ASSESSMENT OF THE CAUSE, PREVENTION AND REPAIRS OF CRACKS IN BUILDINGS

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CERTIFICATION

This is to certify that, this project work titled **"Assessment of the Cause, Prevention And Repairs of Cracks in Buildings"** was carry out by **ONYENUWE GODWIN** matriculation number **ENV/2032050039** in the Department of Building Technology, School of Environmental study, Auchi Polytechnic, Auch Edo state.

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DEDICATION

This project is dedicated to ALMIGHT GOD my creator, the giver of life, my strong pillar, wisdom, understanding and knowledge to complete this project and programme.

ACKNOWLEDGEMENT

I am indeed grateful to God, who created all things and because of his will they came into existence and were created.

I wish to express my gratitude to my project supervisor **Mrs. NKECHI, BENEDICTA, TAIWO** whom assistance and contribution has made it possible for me to successfully complete this project, knowledge impact and for his active role, especially taking pains to read through My Project and made the necessary correction. My gratitude goes to all **Building Technology lecturers,** I sincerely appreciate you all for the knowledge I have acquired, your loving cares and assistance towards me, May God bless you Sir and Ma. I am indeed indebted to you

I also acknowledge with gratitude my loving caring parent, Mrs. Onyenuwe Elete Rita and late Mr. Onyenuwe Favour. For every of this assistance you are the best Mum and Dad. My appreciation goes to my loving brother, aunty and uncle. Mr. Onyenuwe Chukwuka, Mr. Onyenuwe Ikechukwu Peter, Miss Laweretta Ineh, Mrs Odanieh Nkechi Rosemary, Mrs Chioma Ann Opone, Mr. Christain Nmor for all your support physical, spiritually, financially and otherwise I am indeed grateful to you all.

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Abstract

This study was carried out by employing several observatory and analytical techniques to observe and understand the causes, prevention and nature of cracks associated with building, the causes of such cracks, what could have been done to prevent these cracks as well as reparative measures that could be employed to remedy the cracks. Reconnaissance study was carried out on the structure to discover the nature and extent of cracks with the aid of traditional laboratory tools that can measures and monitor the cracks. From the overall properties and behaviours of the cracks, their possible causes and reparative measures could be established. The majority of the cracks observed in the building are non-structural cracks. The main structural cracks observed in the building were caused by differential settlement of soil, faulty design and poor workmanship. Some of these are still actively cracking and hence pose a real threat of future collapse. Hence, they require urgent professional repairs. The appropriate remedy to cracks should be such that its nature and causes should be properly investigated and established before repair. Otherwise, wrongly treated cracks would reappear after some time

CHAPTER ONE

INTRODUCTION

1.1 Background to the Study

As man grows and advance in knowledge with advent to science and technology the cave home gave way to more convectional buildings of huts made with palm front, bamboo walling and raffia palm thatch roof, to mud homes and today we are having more sophisticated modern building with the state of art filling and service for comfort and convenience of any occupants. Since shelter is one of the basic need of human being it is necessary to construct building for their survives. Buildings demand many skills and ideals in planning design, construction, selection, the use of many material and techniques. After construction, buildings have to meet various requirements as they are expected to last for many years. Despite all this planning, control and construction, defects do occur in building. Therefore it is necessary that consideration must be giving to every stage of the building to reduce the incidence of defects with a view to prolonging the durability of the building.

A building means "any structure or enclosure of space with roof and walls for the protection of life and property (National Building Code, 2006). Modern building require certain activities for comfort of the users or occupants of such building either on permanent or temporary occupation (Balla-Omunabe, Olawole Fadele & Kaseem Alao, 2013). Building can equally be define as a free standing structure comprising of one or more rooms, either covered or not by a roof, it may or may not be enclosed within an external walls (Bella-Omunagbe, Ufuah, Elmah Daniel, Fedele Samuel & Olawole, 2012). Building is a form of shelter that comprises of main structural elements such as

foundation, well floors, windows and the roof structure (Bella-Omunagbe, et al., 2013). Olusola (2002) defines buildings as essentially a space that is protected from the natural environment and is constructed for a specific use.

Building cracks are most common problem in any types of building. It is very important to understand the various forms of cracks and proffer measure to be taken to prevent it. Cracks in a building are of common in Auchi, most common reasons of building crack development is the maybe as well as planned but cracks will still occur due to site personal, bad workmanship, inadequate supervision and the use of poor materials.

Most building crack is as a result of durability service lifetime, the appearance of cracks in building put fear in human. Cracks in a building are symptom of distress with the structure of the building and brings about bad name to the builders, consultant, engineer and company etc. Modern structures are comparatively tall and slender, have thin walls are designed for higher stresses. They are structure which are more liable to cracks are compared with old structure that are low, had thick walls were lightly stressed and were built at a slow pace. Cracks develop due to deterioration of concrete or corrosion or reinforcement bars due to poor construction or inappropriate selection of material and by temperature and shrinkage effect. IS-456 (2000) the surface width of crack that does not exceed 0.3mm, is not harmful and does not have any serious adverse effects upon the reinforcing steel, nor upon the durability of the structure. The structure member that is, crack in tensile zone is harmful because they are exposed to moisture or in contact of soil or ground water.

Deterioration is the development of defects in a structure. It may occur due to natural causes of ageing. If deterioration is not checked or is allowed to occur, decomposition of materials results and replacement become the only solution. The rate of deterioration depends on the resisting capability of material, improper execution during construction, failure to supervise not during construction, failure to perform maintenance and inadequate planning, budgeting and allocation of funds for maintenance activities. It can also be caused through chemical reactions by certain materials with the surrounding environment. This leads to dissolution, softening or discoloration of the material or components. Corrosion is the result of chemical reactions of material with air and water in the environment. Cracks are a kind of universal problem of concrete construction as it affects the building artistic. It also destroys the wall integrity by affecting the structural safety which in turn reduces the durability of structure (Ajabe, 2018). Buildings have a unique place in the area of construction engineering. Buildings are made to last for decades. Not only because it shares emotional bonds with its residents, other reasons being the construction cost and time taken. With the passing of time, the slow reactions which were continuously working inside the building components (concrete members), start showing their effects in the form of cracks.

Therefore in every stage of building process, it is necessary that consideration must be given to reducing the incidence of cracks with a view to prolong the durability of the building. Timely measures ought to be followed to save and manipulate cracks and its formation. Not all of the creaks evolved are dangerous but there are some forms of cracks which can be severely structurally unsafe.

1.2 Statement of the Problem

Cracks in buildings are of common occurrence in Auchi which scare both client and occupant. Crack have be one of the most prevailing problems in building in Auchi Etsako West Local Government Area, Edo State. Despite the increase rate of mishap caused by crack in residential buildings in Auchi Etsako West Local Government Area of Edo State, much has not been done to discover the main causes of cracks in buildings especially during earth movement, the effect on lives and properties and how it can be mitigated or presented to avoid future occurrence. The need of this study is to fine out strategies for controlling cracks.

