

STUDY OF RISING DAMPNES PROBLEM IN HOUSING AREA IN KLANG VALLEY, MALAYSIA

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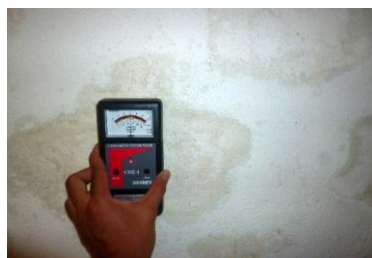
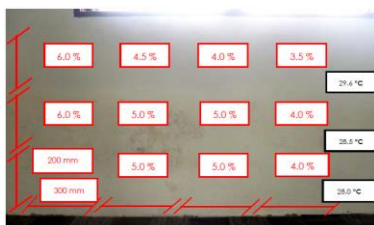
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Graphical abstract



Abstract

Dampness is a major problem in building. It can leads to old and modern buildings to deteriorate and contribute to building decay. Rising damp is part of dampness that can be categorized as one of the major problem in building particularly in residential building whereas it can affect the building and health of the user. This study was conducted to investigate and examine rising damp problem in landed residential building throughout Klang Valley area. From the site observations, rising damp had been identified during the inspection and investigation. Some of the owner of the affected building does not realized and have knowledge about the problem until this study was carried out at their buildings. Hence, this study identified some of the causes are defective damp proof course, effects of the soils salts in groundwater, humid conditions, water penetrations and piping leakage. Thus, the correct diagnosis and analysis of rising damp problem was carried out to overcome the problems in.

Keywords: Residential building in Klang Valley, rising dampness, diagnosis and analysis

Abstrak

Kelembapan adalah masalah utama didalam sebuah bangunan yang boleh membawa kepada kerosakan dan kegagalan fungsi sebuah elemen bangunan. Kenaikan lembapan ialah sebahagian daripada jenis kelembapan yang terdapat didalam bangunan yang boleh dikategorikan sebagai masalah lembapan utama di bangunan yang boleh membawa kepada kemerosotan bangunan dan boleh menjejaskan kesihatan para pengguna. Justeru, kajian ini telah dijalankan untuk penyiasatan awal dan meneliti kenaikan lembapan serta mengenalpasti punca-punca awal masalah tersebut bersama-sama dengan beberapa cadangan awal untuk membaikinya di kawasan-kawasan yang telah di siasat sekitar Lembah Kelang. Sehubungan dengan itu, daripada penyiasatan yang telah dijalankan, beberapa punca telah dikenal pasti antaranya ialah kerosakan atau tiadanya *Damp Proof Course (DPC)*, kesan daripada garam air bawah tanah, kurangnya pengudaraan di dalam bangunan dan kebocoran paip. Sebagai penyimpul kata, diagnosis dan analisis yang tepat mengenai *rising dampness* haruslah dibuat dan diaplikasikan untuk mengelakkan masalah tersebut menjadi lebih buruk pada masa akan datang.

Kata kunci: Kenaikan lembapan, penyiasatan awal, Lembah Kelang

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1.0 INTRODUCTION

Malaysia deals with tropical climate being hot and humid throughout the year makes it the biggest

challenge in construction industry. Due to unexpected weather being hot and rainy, the most notable building defects present is dampness. Dampness is one of the main internal and external

defects and poses to serious defects in a building caused by the presence of high moisture in building component. Dampness presence in many forms. One of them is rising dampness. Many book authors, researchers mentioned about rising dampness when discussing about dampness as building defect. Because rising dampness is one of the serious type of dampness in building that may affect building and users in many ways.

