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BUILDING DEFECT: CASE STUDY AT TAMAN SERI INDAH, PULAU PINANG

NUR DIYANA BINTI MD.KASIM

UNIVERSITI MALAYSIA PAHANG

BUILDING DEFECT:
CASE STUDY AT TAMAN SERI INDAH, PULAU PINANG

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A thesis is submitted in partial fulfilment of the
requirements for the award of the degree of
Bachelor of Civil Engineering

Faculty of Civil Engineering & Earth Resources
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NOVEMBER 2009

I declare that this thesis entitled "*BUILDING DEFECT: CASE STUDY AT TAMAN SERI INDAH, PULAU PINANG"* is the result of my own research except as cited in the references. The thesis has not been accepted for any degree and is not concurrently submitted in candidature of any other degree.

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ABSTRACT

Malaysia is one of the developing countries and many projects are being implemented. Currently, which some of the projects involve construction of buildings. The construction industry helps to generate the nation's economy as well as providing benefits to construction companies. But some of these firms acted unprofessionally by involving in projects that do not meet the standard especially in housing development. There are a lot of defects to the houses purchased by house buyers especially in terms of material and workmanship. This study is conducted to identify types of building defect occur in building and to identify causes of building defect occur in building. Besides that, study on building defects which occur at case study area also has been done. The resident satisfactions level on their housing after defect liability period also being analyzed. The study area is located at Taman Seri Indah, Penang. The methodology adopted is through literature review and interview with the developer and house buyers. The data are collected through questionnaire that had been distributed to the parties involve in construction and the house buyers at study area. Types and causes of building defect also can be identified according to survey that has been done to people that involve in construction industry. The results also show the poor workmanship is the major contributor to poor quality of construction. In order to minimize the problem, the contactor has to provide workers with necessary experience and skills. The finding of this study can be used for future references.

ABSTRAK

Malaysia merupakan sebuah negara yang membangun dengan projek-projek baru dan antara projek ini adalah melibatkan projek pembinaan bangunan baru. Industri pembinaan dapat menjana ekonomi dan dapat memberi keuntungan kepada sesebuah firma. Namun begitu, terdapat sesetengah firma ini bertindak secara tidak profesional dengan menceburi bidang ini tanpa mengira spesifikasi yang telah ditentukan. Terdapat banyak aduan yang diterima mengenai kecacatan ke atas rumah yang dibeli, samada dari segi kualiti kerja mahupun bahan binaan yang digunakan. Kajian ini dijalankan bagi mengkaji jenis-jenis kecacatan dan punca-punca yang kecacatan yang berlaku di dalam bangunan. Di samping itu, kepuasan pembeli di kawasan kajian selepas tempoh tanggungan kecacatan juga telah dikenalpasti. Kajian telah dijalankan di Taman Seri Indah, Pulau Pinang. Penggunaan pendekatan kajian literatur dan temubual dengan pemaju dan pembeli rumah akan menjawab objektif kajian yang telah ditetapkan. Data dikumpul malalui kertas kaji selidik yang telah diedarkan kepada mereka yang terlibat dalam industri pembinaan dan pembeli rumah di kawasan kajian dijalankan. Hasil kajian menunjukkan, jenis-jenis dan punca-punca kecacatan ke atas bangunan dapat dikaji. Selain itu, berdasarkan kepada keputusan kajian, ketidakmahiran pekerja merupakan penyumbang terbesar kepada kecacatan dan kualiti bangunan. Sebagai langkah untuk mengurangkan masalah ini, pihak kontraktor dikehendaki menyediakan pekerja yang mempunyai kemahiran tinggi dan juga berpengalaman di dalam bidang masing-masing.

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CHAPTER 1

INTRODUCTION

1.1 Introduction

Nowadays, as the technology advances and changes, the need of more infrastructures will be more appear. Buildings in particular are important structures and are main concern of the government to make sure it is maintained regularly to prevent it from deteriorating and eventually could pose as fatal to public.

Defects in buildings are so common that Malaysians do not bat an eye anymore, or one could say they are immune to news of these defects when highlighted. A building defect is a building flaw or design mistake that reduces the value of the home, and/or causes a dangerous condition. Some defects are obvious (such as water seepage) but many are less obvious and do not become apparent until years after a building was constructed. A construction defect can arise from a variety of factors, such as poor workmanship or the use of inferior materials.

Now one might ask, how were these defective buildings allowed to be occupied assuming that they have met the requirements of building by-laws and are certified fit for occupation. Many researches had been done to prevent this problem. However, this problem still cannot be solved. If this problem can be solved, it will prevent uncomfortable to customer, reduce the maintenance of building to people which maybe close up million dollars per year.

The quality of the workmanship is another aspect that has been giving contractors a bad name. The Construction Industry Development Board (CIDB) is supposed to wrestle this issue by requiring all relevant laborers or those in a similar trade to undergo a skills training programmer conducted by the CIDB Academy.

Besides, lack of enforcement and supervision also contributed to these defects. However, a good project management team acting on behalf of the client should be able to look after the interest of its clients by making sure the contractors do not compromise on the quality of the workmanship through its resident engineer.

Traditionally, we are only concerned with the financial burden of getting the building erected and we are not made aware of the yearly maintenance cost, the operational cost and replacement cost. At times, the total cost of these three elements might surpass the construction cost (Siti Hamisah Tapsir, 2007).

1.2 Problem statement

Building defect is one of the major components of building that needed attention. When a building fails to perform as it should, we immediately look for answers. Is the problem is the result of someone's failure to assemble it properly? Is the problem an act of nature? Was the proper maintenance of the building not performed as it should have been? The answers often depend upon a number of factors: the age of the affected building component, the exact nature of the problem, the presence or absence of human error, or some combination of all three (3).

According to the National Building Agency (1985), defects occur either because of poor design, or low quality workmanship, or because the building was not constructed according to the design, or because it has been subject to factors not allowed for in the design. These primary causes may operate singly or in combination and result in defects indicated by changes in composition of materials; in the construction itself; in the size, shape or weight of materials; or simply in appearances.

As stated in The Star Tuesday May 1, 2007, "Pak Lah orders immediate inspection of government buildings" (Appendix A). Based on this statement, The Prime Minister ordered an immediate inspection of all government buildings for defects referring to a spate embarrassing defects in new government offices - the collapse of a ceiling due to a leaky sprinkler system at the Entrepreneur and Co-operative Development Ministry in Putrajaya.

Besides that, some 170 residents of block four at Taman Jaya, Skudai, are living in fear as the building they occupy may collapse anytime due to severe cracks on the walls and floors. According to one of residents of that block, the problem started three (3) years ago when a wall that divided two (2) ground floor units situated at the left side of the building cracked. She also said, “The fracture was so serious that the bricks fell off, exposing the steel bars used as supports”. More over, residents were also afraid if the building will collapse and don’t know where to move. This statement is stated in The Star Wednesday July 16, 2008 (Appendix B).

More over, as stated in The Star Sunday November 16, 2008, Housing and Local Government Minister Datuk Seri Ong Ka Chuan, said the ministry had received about 250 complaints every year on building defects from buyers. “Many of those defects are caused by defective or poor quality building materials” (Appendix C).

Then, the Bukit Damansara tragedy has open many eyes toward the significant of proper maintenance not just to avoid building defect but the world disaster. As stated in New Straits Times Sunday December 14, 2008, Works Minister Datuk Mohd Zin Mohamed is baffled how rainwater was trapped atop Taman Bukit Mewah which he believes led to the Bukit Antarabangsa landslide.

"I suspect this is caused by humans, so let's not blame Mother Nature," he told Public Works Department (PWD) engineers. He ordered the PWD, which is spearheading a three-month geotechnical, forensics and integrity probe of the slope and building structure stability, to come up with answers on the cause of the landslide and provide recommendations to avert disasters (Appendix D). Will the tragedy of landslide in Bukit Antarabangsa teach us some lesson? Or will it be a platform for people to point fingers at each other, or will it be the stage for people to condemn the work of God?

Because buildings are not single products but rather an assembly of individual parts and components often put together by different contractors; and because the materials used often require periodic maintenance to maintain their projected service lives; and because acts of nature often intervene to test the resistance of building components to leaks and decay, it is usually never exactly clear why a particular building defect occurs. The average person who might sit in judgment one day cannot easily understand, much less unwinds the disputes that arise over these enigmatic, technical and often costly problems (Tyler, 2008)

1.3 Objectives

The objectives of carrying out this study are as follow:

a) To identify types of building defect occur in building.
b) To identify causes of building defect occur in building.
c) To study on building defect occur at case study area.

1.4 Scopes of Study

In relation with the objectives of the study, the scopes of study are:

a) The study will be conducted at Taman Seri Indah, Kepala Batas, Penang as case study area.
b) The study will be carried out the data on building defect occur at case study area.
c) Questionnaire will be prepared and interview will be conducted with the parties involve in construction industry and residents at case study area.

1.5 Study Methodology

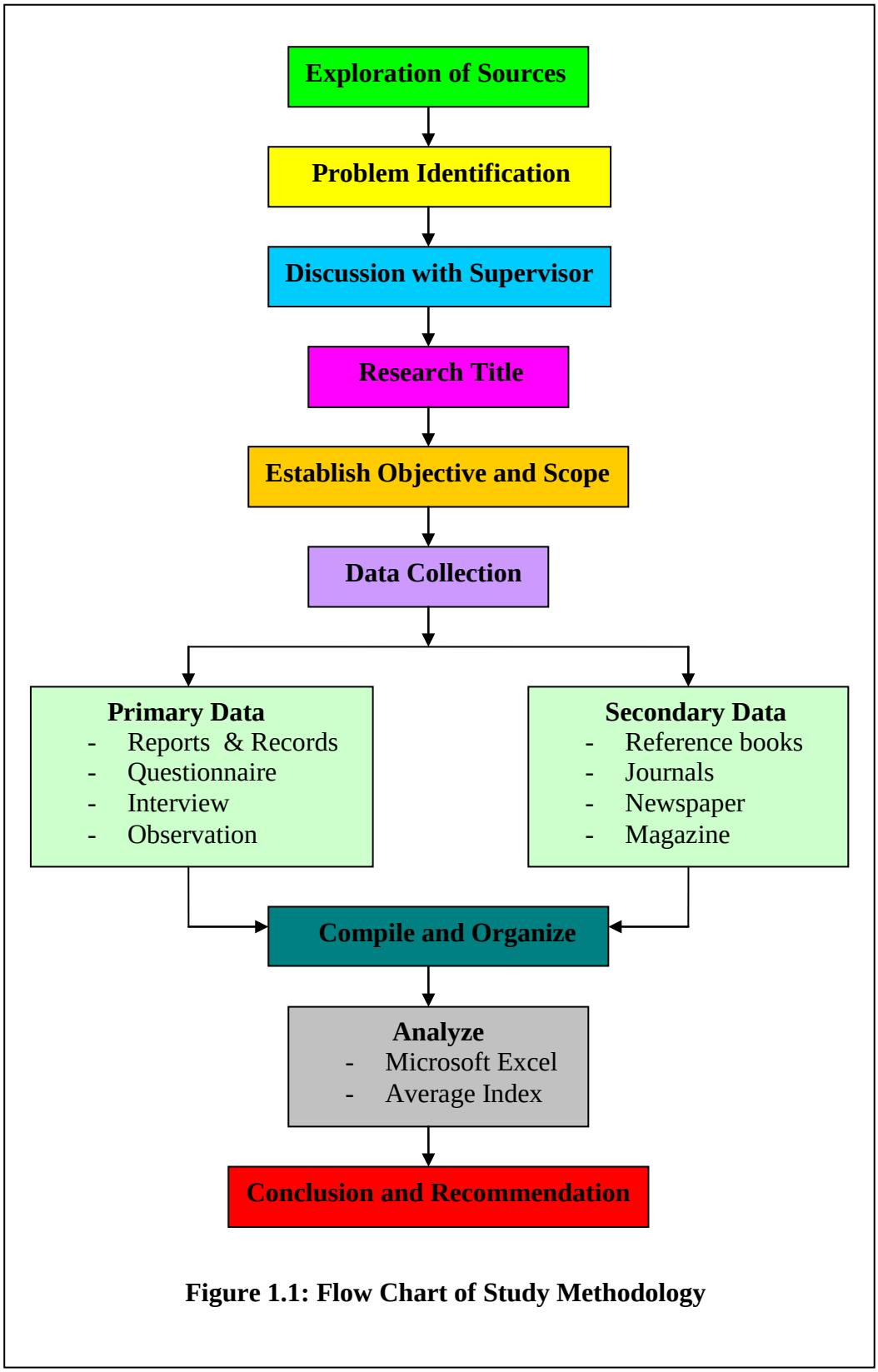

Figure 1.1: Flow Chart of Study Methodology

1.6 Significance of the Study

Building defects are so common that Malaysians do not bat an eye anymore, or one could say they are immune to news of these defects when highlighted. The question is why we must let this issues conquer the development of building? Nothing packs a more costly punch and ruins a project than a construction defect dispute. I choose this title for my study because I personally interested to understand this issue more deeply and get the knowledge by my own way and experience.

When a building suffers defects, the causes of that defect have to be properly identified before any remedial work can be undertaken. The study has been done to assist professionals and students who are involved in building construction to identify types of building defects and its causes. Besides, the readers will know the satisfaction level of residents at my case study area.

CHAPTER 2

LITERATURE REVIEW

2.1 Introduction

Construction defects can take many different forms, and range from minor problems to major structural failures. Residential and commercial constructions are both governed by detailed building codes. The code which applies to a given structure is that code which was in effect at the time the permit for construction was issued. Not only must a general contractor construct the structure according to the applicable building code, but he must also satisfies the plans and specifications for construction.

Typical defects reported by building owners include: inadequate moisture proofing, resulting in interior leaks, rot and mold; foundation cracks; inadequate grading, causing water to pool around the structure; defective roofing; leaking windows; improper framing; and flooring and ceiling defects. These problems may be traced to a variety of culprits.

