

General Building Defects and Cracks

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Abstract: Occurrence of defects in a building is very common and is a major issue which needs attention. When such defects arise, we must immediately seek for its cause. These defects are seen either due to poor construction techniques, poor masonry work or poor maintenance of the structure. This paper will review and discuss about the cracks and other major defects caused due to environmental agencies and their effects on constructional materials. It also discusses, symptoms and preventive measures for the defects.

Keywords: Dampness, defects, non-structural, peeling paint, settlement, structural.

1. Introduction

A building is a place where people accommodate or come to work together, the major purpose of the building is to give a comfortable and healthy surrounding for people to conduct activities, to provide security, sustain load and environmental shelter. However, there is occurrence of defects and failures in the buildings due to various causes. Defects are major issue in construction industry which needs attention. For example, hairline cracks at beams, structural cracks in wall reinforcement bars of columns became rusty due to expose to sunlight and rainwater etc. These defects affect the health and safety. All building materials will have life span over which they degrade or eventually fail. Proper and timely maintenance will help to extend functioning by offering protection against degradation. Notwithstanding the fact that materials will fail at some point and require repair, replacement.

Early failure may take place due to following reasons,

1. Poor manufacture
2. Poor design
3. Poor specification
4. Poor construction
5. Poor maintenance
6. Inappropriate use

Some things are aesthetically defective example – quality of finished surface, plaster or paint. This can be matter of relative judgment or relative experience. A building defect may also include damage caused by land movement or earth settlement. Defects can be broadly classified in two types – (a) structural defects (defect in the structural element such as beam, column etc.), (b) non – structural defects (includes defects in bricks, dampness, defects in plaster works etc.)

2. Factors responsible for deterioration of the building

Factors responsible for the deterioration of the building are,

A. Human factors

This, may be further be divided into 2 parts,

- Misuse of building by occupants
- Lack of maintenance in maintenance staff.

B. Chemical factors

The interaction of building material with surrounding environmental agencies such as rain, temperature variation and fumes also leads to deterioration of building.

C. Environmental aspects

Generally, environment results in weathering. It is a process of decomposition due to weather components apart from these biological agencies, ground water and salt also affects durability of construction materials E.g. Material absorb radiation depending upon their nature and color of surface, this absorption leads to degradation of paints, plastics, bitumen etc. Temperature variation also affects the structure.

D. Moisture effect

Moisture in any form solid, liquid, gaseous state is main agent of deterioration of all kind of materials. It freezes in pores of concrete, stone; brick etc. exerts excessive pressure on structure causing its spalling and cracking. It also reacts with iron element causing its corrosion thus leading to reduction in strength.



Fig. 1. Effect of moisture

E. Effects of biological agencies

Many construction materials like timber, bricks; concrete gets affected by biological agencies. Bricks and concrete are affected by growth of algae and moss leading to a damp condition and affecting the aesthetics of a build structure. Timber is affected by wet rot which develops the wet conditions and reduces the strength of structure.



Fig. 2. Effect of biological agencies

F. Effects of gasses

Sulphuric acid and carbon dioxide affects the buildings. Sulphuric acid promotes corrosion to the steel reinforcement and also erodes some stone causing blisters and spalling where as carbon dioxide leads to erosion of lime stone and concrete.

G. Efflorescence

Magnesium sulphate is present in ground water, which disintegrates the rendering and masonry surface aggressively. Leading to the formation of white patches on the surface.

H. Fire hazards

Concrete and steel both are affected by fire. The heat of fire along with water used for firefighting leads to distortion, cracking, spalling and swelling of all components.

3. Effect of deterioration on building materials

A. Effects on bricks

- Bloating – it is caused due to presence of excess carbonaceous matter and Sulphur in the brick.
- Efflorescence - Efflorescence is the presence of drying grey or white powdered patches on brick surface. It occurs due to water absorption and crystallization.

B. Effect on stone

- UV-radiation, weathering and acid rain can cause damages on the stone surface especially on soft materials stones like marble or limestone. Polished marble and limestone will lose their gloss and become matt; they appear to be bleached out.

C. Effect on concrete

Concrete is affected by,

- Temperature - Variation in temperature causes thermal and moisture movements in concrete resulting in shrinkage and settlement of cracks.
- Growth of vegetation

D. Effect on metal

Corrosion is the main cause of deterioration of metal, yet creep and fatigue have some effects on metal too. Creep is deformation caused by loading; if the loading continues beyond the elastic range of metal permanent creep will be developed. It is developed due to sustained loading, it is a slow process and is influenced by temperature at time of loading and the range of loading. Fatigue is a phenomenon developed due to large

number of cycles of loading and unloading causing of reversal of stress.

4. Effect on external rendering

Render has a tendency to develop hairline cracks over time. If the wall behind the render surface moves or cracks, so will this covering. So the cause is sometimes linked to structural movement. The most common cause of cracking and bulging, however, tends to be frost action on moisture trapped between the render and the wall. This is why small hairline cracks should be sealed when they first develop, otherwise water penetrating through can freeze and expand, blowing the render surface loose-resulting in even larger cracks. Cracking due to shrinkage can also develop where the original render mix was too strong.



