

COMMON BUILDING DEFECTS IN NEW TERRACE HOUSES

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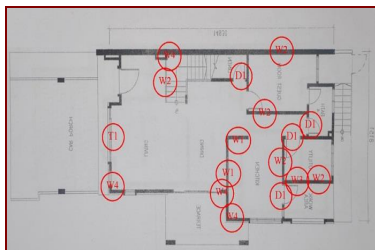
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Graphical abstract



Abstract

Building defects are a common issue associated with housing provision in Malaysia. Theoretically, new houses should be free of defects. To verify the quality of constructed housing, buildings should therefore be inspected starting from the early phases of construction up until the handing over stage. This study reveals the common building defects detected in new houses through visual inspections of 72 new terrace houses. The observed data are then analyzed using the Condition Survey Protocol system, which consists of two main assessments: condition and priority. The defects are identified and classified according to defect type, and overall results indicate that most of the common building defects in new houses are categorized as cosmetic. These defects are mainly caused by poor workmanship. To mitigate this problem, developers must ensure that the appointed builders/contractors are qualified and thorough building inspection is performed before the house being accepted.

Keywords: Building defect, housing, condition assessment, new house, visual inspection

Abstrak

Kecacatan bangunan adalah isu yang sering dikaitkan dengan penyediaan perumahan di Malaysia. Secara teori, rumah yang baharu dibina seharusnya bebas daripada kecacatan. Bangunan perlu diperiksa bagi memastikan kualiti rumah yang dibina adalah baik sejak dari fasa permulaan pembinaan sehingga penyerahan kepada pelanggan. Kajian ini mendedahkan kecacatan bangunan yang biasa ditemui pada rumah baharu melalui kaedah pemeriksaan visual terhadap 72 buah rumah teres yang baru siap dibina. Data dianalisis menggunakan sistem Condition Survey Protocol (CSP) yang terdiri daripada dua penilaian utama; iaitu keadaan dan keutamaan. Kecacatan yang dikenal pasti dikelaskan mengikut jenis kecacatan dan keputusan keseluruhan menunjukkan kecacatan yang paling ketara berlaku adalah dari kategori kosmetik. Kecacatan ini biasanya berlaku disebabkan kualiti kerja yang lemah. Untuk mengatasi masalah ini, pemaju perlu memastikan jurubina/kontraktor yang dipilih adalah kompeten dan pemeriksaan bangunan secara menyeluruh adalah dijalankan sebelum rumah tersebut diterima oleh pihak pemaju.

Kata kunci: Kecacatan bangunan, perumahan, penilaian keadaan, rumah baharu, pemeriksaan visual

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1.0 INTRODUCTION

Over Residential buildings are rapidly being constructed in response to high demand. However, these developments suffer from poor building quality,

according to numerous reports. In the worst-case scenario, buildings are abandoned by developers. Ali and Wen pointed out that recently developed

residential building are poorly constructed despite rapid industrial progress [1]. Moreover, the affordable housing program launched by the government also faces problems regarding quality and defects [2]).

Such poor construction work affects customer satisfaction [3]; thus, some people renovate their houses to enhance property value and comfort [4]. This conclusion is supported by previous studies, which claim that the housing environment is associated with the life quality of residents [5, 6].

Building quality can be validated through building inspections. These inspections start from the early phases of construction and ensure that construction standards are met. A new building should be free of defects; therefore, the level of tolerance is very low in the inspection of new houses. Hashim revealed that design, size, the materials used, and finishing are physical aspects that affect building quality [7].

Ishan listed 20 cases related to building defects as reported by the local media and other sources [8]. Malike obtained 80 local media reports dated from August 18, 2007 to May 24, 2012 to examine the quality of public school buildings in Malaysia [9]. Both statistical studies indicate that building defects are a serious issue and may be found in any building. Therefore, this study focuses on the common building defects in new houses. New terrace houses were inspected to obtain all of the defect data on the buildings. These data were then analyzed to identify the common building defects in new houses in terms of defect types and causes, in particular.

