International Journal for Multidisciplinary Research (IJFMR)
E-ISSN: 2582-2160 ● Website: www.ijfmr.com ● Email: editor@ijfmr.com

A Case Study of Paint Defects and their Remedies on Painted Residential Buildings in Sekondi-Takoradi Metropolis

Francesca Evans-Solomon[1], Kennedy Sangban[2], Ebenezer Adjetey Okang[3]

[1]Senior Lecturer, Department of Industrial Painting and Design, Takoradi Technical University, Ghana
[2]Lecturer, Department of Industrial Painting and Design, Takoradi Technical University, Ghana
[3]Assistant Lecturer, Department of Industrial Painting and Design, Takoradi Technical University, Ghana

Abstract
Paint defect is a common occurrence on painted residential buildings that affect both aesthetic appearance and structural integrity. This research present a case study conducted in Sekondi-Takoradi metropolis, focusing on identifying rampant paint defects on residential buildings and exploring effective remedies. Qualitative research approach was employed using visual inspection and interviews with landlords, autodidact painters and professional painters. Data collection and analysis revealed various paint defects such as blistering, cracking, peeling flaking, and fading along with their fundamental causes such as poor surface preparations, use of inferior materials, and environmental factors were observed. Drawing upon empirical findings, the research proposed a set of practical remedies and preventive measures to mitigate paint defects on residential buildings in Sekondi-Takoradi Metropolis encompassing proper surface preparations methods, excellent-quality of paint materials selections, adherence to manufactures recommendations and regular building maintenance practice. The research contributes valued understandings into paint defects prevalence on residential buildings in Sekondi-Takoradi offering actionable recommendations for landlords, painters, and stakeholders involved in the building industry to apply paint according to industry standards and manufacturer's instructions.

Keywords: Paint Defect, Autodidact Painter, Landlords, Sekondi-Takoradi

1. Introduction

Paint performs a crucial dual purpose on residential building structures both improving aesthetics and providing vital defense against environmental factors (Bramstoft, Huang & Janssen, 2019). As a protective film, paint protects structures from ultraviolet (UV) radiation, moisture, and mechanical abrasions, in so doing prolonging their lifespan and decreasing maintenance necessities (Husin, Othman, & Bakar, 2019).). In urban areas such as Sekondi-Takoradi Metropolis, where residential buildings are subject to diverse environmental stressors, the choice of paint and its application are vital for ensuring structural resilience and visual appeal (Adams, 2020).

Detecting and addressing paint defects is indispensable for maintaining the quality and sustainability of residential buildings. Paint defects, such as cracking, blistering, peeling, and fading not only weaken from the building's aesthetic significance but also compromise its structural integrity over time (Jamaludin, Kadir, Ismail, & Ali, 2020). These defects can arise from various factors, including improper adverse weather conditions, use of substandard materials, inadequate surface preparation and maintenance practices (Cheng, Chen & Song, 2020).

Given the implication of paint defects on urban residential buildings, predominantly in the Sekondi Takoradi Metropolis, knowing their root causes is important for effective remediation (Lim, Othman, & Othman, 2017). Therefore, this study seeks to investigate the pervasiveness of paint defects, their fundamental causes, and potential remedies through a case study approach in the Sekondi Takoradi Metropolis.

2. Statement of the Problem

Despite the vital role of paint in preserving and improving the quality of residential buildings in the Sekondi-Takoradi metropolis, the persistence of paint defects presents a pressing research problem. Paint defects, including blistering, cracking, peeling, and fading, undermines the structural integrity and visual appeal of buildings, leading to increased maintenance costs and decreased property value. These defects can result from numerous factors, including improper surface preparation, the use of inferior materials, adverse weather conditions, and poor maintenance practices.

The prevalence of paint defects on painted residential buildings in the Sekondi-Takoradi Metropolis shows the need for an investigation into their root causes, effective remedies and preventives tailored to the region. For this reason, the research aims to address the problem by conducting a Case Study of painted residential buildings with the goal of acquiring knowledge into the existence of paint defect.