Fig. 3. Deterioration of external rendering

5. Cracks

Development of cracks in a structure is very common phenomenon. Crack is a line along which a material is broken into two parts. Most of the building materials such as brick, mortar and concrete contains sufficient amount of water. These materials shrink on drying and expand when wetted, due to this tensile stress develops in materials hence cracks are developed.

A. Classification of cracks

Broadly cracks can be classified into two types,

1) Structural Cracks

Depth of these cracks is more, these can be seen in beam, foundation etc. These cracks directly affect the safety of the building. These cracks develop due to Incorrect design, Faulty construction, over loading, Settlement of foundation, Effect of temperature variation, Swelling of soil below the foundation etc.

2) Non – Structural cracks

These cracks are developed due to inducement of internal stresses; they exist on the surface only. These cracks do not affect the safety of the building but affects the appearance and creates impression of faulty work.

3) Classification according to width of cracks

- Less than 1 mm in width - thin
- 1 to 2 mm – medium
- More than 2 mm wide – wide

B. Nature of cracks

- a) Active cracks – a crack which is still in progress.
- b) Dormant cracks – If development of crack is not observed during considerable period of time it is called dormant crack.

C. Causes of cracks

Cracks are formed due to overloading, foundation movement and settlement of soil or due to the effect of environmental agencies.

D. Investigation of cracks

1) Direction of the crack

It indicates the approximate cause of formation,

- Vertical cracks – these indicate overstressing of masonry due to its overloading or differential settlement of soil.
- Horizontal cracks – these in general indicate settlement of foundation
- Diagonal cracks – this indicates settlement of isolated footing.
- Straight line crack – These types of cracks generally show shearing of bricks due to overstressing.
- Zigzag cracks – These types of cracks occur due to settlement of foundation. These cracks can be seen in compound wall.
- Through cracks – these cracks occur due to bulging of wall.
- Vertical cracks wider at top – these cracks occur due to swelling of soil below the foundation.

2) Extent of the crack

1. Cracks in the that are formed near ground and passing through D.P.C up to opening indicate settlement of foundation Width of the crack – cracks with more width at one end and less on another end are either due to swelling of soil etc.
2. Depth of the crack – depth of the cracks helps us to determine whether the crack is structural or non-structural. For determining the depth of the crack properly inspected using thin wire or some other such thing.
3. Alignment of the crack – it helps in determining the major reason of cracks, it helps us to determine the force responsible for the cracks.
4. Cleanliness of faces - it the area near by the crack is clean it indicates that the crack is developed recently, it helps us to determine whether the crack is active or dormant or dead.
5. Sharpness of the edges – it also helps us to determine the reason of cracks, for e.g.: cracks formed due to compressive forces in general have roughened surface.

E. Development of cracks in building members

Generally, cracks are seen in the following members of the building -

1. Cracks in the load bearing wall.
2. Cracks at the ceiling level
3. Formation of cracks at the base of parapet wall
4. Horizontal crack in the top most storeys below slab level.
5. Diagonal cracks in walls.
6. Vertical cracks along window jambs.
7. Cracks in compound wall.
8. Cracks due to settlement of foundation.

Apart from these, cracks are also formed at several other places.

F. Preventive measures

1. Plaster work should not be started until and unless masonry work has properly dried out after curing.
2. Measures to provide proper heat insulation should be done i.e. providing a layer of some heat insulation material of good insulation capacity with high reflective finishes. In western India to do the same broken china tiles are used in lime mortar over lime concrete terracing.
3. Proportion of mortar used in parapet construction should be 1:1:6 (1 cement, 1 lime, 6 sand).
4. Plaster on R.C.C should be done after a month, and at junctions the plaster should be broken by providing a groove.

6. Dampness

A state between wet and dry conditions is called dampness; it leads to the growth of various kinds of bacteria of many diseases and insects which causes damage to the health of the inhabitants and house hold articles. Hence dampness should be removed as early as possible.

A. Causes of dampness

Water is necessary element of construction but presence of moisture in structure is very harmful as it causes damage to the structure.

B. Effects of dampness

1. Discoloration – Dampness develops unpleasant patches on walls and ceilings.
2. Weathering – dampness causes dry rots to the wooden members leading them to swell and it also damages steel members.
3. Decay of materials – moisture can cause decay and disintegrations of materials such as bricks, stone etc.
4. It leads to crumbling or peeling of the plaster and it also damages the electrical appliances and damages floor carpets.
5. Damage of paints.
6. Growth of vegetation.

C. Remedial measures for preventing dampness

1. Temporary solution

Application of waterproof solution, application of cement wash, coating hot linseed oil after cleaning surface.

2. Permanent solution

Application of damp proof course

7. Conclusion

There are several kinds of defects which affects the life span of the structure and health of the tenants living in it. These defects might arise due to improper design, poor construction techniques or due to use of poor quality materials. A portion of the research also discusses about the cracks that are developed during the time after the period of construction, its causes, types nature and the measures to prevent them. All the buildings are subjected to one or the other defects, failure, deterioration. This research has brought into consideration effect of various factors and agencies on the building. It is important to appraise each defect and failure in every part of building and find out the primary causes of each individual defect and failure, and finding correct measures to cure these defects. Once finding the possible causes it is important to identify how to keep away from it in future and reduce its effect to the minimum.

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