Rising Dampness refers to the capillary or upward movement of moisture that rises that present in buildings walls as a result of water in ground upwards through the walls in a building whether it be brick, block or stone. For example, the effect can be seen by simply placing a piece of stone, porous brick or mortar in a shallow tray of water. Then observing how the water is absorbed into the porous material and transported above the water line. Researchers identified this phenomenon by a characteristics 'Tide mark' or 'tide lines' of staining or blown plaster in the lower area of your wall above your skirting board or at the edge of the damp walls as a result salt deposition contained in the groundwater, defective damp-proof course and many more. We may see white, fluffy deposits in plaster; these are 'salts' which the damp has washed out of your bricks and into your plaster. Black spots of mold may also appear on the damp areas of building walls. Rising damp should be deal with proper action to treating and repairing it. The remedy not only could be laying new screed on a damp proof course but many more. In this study, the researcher will provide some example and rising damp problem occurred in Klang Valley together with the causes and how to treating it. Tropical climate countries such as Malaysia can cause damp houses can be unhealthy and expensive to remedy [1]. Knowledge about dampness may reduce the anxiety and expense to the building owner. Most dampness problems can be repaired with proper knowledge about it. Buildings in Malaysia are exposed to deteriorate and damages due to unexpected weather which is occur happened in tropical climate region. [2], the characteristic features of the climate of Malaysia are uniform temperature, high humidity and copious rainfall and it is extremely rare to have a full day with completely clear sky. This is why building in Malaysia are easily exposed to damages and vulnerable to dampness. Residential buildings issues are mainly affected by defects which are dampness and water leakages problem that required high level of maintenance [3]. Dampness also was the most serious defects that can be found in buildings in Malaysia. Poor and low quality of workmanship is one of the main factors that cause leakage in the elements of the buildings. Sources of dampness can be classified as rising dampness, penetrating dampness and condensation and pipe leakages

2.0 OVERVIEW OF DAMPNES

The presence of dampness is because of the penetration of water through the walls and elements of a building with an excessive quantity of moisture contained in building materials and components which causes deterioration and damages to the building. Dampness is the most frequent and main building defects and contributes more than 50% of all known building failures [4]. If left unattended, unrepaired, dampness in building may lead to structural deterioration it will damaged wall decorations, increase the development of mold and fungi and can be dangerous to user health. Epidemiological studies stated that building dampness affected the respiratory health systems of the user [5]. The study stated that high air humidity, condensation, permanent dampness in building construction is one of the factor of the prevalence of asthma and has increased in the last decade.

2.1 Rising Damp

Agyekum *et al.* [6] mentioned that walls in residential building that have symptoms were hygroscopic salts, decayed skirting, dampness below 1.5m and mould growth up to 1m high because of the presence of rising damp. It tends to cause many problems to a building with associated health, environmental, social and economic implications. Ahmad and Rahman [7] in their research mentioned that ground water is a common source of water that contributes to rising damp problems in the masonry wall. The higher the ground water table, the more severe the rising damp problem. The water table differs from one place to another depending on the geographical locations of buildings and type of soils. Growth of moulds related to high humidity due to damp walls can lead to many problems to occupant health. Rising damp can make a building unpleasant and not comfortable to occupy [8].

2.2 Condensation

Condensation in simple science defines when cold surface been intact with warm moist air inside. [9] Stated that characteristics of condensation is when water is presence and been deposited on the cooler surface of the building and the product is the development of moulds in the areas. This is because mould required pure water to growth and condensed water is pure water. Usually, building user find it hard to believe this kind of dampness is cause by condensation. Water vapour sources such as cooking dish washing, bathing and drying clothes does not necessarily can cause condensation in a room. Condensation mostly occurred in area that disperse through the dwelling into colder spaces such as windows, roof spaces, cold area in building, an area that does not have enough ventilation and free movement of air [9].

2.3 Penetrating Damp

Dampness that comes through the wall. Penetrating damp is the same as lateral dampness [10]. Often lateral dampness can be mistaken for rising damp if it is at low level and condensation if it is at high level. Penetrating dampness is mainly caused by defective roofs, gutters, downpipes, spalling, openings etc. This is where water permeates through the walls because of poor wall materials or inadequate gutters and downpipes. This type of damp can cause severe destruction to properties irrespective if it does not infiltrate all the way through a wall.

