads. The blocks should be well seasoned and impregnated against rotting.

(c) Laying precautions

Blocks are laid on concrete sub-floor floated on 1:3 screed of 19mm – 25mm thick. They may be laid with close joints or uniformity spaced joints bedded and grouted in c/s 1:3 mix.

They may be dipped into hot composition of soft pitch and laid with close joints filled with bituminous grout. Expansion joint should be left at the edges of the area. Where the floor is liable to excessive vibration, these blocks are laid on a dowelling system to prevent lifting.

(d) Maintenance

No major maintenance is required for heavy duty. Creosoted wood pairing, but occasional wax polishing may be desirable on the other types of floors.

(e) Repair

Consist of removal of damaged blocks. The new blocks replaced, sanded and polished.

(f) Typical uses

For exceptionally heavy-duty floors.

(g) Relevant British Standards

CP. 201 timber floors.

2.2.30 CONCRETE-BASED GROUPS FLOORING

General characteristics

Generally masonry/concrete floors are hard and durable. Are intended to be used in heavy traffic areas. Majority of them are resistant to staining, deterioration by solvents, acids and alkalis. They require sand floors which are structurally sound, level and clean.

2.2.31 TERRAZZO

(a) Types and general description

This material consists basically of cement and sand. It's normally laid either in pre-cast slabs and tiles or in situ.

In in-situ form, it's laid in two layers/coats directly on the concrete base. This provided that the surface is smooth; no addition cement would be required, but the surface must be grouted with "slurry" to provide a key.

The terrazzo under coat, consisting of small aggregates (less than 5mm) and cement/sand in 3:1 proportion is then applied to a thickness of 18mm.

(b) Properties

Terrazzo is attractive, hard wearing, noisy and cold. However they have advantage of being free from dusty conditions. It should be noted that it has a tendency to crack under conditions of differential settlement. When laid in range areas.

(c) Laying precautions

Terrazzo topping should be laid on the screed whilst this is till green, in order to reduce possibility of shrinkage (due to high proportion of cement in the mix). This shrinkage could be controlled by laying the terrazzo in panels of about a plastic strips. Alternatively use is made of separating layers as of bituminous felt or building paper laid beneath the tile bed.

When terrazzo is to be laid continuously from floor to a wall as a covering starting or dado, it should be noted that a firm foundation of brick, stone or concrete should be supplied. Terrazzo would not adhere to lime or plaster board. Terrazzo must not be laid on a wood sub-floor.

(d) Maintenance

Maintained by use of sealants and simple washing.

(e) Repair

Can be carried out by cutting away and relaying and polishing, but not by filling cracks

(f) Typical uses

Terrazzo surfacing may be used in corridors, halls and staircases which carry heavy traffic and where silence is not important.

Due to their non-absorbency, they are used in washrooms and toilets.

(f) Relevant British Standards

BS code of practice, CP. 204, in situ flooring, part 3: terrazzo flooring.

2.2.32. GRANOLITHIC CONCRETE TOPPING

(a) Type and general consideration

Granolithic topping normally consists of crushed granite, carefully graded, from fine to coarse. Such aggregates should be hard and angular rock with particle size of 5mm to 9mm. BS. 882, 1201. The topping may be coloured by adding pigments to the mix.

The mix generally is 1 part cement: I part of sand: 2 parts by vol. of aggregates.

(b) Properties

Grano is hardwearing, smooth surfaced, fairly free from dust, if correctly laid. Sodium silicate or other types of hardness may be added. They are also noisy and cold.

A good dense granolithic surface tends to polish in use. The floor can be made less slippery by incorporating into the surface carborundum grit during the final toweling.

(c) Laying precautions

Where expansion joints have been incorporated in the sub-floor, they should be brought up to the finished floor level. Whereas where granolithic topping is laid on existing concrete which shows evidence of structural movement special consideration should be given to incorporation of such joints.

The trowelling requires skills and should be done 3 or 4 times during the 6 – 10 hours it takes to harden. Curing should be done and it should be kept for at least 7 days damp.

Laying can only be considered integral with the base if grano is placed shortly after the base. After 3 hours, the seating of the cone. Base is too advanced for a complete bond to be obtained, unless special precautions are taken.

Integral grano should be between 12mm to 20mm thick and consolidated by hand tamping. Vibrated tampering or using a power float. Thickening the grano to 25mm and above is liable to curl the whole slab. Sizes of the bays would depend on the thickness of the base slab and of topping; for thinner slabs the size varies from $14m^2$ while it varies between $23 - 27m^2$ for thicker slabs.

(d) In laying grano over hardened base, note the following

- All laitance to be removed form the top of the base concrete.
- All dust traces also to be removed.
- The old concrete should be thoroughly soaked, watered probably by ponding.
- Laying should be in bays of maximum stated areas.
- Immediately before laying the topping, remove excess water and a thin layer of grout scrubbed into the surface of the base concrete.
- In order to minimize shrinkage very dry mix should be used, with minimum water content.

(e) Maintenance

Only brushing and washing are normally recommended.

(f) Types of uses

For stores, workshops, work lavatories, corridors, staircases.

(g) Relevant British Standards

For cement; BS 12 BS 1014

For aggregates; BS 882, 1201, cone. Aggregate form natural sources.

BS codes of practice CP 204 in situ flooring.

2.2.34 CEMENT SCREED

(a) Type and general description

Whatever the finish to be used, its standard modern practice is to cover the comparatively rough concrete slab with screed of cement and sand in order to provide a smooth surface/base.

The finished surface is normally immediately exposed to "follow on" trades and is wide open to damage. Its therefore more usual to screed the floor later, the operation being left till the job is nearly finished thus presenting the surface finish from damage.

(b) Properties

It provides a durable and firm surface. The surface is cold and noisy.

(c) Laying precautions

The thickness of the screed should be related to the state of the base concrete when, as is more usual, floor screeds are laid at a later date and the base concrete has been allowed to harden, then to form a good bond it should be hacked, cleaned and damped to reduce suction. It is then grounded immediately before the screed is laid. The screed should have a minimum of 40mm thick a proportion of 1:4 (by weight) of cement and sand is suitable.

2.2.35 ENGINEERING BRICK (VITREOUS) FLOORING

(a) Type and General Description

These bricks are normally blue and red and should have a dense vitreous structure. They are made from clay souls having fairly high iron oxide content and should be free from injurious particles of lime and other deleterious materials. The red and blue colours are due to iron with red being those manufactured under oxidation and blue under reduction.

They are supplied in nominal sizes of 225mm x 112.5mm x 75mm or 50mm.

(b) Properties

Bricks should have a high density and low porosity. Are very resistant to wear and bricks resistant to acids can be obtained for such conditions. They are generally slippery when wet or polished but special non-slippery properties can be obtained as in ceramic tiles.

(c) Laying precautions

Are laid on edge or flat as required by particular conditions. First grade can be laid with mortar joints without wetting the bricks. However some bricks may require wetting to avoid excessive absorption. If the base on which the bricks are laid is dry, it should be thoroughly wetted, coated with a cement slurry bedding mortar; freshly mixed and spread on the base and tamped form to required level.

They should be laid with 10mm joints fined with the same materials for bedding. The flow should be allowed to mature undisturbed for 2 – 3 days after which it might be used in lightweight pedestrian traffic.

(d) Maintenance

Require little maintenance and may be kept clean by scrubbing with clean water and scouring powder.

(e) Typical uses

Bricks are used where heavy traffic is encountered, such as in heavy engineering shops or foundries or while steel tired trucks are in use. It's the best-known medium for covering chemical floors subject to corrosion.

(f) Relevant British Standards

BS. 1301: clay engineering bricks.

CP 202: tile flooring and slab flooring.

2.2.36 WELDING OF JOINTS TO SHEET AND TILE FLOORING

The jointing of two or more sheets of flooring to provide a jointless surface is referred to as welding, regardless of the method used. It's mainly used in conjunction with PVC flooring, although linoleum can also be included in this category.

There are various methods of welding or sealing the joints and reference should be made to the manufacturer's instructions and recommendations. There are generally two methods of welding namely;

Hot air welding and cold air welding.

Hot air welding

Carried out as follows;

(i) The joints in sheets are cut in to provide a neat, tight joint with the edges butting together.

(ii) A groove approximately two-thirds the thickness of the flooring is then routed out, either by hand or machine.

(iii) A suitable welding rod of similar composition to the flooring material is then heat softened by a means of a hot air welding gun and fused into the V or U shaped joint.

(iv) When cool the surplus material is then removed leaving a smooth flat surface.

Joints made in this way are usually sufficiently strong to withstand any shrinkage tendency within the sheet or tile.

Cold welding

The term is generally applied to other means of sealing joints in decorative flooring.

(i) The joints between the joints are routed/grooved as in the above.

(ii) The edges of the joints are usually protected by application of a suitable masking tape.

(iii) Welding paste is applied with a spatula or putty knife in sufficient quantity to fill the grooves. Any surplus is then removed

(iv) The masking tape is removed after removal of surplus paste, leaving a narrow band of cement filling the joint.

Another form of cold welding is by filling the joint with a solvent-based solution of Pvc applied by means of a small application. This method is only suitable for certain types of flooring.

2.2.37 FLOORING ACCESSORIES

Stair nosings

Stair nosing can be obtained in variety of pre-formed sections to suit most types of stair profiles. Nosings are manufactured in various metals, plastics and rubber. The most common nosing is the aluminium extrusion, usually with slip resistant composition infill.

Aluminium nosings

These are available as single or double channels of a suitable profile to suit most stairs treads details. They are manufactured in heavy duty and slim line to suit floorings of 2 or 3mm thickness. Special sections are available for carpets.

Metal nosings can either be adhered using a suitable adhesive or drilled and screwed, depending on the situation.

Plastic nosings

Are mostly confined to the internal situations and in less heavily trafficked areas. They are available in various colours and adhered to the tread with special adhesives.

Coving

There are a variety of special sections of pre formed coving, some having built-in sections, suitable for the inclusion of telephone cables and such like.

'Sit on' coving

An extruded PVC profile with a small radius toe, which is fixed to the wall surface, and the toe covers the joint between flooring and wall. It's generally used in conjunction with vinyl tile flooring.

'Set in' coving

This has an external toe which enables it to be set in flush with the floor finish of suitable thickness and can be welded to the floor finish of PVC to enable a join-free floor be installed.

2.2.40 CARPETS

Carpets are produced by a wide range of manufacturing processes and the production method is not necessarily indicative of the suitability of any particular use. All production methods have advantages and limitations viz

2.2.41 TRADITIONAL WEAVING

There are two main methods within this category i.e. Wilton and Axminster.

2.2.411 Wilton

Wilton weaving produces a particularly high-density material with all yarns (backing and pile)

Closely inter-woven. For example, a two colour Wilton, where one colour is not shown on the surface the yarn is not cut off but woven into the backing. The amount of pile yarn used accounts highly for the total cost of high grade Wilton.

Normal cut price Wilton is woven in the form of loops, which are cut after weaving, the height of which is determined by the width of the 'wires' over which the loops are formed during weaving.

2.2.412 Installation

Is mostly on a separate underlay and fitted to tackless gripper battens around the perimeter of the area. It can be adhered directly to the sub-floor if rubber or PVC secondary backing is incorporated, though this is not a common practice.

2.2.420 Axminster

There are two methods to Ax Minster weaving, Gripper and spool Ax Minster. The components of the carpets are usually identical, but the manner in which they are put together is different. A hybrid version of spool and gripper – spool gripper – which combines the best features of both methods is now quite popular. In all versions of Axminster weaving, however, the pole is formed by individual tufts being cut on the loom and laid into the backing during weaving. Each tuft is in the form of a 'u' and is held in place by the backing weft which runs along the width of the carpet.

2.2.421 Installation

Installed either on separate underlay and fitted to tacklers Gripper patterns around the perimeter of the area of adhesive fixed to the sub-flour if a rubber or PVC secondary packing is incorporated.

2.2.3.40 CARPET TILES

Carpet files are available which require all-over adhesive bond and also for loose lying on the sub-floor with only limited fixing in these spots where particular stress can occur e.g. at turning points at the foot of the stair case or any similar area with heavy traffic where a pivot action of the foot is used to change direction.

The loose lay tile dominates the carpet tiles market due to the advantages it has including; its ease in application, replacement of damaged tiles, mobility in alternating different areas of carpet tiles to afford equal wear, access to underfoot services and the use of colour and design to create patterned effects.

Carpet tiles are generally available in sizes of 500 x 500mm and the manufacturing processes include woven, tufted and needle punch. A wide range of fibres is used from wool and other animal hair to most synthetic fibres.

Loose-lay carpets are generally provided with a backing of sufficient weight, composition and stability to allow the files to hug the floor and restrict lateral movement causes by pedestrian traffic. Backings include PVC, polypropylene, natural and synthetic rubber and bitumen-impregnated feet.

Most carpet surface effects are available in loose-lay tiles, including cut pile, loop and cord effects with the woven and tufted products, and a hairy pile surface with needle products.

2.2.3.41 Installation;

When fitting loose-by carpet tiles, it's essential that each tile is butted up tightly to its neighbour and that the perimeter tiles are all tightly cut in. Failure to ensure this can result in the tiles creeping, leaving unsightly gaps. It's recommended that within areas likely to be subjected to heavy turning traffic/ loading should be adhered in some manner to contain and restrict the possibility of movement.

Various methods of fixing the carpet tiles are available, from overall adhesion, spot fixing with adhesive or double-sided tape depending on the traffic situation where the tiles are laid on sub-floors in direct contact with ground, then effective sharp proof membrane (DPM) should be incorporated.

2.30 ADHESIVES

This sub section gives a general guide to the types of adhesives used in construction with various flooring and flooring accessories and the methods of application. This in no way over rides the specifications given by the adhesives manufacturers with respect to their installation requirements.

2.3.10 PREPARATION AND CONDITIONS OF THE BASE

Before any adhesive is applied it is necessary that the base is structurally sound, smooth, clean, dry, and free from dust, grease, oil, paint, polish or any other contaminant that may affect adhesion. CFA, 1989. A concrete sub floor or cement/sand screed must fully cured and without laitance.

An effective Damp Proof Membrane must be provided where necessary in relation to the floor covering used and the site condition must comply to CP 203 and good ventilation needs to be provided to enable the adhesives to dry and also to afford dissipation of vapours from solvent- based adhesives.

Further CFA recommends that before any adhesive is laid the moisture content of the concrete sub base must not exceed 75% relative humidity. If the floor is too warm, adhesives will dry too quickly resulting into late placing of the floor covering with frequent lack of adhesive transfer and overall bonding.

Highly absorbent sub-floors will promote quick drying out of the adhesives. Where such a condition is likely to occur the following measures are suggested; timber sub-floor of flooring grade plywood or chipboard should be primed as recommended by manufacturers.