1.1 Types of Building Defects

This section provides only an overview of building defects and does not fully detail building defect theory because the current study merely emphasizes the common building defects encountered in Malaysia as derived from among an exhaustive list of defects. In principle, building defects are defined as capacity failures or malfunctions with respect to the building guidelines or requirements set by tenants. These requirements may concern structure, frame or fabric, services, and other building facilities [10]. Ahmad classified building defects into 14 types as follows [11]:

- i. Leaks- mainly caused by rain, the water supply in the building, or waste water leakage.
- ii. Distortion- observed in most materials composed of wood and metal and in frames constructed from both materials.
- iii. Rust – found on building materials made of metal, especially steel. Active corrosion is induced by highly oxidized and humid atmospheres. It is also caused by sodium-exposed material, such as soapy water.
- iv. Exfoliation- typically plagues materials or building elements that are insulated or painted.
- v. Rot and mold – found on components or materials composed of wood and brick, as well as rusted steel or cast iron. This decay can be

- generated in both dry and wet conditions. Rotting components are often moldy as well.
- vi. Moisture/dampness- often the result of high water content in building components, especially walls and floors.
- vii. Bending/sagging- frequently occurs in construction materials made of wood.
- viii. Sedimentation - usually occurs in building bases. It involves the lower floor and the building apron or perimeter.
- ix. Condensation - often caused by hot weather and humid conditions. It also occurs in cold, cramped areas with limited air flow and sunlight.
- x. Stretching and tearing- common in both external and internal building fittings.
- xi. Crack – observed in many building components. Cracks are classified into various types, which range from capillary to large cracks. External cracks do not affect the building structure or the wall; however, serious cracks can harm consumers.
- xii. Installation errors - typical in various types of fittings and equipment or in services, including piping, wiring, and machinery.
- xiii. Pest attacks- commonly plague building materials and wood-based building components.
- xiv. Clogging- occurs in many piping systems that are either tap or wastewater channels.

Ahmad (2004) concludes that some defects are a result of design and construction errors, as well as building abuse. Therefore, the study does not list defects that are induced by these errors, including hollows, gaps, uneven surfaces, malfunctions, and unfinished construction.

2.0 RESEARCH METHODS

The current study examined 72 new terrace houses located in Bangi, Selangor. The houses were surveyed using the visual inspection technique (Protocol 1). No destructive tests were conducted. The following tools were utilized in the building inspection:

- a) Digital camera with flash– to capture photographs, provide proper visual evidence of the subject, and to identify defects.
- b) Plans and a checklist – to note important points or to draw sketches during survey.
- c) Measuring tape – to measure defect length.
- d) L-square – to obtain measurements at a 90°-angle.
- e) Plumb bob- a vertical reference line to determine straightness.
- f) Spirit level – to measure the evenness of a surface.
- g) Mirror – to examine whether hidden areas, such as the top of a door leaf, are painted or not.
- h) Steel ruler – to measure short distances, including the gap between the door leaf and floor finishes.
- i) Vernier caliper – to measure very short distances/gaps that cannot be determined by a steel ruler.

j) Steel rod – to check for hollowness under tile surfaces.



Figure 1 Building inspection tools

Figure 1 shows samples of some of the tools used in the building inspection of new terrace houses.



Figure 2 Defects indication plan

All detected defects found were photographed and tagged as evidence in the layout plan. Figure 2 depicts an example of the defect indication plan used in building inspection.

Building condition was assessed decisively because the inspected buildings are new houses. Therefore, small defects were considered severe, especially if they were related to cosmetic defects. Moreover, any non-compliance to the construction standard was regarded as a defect because all building conditions should meet this standard [12].

Building condition was assessed using the Condition Survey Protocol (CSP) 1 matrix system [13]. Matrix evaluation was based on two defect factors, namely, condition and priority assessment. Figure 3 displays this evaluation system. Defects were rated according to three categories: good (green), fair (yellow), and dilapidated (red).

Scale		Priority Assessment			
		E 4	U 3	R 2	N 1
Condition Assessment	5	20	15	10	5
	4	16	12	8	4
	3	12	9	6	3
	2	8	6	4	2
	1	4	3	2	1

Figure 3 Defects indication plan

The observation data were recorded using this CSP system (<http://csp.ukm.my/csp/>). Figure 4 exhibits a sample defect analyzed by the system.

