# Causes Prevention and Repair of Cracks in Building

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**Abstract :**

Cracks in buildings are a common issue that compromise structural integrity, aesthetics, durability, and occupant safety. These cracks originate from a variety of factors including structural overloads, foundation settlement, thermal movements, shrinkage of concrete, poor construction practices, and environmental influences such as moisture variation and seismic activity. The nature and severity of cracking vary from harmless hairline surface cracks to serious structural fissures that can lead to partial or complete failure if left unaddressed. Effective mitigation begins with understanding the root causes through careful site investigation, material testing, and structural analysis. Preventive measures include proper mix design and curing of concrete, quality control during construction, adequate reinforcement detailing, provision of expansion joints, and ensuring uniform and well-designed foundations. Where cracks occur, repair methods must be selected based on crack width, depth, location, and underlying cause. Common repair techniques include epoxy injection, routing and sealing, grouting, stitching, and application of carbon fiber reinforcements, all backed by appropriate surface preparation and durability considerations. This paper reviews the principal causes of cracking, discusses practical preventive strategies, and evaluates contemporary repair technologies to enhance building performance, extend service life, and reduce maintenance costs. Understanding and addressing cracks holistically is essential for ensuring structural safety and sustainability in the built environment.

Keywords: Building Cracks Causes of Cracks Structural Cracks Non-Structural Cracks

## 1.INTRODUCTION :

Cracks are the common problem which occur in the any type of building structure. Cracks occur due to several reasons which are poor workmanship, improper design, due to low quality material, improper construction. Cracks in plain and reinforced concrete possess a challenging to civil engineers from the six decades. Cracking is the initial sign of distress of the structure baring other forms of distress and deterioration like deformation, surface deposits and construction defects etc. causing damage to structural strength, durability and serviceability. The effects of freeze-thaw alongside chloride ingress in the presence of cracks present ideal circumstances to promote the premature deterioration of the concrete material. The presence of cracks leads to poor durability and a shorter service life of the structure. The successful repair of cracks would reduce the deterioration effects resulting in a longer service life. Prolonging the service life defers the rehabilitation or replacement of the bridge and the government sectors responsible for the management of multiple bridges would experience economic benefits. The result of a longer service life is also indicative of a sustainable practice. Cracks can be treated as a cancer in the R.C.C structure which in its preliminary stage is up to a certain extent but as the time passes it becomes non curable in the later stage. Repairs can be treated only if the root cause is identified. If the cause is properly identified, satisfactory repairs can be performed and improvement and durability of the structure is ensured. Cracks that occur before hardening, primarily due to settlement, construction movements, and excessive evaporation of water, are called plastic cracks. Plastic cracking that can be predominantly eliminated through close attention to the mixture design, material placement, and curing. Cracks that occur after the concrete has hardened may be due to variety of reasons. These may be due to mechanical loading, thermal gradients, moisture and incompatibility due to chemicals reactions. Cracks can be basically divided into two predominant companies: - 1) Structural cracks: Structural cracks are shaped due to faulty design, faulty construction which closely risks the protection of building. Examples of structural cracks are the cracks in beam, column, slabs and footings. 2) Non-Structural cracks: Non-Structural cracks are the end result of induced stresses in constructing materials and due to internal forces developed because of variant in moisture content material, temperature version, crazing and so on. Examples of Non-Structural cracks are cracks on parapet.

OBJECTIVE

• To study the various types of cracks in concrete

• To study causes of cracks in concrete.

• To study the prevention of cracks in concrete.

• To study the techniques to repair and filling up crack sin concrete.

## 2.LITERATURE REVIEW

2.1 Rishabh Pathak, Deepak Rastogi concluded from their research on "Case Study on Cracks in Public Buildings and their" cracks are inherent and detrimental elements of building detailed investigation should be carried out regularly to ensure the accessibility and serviceability of the building. For rehabilitation of cracks, it is important to understand thecausesandthetypesofcracksappearedinthestructure.Thispapershortlydescribesthecausesand types of cracks and their remedial measures. Non-destructive testing methods are used to access the strength of the structure at a first instance to know the actual state of the structure whether it will be serviceable/workable or to be demolished. Few case studies were conducted at different public buildings at Gwalior M.P. Political science, economic and archaeological blocks of Jiwaji University. Moti Mahal building. NITM (Nagaji institute of Technology and Management building. Which were reported cracks and they were in suspension to whether it will work or should be demolished. The purpose of this study is to determine the position ofstructurewhetheritisfurtherserviceableornotandsecondly,ifweusethesamebuildinghowitwill be repaired.

