Dimensi Teknik Sipil, Vol. 3, No. 2, September 2001, 64-68
ISSN 1410-9530

A REVIEW OF FACTORS AFFECTING BUILDING DEFECTS IN SINGAPORE

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ABSTRACT

In developing countries, building maintenance technology is currently vastly underrated and ignored by owners, managers, and professionals. The building and construction authority of Singapore (BCA) has identified that the complaints about building defects have gone up in recent years with common problems such as leaky roof and walls, floor defect, and improper outlet pipe. This paper presents a brief description on building defect in use for commercial building as well as residential buildings in Singapore. The main objective is to highlight the important problems and suggest a greater participation of professionals in building maintenance. It also provides some site investigations photographs of various defects, which is expected to be useful for builders, architects, and others who deal with building materials.

Keywords: building defect, common problem, prevention, quality control.

INTRODUCTION

Building defects arise through inappropriate or poor design, specification and construction as well as to insufficient attention given to building maintenance. The tropical climates condition, such as in Singapore, the also one problem that can affect significantly to the building defects.

The correct identification of types of building material for maintenance purposes, as to be cleaned, refinished, renovated, or restored is the most important first step in the process of identifying the building defect. A thorough investigation should be carried out before any repair work is undertaken. Therefore, the technical requirement of investigating and diagnosing faults to asses condition, the organizational needs to specify, select, implement, and supervise, and corrective program are needed to be handled properly. There is no doubt that improved quality increases costs in labor and supervisor. However, this careful construction of structures attracts a proportionate consequence in necessary maintenance and repair cost during the life of a building. It is true the old paradigm "prevention is better than cure", now is extended to a new concept that prevention care is economically sound, socially desirable, technologically possible and environmentally friendly.

This paper shows some common causes responsible for the problems of building defects in Singapore. The simple diagnosis and recommendation solution of these defects are also discussed.

CASUALTY LOSSES OF DEFECTIVE DESIGN AND CONSTRUCTION

A thorough inspection and supervision should be carried out in building works to ensure that construction was done according to approved structure plan. However, there are many cases of building defect due to the careless construction work. In Singapore, it is found by building and construction authority (BCA) that about ten complaints are made in a month about property defects recently. Leaky roofs and walls, chipped and cracked tiles, wall cracks, bad plumbing, and electrical problems are the most common problem of building defect. Due to very poor work or bad quality of the building material, most of defects may show up in building as soon as they are completed and handed over to the building owner instead of after a period of use. As it is shown in Figure 1, many common defects are uncovered during building investigation.

Note: Discussion is expected before November, 1st 2001. The proper discussion will be published in "Dimensi Teknik Sipil" volume 4 number 1 March 2002.

Dimensi Teknik Sipil
ISSN 1410-9530 print © 2001 Universitas Kristen Petra
http://puslit.petra.ac.id/journals/civil

