

EXPERIMENTAL STUDY ON FRACTURE MECHANICS OF CONCRETE

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Abstract - The paper presents an Experimental study on fracture mechanics of concrete. The behavior of concrete beams subjected to shear and slabs subjected to punching are illustrating examples, especially when size effects are concerned. According to literature review micro cracks become stable first, and after evenly become unstable due to maximum principle compressive stress. Here according to analysis of cracking technology there are two types of approach. i.e. realistic and consistent. We have studied about finite non linear zone where material undergoes progressive micro cracking. and another one is crack band theory where size effect as a gradual transition (linear fracture mechanism). It based on crack band theory. here in our project we use chips of 10mm aggregate, 20 mm aggregate, the present paper is to show some experimental result concerning the influence of the specimen size by means of compact tension test the strain softening diagram was also analyzed and the possible mechanism of size effect on fracture energy of concrete is discussed. The cube is tested and crack length is identified and found that the propagation of crack assurance in 10mm aggregate is less than 20 mm aggregate.

Key word: Crack band theory, Crack propagation Linear zone, non linear zone

1. INTRODUCTION

Cracking of concrete is a frequent complaint cracking is caused by restraint of volume of change, commonly brought about by a combination of the factors such as drying shrinkage, thermal contraction, curling and settlement of the soil support system and applied loads. The main reasons for occurrence of cracks are plastic shrinkage, expansion of cracks, cracks caused by overload, cracks due to premature drying.

Plastic shrinkage of cracks

When the concrete is still in its plastic state, it is full of water. When that water eventually leaves the slab, it leaves behind large voids between the solid particles. These empty spaces make the concrete weaker and more prone to cracking. This type of cracks are known as plastic shrinkage.

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. The expansion joint is a point of separation between two static surfaces.

Cracks caused by overload

Placing the excessive amount of weight on the top of a concrete slab can cause cracking.

Cracks due to premature drying

Crazing cracks are very fine, surface cracks that resemble spider webs or shattered glass. When the top of the concrete slab loses moisture too quickly, crazing cracks will likely appear.

2. MATERIALS

Cement

A cement is a binder material used to harden the concrete, the most commonly used is ordinary Portland cement, is the most prevalent kind of concrete binder. According to the specific gravity of cement it is graded into 33,43,53. Here ordinary Portland cement of grade 53 is used for experimental work.

Fine aggregate

Here M sand is used for the experiment. It has both physical and chemical properties. It can withstand harsh climatic conditions. It has the defects to overcome defects in concrete like segregation, honeycombing, corrosion of reinforcement steel, voids, capillary, bleeding etc. It has higher strength and greater durability. It is also eco-friendly.

Coarse aggregate

Coarse aggregate are a component of composite materials such as concrete and asphalt concrete, the aggregate serves as reinforcement to add strength to overall composite material. Here 10mm and 20mm aggregate is used for the experimental work.

10mm aggregate



20 mm aggregate



Water

Water is the main ingredient, which when mixed with cement, forms like the paste that binds the aggregate and steel together. The water causes the hardening of concrete due to hydration.

3. EXPERIMENTAL WORK

Workability test

Workability of concrete is the property of freshly mixed concrete, which determines the ease and homogeneity with which it can be mixed, placed, consolidated, and finished. The workability of concrete depends on many factors which are explained in factors affecting workability of concrete.

4. RESULT AND DISCUSSION.

The result is discussed after compression and tensile test, the crack propagation and occurrence of cracks will be found for 20mm aggregate and 10mm aggregate.

Compression test

Compression strength of concrete is the strength of hardened concrete measured by the compression test. The compression strength of concrete is a measure of the concrete's ability to resist loads which tend to compress it. Fracture in the cubes are tested and identified.