Highly absorbent concrete sub base should be skimmed with recommended cement based smoothing compound.

2.3.20 SELECTION OF ADHESIVES

A guide to the types of chemical adhesives to suit various floor coverings is found in BS 5442 Part 1 1977, "Classification adhesives for construction, flooring materials." Preference should also be made to technical data sheets provided by adhesives manufacturers.

2.3.30 Application of adhesives

Most flooring adhesives are applied using serrated edge, rectangular steel trowel in order to gauge the quantity of adhesive used. The serrations comprise V-Shaped cuts varying in depths and distance apart. Shallow notches set close together are used for the thinner and more flexible flooring whilst wider spacing with greater depths are for thicker and more rigid flooring materials.

CFA provides various types of adhesives under the following groups;

Gum spirit; an alcohol solution of rosin containing fillers and possibly other modifiers.

Lignin paste; an aqueous dispersion of sulphite lye with filler. *Non-flammable.*

Rubber solution (contact adhesive); a solution of synthetic or natural rubber in organic solvent containing resinous or other modifiers. Flammable.

Rubber/resin emulsion; an aqueous emulsion of blend of styrene-butadiene rubber which may contain synthetic resin modifiers and fillers. *Non-flammable.*

Acrylic emulsion; an acrylate ester copolymer emulsion, which may contain resin modifiers and and/or fillers. *Non-flammable.*

Bitumen solution; a solution of blend of bitumen in suitable solvents, with the addition of powdered and/ or fibrous mineral fillers complying with type 5a (i) of BS 3940, 1965. *Flammable.*

Bitumen/ rubber emulsion; an aqueous emulsion of bitumen of appropriate grad with the addition of natural or synthetic rubber latex complying with type 5a(ii) of BS 3940, 1965. *Non-flammable.*

Epoxy resin; two component system comprising of liquid epoxy resin and liquid hardener, both of which may contain fillers and which mixed immediately before use. *Non-flammable and flammable.*
Polyvinyl acetate (PVAC), Emulsion; an aqueous emulsion of polyvinyl acetate homopolymers or copolymers, which may contain fillers. Non-flammable.
Hot bitumen; as type 3a (i) of BS 3940, 1965. Non-flammable.
Polymer resin; a blend of polycondensation product of unsaturated dycarboxylic with polyhdric alcohol, usually as a solution of styrene, with accelerator catalyst, fillers and structuring agents and supplied as multi-component material requiring mixing before use. Flammable.

The various adhesives for various flooring finishes can be summarized in a table as the one below;

Floor finishes	Adhesives
Vinyl sheet and tiles (BS 3261 Part 1, 1973, type A)	1,2,10.
Vinyl tiles (BS 3261 Part 1, 1973, type B)	1, 3, 4.
Vinyl sheet and tile cellular PVC Backed	1, 2.
Vinyl sheet and needle loom, felt Backed (BS 5085, part 1)	1, 6, 7.
Vinyl sheet, latex asbestos Backed.	1, 2.
Vinyl asbestos tiles, BS 3260	1,2,3,4.
Thermoplastic tiles, BS 2592	1, 2, 3, 4.
Linoleum sheet and tile	7, 8.
Linoleum tile (PVC backed)	1, 2.
Linoleum tile, felt backed	1, 7, 8.
Rubber sheet and tile	5.

Key

1. SBR Emulsion.
2. Acrylic emulsion
3. Bitumen solution
4. Bitumen rubber emulsion
5. Rubber solution
6. PVCA emulsion.
7. Gum spirit
8. Lignin paste
9. Hot bitumen
10. Epoxy resin
11. Unsaturated polyester resin.
12. Polymer modified cement.

Adhesives for various flooring finishes, continued.

Cork tiles	1, 5, 7, and 8.
Wood blocks	4, 9.
Wood mosaic	4.
Ceramic floor tiles on Concrete base	10, 12.
Stair nosings aluminium	5, 10, 11.
Vinyl flooring accessories	5.
Textile flooring, cellular Pvc backed	1, 2.
Textile flooring cellular Rubber backed.	1.

Above, Table 2.20. Recommended adhesives for fixing various finishes. Source BRE, 1989.

2.4.0 FLOOR FINISHES DEFECTS

Introduction

According to BRE, 1989, building defects can be broadly split between those occurring in the finish and those occurring in the structure. Structural defects may only become apparent when the fails or an adjacent part of the structure behaves abnormally.

The defects in suspended floors are confined to occasional excessive deflection and to fungal and insect attack. Solid concrete ground floor defects are invariably related to one of the three causes as;

- Ground fill,
- Concrete mix from which the floor is constructed and,
- The incorrect detailing and application of the DPM

On the other hand, a wide range of finishes is available to the specifier to suit most circumstances of use. Either wrong specification or a change of use of the building can result into a failure finish.

Although the first signs of problems with a floor may be hidden by applied finish, it's often the appearance of cracks or dampness in the finish that will draw attention to it.

According to BRE, 1978, the building defects can be classified as;

(i) Affecting habitability; are broadly any defects which diminish the functional performance of the structure.

(ii) Affecting appearance; any defect of a superficial, largely aesthetic nature.

(iii) Affecting safety; where any defect involved, or might involve hazard to life.

Causes of defects;

The four main causes of defects according to BRE, 1978, are;

Faulty design,

This is a situation where the failure or defect could be attributed to a failure to follow established design criteria, whether in building regulations, codes of practice or standards or in accepted good practice.

The design fault would normally lie with the designer, but could also be brought onto a component, or in a sub contracted service e.g. granolithic paving.

Faulty design also arises from inadequate provision of expansion joints e.g. in floor tiling.

Faulty execution,

This is attributed to the part of the contractor, or sub-contractor to effectively carry out a design, which was satisfactory in itself, and properly specified.
This is more complex because many parties are involved in this stage than in the design stage thus a higher standard of supervision is necessary if more glaring examples of poor workmanship and omission of vital details are to be avoided.

Faulty material components or proprietary systems.

This is the failure of the materials to meet their accepted performance levels. This also arises from wrong choice of materials or components for the particular design situation e.g. wrong specification of adhesives for floor finishes. However, many of the problems with materials and the like could be avoided if only designers were more critical in their selection and specification and refused to accept materials, components or systems which can not offer any worthwhile guaranteed performance measured against the accepted independent criteria.

Unexpected user requirements

These are defects caused by the user expecting more from the designer than anticipated. Examples of such instances where the expectations of the occupiers work against the design include the use of very aggressive cleaning agents on vinyl floorings, leading to loss of plasticizers.

The various floor finishes and their defects can be grouped into the following according to building research establishment, 1989.

CONCRETE FLOORS:

A. FLOOR SCREED

(i) Hollowness, lifting and curling;

Faults occur in sand cement screeds for a variety of reasons. A lot of them are directly to poor workmanship and supervision.

Symptoms:

The observed effects depend somewhat upon the nature of the applied finish. In situ finishes may crack along the line of bay joints in the screed and may be accompanied with cracking at edges. The floors may also sound hollow when walked upon or tapped. There is need for care to be taken in applying the screed to obtain a good bond between it and the concrete base. If the bond is poor and the shrinkage stresses are high, the screed will crack with a tendency to curl at the edges of the cracks.

Diagnosis

There are various factors that can cause screed to fail, which may act singly or in combination. The factors include; poor preparation of the concrete base, incorrect design including unsuitable mix specification, poor workmanship, and supervision, either by having the mix too wet or too dry; too rapid drying of the screed.

Cure.

Where cracking and curling are not excessive and soundness is fine/ok, it may be sufficient just to cut out and replace the worst affected areas. Grind down all edges and make good with a proprietary leveling compound.

Localized indentation may also be dealt with this way, but more general indentation would indicate that the whole screed is faulty and the only possible cure is replacement. Here, care needs to be taken on the use of modified cement: sand ratio.

(ii) Cracking, pitting and breaking up.

In this defect, screeds crack in well defined lines. Pitting is the formation of small holes in concrete finishes or hard surface; commonly caused by 'spiked' heel shoes and the impact of such sharp objects. Ground floor slabs constructed from concrete laid on hardcore are particularly vulnerable to attack by water-soluble sulphates in the hardcore. The effects of swelling due to other chemical constituent changes are similar but not common.

Symptoms

Sheet flooring laid on the screeds are cracked or split or there is unevenness along lines, the finish on one side of the line being slightly proud of that on the other. There may be a slight difference on the level in the tile and block flooring.

Diagnosis

Most screeds provide a satisfactory base for laying of a floor finish even if there is a slight loss of adhesion between the base concrete and the screed.

When bay or day work joints are included in the screed, cracking will almost certainly take place along the same line. Where floating screeds have been formed by laying sheets of insulation materials on the base slab and there are gaps between these sheets, the screed will crack along the lines of these gaps.

Cure

It will only be necessary to carry out remedial work only if the floor finish has been badly affected or has been brought about by a difference in levels, which is likely to be hazardous to foot or wheeled traffic.

The extent of the work will depend on the state of the screed, if weak, it will be better to take it all out and relay; if cracked, but lifted slightly it may be sufficient to grind one side down to the level of the other.

Figure 2.10, Floor cracking, pitting and breaking up in dense in-situ concrete floor finishes. Source, Building Research Establishment, 1989. (Turn overleaf)

Photos 1, 2 & 3 Cracking of dense, in situ, floor finishes.

Photos 4 & 5 Cores drilled from a granolithic floor topping showing poor compaction and a high percentage of voids.

Photo 6 Good core sample from an area in sound condition.

(iii) Disintegration

This defect occurs where the floor is subject to spilled water and/ or chemicals.

Symptoms

Concrete slab, with or without either granolithic or permeable finishing gradually disintegrate. It's as a result of abrasion of the surface during the burnishing or from heavy traffic. Finishings that allow liquids to pass through fail because the concrete breaks at these joints.

Figure 2.20 Disintegration of concrete-based flooring, Source, BRE, 1989.

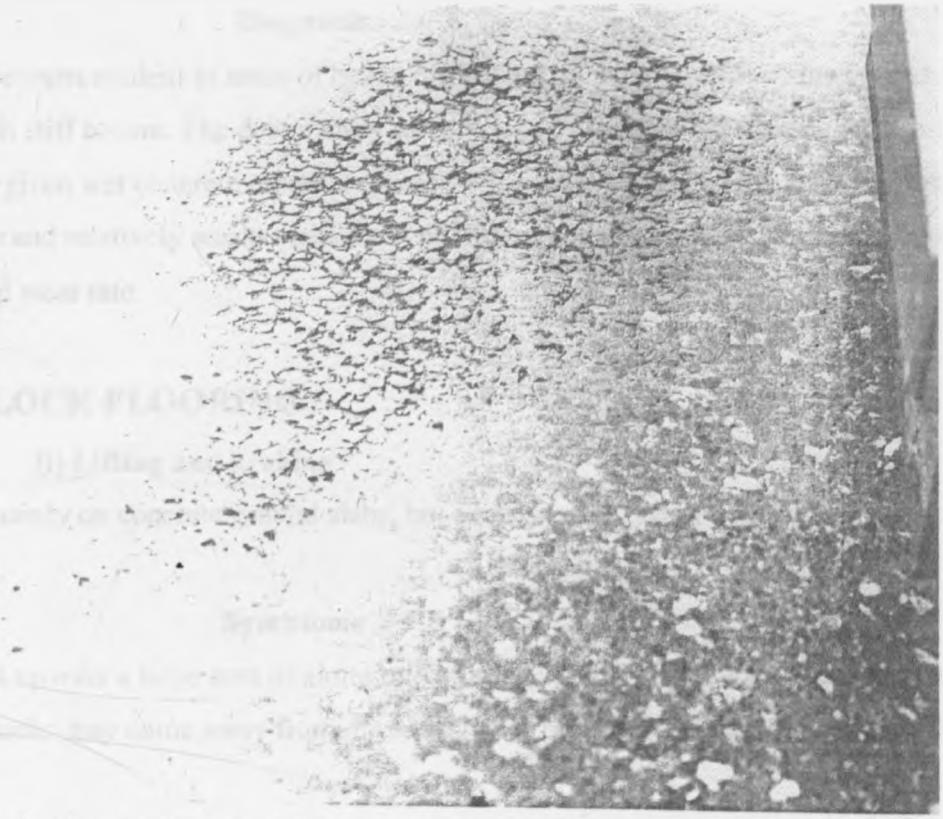

Photo 1 Breakdown of terrazzo finish at a buffet checkout caused by a combination of wear and spills of milk and other food stuffs.

Diagnosis

Concrete constructed with normal Portland cement will absorb liquids if they not protected with impervious finish. Granolithic floor finish will be attacked for the same reasons, but may offer better short-term protection due to its smoother finish.

Cure

Can only be effected by cutting out any defective areas and replacing with suitably resistant material. Where possible, install a better drainage and organize frequent washing down areas where spillage is inevitable. Be sure the floor pad being used is not too aggressive for the finish used.

(iv) Granolithic floor dusting.

This condition may occur in bays or larger areas and cannot be cured by simple sweeping.

Symptoms

The surface is covered with fine dust and wears rapidly. It may also be cracked, sometimes deeply.

Diagnosis.

The dusting would be most evident in areas of heavy traffic, but all areas would produce clouds of dust when swept with stiff broom. The dust mainly consists of cement and very fine aggregates. The problem occurs given wet concrete mixes are easier to lay than dry ones. This leads to formation of excessive laitance and relatively weaker concrete with higher drying shrinkage hence possibility of cracking and rapid wear rate.

B. WOOD BLOCK FLOORING

(i) Lifting and arching

This defect occurs mainly on concrete ground slabs, but can also occur on upper floors in certain humidity conditions.

Symptoms

The wood blocks lift up over a large area or along two or three rows. The point of failure of block may vary (i.e. the blocks may come away from the adhesive or the block and the adhesive may come out of the screed.)

Diagnosis

The primary cause is an increase in the moisture content of the blocks which causes them to swell and sets up a comprehensive forces which, if continues for long forces the blocks from their bedding. The increase in moisture may arise from construction water still present; high humidity conditions in the building, flooding or lack of damp proofing membrane.

The trouble also arises when the blocks are laid in a very dry condition in a building where subsequently the atmospheric humidity is high.

Cure

If the damp conditions are only temporary, the blocks can be re-laid when they have dried out, but where this is not the case, some preventive measures must be taken. If the normal humidity conditions in the buildings were high it would be advisable to condition the blocks to a higher moisture content than normal so that they approximate the moisture content of the air.
The provision of a compression joint in the floor finish around the perimeter of the building is recommended.
See the figure below.