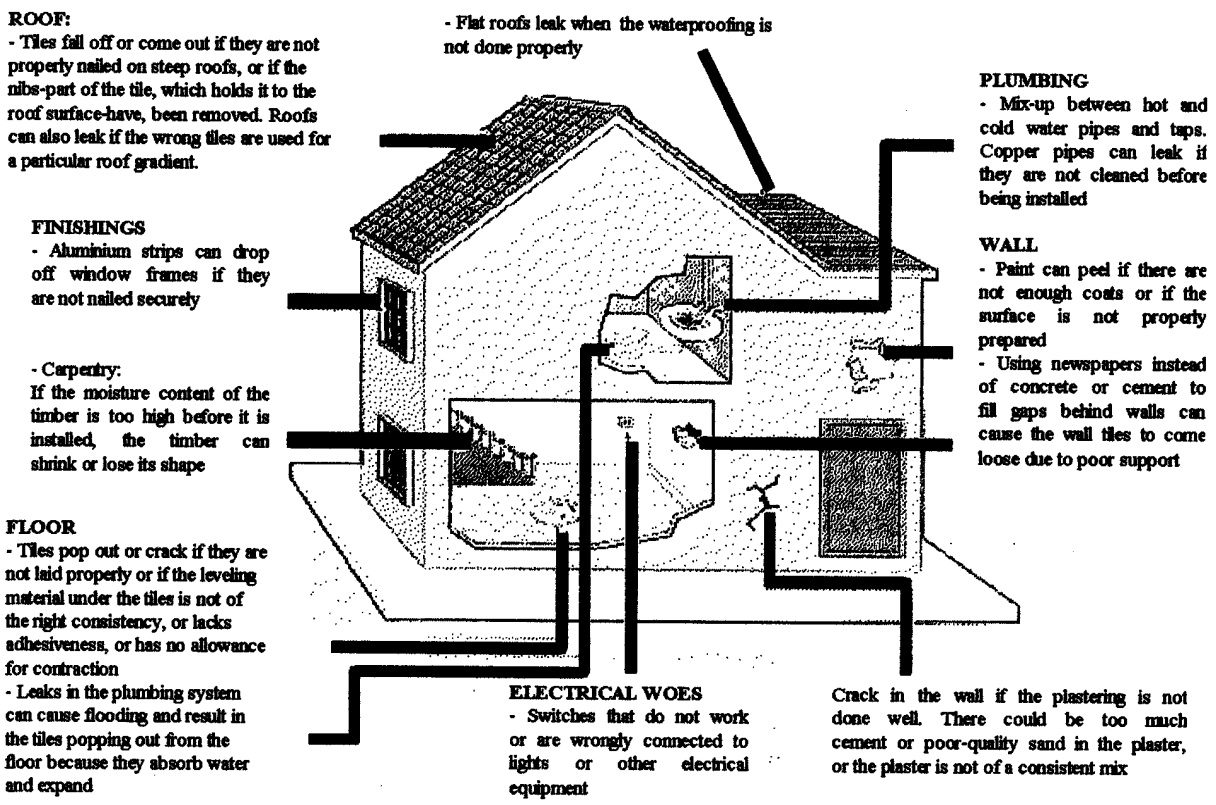

Figure 1. Common defects that are detected during their investigations

It is evident that some cases of building defects problem in Singapore can cause a very serious disaster (Figure 2).

Figure 2. The roof collapse of Compassvale primary School's multipurpose hall (in June 1999) had caused 7 workers injured. It is due to bad welding work at roof steel joints.

Some possible causes responsible for building defects are [1,2]:

a. Action of load underestimated at the design and construction stage.
b. Insufficient knowledge on construction/fixing of building elements/components.
c. Failure to carry out necessary maintenance or incorrect identification of the cause of defect resulting in more damage done.
d. Failure joint elements due to:
   - Poor joint design;
   - Inappropriate choice and use of joint material
   - Poor workmanship in installation
   - Environmental changes resulting in excessive defects
   - Designer lacks the knowledge of the physical properties, performance and potential deterioration of the materials.

Other building defects that usually occur when building in already in use, can be seen as the following:

Reinforced corrosion

It is one cause of poor durability of reinforced concrete. This deterioration is possible due to chloride or carbon dioxide attack that reduce the passivity of the reinforcement in the alkaline concrete system (Figure 3).

Figure 3. Cracking due to reinforcement corrosion [1]

Leakage

Figure 4 shows the example of extensive leaking through such a joint between a pool structure and decking due to differential effects.

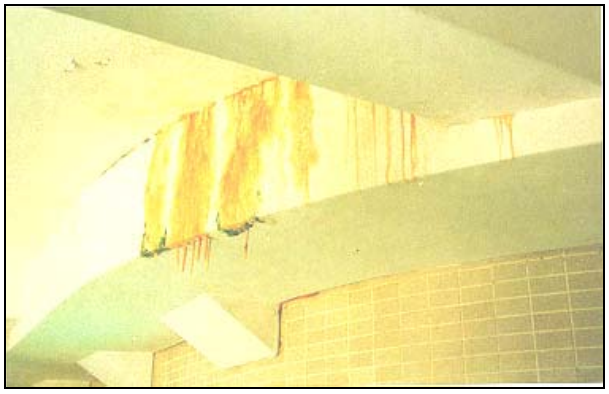

Figure 4. Leakage [3]

Support cracking

The vibration effects from service equipment like air conditioning coolers may affect the support damage (Figure 5). Insulation pads should be fitted to prevent possible problem to the flat roof.

Figure 5. Support cracking [3]

Metal Corrosion

Metal Corrosion is quickly occurring due to exposed installations (Figure 6). Special protective surface coatings should be applied. Rust dripping from fittings can also damage the roof finish.