A building or construction defect is a defect or deficiency in the design, construction, or materials on a construction project. Broadly speaking, building defects fall into two (2) categories: defects that affect the performance of the structure, and defects that affect the appearance of the structure. From the legal perspective, a building defect is defined in somewhat different terms. Legally, a building defect is a violation of the applicable building code, a violation of the standard of care in the community in which the project is located, or a violation of the manufacturer's recommendations (Robert S.Mann, 2007)

Defect is the nonconformity of a component with a standard or specified characteristic. Defect is used sometimes as a synonym for "failure", but the preferred meaning is to indicate only a deviation from some (perceived) standard that may, but will not necessarily, result in failure (David, 1997)

2.2 Types of Defect

2.2.1 Erosion of Mortar Joints

Basically, the main function of a mortar joint is to even out irregularities of individual blocks, whether they are of stones or bricks. At the same time it provides some adhesion between the blocks. Decayed mortar can be removed forcibly by the use of a mechanical disc or carefully raked out by using a knife or spike manually.

2.2.2 Peeling Paint

Peeling paint usually occurs on building facades, mainly on plastered walls, columns and other areas which are exposed to excessive rain and dampness. Some buildings located near the sea may face a much greater risk once the signs of peeling paint are visible on the exterior walls.

2.2.3 Cracking of Walls / Leaning Walls

Apart from distributing loads from roofs and floors to foundations, external walls may be harmful to a building if they are structurally unsound. Cracks in wall, either vertical or diagonal, are common symptoms of structural instability.

2.2.4 Unstable Foundations

Foundations are a part of a building which distributes loads from roofs, walls and floors on to the earth below. They are structurally important to the permanent of a building and if this is lacking there is no point of spending large sums of money on other superficial restoration work.

2.2.5 Roof Defects

Besides being one of the main structures in a building, roof may act as a weather shield, giving protection to users or occupants from rain and sun. Therefore, it is important to treat any aging roof tiles.

2.2.6 Honeycombing

Honeycombing refers to voids in concrete caused by the mortar not filling the spaces between the coarse aggregate particles. It usually becomes apparent when the formwork is stripped, revealing a rough and 'stony' concrete surface with air voids between the coarse aggregate. Sometimes, however, a surface skin of mortar masks the extent of the defect. Honeycombing may extend some depth into the member. Honeycombing is always an aesthetic problem, and depending on the depth and extent may reduce both the durability performance and the structural strength of the member. Formation of honeycombing is due to the presence of air and bubble at the surface of formwork and results a separation between aggregates and cement mixture. This problem will damage the concrete and more serious attack the reinforcement bar in concrete.

2.2.7 Dampness

Dampness can be a serious matter, particularly to buildings located near water sources. Not only does it deteriorate building structures but also damages to furnishings. The main cause of dampness is water entering a building through different routes. Water penetration occurs commonly through walls exposed to prevailing wet wind or rain. With the existence of gravity, water may penetrate through capillaries or cracks between mortar joints, and bricks or blocks before building up trap moisture behind hard renders. Water may also drive further up the wall to emerge at a higher level. Dampness also occurs in walls due to other factors such as leaking gutters or down pipes, defective drains, burst plumbing and condensation due to inadequate ventilation.

2.3 The causes of building defect

2.3.1 Erosion of Mortar Joints

Erosions of mortar joints are caused by factor as discussed below which are weathering action, unaccommodated building movement and influence of the freeze cycle or thaw cycle.

2.3.1.1 Weathering Action

Weathering is inevitable. Wind and rain erode mortar. Mortars lacking Portland cement are especially vulnerable to weathering from acid rain. On extreme exposures, the mortar joint can be weathered away to a depth of several inches. Usually, weathering of mortar is accompanied by deterioration of masonry.

2.3.1.2 Unaccommodated Building Movement

Prior to the 20th century, building movement caused by wind, thermal cycling, and masonry growth due to moisture absorption was poorly understood. Tolerance for movement was not designed into structures. When movement or uneven settling of a building's foundation or walls, occurs, cracking of the masonry, usually at mortar joints will occurs. Repeated thermal cycling causes the masonry to expand and contract breaking the bond between the mortar and units.

2.3.1.3 Influence of the Freeze/Thaw Cycle

Moisture entering at a cracked or open mortar joint can freeze, expand, and cause a section of the joint and a portion of the surrounding masonry to pop off. This is called spalling. It can be repetitived and cause a chain of failures.

2.3.2 Peeling Paint

2.3.2.1 Water

If water vapor condenses underneath the primer or finish pressure will result causing the paint to lift from the surface and crack. This crack will be very small, but it will allow more water onto the surface and behind the finish. This process accelerates until peeling paint is notified. A possible cause of water infiltration is inadequate or split caulking. Applying the best sealant and using proper caulking techniques can make or break any paint job. An additional area of concern is water vapor in the exterior walls. This can be a major problem with older homes that do not have plastic vapor barriers installed between the framing and drywall or plaster.

2.3.3 Cracking of Walls / Leaning Walls

2.3.3.1 Settling

Footers (the things foundation sits on) may be built on loose material. It might expand or contract over time because of the weight on it. In any case, settling results from the shifting. So, cracks that develop from that settling will be seeing. Loose backfill that has been placed around the house can also settle and exert extra pressure on the walls, creating the same problem, especially if that backfill is comprised of lots of dense clay materials.

2.3.3.2 Deterioration

Deterioration is the gradual adverse loss of physical or chemical properties of a material (American Society 1990; American Concrete 1979) People expect their roofs to need replacing periodically. They also expect to re-paint their home periodically. What they do not realize is that the same thing applies to a foundation. The coatings put on the walls can break down over time, allowing water to come in contact with the concrete. Once that happens, the water begins to affect the strength of the concrete. At that point, discolorations, water, cracks, or bowing of the walls might begin to see.

2.3.3.3 Shrinkage

Shrinkage comes from the curing of the concrete or mortar. As it shrinks, cracks develop, usually along mortar lines, but sometimes in the form of vertical cracks. Once there is a crack, it is weaker than the surrounding wall and that leads to the possibility that pressures from outside will begin to bow that wall. Later shrinkage is caused by continuing hydration and carbonation (Rollings, 1993)

2.3.4 Unstable Foundations

2.3.4.1 Lateral pressure

Lateral pressure can affect the overall integrity of a house. Severe damage results in a visible opening between the top of the basement wall and the structure. Since water is one of the main causes of these cracks, water infiltration becomes significant in the largest of the cracks. Filling these cracks with epoxy, without solving the water problem, only moves the lateral pressure to another section of the wall.

The difference of the outside ground level and the basement floor creates a mass of soil that must be retained thus causing a lateral pressure. The pressure of soil weight is typically considered during the design of an engineered wall using theoretical earth pressures.

Clay soils undergo a change in volume when the moisture content of the soil changes. When expansive clays are placed against basement walls, the swelling of these soils can induce lateral pressures not accounted for in the original design. Cyclic shrink or swell can also reduce the shear strength of the backfill and thus increase the lateral pressures. The solution to this problem can be as easy as replacing clay backfill with gravel or other non-swelling material. When used in conjunction with a footing drain, gravel will prevent increased lateral pressure.

2.3.4.2 Structural Settlement

Structural settlement is characterized as either total and /or differential settlement. Total settlement is a complete structure downward movement. Differential settlement is the difference in vertical movement between various locations causing structure distortion. Generally, total settlement is not a critical factor as long as it is uniform. Utility connections are affected to the greatest degree by total settlement. Even relatively small differential settlements can cause cracks in floor slabs, brick walls and drywall.

Settlement can be tolerated in most homes provided it is within specified limits. Small amounts of settlements are anticipated in most design work. When homes experience excessive settlement special procedures must be employed to stop or limit the amount of settlement. These special procedures usually employ the use of resistance piers or helical anchors. A foundation engineer is recommended when implementing underpinning procedures.

2.3.5 Roof Defects

2.3.5.1 Thermal Movement

Extremes between winter and summer, day and night, create expansion and contraction in the concrete beams and slab, (steel beams will be even more prone to movement). This causes regular stresses on asphalt membrane and tile joints above.

2.3.5.1 Surface Cracking

The tile joints and even the tiles themselves will quickly give in to the movement (sometimes within the first season, or following an exceptionally hot summer or very cold winter) and hairline cracks will appear.

2.3.5.2 Membrane Cracking

Initially the asphalt membrane will be more flexible and hence, more tolerant to some minor movement, but over the years it becomes brittle as compounds evaporate out from the material. Regular movement will cause fatigue along the movement lines and eventually break though the asphalt.

2.3.5.3 Surface Decay

While the membrane tires over the years, foot traffic and weathering will also break down the water resistant surfacing of the tiles and the cracked joints will allow for passage of water directly to the membrane. Point loads such as water tanks can also cause problems.

2.3.5.4 Water ingress

Once water gets to the failing membrane, it will soon track through to the living space. Ceilings will get stained or later risk collapse, the beams will start to decay and rainy days may call for a few strategically placed buckets. Poor laying or bowing of the roof can also create pooling areas which will normally cause more extensive ingress.

2.3.6 Honeycombing

2.3.6.1 Segregation

Segregation is the differential concentration of the components of mixed concrete, resulting in nonuniform proportions of the mass. Usually, segregation refers to a horizontal Stratification caused by gravity (American Concrete 1979; American Concrete 1990)

2.3.6.2 Poor workmanship

The low quality of material used and the material used not suitable in term of mixing concrete. Besides, the faulty in poor workmanship also because the workers did not know how to mixed concrete with right composition.

2.3.7 Dampness

2.3.7.1 Rainwater

Rainwater is dangerous to building because its water contain chemical reaction that can cause external such as defects uttering, proofing, pointing, rendering, overflows etc. The symptoms are water ingress, defective plaster and timber decay.

2.3.7.2 Leak in plumbing

Most plumbing problems occur at or near such fixtures as sinks, tubs, and toilets. Sometimes, however, the pipes themselves are the root of the problem. Pipes can be temperamental - they can leak, sweat, freeze, or make loud noises. Leaking in plumbing is one of dampness causes.

2.4 Factors That Govern Building Defects or Problems

In the care and conservation of historic buildings in Malaysia, Ahmad (2004) expressed that understanding the nature of the building materials and accurate diagnosis of defects is most important. This is because historic buildings are like older people, vulnerable to all sorts of diseases. Therefore, in order to chase this problem, conservators, architects, engineers, builders, building surveyors, contractors and those involve in building conservation should first become familiar with the building materials in common use before going deeper into the proper techniques to repair and maintenance in historic buildings, structures and monuments. It is important to be able not only to diagnose simple defects and instruct repairs, but also to recognize and describe those problems which need expert help and act accordingly (Oram, 1994). There are five (5) main factors that govern building defects or problem to historic buildings which are; (Ahmad, 1994:1).

2.4.1 Climatic Conditions

It is important to consider the climatic conditions of Malaysia and the effect on building materials. Like many other tropical countries, Malaysia has heavy rainfall and warm sunshine all year round. This implies that buildings in the country tend to weather rapidly, particularly in respect to external building materials which are exposed to external causes such as rain, wind, solar radiation including ultra-violet light; and atmospheric pollution. Fungal stain, harmful growth, peeling paint, erosion of mortar joints and defective plastered rendering are a few examples associated with this factor.

2.4.2 Location of Building

Buildings that are located near the sea or rivers tend to have common building defects. This is because the water coming from the ground causes dampness penetration and structural instability. For example, during the conservation work of the Sultan Abdul Samad Building in Kuala Lumpur, damp-proof courses had to be installed in order to prevent rising water coming from nearby Gombak River. In addition, soluble salt which comes from sea and together with the presence of a polluted atmosphere can cause damage to the exterior surface of the buildings.

2.4.3 Building Type and Change in Use

Most historic buildings that maintain their original functions or uses appear to have fewer problems internally, even though there were symptoms of building defects found on the external fabric. Buildings that change their use and spaces should consider the effect of the new use on the existing structure. This is because historic buildings were built to only hold certain loads and sometimes may not withstand additional loads. Where buildings which have been converted into either commercial or office purposes, the need to install air-conditioning systems to meet modern building requirements seems necessary. It has been found that in a few cases the air-conditioning units were placed improperly. This not only affects the appearance of the buildings but intervenes with the existing fabric, particularly when ducts are running in full view on the ceiling.

2.4.4 Maintenance of Building

Building maintenance organized through a rigorous programme of cyclical maintenance plays a major role in preventing building defects. Historic buildings that neglect building maintenance may fall into several defects which may lead to structural failures. Any inspections carried out by either architects or surveyors should include checking for any signs of abnormal deterioration, cleaning out gutters of leaves or harmful growth, checking lighting conductors, cleaning out all voids and spaces; and changing tap washers. To secure the general structural stability and life of a building, it is important to regularly inspect not only the main structural elements including foundations, walls and roofs; but other common building problems.

2.4.5 Building Age

All elements of historic buildings tend to deteriorate at a lesser or greater rate depending upon their location and function. Aging building materials, particularly timber should be checked once there are signs of fungal and termite attacks. Building that was built in the early period of British occupation, for instance, often face problems in building materials. Therefore, proper treatment of building repair and maintenance should be given full consideration.

2.5 Buildings Materials and Their Common Defects

Building material is any material which is used for a construction purpose. Many naturally occurring substances, such as clay, sand, wood and rocks, even twigs and leaves have been used to construct buildings. Apart from naturally occurring materials, many man-made products are in use, some more and some less synthetic. The manufacture of building materials is an established industry in many countries and the use of these materials is typically segmented into specific specialty trades, such as carpentry, plumbing, roofing and insulation work.

Most of the historic buildings in Malaysia use building materials which are easily available locally. Such building materials include timber, stone, brick and plaster. In the care and conservation of historic buildings, understanding the nature of the building materials and accurate diagnosis of defects is most important.

Timber has long been used by man especially in building construction. It is the most useful material available for wall, floor, roof and other structural framing. All commercial timbers can be classified into softwoods (such as Pine, Fir and Damar Minyak) and hardwoods (such as Chengal, Meranti and Kapur), depending on the characteristics of their grains, weight and moisture content.