1.3 Research Questions

i. What are the various forms of cracks that exist in residential buildings in the study Area.

ii. What are the impact of crack on residential buildings

iii. What are the various roles building material play in generating cracks defeat in residential building

iv. What proffer measures used to mitigate the impact of cracks on the performance of residential building Auchi

1.4 Purpose of the Study

The purpose of this research is to identify the cause, prevention and repairs of cracks in residential buildings. To achieve this purpose, the following objective has be stated.

i. To assess the various forms of cracks that exist in residential buildings in the study areas

ii. To examine the impact of cracks in residential buildings in Auchi

iii. To assess the roles of building materials in generating cracks defect in residential buildings in Auchi

iv. To proffer measure to mitigate the impacts of cracks on the performance of residential building in Auchi

1.5 Scope of the Study

The research specifically investigate the causes, prevention and repairs of cracks in building in Auchi, Etsako West Local Government Area Edo State which comprises of Twenty five villages namely Utsogun, Egelesor, Ughidane, Idani-Yelwa, Osomeke, Oluedide, Oki, Oshiomhole, Akpekpe, Osuali, Idanirace, Omemi, Isaami, Ikelebe, Aibotse, Oguokhai, Aliogbomhi, Igbei, Ozomode, Akharumha, Iyekhei, Aimhanesi, Utsokhwili, Oikilokhai and Igiebor (AbdulRaheem, 2020)

1.6 Significant of Study

This research work will be of great benefit to numbers of people in the construction industry such as clients, contractors, consultancy firms and construction managers. This is as a result of the fact that, in the end solution would be obtained to enable the players to achieve quality work. The research work will also be a good references to any researcher who intent to carry out research on the study area.

1.7 Limitation of the Study

The limitation faced in this work is the inability of the researcher to get enough documented evidence Cause, Prevention and Repairs of Cracks in Buildings as many incidences were not documented. Secondly combining academic and that of research work was another limitation.

1.8.1 Operational Definition of Terms

i. **Construction:** Construction, also called building construction, the techniques and industry involved in the assembly and erection of structures, primarily those used to provide shelter. Construction is an ancient human activity. It began with the purely functional need for a controlled environment to moderate the effects of climate. Constructed shelters were one means by which human beings were able to adapt themselves to a wide variety of climates and become a global species

ii. **Building:** A building, or edifice, is a structure with a roof and walls standing more or less permanently in one place, such as a house or factory

iii. **Building Project:** A construction project, sometimes just referred to as a 'project', is the organized process of constructing, renovating, refurbishing, etc. a building, structure or infrastructure.

iv. **Crack:** If a structure is unable to accommodate this movement, cracking is likely to occur. The appearance of distortions and cracks can be visually unattractive and disconcerting for occupants, and if left untreated they can affect the integrity, safety and stability of the structure.

v. **Repair:** Repair is a maintenance job performed over any equipment, vehicle, machinery, building or any other item, either physical or intangible.

vi. **Prevention:** Prevention is the act of stopping something or ensuring something does not happen. Stopping teenagers from using drugs is an example of drug prevention.

CHAPTER TWO

REVIEW OF RELATE LITERATURE

2.1 Forms of Crack that Exist in Residential Building in the Study Area

2.1.1 Thermal Movement

Thermal movement is one of the most potent forms of cracking in buildings. All materials more or less expand on heating and contract on cooling. The thermal movement in a component depends on a number of factors such as temperature variations, dimensions, coefficient of thermal expansion and some other physical properties of materials. The coefficient of thermal expansion of brickwork in the vertical direction is fifty percent greater than that in the horizontal direction, because there is no restraint to movement in the vertical direction. Thermal variations in the internal walls and intermediate floors are not much and thus do not form cracking. It is mainly the external walls especially thin walls exposed to direct solar radiation and the roof which are subject to substantial thermal variation that are liable to cracking. Thermal joints can be avoided by introducing expansion joints, control joints and slip joints. In structures having rigid frames or shell roofs where provision of movement joints is not structurally feasible, thermal stresses have to be taken into account in the structural design itself to enable the structure to withstand thermal stresses without developing any undesirable cracks.

The magnitude of movement depends on their molecular structure and other properties. Cracks due to thermal movement could be distinguished from these, due to shrinkage or other causes. Concrete has an high drying shrinkage where done in summer, during high ambient temperature. Contraction due to drop of temperature is a possibility shrinkage cracking. Most material expend when they are heated and contract when they

are cooled. The expansion and contract with changes in temperature occur regardless of the structure cross-sectional area.

2.1.2 Creep

Concrete when subjected to sustained loading exhibits a gradual and slow time dependent deformation known as creep. Creep increases with increase in water and cement content, water cement ratio and temperature. It decreases with increase in humidity of surrounding atmosphere and age of material at the time of loading. Use of admixtures and pozzolana in concrete increases creep. Amount of creep in steel increases with rise in temperature.

Creep of a material is defined as the property due to which the material continues to deform with time under sustained stress. In concrete extend of creeps movement depends on the factors, such as water and cement content, water cement ration, temperature humidity, use of admixtures wand pozzolanas, age of concrete at the component. It movement increases in water and cement content, water cement ratio and temperature; it decrease with increase in humidity of the surrounding atmosphere and age of materials at the time of loading. In the case of brick/block work, amount of creep depends on stress/strength ration and with weak mortar make higher stress/strength.

2.1.3 Moisture Variant

As a general rule, most of the building materials having pores in their mortar, burnt clay bricks, some stones, timber, etc. Expand on absorbing moisture and shrink on drying. These movements are reversible, that is Study on control of cracks in a structure through Visual Identification & Inspection Cyclic in nature and is caused by increase or decrease in the inter-pore pressure with moisture changes, extent of movement depending

on molecular structure and porosity of a material. The various effects of moisture changes: Reversible Movement, Initial Shrinkage.

2.1.4 Chemical Reaction

Chemical reactions in building materials increase their volume and internal stress forms cracks. The components of structure also weaken due to chemical reactions. Some common instances of chemical reactions are following. Prevention: Use dense and good quality concrete i.e. richer mix of cement concrete 1:1.5:3 (M20) to prevent cracks. Repair corrosive cement concrete surface by 'gaiting'/ injecting technique after removing all loose and damaged concrete and cleaning reinforcement from all rust also.

Chemical reaction occurs due to the material to make the concrete. Contact with the concrete after it has hardened. Concrete may crack with time as the result of slowly developing expansive reactions between aggregates containing active silica and alkalis derived from cement hydration admixtures or external sources.