Figure 6. Water tank corrosion [3]

Cement Oozing

The shoddy workmanship resulted in cement oozing or white deposit from between the bricks. This condition is called efflorescence, which is formed by chemical composition of salts or stains on the surface of bricks.

Figure 7. Cement oozing

Popping Tiles

Popping Tiles is one of the main concerns with tiling failure faced by owners (Figure 8). This usually occurs due to a result of adhesion failure between the ceramic tiles and the concrete base the cohesion failure of the render, or fails to resist the movement of the tile due to thermal and moisture expansion.

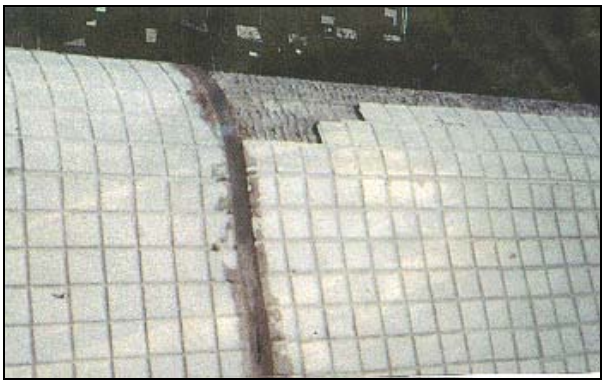

Figure 8. Popping tiles

Leaky roof

Another problem in some building is leaky roof (figure 9). The leaks allow water to penetrate the roof. This is normally caused by a problem with porous concrete, hydrostatic pressure of water, or infiltration of water through voids in the concrete.

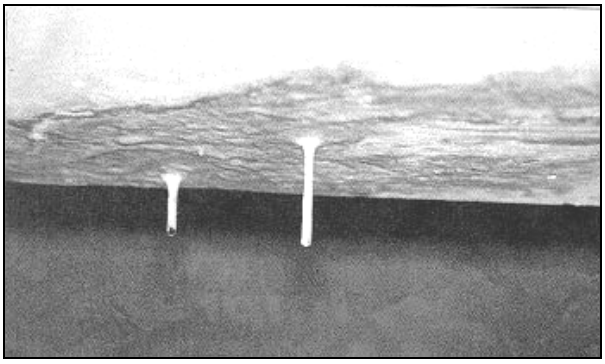

Figure 9. Leaky roof

Bad plumbing

Bad plumbing can lead to leaks and rusting (Figure 10). The poor workmanship due to lack of skillful labor training is the main cause of this defect. The leaks and rusting may lead to other defect such as water penetration.

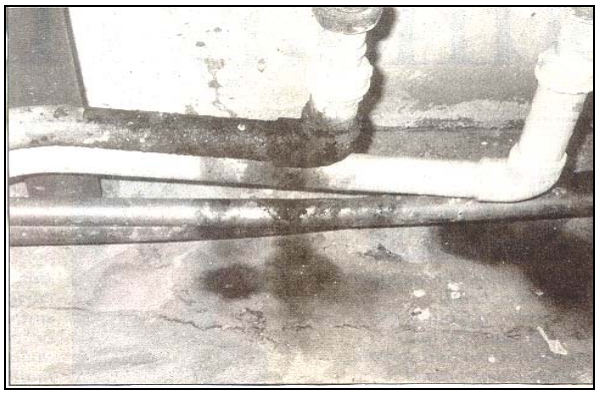

Figure 10. Bad plumbing

Line crack

The line crack occurs along the tiles due to excessive load and differential settlements (Figure 11). Inaccurate design load, poor fixing method, and overloaded can be the causes of the crack.

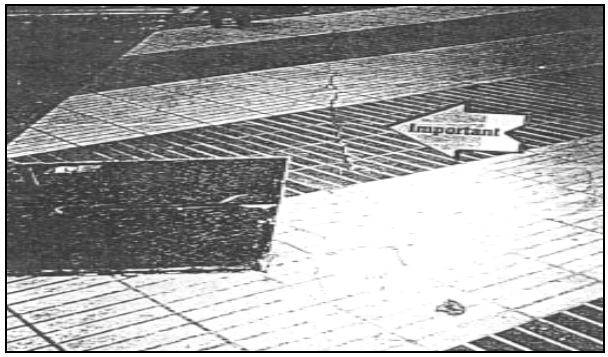

Figure 11. Line crack

Tile spots and stains

The surface of the tiles in some zones of its surface may have some spots and stains (Figure 12) due to water rising from underlying layers or the quality of tile where there is chemical instability of the glaze or some of its parts.