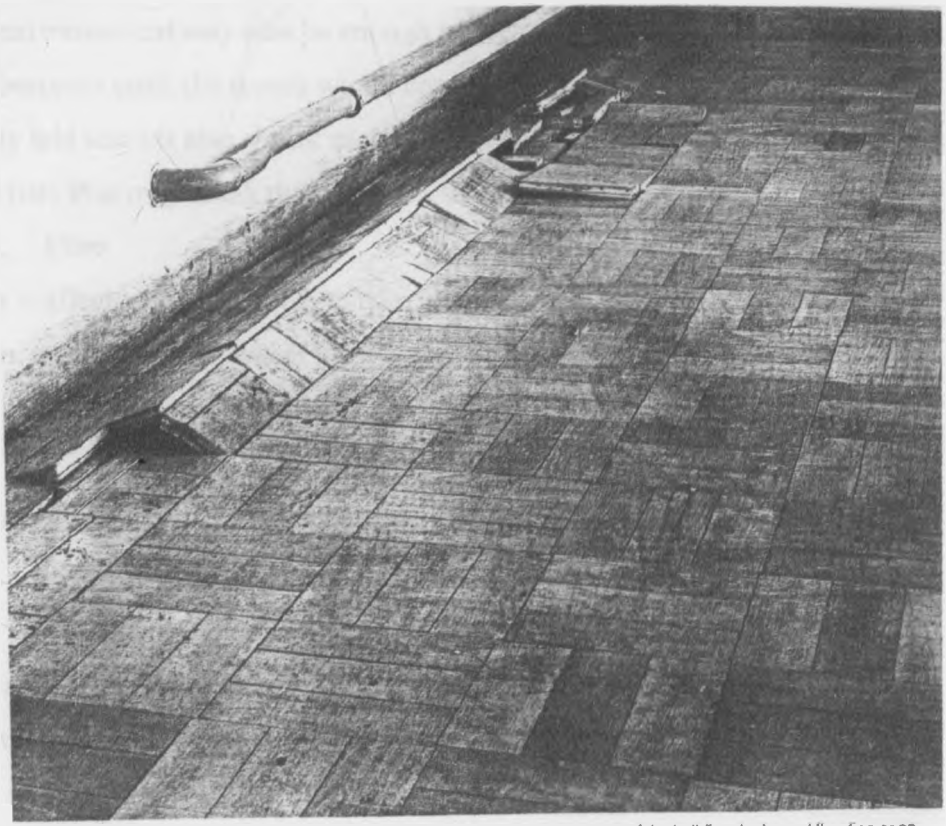

Photo 1 The lifting and arching of the blocks is caused by construction water, use of the building, leaks and flooding or an inadequate damp proof membrane.

Figure 2.30, Lifting & Arching of Wood blocks. Source, Building Research Establishment, BRE, 1989.

C. CLAY TILE FLOORING

(i) Lifting or arching;

Symptoms

The tiles lift over a large area by arching or along two or three rows by 'tending up.' Before this they may show signs of hollowness when tapped, the final failure often occurring suddenly and with appreciable noise as the tile part company with the bedding.

Diagnosis

There are three causes which singly or together can lead to the tiles becoming loose and lifting up with the majority of cases being due to more than one.

These include;

(i) Being a ceramic product they are faced the problem of irreversible expansion as a consequence of absorption of moisture.

(ii) Thermal movement may also be enough to break the bond, particularly when the floor becomes cold, the screed would contract more than tiles.

(iii) Freshly laid screeds also shrink as they dry. The shrinkage will be grater than that of the tiles thus may break the bond.

Cure

If a large area is affected it's advisable to take up all the tiles and relay them. If only a small partition, then only those which have loosened are removed.

D. THERMOPLASTIC AND VINYL TILES FLOORING.

(i) Lifting and edge deterioration

Symptoms

The edge of the individual tile lifts or the whole tile become loose. The adhesives could have been squeezed out from between the tiles. The tiles may be delaminating and have powdery appearance.

Diagnosis

The primary cause of such a defect is water which has been made alkaline by passage through the concrete base on which the tiles are laid. Strong alkalis may attack the adhesive or affect its adhesion to the concrete causing the tile to be loosened so that it becomes liable to be damaged by or

displaced by foot traffic or normal cleaning operations.

Excessive use of water for cleaning the floor surface or gross spillage of water onto the floor may be to blame.

Cure

It's essential to establish the source of water reaching the tiles and eliminate its presence in future. Where possible the cleaning should be restricted to wet mopping.

Photo 2 Lifting plastics tiles over defective damp proof membranes (see also 7.2.13)

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Figure 2.40. Lifting of tiled finishes. Source, BRE, 1989.

E. PVC FLOORING

(i) Shrinkage

This defect is frequently seen in hospitals and restaurants in areas subjected to soiling and therefore frequent wet cleaning. It can occur in any location where PVC flooring is used.

Symptoms

Over a period of time, gaps appear at the joints of the tiles or the PVC flooring. At times the tiles could move under traffic causing very wide gaps to appear.

Diagnosis

The shrinkage of PVC flooring is caused by the loss of plasticizers from the flooring. This can be from two sources viz;

1. Wrong choice of adhesives for bonding. Some adhesives cause movement of plasticizers from the flooring into the adhesive.
2. Where chemicals used for cleaning agents remove plasticizers from PVC e.g. gel cleaners.

Cure

Remove the existing flooring and replace with new. Any residual adhesive to be cleaned thoroughly before a new one is laid.

(ii) Tile staining

Staining of tiles when new is generally an indicative of bedding cement or jointing cement deposits or smears on the surface of the tiles. Where jointing material, its logical therefore causes the stain that the joint itself may be attacked. Seek specialist advice where substantial staining is involved. White or grey cement stains are best removed with dilute solution (5%) of hydrochloric acid (provided that the joints are not cement based also applied by brush, followed by washing and scrubbing with water and mild detergents. Stubborn areas should be re treated.

F. SHEET FLOORING

(i) Parallel ridging.

Ridging in sheet occurs in sheet flooring laid on timber boards.

Symptoms

Regular parallel ridges form on the surface of the sheet flooring, which worsen over a period of a few weeks. The defect usually occurs soon after the floor is constructed, but can occur if the heating of a building is improved.

Diagnosis

When the boards are revealed, they will be seen to have curled up at the edges and probably have greater moisture content on the underside than the top.

All fixings should be checked for tightness and replaced as necessary.

(ii) General loss of adhesion

This defect occurs most commonly on concrete ground floors.

Symptoms

The sheet flooring loses adhesion with the slab. This may be localized causing surface blistering or rippling or more generalized failure over large areas.

Diagnosis

There are two possible causes of such defects; failure of adhesive or damp penetration.

Loss of adhesion may be caused by entrapped solvent contained in the adhesive. The most probable cause of failure is moisture movement. Excessive use of cleaning water which is allowed to stand on the surface will also increase the risk of damage.

G. FLOORING GENERALLY.

(i) Indentation

Symptoms

These are self evidence as depressions on the surface under the legs of furniture where they are kept for a very long time at the same place.

May also be seen in areas of the floors subjected to heavy foot traffic; those caused by narrow shoe heels.

Diagnosis

Indentation occurs when concentrated loads are applied to the finish for an appreciable length of time; frequently the case with furniture. If the correct finish is not chosen to cope with these loads, indentation will occur and will be further magnified if the sub layer is not of sufficient density to resist the applied loads itself.

Cure

It's not advisable to fill the depressions in the surface. Further indentation by the furniture could be prevented by using spreader caps under the legs.

(iii) Slipping

(iv)

Symptoms

The finish surface becomes very slippery when wet with the grout between the tiles eroding.

Diagnosis

Some finishes are intrinsically slippery to certain types of footwear while others are only slippery when wet. Synthetic rubber or similar foot wear, whilst providing good water resistance, may slip easily on wet floors. Slipperiness could be prevented by use of tiles provided with dimples or other raised patterns e.g. Studs.

(iii) Uneven wear

Occurs in areas subjected to heavy traffic and where the concentration of traffic occurs such as corridors, stair landings etc.

Symptoms

Discernible wear pattern is generated on the floor finish where people are concentrated at a particular line of travel. It's easily noticeable in passageways and corners of entrances into rooms. It's often accompanied by changes in colour of the worn out areas.

Diagnosis

Traffic is often guided along the paths, by doors, narrow corridors etc. Under these circumstances the selected floor finish may have sufficient resistance to wear or the workmanship in laying may not have produced the expected wear characteristics.

Cure

The cheapest remedial action is to replace only the worn out areas with new flooring. This is easy with tiles but in sheet, it's difficult to effect the same remedy and it's preferable to wait till the whole floor wears so that it's economical to replace the whole floor area with tiles. The replaced portion must match the existing surrounding area.

Occasionally a new finish could be laid on top if the worn out but care must be taken to ensure that the worn out areas provide a satisfactory base for the new finish and that they level up.

(iv) Disfiguration pattern.

This defect occurs with the floor finishes that have been stuck down on a base generally of concrete.

Symptoms

The disfiguration shows the pattern formed when combing the adhesive prior to the laying of the sheets or the tiles. It's often resistant to cleaning.

Diagnosis

The pattern is that of adhesive prior to the laying of floor finish on it. The pattern could be an indication that the adhesive became hardened before the finish was laid. The finish then rests on tops of the edges of ridges produced by the combing of the adhesive instead of flattening them under the pressure.

The high spots which are generally in the form of covered parallel lines are only marginally higher than the remainder of the finish, but they become preferentially worn and liable to scratches. Dirt collects on the scratches and produces patterns which are very difficult to remove.

Cure

A change in the method and frequency of cleaning the floor may result into some improvement; however, if the result is aesthetically not acceptable, the only cure is to replace the finish.

(v) Peeling

This is where the floor pulls away from the floor surface in large flakes or strips. It's caused by poor adhesion related to alkalis residues.

(vi) Crazing

A small irregular or breaking in a floor finish film or coating after it has dried on a surface. These cracks allow dirt and soil to penetrate. Crazing can result into deterioration, chalking, dulling and rapid walk-off of the finish. Surface crazing is more common in cementitious monolithics than in resin toppings, which points the way to evaporation. Crazing through cementitious monolithic toppings, though resembling surface crazing in concrete, is more and generally extends through to substrate. In the initial stages the cracks very small' usually 0.10mm

Cure

In dry areas there should little effect on the performance, whilst on ht e other areas it may be necessary to overcoat with an elastic floor finish such as polyurethanes or, as last resort, remove and replace the entire defective floor finishing with resin based floor system with more elasticity.

vii) Tile staining

Cattel D, 1983, says that the staining of tiles while new is generally an indication of bedding cement or jointing cement deposits or smears on the tile surface. Where the stain is caused by jointing material, its logical therefore that the joint itself may be attacked. Seek specialist advice where substantial staining is involved.

White /grey stains are best removed with dilute solution, (5%) hydrochloric acid (provided the joints are not cement based.) applied by brush, followed by washing and scrubbing with water and mild detergents.

Stubborn areas should be re treated.

The various floor defects can be summarized in a table form as shown below; both to the structure and to the finishes themselves.

Deflection, cracking and collapse, dampness

Element	Symptom	Location	Materials
Suspended floor	Excessive deflection	Between supports	RC. Concrete
Ground floor slab	Distortion and cracking	Random	Concrete on h/core
Ground floor slab	Cracking and lifting	Whole area	Concrete on h/core
Ground floor slab	Cracking of asphalt	Day work/bay joins of concrete.	Asphalt on concrete
Suspended floor	Loss of strength and Stiffness.	Damp areas	Chip board
Suspended floor	Reduced strength	Notched and drilled joists.	Timber.
Suspended floor	Decay/rot	Ground floors	Timber
Solid Ground floor slab	Occasional dampness	On surface mainly at Perimeters	Concrete
Solid Ground floor slab	Persistent dampness	Whole area	Concrete

Above. Table 2.30. Defects on the floor structure Source BRE, 1989, Page 262.

2.40 FLOOR FINISHES

Deterioration, cracking, wear and dampness.

Element	Symptom	Location	Materials
Floor screed	Hollowness, lifting, curling	Any location	Sand/cement
Floor screed	Cracking and breaking up	Any location	Sand/cement
Concrete floor And finish	Disintegration	Mainly in industrial Buildings	Concrete plus finish
Dense Concrete Floor Finish	Cracking and curling	Any location	Granolithic and terrazzo
Floor Finish	Surface dusting	Trafficked areas	Granolithic
Floor Finish	Disintegration	Damp areas	Magnesium oxychloride
Floor coating	Breaking up, lifting	Vehicle bays	Two-pack epoxy paint
Floor coating	Blistering	Hygienic area	Epoxy resin on granolithic
Sheet flooring	Ridges at board joints	Any location	Linoleum on timber boards
Block flooring	Lifting or arching	Any location	Woodblocks
Tile flooring	Lifting or arching	Any location	Clay tiles
Tile flooring	Lifting, edge deterioration	Any location	Thermoplastic and (PVC) Vinyl tiles
Sheet flooring	Loss of adhesion	Solid ground floors	Thermoplastic and (PVC) On concrete

TABLE 2.40 DEFECTS ON FLOOR FINISHES CT'D.

Deterioration, cracking, wear and dampness

Element	Symptom	Location	Materials
Tile flooring	Cracking uplifting And slippery surface	Industrial kitchen	Ceramic tiles on screed
Tile or sheet flooring	Surface indentation	Any location	Linoleum, PVC, Vinyl, etc.
Tile or sheet flooring	Disfiguration pattern	Any location	Linoleum, PVC, Vinyl, etc.
Floor covering	Uneven wear	Heavily trafficked areas	Sheet or tile flooring.
Tile flooring	Shrinkage	Frequently washed Areas	PVC Tiles.
Floor finishing	Disfiguration surface marks	Any location	Sheet or tile flooring.
Floor finish	Sweating	Surface	Magnesium oxychloride

Above. Figure 2.40. Defects on the floor finishes. Source BRE, 1989, Page 262-3.

CHAPTER THREE

3.0 METHODOLOGY

Overview

This section of the research study describes the procedure followed in sourcing and conducting the study. The field study was carried out between May 2004 and June 2004.

3.10 THE DESCRIPTION OF THE STUDY AREA AND POPULATION

3.11 Study area

The study is designed to cover two of the public universities viz university of Nairobi and Kenyatta university. The two universities were chosen subject to constraints in time and finances and proximity reasons. JKUAT university was eliminated due to the foreseen impossibility in data collection given the respondents (students) are out of the institution during the study period. Other public universities were eliminated on the basis of proximity problems.

The study at the University of Nairobi is to be in main campus whilst in Kenyatta it's to encompass the entire university.