In general, timbers either of softwoods or hardwoods have a moisture content of between twelve (12) to fifteen (15) per cent. Normally, a well dried timber has a moisture content of twelve (12) per cent. If the moisture content of the wood exceeds above twenty (20) per cent, fungal rots, insect infestation and termite attack will eventually take place.

This will further lead to structural failure. Therefore, before timber is being used for building construction, it is important for the material to be seasoned and preserved. The primary aim in seasoning timber (either of air or kiln seasoning) is to render timber as stable as possible, for the timber increases its strength properties as it dries. On the other hand, the preservation of timber, usually by chemical processes either before manufacture or after, concentrates on fungicidal preservation, flame-proof protection and water-repellence application.

Like timber, stone has been used in building construction for thousands of years. Due to its natural durability and strength, stone is used for structural columns, exterior walls, staircases, window framing as well as roofing materials. Stone comes in different types and properties ranging from the hard impervious such as granite, slate, marble to the softer and pervious sandstone and limestone. Although stones will last for many hundred years, its tendency of decay in any kind of weather is possible. Such weathering occurs in three situations.

First, the attacks from soluble salts especially when it comes up from the ground where there is no damp course, in locations near seas or from a heavily polluted atmosphere. Secondly, trouble arising from the slow build-up of soot deposits and dust, leading to possible onset of decay due to small vegetation organisms. Thirdly, the straight forward erosion by wind and rain. Stone will become saturated when it is exposed excessively to driving rain. As a result, its surfaces become marked and rough. Besides weathering, stone may also decay through faulty materials and workmanship.

Another type of material used in buildings masonry is brick or burnt clay block. Brickwork has been used in many historic buildings in Malaysia, particularly the ones built during the British occupation. Some of the colonial buildings have exposed brick walls and others are plastered and painted. Old bricks are slightly different than modern bricks. The texture of modern bricks looks closer and smoother, and the edges are straighter and sharper compared to the old materials. Colour and size are also different. Brick may decay through weathering process including sulphurous smoke caused by polluted atmosphere, water penetration through small holes and openings of the brick as well as mortar joints; and dampness in wall caused by no damp course in locations near sea or river.

Brick may deteriorate due to harmful vegetation and also mould or fungal growth that accumulate in the brick surface. Brick can also decay due to cracks caused by structural movements. Such structural movements may come from building foundations when subsoil is compressed through the decades or centuries followed by wall deflections due to the foundation weakness or an uneven loading distribution from above wall structure.

Like timber, stone or brick; plaster tend to deteriorate over a period of time. Plaster normally contains lime, sand and water and sometimes chopped animal hairs to give tensile strength. Plaster is used widely in decorative panels, ceiling renderings, cornices and internal walls. Causes of deterioration include direct exposure to driving rain, condensation, evaporation, air pollution, aerosols, capillaries, thermal stresses, vegetal causes, insect attacks, animals and human activities. Plaster may become cracked due to either shrinkage or movement in the substrate. Shrinkage usually occurs early in the life of the building but substrata movement is often the reason for failure in historic situations.

CHAPTER 3

METHODOLOGY

3.1 Introduction

Methodology is a description about a study flow from the beginning until completion of a project. Methodology shows and elaborates the steps taken to carry out a project either during information and data gathering, data analysis, and getting results. The study is done by following the plan in order to prevent any problems while doing the project. Thus, it should have some preparation and many sources will be used to get the related information for completing the project such as journals, articles, magazines, newspapers, books and website. This chapter is discussing on the methodology of a study on building defects: Case Study at Taman Seri Indah. Methodology of this study consist of the steps taken in carried out the study including information gathering in literature review, method used in data collection, data analysis and research outcomes.

3.2 Literature Review

Literature review for this study is obtained from reference books, journals, articles, magazines, thesis, and website related to the study. The related topics that have been focused in this study are types of building defects, causes of building defects, factors that govern building defects and buildings materials and their common defects.

3.3 Data Collection

There are two (2) types of data collection that have been used for this study, which are:

3.3.1 Primary Data

Primary data refers to all raw data collected within the study area. This data can be obtained through record, questionnaire, interview and observation.

3.3.1.1 Reports and Records

Collecting reports and records from consultant of the building will give overview of types and causes of building defects occurred in the building. In doing so, it will help to accomplish the objectives of this study such as to identify types of building

defects occurred in the building, causes of building defect occurred in the building and to analyze building defects occurred in case study area.

3.3.1.2 Questionnaire

The purpose of preparing a questionnaire is to obtain answers and opinions for question that will be asked in relation to the objectives of the study. Questionnaires are prepared beforehand by referring to information and sources gathered in literature review. The questionnaires will be designed by using Likert Scale. The questionnaire will be distributed to 100 targeted respondents that involved in this study.

3.3.1.3 Interview

Interview session is a two (2)-ways communication which permits exchange in ideas and information. It is conducted with professional and experienced parties that involved in this study. The session will provide important ideas and opinion on types and causes of building defects occurred in the building. The interview is important part to get the data and information from the professional personnel. This will show the enthusiastic, sincerely and ability to get the data and information.

3.3.2 Secondary Data

Secondary data is data or information collected from reference books, journals, newspapers, magazine, articles, website and thesis. The secondary data usually useful for literature review writing which this type of data will provide a lot of information related to the topic of study.

3.4 Data Analysis

All the data and information that have been collected through reports, questionnaires, interview and literature review will need to be organized, summarized and analyzed in a correct order to perform a quality result of study. Information that will be analyzed is on types and causes building defects occurred in the building. More important, information of the building defect occur at study area also can be obtained. Result will be analyzed using average index. It is then presented in a clear manner by using graphs histogram, pie charts and others. Tables and pictures are attached together in order to give illustration of the result obtained.

3.4.1 Average Index (AI)

The average index (AI) is calculated based on the following formula: (Sheena, 2008).

$$\text{Average Index} = \frac{\sum a_i x_i}{\sum x_i}$$

Where:

a_i = constant expressing the weight given to i

x_i = variable expressing the frequency of respondent, for i = 1, 2, 3, 4, 5

AI method is used to determine the frequency of types of building and causes of building defect occurred in building. The categories of scale are:

1 = least frequent	$1.00 \leq$ min index < 1.50
2 = less frequent	$1.50 \leq$ min index < 2.50
3 = average	$2.50 \leq$ min index < 3.50
4 = frequent	$3.50 \leq$ min index < 4.50
5 = very frequent	$4.50 \leq$ min index < 5.00

3.5 Conclusion

This study utilizes various types of data collection technique. After data have been analyzed and tabulated for easy reference, conclusion will be made based on the result obtained in conjunction with the objectives of the study. Recommendation will be made for future study as well as improvement in maintenance for the building defects.

CHAPTER 4

DATA ANALYSIS AND RESULT

4.1 Introduction

This chapter discuss on data analysis which all the data have been collected through survey questionnaires that have been distributed to the construction companies and residents of my study area. The purpose of distributing the questionnaire is to get information from the respondents about the types and causes of building defect that usually occur on building. Besides, the most important purpose is to study the building defects that occur in my study area. All data that have been obtained from the questionnaires will be analyzed using Microsoft Excel (Average Index Method). The feedback frequency will be calculated and presented in table and figure.

4.1 Data Collection

In order to achieve the objective of the study, the questionnaires have been distributed by hand to construction companies and residents at my study area, Penang, from June 2009 until 16 August 2009. In order to obtain more information for this study, interview session also has been conducted.

The purpose of this questionnaire survey is to get information from the respondent about the types and causes of building defect that usually occur on building. Besides, the most important purpose is to study the building defects that occur in my study area.

The respondents of the questionnaire survey include the person who involve in civil construction. Besides, the residents of Taman Seri Indah, Penang are also among the respondents of the questionnaire survey. This means, there are two (2) types of respondents in my case study that may help in contributing valuable information for my study.

From 100 set of survey form that has been distributed for person who involve in civil construction, only 50 respondents from private and government sector are giving cooperation in this study which are:

1. Uda Land (North) Sdn.Bhd.
2. Jabatan Kerja Raya (JKR)
3. Imbangan Juara Sdn.Bhd.
4. I & R Sdn.Bhd.
5. Masoha Sdn.Bhd.
6. Mekar Industries Sdn.Bhd
7. Penang Regional Development Authority (PERDA)

Number of respondents who give feedback from the questionnaire and the success rate from survey is shown in Table 4.1 below:-

Table 4.1: Respondents Success Rate (Indusry)

Amount Distributed	**Number of Respondents**	**Success Rate (%)**
100	50	50%

From 100 set of survey form that has been distributed for residents at my study area, only 46 respondents are giving cooperation in this study.

Number of respondents who manage to answer the questionnaire and the success rate from survey is shown in Table 4.2 below:-

Table 4.2: Respondents Success Rate (Residents)

Amount Distributed	**Number of Respondents**	**Success Rate (%)**
100	46	46%

4.3 Types of Building Defect

Table 4.3: Analysis on Types of Building Defect

TYPES OF BUILDING DEFECT			FREQUENT ANALYZE					* AI
			*1	*2	*3	*4	*5	
1	Peeling Paint	*NR	11	16	20	3	0	2.30
		*PR	22	32	40	6	0	
2	Wall Cracking	*NR	5	7	22	7	9	3.16
		*PR	10	14	44	14	18	
3	Unstable Foundations	*NR	24	9	14	2	1	1.94
		*PR	48	18	28	4	2	
4	Roof Defects	*NR	5	11	27	6	1	2.74
		*PR	10	22	54	12	2	
5	Dampness	*NR	8	17	22	3	0	2.40
		*PR	16	34	44	6	0	
6	Honeycombing	*NR	6	14	20	6	4	2.76
		*PR	12	28	40	12	8	
OVERALL AVERAGE INDEX (AI)								**2.55**

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

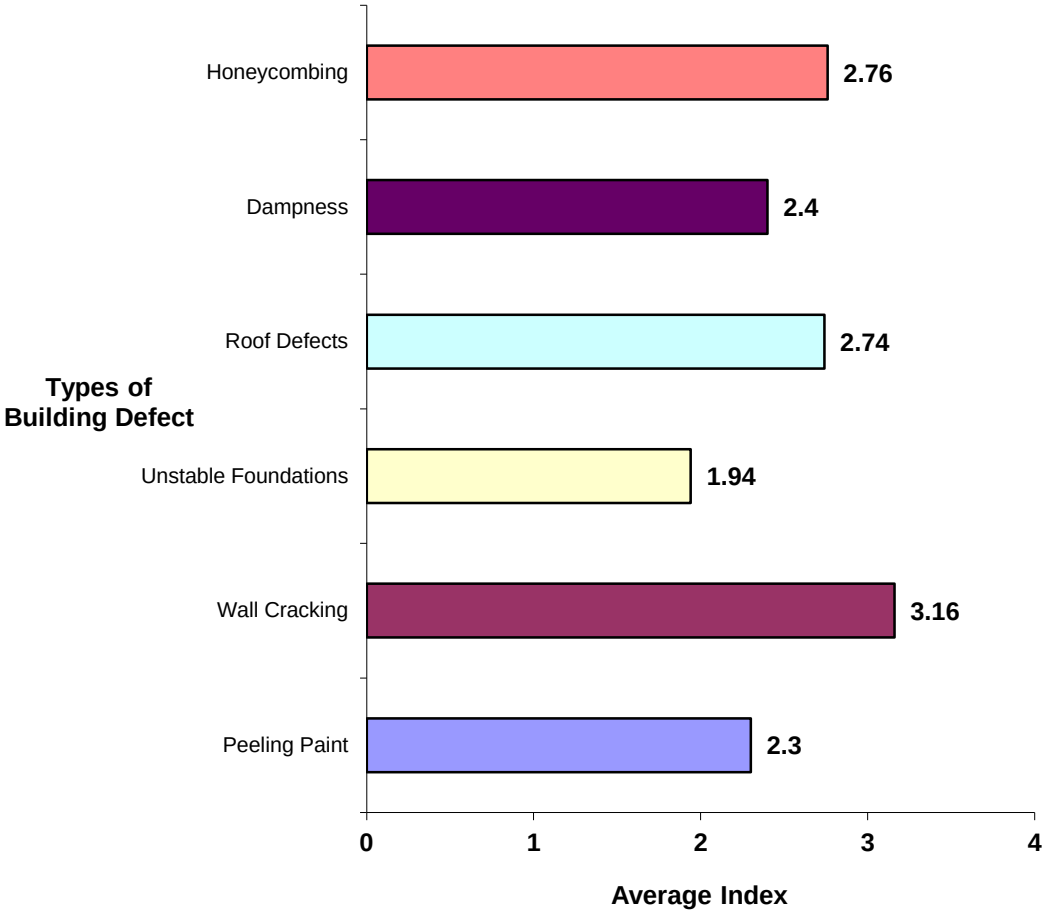

Figure 4.1: Types of Building Defect

In section B, the questionnaire is asking about the defect that normally occurred in the building. Most of the respondents agreed that the defects that normally occurred are peeling paint, wall cracking, unstable foundations, roof defects, dampness and honeycombing.

The average values have been used to quantity the frequency of each types of building defect. Each scale represents the following rating:

1 = least frequent	$1.00 \leq$ min index < 1.50
2 = less frequent	$1.50 \leq$ min index < 2.50
3 = average	$2.50 \leq$ min index < 3.50
4 = frequent	$3.50 \leq$ min index < 4.50
5 = very frequent	$4.50 \leq$ min index < 5.00

Table 4.3 and Figure 4.1 show the feedback of the respondents for building defect is under category of ‘average’ with average index 2.55. Among six (6) types of building defects that have been listed, most respondents agreed that wall cracking is the top rank with average index 3.16 and can be classified as the ‘average’ in the construction industry. Besides that, unstable foundations have the lowest rank with average index only 1.94 and this can be classified as ‘less frequent’ in the construction industry.

This shows that wall cracking is the highest type of defects contributes to the building defects followed by honeycombing, roof defects, dampness, peeling paint and unstable foundations.