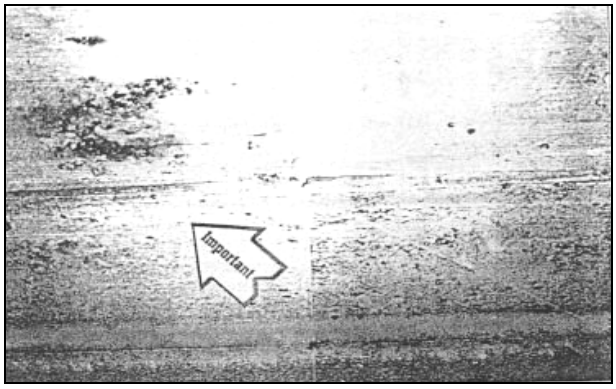

Figure 12. Tile spots and stains

Water penetration

The water penetration (Figure 13) problem may due to the accumulation of infiltrated water in the air space between the stone cladding and concrete backing. The trapped water could either flow inwards into the building structural frame or stain the stone facades.

Buckling

The buckling effect (Figure 14) occurs due to bad joint design and tolerance allowed for movement. The environmental effects such as temperature or moisture change, and creep may deteriorate more seriously the buckling defect.

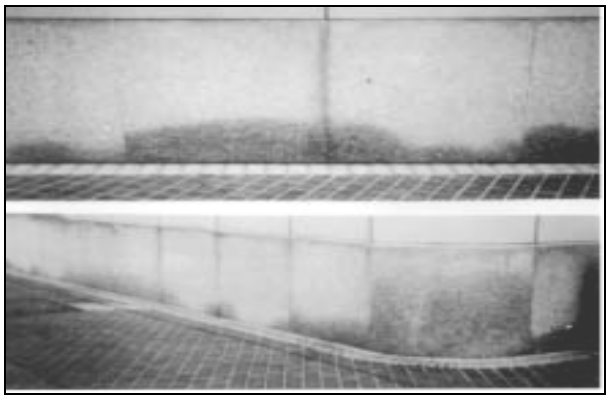

Figure 13. Water penetration [1]

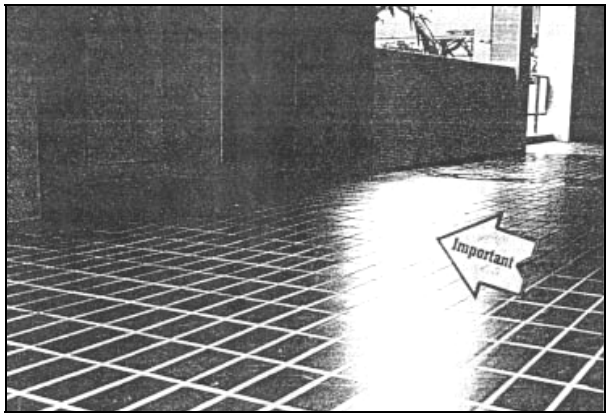

Figure 14. Buckling

CONCLUSION

A well-designed and constructed building will have a relatively maintenance free material. In this case, qualified and experienced civil and structural engineers are essentially needed. Their involvement in building construction has a great deal of responsibility.

In most cases, the problem derives from the design and management phase. To ensure the construction product of the desired quality and to tackle the problem of poor building quality, it is suggested:

a. Increasing protection for owners or building buyers by extending the defect liability period to a certain period.
b. Residents should be allowed to manage their property as soon as they occupy the development.
c. A requirement of insurance scheme.
d. The authorities should study the common defects and hold dialogues with property managers who deal with these problems, developers, architects and engineers, so that the problems are not repeated.

REFERENCES

1. Chew M.Y., Wong C.W., L.H. Kang, *Durability of Building Facades in Singapore*, UNIBEAM, Building and Estate Management Society, National University of Singapore, Vol. XXV, 1998.

2. Chew M.Y., *Durability of Concrete Structures*, Building Maintenance Technology in Tropical Climates, Singapore University Press, 1995.

3. Brieffeit C., *Flat Roof Problems*, Building Maintenance Technology in Tropical Climates, Singapore University Press, 1995.