3. Research Objectives

The objectives of the research are:

1. To identify the root cause of paint defects on painted residential buildings in Sekondi Takoradi Metropolis.
2. To recommend practical measures for remedying and preventing paint defects on residential buildings.

4. Research Questions

1. What are the root causes of paint defects observed on walls of painted residential buildings within the Sekondi Takoradi Metropolis?
2. What practical remedies can be proposed to address and prevent paint defects on walls in residential buildings, bearing in mind the context of Sekondi Takoradi Metropolis?

5. Purpose of the Study

The purpose is to investigate paint defects on painted walls of selected residential buildings within the Sekondi Takoradi Metropolis, Ghana.

6. Literature Review

Common Paint Defects and Their Causes

A great deal of research has been done on paint defects, determining prevalent problems and their underlying causes. One of the most common defects, blistering, has been linked to moisture being trapped under the paint layer as a result of improper surface preparation or application in inclement weather (Singh et al., 2018; Salleh et al., 2020). Another common defect is cracking, which can be caused by temperature changes, substrate movement, or the use of flexible yet low-quality paints (Husin et al., 2019; Yao et al., 2021). Poor surface adhesion, mismatched coating systems, or substrate contamination can all lead to peeling, a visual indicator of adhesion failure (Fang et al., 2019; Cheng et al., 2020). Paints with insufficient UV protection can induce fading, which is usually brought on by UV light (Yao et al., 2021).

Studies on Paint Defects on Residential Buildings

Several studies have investigated paint defects specifically in residential buildings, shedding light on their prevalence and contributing factors. A study by Lim et al. (2017) conducted in urban residential areas highlighted the significant occurrence of paint defects, with peeling and cracking being the most common issues. The research attributed these defects to poor surface preparation, low-quality paints, and improper application techniques. Similarly, a study by Jamaludin et al. (2020) in suburban residential neighborhoods identified blistering and fading as predominant defects, with environmental factors such as humidity and UV exposure playing crucial roles. These studies underscore the importance of understanding localized factors influencing paint defects in residential settings.

While previous study on common paint flaws and their causes is helpful, there is a noticeable lack of studies that particularly address the Sekondi Takoradi Metropolis environment. To gain a better understanding of the occurrence and features of paint defects in residential structures within the city, localized studies are necessary, taking into account the distinct environmental conditions, building materials, and construction procedures of the region. By performing a thorough case study that not only identifies common paint faults but also looks at workable solutions particular to the Sekondi Takoradi Metropolis, this research seeks to close this gap. Through such endeavors, this study seeks to contribute to the body of knowledge on paint defects in residential buildings and inform practical interventions to enhance the durability and aesthetic appeal of painted structures in the region.

Paint Defects Impact on Building Aesthetics and Durability

Paint defects are a broad category of problems that can seriously affect residential buildings' structural soundness and visual appeal. Blistering, which is defined as the development of bubbles or blisters on the painted surface, impairs the paint film's ability to prevent water infiltration and substrate degradation in addition to taking away from the paint's aesthetic appeal (Bramstoft et al., 2019). Another frequent defects is cracking, which ruins the building's look and permits moisture to seep in, further degrading the substrate (Husin et al., 2019). In addition to ruining the aesthetic look, peeling, a sign of adhesion failure between the paint layer and substrate, exposes underlying surfaces to environmental degradation (Cheng et al., 2020). Fading, caused by UV radiation, not only diminishes the vibrancy of colours but also accelerates paint degradation and necessitates premature repainting (Yao et al., 2021). These paint defects collectively undermine the durability and aesthetics of residential buildings, highlighting the need for effective remedies.