The alkahi silica reaction results in the formation of swelling gel. This tends to draw water from other portion of concrete. Expansion occur and result in cracks in the structure.

2.1.5 Poor Maintenance

After a certain period every structure wishes to be required and maintained. Some structures do not longer want to completely early appearance whilst some may additionally need a very at their deterioration troubles. It is usually better and wishes to become aware of troubles earlier than they forme any harm. A structure needs to be maintained after certain period its construction completion. Some of the structure need early looks into their deterioration problems, while others can sustain well. More

depending on the quality of design and construction, regular painting of the building helps in protecting the building against moisture and other chemical attacks.

Waterproofing and protective coating reinforcement steel or concrete are all second line of defense and the success of their protection will greatly depend on the quality concrete. The rate of corrosion increases because the rusted steel is entirely exposed aggressive environment. Finally, it is not only essential to repairs the deteriorated concrete but it is equally important to prevent the moisture and aggressive chemical to enter concrete and prevent further deterioration.

2.1.6 Improper Structural Design and Specification

Every shape loses its sturdiness over a period of time or in the course of time course of the time of coaching of specification for concrete different substance. During the layout of any shape each designer and architect ought to talk into consideration the environmental factors of the website online. It is most vital to also take into consideration the geotechnical elements for willpower of soil type, type of foundation required, grade of concrete and steel required and so on. Error that occurs in structural design and specification to defective specifications, improper abilities, loss of level in of contractor, inadequate thickness, insufficient reinforcement, incorrect geometric, incorrect detailing and unskilled employees ultimately gives rise to the deterioration of building or any structure. It is of crucial that designed consider the environment conditions existing around the building site.

2.1.7 Foundation Movement and Settlement of Soil

Shear cracks occur in buildings when there is large differential settlement of foundation due to any of following causes.

- Bearing pressure being in excess of safe bearing strength of the soil.
- Low factor of safety in the design of foundations
- Local variation in the nature of supporting soil Prevention: The design of foundation must be based on sound engineering principles and good practice.

2.2 The Impact of Crack in Resident Building in Auchi

In general, crack makes the concrete and the structure more valuable in external impact, accelerates the ageing process and can immediately reduce the ability of a structure to absorb stress and may lead to collapse. If cracks form, the impartation on strength of the structure should be evaluated and monitoring plan should be drawn up. Concrete is the most widely used construction materials on the world due to its low cost and easy availability of its ingredients. It also exhibits excellent strength properties in compression. Impact of cracks in reinforcement concrete (RC) is unavoidable due to its low tensile strength. These factors affect the initiation and propagation of corrosion of steel in reinforcement concrete (RC). The cracks this form in concrete varies in widths, numbers, geometry, depths e.t.c (Matha and Gerwick, 2015).

2.2.1 Horizontal or Diagonal Impacts

In construction, walls have an important role in the behaviors and performance of the influenced by expansion and contraction of a slab, deflection of slab and thermal effect. The defects in building like cracks in brick walls increase the cost of building repairing. Horizontal cracks in well of load bearing structures.

i. **External Cracks in Cross Walls at Ceiling Level:** In a load bearing structures, when a roof undergoes expansion and contraction alternatively. It is due to heat from the sun it gain and loss of heat when radiation into the open sky. Horizontal

cracks may occur in cross walls at ceiling level due to the expansion and contraction of the reinforced cement concrete (RCC) slab. Horizontal cracks in building are more dangerous when close to heavy structure restrains the one side movement of the slab. Horizontal cracks can be much dangerous if the thickness of insulation or protective cover, top of roof slab is inadequate.

ii. **External Horizontal Cracks at the Topmost Stony Below Slab Level:** Horizontal cracks occur due to deflection of a slab and lifting up of the edge of the bearing slab. Horizontal movement in slab due to shrinkage affects the horizontal cracks at the topmost stony below slab level. These cracks occur as a result if topmost stony of the building to the light vertical gravity load on the wall. Hence cracks are restrained as movement is retrained.

iii. **External Horizontal Cracks at the Bottom Level of Parapet:** Horizontal cracks appear in masonry at parapet base level as a result of horizontal shear stress developing at a junction. This type of cracks in walls also develops as the thermal coefficient and drying shrinkage of the brickwork and concrete are not same, suck crack in brick block walls occurs at parapet level or at balcony and occur at mullion of brick-cum-iron safety railing over reinforced cement concrete (RCC) cantilevered slab.

iv. **External Horizontal Over in Walls Liutel/Sill Level in the Topmost Story:** This type of external horizontal cracks in walls occurs due to the pull exerted on the wall by the slab of the topmost stony. They pull exerted on the wall as a result of drying shrinkage and thermal contraction.

v. **External Horizontal Cracks in Block Walls of top Most Storey Building at the Corners:** These types of cracks appear in the building when the corner of slab lifts vertically upwards due to the deflection in the slab in both directions. In the lower storeys, lifting of slab corner in prevented by the vertical load of the upper storey. Hence cracks occurs only in the top storey corner of the building.

vi. **External/Inter Horizontal Cracks in Mortar Joint of Bricks Walls:** These types of cracks appear after two or three years in construction if not proper mix. Horizontal cracks occur when the mortar joint are weakened due to the sulphate attack. There is no effective curative remedy against these cracks, except the use of sulphate resisting materials at a time of construction.

2.2.2 Vertical Crack Impact in Building

Study this directly, vertical cracks in concrete wells typically indicate from foundation. If a vertical crack widens at the top or bottom, the wall is either setting or gradually heaving, which may present serious issues. Measure the width of cracks with measuring tape. Typically, wider cracks tracks signify more serious issue than thinner cracks. Cracks less than 1/8-inch thick are considered stress cracks are harmless, while cracks ¼ inch wide and larger are often more serious. Earth movement and foundations are typically responsible for setting, which may result in cracks in the ceiling or walls is nothing to worry about, certain cracks indicate serious structural damage. Regularly inspect cracks above door frames and in walls for certain signs to determine whether the cracks require professional attention. Some of the cracks on block walls appear like the shape of stairs, the wall in straight horizontal line followed by a vertical line and then another horizontal line again appearing like stairs, such kind of cracks it happening ion

structure. It means that the information in a state of turmoil, which can be a natural part of the building when firstly built. Vertical cracks see at structural components as blocks have failed and significant stresses within the building structure vertical cracks can lips to move and lead to wrinkles

2.3 The Roles Building Materials Play in Generating Cracks Defeat in Residential Building in Auchi.

The development of technological cracks in the structure of the material occurs at the start stage and formation of a building. Cracking is a common damage forms by stress in a material that can easily be exaggerated. Cracking affects a variety of materials across multiple industries including metal, concrete, paint, asphalt and other protective coating. Preventing of Cracks in Building is better to take care and follow safety measures when building, maintenance and renovation. Cracks can be avoided by using adequate construction materials and techniques proper design and efficient supervision

2.3.1 Stress Corrosion Cracking (SCC)

Stress Corrosion Cracking (SCC) is a material defeat commonly found in ductile metals, caused by the combination of corrosion and tensile stress. Tensile stress on an as Tensile stress on an asset can be caused by stress from various operational activities, including welding, heat treatment, forming, and grinding, and can be exaggerated by the build-up of corrosion in confined spaces. SCC cracking can be microscopic, making it extremely hard to detect, but it can degrade long-term integrity in metal assets.