3.12 Population

The population under study is the entirety of students' hostels in the two areas described above. The total number of students' hostels forming the population under study is eighty six (86); thirty from Nairobi and fifty-six from Kenyatta University. Thus the sampling frame consists of the following observational units;

University Of Nairobi, Main campus;

Has a total number of thirty, (30) hostels namely;

Halls 1 to 13; Prefabs1 to 10; Box A, B & C; Stella Awinja; Mamlaka A& B; and Stat House Road Hostel.

Kenyatta University;

Kenyatta University has fifty-six hostels and is divided into three zones viz; Eastern, Western and Nyayo zones. The first two are the oldest hostels having been acquired from the Army where they were used as Army barracks. They were first used in the Teachers Development Education, TED, before eventually being transformed into a constituent college of university of Nairobi, 1972 and finally to a fully-fledged university in 1985.

The various halls under each zone are as follows;

Eastern zone;

Of these hostels, the older ones were acquired from the army and have similar characteristics as design, shape and finishes, here considered floor finishes.

Old Menengai hostels, 1, 2, 2B, 3 4 and 5

Mfumbiro hostels, 1, 2, 2B, 3 &4.

Nyandarua hostels, 1, 2, 2B, 3, & 4

The new ones put later include the following;

New Menengai hostels 1-5.

New Aberdares hostels, 1-4.

Old Menengai 5B.

Western zone

The older ones were acquired from the army and have similar characteristics as design, shape and finishes, here considered floor finishes. They include;

Lukenya hostels, 1, 2, 2B, 3, &4

Usambara hostels, 1 - 4

Longonot hostels 1 - 5

Old Rwenzori hostel

The new ones put later include the following;

New Rwenzori hostels 1 - 10

Ngong hills hostel

Kilimambogo hostel.

Nyayo zone

These are the most recent set of hostels built in Kenyatta University having been put up in 1990. They are;

Nyayo 1 – Nyayo 4 all built in similar, Z-shaped design with the same floor finishes applied.

3.20 SAMPLING TECHNIQUES AND SAMPLE SIZE

3.21 Sampling techniques

The techniques used in arriving at the representative samples of the hostels are simple random sampling and systemic random sampling.

For halls 1 to 13, simple random sampling for Eight (8) halls out of 13 was done. Five (5) hostels of the Prefabs 1 to 10 were obtained through systemic random sampling for every second hall starting with prefab one.

The sample thus consists of the following hostels as the selected observational units:

Halls 1, 2, 4, 5, 6, 9, 12, &13; prefabs 1, 3, 5, 7, &9; Mamlaka A and B, and state house hostel from main campus, University of Nairobi, AND,

In Kenyatta University, the population (Hostels) was first stratified into three zones before a simple random sampling was done. The following hostels were then selected for study after the sample for both old and new hostels;

From **Eastern zone**- Nyandarua hostels and Mfumbiro hostels

From **Western zone**- Rwenzori hostels and Ngong hills hostel.

From **Nyayo zone**- Nyayo 2 and Nyayo 4 Halls.

From the sample above, both the new and old hostels were represented as;

New hostels- Nyayo hostels, new Rwenzori Kilimambogo and Ngong hills hostels.

Old hostels- Nyandarua and Mfumbiro hostels.

The total number of hostels selected as a sampling frame is thus 62 out of 86, representing 72.2% of the total population.

3.30 DATA COLLECTION INSTRUMENTS

The data collection instruments for the study include Questionnaires, interview schedules and observational forms/tables.

Questionnaires; (See appendix 1 & Appendix 2) are of two types viz; those to be administered to the students cum occupants and those to be administered to the officers in charge of the halls of residence.

Observational forms; (See appendix 3) these will be personally used for direct observation as a check list especially with respect to the data on the common spaces as corridors, stairs, common rooms and wet areas. This will be for entering data directly observed and measured.

Interview schedules; to be administered to those involved in direct and actual cleaning (cleaners) of the finishes and to the officers in charge of the halls. Basically, the questionnaires are also to be used as the interview schedules.

Physical traces; this involves photographing the various finishes in the various spaces to indicate the extent of deterioration and types of defects. See plates.

3.40 DATA COLLECTION PROCEDURES;

3.41 Questionnaires administration;

The questionnaires are to be administered/served to occupants of randomly selected rooms. These are to source data on the various types and extent of defects in the individual students' rooms.

3.42 Direct observation;

Additional information is to be gotten by direct observation of the condition and the situation of the flooring materials. This would be through observation, measurement and recording of such data into a pre designed observational forms. Also in use would be the Physical traces method where various defect are to photographed for more detailed scrutiny and evaluation (See Appendix 3).

3.43 Interviews and note taking;

Interviews are to be carried out with the following groups of people:

The actual cleaners as sweepers to establish the frequencies of and types of cleaning to such finishes.
The students, who are the actual users of the materials under study, on their views pertaining to the status of the same.
Halls officers who are in charge of the daily running of the hostels and would be in a better position to provide the necessary records pertaining to the required data.

3.50 DATA ANALYSIS

The data collected by the above named methods, being both qualitative and quantitative will be analysed mainly using the types of descriptive statistics measures of central tendency namely;

(1) Mean: this is where the various responses are evaluated by calculating the averages/mean of the responses given.

(2) Percentiles: various responses given are then described by calculating the percentages of responses in each choice, where a variety of options are given.

(3) Mode: this is used to describe the response options which are given by the majority of the respondents.

(4) Range: this is used in describing the various extremities of the responses given.

(5) Standard deviations: used in analysis of the data's cohesiveness.

(6) Relationships: this is basically used to investigate the consistencies on the answers given on questions which are correlated, for example, question on the conditions of finishes descriptively, (using choices- v. poor to v. good) and the same quantitatively, (using a scale of **1** to **10**).

The preliminary analysis is done using a sheet, the response evaluation sheet, See appendix 4.

The analysis

As was stated earlier in chapter one, the study will look at the finishes with respect to the space usage, or per each room/location, the analysis here groups and analyses the finishes as per their respective locations. The researcher observed virtually the conditions in all the halls of residents from the population under study, but 72.2% of these are documented. As Gay says inn his book 'Research competencies for analysis and application' a response of 70% and above gives a strong basis for data analysis and drawing of conclusions. Seventy two percent (72.2%) of the hostels

served with questionnaires, duly filled and returned, would thus form a strong basis for data analysis and conclusions.

The data collected from the afore said persons through questionnaires, direct observational tables and by way of interview schedules will be presented by way of description of responses, table presentation and percentages and ranges. The halls are each grouped into categories for purposes of management and each group is under a Halls officer. All the Halls officers were interviewed and/or administered to questionnaires which were all duly filled and returned.

Case studies.

The case studies were taken from two public universities viz Nairobi and Kenyatta universities. From **Nairobi's main campus** the following samples were studied and their analysis is as follows;

3.5.1 LOWER STATE HOUSE ROADS HOSTELS.

This comprises halls 1, 2,3,10, 11 and Lower state house road hostel. In all these hostels, there has not been any regular maintenance except for the mopping, with soapless detergents and sweeping by the students. This, they normally carry out within a period of two to three weeks. There is as well no clearly defined modes of carrying out inspection for defects and the monetary allocation is hardly enough for this purpose. The only repairs, which are also seldom, done are the replacements of light tubes and sockets.

3.5.11 HALLS ONE AND TWO

These halls were built in 1959 with the finishes they still have today. This was as shown in the proposed detailed drawings from the Clerk Of Works Office.

Rooms

The rooms in these hostels are finished in PVC tiles of sizes 150mmx150mmx2mm thick. The various defects noticed on the finishes include mass lifting of the tiles, tiles peeling off the bed with some rooms literally having no original finishes as can be seen from some respondent's answer that

there is no finish on his floor. The surface of the screed left without PVC are also showing signs of pitting, meaning that the state has existed for a very long time.

The condition of the floor finishes is ranging between Fair and Very Poor with most of them having very poor condition.
The rating is estimated at 2.46, very poor rate, meaning that the deterioration extent is 75.4%. This also means that on average it's only 24.6% of the floor is covered by the PVC finish, but in some rooms there is literally no PVC on the floors.

Entrance

The entrances to these halls are finishes in coloured cement screed and are having mild discolouration and general degradation problem.

Corridors

The finishes used in these areas are PVC and Rubber tiles in hall one and exclusively PVC tiles in hall two. The various defects observed in these finishes include; Mass peeling of the tiles and general deterioration, with the condition being worse, the performance condition being estimated at only 30%.

Common rooms

This is the TV room which is finished in coloured cement sand screed and is still in a fair/ average condition. The various defects on this finish are minor discolouration, cracks and screed pitting.

Washrooms

Are also finished in coloured cement sand screed which suffer from slipping and general deterioration, but the condition is still generally fair with an estimated deterioration rate of 50%.

Offices

The offices are made of PVC tiles which are in good state though some tiles suffer edge breakages and peeling off the bed. The extent is 30% deterioration.

Stairs

The stairs are of cement sand screed still in fair/average condition. It has minor cracks and discolouration with deterioration of 40%.

3.5.12 LOWER STATE HOUSE ROAD HOSTEL, (HALL 15)

Rooms

The rooms are finished in timber parquet laid in herringbone pattern in ground floor while in first floor the finish used is PVC tiles. There have not been replacements of the parquet and tiles thus the condition is not that good today. This lack of maintenance has resulted into the parquet and tiles lifting, peeling off, tile staining and dicolouration.

The floor finishes are generally in fair state. The performance rating is 4.69, fair, but slightly below average. This means the standards have deteriorated by 53.1 percent.

Corridors

The corridors in ground floor are of parquet and are suffering from uneven wear due to traffic hence discolouration, (See plate 4). They are tending to 'poor' state with deterioration percentage of 60. In the first floor corridors the finishes are PVC tiles which suffer lifting defects due to adhesive failure under high traffic.

Washrooms

One side is finished in screed which suffers immensely from the general deterioration, degradation and pitting. The condition here is just poor with a rating of 25% performance standards. The other side containing the water closets and bath rooms are finished in terrazzo which have no noticeable defects thus are still in good state. Their performance standards can be estimated at 75 percent.

Common rooms

Is of parquet that suffers general degradation and is estimated to be having 60 percent performance standards.

Offices

Are finished in PVC tiles which have defects as of few tiles peeling off the bed. The deterioration extent is estimated to be 50 percent.

Stairs

The stairs are finished in terrazzo and have no major defects observed thus are in good condition and can be rated at 30 percent deterioration.

3.5.2 UPPER STATE HOUSEROAD HOSTELS

This comprises halls Four, (4), built in 1962, - Nine,(9), 1968 and as in the above there is no defined mode for carrying out the inspections of defects. Further to this, the money allocated for this function is hardly enough for maintenance works hence it's used in the replacement of other requirements of the hostel as that of tubes and electric sockets. Here there was some replacement of tiles in hall four mainly in the TV room; otherwise the only maintenance available is the regular cleaning of the finishes through mopping and sweeping by the students as in the above.

3.5.21 HALL 4, NYERERE.

Rooms

The floors are finished in 250x250x2mm thick PVC tiles. Noticed defects are the tiles peeling and lifting from the beds, staining and discolouration of the tiles. The resulting beds are also suffering from pitting in some rooms.

However the condition of the finishes in such rooms range from good to poor with greater number being of Fair/average condition. The performance grade is 5.15, average/fair condition, meaning the finishes can still perform up to 50%.

Entrance

The entrance is also finished in PVC as the rooms which are staining, have scratches and indentations, but still in relatively fair to good state. The performance standards are above average at 60%.

Corridors

The finishes conditions and defects are like those of the entrance.

Washrooms

The washrooms are finished in Granolithic paving which suffer from slipping and general degradation, but are still in good shape on average

Common space

The common space is the TV room which were originally finished in timber parquet tiles which were then replaced with PVC tiles. The tiles are in good state with very little noticeable defects like scratches and disfiguration on the finish.

Offices

The offices are of PVC tiles with not much of the noticeable defects.

The finishes are thus still in a Fair/average condition.

Stairs

Are finished in grano paving with minor slipping especially at the landings, but the condition is still fair.

3.5.22 HALLS FIVE (ELGON), AND HALL SIX, 1964.

Rooms

The rooms of these halls are finished in cement sand screed with defects as screed spitting and discolouration in many rooms, but still there are some rooms which do not have noticeable defects at all.

The condition of these finishes range from poor to good, but majority fall in the good and average category. The average performance rating is 5.432, (good).

Entrance

The finishes used are cement/sand screed and granolithic paving. Both are suffering from slipping and mild cracks. On average the state is fair having suffered respectively 50% and 40% for halls five and six.

Corridors

Those of hall five are similar in nature and extent as those above. Hall six has grano and PVC tiles in its Corridors, though a small portion. They are in good state and unlike the entrance and have suffered 30% deterioration.

Washrooms

Hall five has cement sand screed in its washrooms which suffer the problems of slipping and degradation of the screed. Here the deterioration is worse than in corridors and is estimated at 65%. Hall six has granolithic paving in its washrooms and has very negligible amount of defects, as the deterioration is 30%.

Common room

Covered under this are the TV rooms. That of hall five is cement- sand screed suffering from same defects as above with a deterioration extent of 60%. Hall six has PVC tiles as its floor finishes which suffer from disfiguration and few tiles lifting and peeling off. Grading of deterioration rate is 40%.

Offices

Offices in both halls are of cement sand screed suffering general deterioration and the condition is average/fair. Deterioration rate is 50% in hall five while it's only 20% in hall six.

Stairs

Stairs in hall five are finished in cement sand screed and are seen to be slipping to 50% deterioration whilst hall six's stairs are finished in granolithic paving with a deterioration rate of 40%.

3.5.23 HALL NINE, (TOM MBOYA), 1968.

Rooms

The finishes here are PVC tiles of sizes 150x150x2mm thick.

As a consequence of lack of maintenance, the general status of the finishes has gone down and is ranging between poor and very poor with the 'poor' state taking the greater proportion. The performance rating is 3.413, (poor).

Entrance

The entrance is of granolithic paving, which show defects as minor cracks, and slipping. The grano is still in good shape and is rated as average.

Corridors

These are of PVC tiles 150mmx150mmx 2mm thick, which suffer edge breakages, lifting and peeling off the bed. Generally their corridors have lost 60% of their performance capacity

Washrooms

Washrooms are finished in granolithic paving which only show defects of general deterioration and have an average of condition, meaning, the deterioration has reached 50%.

Common rooms.

Hall nine has one common space, the TV Room, which is finished in parquet suffering the general degradation with a few blocks lifting. The state is, however still fair/average with a deterioration extent of 60%, see plate 12

Offices

The offices are finished both in coloured grano and PVC tiles. The tiles show defects of edge breakages whilst the grano shows no noticeable signs of defects. The conditions of finishes are still good; having 60% percent performance standards.

Stairs

Stairs are finished in granolithic paving with not much noticeable defects and the standards are as in the offices.