Approaches and Remedies to Address Paint Defects

Researchers have proposed various approaches and remedies to address paint defects, aiming to enhance

the longevity and performance of painted surfaces. Surface preparation plays a crucial role in preventing defects such as blistering and peeling, with proper cleaning, priming, and sanding recommended to ensure good adhesion and substrate compatibility (Fang et al., 2019). Issues such as fading and cracking can be lessened by using premium paints with appropriate formulations and additives, for example UV stabilizers and anti-fungal compounds (Yao et al., 2021). Application methods that regulate humidity and temperature while painting can reduce flaws like blistering and cracking (Salleh et al., 2020). According to Bramstoft et al. (2019), consistent maintenance procedures, such as cleaning and repainting when necessary, help stop defects from recurring and increase the longevity of painted surfaces. In addition to these preventive measures, researchers have also explored remedial actions to address existing paint defects. Remedies such as sanding, filling, and recoating are commonly employed to repair defects such as cracking and peeling, restoring the integrity and appearance of the painted surface (Husin et al., 2019). Innovative solutions, for instance nanotechnology-based coatings and self-healing paints, are being developed to enhance the durability and resilience of painted surfaces against common defects (Cheng et al., 2020). Generally, the literature underscores the importance of proactive measures and effective remedies in addressing paint defects and ensuring the long-term performance of painted residential buildings.

7. Methodology

To capture a general understanding of paint defects and remedies, qualitative research approach was employed. The approach enabled the exploration of various reasons contributing to paint defects and the effectiveness of remedial actions. Data collection involved the use of interviews, and visual inspections to collect extensive information from several perceptions.

Population and Sampling Strategies

Gathering a wide range data on the dynamics of Sekondi-Takoradi metropolis, a systematic procedures was followed in selecting both the population and samples. The population understudy encompasses the entirety of Sekondi and Takoradi with their diverse residential landscapes. Random sampling technique was used to ensure a representation subset of residential buildings with their landlords within the metropolis. Nine residential buildings along with their Landlords were selected to participate in the research. The selection process aimed for a balance representation across various neighborhoods resulting the following breakdown: Two residential building selected from in Ntankoful, Three from New Takoradi, One from Tanokrom, and Three from Effiakuma. This approach did not only ensures geographic diversity but also justification for the varying demographics and social economic characteristics presented within the metropolis.

Furthermore, to delve deeper into specific professional demographics within the community, purposive sampling technique was also utilized. Five autodidact painters from Sekondi and Takoradi, each with a distinct range of experience spanning from one to five years, were selected purposively. This deliberate selection process allowed for understanding of the challenges and opportunities faced by painters at different stages of their careers. Additionally, to corroborate findings and ensure the robustness of the data collected, five professional painters with Technical Educational structural painting backgrounds were also sampled. This subgroup was specifically targeted to validate and enrich the insights garnered from the autodidact painters, providing a comparative lens through which to analyze the data. There were two motives for selecting these sample sizes and selection criteria. Firstly, the goal was to reconcile the realistic limitations of time and resources with the requirement for an extensive dataset by

selecting nine residential structures with their landlords. Secondly, the desire to represent the variety of backgrounds and perspectives seen in the neighborhood where the painted houses were, guided the choice of autodidact and professionally educated painters. This two-pronged strategy warranted that the results were comprehensive and subtle, painting a complete picture of the dynamics at work in Sekondi-Takoradi.

Data Collection

Profound insights from a variety of stakeholders were made possible by semi-structured interviews, which were the cornerstone of data collection. Professional painters, autodidact painters, and landlords were among the participants. The purpose of these crafted interviews was to delve into the delicacies of paint defects, investigating their underlying causes, current repair methods, and recommendations for improvement. The interviews were done on telephone calls as well as in-person, giving participants' schedules and flexible preferences. A subset of landlords and all of the selected autodidact painters participated in in-person interviews. This face-to-face connection increased the depth of comprehension by promoting rich conversation and enabling the observation of nonverbal evidences. Phone call interviews were used to interview certain landlords and professional painters in order to increase participation and get around logistical issues. Phone call interviews were a productive way to collect information from a geographically distributed group of participants, even though they did not have the same immediate benefit as in-person interactions.