Some other forms of SCC our customers commonly deal with include:

- Chloride SCC
- Caustic cracking

- Ammonia SCC
- Amine SCC
- Carbonate SCC
- Liquid Metal Embrittlement

2.3.2 Wet Hydrogen Sulfide (H_2S) Cracking

Wet Hydrogen Sulfide (H_2S) cracking is a defect common in oil & gas and petrochemical assets in which aqueous hydrogen creates hydrogen sulfide corrosion cracking to degrade steel materials. When steel assets have irregularities or impurities, hydrogen can collect in these open spaces and cause damage when the asset is located in a wet hydrogen sulfide environment. This type of damage is extremely difficult to detect with only visual inspections (VT) techniques, and can cause devastating damage to assets, especially in hard-to-research locations like vessel interiors.

2.3.3 Thermal Contraction in Cracking

Thermal Cracking causes massive temperature deviation in mass concrete. It appears on surface level after few days of formwork. The crack in concrete construction can be a major issue. It can be prevented by taking the right measurement or proportion of well mixed in concrete. There are various causes for which cracks can be developed in concrete construction.

i. **Quality of Concrete:** Quality of concrete depends on the use of standard materials. Therefore, it is needed to use only best quality construction material that reduces the risk of Cracks.

ii. **Temperature Fluctuation:** During the contraction materials heated up and gradually cool it down. The expansion and contraction with temperature change all structures cross sectional area.

iii. **Reinforcement Corrosion:** In due time, it is natural to develop corrosion in reinforcement due to atmospheric reaction to it.

There are other reasons-

- Carbonation.
- High Chloride.
- Moisture reaction.
- Lack of proper measure during storage.

iv. **Design:** Poor structural design & specification can be another major cause of it.

Cracking happens due to huge difference between the maximum temperature and minimum temperature in concrete. The Designer and Contractors are mainly responsible to minimize any type of cracking by following the specifications.

- Usage of Port land Cement that generates relatively low heat.
- Avoid specifying an excessively low w/cm (water-cementations materials ratio).
- Thermal Control measures have to be decided before starting any construction work.

2.3.4 Plastic Settlement Cracking

At initial level when the concrete mix is not solid at this time, this type of cracks is formed at the surface. After some hours of placement only it can be identified by the following;

i. By using High Quality Concrete Mix.

ii. Using Shrinkage Compensating Admixture into Concrete Mix.

iii. Controlling the vibration during construction.

iv. Re-vibration of concrete after they are formed

v. Plastic Settlement cracking is a common error but it can be eliminated if the points mentioned above are followed properly.

2.3.5 Reinforcement Corrosion

Reinforcement bars are the main component that strengthens the structure because it bonds with concrete. Corrosion of TMT Rebar can be one of main issue if that is not taken care on time. Reinforcement corrosion can be major issues that cause cracking to the structure. There are some methods that can stop developing corrosion in reinforced steel that are:

i. Anti-Corrosion Coating on TMT Rebars before applying it to the construction site.

ii. Corrosion Inhibitor Admixtures.

iii. Cathode Protection.

But above all 2 things are most important to prevent corrosion. Water penetration and choosing the best quality TMT Bar those are highly corrosion resistant. These are the major reason to develop cracks in concrete structure. It is important to take the precaution before it goes wrong. It is important to use best quality building materials that will strengthen the structure forever.

2.3.6 Concrete Mix

Drying Shrinkage mainly occur for usage of more water in concrete mix. It can be reducing during the design stage;

- Drying Shrinkage Cracking can be reduced during the design stage.

- Provide sufficient movement joints.
- Sufficient Crack Control Reinforcement can also reduce this type of cracking in concrete.
- During the placement avoid adding additional water to the mix

2.3.7 Cracks Due To Quickness and not Maintaining Specification of Item Work, Material and Method of Work

Nowadays everyone wants their results, construction work very quickly for that if new and proper technology is adopted then it ok, but even with the old technology and old method of working operations some people wants their money output from construction as soon as possible. They just want to get reed of work anyhow, so that they are not adopting proper methods of construction and not allowing that much time which should have at least any structural member to gain sufficient strength for further constructions works. This practice is generally done by contractors and sometimes by owners, and if engineer ignore this thing then in future leads to cause of formations of cracks, leakages in structures.

2.3.8 Cracks Due to Fluctuations of Water Level By Natural or By Manmade Events

Actually, water for structure any way harmful because anyway it creates problems for structure it is necessary to take observation on water related items that might be anything such as foundations levels soil, etc. water level low as well as high creates problems. for example if structure is constructed on black cotton soil then it is very crucial to pay attention on water level below soil because black cotton soils bulkiness behaviour is very large means it change very drastically on water level high or low. Other

observed cracks in building are normal and their reason to form is mention already in previous introduction chapter so one can prefer from there. In that chapter we clearly mention that what are the various causes of cracks in building, etc.

2.3.9 Preventive Measure that Must be Taking to Avoid Cracks Formation

i. While planning we hate to observe the all site. We have to investigate foundation soil very well. For foundation we have to take sufficient test pits of soil investigation and study the soil behaviour, its property, its formations so that in future any problem will not come except natural reasons.

ii. Architecture or structural engineer should design the structure very well. They have to study all things for design process and consider all necessary things before cracks are form due to improper structural design of structure such as improper load estimation or improper design specification of any structural member. This leads to stress on particular point in structure then in future it leads to cracks.

iii. Site engineer or consult engineer staff play an important roles behind structural behavior's, looks and strength. If consult engineer staff ignore their works or if they don't perform their responsibilities very well then it leads to fault in construction of building then in future time this will lead to causes of cracks in building.

iv. If consult engineering staff is not maintaining the specification of any item work of structure, if they not using well and good quality material, if are not following proper method of working that should be practice on site, if they are not taking testing of any material time to time, if they are not using design norms, rules and

regulations all these things in future leads to various types of cracks in building or any other structures.

v. It has observed that if any pipeline is pass through any structural member and previous provision are not made before then labours chiseleds the structural member such as column.

