

# A STUDY ON CRACKS ON STRUCTURES DUE TO SEEPAGE OF WATER

Mr. S. Manikandan<sup>1</sup>, D.Mugunthan<sup>2</sup>, M. Naveen kumar<sup>3</sup>, B.Chakresh<sup>4</sup>, R. Charan kumar<sup>5</sup>

<sup>1</sup>Assistant Professor, Department of Civil Engineering, Panimalar Engineering College, Chennai

<sup>2,3,4,5</sup>Final year student, Department of Civil Engineering, Panimalar Engineering College, Chennai

\*\*\*

**Abstract** - Cracks in structure are most commonly found in all types of buildings. They result in ugly appearance and feeling of instability of occupants. But all cracks are not harmful to life of the building. Structural cracks usually affect the buildings whereas non structural cracks don't affect the main structure of the building. Any type of structural cracks may be eliminated by proper design and through supervision. Non structural cracks do not affect the main structure of the building if they are treated appropriately in time. This paper deals with various factors that effect cracking, methods to identify cracks, stages of cracking, and methods to treat cracking.

**Key Words:** Structural cracks, Non structural cracks, leakage detection, treatment of cracks.

## 1. INTRODUCTION

The success of the repair activity depends on the identification of the root cause the deterioration of the concrete structure. When the causes are identified properly, satisfactory repairs can be done for the improvement of strength and durability, thus extending the life of the structure, is not difficult to achieve. Repair of the structure should be carried out as soon as the deterioration of the concrete is observed. When it is found by the various test that concrete is porous/ honey combed, it should be treated with pressure grouting, guniting is another way to rehabilitate the structure, in which a dense and firmly adhesive coating applied over the exposed surface.



Figure.1 Seepage crack

## 2. CAUSES OF CRACKING

Concrete deterioration is the main cause for cracking in the slab. The spalling in concrete is caused due to

### 2.1 Implications of use of higher water cement ratio

When the W/C ratio is more than 0.6 to 0.7, then the concrete pores do not get segmented even with proper curing. Some other reasons, when the construction quality is poor, the concrete becomes pervious to water. Therefore due to capillary attraction water enters into the porous concrete.

### 2.2 Ineffective Sealing of Joints

Leaks when ineffectively sealed, construction joints, expansion joints and other active cracks may occur. Thus sealants like polysulphide are used to seal the crack.

### 2.3 Slope not proper – Defective Gradient of Terrace

One of the major reason of water leakage of roof slabs is improper gradient, improper drainage and rainwater collection arrangement. The gradient sloping towards khurras therefore should be proper. The slope of the gradient must always be atleast 1 in 48 to avoid leakage. When the drainage of water is proper most of the leakage problems are solved.

### 2.4 Defective Waterproofing

When coping is not proper at the junction between parapet walls and the terrace leakage, it proves to be ineffective in arresting leakage of water. Thus coping must be effectively provided and it should be under close supervision.

### 2.5 Extreme Weather Condition

If the outside of the building has high pressure than that of inside pressure, because of suction effect, during high humid conditions, the air carrying external moisture may intrude inside the structure causing damp conditions.

Some other reasons are

- Corrosion of steel reinforcement or other embedded metal.

- The freezing of the porous or the cracked concrete.
- The chemical attack on concrete.
- Concrete that is of poor quality.
- Overloading or insufficient reinforcement.
- The thermal shock creating fire or firefighting activities.
- Mechanical damage due to accidents.
- The bearing of the concrete member or another with joint that is insufficient or that is choked.
- The bearing edge forming too close to the edge or at the end of a concrete member.

### 3. TYPES OF CRACKS

#### 3.1 Plastic shrinkage concrete cracks

When concrete remains in its plastic state (before hardening), it is full of water. When that water is left from the slab, large voids are left behind between the solid particles. Thus the concrete became much weaker because of the empty spaces and are more prone to cracking, called “plastic shrinkage cracking”.



Figure.2 Plastic shrinkage crack

#### 3.2 Expansion concrete cracks



Figure.3 Expansion cracks

Excessive heat causes concrete to expand like a balloon. During this expansion of the concrete, it pushes against anything in its way (a brick wall or adjacent slab for

example). When the slab fails to have required ability to flex, cracking occurs, called expansion cracks. Expansion joints act as a point of isolation, between other static surfaces.

#### 3.3 Heaving concrete cracks



Figure.4 Heaving cracks

During cooler season when the ground freezes, then sometimes it lifts many inches before thawing and settling back down. This freezing and thawing cycle which caused the ground movement is a huge factor causing concrete cracking. If the slab is not at all free to move with the ground, then heaving cracks occurs.

#### 3.4 Settling concrete cracks

Sometimes ground settling below a concrete slab may also cause cracking. Such settling cracks typically occur in situations when a void is created in the ground down the concrete surface.

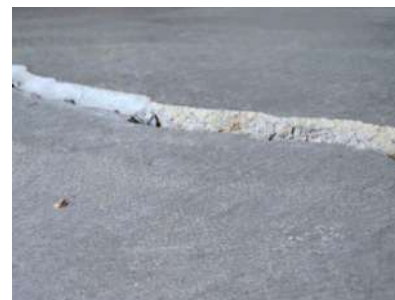


Figure.5 Settling cracks

#### 3.5 Concrete cracks caused by overloading the slab

Even though concrete being a very strong building material; it does have its limits. When an extremely excessive amount of weight is placed on the top of a concrete slab, it can cause cracking. After a heavy rain or snowmelt when the ground below is soft and wet, and when excessive weight is placed on the slab it can press the concrete down which result in cracking.