3.5.3 MAMLAKA SMU UNIT

This unit has halls as Mamlaka A and B and Prefabs 1-10 hostels. Here, according the halls officer's records, the maintenance done is corrective where the maintenance is done on and when noticed, but still, the money given is far below the maintenance requirement. This then leaves the finishes

without any consideration for allocation for maintenance funds. The only major maintenance which can be traced for these halls are on the maintenance carpentry works. Further to this, there are no laid down procedures for analysis of defects and their solutions.

3.5.31 MAMLAKA HOSTELS

Rooms

The rooms in Mamlaka hostels have 150x 150 x2mm thick PVC tiles as the finishes. The finishes have defects such as peeling off the bed, discolouration, staining and pitting of the concrete in their respective order of intensity.

The general condition of the finishes in these rooms range between 'good' and 'poor' with majority of the rooms having the "fair/average" condition. The performance grading is 5.30 out of 10.

Entrance

This of terrazzo and concrete paving blocks that only show minor cracks and are in good order with the deterioration grade estimated to be at 40%.

Corridors

The corridors are also of terrazzo paving having no much noticeable amount of defects and here the grading is estimated to be 30%.

Washrooms

Are finished in terrazzo and are similar in characteristics of nature and deterioration as in corridors.

Common room

The common rooms here are the TV rooms, which have the same description as above.

Offices

Are of 150x150x2mm thick PVC tiles. Of these some tiles are lifting, but the condition is 'fair'.

Stairs

he stairs are finished in terrazzo which has negligible observable defects. The condition is rated at 0% deterioration, meaning the tiles still retain 70% of their performance standards.

.5.32 PREFABRICATED BUILDINGS

Rooms

he rooms are finished in coloured cement screed which basically suffer from discolouration and creed pitting.

ome few maintenance works of filling the cracks have been carried out. Besides this, there is egular cleaning by mopping and sweeping of the rooms.

he majority of finishes are in 'fair' – 'good' state with a rating of 5.772, good.

Corridors

re also of cement sand screeds having defects as minor cracks, pitting and uneven ear/discolouration of the screed. The condition is as above in rooms.

Washrooms

re of the same finish, but besides the above they also suffer from slipping and degradation with a ating of 70 percent deterioration. See plate10.

3.5.4 WOMEN'S HALLS UNIT

his unit has halls as Box, Stella Awinja and halls 12 and 13. The records show that the general nspections are done every year when the students are out of session, however, there is no criterion sed for inspecting and remedying the defects. The maintenance funds are released in consolidation vith the other monies for the needs of the halls, but the other needs are taken care of at the expense f the finishes due to the inadequacies of the funds.

The tiles in the corridors of Box, wings A & B were replaced 2-5 years ago as the latest repairs in hese halls for floor finishes, otherwise there are no other maintenance done except for those of egular sweeping and mopping by the students after every 2-3 weeks.

3.5.41 HALLS 12, (R. NGALA) AND 13, (K. NKHURUMA)

Rooms

Both of these halls were built in 1972 and were finished in PVC tiles as they are today. The general conditions of the finishes can be described as ranging between fair to poor. The condition rating being 4.45, meaning the finishes can achieve only approximately 40% performance standards. See plate 5.

Corridors

Hall 13 has granolithic paving on its corridors whilst hall1 2 has PVC tiles. The grano is slipping when wet, but performance standard of 65% is still achievable. The PVC tiles in hall 12 hostel have peeled off the bed in mass and are in a poor state that requires agent attention. They have a deterioration extent of 65%, meaning the said percentage of tiles' performance has been lost.

Common room

The common rooms in hall 13 are the TV room and photocopy room, both of which are finished in PVC and are highly deteriorated, with most of the tiles peeled off to a deterioration grade of 70%, see plate 13. Hall 12 TV room, on the other hand is finished in timber parquet which show signs of dusting and general degradation, but are still in fair/average state. See plate12.

Offices

Are in PVC tiles and have defects as edge breakages with a deterioration of only 0.30.

Washrooms

The rooms of both the halls are finished in granolithic paving having defects of slipping when wet and deterioration is 0.40 in these halls.

Entrance

That to hall 12 is of engineering bricks whilst that to hall 13 is of grano. Both the situations show a marked resistance to effects of abrasion and heavy traffic. They can be seen to have minor cracks with a grade estimated at 45% deterioration or 55% performance standards.

3.5.42 WOMEN'S HALL, (BOX, HALL 20), 1967.

Rooms

This hall was built in 1967 and has its rooms finished in PVC, 200x 200x2mm thick. The tiles as a consequence have such defects as lifting and arching, discolouration and tile staining. The conditions of the rooms are poor with a deterioration grade of 4.40; meaning 44% of the original performance standards has been lost.

Entrance

The entrance is constructed of terrazzo paving which are still in relatively good condition only of minor cracks.

The sweepers do clean them regularly by using Omo detergents and sweeping and have a deterioration grade of 20 percent.

Corridors

Corridors in wings A & B are also of terrazzo paving and PVC tiles still in good shape. Wing C is of PVC but, due to non replacement of the tiles, they are not in good condition as a great number of them have peeled off the bed and edge breakages with a deterioration grade estimated at 70 percent. In the contrary the finishes in wings A 7 B have only a grade 30 percent.

Washrooms

These are or terrazzo finishes which of good conditions.

Common rooms

These are TV room and saloon, which are respectively finished in PVC and screed. The screed is still in good condition with no major noticeable defects whilst the tiles are suffering defects as peeling off the beds and edge breakages.

Offices

Are finished in PVC tiles which are still in good condition with few noticeable defects.

Stairs

re of terrazzo having god condition with no appreciable amounts of defects.

rom Kenyatta University, the hostels are categorized into three zones namely Eastern, Western and yayo zones. The following hostels were studied and the following results were found out;

3.5.5 NYAYO ZONE

yayo zone has got four, (4) halls viz Nyayo 1-4 built up in 1990.
ike the rest of the hostels there exists no defined mode or model for inspection and remedying of e various defects found in these hostels, but there is a rudimentary method entailing of moving om hall to hall, without any records kept to show the procedure and methodology.

he maintenance funds are not enough for the intended purposes hence the finishes are always the ctim of being sacrificed at the expense of the others as replacement of sockets and lighting tubes. he floors are thus not maintained except by the regular mopping and sweeping by the students. The cords of the halls officer show the last time these floors were repaired was when constructed!

.5.51 NYAYO ONE AND NYAYO TWO HALLS

Rooms

oth the halls studied are finished in PVC tiles 150x150x2mm thick and are suffering from various efects namely; lifting/arching, and peeling off the bed, and staining of the tiles. The double-Decker eds used in these hostels are found to cause the tile breakages under the legs of beds. See plate 6. uch a happening is not observed in Nairobi university, given use of double Decker is only limited prefabs with screed finishes.

he halls are generally of 'fair' rating with an average condition rating of 5.078 out of 10. The dies' halls (Nyayo 1&2) are in poorer state. The floors generally have a condition ranging from ood to very poor, but the majority falls within the 'fair' state.

Entrance

Are finished in grano which are slipping when wet and minor dusting. The condition is still so good with about 30 percent deterioration.

Corridors

Are finished in PVC tiles which are showing signs of defects as edge degradation and peeling off the base. The state of deterioration is fair with a rating of 50% and 60% respectively for Nyayo 4 and Nyayo 2.

Washrooms

Washrooms are finished in granolithic paving which show similar characteristics as those in the entrance.

Common spaces

These halls have two types of common spaces namely the TV rooms and Reading rooms both of which are finished in PVC tiles showing defects as Mass peeling off the bed, with a respective condition rating of 70% and 75% deterioration. See plate7.

Offices

Are of PVC tiles and cement sand screed which are still relatively in good condition with negligible noticeable defects.

Stairs

The stairs are of grano which are slipping especially at the landing areas. However, the condition is still good with performance standard between 65 and 70 percent.

3.5.6 WESTERN ZONE.

The hostels in this zone are as described in population. The hostels officers have no defined procedure for diagnosis and remedying of these floor finishes defects.

Like in Nairobi University, there are very limited funds which is usually given in consolidation with other halls' needs hence the finishes are sacrificed.

The students do carry out a 2-3 weeks routine maintenance by moping and sweeping of these floors.

3.5.61 NGONG HILLS HALL

Rooms

The finishes in this hostel are 200x200x2mm thick PVC tiles. The tiles have defects as discolouration, staining and lifting and peeling off the bed. In 100 percent of the sampled rooms, the occupants indicated that tiles suffer the problem of lifting and peeling off bed. The condition on these finishes range from average to poor with the former being of greater percentage. The performance rating is 4.05meaning the floors are in poor state.

Entrance

This is finished in finishes as above and are lifting and peeling off the bed due to adhesive failure under heavy traffic. The general state is poor with 65% deterioration rating.

Corridors

Are also finished in PVC tiles with deterioration percentage of 70, suffering from lifting and peeling of the tiles off their beds. See plate 9.

Washrooms

Washrooms are finished in granolithic paving which are still in a good state having a performance standard of 60 percent. There are negligible noticeable defects.

Common space

This is the TV room with mass peeling of tiles under the influence of pressure of chairs. Here the performance standards have deteriorated to 45 percent.

Offices

Are in PVC finishes with the tiles still in good shape and performance standards of 65 percent, having noticeable defects as edge breakages.

Stairs

These are finished in granolithic paving without major noticeable defects making it be rated at 40 percent deterioration.

3.5.62 NEW RUWENZORI HOSTELS.

Rooms

These are a representative of those halls that were put up in Kenyatta University in the early 1980s. The others with which they were constructed include, New Menengai and new Aberdares hostels all of which were constructed in the same design, shape and finishes used (for floors) and were built in the duration as one project.

The finishes use here are cement sand screed which suffer from myriad of defects as pitting, staining and discolouration, and minor cracks. The general conditions of these floors range between fair and poor with the majority of them in the 'poor' state category. The rating grade is estimated at 4.62, (fair condition).

Corridors

These are made of cement/sand finishes which suffer the defect as pitting, slipping and degradation. Their deterioration grade is 0.50, average.

Washrooms

The washrooms are also constructed of cement sand screed which has defects similar as those in the corridors, but the degradation is worse and very severe in the bathrooms, see plate 10. The finishes have a rating of 60% deterioration.

Common room

The common areas here are the TV rooms under which these hostels operate. The finishes in these rooms have similar characteristics as those in the corridors above, meaning the deterioration rating is 55 percent.

Offices

The offices here are separate from the hostels and are finished in PVC tiles which experience edge deterioration, though the tiles are still in good state of performance. The grade is 60% deterioration.

3.5.63 KILIMAMBOGO HOSTEL

Rooms

Is finished in 200x200x2mm thick PVC tiles. They suffer from mass lifting of tiles off the bed and edge breakages. The condition is still fair with the performance rating is 50 percent.

Entrance

The entrance is constructed of tiles as described above and have few defects as general deterioration of the tiles. The condition is still okay with a grading of 40% deterioration.

Corridors

Corridors have materials as above, though the defects here are mass lifting and peeling of the tiles particularly those at the landings of staircase, See plate 8. The rating is 65% deterioration.

Washrooms

Are constructed of granolithic paving which does not have appreciable defects and the deterioration extent is 40 percent.

Offices

Are finished in PVC tiles as the above and experience very little deterioration of 40%.

Staircase

The stairs are granolithic paving finished having no defined defects other than the general deterioration. The deterioration rating is 40 percent.

3.5.7 EASTERN ZONE

The zone has halls as mentioned under the population description and the situation here is like in the western zone described above.

3.5.71 NYANDARUA HOSTELS

Rooms

These hostels were acquired from the military where they were used as Army barracks before the institution was handed over to the Kenya government by the British government in 1965. There are many other hostels with which they were acquired and then given various names as Usambara, Longonot, Lukenya, Ruwenzori, Mfumbiro and Menengai.

The floor finishes here are terrazzo tiles though the occupants have described them as cement sand screed. The various defects here in their respective order of intensity include discolouration, pitting and staining. The floor grade is 5.66, (Fairly good), meaning hitherto, the performance standards still stand at 56.7%.

Corridors

The corridors to these buildings are more like pavements and are finished in coloured paving blocks which only show minor cracks and are still in good state estimated to be 40% deterioration, meaning until today they have retained 60% 0f their performance standards.

Common rooms

These are the TV rooms also finished in terrazzo which only show minor cracks. See plate 11. The condition is as in above.

Washrooms

These are finished in finishes as described for the above space/location. See plate 11.

Offices

The offices are also of terrazzo paving with negligible noticeable defects and the deterioration extent estimated at 30 percent.

4.00 CHAPTER FOUR.

RESULTS.

4.10 Introduction

The floor finishes for various buildings were evaluated by way of direct observational sheets, Questionnaires and interview schedules. The direct observational forms were for evaluating the locations other than the rooms, See Appendix 3 whilst the Questionnaires were for the students' rooms, See Appendices 1&2.

4.20 The Locational application of finishes.

The various locations in a typical hostel which were considered and consequently evaluated include; Rooms, Entrances, Corridors, Stairs Washrooms, Offices and Common Rooms, each of which require critical evaluation of the finishes to be used.

From these, the following types of finishes were established to have been used in the these hostels in various locations namely;

PVC tiles,- which are used in the rooms, entrances, offices and corridors.

Cement sand screed, - used in all the locations named above.

Granolithic paving, - these have been used stairs, corridors, washrooms, common spaces and entrances.

Terrazzo, - used in places as above for grano.

Rubber tiles, - corridors of hall one.

Timber parquet, - this are used as finishes in common spaces, rooms, entrance and corridors.

The percentage of usage of various floor finishes in their respective locations can be summarized as per the below table.

FINISHING	Locations and the percentages of Use.						
MATERIALS	Rooms	Offices	Corridor	W/Rooms	Com-Sp	Stairs	Entrance
PVC tiles	75%	75%	47.60%	Non	44.40%	Non	20%
Cem-Sand Screed	17.86%	29%	19%	31.60%	27.80%	20%	26.70%
Rubber tiles	Non	Non	4.80%	Non	Non	Non	Non
Parquet	3.57%	Non	4.80%	Non	16.70%	Non	6.70%
Granolithic paving	Non	Non	9.50%	47.40%	Non	60%	26.70%
Terrazzo paving	3.57%	5%	9.50%	21%	11.10%	20%	13.30%
Eng. Bricks.	Non	Non	4.80%	Non	Non	Non	6.60%

Above Table 4.10, Locational application of finishes. Source Own observation, June 2004.

4.30 Locational performance of finishes.

The above named locations were each observed, examined and evaluated for all the defects and deterioration and consequently performance ratings were then assigned to each with regard to the finish types used for comparisons of their performances. The performance standards were assigned on a scale of 0-10 with 10 being the best possible attainable performance standards.