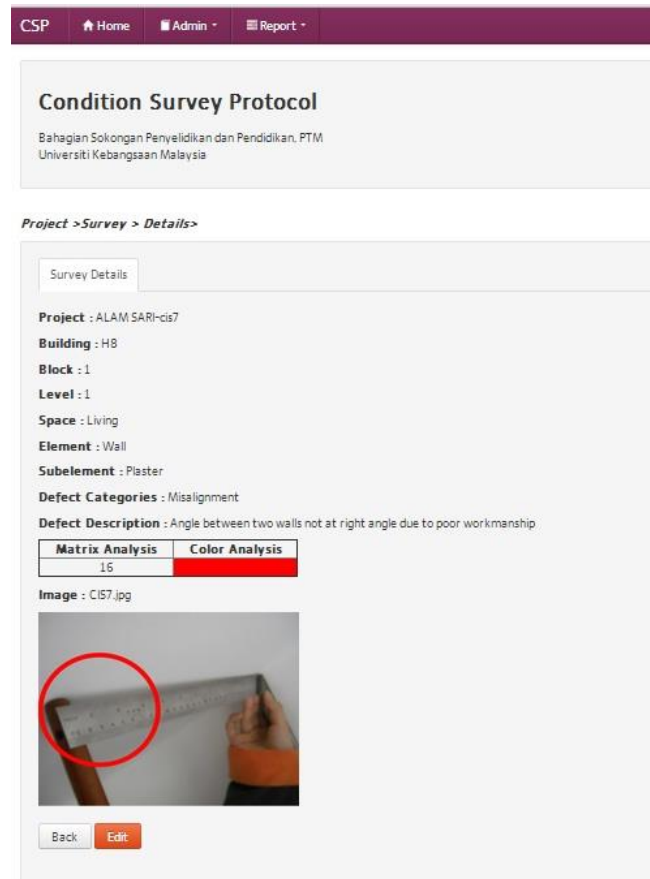


Figure 4 CSP analysis system

3.0 RESULTS AND DISCUSSION

A case study revealed that most of the defects in the new houses were cosmetic. These defects were mainly caused by construction errors, especially by poor workmanship quality. Figure 5 shows examples of the common defects detected, along with their details and the matrix assessments based on condition and priority.



Figure 5 Defects at the wall skirting

The defects at the wall skirting (left) and at the connection between the wall skirting and the door frame (right) can be observed visually without the use of inspection tools. The photograph on the left indicates that the edges of the wall skirting are not aligned. Furthermore, an opening was detected at the joint of the edges. This defect may have been caused by poor workmanship quality and the use of poor building/adhesive materials. The photograph on the right suggests that the connection of the tiles at the joint is uneven and that this defect is the result of poor workmanship quality. Both defects were rated as dilapidated by the matrix assessment (five marks). The defects were also considered to be in need of urgent action (three marks) because they are unacceptable in new houses. Therefore, the defects are classified as dilapidated overall (15 marks).



Figure 6 Hollowness in the wall tiles.

Figure 6 depicts the building defects on the walls through photographs. These defects were classified under hollowness; they were not observed visually and could be identified only by tapping a steel rod on the defective areas to produce a hollow sound (a sound different from the norm). This defect is attributed to poor workmanship quality, such as the inaccurate ratio of cement and sand mixture, uneven internal walls, and entrapped air. These defects were rated as dilapidated by the condition assessment (five marks) of a new house. Thus, urgent action (three marks) must be taken. Overall, the defects were classified as dilapidated (15 marks).



Figure 7 Walls angled incorrectly

Figure 7 displays the wall defects as identified by a spirit level (left) and an L-square (right). The photograph on the left presents a slanting wall that is not at a 90° angle from the floor. The photograph on the right indicates that the angle between the two depicted walls is not 90°, as it should have been, because the wall surfaces are uneven. This unevenness is ascribed to the improper alignment of the brick wall. Both defects were the result of the poor workmanship of the contractor. Although the defects are not harmful to building tenants, the quality is not commensurate with the price paid by the homebuyers, who expect to receive houses that meet the specifications. Therefore, these defects were rated as dilapidated (12 marks). Moreover, the unit is in very poor condition (four marks) and requires urgent action (three marks).



Figure 8 Unevenly applied wall paint.

Figure 8 displays the unevenly applied paint on the walls, which is considered a cosmetic defect. This defect can be observed visually without the use of any tools and may have been caused by poor workmanship quality, including unfinished construction and worker negligence. Although this defect is only cosmetic, it cannot be tolerated as an acceptable standard for new houses. Thus, it requires urgent action (three marks). Moreover, the defect condition was rated as very poor (four marks). Therefore, serious effort must be made to improve the building condition (12 marks).

