The 2nd International Building Control Conference 2011

A Review Factors Affecting Building Defects of Structural Steel Construction. Case Study: Student Accommodation in UiTM Perak

S.N.A. Wahab*, M.Y. Hamid

Faculty of Architecture, Planning and Surveying, Universiti Teknologi Mara Perak

Abstract

In Malaysia, building condition survey is currently vastly underrated and ignored by owners, managers and professionals. The building owners or facilities managers has identified that the complaints about building defects have gone up in recent years with common problem such as leaky roofs and walls, dampness and water penetration from the upper toilet, crack at floor slab and others. This paper presents a brief description of building defect in use of student hostels in UiTM Perak. The main objective is to highlight the important problems and suggest a possible remedial work and increased the awareness of building owners regarding building condition survey and its relation to building maintenance management. The building condition survey will take quite a range of Building Surveyor specialist equipment to seven hostel buildings in UiTM Perak. This paper has gained an insight into a better understanding of factors affecting building defects of structural steel construction. It also explores opportunities for improving the understanding of building surveying profession in our country.

© 2010 Published by Elsevier Ltd. Selection and/or peer-review under responsibility of Universiti Teknologi Mara Perak And Institution of Surveyors Malaysia (ISM)

Keywords: Building defect, Building Surveyor, condition survey, common problem.

1. Introduction

Past and present research has helped Building Surveyor to identify the principle causes of building defects which related to poor design, specification and construction, repair and maintenance. The tropical
climates condition, such as in Malaysia is one of the problem that can affect significantly to the building defects. Therefore, it is advisable for the surveyors carrying out building surveys identify the construction and materials used in the property. The correct identification of types of building material for maintenance purposes is the most important in the process of identifying building defect pound by other researcher. The starting point during investigating the cause of building defects should therefore looks on the symptom that triggers the investigation, the location of the symptoms and the material involved [1]. A practitioner, surveyor, students and others must have awareness and understanding the type of building defects [2]. This is an essential requirement to successful diagnosis and making appropriate recommendations for remedial action. As with all repair work, the first step to solving any building defect problem is to diagnose the cause correctly. As example, an assessment of dampness problems are varies from the use of visual inspection, non-destructive, destructive testing equipment and of in situ tests to confirm possible root causes. A further assessment in laboratory sometimes required to confirm on the possible cause of dampness. This aligned with survey definition stated as ‘the inspection and investigation of the construction and services of a property in sufficient detail to enable a surveyor to advise what impact the condition and the circumstances of that property will have upon the client’ [3].

The building condition survey was undertaken by seven groups of students with one supervisor experienced in building condition survey and building maintenance management. Seven hostel buildings were inspected over a period of one month and the reports were presented to the Facilities Management Division, UiTM Perak. This paper shows some common building defects found in the structural steel construction. The simple diagnosis and recommendation solution of these defects are also discussed.

2. Scope And Methodology

The inspection is carried out based on the agreement between the owner representative (Facilities Management Division, UiTM Perak) and the Building Surveying Department, UiTM Perak. The extent of inspection is to identify the following:

i) To investigate the defective wall area (dampness and mould growth)

ii) To prepare professional condition survey report on the subject property

iii) To recommend rectification work to be undertaken with work specification for the ease of appointed contractor.

The assessment will take quite a range of Building Surveyor specialist equipment to seven hostels building in UiTM Perak. The survey was carried out by UiTM Degree students of Building Surveying. Four students were allocated to each hostel unit and their report submitted within four weeks of carrying out the survey. The supervisors of the student survey group have advised and prepared for the final report. The report will make comments on the findings with general recommendation of the subjects matter for the benefit of the parties involved. Priority of works according to the seriousness of the defects is highlighted. The report does not include estimates costs of repair since this is out with the scope of studies of the students at this stage. Figure 1 shows an overview of one of the building been inspected.
3. Findings On Common Defect