4.31 ROOMS

The finishes observed gave various performance standards in the rooms as follows.

PVC Tiles

Of the sample surveyed, three-quarters were PVC tiles. In these rooms, the PVC has better aesthetic appeal and is relatively cheaper to install than parquet and terrazzo. JBC Price list, 2004. However, due to lack of maintenance, have suffered myriad of defects ranging from staining to mass lifting off the bed. The condition of the PVC range between 'fair' and 'poor' with the majority or the m in the state ' poor'. The condition in the older halls as halls 1,2 and 3 is worse to the extent that some floors

have virtually no single PVC on them. This explains some of the answers got from these halls saying, they have 'no finishes' on their floors. Refer to plate 3.

In Kenyatta University, it's also established that there is a lot of tiles breaking under the heavier concentrated loading where the tiles under the 'legs' of the beds are broken and peeled off. Refer to plate 3. The students here use double-Decker beds thus exerting too much pressure on the tiles, which the tiles cannot bear.
The tiles are also seen to have deteriorated at faster rates in situations where the occupants do cook directly on these finishes. This was also observed in some halls with the affected tiles burning up or peeling off the bed altogether. Refer to plate 6. This was also confirmed by the halls officers' response to the question on the same where they all indicated that they have noticed tiles peeling off the beds due to cooking by the students. This subjects the tiles to higher intensities of temperatures, which then weaken, and consequently destroys the bonds of the adhesives.

Over 80% of the students, to whom the questionnaires were administered, do cook in their rooms. This compounds the problem. In addition to this, 83% of the students also wash their rooms in harsh detergents like omo, not withstanding the fact that water penetration into the adhesives would loosen and consequently destroy them.
The PVC finishes have an average performance standard in the rooms of 4.404, poor.

Screed -

These comprise 17.86% of the total finish usage in the sample under survey. These are mostly in the older hostels and the prefabs, but have still remained in relatively good condition with 67% of them in fair state whilst 33% are in good state. The performance rating ranges between 5.432 and 5.722, giving an average performance standard of 5.605 in the rooms.

The only defects suffered by these finishes are discolouration, staining and minor pitting. Some rooms have actually been described by the occupants as having no defects on their floor finish.

Timber Parquet

This was observed in few hostels comprising only 3.57% of the total sample frame. These have resisted deterioration agents with only few defects as peeling off the bed and uneven traffic wear. They also lack regular polishing requirement besides lack of maintenance. The parquet is still in a fair condition with a performance standard rating of 4.69 in the rooms.

Terrazzo Tiles

Terrazzo is very expensive in its installation costs, they have live the time. These are used in the former Military houses before they were handed over to the then Kenyatta College and are still in good condition. Even though over four-fifths of the students do cook in their rooms, there are no noticeable defects resulting from such activities. The rating of their performance standards in the rooms is 5.67.

4.32 OFFICES

The offices were finished in various finishes as can be seen from table 4.10 above. Here as well, they showed varied performance standards as described below.

PVC Tiles

The offices finished in PVC surveyed revealed presence of defects such as few cases of minor peeling, edge breakages and deterioration. However, these finishes are in good condition with the performance standards rating of 5.609 in the offices. In certain cases, especially with newer halls, there are no noticeable defects.

Cement Sand Screed.

This comprises 20% of the observed sample frame and have very rare occurrences of defects noticed during the survey, except for minor cracks. The average performance standard of screed in offices is 6.583.

Terrazzo paving

These are used in Kenyatta University's hostels, which were acquired from the military and are of good state. Here, they have a rating of 6.00.

4.33 Corridors

The corridors also showed a marked difference in the rates of finishes deterioration as;

PVC Tiles

47.6% of the corridors under investigations were finished in PVC tiles and here, they showed defects as mass peeling off the bed, especially in older hostels as halls 1,2,12 and Ngong and Kilimambogo hostels. The extent of defects is greater than in the rooms with those tiles at or near the landing being the most affected. Refer to plate 8. Their performance rating in the corridors is as low as 4.35.

Rubber tiles

These are only noticed in hall on of main campus of Nairobi University and are seen to be badly damaged by defects of mass peeling off. Their performance rating is estimated at 3.00.

Cement Sand Screed

Both plain and coloured screeds have been used in these halls. Here, these finishes suffer defects as discolouration of the coloured screed, cracks and pitting. They have a fair performance rating of 4.722.

Timber Parquet

These suffer from discolouration due to heavy traffic wear and a few of them lifting. The standard is rated as poor at 4.00.

Terrazzo paving

These are used Mamlaka halls and have no serious and noticeable defects. They have a good performance rating in corridors of 6.78.

Granolithic paving

Are used in corridors of hall 13 and have similar conditions as those of terrazzo above.

Engineering Bricks

These are observed to be still in good shape with no noticeable deterioration except of the natural degradation. Has a standard of 6.00.

4.34 WASHROOMS

The washrooms are finished in various finishes, which also show performance with different materials as;

Cement Sand Screed

This comprises 31.6% of the sample frame surveyed. The screeds in these locations are found to have various defects as slipping and high degree of degradation, which is pronounced in many hostels in these finishes. Refer to plate 10. Their statuses range between poor and fair with 'poor' state taking greater proportion. The performance rating of screed in washrooms thus is 3.667.

Granolithic paving

Comprises 47.4% of the total sample frame. The finishes are still in relatively in good condition with a performance standard of 5.857. No major defects are noted on these finishes.

Terrazzo paving

These have performance standards in washrooms similar to those in granolithic paving above. Their rating however is 6.70.

4.35 COMMON ROOMS

PVC Tiles

The tiles used for such purposes are found to be highly deteriorated suffering from defects such as mass peeling off the bed due to the concentrated loading under the seats' 'legs'. They have an average performance rating in these common spaces estimated at 4.446, poor.

Cement Sand Screed

These comprise 27.8% of the total and also suffer myriads of defects as discolouration, staining and pitting mainly in the older halls as halls 1 and 2.the average performance standards thus of screed in the common spaces is 4.43, poor.

Terrazzo

The terrazzo usage to the common spaces was very limited, however, the existing ones are in very good state in terms of their performance. They have a rating of 6.50 in common spaces and no noticeable defects are present on these finishes.

Parquet.

Are used mainly in old buildings in main campus and are of average performance standards in common spaces with a rating of 5.00.

4.36 STAIRS

Screed

Only a fifth of the sample frame has their finishes in cement sand screed. They show defects as slipping especially at the landings. They have average performance standards in stairs with a rating of 5.33.

Granolithic paving.

This forms the main stair finish used in the students' hostels, being 60% of the total. Their performance rating in stairs is 5.788, good.

Terrazzo paving

These have very good conditions and have a performance standard of 7.333 in stairs. The only observed defects are minor slipping and cracks.

4.37 ENTRANCES

PVC Tiles

The entrances finished in PVC are found to be 20% of total and have defects as tile breakages, staining and peeling off. The average performance standard is 4.88, fair, which is slightly below the average standards.

Screed

This comprises 26.7% of the total sample frame. The coloured screeds here were found to be suffering from defects as discolouration, staining slipping and generals degradation and deterioration, especially with the older halls.

The condition, however, is still fair on average with a performance standard of 5.25 in the entrances.

Parquet

These were seen to suffer from defects as lifting, uneven footwear and the general degradation. Parquet has a performance standard in entrance of 4.50, poor.

Granolithic paving

Out of the sampled hostels, 26.7% of the finishes used were found to be granolithic paving, which for the edged hostels have defects as minor cracks, slipping and dusting observed in Nyayo hostels of Kenyatta University. However the general performance standards are still very good on average. The performance rating of grano in entrances is 6.20.

Terrazzo paving.

These are used in the entrances of Mamlaka and Box/Women's hostels and comprise 13.3% of the total sample size. They have similar characteristic as those of the grano above. They have a performance standard in the entrances of 6.20.

Engineering bricks

These are used in the entrance of hall 12 of Nairobi University and show no major noticeable defects other than the natural degradation. They have a performance standard of 6.50 in the entrance.

The table below thus summarizes the performance standards ratings of various finishes when used/applied in different locations.

FINISHING	Performance rating when used in: (Locations.)						
MATERIALS.	Rooms	Offices	Corridor	W/Rooms	Com-Sp	Stairs	Entrance
PVC tiles	4.404	5.609	4.350	Non	4.486	Non	4.488
Cem-Sand Screed	5.605	6.583	4.772	3.667	4.43	5.330	5.250
Rubber tiles	Non	Non	3.000	Non	Non	Non	Non
Parquet	4.690	Non	4.000	Non	6.000	Non	4.500
Granolithic paving	Non	Non	7.000	5.857	Non	5.778	6.200
Terrazzo paving	5.670	6.000	7.000	6.700	6.500	7.333	6.200
Eng. Bricks.	Non	Non	6.000	Non	Non	Non	6.500

Table 4.20, Locational performance ratings. Source, Own survey, June 2004.

4.40 Other findings generally.

4.41 Cooking

Of the data collected from cases observed, respondents interviewed and questionnaires administered and duly filled and returned, 87.61% showed that the students cook in their rooms. This was found to cause a lot of damage to the floor finishes given a good number of them put the cooker/heater directly on the finishes. The PVC finishes subjected to this kind of treatment are found to either peel off the bed or burn. See plate 6. The halls officers' responses on this question also affirm that they have noticed floor finishes destroyed due to cooking by the students.

4.42 Maintenance

No maintenance is carried out on these finishes generally. The halls officers' responses indicated that the money for maintenance is given in consolidation with the other halls' needs.

This fund is usually not enough for this purpose and as a result the floor finishes are usually sacrificed at the expense of the others like repair of electric sockets, carpentry and inflorescent light

tubes. Further to this, the responses reveal no clearly established criteria for the inspection of these defects, but instead they do corrective and unplanned maintenance, if any.

4.43 Regular cleaning (students)

The students do carry out the regular maintenance of their rooms by sweeping and mopping with Omo and other detergents. This is the mode of cleaning in all types of finishes despite the fact that certain types of floor finishes are to a given extent affected by such chemicals. The cleaning is mainly done in duration of 2-3 weeks, with a few doing it daily.

4.44 Regular cleaning (workers)

The common spaces are cleaned by the university workers who clean the spaces daily. They use 'Bio clean' detergents for this purpose.

4.45 Conclusion

Over 93% of the students agree that the university is not doing enough in maintaining the facilities especially the floor finishes in both the two universities studied whilst all the halls officers (100%) also re-affirm the same.

CHAPTER FIVE

DISCUSSIONS, CONCLUSIONS AND RECOMMENDATION.

5.10 SUMMARY

In summary, the research was designed to establish the design criteria for a relatively 'maintenance free' floor finishes in various locations of the students' hostels. In pursuit of the above, the study was conducted in two areas viz; Nairobi University's Main campus and Kenyatta University.

The research was conducted through direct observation tables, interview schedules, questionnaires and interviews with the occupants, halls officers, Clerk of Works, COW, Students Welfare Authority, SWA, and Central Accommodation Board, CAB.

The results from the above were then analyzed and represented by use of tables, percentages, ranges, frequencies, photographic plates and descriptions. The results obtained can be summarized as follows;

(a) That after some time,

(i) A particular floor finishing material shows varied rates of performance standards in different locations of the same hostel, but subject to different functional requirements.

(ii) Different finishes show different rates of performance standards when used in the same locations with similar functional requirements.

(iii) Other than the normal wear and tear arising from the normal usage of the, these finishes are affected by various activities, which were not foreseen at the design stage; the effect of each is also not equal in all of them, with some giving in faster whilst others resist and give in only at later years.

(b) Other than the natural wear and tear, the following activities have been established to increased rates of performance degradation namely;

(i) Cooking in the hostels

(ii) Washing in the rooms and wrong choice of the modes of cleaning for the various categories of finishes.

(iii) Wrong choice of locational application of finishes.

(iv) Presence of un-anticipated concentrated loading from the use of double Decker beds especially in Kenyatta.

(v) Lack of maintenance of defects on these finishes.

(c) There are no clearly defined inspection modes; diagnosis and solution to the defects on these floor finishes.

5.20 DISCUSSIONS OF THE MAIN FINDINGS

A (i) Varied rates of deterioration of a particular finish in different locations;

From table 4.20, it can be seen that a particular finish cannot suit all the application requirements in every location. In these hostels' rooms, terrazzo and screed do better than the others notably PVC tiles and parquet blocks.

A particular finish like, pvc, is seen to perform better in locations as offices than in the common rooms and the habitable rooms whilst rubber tiles are found to be worse in performance when applied in the corridors.

The screed, on the other hand poorly performs when used in the washrooms particularly in the bathrooms. Parquet, has better performance when used in common rooms than in corridors and entrances, at which it's prone to uneven traffic wear over time.

Terrazzo and grano have higher and better performances in all the locations; the only problems are their installation costs and aesthetic properties in certain areas.

(ii) Varied deterioration rates for different finishes in the same locations:

The finishes were also found to deteriorate to differing levels after some time in the same locations with similar characteristics and functional requirements. This is because various finishes have varying qualities thus demand different functional application requirements.

From the same table 4.20, it can be noted that in rooms, terrazzo and screeds have performed better than the others as PVC and parquet.
Infact PVC has the worst performance in these locations.

In the offices, the performance trends show some drastic changes due a change in the functions. Offices are subjected to limited activities which could be harmful to the finishes unlike in the students' rooms hence many finishes are fond to survive for a longer periods of time before their performance standards are impaired. The various finishes in the offices were found to be in good conditions.

The functional requirements in the corridors and entrances stipulate inter alia that the finishes be resistant to heavy traffic wears and hence those finishes which les resistance to wear deteriorate faster in these locations. In the corridors and entrances, the best performing finishes are the cement-based as terrazzo, grano and screed to some extent. The PVC, rubber tiles are found to wear out very fast when used in such locations.

Corridors are also subjected to heavy traffic particularly at the landings thus care needs to be taken in the choice of materials and workmanship in their installations.

The washrooms require finishes which are resistant to continuous dampness and occasional pooling of water noted in these hostels. This thus requires a seamless type of floor finish, which does not use adhesives for their application. The most appropriate finishes to be used in such situations are the concrete based like grano and terrazzo, but cement sand screed is not appropriate for these locations as they degrade faster, particularly in the showers. See plate 10

In the common spaces, especially the TV rooms, the effect of concentrated loading from the 'legs' of the seats is high and hence there is need for the finishes used in such locations to be those which resist the effects of concentrated loading. The study established that the TV rooms finished in PVC are highly deteriorated and have peeled off the beds due to this. The concrete based finishes were found to have resisted better that effect of concentrated loading.

(B) Un-anticipated or Unforeseen user requirements.