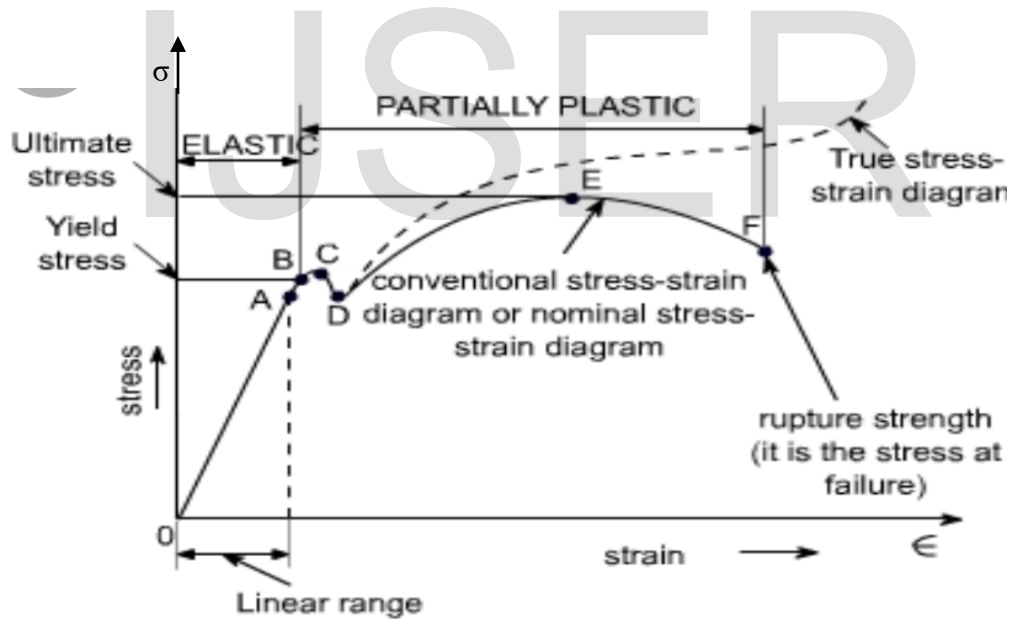


Crack Propagation

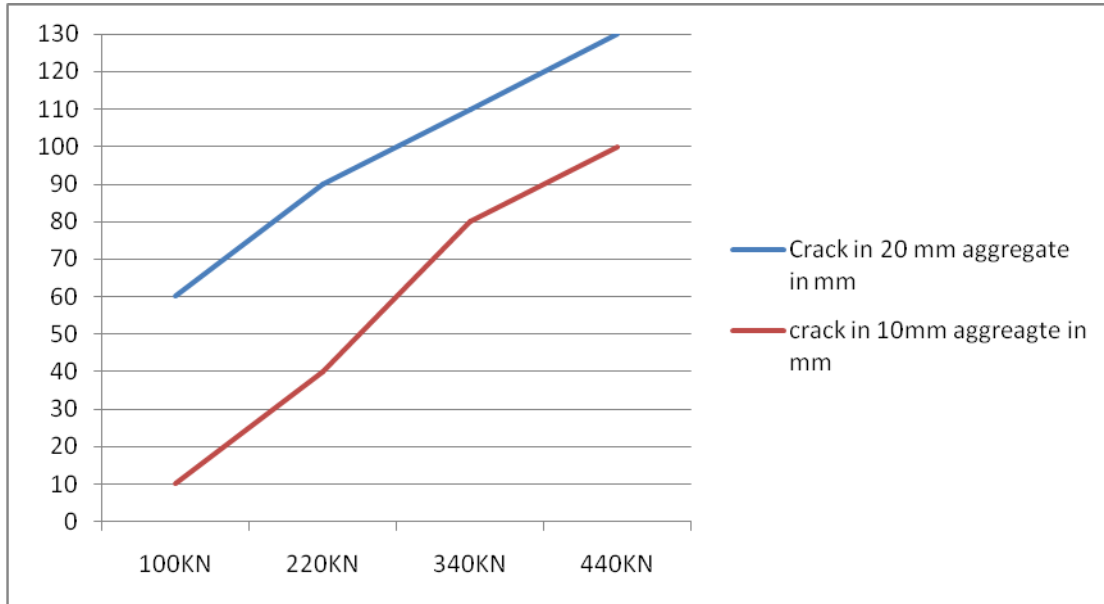


Cube Testing

Stressstrain table of concrete



Crack accuring in 20mm and 10mm aggregate



Compression test result

Compression test Load "KN"	Crack propagation in 20mm aggregate "mm"	crack propagation in 10 mm aggregate "mm"
100KN	60mm	10mm
220KN	90mm	40mm
340KN	110mm	80mm
440KN	130mm	100mm

5. CONCLUSION

- The experimental study on fracture mechanism of concrete for 10mm aggregate is less than 20mm aggregate.
- Elastic medium containing flaws or micro crack is that of the fractural mechanism of concrete is that of crack extension due to initiation of crack branches, followed by propagation of these branches which is at first stable but evenly becomes unstable and leads to complete disruption in the direction of the maximum principle compressive stress.
- The form of the fracture mechanics to be used must be nonlinear, taking into account the existence at the fracture front of a finite nonlinear zone in which the material undergoes progressive micro cracking
- Slow crack growth is to be regarded as a partial stress relaxation at the crack tip due to softening rather than a real crack propagation

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