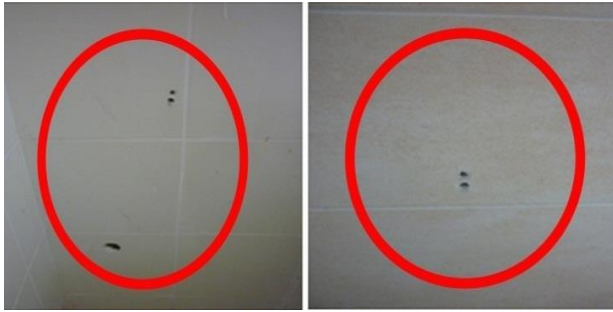


Figure 9 Holes in the wall tiles

Figure 9 exhibits the cosmetic defects in the wall. These types of defects are observed visually and may be caused by installation errors (location) or the carelessness of workers. Furthermore, they are considered serious defects for new houses, which are expected to be defect-free.



Figure 10 Unacceptable windows

The wall tiles are damaged (five marks) and are unacceptable under the current standard (three marks). These defects are therefore rated as dilapidated (15 marks) although they are only cosmetic and cannot result in fatality or injury.

Windows area wall component that connects the internal and external environments. Figure 10 shows the defects detected on the windows; the photograph on the left depicts a window that is difficult to open and close. Although the window remains functional, its functionality is unacceptable at the current standard for new houses; hence, the window is considered defective. The photograph on the right displays the window leaf that cannot be closed tightly. Thus, it displayed a gap. The condition of this window was considered defective because the window failed to function properly. This defect may have been caused by the poor-quality windows supplied by manufacturers. Damage may also have been initiated during installation. Both defects are rated as dilapidated (12 marks) and in very poor condition (four marks). Thus, they require urgent repair or replacement (three marks).



Figure 11 Incomplete construction

Figure 11 displays incomplete construction, which is definitely classified as a defect. The photograph on the left shows that the staircase has no handrails because of incomplete installation. The photograph on the right depicts a door without a knob as a result of the unfinished installation of door accessories. This construction error was caused by employer and worker negligence, and both defects were categorized as dilapidated (15 marks). The matrix assessment rates them as dilapidated (five marks) in condition and regards them as defects in need of urgent replacement (three marks).



Figure 12 Moisture problem

Figure 12 displays the internal (left) and external (right) dampness to the houses. These defects were attributed to the leakage at the upper component, which exposed the defective components to moisture. The condition may have been induced by either improper installation (roof tiles) or poor material quality, although the main cause is poor workmanship quality. The condition of the defects is very poor (four marks), and the components in question do not function at the acceptable standard (three marks). The defects require serious attention (12 marks).

In summary, a total of 2,138 defects were detected in the 72 housing units. Among these defects, 1,546 (72%) were serious defects, 235 (11%) were moderate, and 357 (17%) were minor. The overall rating for the houses is 13.16, which indicates that the houses are dilapidated. Thus, the repair or replacement of any defective components must be prioritized.

Most of the defects are closely related to poor workmanship quality, according to the survey. Dhillon

and Liu reported that human error is the greatest contributor to building defects [14]. Such errors include operation, installation, design, inspection, construction, and maintenance errors. Mohd Zaki also indicated that most of the building defects in houses aged 10 years and below are caused by design and construction errors [15]. The finding derived from the current study supports this statement, especially in relation to poor workmanship quality (a human error) causing construction errors.

4.0 CONCLUSION

The building defects in new houses should be prevented to enhance living environments and to commensurate with the price paid by homebuyers. Building defects should also be minimized to prevent building disasters that may result in fatalities or injuries. The best way to validate the freedom of new houses from defects involves the inspection of buildings starting from the construction phase, down to the handing over stage, and as construction is being completed.

Building inspection is important in the detection of defects and to maintenance. The current study determined the common building defects for new houses and noted that poor workmanship quality caused most of these defects. Therefore, building components that are closely related to workmanship quality should be prioritized. Developers must lead the mitigation of defective products by ensuring that the workmanship quality of builders/contractors meets an acceptable standard for homebuyers. In addition, contractors must ensure that their workers are qualified for particular tasks that may affect the quality of the houses. In conclusion, new houses must be free from any cosmetic defect to enhance the value for money of homebuyers.

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