JECRC Foundation

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTRE

JAIPUR ENGINEERING COLLEGE AND RESEARCH CENTER

Class – 3rd Year - V Semester: B.Tech. (Civil Engineering)
Subject –Repair and Rehabilitation of Structures
Ch – Cracks in Concrete&Masonary Structures UNIT 2
Presented by –Hetram Sharma (Assistant Professor)

VISSION AND MISSION OF INSTITUE

Vision

To become a renowned centre of outcome based learning, and work towards academic, professional, cultural and social enrichment of the lives of individuals and communities.

Mission

M1. Focus on evaluation of learning outcomes and motivate students to inculcate research aptitude by project based learning.
M2. Identify, based on informed perception of Indian, regional and global needs, areas of focus and provide platform to gain knowledge and solutions.
M3. Offer opportunities for interaction between academia and industry.
M4. Develop human potential to its fullest extent so that intellectually capable and imaginatively gifted leaders can emerge in a range of professions.

VISSION AND MISSION OF DEPARTMENT

Vision

To become a role model in the field of Civil Engineering for the sustainable development of the society.

Mission

M1. To provide outcome base education.

M2. To create a learning environment conducive for achieving academic excellence.

M3. To prepare civil engineers for the society with high ethical values.

CONTENTS

1. Types of concrete cracks
2. Measurements and Preventive

Types of cracks

Six Common Types of Cracks in your Concrete

- Plastic **shrinkage** concrete cracks. ...
- Expansion concrete cracks.
- Heaving concrete cracks.
- Settling concrete cracks. ...
- Concrete cracks caused by overloading the slab. ...
- Concrete cracks caused by premature drying.

1. Plastic shrinkage cracks appear in the surface of fresh **concrete** soon after it is placed and while it is still **plastic**. These **cracks** appear mostly on horizontal surfaces. ... **Plastic shrinkage cracking** is highly likely to occur when high evaporation rates cause the **concrete** surface to dry out before it has set.

2. Expansion Cracks

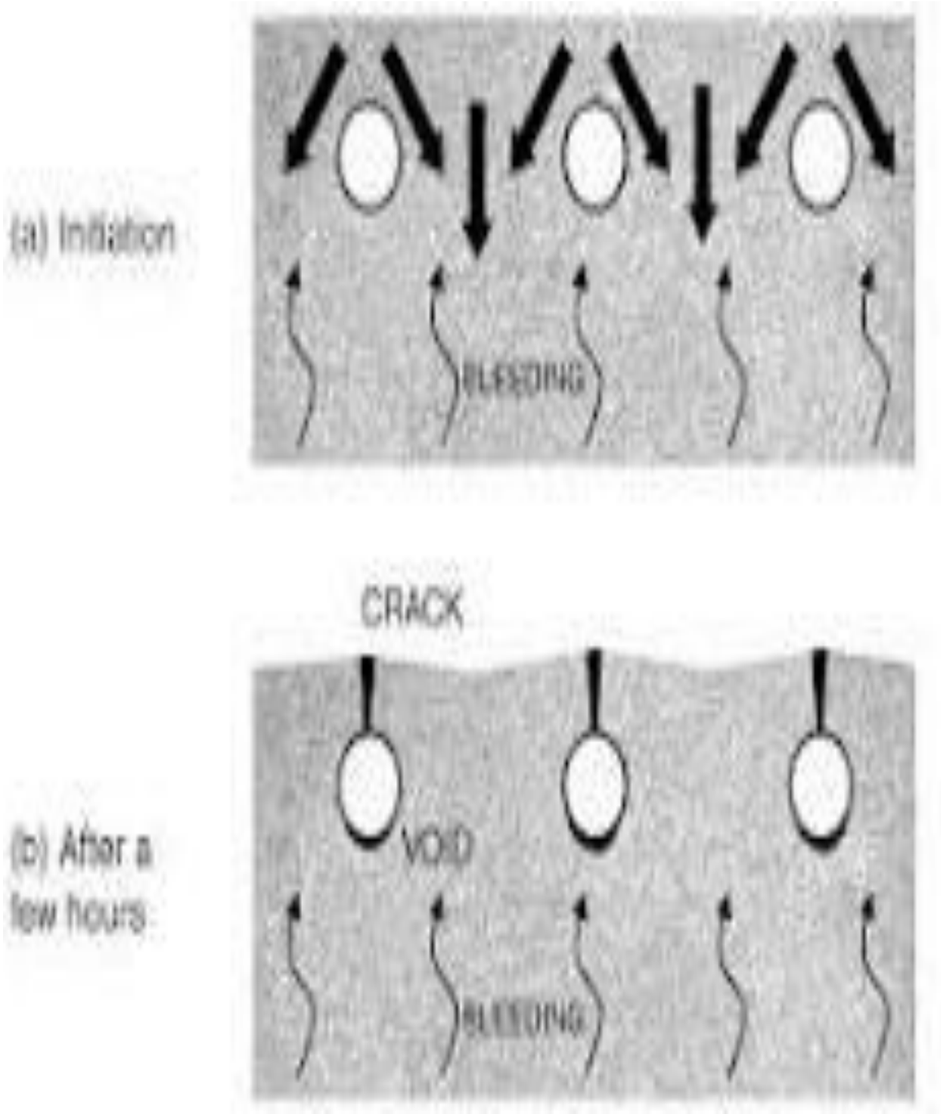
As the **concrete** expands, it pushes against any object in its path, such as a brick wall or an adjacent slab of **concrete**. If neither has the ability to flex, the resulting force will cause something to **crack**. An **expansion** joint is a point of separation, or isolation joint, between two static surfaces.