To determine the severity of paint defects directly from the root cause, visual inspection of painted residential buildings were carried out. A physical visual evaluation of the sampled painted residential building surfaces from the various neighborhoods in the Sekondi Takoradi Metropolis was carried out. Researchers inspected external walls, trims, windows and other painted components in order to determine the prevalence of paint defects and their level of severity. During inspections, a thorough observations, pictures and paperwork notes were made to record the kinds, volume of affected areas, and other features of paint defect found. The visual inspections gave important personal information about painted surfaces conditions which supported interview findings and guide for further study.

Data Analysis

Themes emerged from semi-structured interviews with landlords, autodidact painters, and professional painters. The interviews were verbatim transcribed into notes. Patterns, themes, and meanings within the interview data are methodically found, analyzed, and interpreted. Transcripts were first read and reread to acquaint with the material. After that, codes were created to represent important notions, patterns, and concepts pertaining to the reasons behind paint defects and suggested fixes. The themes that emerged were analyzed in light of the research questions, offering detailed insights into the variables causing paint defects and possible remedies within the framework of the Sekondi Takoradi Metropolis. Through iterative analysis, codes were arranged into more comprehensive themes that made it possible to identify similarities and differences between the viewpoints of the participants.

8. Findings and Discussions

Identification of Root causes of Paint Defects

The study determined a number of underlying factors that contributed to common paint defects in residential buildings in the Sekondi Takoradi Metropolis. The research findings spell out the frequency of paint defects, their underlying causes, and the efficacy of current preventative methods on painted residential buildings in the Sekondi Takoradi Metropolis. The participants revealed that paint quality

plays a crucial role in defining painted surfaces' lifespan and performance. A major contributing factor to paint defects, such as fading, inadequate adhesion and poor colour retention has been shown to be the usage of inferior-quality paints. The significance of making an investment in premium paint materials that are designed to withstand regional climatic circumstances and offer long-term protection was underlined by the participants. Once more, paint defects were found to be a result of incorrect application, which included uneven coverage, over-application, follow-up recoating without allowing appropriate drying time between coatings, and under-application of paint. Uneven application methods were found to be a common cause of problems including streaks and uneven sheen and colour variation. The interviews emphasized how essential it is to use the exact application processes in order to obtain paint finishes that are effectively required and long-lasting.

In addition, the importance of appropriate surface preparation in reducing paint defects kept coming up in the interviews. The integrity of painted surfaces were negatively impacted by painter's inability or lack of surface preparation knowledge, carelessness of working procedures, unaware of environmental elements, specifically excessive humidity and exposure to extreme weather, was discovered by participant interviews. These factors were found to accelerate paint deterioration over time and worsen pre-existing paint defects. One important element impacting the beginning and advancement of paint defects was specifically mentioned: the humid climate and rising water from the ground levels is common in the area. Participants stressed how improper surface preparation, including improper cleaning, treatments, scraping, sanding, and priming, cause paint failure too soon by compromising paint adherence. Blisters, peels, and cracks were shown to be more common on surfaces that were not properly prepared. In order to reduce the possibility of paint defects, professional painters stressed on the significance of implementing best practices in paint selection, surface preparation, and paint application. They emphasized that in order to obtain the best painting finish, it is essential to use premium-quality materials, adhere to manufacturer requirements, and use experienced craftsmanship. Furthermore, early repairs and routine maintenance culture were recommended as important steps to protect painted surfaces and stop paint defects from reoccurring.

Visual Inspections

Physical inspections on painted surfaces of selected residential buildings verified the existence of paint defects with blistering, cracking and peeling being specifically common. The degree of these defects differed from building to building; some had minor problems, while others had more substantial damage. Visual examinations provided firsthand proof of the concrete effects paint defects have on a building's permanency and beauty, highlighting how important it is to resolve these problems.

Figure 1: First Selected Residential Building from New Takoradi

Figure 2: Second Selected Residential Building from New Takoradi.

