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Housing Defect of Newly Completed House: An Analysis Using Condition Survey Protocol (CSP) 1 Matrix

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***Abstract*—**Housing is a basic human right. The provision of new house shall be free from any defects, even for the defects that people do normally considered as 'cosmetic defects'. This paper studies about the building defects of newly completed house of 72 unit of double-storey terraced located in Bangi, Selangor. The building survey implemented using protocol 1 (visual inspection). As for new house, the survey work is very stringent in determining the defects condition and priority. Survey and reporting procedure is carried out based on CSP1 Matrix that involved scoring system, photographs and plan tagging. The analysis is done using Statistical Package for Social Sciences (SPSS). The finding reveals that there are 2119 defects recorded in 72 terraced houses. The cumulative score obtained was 27644 while the overall rating is 13.05. These results indicate that the construction quality of the newly terraced houses is low and not up to an acceptable standard as the new house should be.

***Keywords*—**terraced houses, building defects, construction, CSP1 Matrix, Malaysia.

I. Introduction

THERE are many development projects in Malaysia to improve the standard of living. This includes housing development projects, buildings and infrastructures. For any country, housing development is very important to meet the basic needs of the citizen. New houses with multiple defects are not a new scenario in Malaysia. This does not mean that the new built houses should always be defect-free. In the theory of manufacturing, a defective product is going to happen, be it as good as the quality control process is applied. Such cases also apply in the construction industry.

The acceptable construction product shall be determined as a standard of quality for new housing construction. Based on the standard, developer works should be accepted and the process of improving the construction quality should be continuing. Accordingly, this research was conducted as to assess the quality of newly constructed house, whether or not it achieves the acceptable standard of housing quality.

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II. Literature Review

The construction industry plays an important role in the growth of the nation's economy. This sector is the engine of the country's economic development through the multiplier effects to other industries such as manufacturing, finance, education and others [1]. The construction industry also improving the quality of Malaysians life with various forms of physical development. House has been described as a basic human right in international conventions. Therefore, housing quality is important because it also associated with residents' life quality [2]. The better the housing, the better human basic right provided. According to [2], housing quality measurement can be done in an objective and subjective.

By using a standard, the building inspector can provide objective data on the status of the building for the property manager [3]. Quality indicators based on the condition of the building is a model that was developed to measure the performance and quality of the building. Previous research, BEPAS (a life cycle assessment model environmental performance assessment model) is related to the quality indicator. BEPAS is model-based life cycle assessment (LCA) for the first building in China [4].

In the meantime, many past studies related to defects in the building done in the post-construction, which includes the operation and maintenance of buildings. However, not many similar studies done in the design stage and during the construction phase [5]. This study focusing on the newly completed construction product as in support to the concern of [5]. This is because defects in the building at the operational/maintenance of the building is influenced by the defects that occur in the construction process [5].

In Hong Kong, [6] has reviewed the effectiveness of the Performance Assessment Scoring System (PASS) which was implemented by the authority in assessing the ability of Hong Kong contractors in managing the project according to the standards. The system is seen as an effective evaluation and incentive system to encourage continuous quality improvement. However, analysis of PASS scores has shown that the quality of construction has not increased. Therefore, [6] has recommended several steps to achieve continuous quality improvement in the construction of public housing.

Assessment of housings condition are very important, especially to meet the needs of the buyer. According to [7], the quality is to meet the requirements. Juran (1989) suggest the basis of successful quality management system is a failure that repealed. While quality is defined as the MS ISO 8402-1986 is the properties and characteristics of the whole of a product or

service depends on the ability to meet the needs of the state, expressed or implied. In addition, a study conducted by [9] to identify why the owner renovated their house found that they are not satisfied with the quality of their house and services provided in their house units. This situation supported statement that quality is whatever is needed or desired by the customer.

Besides, the evaluation of housing condition is also important to ensure the health and safety of the occupants. Structural failure may result in loss of life and property damage [10]. According to [11] the maintenance is significantly influence the building safety and health of residents. Therefore, assessment of housing conditions is essential to obtain information related to carrying out maintenance work effectively. In addition, the quality of housing construction also reflects the image of the developer.

Building defects is "the non-fulfillment of intended usage requirements" [5]. Zuriani (2003) has describe six common defects occurs in her research such as crack, moisture, peeling off, painting defect, rust and rot. Besides, [13] has classified generally 14 types of building defects such as leak, bend, rust, rot, moisture, sedimentation, crack and others [13]. In addition, [13] stated that there are some defects occur as the result of design errors, construction errors, and misuse of the buildings.