2.4 Dampness Diagnosis

Knowledge of building pathology and knowledge of technique of investigations are important to diagnose of dampness in buildings [11]. Diagnosis of the main cause is important to permanent remedies. Without enough diagnosis the surveyor will never know the main cause of the problem. Diagnosis of dampness must be carried out before conducting damp cure [9]. Thus, every suspected damp area should be discovered and it is important to find all the possible causes so the problem can be cured before getting even worse. The sources of damp will be visible from damp areas; is it from broken piping or leaking gutter or roof.

3.0 METHODOLOGY

3.1 Work Procedures

Several procedures that must be followed to diagnosing dampness defect. Based on their study, visual inspection and non-destructive test are the two protocols that have been applied. There are four important procedures in dampness investigations [4]. The procedures are visual inspections for first procedures, investigations using non-destructive equipment as the second procedure, followed by more detailed investigation using specific tools and end by depth research study in the lab [6]. To survey a house with damp problem, one must follow all the proper procedures by start survey from the ground floor and conducting survey in each room one by one. The visual inspection was conducted through the inspection of the area, survey of the damp zones and visually predicting the causes of the dampness based on the symptoms identified. Furthermore, examinations of the exterior of the building from street level and from higher access were carried out for any obvious defects. Hence, this study used visual inspection and non-destructive investigation towards the problem in a wall that shows rising damp symptoms such as peeling of paint, staining, blistering of paint and mould growth. All the data received were recorded.

3.2 Data Collection

In this study, two procedures which are visual inspection and using non-destructive tools were used to carry out the study. First, visual inspection was done to observe the building surroundings, determine the damp area and observed/find the possible causes of the identified damp internally and externally (from the street level) of the building. Second, non-destructive testing was conducted on the wall that were affected by rising damp using the TRAMEX Concrete Encounter CME4 moisture meter for concrete and FT3700-20 Infrared Thermometer and distance meter to study, identify and analyze the damp areas as shown in Figure 1.

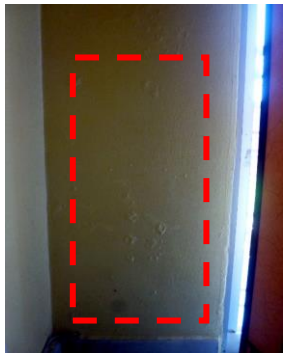


Figure 1 Moisture meter (left) and Infrared Thermometer (right) intact with dampness area

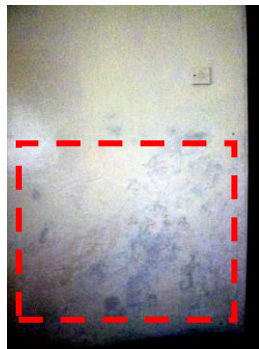
The data from the concrete moisture meter and infrared thermometer was recorded in each damp that shows potential damp problems such as peeling of paint, blistering of paint, staining, mould growth and many more. All the data recorded will be explained in the next chapter. Before placing the moisture meter onto the damp areas, first we must find the reference scale for the affected area. To find reference scale, place the moisture meter outside the damp area to find the equal scale around the damp area to determine the scale outside the damp areas (Figure 2). If the damp areas is sharp changes from the reference scale, the area are consider damp. But in this research, the researcher found that most of the reference scale is 2.5% to 3.0% of H₂O. If the readings are more than that, the area is damp. The maximum readings from CME4 moisture meter is 6.0% of H₂O % concrete. If the readings indicates the damp area are more than 6.0% scale, the readings are recorded by more than 6.0% (>6.0%). Figure 2 (a), (b), (c) shows some of the rising damp problems occurred in the case study area.