4.4 Causes of Building Defect

Respondents also have been asking on the causes of building defect. The defects that would be analyzed are based on the top rank of building defects occurred.

The average values have been used to quantify the frequency of each causes of building defect. Each scale represents the following rating:

1 = least contribute	$1.00 \leq$ min index < 1.50
2 = less contribute	$1.50 \leq$ min index < 2.50
3 = average contribute	$2.50 \leq$ min index < 3.50
4 = frequent contribute	$3.50 \leq$ min index < 4.50
5 = very frequent contribute	$4.50 \leq$ min index < 5.00

4.4.1 Peeling Paint

Table 4.4: Number of Respondents and the Average Index of the Peeling Paint

TYPE OF BUIDING DEFECT	**CAUSES OF PEELING PAINT**		**FREQUENT ANALYZE**					***AI**
			***1**	***2**	***3**	***4**	***5**	
Peeling Paint	Water	*NR	9	10	21	9	1	**2.66**
		*PR	18	20	42	19	2	

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

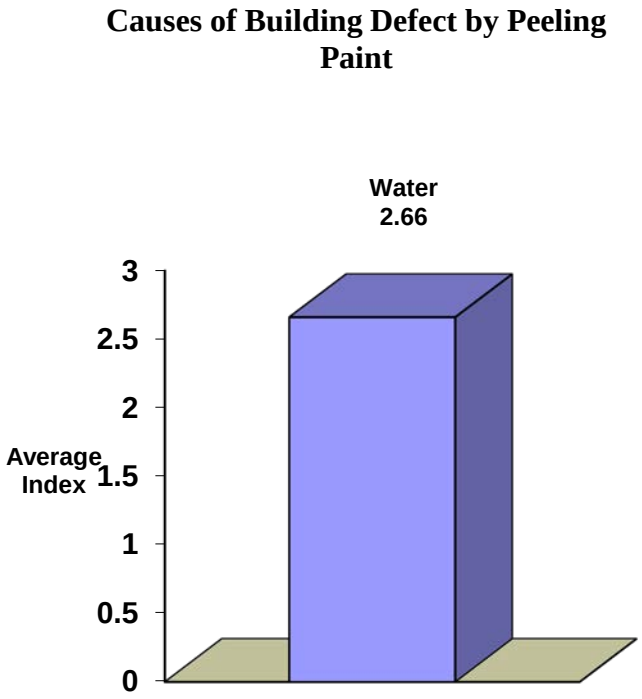

Figure 4.2: Causes of Building Defect by Peeling Paint

As shown in Table 4.4 and Figure 4.2, one major cause that contributed to the causes of peeling paint on building is water. The average index is 2.66 and can be classified as ‘average contributed’ to the causes of peeling paint.

4.4.2 Wall Cracking

Table 4.5: Number of Respondents and the Average Index of the Wall Cracking

TYPE OF BUIDING DEFECT	**CAUSES OF WALL CRACKING**		**FREQUENT ANALYZE**					***AI**
			***1**	***2**	***3**	***4**	***5**	
Wall Cracking	Settling	*NR	5	13	21	11	0	**2.76**
		*PR	10	26	42	22	0	
	Deterioration	*NR	3	21	19	7	0	**2.60**
		*PR	6	42	38	14	0	
	Shrinkage	*NR	1	15	23	6	5	**2.98**
		*PR	2	30	46	12	10	

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

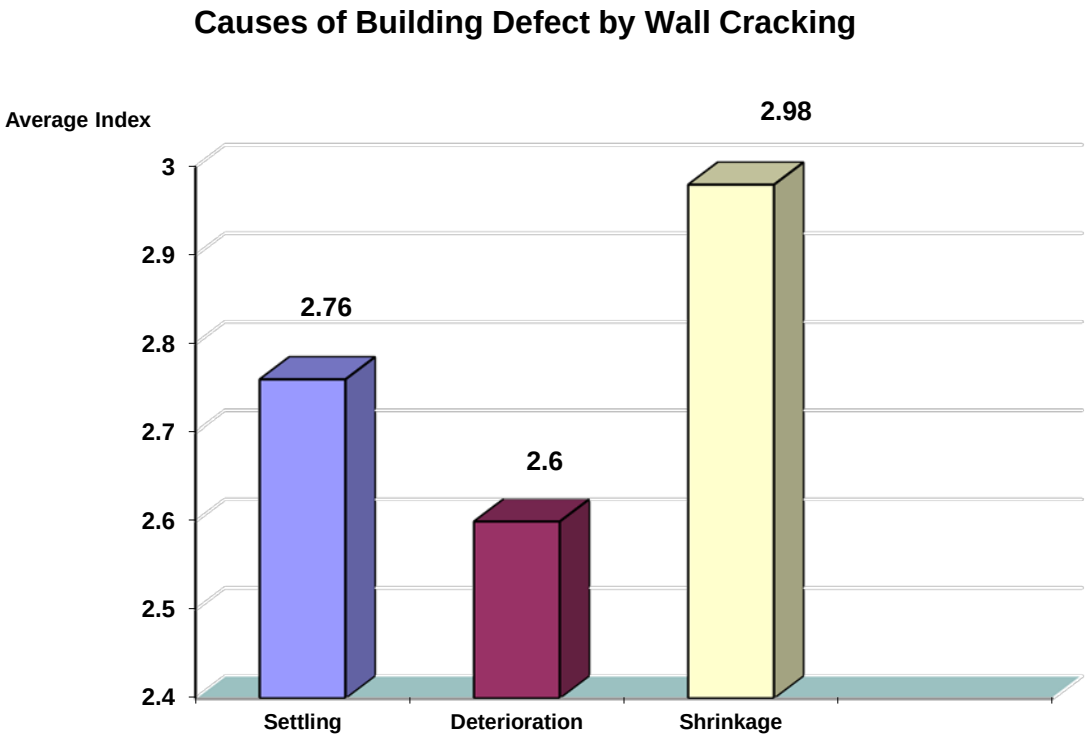

Figure 4.3: Causes of Building Defect by Wall Cracking

Based on literature review that has been done, there are three (3) major causes that contributed to the causes of wall cracking. As shown in Table 4.5 and Figure 4.3, shrinkage is in the highest rank that contributed to the causes of building defect with average index 2.98 and can be classified as the 'average contributed' to the causes of wall cracking. However, settling and deterioration can be also classified as 'average contributed' to the causes of wall cracking with average index 2.76 and 2.60.

The analysis shows that all of the causes that contributed to the occurrence of wall cracking are in the category of 'average contributed' which means the effect of each of this causes are almost same which lead to the occurrence of wall cracking.

4.4.3 Unstable Foundation

Table 4.6: Number of Respondents and the Average Index of Unstable Foundation

TYPE OF BUIDING DEFECT	CAUSES OF UNSTABLE FOUNDATION		FREQUENT ANALYZE					*AI
			*1	*2	*3	*4	*5	
Unstable Foundation	Lateral pressure	*NR	11	15	18	6	0	**2.38**
		*PR	22	30	36	12	0	
	Structural Settlement	*NR	11	12	21	5	1	**2.46**
		*PR	22	24	42	10	2	

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

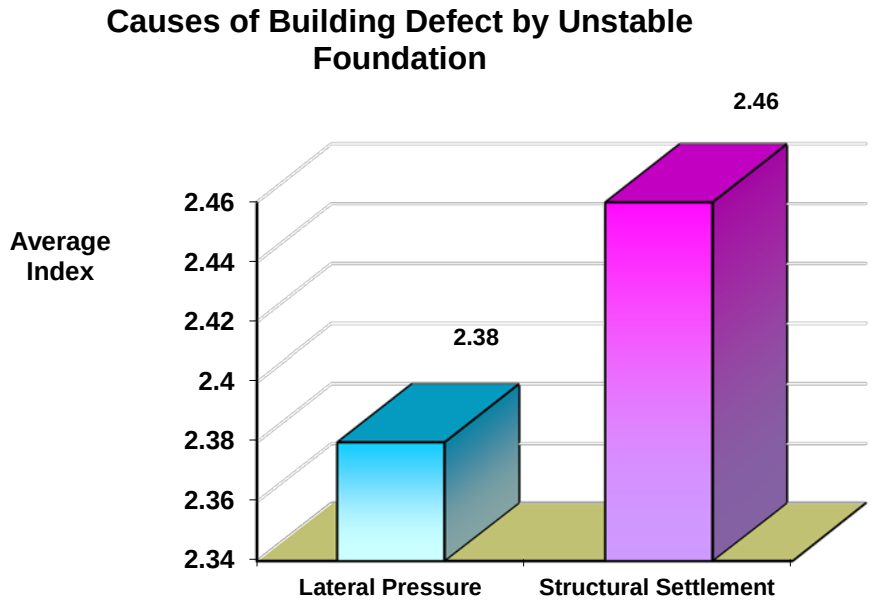

Figure 4.4: Causes of Building Defect by Unstable Foundation

Table 4.6 and Figure 4.4 shows there are two (2) major causes that contributed to the causes of unstable foundation. Structural settlement is in the highest rank that contributed to the causes of unstable foundation with average index 2.46 and can be classified as ‘less contributed’ to the causes of unstable foundation. However, lateral pressure also can be classified as ‘less contributed’ to the causes of average index with average index 2.38.

4.4.4 Roof Defects

Table 4.7: Number of Respondents and the Average Index of Roof Defects

TYPE OF BUIDING DEFECT	**CAUSES OF ROOF DEFECTS**		**FREQUENT ANALYZE**					
			***1**	***2**	***3**	***4**	***5**	***AI**
Roof Defects	Thermal movement	*NR	12	17	18	2	1	**2.26**
		*PR	24	34	36	4	2	
	Surface cracking	*NR	3	18	21	7	1	**2.70**
		*PR	6	36	42	14	2	
	Surface decay	*NR	4	11	26	7	2	**2.84**
		*PR	8	22	52	14	4	

(*NR=Number of Respondent,*PR= Percentage of Respondent, *AI=Average Index)

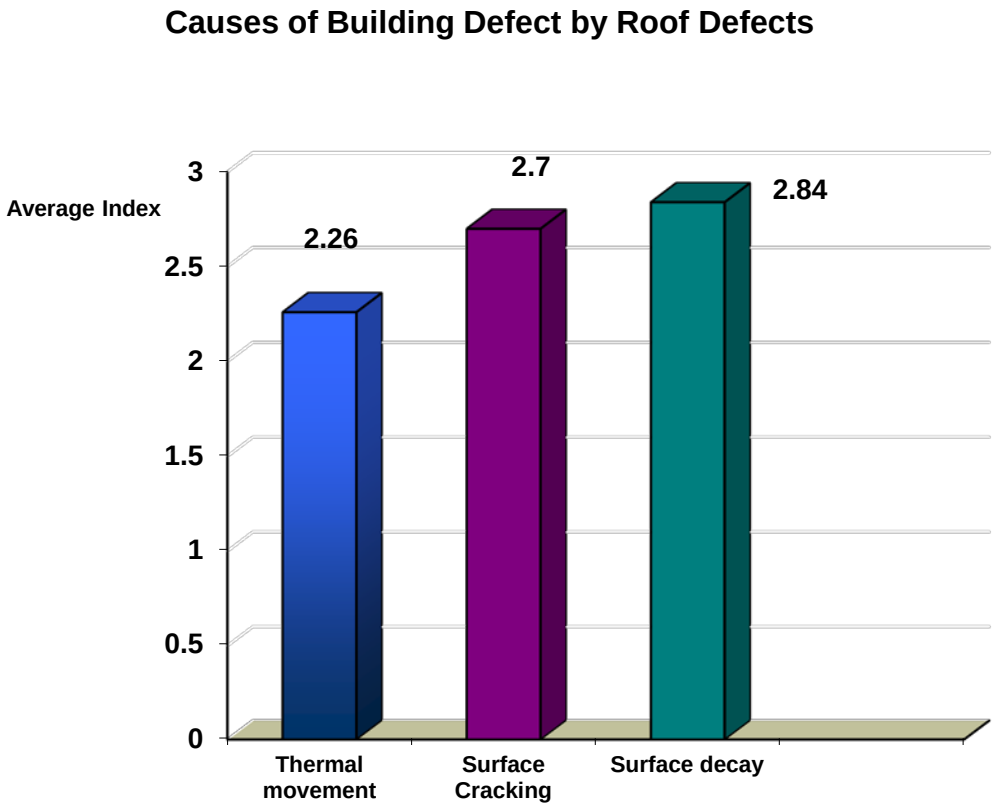

Figure 4.5: Causes of Building Defect by Roof Defects

Based on literature review that has been done, there are three (3) major causes that contributed to the causes of roof defects. Table 4.7 and Figure 4.5 shows, thermal movement is the highest rank that contributed to the causes of roof defect with average index 2.84 and can be classified as the 'average contributed' to the causes of roof defects. However, surface cracking is also can be classified as 'average contributed' to the causes of roof defects with average index 2.70. On the other hand, thermal movement is 'less contributed' from average index classification with average index 2.26.