Based on analysis of concrete defects factors in Malaysia, [14] stated that there are seven types of defects usually happen on concrete structure such as crack, failed jointing, leaking, corrosion of steel reinforcement, sedimentation, honeycombed and disintegration of concrete. According to [14] there are five main factors of concrete strcuture defects which is design error, building material, geotechnique, construction errors and unpredicted errors.

These literature review suggests the need to perform the buiding condition survey, particularly to the newly completed construction product, as one of the method in tracking the construction defects. This also help the developers to identify and prioritize the most defected components in supporting the continuos quality improvement process.

III. Materials and Methods

This research involves the evaluation on the newly completed 72 unit terraced houses. Building condition survey works has carried out using protocol 1 (visual inspection) techniques. The sample of the houses in this research is terraced houses located in housing area in Bangi, Selangor.

The condition of building component is evaluated using a Standard Building Inspection Code published by the Royal Institutional of Surveyors Malaysia (RISM) and Condition Survey Protocol (CSP) 1 Matrix. These code and protocol is a guideline to the Building Surveyor to assess any defect of building based on priority and condition. This matrix has its own scoring system (see [15]) to facilitate the examiner to assess the condition of building carefully and entirety. All defects identified are assessed and recorded on-site with the evidences (photos and plan tag). The score obtained from the scoring system determine the level of defects/component such as good, fair and dilapidated. Besides, the possible cause of the defects also identified.

This information recorded in Defect Sheet, and then it was compiled in the Schedule of Building Condition. Findings from the condition survey are analyzed using CSP1 Matrix reporting system. By this method the number of defects, building defects score and rating for the buildings determined. Result of the research has been simplified in table form.

IV. Result and Discussion

Building condition survey has been carried out on 72 unit terraced houses. Overall, there are 8 blocks of the houses and there are 5 types of house design. Table I shows the result for overall houses. Based on Table I, there are 2119 defects has been recorded which is 359 minor defects, 234 fair defects and 1526 major defects. Cumulative score for the overall defects is 27644 while the overall rating is 13.05, which is in the poor condition and need serious attention.

TABLE I
Overall CSP1 Matrix Result

The number of defects			Total	Overall score/mark	Overall Rating
Minor 1-4	Fair 5-12	Dilapidated 13-20			
359	234	1526	2119	27644	13.05

A. The Number of Defects

Based on Table II and Figure 1, there are 6 ranges of defects number determined. This is to simplify the data for overall 72 houses. From Table II, the highest number of defects is between 1-25 where majority 44 houses have that range of defects number. Then followed by 26-50 and 51-75, each ranges have 15 and 9 houses. For the number of defects between 76-100 and 126-150, there is the same number of houses which is 2 and there are no house has between 121-125 defects. Individually, the lowest number of defects recorded in house Lot PT27410 with 3 defects while the highest number of defects recorded in house Lot PT27439 with 133 defects. This figures show that there a significantly difference between the highest number of defect and the lowest number of defects. Furthermore, this result also shows that the majority 61.11% of the houses have less than 25 defects. But, this figure does not mean that the houses are in good condition. It depends on the level of the defects that will be discussed in next section.

TABLE II
The Number of Houses Based on Defects Number

	The Number of defects					
	1-25	26-50	51-75	76-100	121-125	126-150
No. of houses	44	15	9	2	0	2
Percentage (%)	61.11	20.83	12.5	2.78	0	2.78

B. CSP1 Matrix Mark/Score

Table III and Figure 2 show the number of houses based on CSP1 Matrix score. Based on TABLE III, majority 35 houses get between 1-250 marks followed by 25 houses that get between 251-500 marks. Besides, the numbers of houses that gets score between 501-750 and 751-1000 each 3 and 4 houses. While 5 houses get more that 1000 marks. Individually, the lowest score recorded at Lot PT27410 with 12 marks while the highest score recorded at Lot PT27439

with 2315 marks. This shows that there are significant differences between the condition of the best and the poorest houses.

TABLE III
CSP1 MATRIX SCORE

Matters	CSP1 Matrix Marks				
	1-250	251-500	501-750	751-1000	>1000
No. of houses	35	25	3	4	5
Percentage (%)	48.61	34.72	4.17	5.56	6.94

C. CSP1 Matrix Rating

Table IV shows the number of houses based on CSP1 Matrix rating. Based on Table IV, there are majority 52 houses getting the rating between 13-20. While there are 10 houses getting the rating between 1-4 and 5-12. The lowest CSP1 Matrix rating means the best rating is recorded in house Lot PT27426 with 3.38. Meanwhile, there are 5 houses get the poor or highest rating with 20.00 (see Figure 3). From Table IV, clearly that 72.22% of the houses are in dilapidated condition. The result shows that the overall conditions of the evaluated houses are dilapidated.