(a) Rising damp clearly seen at the base of the wall



(b) Blistering of paint cause by rising damp



(c) Rising damp affect the internal wall surface

Figure 2 Sign of rising dampness problems

3.3 Site Observation

This study was conducted throughout Klang Valley. Klang Valley comprising Kuala Lumpur city and its suburbs and adjoining cities, town in the state of Selangor as been shown in Figure 3. Klang Valley is home to large number of Malaysian citizens because they work and lives in the area. Klang Valley has a population about 7 million people based on 2014 data from Department of Statistics Malaysia. This is why there are abundance of residential area throughout the area. The study was conducted specifically at landed residential house at different area across Klang Valley. Each of the chosen area is affected by rising damp problem.

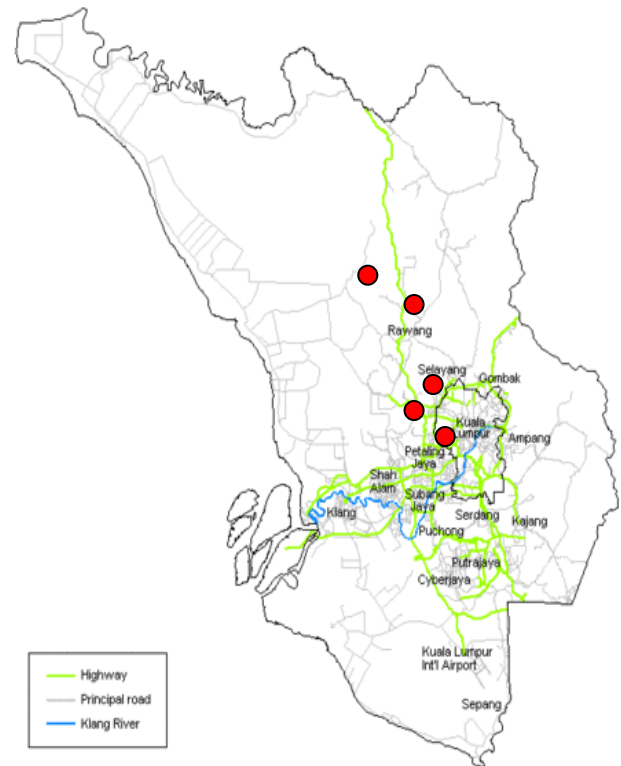


Figure 3 The area of study (marked in red circle) in Klang Valley area

3.4 Data Analysis

Before conducting all the inspection and survey at the suspected area, assessment of residential hazards involves visual and occupant survey must be conducted [12]. The researcher is following all the procedures stated in literature review in previous chapter and implements the assessment strategies which are:

- Visual Inspections: Determine building characteristics, structural deficiencies that leads to a potential health hazard
- Occupant Survey: Identify symptoms of a hazard, interviews

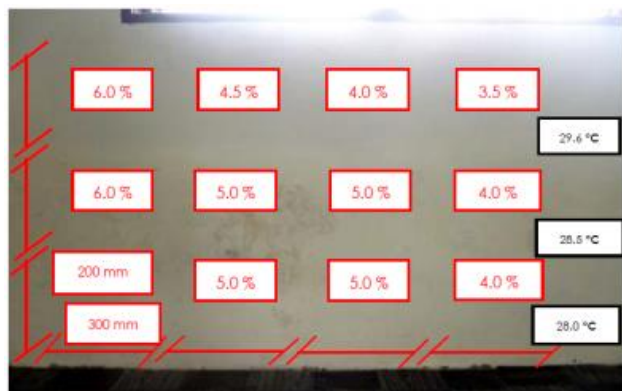
The data from rising dampness problems were collected in 9 houses throughout Klang Valley area. The affected house with rising dampness has their characteristics why the house has been attacked by the problems. Table 1 indicates the number and address of the houses in case study area that has been affected by the problem:

Table 1 The houses and its material that were affected by rising dampness

Distribution of Area	No. of houses inspected	Building materials	Notes
Jalan Kuari, Kampung Cheras Baru	i. Lot 16, Lrg Bukit B-1 ii. Lot 16A, Lrg Bukit B-1 iii. Lot 14, Lrg Bukit B-1	Plastered Brick-wall Plastered Brick-wall Plastered Brick-wall	Rising damp Rising damp Rising damp
Batu 4, Sentul	i. No. 78, Lot 588 ii. No. 80, Lot 588	Plastered Brick-wall Plastered Brick-wall	Rising Damp Rising damp, Condensation
Taman Tun Perak, Rawang	i. No. 28, Jalan TP 15	Plastered Brick-wall	Rising damp, Condensation
Taman Cheras Jaya Balakong	i. No. 20, Jalan 11/3 ii. No. 4, Jalan 12/7	Plastered Brick-wall Plastered Brick-wall	Rising Damp Rising Damp
Taman Kemacahaya, Batu 9, Cheras	i. No. 48, Tmn. Kemacahaya	Plastered Brick-wall	Rising Damp, Rain splash back

4.0 RESULTS AND DISCUSSION

The results were based on the collected data in all the inspected houses. The dampness data was collected by using 200 mm x 300 mm of grid around the affected area with the usage of moisture meter in order to determine the H₂O % concrete and infrared thermometer to determine the temperature of the defect area. Figure 4 shows an example of rising damp data which was obtained using the moisture meter and thermometer.

**Figure 4** Example of rising damp data was obtained using moisture meter and thermometer

4.1 Case Study 1: Jalan Kuari, Kampung Cheras Baru, Kuala Lumpur

There were three houses in the area that were affected by rising dampness internally and externally. Most of the affected areas by rising dampness in this building are at the base of the wall. The areas affected by the rising damp problems were mainly located at internal wall in bedroom, kitchen and dining area. Most of the problems inspected are categorized as fair rating. However, from the analysis result, the differences of dampness rating were based on numbers of H₂O % in concrete. The higher the readings of the moisture meter, the higher the dampness rating. Table 2 shows the relationship of defect rating and moisture meter readings obtained during the case study 1

Table 2 Relationship of defect rating and moisture meter readings for case study 1

Defect Rating	No. of Defects	Average H ₂ O % (moisture meter)
Good	1	2.5% - 3.5%
Fair	7	3.5% - 4.5%
Poor	3	4.5% - >6.0%
Very Poor	-	More than 6.0%

4.2 Case Study 2: Batu 4, Sentul, Kuala Lumpur

In this area, two houses were affected by rising dampness problems. Both the houses are single story house in a private land. Rising damp mostly occurred in living room and balcony, probable causes are defective damp proof course (DPC) allowing ground water to rise and less ventilation. Data were collected and the results from Table 3 shows that most of the problems are categorized as poor as when the moisture meter been intact with the damp, it shows sharp changes. It proves that rising dampness is occurred in the houses.

Table 3 Relationship of defect rating and moisture meter readings for case study 2

Defect Rating	No. of Defects	Average H ₂ O % (moisture meter)
Good	-	2.5% - 3.5%
Fair	2	3.5% - 4.0%
Poor	4	4.5% - >6.0%
Very Poor	-	More than 6.0%

4.3 Case Study 3: Taman Tun Perak, Rawang, Selangor & Taman Kemacahaya, Batu 9, Cheras

There were some similarities between these areas. Both areas are near water sources such as river or swamp. Each of the area has one house that was affected by rising dampness problem. Total of two houses were inspected and all the data of dampness were measured. Internal wall in living area, kitchen

and storage room were affected by rising dampness. Based on the visual inspection, the probable causes are because water from ground is rising and the water may contain salt and lack of proper ventilation. Both of the affected houses are collected and it tends to show that most of the rising dampness are categorized as fair. Table 4 summarized the relationship of defect rating and moisture meter readings obtained from case study 3.