2.4 Proffer Measures to mitigate the impact of Creaks on the performance of Residential building in Auchi

It is good to find ways to keep away from the problems resulting from cracking by way of adopting good enough substances and strategies, right layout and effective specs and supervision. The preliminary matters that need to be taken care of to avoid the phenomena of cracking are as follows.

2.4.1 Use of First Rate Aggregates

Use of aggregates which are too first-rate and largely contain and excessive amount of a clay or silt, not graded property have to be avoided. The permissible percentage of clay and slit in higher-quality combination have to now not be extra than three%

2.4.2 Use of Coarse Aggregates

The allowable permissible length of coarse aggregate ought to be decided as consistent with task necessities. Also for concrete work coarse aggregates used need to be properly graded in an effort to reap excessive sturdiness and density. The quality content material in course mixtures should.

2.4.3 Underpinning

Underpinning is a sensitive remedial measure of crack in building in Auchi, when we have to understanding and judge the soil strata, the current situation and problems concerning the entire foundation, the required depth and extent of the new foundation. The main objective of underpinning is to transfer the load carried by the foundation from its existing bearing level to a new level at a lower depth. Underpinning techniques can also be used to replace an existing weak foundation (Roy and Roger, 2010)

2.4.4 Crack Stitching

Stitching is a manner of drilling of holes on each the edges of crack in which grouting is done with the assist of U-formed steel devices that covers the crack. When cracks are fashioned the tensile energy is relatively misplaced, on the way to advantage this misplaced tensile energy sewing is used, at the side of the drilling of holes, this system also entails cleansing the holes and filling the holes with the grout having significant bonding power.

2.4.5 Injection of Epoxy

This technique is very beneficial for repairing dormant or non- transferring cracks in slabs, partitions, columns and piers. It is considered as one of the most economical techniques and could be very a good deal able to maintaining the comp active strength of concrete. Pumping of epoxy in vertical cracks must be in this kind of way that epoxy have to begin coming into the bottom elevation till the extent of epoxy reaches the extent of entry port above. This technique is repeated until the crack has been completely packed with epoxy. In case of filling of horizontal crack, the process of injecting of

epoxy begins from one stop of the crack to the alternative stop of the crack inside the same way. Due to renovation of required pressure, the crack is filled.

2.4.6 Plugging and Drilling

This method consists of drilling through the whole duration of crack and filling or grouting it within the form of a key. This approach is majorly relevant whilst orientation of cracks is inside the shape of straight strains, and is available at one end. This approach is typically used for repairing vertical cracks in retaining partitions. Generally, a hole of 50-75mm diameter must be drilled in this system.

2.4.7 Sealing and Routing

This method is ideally used in conditions which require restore and upkeep and in which repair of systems isn't vital. In this method the crack is enlarged along its face that is uncovered, that is followed through filling with a suitable sealant. This is the commonplace and the most cost effective method as compared to other strategies like epoxy injection. Though routing and sealing may be done on vertical surfaces as well as on the curved surfaces it's miles usually relevant to flat horizontal surfaces consisting of slabs, pavements.

2.4.8 Sealing Cracks with Gravity Filling

Resins and monomers having comparatively low viscosity can be extensively used to seal cracks by using gravity filling. Urethanes having high molecular weight and some low viscosity epoxies have been efficaciously used previously. This technique normally includes cleaning the floor via water blasting or air blasting through this technique it's miles almost understood that decrease the viscosity of the filling the finer the cracks may be without problems filled.

2.4.9 Impregnation of Polymer

The maximum normally used monomer in this approach is methyl methacrylate. This machine is exceptionally used for effective restore of a few cracks. The monomer system used in that is a liquid monomer so that you can ultimately polymerize into strong.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Introduction

This chapter comprises the methodology that was use in carrying out the research survey which include; the research design, population, sample size, sampling techniques, sources of data collection, method of data presentation and method of data analysis.

3.2 Research Design

The research design adopted in this study is the survey and descriptive design method. The design is adopted because the study involves the use of a representative from the population and drawing of conclusion based on the analysis of available data.

3.3 Population of the Study

The population of this study comprise of individuals who are building professionals, building contractors and sub-contractors, quantity surveyors, engineers, Architects and Builders in Auchi Etsako West Local Government Area. Sample was distributed to Builder, Architect, Quantity Surveyor and Project manager. It is the most familiar and indispensable tool in research studies. It involves taking a portion out of the population or a general body and from this sample conclusion are drawn relating to the whole. This is based on the subject of the research and the need of diverse views of professionals in the construction industry.

3.4 Sampling Size

Using unknown formula,

The sample size was determined using the formula:

$$n = \frac{z\,(p)\,(q)}{(e)^2}$$

where

n = minimum required sample size when population is unknown

z = the value of the z table at a given confidence level. (95% = 1.96)

p = maximum variability of the population. (50% = 0.5)

q = 1-p

e = Error margin = +_7.9% = 0.079

Mensah, (2014)

Hence,

Therefore: $n = \frac{(1.96)^2 (0.5) (1-0.5)}{(0.079)^2}$

$n = \frac{3.84(0.5) (0.5)}{0.00624}$

$n = \frac{0.96}{0.00624}$

$n = 153.8461$

Approximately =154

The population size of 154 shall be distributed to witness, builders, architect, engineers, contractors and sub-contractor. To analyze the data generated, statistical technique will be used. Simple percentage will be used to analyses the respondent opinions in the structured questionnaire. In testing the various hypotheses, the chi-square (X2) statistic was employed

3.5 Sampling Technique

To analyze the data generated, statistical technique shall be used. Simple percentage shall be used to analyses the respondent opinions in the structured questionnaire. In testing the various hypotheses, the chi-square (X^2) statistic shall be

employed. The research draw inferences from the data generated from primary and secondary source.

3.6 Method and tools for Data Collection

In gathering the data required for this research, the researcher shall use two major sources of data, which are as follows:

Primary Data: Data that shall be generated from the use of questionnaires and personal interview constituted the primary sources of data for this research work.

i. **Questionnaire:** Questionnaires shall be administered to some individuals in the affected areas. They shall be designed to find out the respondent's opinion about of building crack in Auchi, Etsako West Local Government Area, Edo State

ii. **Secondary Data:** In order to be more comprehensive, the researcher shall use data collected from textbooks, journals and internet.

3.7 Techniques of Data Analysis

The data collected shall be presented in tables to show the frequency of responses to the questionnaire. The researcher shall make use of simple percentage to analyze the data collected to ensure that results arrived at are valid and not of chance while chi-square shall be use for testing the hypothesis.

Formular for chi-square

$X^2 = \underline{(Fo-Fe)^2}$

Where:

X^2 = Calculated value of Chi-square

Fo = Observed Frequency

Fe = Expected Frequency

CHAPTER FOUR

DATA PRESENTATION, ANALYSIS AND HYPOTHESIS TESTING

4.1 Introduction

This chapter is concerned with the presentation and analysis of the data obtained via the administered questionnaires, and to test the hypothesis stated in the chapter one of this research work.