TABLE IV
CSP1 MATRIX RATING

Matters	CSP1 Matrix Rating		
	1-4 Good	5-12 Fair	13-20 Dilapidated
No. of houses	10	10	52
Percentage (%)	13.89	13.89	72.22

D. The number of defects based on building components and sub-components

Besides the number of building defects, score and rating, this research also focus on the building components. This is aim to discover the potential defected components. Based on the survey, there are 22 components that recorded to have defects. From these 22 components, 5 most defected components are walls, doors, floors, windows and ceilings. The highest defects found on walls with 891 defects followed by doors (389), floors (358), windows (135) and ceilings (106).

When focused on sub-component, the highest defected sub-components are closely related to the five components. Totally, there are 40 sub-components that have identified. This paper only reported the five components that have highest number of defects. The highest number of defects found on plasters with 631 defects followed by tiles (539), door leafs (276), frames (101) and side finishing (81). Refer to Table V.

TABLE V
THE NUMBER OF DEFECTS ON SELECTED COMPONENTS AND SUB-COMPONENTS

Components	No. of defects	Sub-components	No. of defects
Walls	891	Plasters	631
Door	389	Tiles	539
Floors	358	Door leafs	276
Windows	135	Frames	101
Ceilings	106	Side finishing	81

V. CONCLUSION

Along with the rapid development in the construction industry, particularly in residential construction, assessment of the quality of housing construction is very important to ensure that user requirements are met. In addition, the assessment of housing condition can also ensure the health and safety of consumers can be guaranteed. For the developer, the evaluation of housing conditions can help developer to maintain their works in order to give the good image for the developer. The findings revealed that there are weaknesses in term of construction works quality. The overall CSP1 Matrix rating for the houses is 13.05. This value shows that the houses are in dilapidated condition and requires serious attention. Besides, to met user requirement for the new built houses, urgent maintenance work must be done to upgrade the condition of the houses. In term of study on the houses components and sub-components, it was found that wall is the largest components that contribute for the defects. Meanwhile, plaster is the largest sub-components that contribute for the defects. This two components and sub-component are closely related to human factor or workmanship. This scenario indicates that the qualities of work in this construction project are not up to the standard as to be delivered to the house buyers.

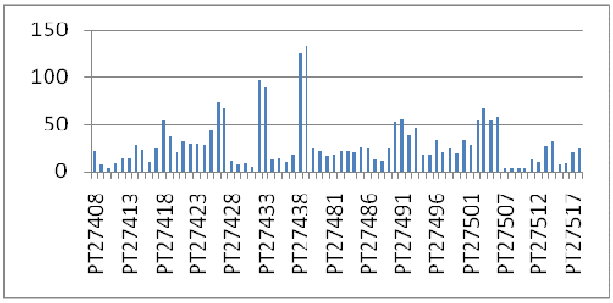

Fig. 1 The number of defect for each houses

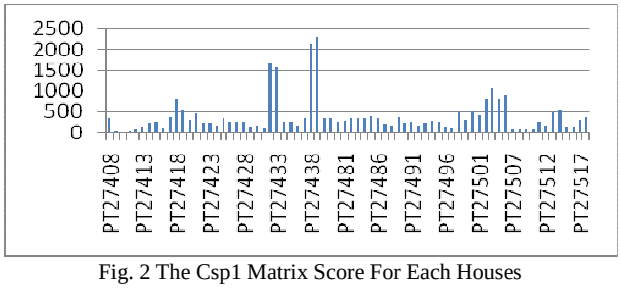

Fig. 2 The Csp1 Matrix Score For Each Houses

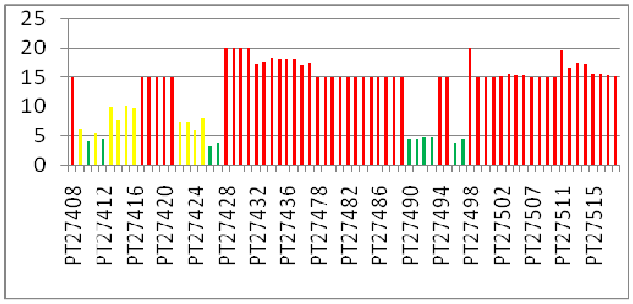

Fig. 3 CSP1 Matrix Rating For Each Houses

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