3. Heaving concrete cracks.

What Causes Slab **Heave**?

Slab **heave** is caused by clay soils expanding when they absorb moisture. The source of moisture can be rainwater, broken sewer pipes, groundwater, poor surface drainage and garden irrigation. The amount of water in the ground is often uneven and so the movement in the house is uneven..

4. Plastic **settlement cracks**. **Cracks** caused when the **settlement** of fresh **concrete** is restrained by reinforcement or formwork. Plastic **settlement cracks** can form in young **concrete**, within the first few hours after placing. As water moves upward through the mixture, the denser constituents move downward.



5. Concrete cracks caused by overloading the slab

Placing excessive amounts of weight on top of a **concrete slab** can **cause cracking**. When you hear a **concrete** mix has a strength of 2000, 3000, 4000, or 5000+ PSI, it is referring to the pounds per square inch it would take to crush that **concrete slab**.

6. There are two common types of **cracks brought on by premature drying**. Crazing **cracks** are very fine, surface **cracks** that resemble spider webs or shattered glass. When the top of a **concrete** slab loses moisture too quickly, crazing **cracks** will likely appear. While unsightly, crazing **cracks** are not a structural concern.

How to Prevent Cracks in Concrete Structures?
Preventive measures to avoid creation of cracks:
Preventive measures must be taken at the time of concreting and later to reduce cracks after concrete formation. Main factors are:

Reduce Water Content in Concrete:
A low water cement ratio will affect the quality of concrete. W/C ratio is weight of water to the weight of cement used. A lower w/c ratio leads to high strength in concrete and lesser cracks.

W/C ratio shall not exceed 0.5 in concreting, which reduces the workability of concrete which can be covered by use of plasticizer or super plasticizer. Less water content increases the durability of concrete Concrete expands and shrinks with changes in moisture and temperature. The overall tendency is to shrink. Shrinkage is the main cause of cracks, when concrete hardens it evaporates the excess water and thus shrinks, so lesser the water content, lesser is the shrinkage. Cracking shrinkage in slabs is ½ inch per 100 ft. The shrinkage of concrete pulls the slab apart showing it as cracks on surface.

Proper Concrete Mix Design and use of Quality Materials

The concrete itself must be properly proportioned, and properly mixed. If you use too little cement, you can almost guarantee cracks. Using too much water will make the concrete weak, leading to cracking.

Use good quality aggregates so will produce lower shrinkage concrete. Hard, dense aggregate, using a large top size aggregate and optimizing the gradation of the aggregate is able to reduce the shrinkage of the concrete.