4.4.5 Dampness

Table 4.8: Number of Respondents and the Average Index of Dampness

TYPE OF BUIDING DEFECT	**CAUSES OF DAMPNESS**		**FREQUENT ANALYZE**					***AI**
			***1**	***2**	***3**	***4**	***5**	
Dampness	Rainwater	*NR	2	6	26	15	1	**3.14**
		*PR	4	12	52	30	2	
	Leak in plumbing	*NR	1	7	28	12	2	**3.16**
		*PR	2	14	56	24	4	

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

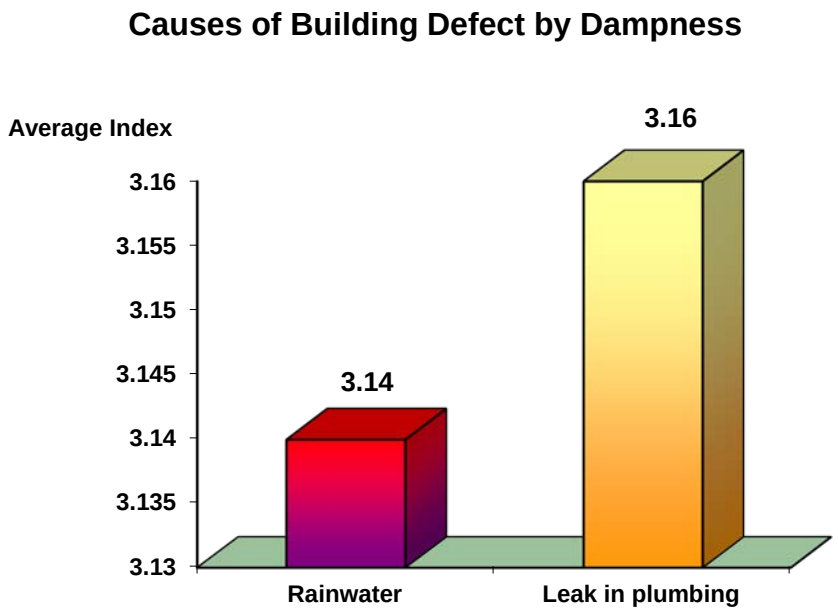

Figure 4.6: Causes of Building Defect by Dampness

As shown in Table 4.8 and Figure 4.6, there are two (2) major causes that contributed to the causes of dampness in building. Leak in plumbing is the highest rank that contributed to the causes of dampness with average index 3.16 and can be classified as ‘average contributed’ to the causes of building defect. However, rainwater also can be classified as ‘less contributed’ to the causes of dampness with average index 3.14. Both average indexes are almost in the same scale but rainwater value is smaller than leak in plumbing.

4.4.6 Honeycombing

Table 4.9: Number of Respondents and the Average Index of Honeycombing

TYPE OF BUIDING DEFECT	**CAUSES OF HONEYCOMBING**		**FREQUENT ANALYZE**					***AI**
			***1**	***2**	***3**	***4**	***5**	
Honeycombing	Segregation	*NR	3	10	26	9	2	**2.94**
		*PR	6	20	52	18	4	
	Poor workmanship	*NR	4	4	28	11	3	**3.10**
		*PR	8	8	56	22	6	

(*NR=Number of Respondent,*PR= Percentage of Respondent,*AI= Average Index)

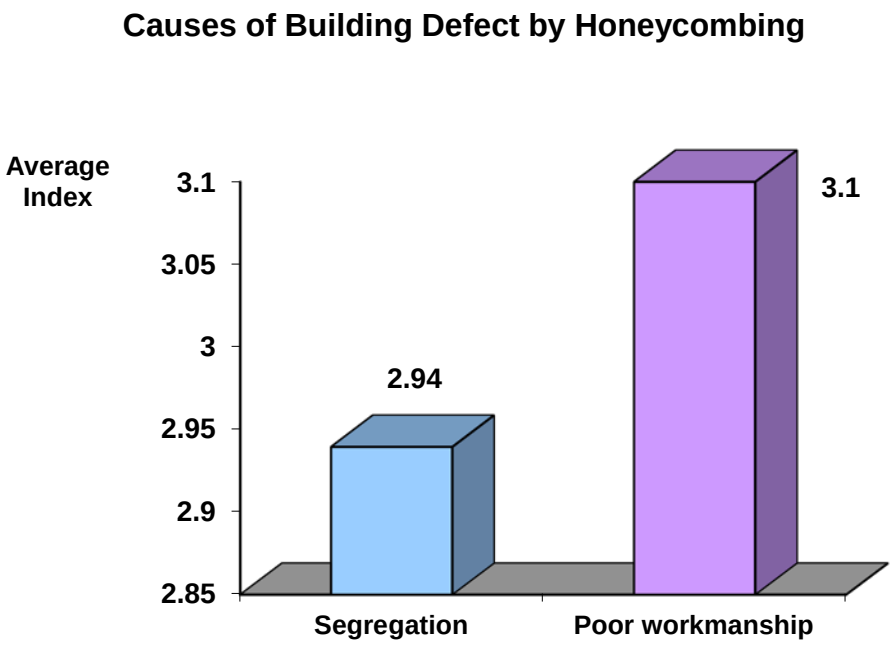

Figure 4.7: Causes of Building Defect by Honeycombing

Based on literature review, there are two (2) major causes that contributed to the causes of honeycombing. From Table 4.9 and Figure 4.7 shows the poor workmanship is in the highest rank that contributed to the causes of honeycombing with average index 3.10 and can be classified as the ‘average contributed’ to the causes of building defect. However, surface cracking is also can be classified as ‘average contributed’ to the causes of honeycombing with average index 2.94.

4.5 Building Defects Occur at Taman Seri Indah, Penang (Case Study)

Table 4.10: Building Defect Complaint Refer to Trade at Study Area

No	Trade	Defects
1	Roof	Leaking roof, broken roof and material use inequality.
2	Plumbing	Pipe damage, blocked water hole and water tank leaking.
3	Sanitary	Flush not properly function and sink broken.
4	Floor	Cracking floor, wet floor, floor finishing untidy and dirty.
5	Wall	Cracking wall and plaster not flawless.
6	Door	Sliding door hard to open, frame untidy and door key damage.
7	Window	Window hard to open, window key broken and untidy finishing.
8	Ceiling	Leaking and broken ceiling.
9	Electrical	Switch broken and wire is untidy.

Table 4.10 shows, all the defects that occur in study area which can be divided into nine (9) trades. The trades are roof, plumbing, sanitary, floor, wall, door, window, ceiling and electrical. The defects descriptions shown in Table 4.10 are obtained from the complaint made by the residents in study area.

Table 4.11: Percentage of Roof Defects Complaint

Defects	Complaint	Percentage
Leaking roof	12	71%
Broken roof	1	6%
Material use inequality.	4	23%

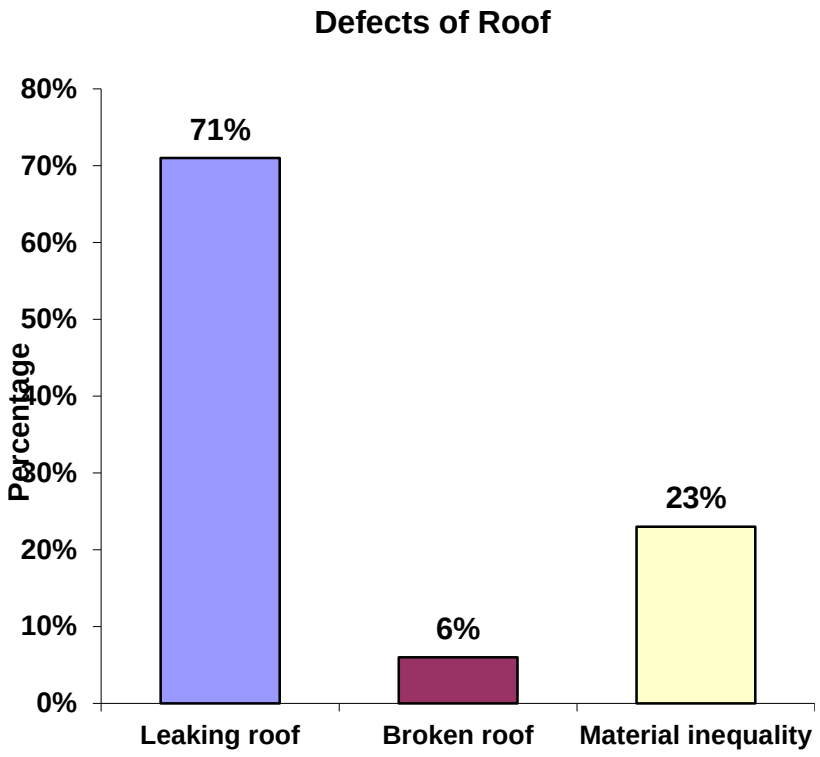

Figure 4.8: Defects of Roof

Table 4.11 and Figure 4.8 show the complaint on the roof of the building and it percentage. There are three (3) roof defects that had been complaint by the respondents. Leaking roof is in highest rank complaint with twelve (12) complaints and (71%). Besides, both defects in material use inequality and broken roof only give percentage of 23% and 6%.

Table 4.12: Percentage of Plumbing Complaint

Defects	**Complaint**	**Percentage**
Pipe damage	1	6%
Blocked water hole	2	13%
Water tank leaking	13	81%

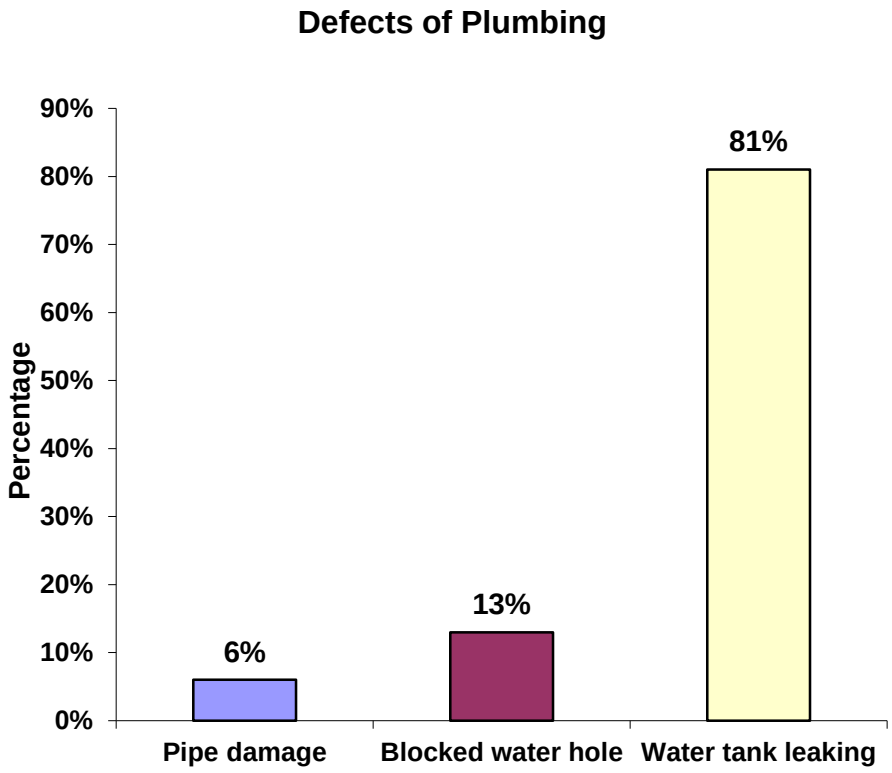

Figure 4.9: Defects of Plumbing

Table 4.12 and Figure 4.9 show the complaint on plumbing. There are three (3) defects of plumbing that had been complaint by the respondents. Water tank leaking is in highest rank complaint with thirteen (13) complaints (81%). Besides, both defects in blocked water hole and pipe damage only give percentage of 13% and 6% of the respondents.

Table 4.13: Percentage of Sanitary Complaint

Defects	Complaint	Percentage
Flush not properly function	3	75%
Sink broken	1	25%

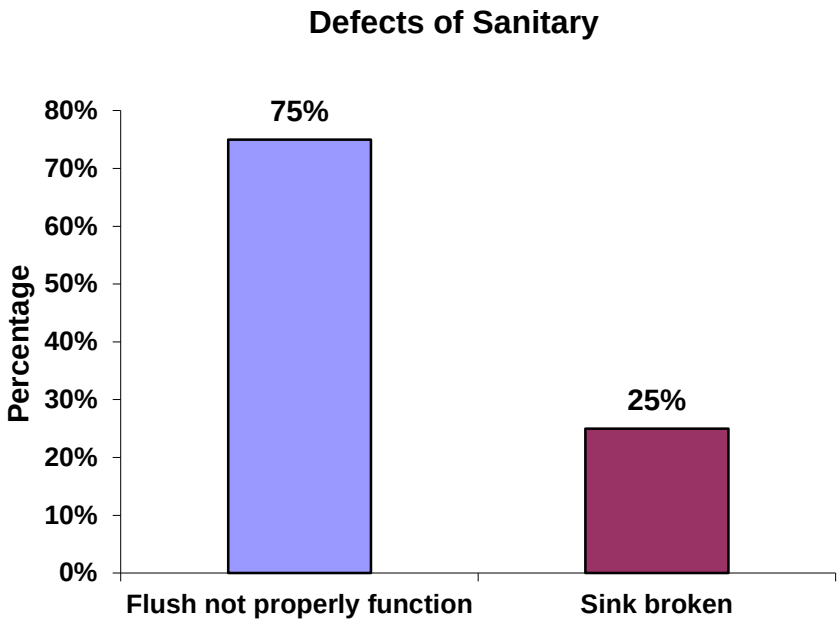

Figure 4.10: Defects of Sanitary

Table 4.13 and Figure 4.10 show the complaint on sanitary. There are two (2) defects that had been complaint by the respondents. Flush not properly function is in highest rank complaint with three (3) complaints (75%). However, defect in sink broken get only one (1) complaint (25%).