All of the student accommodation / hostel buildings, built on site around late 1990’s, are of steel frame structure design with solid brick walls, probably on deep foundations and with solid ground floors. There are 3 staircases located centrally and at the both end of every levels/ wings. The staircase is of concrete construction with metal handrail half round shape. From our inspection we can advised that the sewage system comprises stacks and waste run formed in combination of uPVC. Windows and doors throughout the subjects predominantly comprise aluminium frame design incorporating sliding sash and casement opening sections. Glazing generally comprises single pane clear float glass/ tinted glass. Floor throughout the ground and upper floor levels are predominantly solid concrete construction with 150 mm thickness. Floor covering generally comprised of cement screed an ceramic/ mosaic tiles to all bathrooms. We noticed that leaky roofs, floors and walls, wall cracks, rusting of steel structures, chipped and cracked tiles and finishes are the most common problem of building defect found the by the inspectors. Some possible causes responsible for building defects identified are:

a) Chemical action and change that can adversely affect building materials include the corrosion of metals (steel structures).

b) Insufficient knowledge on construction/ fixing of building materials and components

c) Failure joint elements between the steel structure due to poor joint design, poor workmanship and installation, exposed to environmental change resulting in excessive defects.

d) Unprotected, or nominally painted, mild steel is not suitable for external conditions.

e) Lack of protective coatings to steelwork and not systematically maintained

f) Failure to carry out necessary maintenance resulting in more damage done
3.1 Leakage

Leakage that usually occurred in the building that already in use, can be seen as the following:

a. Water ingress occurred especially during rainy days on the few rooms at the 3rd floor possibly caused by the gaps of steel beam connection to wall (figure 2).

b. Water ingress caused by clogging of down pipe attached to the roof which caused the overflow of the rainwater over the roof beam.

c. Dampness mark and water ingress were found on the internal concrete wall surface and on steel beam structure which possibly due to the water sipping in through the gaps of steel beam (Figure 3).

d. A substantial number of several types of cracks appear at many places especially at right and rear external walls. The cracks is suspected causing water to seeping in and dampen the internal wall and finishes. Fortunately those are not structurally affected but a few different expansion has caused cracks at both sides of wall at right gable end.

e. Penetration of rain water through open staircases and ventilation brick wall effect the corridor area (flooded during heavy rain – Figure 4)

The staining has taken the form of dampness and tidemarks. When tested with electronic moisture level meter very high reading was recorded (95%). Figure 2 shows the example of extensive leaking through such a joint between steel structure and floor at the toilet area and a few rooms at third floor.

Figure 2: Leakage contributed to excessive dampness on wall surface
3.2 Metal Corrosion

Metal corrosion is quickly occurring due to exposed installation. The corrosion of ferrous metals leads to the formation of hydrated iron (III) oxide, $\text{Fe(OH)}_3$ or $\text{FeO(OH)}$ giving the well known red brown layer of rust (Figure 3).

Water contributes to oxidation of metal leading to the corrosion of steel structure and steel reinforcement in concrete. Water also facilitates chemical changes in the component of a building as well as being source of damage where it penetrates into a building. Excess moisture, caused by rising and penetrating damp, condensation, leakage, spillage or construction processes is the most widespread and damaging cause of deterioration and decay affecting buildings [4]. Externally the protective coatings to steelwork need to be properly and systematically maintained and appraising engineer will need to establish the extent to which this requirement is being met.
4. Conclusions

Broad conclusions about the factors affecting building defect of structural steel construction in student accommodation buildings can be drawn from this paper. The assessment of the defect problem is conducted and the result had been summarised. In general, the main defects identified from this projects were leakage problem, corrosion of steel structure, penetration of rain water into the building, horizontal cracks in the external and internal walls. An understanding of the building defects is a vital part for the assessment because it will lead to the true diagnosis and investigation of the problem in the institutional building. A well designed and constructed building is required including appropriate maintenance work. In this case, qualified and experience Building Surveyor are essential needed with the help of Civil and Structural Engineer to assess the structural performance of the buildings.

References

[1] Carillion (2001) *Defects In Building – Symptoms, Investigation, Diagnosis and Cure*, United Kingdom, The Stationery Office.
[2] Hamid, Y. and Ngah, S. (2010), *Assessment of Dampness Problems in the Higher Education Institution Building*, 12th International Surveyor’s Congress (Reaching 50 and Surveying Ahead), Hotel Istana, Kuala Lumpur, 17-18 June 2010.
[3] Hollis, M. (2000) *Surveying Building*, Coventry, RB-RICS Books.
[4] Watt S D. (1999) : *Building Pathology – Principles and Practice*, Cambridge, Blackwell Science.