It was found out from the survey that there are certain actions of students which, which could not be anticipated during the design stage of these hostels, but enhances the rate of deterioration of the finishes in the rooms.

(i) Cooking

Approximately 87.61% of the students cook in their rooms with some putting the heater directly onto the floors. This has the severe effect on the adhesives used in bonding the tiles to the beds. This explains why some of the PVC tiles in such rooms are burnt or peeled off the beds. Refer to plate 6. This raises the temperature of these floors thus resulting into weakening of the bonds and consequently their failure.

The hostels finished in screed do no show the effect of over heating, though the students cook on them as well.

(ii) Washing in the rooms and mopping.

The students also mop and wash in their rooms using some harsh detergents as Omo and such other detergents on all types of finishes with no regard to the adverse consequences of these detergents on some types finishes namely the PVC tiles. Use of excessive water on tiled finishes leads to attack on the adhesives used in bonding such tiles. The recommended mode of cleaning such finishes should be wiping in wet clothes/mops.

(iii) The effect of the use of double Decker beds.

The use double Decker beds in the rooms, mainly in Kenyatta University, were found to injurious to the PVC tiles. They were found to have caused and continue to cause tile breakages, and even peeling off and disfiguration of these finishes. Conversely, such beds used on the cement-based finishes do not cause as much defects as in PVC finished rooms.

These beds exert too much pressure on these finishes, and depending on the levels of resistance to such forces of the finishes, they give in but at different rates with PVC most affected.

(iv) Wrong choice and application of finishes.

Some materials were found to have been used in locations they ought not. Such include the use of PVC in the corridors and screed in the bathrooms. This has speeded up the rates of deterioration in such locations.

(C) Lack of maintenance

The University's facilities mainly buildings proper lack due care. This begins from lack of clearly defined mode of defects inspections amongst the officers. Perhaps the lack of mode of inspection is due to the perennial lack of funds for this purpose hence it would be of no need to carry out inspections where there is not going to be any repairs done.

From the foregoing, it can therefore be concluded that there are many finishes but not all can be used successfully in the various locations. For this the various finishes found to be suitable in the various locations can be grouped as follows; (from table 4.20),

(i) **Rooms**- use can be made of coloured screed and terrazzo tiles.

(ii) **Offices**- PVC tiles and coloured screed.

(iii) **Corridors**- terrazzo and granolithic paving.

(iv) **Washrooms**- terrazzo and granolithic paving.

(v) **Common rooms**- terrazzo and timber parquet.

(vi) **Entrances**- engineering bricks, terrazzo and grano paving and screed.

(vii) **Stairs**- terrazzo and grano paving and screed.

HYPOTHESIS TESTING;

Chapter one had the hypothesis which reads thus, ***'jointless flooring materials have a better performance and are hence more suitable for use in the students hostels'*** From the field study data collected and analyzed, the above hypothesis was found to be true. It should however be noted that every location has its unique characteristics thus a particular finishing material cannot be used in all the hostel's spaces or locations, but only those materials which can accommodate such requirements. In general, nonetheless, the materials found to be most suitable for use in these locations fall in the category of 'jointless materials' namely Terrazzo, Grano and Screed.

5.30 CONCLUSIONS

It's impossible to make a choice of floor finishes for all the environments and no single material can successfully be applied in all the locations in the building (hostel) due to differences in functional requirements of these areas. Also, the evaluation of the most suitable finish(es) involves other factors as the cost other than the technical and maintenance requirements, which must be considered in order to reach a very concrete decision.

In the two universities' hostels it's been found that many at times the finishes are later subjected to conditions never anticipated for at the design stage viz; lack of maintenance and repair, user abuse/harsh treatments accorded to such finishes by the students. There is therefore need to take thee factors into consideration in the future specification of finishes by the universities.

5.40 IMPLICATIONS AND RECOMMENDATIONS.

Every building has a floor, which must be finished in a given specified material and need careful selection and design installation. One of the major difficulties in the finishes design is the range of functional use to which such material finishes are put from the aspects of loading, wear to aggressive chemicals.

The hostels do have several of such locations and each location has different functional requirement hence different finishes application. This has not been appreciated in installation of finishes in most of these hostels due to inter alia; the unforeseen user requirements, costs and the varied number of finishes to choose from.

(A) There is need for the students to be informed of the right kind and mode of cleaning their rooms as some of the finishes are highly affected by the mode of cleaning (mopping) and the types of detergents used in the cleaning of such finishes. PVC tiles and other tiled finishes are affected by too much dampness and only wet mopping should be used to clean them.

Likewise washing in the rooms finished in PVC should be stopped. These types of mopping should only be used on the jointless finishes as the screed, grano and terrazzo paving.
The manufacturer's instructions on the treatment of the finish should be strictly adhered to.

Some of the general guides to the use and maintenance of various floor finishes are as shown below.

TYPE OF FLOOR	DETERGENTS TO USE	DETERGENTS TO AVOID
Wood & Wood composition, Cork.	Solvent- based and neutral detergents	Alkaline, abrasive powders and detergent crystals.
Magnesite	Solvent- based and neutral detergents	Strong alkaline detergents, abrasive and detergent crystals.
Concrete and Granolithic paving	Neutral, alkaline detergents crystal Solvent based detergents.	None.
Terrazzo and Marble	Neutral detergents, mild alkaline detergents, mild abrasive powders.	Strong alkaline detergents, detergent crystals solvent based detergents and oily materials.
Natural stone: Granite, limestone, sandstone, and Quartzite slate.	Neutral alkaline solvent based detergents Abrasive powders and detergent crystals.	Oily materials.
Clay (Quarry tiles)	Neutral, alkaline and mild abrasive powders.	Solvent based detergents and oily materials.
Bricks	Neutral, alkaline and solvent based detergents.	Oily materials.
Thermoplastic tiles, PVC, Asbestos and Rubber.	Neutral, mild alkaline detergents.	Strong alkaline detergents, detergent crystals, abrasive powders and oily materials.
Plastic seamless screeded, self-leveling and decorative.	Neutral, alkaline and solvent based detergents	Abrasive powders and oily materials.
Linoleum	Neutral, mild alkaline and solvent-based detergents.	Strong alkaline detergents, abrasive powders and detergent crystals.

Above; Table 5.10, Floor maintenance Chart, Detergents. Source, J.K.P. Edwards; Floors and their Maintenance.

(B) Proper choices need to be made for various locational requirements of the finishes due to the fact that every location has its unique functional requirements hence a particular finish cannot be used in all the locations in the same hostel. From the survey and the analysis thereafter, the following finishes were established to have better application characteristics per location and are consequently recommended for such applications.
The manufacturer's instructions on the treatment of the finish should be strictly adhered to.

Rooms; For the actions of the students, which could not be foreseen during the design, cannot accommodate the performance of PVC tiles for a long time without replacement, it's hereby recommended that coloured cement sand screed be or terrazzo tiles be used. Given the cost of terrazzo is too high, the coloured screed therefore remains the better option for use in the students' rooms. The above notwithstanding, where the initial cost can be met then coloured terrazzo tiles would provide a long lasting finish relatively 'maintenance free' which would be able to accommodate such actions which could not be anticipated initially.

Offices; The better performing finishes here are PVC tiles and, coloured screed and terrazzo, but due to the aesthetic requirements in these locations, and the high cost of installation of terrazzo, the latter would not be appropriate for use in the offices. It's therefore recommended that for higher level offices like those of the halls officers and senior halls officers be finished in PVC whilst those of the house keepers, assistant halls officers and custodians be in coloured screed. This is because the latter rooms are also frequented by students for various requirements and reading newspapers.

Corridors; These are subjected to higher traffic load of the students hence require those finishes which can resist, for longer duration the lack of maintenance and replacement, before wear and tear. It's recommended that the corridors not be finished in PVC tiles, but in terrazzo and granolithic paving, with terrazzo offering a better option for application.

Washrooms; Washrooms are usually subjected to blocked down pipes and faulty water closets and are hence always damp thus the tiled finishes can not be appropriate for applications in such locations. The appropriate finishes are those that are jointless as grano and terrazzo paving. Screed,

on the converse, is found to give in so fast especially when used in the bathrooms. Therefore, the appropriate finishes for application in these locations are terrazzo and granolithic paving.

Common rooms; there are several types of common rooms but the most common are the TV rooms, which are faced with the problem of concentrated loading from the 'legs' of the seats used in these halls. This exerts much pressure on the finishes with many of these finishes giving in to the pressures. The best performing finish recommended for use in these areas are established as terrazzo and parquet.

Entrances; The entrances also receive good amounts of traffic loading and wear and hence should not be finished in PVC tiles as they ca not sufficiently withstand such pressures. The finishes recommended for use in such places are grano, terrazzo and screed, but given the corridors are recommended for the first two it would be necessary then to finish the entrance in the same finishes namely grano and terrazzo paving.

Stairs; these should be well-designed and constructed with greater emphasis put in the landings. Given the only means of accessing the upper floors in these hostels is stairs, there is therefore great amount of pressure exerted on these locations, which needs to be taken care of when specifying the finishes to such locations. This thus qualifies the use of terrazzo and grano to be the most appropriately recommended finishes for application here.

Therefore, the recommendation on the various locational applications of the finishes can be summarized as shown in the table 5.20 below.

LOCATION OF APPLICATION	FINSHES OPTIONS.	FINSHES OPTIONS.	FINSHES OPTIONS.
	1st (Best) option.	**2nd Best Option**	**3rd Best Option**
Entrances	Terrazzo paving	Granolithic paving	Engineering bricks
Corridors	Terrazzo paving	Granolithic paving	Cement-sand Screed**
Stairs	Granolithic paving	Terrazzo paving	Cement-sand Screed**
Washrooms	Terrazzo paving	Granolithic paving	*** *** ***
Students' Rooms	Coloured screed	Terrazzo paving**	*** *** ***
Common rooms	Terrazzo paving	Timber Parquet	*** *** ***
Offices	PVC Tiles	Coloured screed	*** *** ***

NB. ** To be used only as the last resort; *** *** *** Other Finishes covered here should be avoided

Table 5.20, Finishes Options for various Locations. Source; Own Survey, June 2004.

(C) Cooking in the hostels especially, directly on the PVC tiles should be avoided completely. This is not only dangerous to the lives of the occupants but also to the continued existence and performance of the PVC tiles. The cooking has been found to cause a large amount of peeling off the beds of the PVC tiles hence in hostels, which are already finishes in PVC no cooking should be tolerated by the university management at all!

(D) The use of double-decker beds on the floors finished in PVC should be avoided at all costs. They, the double-decker beds, were established to cause accelerated rate of floor finishes deterioration; mass peeling in PVC and pitting in screed, with worse effect on the pvc tiles. There is also need for use of leg spreader caps to help spread the concentrated loading from these structures, though the effect would be minimal.

The above criterion needs to be backed with a well-designed inspection mode for the defects. The starting point being that the user must have knowledge of various floor defects and their causes as was outlined in chapter two. The procedure uses a model called 'Decision tree for Diagnosis of building defects'. See the figure 5.10 below.

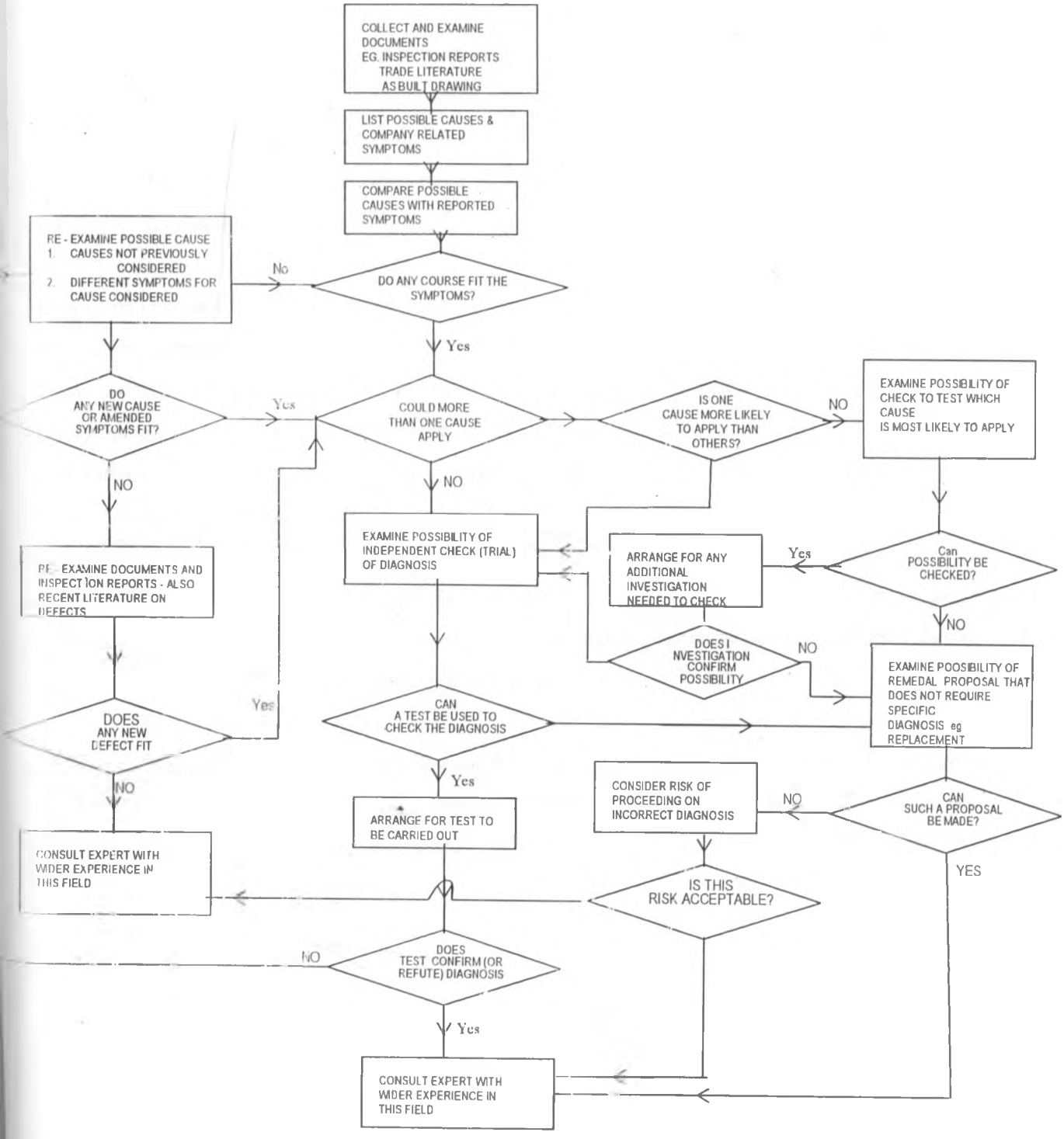

Figure 5.10. The Decision tree for Diagnosis of Building Defects, Source, BRE, Building Defects, 1989.