Table 4.14: Percentage of Floor Complaint

Defects	Complaint	Percentage
Cracking floor	5	25%
Wet floor	2	10%
Floor finishing untidy and dirty	13	65%

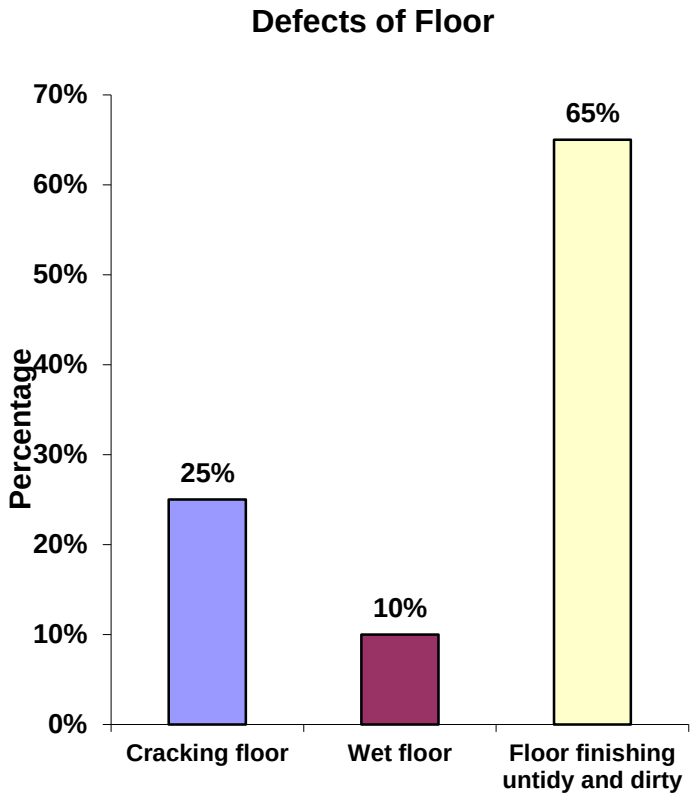

Figure 4.11: Defects of Floor

As shown in Table 4.14 and Figure 4.11, the complaint on floor. There are three (3) defects that had been complaint by the respondents. Floor finishing untidy and dirty is in highest rank with thirteen (13) complaints (65%). Besides, both defects in cracking floor and wet floor give percentage of 25% and 10% of the respondents who manage to answer the questionnaire.

Table 4.15: Percentage of Wall Complaint

Defects	**Complaint**	**Percentage**
Cracking wall	15	88%
Plaster not flawless.	2	12%

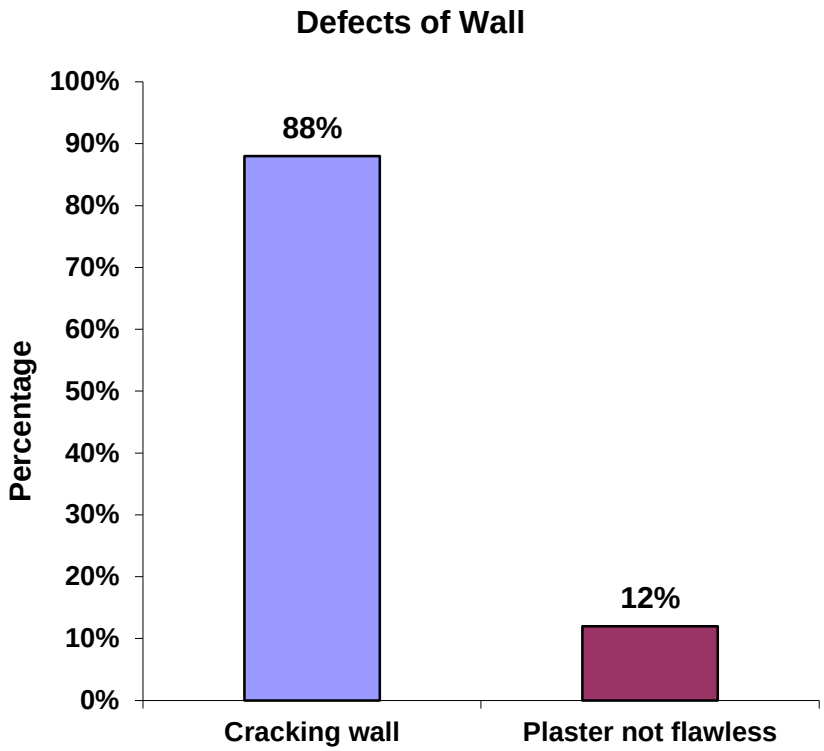

Figure 4.12: Defects of Wall

Table 4.15 and Figure 4.12 show the complaint on wall which there is two (2) defects that had been complaint by the respondents. Cracking wall is in highest rank with fifteen (15) complaints (88%). However, defect in plaster not flawless get two (2) complaints (12%) respondents.

Table 4.16: Percentage of Door Complaint

Defects	Complaint	Percentage
Door hard to open	8	47%
Untidy frame	5	29%
Door key damage	4	24%

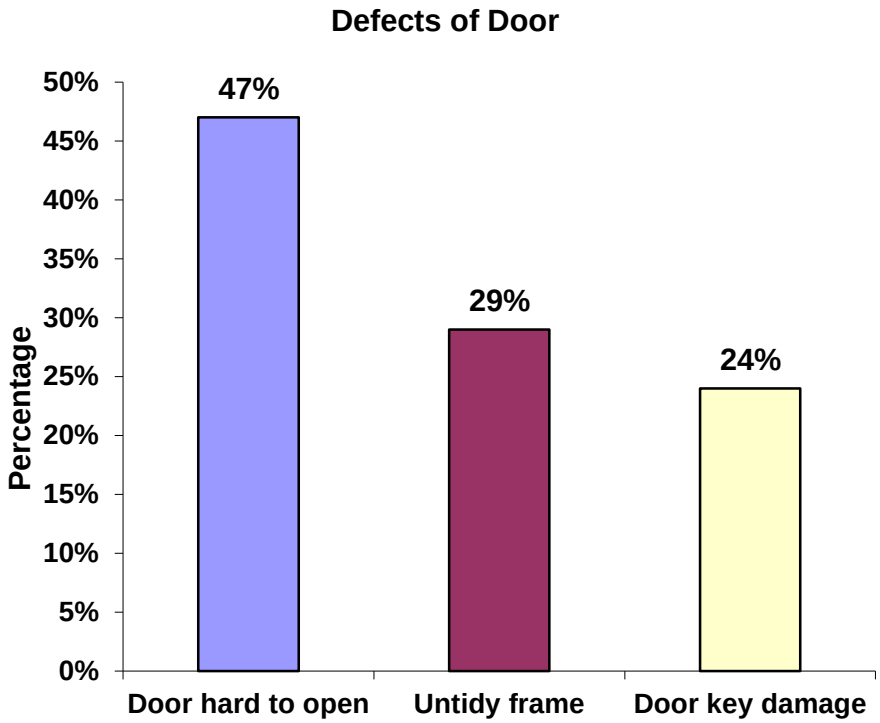

Figure 4.13: Defects of Door

Table 4.16 and Figure 4.13 show the complaint on door which there is three (3) defects that had been complaint by the respondents. Door hard to open is in highest rank with eight (8) complaints (47%). Besides, both defects which are untidy frame and door key damage give percentage of 29% and 24%.

Table 4.17: Percentage of Window Complaint

Defects	**Complaint**	**Percentage**
Window hard to open	8	50%
Window key broken	6	37%
Untidy finishing	2	13%

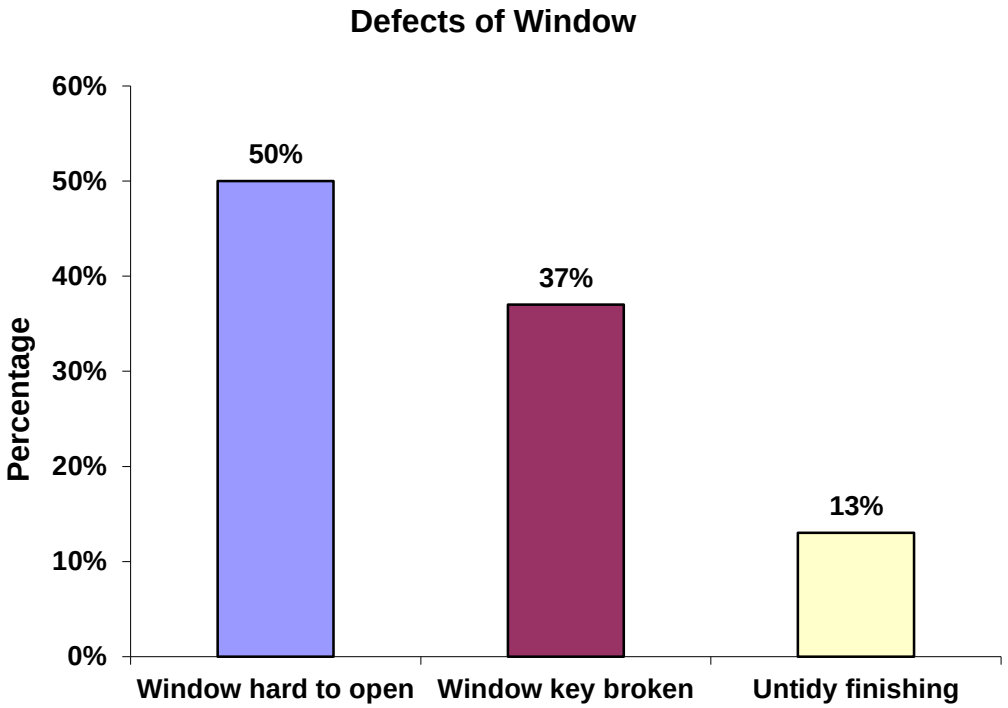

Figure 4.14: Defects of Window

Table 4.17 and Figure 4.14 show the complaint on window which there is three (3) defects that had been complaint by the respondents. Window hard to open is in highest rank with eight (8) complaints (50%). Besides, both defects in broken window key and untidy finishing give percentage of 37% and 13% of the respondents.

Table 4.18: Percentage of Ceiling Complaint

Defects	Complaint	Percentage
Leaking ceiling	7	78%
Broken ceiling	2	22%

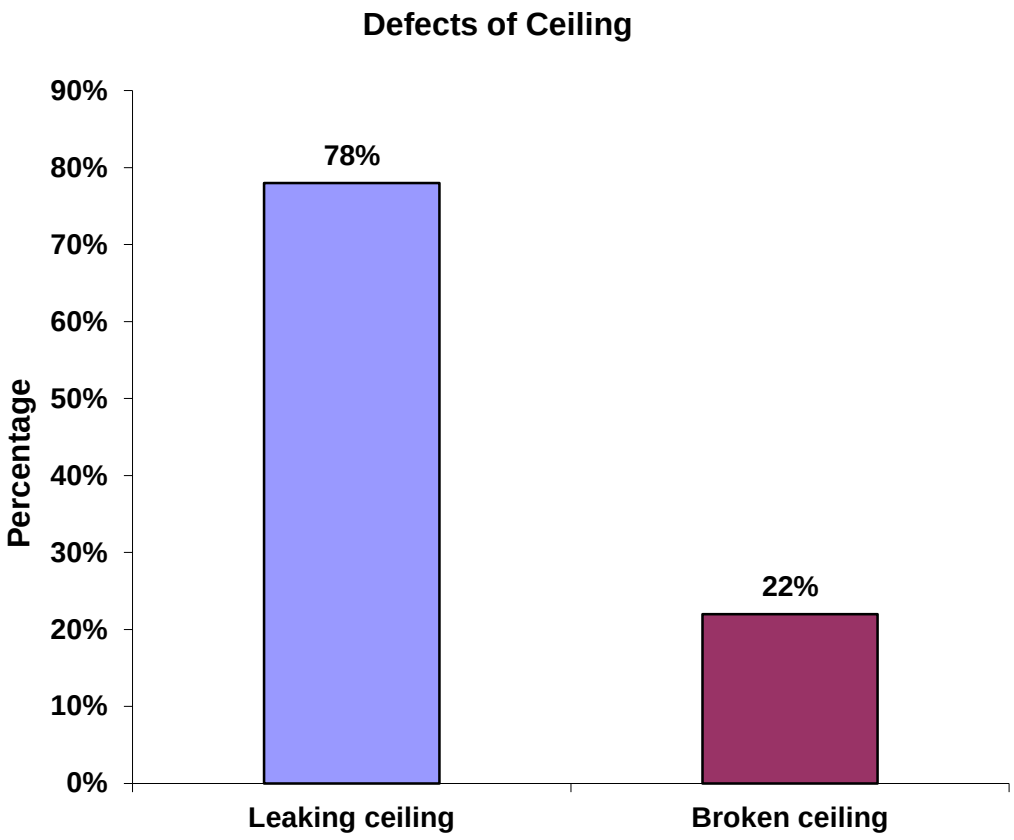

Figure 4.15: Defects of Ceiling

Table 4.18 and Figure 4.15 show the complaint on ceiling which there is two (2) defects that had been complaint by the respondents. Leaking ceiling is in highest rank with seven (7) complaints (78%). However, defect in broken ceiling with two (2) complaints and (25%).

Table 4.19: Percentage of Electrical Complaint

Defects	Complaint	Percentage
Switch broken	9	64%
Untidy wire	5	36%

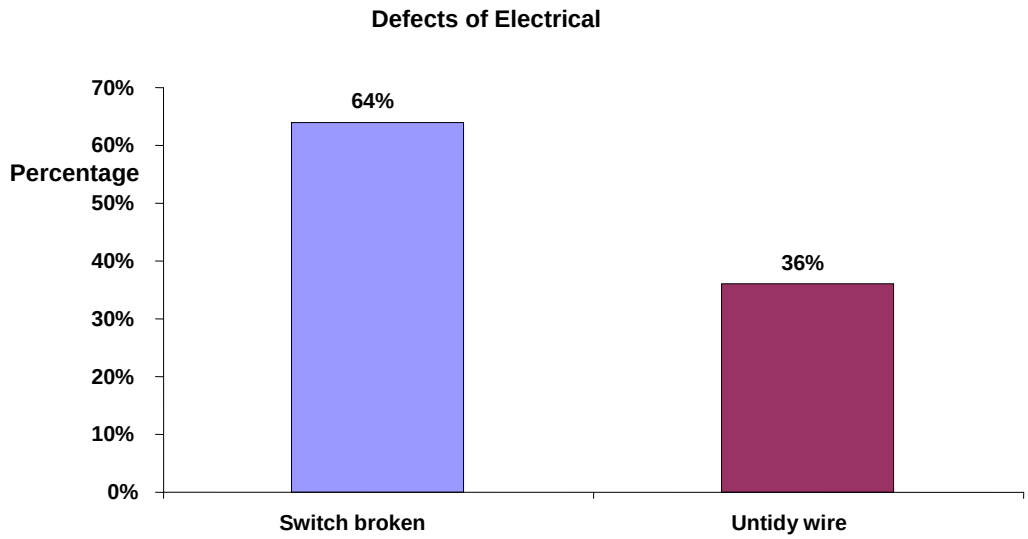

Figure 4.16: Defects of Electrical

Table 4.19 and Figure 4.16 show the complaint on electrical which there are two (2) defects that had been complaint by the respondents. Broken switch is in highest rank with nine (9) complaints (64%). However, defect in untidy wire get five (5) complaints and (36%).