2.2 Pooja Nama, Ankush Jain, Rajat Srivastava and Yash Bhatia has come to an end from their research on "Study on Causes of Cracks & its Preventive Measures in Concrete Structures" The problem of cracking in building is becoming a difficult puzzle for engineers nowadays. Cracking is an unavoidable response of any structure while designers are trying to eliminate many of the causes of cracking and design tolerance for other factors. We all want our building structurally safe but it is not so easy. Some faulty steps during construction and some unavoidable reasons different type of cracks starts to appear on various structural and non- structural parts of the building. So, timely identification of such cracks and adopting preventive measure are essential. There pair materials and repair technique are different depending upon forms of cracks according to their positions in structure. Some types of cracks seriously need attention as they are structurally hazardous. In this paper, we will discuss about the problem engineers are facing i.e., of cracking after construction and what preventive measures should betaken along with the techniques to cure crack.

## 3.METHODOLOGY

### Literature Review

- Study of textbooks, IS codes (IS 456, IS 3370, IS 2212), journals, and technical papers.
- Review of previous case studies related to building cracks.
- Understanding standard classification and causes of cracks.

### Field Survey and Data Collection

- Selection of residential and institutional buildings.
- Visual inspection of cracks in walls, slabs, beams, and columns.
- Recording crack type, width, pattern, and location.
- Interaction with occupants to understand building age and maintenance history.

### Identification of Causes of Cracks

Cracks are analyzed based on:

- **Structural causes**: settlement, overloading, poor design, seismic effects.
- **Non-structural causes**: temperature variation, shrinkage, moisture movement.
- **Construction defects**: poor workmanship, inferior materials, improper curing.

### Classification of Cracks

Cracks are classified as:

- Structural and non-structural cracks
- Vertical, horizontal, diagonal, and random cracks
- Active and dormant cracks

### Analysis of Crack Severity

- Measurement of crack width using crack gauge.
- Evaluation of impact on safety, durability, and serviceability.
- Decision on urgency of repair based on severity.

### Preventive Measures

- Proper structural design and detailing.
- Use of quality construction materials.
- Adequate curing and workmanship.
- Provision of expansion and control joints.
- Regular inspection and maintenance.

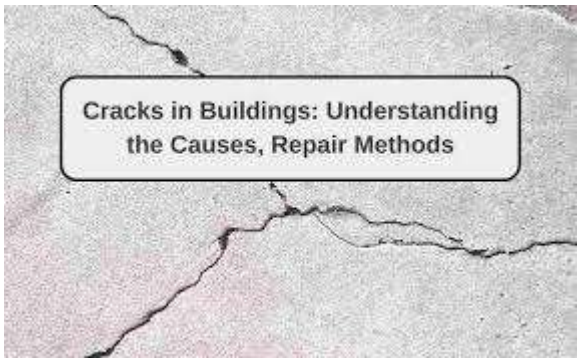
### Repair Techniques

Selection of repair method based on crack type:

- Epoxy injection for structural cracks.
- Cement grouting for masonry cracks.
- Stitching and sealing techniques.
- Polymer modified mortar application.
- Replacement of severely damaged components.

### Evaluation and Conclusion

- Comparison of different repair techniques.
- Assessment of effectiveness and cost.
- Recommendations for crack prevention in future constructions.




## 4. RESULT AND CONCLUSION

From the detailed study of causes, prevention methods, and repair techniques of cracks in buildings**,** the following results were observed:

1. Cracks in buildings mainly occur due to structural causes (foundation settlement, overloading, poor design) and non-structural causes (temperature variation, shrinkage, moisture movement).
2. Improper construction practices such as poor workmanship, low-quality materials, and lack of curing significantly increase the chances of cracks.
3. Early identification of cracks helps in selecting proper repair techniques and reduces repair cost.
4. Preventive measures like proper mix design, adequate curing, expansion joints, and good construction supervision are highly effective in minimizing cracks.
5. Suitable repair methods such as epoxy injection, crack stitching, cement grouting, and sealants successfully restore the strength and durability of cracked members.
6. Regular inspection and maintenance increase the service life of buildings and prevent major structural failures

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