Image credit: Researchers field work (2024)

Image credit: Researchers field work (2024)

Figure 3: Third Selected Residential Building from New Takoradi
Image credit: Researchers field work (2024)

Figure 4: First Selected Residential Building from Ntankoful
Image credit: Researchers field work (2024

Figure 3: Second Selected Residential Building from Ntankoful
Image credit: Researchers field work (2024)

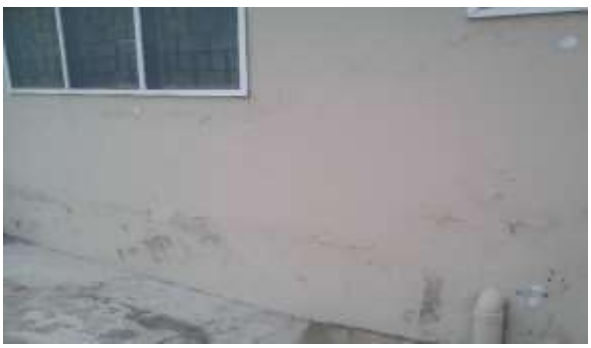

Figure 6: Third Selected Residential Building from Ntankoful
Image credit: Researchers field work (2024)

Figure 7: First Selected Residential Building from Effiakuma
Image credit: Researchers field work (2024)

Figure 8: Second Selected Residential Building from Effiakuma
Image credit: Researchers field work (2024)

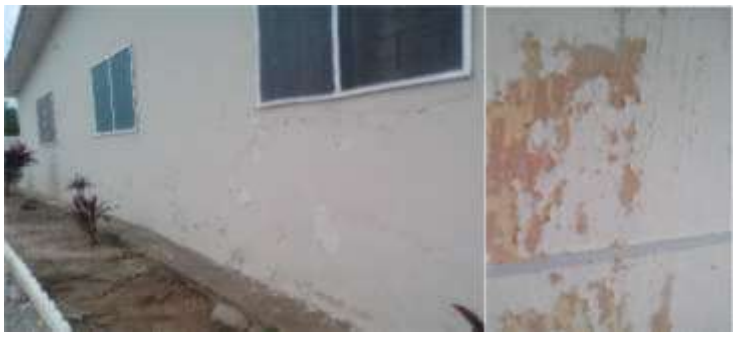

Figure 9: Third Selected Residential Building from Effiakuma
Image credit: Researchers field work (2024)

To improve the thoroughness of the research's visual conclusions, a frequency distribution table that lists the recorded instances of different paint defects based on visual inspections carried out during the investigation has been created. "Frequency" in this sense refers to individual number of residential buildings to each particular kind of paint defects that is seen during visual inspections carried out in the Sekondi-Takoradi Metropolis. A breakdown of these occurrences is shown in the frequency distribution table below, which makes clear on the distribution and occurrence of different paint defects in the sampled residential buildings.

Table 1: Frequency Distribution Table of Paint Defects

Paint Defect	Frequency
Blistering	9 out of 9
Cracking	8 out of 9
Peeling	6 out of 9
Fading	9 out of 9
Other (Specify)	3 out of 9

Blistering category denotes instances where bubbles or blisters form on the painted surface, often due to moisture, inadequate surface preparation, or incompatible paint products. With an occurrences frequency of nine out of the nine sampled residential buildings, blistering emerges as a notable concern within the sampled residential buildings. Occurred five times across the nine sampled residential buildings. Cracking appearing on painted surfaces, attributed to factors such as substrate movement, temperature fluctuations, or poor paint adhesion, are encapsulated within this category. The observed frequency of eight out of the nine sampled residential buildings highlights the significance of cracking as a prevalent paint defect.