Table 4.20: Data Analysis For Building Defect at Study Area

Term	**Complaint**	**Percentage**
Roof	17	13%
Plumbing	16	12%
Sanitary	4	3%
Floor	20	16%
Wall	17	13%
Door	17	13%
Window	16	12%
Ceiling	9	7%
Electrical	14	11%

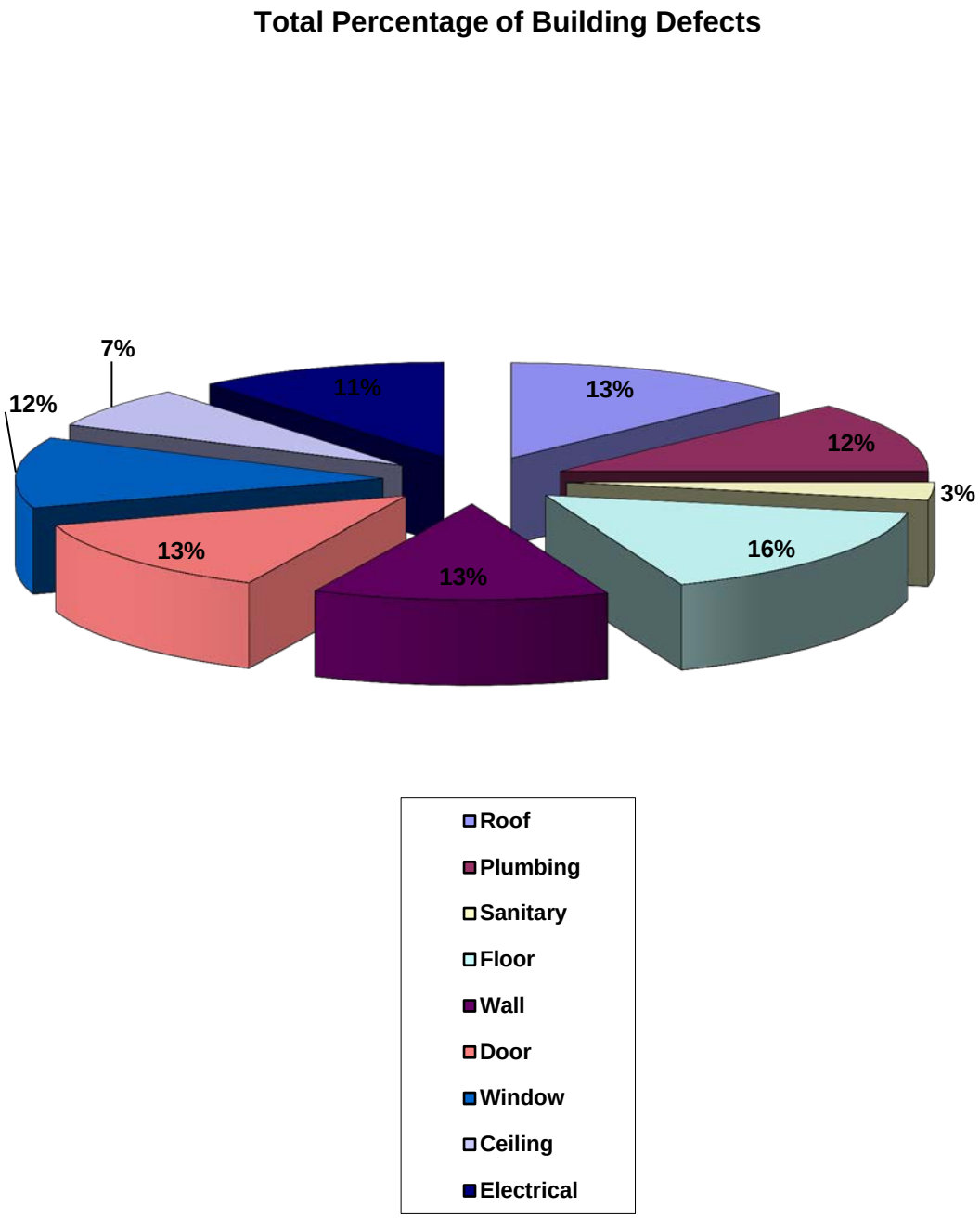

Figure 4.17: Total Percentage of Resident Complaints on All Terms

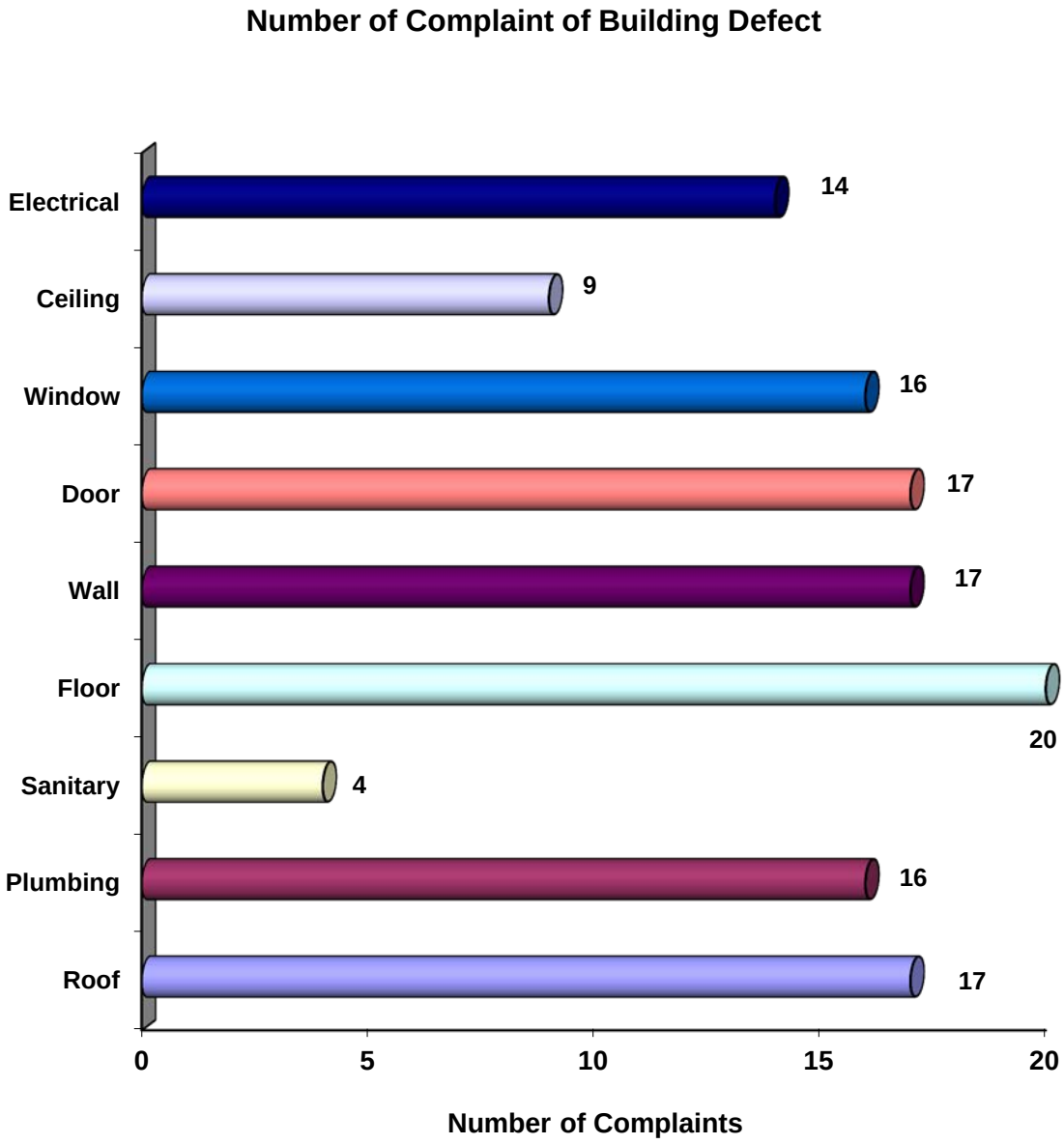

Figure 4.18: Number of Resident Complaints in All Terms

Table 4.20, Figure 4.17 and Figure 4.18 show that the highest complaint among the residents is in term of floor defects. The complaints on floor are from twenty (20) respondents with percentage of 16%. The average complaints are on roof, wall and door defects with seventeen (17) complaints and (13%). However, the complaints on sanitary are four (4) with percentage of 3% only.

Table 4.21: Number of Residents That Satisfied on Their Housing

Amount Distributed	Number of Residents	Quantity	Percentage
100	46	37	80

Table 4.22: Number of Residents That Unsatisfied on Their Housing

Amount Distributed	Number of Residents	Quantity	Percentage
100	46	9	20

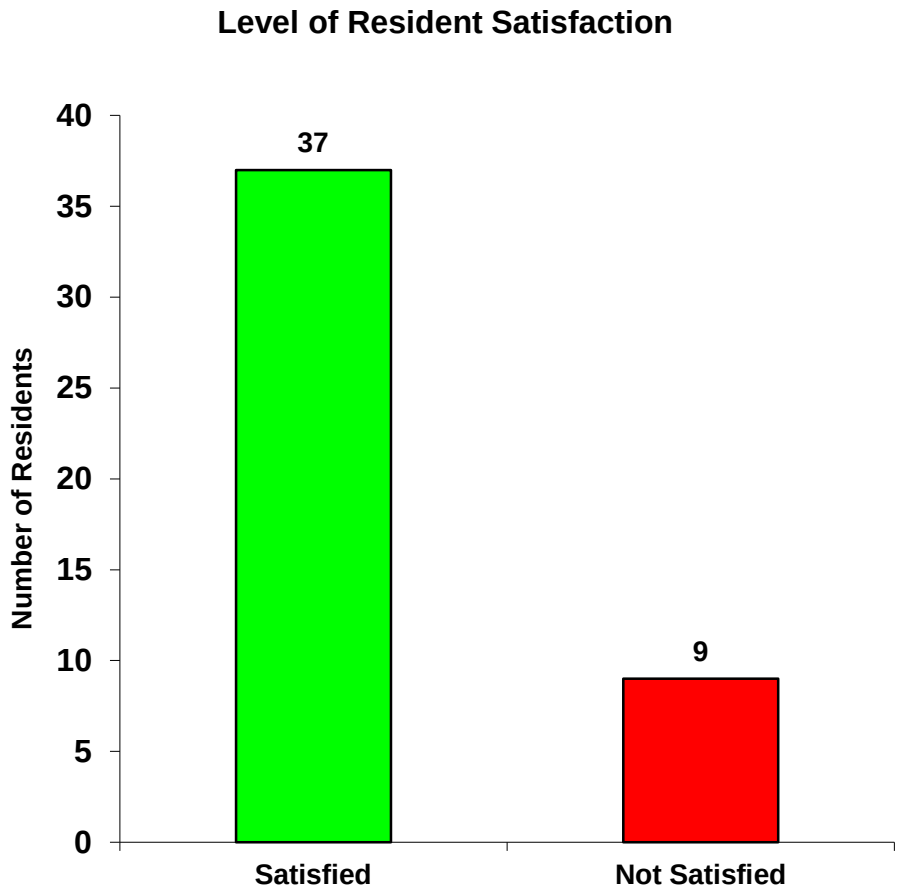

Figure 4.19: Satisfaction Level of Residents on Their Housing

Table 4.21 and Table 4.22 show that thirty seven (37) of the residents were satisfied on their housing while nine (9) residents were not satisfied on their housing. During the interview with the residents, majority of them stated that poor workmanship by responsible contractor is the main causes of building defects. Figure 4.19 shows the satisfaction level of residents on their housing as a result for this study.

CHAPTER 5

CONCLUSION AND RECOMMENDATION

5.1 Introduction

Building defects problem are most common issues that always occur in construction industry. Nowadays, these problems become critical and need some serious action from all parties involve to minimize the risk. Defects will occur either we want it or not. Mostly, if defects occur, it will increase the cost, delay in construction and cause a lot of work to be done. This study had focused on defects that occur in residential area to open our eyes that defects not only occur at mega structure building but also in our living area.

5.1 Conclusion

Overall, there are three (3) objectives which have been achieved to conclude this study. There are:

1) To identify types of building defect occur in building.
2) To identify causes of building defect occur in building.
3) To study on building defect occur at case study area.

5.1.1 Objective 1: Identify Types of Building Defect Occur in Building

From the literature review, there are six (6) types of defect that commonly occur on building which are:

1) Wall Cracking (AI = 3.16)
2) Honeycombing (AI = 2.76)
3) Roof Defects (AI = 2.74)
4) Dampness (AI = 2.40)
5) Peeling Paint (AI = 2.30)
6) Unstable Foundations (AI = 1.94)

Based on the analysis that has been done, wall cracking is the most type of defect which in building and this will be occurs followed by honeycombing, roof defects, dampness, peeling paint and unstable foundations.

5.1.2 Objective 2: Identify Causes of Building Defect Occur in Building.

The purpose of this objective is to define the causes of building defect that occurred in the building. Table 5.1 shows the types of building defect and the causes of the each defect which have been put in ranking.

Table 5.1: Ranking of Types of Building Defect and Ranking of the Causes of Building Defect

Types of Defect	Top Rank of Defect	Causes of Building Defect	Top Rank of the Causes of Building Defect
Wall Cracking	*1	Settling	*2
		Deterioration	*3
		Shrinkage	*1
Honeycombing	*2	Segregation	*2
		Poor workmanship	*1
Roof Defects	*3	Thermal movement	*3
		Surface cracking	*2
		Surface decay	*1
Dampness	*4	Rainwater	*2
		Leak in plumbing	*1
Peeling Paint	*5	Water	*1
Unstable foundation	*6	Lateral pressure	*2
		Structural settlement	*1

(*1=1st Rank,*2=2nd Rank,*3=3rd Rank,*4=4th Rank,*5=5Rank,*6=6th Rank)

5.1.3 Objective 3: Case Study on Building Defect Occur in A Study Area

The study area is located at Taman Seri Seri Indah, Kepala Batas, Penang. The questionnaire had been distributed to 100 units of house but only 46 respondents gave their feedback and good cooperation.