Further, BRE describes diagnosis of defects to be like crime detection where investigation produces evidence then alternative hypotheses are examined in turn to assess which best matches the facts. It should however be noted that new unprecedented defects occur from time to time, and data from investigations can be unreliable or misleading. If an attempt is made at the outset to list the potential causes of defects, the list only provides a reference point to return to when unexplained symptoms are discovered and a diagnosis is challenged. It should further be recognized that diagnosis couldn't entirely be mechanical.

Diagnosis need not be geared towards finding a single cause of defect. In reality defects are often caused by a combination of factors, none of which, on their own would require remedial works. Some times it's only possible to say from the available information that a certain cause is the most likely reason for the occurrence of a particular defect; other possible causes may be known and it may be necessary to carry out further investigations before even a tentative diagnosis can be made of the full range of potential causes.

Whenever some aspects of defect is difficult to explain, it's necessary to go back to the investigation of the construction to see whether the construction site investigations has confirmed what was shown on the drawings or specifications or the records of repairs.

If the recommendation is for remedial to cure the defect, it must be for a cure which will succeed. Where doubts as to the cause remain, of finance is not available to ensure that the defects are put right in all aspects, the recommendation may be for a trial solution and it must be made absolutely clear that the recommendation is for a trial solution.

The results are then entered into a report of a typical format as shown in the Figure 5.20 below;

Typical **Defect Report Form/Sheet.**

Prepared by..... Date.....
Address.....
Position in the Building.....
Description.....
.....

INVESTIGATION
This report is based on the attached site investigation dated..... and on the following findings and additional information e.g. advisory, publication, trade literature and interviews or correspondents with occupants or specialists.

CAUSE OF DEFECT
The following causes of defects were considered;
Cause (or contributory causes) of defects and reason for this conclusion.....
.....
.....
Causes rejected for reasons stated .....
.....

FURTHER INVESTIGATION
It is recommended that the following further investigations or study should be undertaken for the reasons stated.....
.....
Time required for further investigation.....
Approximate costs, Ksh. ....
Effect of the investigation on the building.....
.....

REMEDIAL WORKS
The following works are proposed as remedial works to prevent further damages occurring.....
.....
Time required for work.....
Approximate Cost effect of on the use of the building.....
The following permanent works are recommended for to correct the defects.....
.....
Time required for work..... Approximate cost effect of work on the use of the building.....

Figure 5.20 Format for Office Internal Report on a Typical Defect. Source, BRE, Defects in Buildings.

The above models are also used as guides to the routine maintenance of such floor finishes.

5.50. SUGGESTED AREAS OF FURTHER RESEARCH.

It should be noted that the research has not taken into account, for scrutiny and evaluation, some finishes, which are not used in these hostels, but could be of good performance in the various locations of these hostels. A more comprehensive study should be carried out to examine the appropriateness of various finishing materials available in the market, besides those herein considered, for use in the aforementioned spaces.

Further the Universities are established not to be having enough finance to use in the maintenance of the floor finishes to avert the deterioration and dilapidations currently experienced on these finishes. A research should therefore be designed to establish various ways in which the Universities can source and effectively utilize finances for purposes of maintenance of these finishes.

PLATES

Plate 1.

Plate 2

Plate 3

Plate 4

Plate 5

Plate 6

Plate7

Plate 8

plate 9

Plate 10

Plate 11

Plate 12

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APPENDICES

Appendix One: Questionnaires to Students/occupants.

Appendix Two: Questionnaires to Halls Officers.

Appendix Three: Direct Observational Forms.

Appendix Four: Response Evaluation sheet.

Appendix Five: The Project Monitoring Tool.

QUESTIONNAIRE (FOR OCCUPANTS/USERS/STUDENTS.)

I'm a Fourth Cum Final year student at the university of Nairobi, Department of Building economics and management. I'm desirous of carrying out a study on the topic **"Evaluation of the performance of floor finishes and their suitability for use in the halls of residence; Case study of Nairobi and Kenyatta universities."**

Kindly assist me by **HONESTLY** filling in the following questionnaire. A report of this field research will be made strictly for the purposes of this research but will **NOT** mention any names of the respondents. Thank you in anticipation.

Q1. Name of the hall.....

Q2. How long have you been an occupant of the hall?

- **Less than a semester**
- **One semester**
- **One academic year**
- **Two years-four years**
- **Over four years**

Q3. How often have you seen repairs done to the flooring Materials (finishes) since you occupied the hall?

- **less than once;**
- **1-2 times;**
- **3-5 times;**
- **Over 5 times.**

Q4. What type of repairs? **State e.g. Replacement of tiles/wood blocks etc**.

Q5. How long have you been an occupant of the Room?

.....**Weeks/Months/Years.**

Q6. Which floor finish is in your room?

- **Screed**
- **PVC tiles**
- **Ceramic tiles**
- **Wood parquet/timber blocks**
- **Rubber tiles**
- **Any other (specify).....**

Q7. What defects are there in the floor of your room?

- **Tiles lifting/arching/peeling off.**
- **Discolouration (of coloured screed/timber parquet etc.)**
- **Staining**
- **Screed pitting (formation of holes)**
- **Any other, Specify.**

.....

Q8. Do you cook in your room? **YES/NO.**

Q9. Are there other students who cook in their rooms? **YES/NO**

Q810. If yes in the above, what can you estimate to be their percentage of the whole students population in the hall? .....

Q11. Do you wash in your room? **YES/NO.**

Q12. Do you usually wash your room regularly? **YES/NO**.

Q13. If YES in the above question, how often/after how long?

- **Daily**
- **2- 7 days**
- **2-3 weeks**
- **Over 3 weeks**

Q14. Which chemicals do you use in cleaning your room?.....
.....

Q15. What other mode(s) do you use in cleaning your room other than washing?
(State) .....

Q16. What is the state/condition of your room's floor finish?

- **Very good**
- **Good**
- **Fair/average**
- **Poor**
- **Very poor.**

Q17. If you were to measure and grade the extent of the defects/dilapidation in a scale of **1-10**, what would be the grade of your flooring materials with **10 being the best possible grade**?

Q18. What would you say is the general condition of the floor finishes within the rooms of the hostel you stay in?

- **Very good**
- **Good**
- **Fair/average**
- **Poor**
- **Very poor.**

Q19. Other than your room alone, what can you comment to be the general status of floor finishes in the rooms of the hostels you say in?

- **Very good**
- **Good**
- **Fair/average**
- **Poor**
- **Very poor.**

Q20. In your own opinion is the university doing enough to maintain the floor finishes in your hostel?
YES/NO

Thanks a lot for your cooperation and may God bless you!

QUESTIONNAIRE (FOR HALLS OFFICERS.)

I'm a Fourth Cum Final year student at the university of Nairobi, Department of Building economics and management. I'm desirous of carrying out a study on **"E valuation of the performance of floor finishes and their suitability for use in the halls or residence; case study of the Nairobi and Kenyatta universities."**

Kindly assist me by filling in the following questionnaire **HONESTLY**. A report of this field research will be made strictly for this study, but will **NOT** mention any names of the respondents. Thank you in anticipation.

Q1. Name of the hall……

Q2. In which year was your hall built? ……**19**……

Q3. Do you usually carry out inspections for defects in floor finishes? **YES/NO.**

Q4. If **YES**, how often?

Q5 (a). How do you carry it out? ie. The process……

……

Q5 (b) Is there some vote head allocated for maintenance? **YES/NO**

Q5 (c) If yes in the above is it adequate for its purpose? **YES/NO**

Q6. Have you carried out some **major** maintenance and repair works to the floor finishes in the last five months?

YES/NO

Q7. If NO in the above Q6 when was the last major maintenance and repairs done?

6 – 10 months ago	**2-5 years ago**
11-15 Months ago	**5-10 years ago**
16-20 Months ago	**over 10years ago**

Q8. Which major repairs have been done? Name them……

Q8b. From your records may you enter the years when the various floor finishes in your hall were first installed and the subsequent years of replacement.
Use the table below to assist you.

Finishes Used (name).	**Year of initial Installation**	**Years of subsequent replacement**
❑		
❑		
❑		
❑		
❑		
❑		
❑		

Q9. Other than cleaning which are the other routine maintenance practices carried out on the floor finishes?……

Q10 Which of the following finishes are used in your hall? Tick the appropriate one(s)

- ❑ **Cement sand screed**

- **Ceramic tiles**
- **PVC tiles**
- **Rubber tiles**
- **Granolithic paving.**
- **Wood parquet**
- **Terrazzo**
- **Any other (specify).....**

Q11. On which of the above mentioned do you spend more on maintenance and repair?

Q12. Are you normally given/allocated a vote head for maintenance?
YES/NO

Q13. Is it normally adequate for the purposes of maintenance?
YES/NO

Q14. What then, can you say is the state of maintenance of the floor finishes in your hall?

- **Very good,**
- **Good,**
- **Fair/Average**
- **Poor**
- **Very poor.**

15. What is the general condition of the floors particularly the floor finishes?

- **Very good,**
- **Good,**
- **Fair/average**
- **Poor**
- **Very poor.**

Q16. If you were to grade the above question on a scale of **1-10** what will you give as the respective condition scores for the various individual finishes in your hall; with **10** being the **best possible condition** ?

Finish	**Score (1-10)**
Screed.....	
Granolithic paving.....	
Terrazzo.....	
PVC tiles.....	
Ceramic tiles.....	
Rubber tiles.....	
Wood parquet	
Any others (specify).....	

Q17. In your own opinion is the university doing enough to maintain the floor finishes in your hostel? **YES/NO**

Q18. Are there students who cook in their rooms? **YES/NO**

Q19. If yes in the above, what can you estimate to be their percentage of the whole students population in the hall? .....

Q20. Have you found any damages caused to the finishes due to cooking? **YES/NO.**

Q21. Are there other actions of the students that could cause deterioration to the floor finishes. **YES/NO**.

Q22. If **YES**, which ones?.....

Thank you very much for your response and may God bless you!

DIRECT OBSERVATION DATA

THE PERFORMANCE EVALUATION SHEET FOR HALL..............................

	AREA	FINISHES USED	TYPES OF DEFECTS	RATING
A	ENTRANCE			
B	CORRIDORS			
C	WASH ROOMS			
D	COMMON SPACE			
E	OFFICES			
F	STAIRS			

DIRECT OBSERVATION DATA

THE PERFORMANCE EVALUATION SHEET FOR HALL..............................

	AREA	FINISHES USED	TYPES OF DEFECTS	RATING
A	ENTRANCE			
B	CORRIDORS			
C	WASH ROOMS			
D	COMMON SPACE			
E	OFFICES			
F	STAIRS			

DIRECT OBSERVATION DATA

THE PERFORMANCE EVALUATION SHEET FOR HALL..............................

	AREA	FINISHES USED	TYPES OF DEFECTS	RATING
A	ENTRANCE			
B	CORRIDORS			
C	WASH ROOMS			
D	COMMON SPACE			
E	OFFICES			
F	STAIRS			

DIRECT OBSERVATION DATA

THE PERFORMANCE EVALUATION SHEET FOR HALL..............................

	AREA	FINISHES USED	TYPES OF DEFECTS	RATING
A	ENTRANCE			
B	CORRIDORS			
C	WASH ROOMS			
D	COMMON SPACE			
E	OFFICES			
F	STAIRS			

DIRECT OBSERVATION DATA

THE PERFORMANCE EVALUATION SHEET FOR HALL..............................

	AREA	FINISHES USED	TYPES OF DEFECTS	RATING
A	ENTRANCE			
B	CORRIDORS			
C	WASH ROOMS			
D	COMMON SPACE			
E	OFFICES			

N/B. RATING SCALE IS 1-10 WITH 10 BEING THE BEST GRADE

The Response Evaluation Sheet For Hall(s).....			
QUESTION	**%ge**	**QUESTION**	**%ge**
Question 2		**Question 12**	
Less than one semester		YES	
One semester		NO	
One academic year		**Question 13**	
2-4 years		Daily	
Over 4 years		2-7 days	
Question 3		2-3 weeks	
Less than once		Over 3 weeks	
1-2 times		**Question 14**	
3-5 times			
over 5 times		**Question 15**	
Question 4		**Question 16**	
		Very good	
Question 5		Good	
		Fair/average	
Question 6		Poor	
Screed		V poor	
PVC Tiles		**Question 17**	
Ceramic tiles		Very good	
Wood parquet		Good	
Rubber tiles		Fair/average	
Question 7		Poor	
Tiles lifting/Arching/		V poor	
peeling off		**Question 18**	
Discolouration		Very good	
Staining		Good	
Pitting		Fair/average	
Others		Poor	
Question 8		V poor	
Yes		**Question 19**	
NO		Very good	
Question 9		Good	
YES		Fair/average	
NO		Poor	
Question 10		V poor	
Question 11		**Question 20**	
YES		YES	
NO		NO	

The Response Evaluation Sheet For Hostel/ Hall(s).....			
QUESTION	**%ge Respo.**	**QUESTION**	**%ge Respo.**
Question 2		**Question 12**	
Less than one semester		YES	
One semester		NO	
One academic year		**Question 13**	
2-4 years		Daily	
Over 4 years		2-7 days	
Question 3		2-3 weeks	
Less than once		Over 3 weeks	
1-2 times		**Question 14**	
3-5 times			
Over 5 times		**Question 15**	
Question 4		**Question 16**	
		Very good	
Question 5		Good	
		Fair/average	
Question 6		Poor	
Screed		V poor	
PVC Tiles		**Question 17**	
Ceramic tiles		9-10, (Very good)	
Wood parquet		7-8, (Good)	
Rubber tiles		5-6, (Fair/average)	
Question 7		4-3, (Poor)	
Tiles lifting/Arching/		1-2, (V poor	
Peeling off		**Question 18**	
Discolouration		Very good	
Staining		Good	
Pitting		Fair/average	
Others		Poor	
Question 8		V poor	
Yes		**Question 19**	
NO		Very good	
Question 9		Good	
YES		Fair/average	
NO		Poor	
Question 10		V poor	
Question 11		**Question 20**	
YES		YES	
NO		NO	

N/B; *Every question is analysed against the responses given and the percentages of respondents giving the response in each question is calculated. Further, the averages/mean for each question is calculated and the mode, range and percentiles are noted and calculated. These are then entered into the respective columns or rows or besides the respective row or column in question.*

Building Economics & Management
4th Year Projects
Format and Monitoring Tool

Sections, Chapters, Headings & sub-headings		Timeframe in Weeks & percentage of work completed							
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