Peeling: occurrences where the paint film separates from the substrate and flakes or peels are recorded. Pealing is the most common and observably noticeable paint defects found during the visual examinations, occurring six times in the nine residential structures evaluated. The category of fading includes all occurrences of colour fading or deterioration that are seen on painted surfaces and are frequently ascribed to extended sun exposure, insufficient UV protection, or poor paint quality. Fading is a significant issue in the studied residential structures, as evidenced by the nine incidents out of the nine that were detected. Paint defects not specifically classified above can be accommodated with flexibility using Category Other (Specify). Of the nine residential buildings that were sampled and identified during visual inspections, three instances of additional paint defects were found. These findings add to our thorough understanding of the occurrence of paint defects within the sampled buildings. The overall frequency observed residential buildings represents incidence of all paint defect types in the sample. The Sekondi-Takoradi Metropolis's prevalent paint defects are succinctly summarized in this frequency distribution, which lays the groundwork for additional research and remediation initiatives targeted at enhancing paint quality in residential contexts.

Comparative Analysis of Paint Defects by Building Age

The following table represents a comparative analysis of paint defect s by building age:

Table 2: Comparative Analysis of Paint Defects by Building Age

Defects	Newer Residential Buildings (<5 years)	Older Residential Buildings (5+ years)

Blistering	3	6
Cracking	5	3
Peeling	2	4
Fading	4	5
Other (Bittiness)	1	2
Total	**15**	**20**

The distribution of paint defects in newer versus older residential buildings is shown in above the table. "Newer residential Buildings" in this table refer to residential buildings that are younger than five years old. Five years or more old residential buildings are classified as "Older Residential Buildings". For both older and younger residential buildings, the occurrences of each paint defects are divided into columns. For each categories, the overall frequency of paint defects to number of residential buildings is shown. The data indicates that comparatively older residential buildings (five years or older), to newer residential buildings (less than five years old) show an increased prevalence of paint defects. This raises the possibility of a relationship between the age of a building and the frequency of paint defects, emphasizing the need of routine upkeep and appropriate paint application techniques in older buildings.

Summary Statistics of Maintenance Practices

The following summary statistics provide an overview of the maintenance practices reported by Landlords or residents.

Table 3: Summary Statistics of Maintenance Practices

Maintenance Practices	Number of Landlords or Tenants
Repaint/touch-up every 1-2 years	0
Repaint/touch-up every 3-5 years	3
Repaint/touch-up every 5+ years	9
Repaint/touch-up only when defects are noticeable	2
Follow specific maintenance practices	5
Have requested a repaint or repair due to paint defects	2

Satisfied with the quality of paint used in their building	5

According to the above documented summary statistics of maintenance practices provided by landlords or tenants, neither group repaints or does touch-ups on their building's paintwork within a year or two. Three landlords or Tenants, on the other hand, repaint or touch up their building every three to five years to ensure that the paintwork is maintained on a regular basis. Majority of either the nine landlord or the tenants decide to repaint or touch-up walls five years later after painting, suggest a longer interval between maintenance. There appears to be a significantly less reactive approach to maintenance, as just two landlords or tenants decide to repaint or touch up only when defects become visible. Five of the landlords or tenants follow certain maintenance procedures, which suggests that they take proactive measures to keep the paintwork of their buildings in good condition. But just one in two landlords or tenants ask for a repaint or repair because of paint defects, which suggests that they do not realize how important it is to take care of paint problems as soon as they arise. Out of the nine landlords surveyed, five of them expressed satisfaction with the paint quality utilized on their buildings, indicating that most of them had a favorable opinion of the paint products applied.

The supplementary data tables; Frequency Distribution of Paint Defects, comparative analyses of Paint Defects by Building Age and Summary Statistics of Maintenance Practices offer more awareness into paint defects and maintenance procedure problems on residential buildings in the Sekondi-Takoradi Metropolis by providing extra information and analyzing the research findings. This correspondingly shows how paint defects are compared across older and newer structures, suggesting possible patterns in the occurrence of paint defects according to building age. The discussion of findings emphasized the complexity of paint defects and the necessity of an all-encompassing strategy to successfully address underlying causes.