4.2 Data Presentation and Interpretation

This chapter was specifically written under the sub headings below, data presentation, analysis and discussion of findings, the data collected from the respondent via the questionnaires were presented in tables and analyzed by simple percentage as shown in the tables below

Table 4.2.1: Gender

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
Male	87	62.1	62.1	62.1
Female	53	37.9	37.9	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

The male 87 respondents represent 62.1%, while the female 53 respondents represent 37.9% of the entire respondent. In conclusion male are more than female

Table 4.2.1: Age

	Frequency	**Percent**	**Valid Percent**	**Cumulative Percent**
20-30yeras	21	15.0	15.0	15.0
31-40years	30	21.4	21.4	36.4
41-50years	42	30.0	30.0	66.4
50 and above	47	33.6	33.6	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

Form the above tables of age distribution 20-29 21respondent represent (15.0%), 31-40 represent (21.4%), 41-50 represent (30.0%), above 50 represent (33.6). In conclusion 41-50years of age is more than other age distribution.

Table 4.2.3: Academic Qualification

	Frequency	Percent	Valid Percent	Cumulative Percent
P.hd	8	5.7	5.7	5.7
M.sc	45	32.1	32.1	37.9
B.sc/HND	51	36.4	36.4	74.3
Other specify	36	25.7	25.7	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

The table of academic qualification, Ph.d represents (5.7%), Msc represent (37.1%), B.sc/HND represents (36.4%), secondary school represent (15.0%), represent and primary school represents (10.7%). In conclusion B.sc/HND qualification is more than other qualification

Table 4.2.4: Professional

	Frequency	Percent	Valid Percent	Cumulative Percent
Architech	12	8.6	8.6	8.6
Engineer	17	12.1	12.1	2.7
Builder	68	48.6	48.6	69.3
Quantity Surveyor	35	25.0	25.0	94.3
Others	8	5.7	5.7	100
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

The table of academic qualification, Ph.d represents (5.7%), Msc represent (37.1%), B.sc/HND represents (36.4%), secondary school represent (15.0%), represent and primary school represents (10.7%). In conclusion B.sc/HND qualification is more than other qualification

Table 4.2.4: Occupation of Respondent

	Frequency	Percent	Valid Percent	Cumulative Percent
Suppliers	32	22.9	22.9	22.9
Contractor	26	18.6	18.6	41.4
Project/site Manager	44	31.4	31.4	72.9
Consultant	38	27.1	27.1	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

The table of Occupation of Respondent, suppliers (22.9%), contractors represent (18.6%), project/site manager represents (31.4%) and consultant (27.1In conclusion project/site manager has the highest number of respondent

Table 4.2.5: What are the various forms of cracks that exist in residential buildings in the study Area?

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagreed	25	17.9	17.9	17.9
Disagreed	28	20.0	20.0	37.9
Neutral	15	10.7	10.7	48.6
Agreed	41	29.3	29.3	77.9
strongly Agreed	31	22.1	22.1	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

From the above table 25 respondent representing (17.9) strongly disagreed, 28 respondent representing (20.0) disagreed, 15 respondent representing (10.7) Neutral, 41 respondent representing (29.3) agreed while 31 respondent representing (22.1) strongly agreed. It was concluded that the majority of the respondent agreed that are the various forms of cracks that exist in residential buildings in the study Area

Table 4.2.6: What is the impact of crack on residential buildings

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagreed	30	21.4	21.4	21.4
Disagreed	18	12.9	12.9	34.3
Neutral	20	14.3	14.3	48.6
Agreed	39	27.9	27.9	76.4
strongly Agreed	33	23.6	23.6	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

From the above table 30 respondent representing (21.4) strongly disagreed, 18 respondent representing (12.9) disagreed, 20 respondent representing (14.3) Neutral, 20 respondent representing (14.3) agreed while 33 respondent representing (23.6) strong agreed. It was concluded that the majority of the respondent agreed that are the various forms of cracks that exist in residential buildings in the study Area

Table 4.2.7: What are the various roles building material play in generating cracks defeat in residential building

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagreed	27	19.3	19.3	19.3
Disagreed	17	12.1	12.1	31.4
Neutral	15	10.7	10.7	42.1
Agreed	51	36.4	36.4	78.6
strongly Agreed	30	21.4	21.4	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

From the above table 27 respondent representing (19.3) strongly disagreed, 17 respondent representing (12.1) disagreed, 15 respondent representing (10.7) Neutral, 15 respondent representing (10.7) agreed while 30 respondent representing (21.4) strong agreed. It was concluded that the majority of the respondent agreed that there are various roles building material play in generating cracks defeat in residential building

Table 4.2.8: What proffer measures used to mitigate the impact of cracks on the performance of residential building Auchi

	Frequency	Percent	Valid Percent	Cumulative Percent
Strongly Disagreed	12	8.6	8.6	8.6
Disagreed	11	7.9	7.9	16.4
Neutral	27	19.3	19.3	35.7
Agreed	48	34.3	34.3	70.0
Strongly Agreed	42	30.0	30.0	100.0
Total	**140**	**100**	**100**	

Source: Field Survey (2022)

From the above table 12 respondent representing (8.6) strongly disagreed, 11 respondent representing (7.9) disagreed, 27 respondent representing (19.3) Neutral, 48 respondent representing (34.3) agreed while 42 respondent representing (30.0) strong agreed. It was concluded that the majority of the respondent agreed that there are proffer measures used to mitigate the impact of cracks on the performance of residential building Auchi

4.3 Hypotheses Testing

Hypothesis One

H_o: There are no various forms of cracks that exist in residential buildings in the study Area

H_i: There are various forms of cracks that exist in residential buildings in the study Area

Contingency Table

Response	No of Respondent	Expected	Fo – Fe	Fo –Fe^2	$\frac{Fo\ Fe^2}{Fe}$
Strongly agreed	25	28	**-3**	**9**	**0**
Disagreed	28	28	**0**	**0**	**0**
Neutral	15	28	**-13**	**169**	**6**
Agreed	41	28	**13**	**169**	**6**
Strongly agreed	31	28	**3**	**9**	**0**
Total	140				**12**

Source: field survey, 2022

Calculate value for χ^2= 12 while the table value is 5.99 at 5% level of significance

Decision

For the result above, reveal that various forms of cracks that exist in residential buildings in the study Area is not significant at 5%. This means that the alternative hypothesis is rejected at 5% level of significance and the null hypothesis is accepted

Table 4.2.9: What are the various forms of cracks that exist in residential buildings in the study Area.

