STUDY ON CAUSES OF CRACKS IN BUILDING STRUCTURES AND THEIR MAINTENANCE

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ABSTRACT:
Cracks are the kind of problem of concrete construction. It affects the building artistic and function and also destroys the wall's integrity; even reduce the durability of structure. Cracking is any response in a structure which is unavoidable. Some structure designers are trying to eliminate many of the causes of cracking. We all want our structure safe. Due to some faulty steps during construction and due to environmental reasons different types of cracks starts to seem on various structural and non- structural parts of the building. Identification of such cracks and adopting precautions are essential. There are different material and different techniques to repair cracks according to their size, position in different parts of the structure.

In this paper, we will discuss about the problem civil engineers are facing i.e. of cracking after construction and what preventive measures should be taken alongside to cure cracks.

KEYWORDS:
Cracks, Types of Cracks, Causes of Cracking, Durability of Structure, Preventive Measures.

I - INTRODUCTION

A building crack may be complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing. A building crack is a common occurrence. A component of crack in building develops when stress in the component exceeds its strength. Cracks are of two type structural and nonstructural categories. The structural ones are due to faulty design, faulty construction or overloading which may endanger safety of buildings. The nonstructural cracks are due to internal stresses.

Depending up on the width of crack, they can be classified into 3 types Thin (< 1mm), Medium (1mm to 2mm) and Wide (> 2mm- wide). The stresses which are Internally induced in building components lead to dimensional changes and whenever there is a restraint to movement as is generally the case cracking occurs. Cracks are one kind of problem of concrete construction as it affects the building artistic , building structure as it destroys the wall's integrity, affects the structure safety even reduce the durability of structure. Cracks are developed due to deterioration of concrete or corrosion of reinforcement bars, due to improper bonding between steel and concrete, faulty construction or inappropriate selection of constituent material and by temperature and shrinkage effects.

1.1 Structural Cracks:

Finally, complete content and organizational editing before formatting. Please take note of the following items when proofreading spelling and grammar: These cracks occur due to poor constructions sites, poor soil bearing or overloading and these may effects the safety of a building.

Table 1: Structural cracks formed in Beam, Column and slabs are:

BEAMS	COLUMNS	SLABS
Flexural Cracks	Horizontal Cracks	Flexural Cracks
Shear Flexural Cracks	Diagonal Cracks	Top Flexure Cracks
Torsional Cracks	Corrosion/ Bond Cracks	Shrinkage Cracks
Bond Slip Crack	-	-
Disturbance Cracks	-	-

1.2 Non Structural Cracks:

Non-structural cracks are caused by the changes in the moisture content, thermal movement, temperature variation, crazing, effects of gases and liquids.

Non-Structural Cracks are caused by:

- Plastic Settlement
- Plastic Shrinkage
- Early Thermal Expansion and Contraction
- Long Term Drying Shrinkage

• Crazing
• Due to corrosion of concrete
• Due to Alkali-Aggregate Reaction
• Sulphate attack
• Due to corrosion of Steel

Classification of cracks on the basis of their width is:
a) Thin - less than 1mm in width
b) Medium - 1 to 2mm in width
c) Wide - more than 2mm in width

II- LITERATURE REVIEW

PRINCIPLES OF INVESTIGATION OF CRACKS

STEP 1: Discussion with Client/Owner of the Building One of the simplest and most important things is to discuss with client or owner about the cracks on the building and gathering information from them. Ask them: i. When was the building constructed ?Date and year of construction. ii. Ask for building drawings? And the details of constructions if available. iii. Ask them when the cracks first appeared? Or how long was the cracks seen? iv. Ask them whether any repair work was carried out if yes, what was the result?

STEP 2: Visit the Site i. Check its present use of the structure or any change in the usage of building. ii. Photograph the cracks and number them iii. Mark the width of crack iv. Check for any tilting of walls or tilting of any structural members, deflections, staining, Water leakage and corrosion.

STEP 3: Understand the Cracks and Its Causes i. Find the type of crack i. Try to find out the causes of cracks: corrosion of reinforcement, Moisture variation, temperature variation, poor construction practices, poor structural, creep, chemical reaction, foundation movement & Settlement of soil, growth of vegetation and additional alternation of structures.

STEP 4: Finding the Suitable techniques To Repair Crack
i. Epoxy injection
ii. Routing and sealing
iii. Stitching

iv. Drilling and plugging

v. Gravity filling

vi. Drying packing

vii. Polymer, impregnation and underpinning

STEP 5: Formation of Report

III- CAUSES AND ITS PREVENTIVE MEASURES:

3.1 Thermal Movement :

Expansion of material takes place when they are heated and contract when they are cooled. With the change in temperature the expansion and contraction occurs in spite of the structures cross sectional area. It is one of the most potent causes of cracking in buildings which need attention.

3.1.1 Preventive Measures: Joints should be constructed like construction joints, expansion joints, control joints and slip joints. Planning and designing of the joints should be done prior and then constructed.

3.2 Chemical Reaction:

Chemical reactions may occur due to the materials used to make the concrete or materials that come into contact with the concrete after it has hardened. Concrete cracks with time develops expansive reactions between aggregate as it contains silica, alkalis from cement hydration and other admixture.

3.2.1 Preventive Measures: If sulphate content in soil exceeds 0.2 percent or in ground water exceed 300 ppm, use very dense concrete or either increase richness of mix to 1:1/5:3 and to stop cracking due to corrosion it is desirable to have Concrete of Richer mix for thin sections.

3.3 Shrinkage:

The building materials expand when they absorb moisture from atmosphere and get shrink when dry. Shrinkage can be plastic or dry. The factors behind shrinkage in cement concrete and cement mortar and their preventions are as follow:

3.3.1 Excess Water: The quantity of water in the mortar mix can cause shrinkage. Vibrated concrete has less quantity of water and therefore lesser shrinkage than compacted concrete.

3.3.2 Preventive Measures: It is required to use minimum quantity of water for mixing cement concrete or cement mortar according to water cement ratio. Cement concrete is not allowed to work without mechanical mixer and vibrator.

3.4 Quantity of Cement:

The richer the mix is, the greater the Shrinkage/drying will be.

3.4.1 Preventive Measures: Do not use excessive cement in the mortar mix.

3.5 Earthquake:

Crack may occur due to shifting in lower layer (tectonic plates) of the earth. Voids get collapsed and are filled with the soil present above it. Many geological events can cause earth movements but this is continuous one.

3.5.1 Preventive Measures: The foundation of buildings should be constructed on firm ground while doing construction. The Building should be tied up with connecting beams at foundation level, door level and roof level.

3.6 Vegetation:

Growing trees around the area of walls can sometimes cause cracks due to expansive action of roots growing under the foundation. The cracks occur in the soil as the roots contain moisture in it.

3.6.1 Preventive Measure: Proper check and good quality of materials are required at the time of construction.

IV- CONCLUSION:

This research was successfully carried out, after detailed investigation the following conclusions have been drawn:-

- Cracks may occur due to several reasons as discussed above. The cracks neither can be completely neither remove nor stop but some necessary attempts can be made to lessen the cracks.
- Before construction several prevention factor can be taken to decrease the cracks, Attention and carefully observation is most important on time of construction. So that the damage or destruction in the building could be decrease and the construction building can be succeed for long time.

- It will be difficult to say that cracks can be removed completely but proper repair, maintenance, acquirable, construction material and proper technique and decrease the inclination of cracks.
- Prevention and remedial measure of cracking should be taken for difficult type of cracks as discussed above by doing this we can gain the effective and effective structure as whole.

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