The research's findings provide insight into the frequency of paint defects, their underlying causes, and the efficacy of current preventative methods in painted residential buildings in the Sekondi Takoradi Metropolitan Area. Landlords, building contractors, professional painters, amateur painters, policymakers, and other stakeholders involved in building maintenance and construction can benefit from the research's key findings from interviews and visual inspections. These findings also present opportunities for improvement and intervention to improve the longevity and aesthetics of painted structures in the area. Key findings and their implications for paint application and building maintenance procedures in residential settings were also covered in detail throughout discussions. The Sekondi-Takoradi Metropolis has a notable occurrence of paint defects on painted residential buildings according to the study. Observations of common paint defects including blistering, cracking, peeling, and fading suggested difficulties in preserving the strength and longevity of painted surfaces. In addition to lowering a building's aesthetic value, these defects eventually jeopardize its structural soundness. There are a number of known contributing causes to paint problems in residential structures. One of the main contributing factors was the inadequate scraping, cleaning, dusting-off, sanding, and priming of the surface prior to paint application. Furthermore mentioned as major causes of paint defects were the usage of inferior paints, incorrect application methods, environmental elements such humidity and UV exposure, and neglect of routine maintenance.

The study found inconsistent adherence to best practices despite the fact that landlords and painters (Autodidact and Professionals) acknowledged undertaking maintenance procedures such as routine

repainting and touch-ups. Moreover, poor coordination and communication amongst stakeholders and a lack of knowledge about appropriate maintenance practices made preventive efforts less effective. The results highlight how crucial it is to take preventative action when it comes to paint issues in residential buildings. It has been determined that the best ways to reduce paint defects and extend the life of painted surfaces are to prepare surfaces properly, use premium paints and apply them according to instructions, and perform routine maintenance. To guarantee the implementation of these procedures, landlords, painters, and industry experts must collaborate and communicate effectively.

9. Conclusion

- The research offered important information about how common paint defects occurs on residential buildings in the Sekondi-Takoradi Metropolis, as well as their root causes and workable solutions. The conclusions have a big impact on how residential buildings are maintained, and they highlight how crucial it is to take preventative action rather than waiting to fix paint defects.
- Typical paint defects such as blistering, cracking, peeling, and fading in painted residential buildings within the Sekondi Takoradi Metropolis were analyzed through visual examinations as these flaws are frequently caused by situations identified as improper surface preparation, the use of inferior paints, lack of knowledge on good painting procedures, insufficient application methods, and a lack of routine maintenance. Interview results of the study have implications for better building maintenance procedures, such as appropriate surface preparation, high-quality paint selection, application technique adherence, and routine inspection and maintenance schedules.
- The study's conclusions support the need of taking preventative action when it comes to identifying and fixing paint defects in residential structures. Landlords, painters, and legislators can reduce the likelihood of paint defects and improve the durability and beauty of painted surfaces of residential buildings in Sekondi-Takoradi by making investments in appropriate surface preparation methods, utilizing premium paints, and putting regular maintenance procedures into place. Furthermore, to guarantee that preventive measures are applied consistently and successfully, stakeholders must collaborate and communicate effectively.

10. Recommendations

- Painters in Sekondi-Takoradi Metropolis who receives a painting job contract makes sure that residential buildings surfaces are properly prepared, which includes scrapping, washing down, sanding, dusting off and priming. This will encourage good paint adherence and lessen frequent defects like blistering, cracking, and peeling on the walls.
- Professional painters ought to promote the use of high-quality paints that are specially formulated to endure environmental difficulties, UV stabilizers and anti-fungal compounds components. These choices strengthens walls against fading, dampness and others that cause paint defects.
- The researchers advise painters and landlords to apply paint according to industry standards and manufacturer's instructions, which include using the right application methods, adherence to finishing standards, and provision of excellent skilled labour. Landlords are urged to implement regular maintenance procedures that include cleaning, inspecting, and promptly repainting as needed. By taking preventative measures, flaws are prevented from reappearing and painted surfaces in residential environments are kept structurally and aesthetically intact.

- Additional research on the particular environmental, meteorological, and socioeconomic variables causing paint defects in the Sekondi-Takoradi Metropolis may offer more profound understanding of regional problems and potential remedies.

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