Table 4 Relationship of defect rating and moisture meter readings for case study 3

Defect Rating	No. of Defects	Average H2O % (moisture meter)
Good	-	2.5% - 3.5%
Fair	4	3.5% - 4.0%
Poor	3	4.5% - >6.0%
Very Poor	-	More than 6.0%

4.4 Case Study 4: Taman Cheras Jaya, Balakong, Selangor

In this area, two houses were found to be affected by rising dampness. Inspection had been done, and the dampness data were collected by using all the necessary approaches. Total of two houses consist of one single story and one double story terrace houses were involved. Most of the rising damp problem located at internal wall in kitchen, living room and car porch. The probable causes are effects from ground water because of defective DPC that may contain salt and affected the wall base. The collected data shows that most of the dampness is categorized as fair rating as been shown in Table 5.

Table 5 Relationship of defect rating and moisture meter readings for case study 4

Defect Rating	No. of Defects	Average H2O % (moisture meter)
Good	-	2.5% - 3.5%
Fair	4	3.5% - 4.0%
Poor	1	4.5% - >6.0%
Very Poor	-	More than 6.0%

4.5 Comparison of Case Study area with Different Dampness Rating

Figure 5 shows the comparison of case study area with dampness rating. A total of 29 rising dampness problem were identified throughout the inspection of all the case study area in Klang Valley. It shows that case study one area have the most number of problems with fair rating. But case study area shows that the most cases of rising damp problem were in poor rating. Most of the fair rating dampness are wall that have stain mark, blistering paint, peeling paint and mould. But the poor rating dampness mostly are wet base wall with "tide mark" or effects from water from the ground that affected by capillary action of

ground water, inadequate ventilation and very humid space.

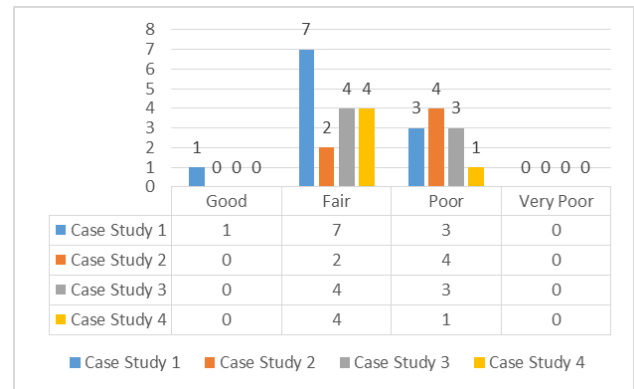


Figure 5 Comparisons of case study area with dampness rating

5.0 CONCLUSION

Rising damp is one of the serious problem in building defect. It can give negative impact to the building and the user in many ways. Based on some surveys and interviews made with the owners, most of them does not recognize and have knowledge by any means in rising damp. This research is intend to help building owner to understand about the problems and to prove that the building that they live are affected by rising damp. Total of 9 houses were inspected and have been identified affected by rising dampness problems throughout Klang Valley Area. Visual inspection and the usage of non-destructive tools approaches had been done by the researcher to identify all the affected wall within the area. The data shows that rising damp are exist in landed residential building. Many factors contributing to it such as faulty construction method, poor construction materials, lack of maintenance and many more. This must be avoided from the pre-construction, during construction and post-construction stage by the professionals involved to avoid rising damp or any building defect happened in the future. With respect to this research study, home owners must understand the scientific of building defects and dampness specifically. They need to take care of the houses because the place is where there live in. Correspondingly to rising damp, home owners or user can used simple preliminary investigation method to detect any sign of rising dampness in their houses. So, they can eliminate the problems in the beginning without wasting abundance of money to hire professionals to repair it. Thus in conclusion this research is intend to prove research world that rising dampness in not only happened in older building but in modern buildings too and to help building owners to determine rising damp by only using simple preliminary non-destructive investigation on their building.

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