From the respondents complaint form, floor is in the highest rank compared to the other defects. Numbers of complaint on floor is twenty (20) with percentage of 16%. Then, it is followed by roof, wall and door which have seventeen (17) for each complaint with percentage of 13%. Both plumbing and window have sixteen (16) complaints with percentage of 12%. Electrical had fourteen (14) complaints with percentage of 11. Ceiling had nine (9) complaints with percentage of 7%. However, complaint on sanitary is the lowest rank which had only four (4) complaints with percentage of 3%.

As a result of this study, the satisfaction level of residents on their housing can be determined and analyzed from the analyses that have been done. Besides, this study also gave an important and valuable experience and knowledge that useful for future practices in construction industry. Last but not least, I would like to conclude that this study had generated self confident in myself to communicate with many types of people.

5.2 Recommendation

5.2.1 Recommendation for the Study

From the analysis and personal side of view, there are several recommendations that have been identified in order to manage the building defect which are:

a) There should be a proper documentation of building maintenance records by all parties involved in construction industry. A database system can provide the fastest and easiest access to obtain information rather searching manual documentation.

b) The residents must be prepared with insurance towards the defects that caused by the poor workmanship by the developer.

c) Professional personnel especially future engineer should undergo more training to gain more exposure on current technologies and techniques that can overcome the problem on building defects.

5.2.2 Recommendation for the Future Study

From this study, there are some suggestions that can be made for the future study. There are as listed below:

a) Conduct a detailed study on building maintenance procurement in order to well understand on the maintenance work of building.

b) To study on the topic of selection of material and repair techniques in maintenance of building defect.

c) To study the importance and the use of information system in building maintenance.

d) To study maintenance method of concrete defect in building.

e) To study the differences of building maintenance works practiced by Public Work Department (PWD) and by contractor.

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APPENDIX A

THE STAR: 1 MAY 2007

PAK LAH ORDERS IMMEDIATE INSPECTION OF GOVERNMENT BUILDINGS

KUALA LUMPUR: The Prime Minister has ordered an immediate inspection of all government buildings for defects.

This comes in the wake of three incidences of collapsing structures in the last three weeks – the most recent case being the new Court Complex in Jalan Duta, where a ceiling came crashing down yesterday.

“I feel angry. I feel ashamed. What the hell is this? It’s so new and such a thing happened.

“Something must have gone wrong somewhere. We need to know. I can’t be jumping all over the place!” said Datuk Seri Abdullah Ahmad Badawi, who directed the Public Works Department to carry out immediate inspections.

Three weeks ago, operations at the Immigration Department headquarters in Putrajaya came to a standstill because of a burst water pipe.

Last Saturday, part of the ceiling of a multi-purpose hall at the Entrepreneurial Development and Co-operative Ministry collapsed, causing a water pipe to drop and burst in the process.

Yesterday’s incident at the Court Complex was the last straw for the Prime Minister.

He said all three buildings were new and therefore it was imperative that investigations were conducted to determine “what exactly had gone wrong.”

“We have to check all (government) buildings because of what has happened. Maybe there are some other places that we think there is no problem but later they, too, collapse.

“I have said repeatedly, ‘Maintenance, maintenance, maintenance.’ But people, as long as nothing happens, couldn’t be bothered,” he told a press conference after chairing the Umno supreme council meeting yesterday.

He noted that investigations at the Immigration headquarters found that one of the joints to the pipes was not properly secured.

Abdullah reiterated that inspections should be carried out on a continuous basis.

“Only then will they see where there may be problems,” he added.

In Shah Alam, Works Minister Datuk Seri S. Samy Vellu said two pieces of 1.22m-long ceiling material collapsed inside the new court complex.

He said the collapse also brought down the downlights or ceiling lights that were not attached to the main structure of the ceiling.

Samy Vellu said the building was designed by architects from the PWD headquarters and built by Johawaki Development Sdn Bhd.

“The two pieces fell, along with the downlights, because the contractor had fixed the downlights without attaching them to the main ceiling structure,” he told reporters before opening the 61st Selangor MIC convention yesterday.

On the ceiling at the multi-purpose hall of the Entrepreneurial Development and Cooperative Ministry, Samy Vellu said Putrajaya Holdings was the master builder but the maintenance of the hall was taken over by Jutabina Sempurna Sdn Bhd from Oct 1, 2004 to Sept 30 this year.

APPENDIX B

THE STAR: 16 JULY 2008

RESIDENTS FEAR TOTAL COLLAPSE

JOHOR BARU: Some 170 residents of block four at Taman Jaya, Skudai, are living in fear as the building they occupy may collapse anytime due to severe cracks on the walls and floors.

Resident Maimon Aghani, 52, said the problem started three years ago when a wall that divided two ground floor units situated at the left side of the building cracked.

"The fracture was so serious that the bricks fell off, exposing the steel bars used as supports," she said while pointing out the huge gap on the floor at the side of the units built on leasehold land.

The woman who lived here with her two children and two grandchildren said that the tiles on the floor of some other units were also cracked and that weeds had began to grow along the corridor of the block.

"I am afraid that the building will collapse anytime, especially during rainy days but I have no money to move elsewhere," she said, adding that she had fully paid the loan for her RM22,000 flat, which she bought about 20 years ago.

"I only work as a cleaner and earn RM480 monthly," she said, adding that her husband passed away 13 years ago.

The resident enforcement committee chairman Rozi Ahmad said only 33 out of 64 units were occupied now and some of the 33 families, including his, had tried to rent a place elsewhere but returned a few months later as they could not afford the higher rentals.

He said the Public Works Department (JKR) had declared the building as unfit for occupancy three years ago but the owners just could not afford to buy another house.

“Three years ago, the Johor Baru Central Municipal Council (MBJBT) offered us some units at Bukit Cagar but the flats there were abolished a few months ago,” he said adding that residents found it inconvenient to move to the flats at Seri Alam as they were used to staying in Skudai.

“It is unfair to us as we paid for the place and, now, we cannot stay there due to the damage,” he said.

Skudai assemblyman Dr Boo Cheng Hau said he hoped the government would look seriously into the matter.

“We hope that the government can get another developer to rebuild the flats and that the land be converted to freehold status,” he said, adding that by reselling the land, the owners would be able to get some returns.

Rozi and Dr Boo met Local Government, Housing, Culture, Arts and Heritage Committee chairman Datuk Ahmad Zahri Jamil two weeks ago to appeal over the matter.

When contacted, Ahmad said that it was agreed that the resident should move out of the dangerous building.

“Discussions can be done with the housing department that these residents be offered to buy the medium cost houses priced between RM50,000 and RM80,000 but we need time,” he said.

APPENDIX C

THE STAR: 16 NOVEMBER 2008

LOCAL MANUFACTURERS URGED TO MAKE GREEN BUILDING MATERIALS

KUALA LUMPUR: Go green and create more energy-efficient building materials.That's the call from Housing and Local Government Minister Datuk Seri Ong Ka Chuan who said: "Designers and building material suppliers should make a headstart in this direction as saving energy is an important initiative that has been advocated in many countries."

As the world turned to green construction and environmentally-friendly products, Ong said it was imperative for local building material manufacturers to also move in that direction to stay relevant.

"Energy-efficient buildings will call for various products including efficient sun shade components, roof insulation materials and insulated window glass panels," he said in his speech at the 32nd anniversary dinner of the Building Materials Distributors Association of Malaysia here on Friday.

He also called on developers and housing contractors to support local manufacturers by purchasing more Malaysian-made materials.Local building materials manufacturers, said Ong, must also play their part by constantly upgrading their products to counter stiff competition from abroad.

On another matter, he said the ministry had received about 250 complaints every year on building defects from buyers.

"Many of those defects are caused by defective or poor quality building materials. However, the number of complaints has been on the decline over the past five years," he said.

APPENDIX D

NEWS STRAITS TIMES: 14 DECEMBER 2008

WORKS MINISTER: DON'T BLAME MOTHER NATURE FOR LANDSLIDE, WANTS ANSWERS FROM

KUALA LUMPUR: Works Minister Datuk Mohd Zin Mohamed is baffled how rainwater was trapped atop Taman Bukit Mewah which he believes led to the Bukit Antarabangsa landslide last Saturday.

"I find it odd for rainwater to have been trapped in the granite rock-filled dense rainforest.

"Why wasn't there proper drainage when water will find its own natural gradient to flow?

"I suspect this is caused by humans, so let's not blame Mother Nature," he told Public Works Department (PWD) engineers.

Zin ordered the PWD, which is spearheading a three-month geotechnical, forensics and integrity probe of the slope and building structure stability, to come up with answers on the cause of the landslide and provide recommendations to avert disasters.
"It looks like the landslide was avoidable.

"We can't just blame it on deforestation. It's a lesson well learnt and we have to respect Mother Nature.

"I hope to obtain a preliminary report on the probable cause of the landslide in a month's time and will brief the cabinet next Friday," he said after a briefing by senior PWD officers at Bukit Antarabangsa yesterday.

Among them were PWD director-general Datuk Seri Dr Judin Karim, deputy director-general III N. Selvanayagam and senior engineer Kamar Kassim of its slope engineering branch.

Kamar gave a briefing on the topographical development in Bukit Antarabangsa since 1969.

Zin said PWD would be assisted by the Mapping Department, Drainage and Irrigation Department, the Meteorological Services Department, Mineral and Geoscience Department, Housing and Local Government Ministry, Ampang Jaya Municipal Council, Department of Environment and several foreign experts.

"We hope to begin clearing the debris from tomorrow and complete the task within a month.

"In the meantime, site and mapping-failure investigation will proceed.

"However, we have to tread cautiously when clearing the base of the landslide so as not to destabilise the slope and cause another landslide."

He said the landslide had brought down 120,000 cubic metres (about 20,000 lorry loads) of earth over an area 200m long, 100m wide and 10m deep.It left four dead, one missing, 15 injured, 14 houses destroyed and nine damaged.

Zin said a manually-operated emergency warning system had helped evacuate 93 residents from Taman Bukit Mewah, Jalan Wangsa 9 and 11, Impian Selatan Condominium and Jalan BJ6A of Taman Bukit Jaya to safety, shortly after the 3.40am landslide.

Gombak member of parliament Mohamed Azmin Ali, who was present at the briefing, asked the PWD to speed up remedial work for the new school term.

He said the 5,000 Bukit Antarabangsa residents used a total of 4,785 vehicles along the narrow and congested neighbourhood roads.

Zin said PWD would tar the damaged main access road as soon as possible.

"PWD will expedite the construction of a Bailey's bridge to complement the army's tactical bridge along an alternate access road.

"Mobile traffic lights will also be installed to ease congestion."

APPENDIX E

UNIVERSITY MALAYSIA PAHANG

FACULTY OF CIVIL ENGINEERING & EARTH RESOURCES

QUESTIONNAIRE SURVEY

- BUILDING DEFECT: CASE STUDY AT TAMAN SERI INDAH

NAME: NUR DIYANA BINTI MD.KASIM

IC: 870519-35-5430

SUPERVISOR: MRS NORZAMZILA BINTI MUSTAFA

SECTION A

COMPANY RESPONDENT PROFILE AND PROJECT DESCRIPTION

Please, thick (√) your answer in the provided boxes.

1. The type of organization or company.

☐ Developer ☐ Client

☐ Contractor ☐ Other, please specify ……

2. Respondent position in the organization or company.

☐ Project Manager ☐ Engineer/Designer

☐ Site Manager ☐ Other, please specify ……

3. State the number of year respondent has experience in construction industry.

☐ 0 – 5 years ☐ 11 – 15 years

☐ 5 – 10 years ☐ Other, please specify ……

4. State the number of construction projects have respondent involved.

☐ 1 – 4 ☐ 11-15

☐ 5 – 10 ☐ Other, please specify……..

Date: ……. Signature: ……...

SECTION B

TYPES OF BUILDING DEFECT

Objective of the Study: To identify types of building defect.

Please, thick (√) your answer. Each scale represents the following rating:

1 = least frequent 3 = average 5 = very frequent

2 = less frequent 4 = frequent

TYPES OF DEFECT	1	2	3	4	5
1. Peeling Paint					
2. Wall Cracking					
3. Unstable Foundations					
4. Roof Defects					
5. Dampness					
6. Honeycombing					

SECTION C

CAUSES OF BUILDING DEFECT

Objective of the Study: To identify causes of building defect.

Please, thick (√) your answer. Each scale represents the following rating:

1 = least frequent 3 = average 5 = very frequent
2 = less frequent 4 = frequent

TYPE	CAUSES	1	2	3	4	5
1. Peeling Paint	1. Water					
2. Wall Cracking	1. Settling					
	2. Deterioration					
	3. Shrinkage					
3. Unstable Foundations	1. Lateral pressure					
	2. Structural settlement					
4. Roof Defects	1. Thermal movement					
	2. Surface cracking					
	3. Surface decay					
5. Dampness	1. Rainwater					
	2. Leak in plumbing					
6. Honeycombing	1. Segregation					
	2. Poor workmanship					

BORANG ADUAN KECACATAN/PELANGGAN

ALAMAT PREMIS :

NAMA PEMBELI/WAKIL :

NO.KAD PENGENALAN :

RUANG RUMAH	ADUAN KECACATAN/PELANGGAN
BUMBUNG	
PLUMBING	
SANITARY	
LANTAI	
DINDING	
PINTU	
TINGKAP	
SILING	
ELEKTRIKAL	

* Adakah pihak anda berpuas hati dengan keadaan kediaman anda sekarang?

☐ Ya ☐ Tidak

TARIKH: ..... TANDATANGAN: .....