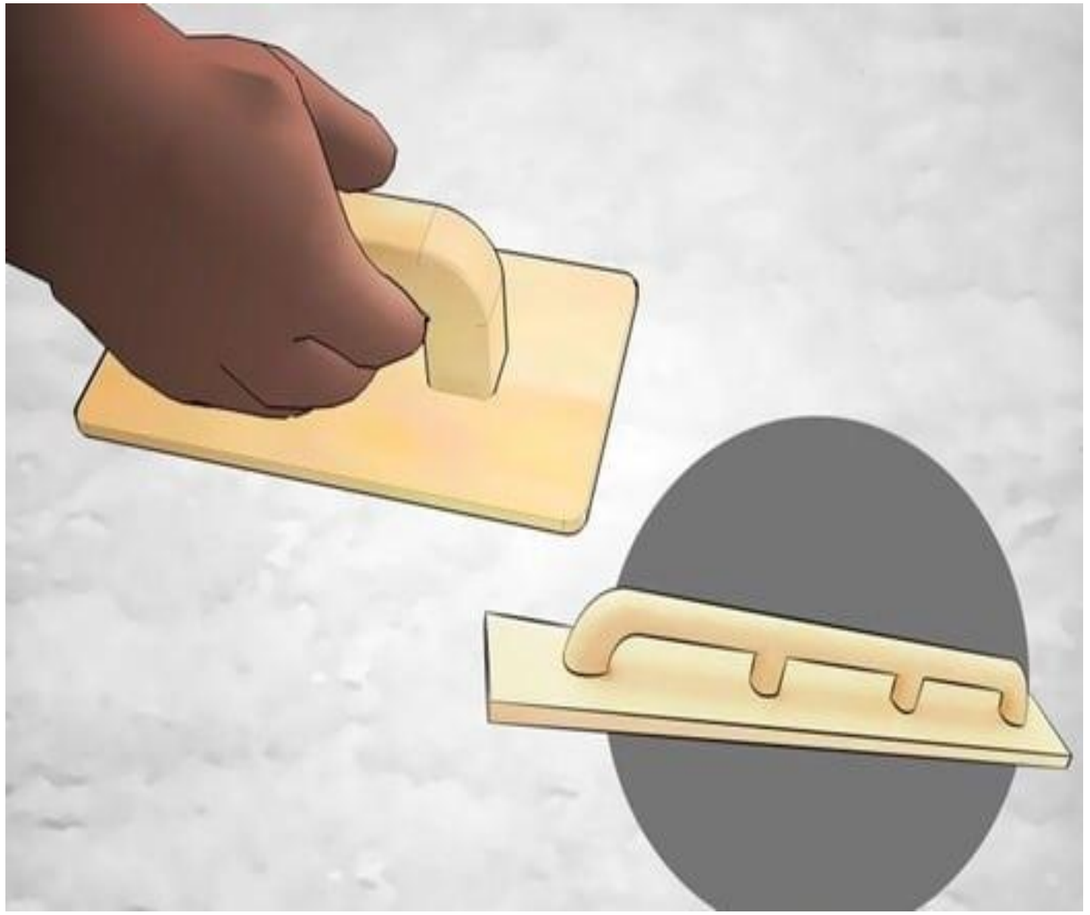
If the aggregate is of poor quality, maximizing the size, gradation, and content may have little effect on the concrete shrinkage. Mixing large aggregate with poor qualities to a mid-size aggregate with good properties may increase the shrinkage of the concrete.

Avoid the use of shrinkage-promoting admixtures (such as accelerators, dirty aggregate which increases water demand and using a cement with high shrinkage characteristics.

Finishing of Concrete Surface

Use proper finishing techniques and proper timing during and between finishing operations. Flat floating and flat troweling are often recommended.

Avoid overworking the concrete, especially with vibrating screeds. Overworking causes aggregate to settle and bleed water and excess fines to rise.



Proper Curing of Concrete

Stop rapid loss of water from surface or drying of concrete due to hydration (liquid concrete converts to plastic and then to solid state) causes drying of the slab, so it's recommended al days. As soon as the concr al practice to make boundary wi keep it filled with water. Cov oaked with water or spray on a curing compound also prevents loss of water.

Curing of Vertical surfaces Curing of Horizontal surfaces

The concrete should not be subjected to load during the curing period, which can last up to one month.

Preventive measures to avoid creation of cracks:

Preventive measures must be taken at the time of concreting and later to reduce cracks after concrete formation. Main factors are:

Reduce Water Content in Concrete:

A low water cement ratio will affect the quality of concrete. W/C ratio is weight of water to the weight of cement used. A lower w/c ratio leads to high strength in concrete and lesser cracks.