S/N	**Various form of crack that exists in residential building in Auchi.**	**5**	**4**	**3**	**2**	**1**	**Sum**	**Ms**	**Ranks**
1	Plastic shrinkage concrete cracks	40	20	60	5	15	475	3.39	3rd
2	Expansion concrete cracks	40	55	20	10	15	515	3.68	2nd
3	Heaving concrete cracks	15	15	60	40	10	405	2.89	6th
4	Settling concrete cracks	57	8	15	40	20	462	3.30	4th
5	Concrete cracks caused by overloading the slab	15	65	0	25	35	420	3.00	5th
6	Concrete cracks caused by premature drying	70	45	25	0	0	605	4.32	1st

Table 4.2.9 above shows the various forms of cracks that exist in residential buildings in the study Area with the following ranking; Concrete cracks caused by premature drying with Mean Score of 4.32, Expansion concrete cracks with mean score of 3.68, Plastic shrinkage concrete cracks with mean score of 3.39, settling concrete cracks with mean score of 3.30, Concrete cracks caused by overloading the slab with mean score of 3.00, Heaving concrete cracks with mean score of 2.89 represents the least rank the various forms of cracks in residential building from the order of the highest to the lowest.

Table 4.2.10: What are the Impact of cracks in residential buildings in Auchi

S/N	Impact of cracks in residential buildings in Auchi	5	4	3	2	1	Sum	Ms	Ranks
1	Destroys the foundations or walls and affects the building artistic.	80	60	0	0	0	640	4.60	1st
2	Reduce the durability and stability of the structure of the buildings	53	87	0	0	0	613	4.34	2nd
3	Crack makes the concrete and the structure more vulnerable to external effects	74	33	33	0	0	601	4.29	3rd
4	Crack can accelerates the ageing process and can immediately reduce the mechanical resistance of the structure	52	28	30	30	0	522	3.73	4th
5	Cracks reduce the ability of a structure to absorb stress and may lead to collapse	42	42	28	28	0	518	3.70	5th

Source: Field Survey 2022

Table 4.2.10 above shows Impact of cracks in residential buildings with the following ranking; Destroys the foundations or walls and affects the building artistic with Mean Score of 4.60, Reduce the durability and stability of the structure of the buildings with Mean Score of 4.34, Crack makes the concrete and the structure more vulnerable to external effects with Mean Score of 4.29, Crack can accelerates the ageing process and can immediately reduce the mechanical resistance of the structure with Mean Score of 3.73, Cracks reduce the ability of a structure to absorb stress and may lead to collapse with Mean Score of 3.70 represents the least rank the impacts of cracks in residential building from the order of the highest to the lowest.

Table 4.2.11: Which Roles of Building Materials Play in Generating Cracks Defeat in Residential Building in Auchi

S/N	Roles of Building Materials that Generating Cracks	5	4	3	2	1	Sum	Ms	Ranks
1	Quality of concrete	57	43	23	12	5	555	3.96	2nd
2	Reinforcements corrosion	53	25	42	13	7	524	3.74	5th
3	Poor maintenance	50	28	39	15	8	517	3.69	6th
4	Poor structural design and specification or poorly constructed extension work	49	45	26	14	6	537	3.84	4th
5	Plaster settlement cracking	52	46	24	15	3	549	3.92	3rd
6	Climate and seasonal changes	28	26	47	0	39	424	3.03	10th
7	Re-active soils	39	49	0	52	0	495	3.54	8th
8	Water damage (flood)	37	0	37	66	0	428	3.06	9th
9	Repairing and sealing wall cracks	56	28	56	0	0	560	4.00	1st
10	Costs of wall cracklings	50	40	0	50	0	510	3.64	7th

Table 4.2.11 above shows Roles of Building Materials that Generating Cracks with the following ranking; Repairing and sealing wall cracks with Mean Score of 4.00, Quality of concrete with Mean Score of 3.96, Plaster settlement cracking with Mean Score of 3.92, Poor structural design and specification or poorly constructed extension work with Mean Score of 3.84, Reinforcements corrosion with Mean Score of 3.74, Poor maintenance with Mean Score of 3.69, Costs of wall crackling with Mean Score of 3.64, Re-active soils with Mean Score of 3.54, Water damage (flood) with Mean Score of 3.06, Climate and seasonal changes with Mean Score of 3.03 represents roles of building materials play in generating cracks defeat in residential building

Table 4.2.12: What are those Proffer measures to mitigate the impact of cracks on the performance of residential building in Auchi

S/N	Proffer measures to mitigate the impact of cracks	5	4	3	2	1	Sum	Ms	Ranks
1	Planning the layout of restraining member	61	41	21	16	1	565	4.04	1st
2	Structural separation to mitigate cracks in reinforced concrete structures	39	58	27	11	5	535	3.82	2nd
3	Closure strip joints and favorable pouring sequences	45	30	45	10	10	510	3.64	4th
4	Released connections (walls/slab release, slab-column release, wall joints)	22	40	28	28	22	432	3.09	6th
5	Addition improved layout of mild reinforcement	26	28	65	19	2	477	3.41	5th
6	Underpinning	55	36	17	13	19	515	3.68	3rd

Source: Field Survey 2022

Table above shows Proffer measures to mitigate the impact of cracks with the following ranking; planning the layout of restraining member with Mean Score of 4.04, Structural separation to mitigate cracks in reinforced concrete structures with Mean Score of 3.82, Underpinning with Mean Score of 3.68, Closure strip joints and favorable pouring sequences with Mean Score of 3.64, Addition improved layout of mild reinforcement with Mean Score of 3.41, Released connections (walls/slab release, slab-column release, wall joints) with Mean Score of 3.09 represents the least rank proffer measures to mitigate the impact of cracks on the performance of residential building.

CHAPTER FIVE

SUMMARY OF FINDING, CONCLUSION AND RECOMMENDATIONS

5.1 Summary of Findings

The following are the findings of the study

For the result above, reveal that various forms of cracks that exist in residential buildings in the study Area is not significant at 5%. This means that the alternative hypothesis is rejected at 5% level of significance and the null hypothesis is accepted

5.2 Conclusion

After completing this case study we found that all cracks were distresses-cracks. Cracks formed because of shrinkage and overload of the structure. They are not affecting the structural stability of the structure. Distress present in the buildings can be easily repaired. All type of crack requires same level of attention. Distress present in the buildings can be easily repaired. Any structure or building should be design for limit state of collapse but it must be check against limit state of serviceability which includes cracking of structure also. And cracks can reduce its appearance, durability, and some time cause failure of structure. Cracks are classified into structural and non-structural categories. The structural ones are due to faulty design, faulty construction or overloading which may endanger safety of buildings. The non-structural cracks are due to internally induced stresses, and environment surrounded the structure or building. OBSERVING case study on crack treatment it is important to keep maintaining structure time to time or else leads to injury and in addition cost will increase for future problems in structures that might be come.