Figure.6 Cracks due to overloading

### 3.5 Concrete cracks caused by premature drying

There are 2 types of cracks brought on by premature drying. Cracking cracks which are too fine. Surface cracks which resemble shattered glass or spider webs. When the moisture on the top of a concrete slab is lost too quickly, crazing cracks are likely to appear. Crazing cracks are not a structural concern unsightly. During the concrete stamping process, which is a method of adding pattern or texture to concrete surfaces, crusting cracks typically happen. On windy or sunny days when the top of the slab gets dried out earlier than the bottom, the concrete top surface becomes crusty. When the stamp gets embedded, the surface gets pulled apart near the stamped joints and it causes smaller cracks around outside edges of the “stones”.



Figure.7 Cracks due to premature drying

## 4. METHODS TO DETECT LEAKAGE WHICH CAUSES CRAKING

### 4.1 Look for standing puddles of water near a wall

One of the simplest and easiest ways to detect water leak in the walls is looking for puddles of water near walls. When

there is conspicuously a wet carpet or when the floor is wet always in a certain area of the home, it means that there is a leakage in that area.

### 4.6.2 Look for discoloration on a wall

When there is a leakage in the wall, obviously there is an discoloration that appears in the outer surface of the wall. Look at the sections where the surface of the wall is whether drywall, wallpapered or even wood when is slightly washed away or may have a lighter color than that of the surrounding area. The discoloration may have irregular shapes.



Figure.8 Discoloration on wall

### 4.3 Inspect walls for a change in texture

- A bubble-like texture is likely to develop behind the walls where there is a water leakage. Paint or wallpaper may get twisted and buckled, as the water distorts their usual texture, forming bubble-like shapes or rips.
- When a dry wall is water-logged it may appear to sag downward. The presence of water in your drywall is also indicated by small bubbles or drooping sections.
- Walls with advanced leaks in it also appear to curve outward. Therefore drywall may eventually, buckle below the weight of water saturating it.



**Figure.9** Change in texture

#### 4.4 Note any signs of mold or mildew

When a leak in a wall has been for some time, it causes the mold to be grown on your wall. On its early stages, mold may appear like a dense cluster of brown or black dots. Even if they don't seem to be appears on the wall, it may still be growing inside of the walls in which have been saturated with water by the leakage. Mold can produce allergies, and leads to other potentially harmful serious health problems. If the mold seems to be growing on a wall, then remove the mold and repair the leak in your wall.

### 5. METHODS TO AVOID LEAKAGE AND CRACKS:

#### 5.1 Scan for moisture inside walls with a moisture meter

Equipment called moisture meter is a piece of equipment, when kept directly against the wall, may analyzes the moisture content of the wall. To precisely locate the point of leakage place the moisture meter at 5 or 6 different spots on the wall. The spot which gives the highest moisture reading is the point of leakage.

#### 5.2 Find the cold, leaky part of a wall with an infrared camera

Heat and temperature of a wall can be indicated by a Infrared camera. A wall that leaks will have a lesser temperature. Place the infrared camera on a wall and detect which section of the wall leaking.

- Hot objects shows red or orange coloring
- Cool objects shows blue or purple coloring.

#### 5.3 Cut into your drywall to find the source of a leak

A hole is cut in the wall big enough for worker's head to fit inside using a utility knife of about 10 inches (25 cm). Look around till the source of leakage is spotted. Once the leakage spot has been spotted, fix the leakage that may prevents cracking.

#### 5.4 Anti-seepage system repair plan

Thermal asphalt may be applied on the top of the wall about 1m core depth. Because of asphalt concrete, it effectively repairs the structure and protects the walls from cracking.

### 6. CONCLUSION

The above review paper has dealt with various causes of cracking, types of cracks, methods to detect leakage that causes cracking and the methods to avoid leakages and cracks. There are also a lot about the cracking and leakage

which has to be studied carefully to avoid failures in the structures. However the ultimate aim of all civil engineers is to determine the water leakage inside the wall and reduce the formation of corrosion.

### 7. REFERENCES

- [1] Kishor Kunal et al, "Study on control of cracks in structure through visual identification and inspection" in IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) in September 2014.
- [2] Rajveer Singh Narwaria et al, "Development of cracks in concrete, preventive measures and treatment Methods" in September 2016.
- [3] Kazem Reza Kashyzadeh, NedaAghiliKesheh, "Study type of Cracks in construction and its controlling". Volume 2, Issue 8, August 2012, PP 528-531.
- [4] IS 456:2000, "Indian Standard of Plain and Reinforced Concrete Code of Practice".
- [5] Hand book HB 84-2006: Guide to Concrete Repair and Protection, A joint publication of ACRA, CSIRO and Standards Australia.
- [6] KishorKunal, NameshKillemsetty. "Study on control of cracks in a Structure through Visual Identification & Inspection". Volume 11, Issue 5 Ver. VI, PP 64-72.
- [7] RytisSkominas, VincasGurskis, IgmantasPatasius. "Research of material suitability for crack repair in reinforced concrete structures". 4th International Conference CIVIL ENGINEERING`13.
- [8] Syed MohdMehndi, Prof. Meraj Ahmad Khan & Prof. Sabih Ahmad. "Causes and evaluation of cracks in concrete structures". Volume 2, Issue 5, PP. 29-33.