Curing of Vertical surfaces Curing of Horizontal surfaces

Proper Placement and Vibration of Concrete

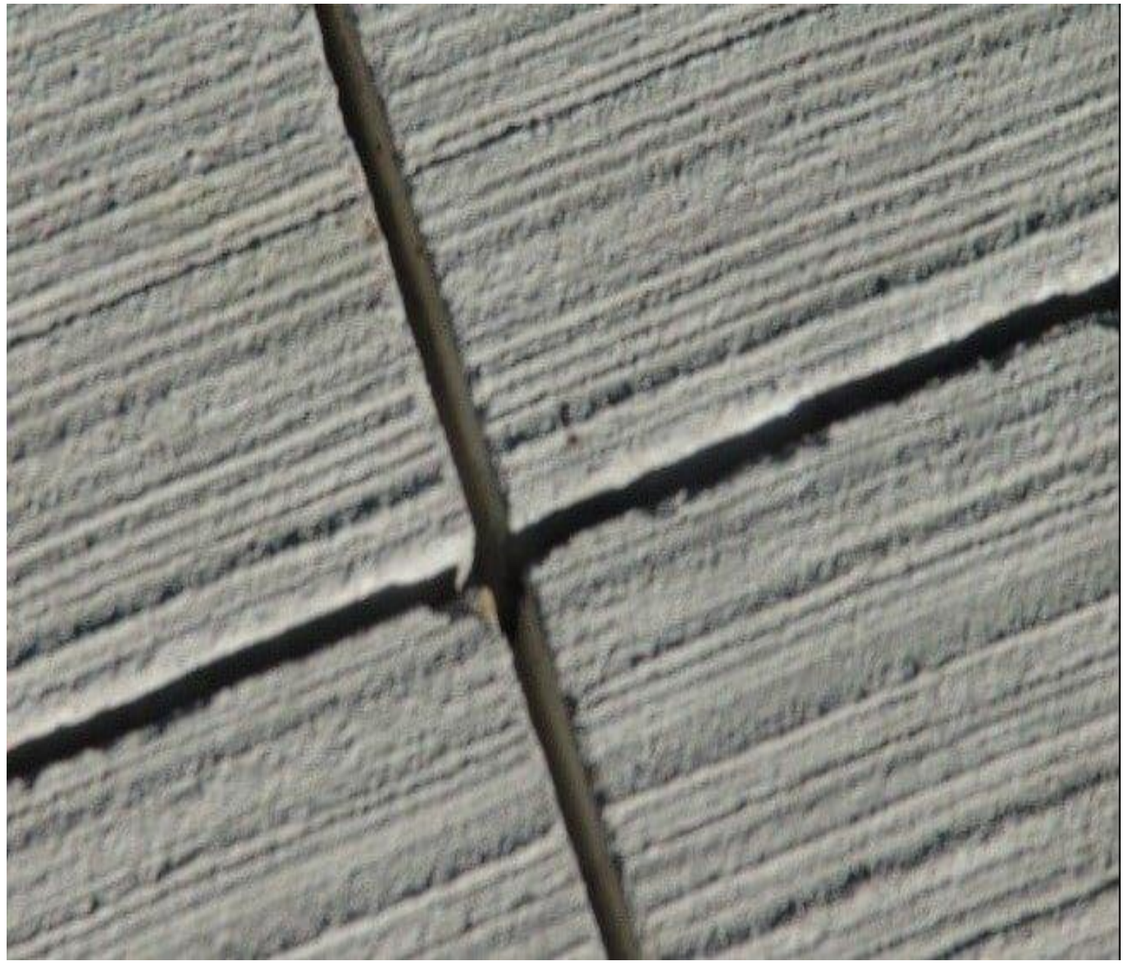
Properly placed, vibrated, finished concrete reduces the chances of producing cracks. Properly vibrate to release entrapped air which later leads to cracks.

Proper Compaction of Soil to Prevent Settlement Cracks in Concrete

The area below the concrete slab has to be compacted properly and in layers so as to ensure against settlement of soil later. If the soil is left loose it will settle over time and create cracks on surface. This applies in the home as well as constructions on highways.

Providing Control Joints in Concrete

Control joints should be located at regular intervals so as to adjust the shrinkage of concrete. Generally, for 4-inch depth of slab joints are provided 8 to 12 ft. apart. Control joints are pre-planted cracks. An engineer should have an idea that concrete will crack at control joints instead of cracking any other location.



Some Other Preventive Control Measures for Cracks in Concrete:

- Applying good acrylic silicone sealer yearly to concrete works
- Avoid calcium chloride admixtures
- Prevent extreme changes in temperature.
- Consider using a shrinkage-reducing admixture
- Warm the subgrade before placing concrete on it during cold weather
- Consider using synthetic fibers to help control plastic shrinkage cracks.

Thank You