Cracks are repaired on the basis of its extend of formation and its cause behind formation on that basis we select the method of repairing crack and selection of crack repair product are choose. Cracks are formed due to flection of water level and type of soil which is present on site, these two combinations depend on situation crates problems and can be a cause of cracks sometimes major and sometimes minor, i.e. black cotton soil and water level fluctuations.

5.3 Recommendations

The potential causes of crack can be controlled if proper consideration is given to construction material and technique to be used. If we focus on the major causes to cracks in our building and take their preventive measures initially, we will able to minimize the problem of cracking in our structure.

Reference

AbdulRaheem, D, (2020) "Prevention and Repair Of Cracks In Buildings" *International Journal of Research In Science & Engineering*, 3 (2) 45-57.

Ajagbe W.O., & Ojedele O. S., (2018) "Structural Investigation into the Causes of Cracks in Building and Solutions: A Case Study "American *Journal of Engineering Research (AJER)* (7) 152-160

Bella Omunagbe, C.O., Fedele, S. O,& Kassem, A., (2013) Building service and Environment Science

Bella Omunagbe, C.O., Ufuah, E.A., Elamah, D., Fedele, S. O, (2012). Building construction made easy

Hyunwoo, M. I (2015), "Causes and Remedies of Cracks in Concrete building" the constructor.org

IS 456:2000 "Plain and reinforced concrete " "Fourth Revision

Jonathan, I, (2012). Building Maintenance Technology

Matha, K., & Gerwick, O. (2015) "Causes, prevention and repair of cracks in building.", Collegelib.com

Omunge, U., Kashyzadeh, K. Shetty, M. S. (2013) Concrete Technology, New Delhi, S Chand Publications

Roy, C.J. and Roger, Y.N. (2010), Study on Causes and Prevention of Cracks in Building. *International Journal for Research in Applied Science & Engineering Technology*, 6, (2) 453 – 461

APPENDICES I

QUESTIONNAIRE

Department of Building Technology,

School of Environmental Studies,

The Federal Polytechnic,

Auchi.

Dear Respondent,

REQUEST FOR COMPLETION OF QUESTIONNAIRE

The undersigned is conducting a Higher National Diploma research survey on "**ASSESSMENT OF CAUSES, PREVENTION AND REPAIRS OF CRACKS IN BUILDING (A CASE STUDY OF AUCHI, EDO STATE) ".** Your kind assistance is required in filling the questionnaire and making relevant information available.

Your feedback will provide insight and necessary information in order to achieve the aim and objective of the study.

I wish to assure you that the information so provided will be treated with strict confidence and use for academic purpose only.

Thank you for sparing me your valuable time.

Yours Faithfully,

ONYENUWE GODWIN

APPENDIX I

QUESTIONNAIRE

ASSESSMENT OF CAUSES, PREVENTION AND REPAIRS OF CRACKS IN BUILDING (A CASE STUDY OF AUCHI, EDO STATE)

Section A: The Bio-Data of the respondents

Instruction: Please tick as appropriate

1. Gender: (a) Male [ ] (b) Female [ ]
2. Age: (a) 20-30 [ ] (b) 31-40 [ ] (c) 41-50 [ ] (d) 50 and above [ ]
3. Occupation of Respondent: (a) Civil Servant [ ] (b) Business [ ] (c) Project Manager [ ] (d) Artisans [ ] (e) other specify [ ]
4. Academic Qualification: (a) PHD [ ] (b) Msc [ ] (c) Bsc/HND [ ] (d) OND [ ]
5. Profession: (a) Architect [ ] (b) Engineer [ ] (c) Builder [ ] (d) Quantity Surveyor [ ] (e) others specify [ ]
6. How often/frequent do you see crack in building? (a) frequent [ ] (b) More often [ ] (c) Neutral [ ] (d) Rare [ ]

Section B

1. **What are the various form of crack that exist in residential building in Auchi**

Below are the various form of crack that exist in residential building in Auchi. Rate the factors in order of priority on a scale of 1 to 5

Strongly Agreed (5) Agreed (4) Neutral (3) Disagreed (2) Strongly Disagreed (1)

S/N	**Various form of crack that exists in residential building in Auchi.**	5	4	3	2	1
1	Plastic shrinkage concrete cracks					
2	Expansion concrete cracks					
3	Heaving concrete cracks					
4	Settling concrete cracks					
5	Concrete cracks caused by overloading the slab					
6	Concrete cracks caused by premature drying					

2. What are the Impact of cracks in residential buildings in Auchi

Below are the factors that impact of cracks in residential buildings in Auchi. Rate the factors in order of priority on a scale of 1 to 5

Strongly Agreed (5) Agreed (4) Nentral (3) Disagreed (2) Strongly Disagreed (1)

S/N	**Impact of cracks in residential buildings in Auchi**	**5**	**4**	**3**	**2**	**1**
1	Destroys the foundations or walls and affects the building artistic.					
2	Reduce the durability and stability of the structure of the buildings					
3	Crack makes the concrete and the structure more vulnerable to external effects					
4	Crack can accelerates the ageing process and can immediately reduce the mechanical resistance of the structure					
5	Cracks reduce the ability of a structure to absorb stress and may lead to collapse					

3 Which Roles of Building Materials Play in Generating Cracks Defeat in Residential Building in Auchi

Below are the Roles of Building Materials Play in Generating Cracks Defeat in Residential Building in Auchi. Rate the factors in order of priority on a scale of 1 to 5

Strongly Agreed (5) Agreed (4) Neutral (3) Disagreed (2) Strongly Disagreed (1)

S/N	Roles of Building Materials that Generating Cracks	5	4	3	2	1
1	Quality of concrete					
2	Reinforcements corrosion					
3	Poor maintenance					
4	Poor structural design and specification or poorly constructed extension work					
5	Plaster settlement cracking					
6	Climate and seasonal changes					
7	Re-active soils					
8	Water damage (flood)					
9	Repairing and sealing wall cracks					
10	Costs of wall cracklings					

4 What are those Proffer measures to mitigate the impact of cracks on the performance of residential building in Auchi

The following factors can be used to show builders, architecture, contractor and structural engineers on how remedial measures of crack in building

Strongly Agreed (5) Agreed (4) Neutral (3) Disagreed (2) Strongly Disagreed (1)

S/N	Proffer measures to mitigate the impact of cracks	5	4	3	2	1
1	Planning the layout of restraining member					
2	Structural separation to mitigate cracks in reinforced concrete structures					
3	Closure strip joints and favorable pouring sequences					
4	Released connections (walls/slab release, slab-column release, wall joints)					
5	Addition improved layout of mild reinforcement					
6	Underpinning					