EXPERIMENTAL INVESTIGATION ON CAUSES OF CRACKS IN CONCRETE STRUCTURES AND TECHNIQUES TO CONTROL THE CRACKS

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ABSTRACT: ***Building cracks are most common type of problem in any type of building. So, it is important to understand the cause and the measures to be taken for prevention. Though cracks in concrete cannot be prevented entirely but they can be controlled by using adequate material and technique of construction and considering design criteria. We all dream of a house structurally safe and aesthetically beautiful but it is not so easy. Due to some faulty steps during construction or some unavoidable reasons different type of cracks starts to appear on various structural and non- structural parts of the building with the passage of time. It is not necessary that all type of cracks require serious attention but there are some typical types of crack (active cracks) that are structurally hazardous. So, timely identification of such cracks and adopting preventive measures is essential. This work briefly describes about various direct and indirect observation methods using simple as well as sophisticated instruments to deal with such problems. It insights the process how cracks leads to ultimate structural failure. It also explains various causes of crack and their respective remedial measures. From this building cracks has direct and indirect impacts. And also, it is found that building cracks do not cause structural problem in direct way but it facilitates the activities which ultimately cause the problem. Hence this work come up with conclusion that different type of crack call for different repair technique depending upon cause and intensity of problem.To used for the repair of crack in Epoxy injection method by add for some mineral like Metakaolin.***

Keywords: cracks, types,and causes of cracking and controll of epoxy injection method.

I. INTRODUCTION

A crack is a complete or incomplete separation of concrete into two or more parts produced by breaking or fracturing. Concrete structure has been started applying since the mid-19th century, because of the low quality of cement and at that time the development of concrete structure was slow. Until the end of the 19th century, concrete structure was getting faster development with the development of production, experimental work, computational theory and improvement of construction technique and now it has become one of the most widely used building materials in the modern construction. Cracks are one kind of universal problem of concrete construction as it affects the building artistic and it also destroys the wall's integrity, affects the structure safety even reduce the durability of structure. Cracks develop due to deterioration of concrete or corrosion or reinforcement bars due to poor construction or inappropriate selection of constituent material and by temperature and shrinkage effects.

II. MATERIAL PROPERTIES

2.1 Metakaolin:

Metakaolin is obtained by thermal activation of kaolin clay. This activation will cause a substantial loss of water in its constitution causing a rearrangement of its structure. To obtain an adequate thermal activation, the temperature range should be established between 600 to 750ºC. Metakaolin is used in oil well cementing to improve the compressive and flexural strength of the hardened cement. Metakaolin also reduces the hardened cement permeability to liquids and gases. Hence by partially replacing Portland cement with Metakaolin not only reduces carbon dioxide Emissions but also increases the service life of buildings.

Figure.1 Metakaolin

2.2 Metakaolin Material Properties:

Table-1 Chemical Properties Of Metakaolin:

MATERIAL	METAKAOLIN
Cao	0.06
Fe2o3	1.07
Al2o3	28.63
Sio2	62.62
Mgo	0.15
Tio2	0.36
K2o	3.46
Na2o	1.57

Table-2 Physical Properties Of Metakaolin

Properties	%
Color	Ivory to cream
Form	powder
Specific gravity	2.6 g
grain size(mm)	2.54

III. METHODOLOGY

Literature collection
Collection of data and materials
Material properties
Mixing solution
Applying Epoxy injection
Testing of specimen
Analysis of result

IV. TESTING OF SPECIMENS

1. Compression Test
2. Flexural Test
3. Shear Test
4. Initial cracking Test

V. Results and Tables:

Table- 3 Compression Test Of Cube

S.NO	Age of test	Grade of concrete	Compressive load (KN)	Failure mode
1.	7	M25	400	Diagonal crack
			390	Vertical crack
2.	14	M25	450	Vertical crack
			460	Horizontal crack
3.	28	M25	630	Diagonal crack
			650	Vertical crack

Table -4 Compression Test after Formation of cracks

S.NO	Age of test	Grade of concrete	Compressive Load (KN)	Failure mode
1.	7	M25	320	Vertical crack
			380	Diagon al crack
2.	14	M25	430	Vertical cracks
			460	Horizontal crack
3.	28	M25	510	Diagonal crack
			530	Vertical crack

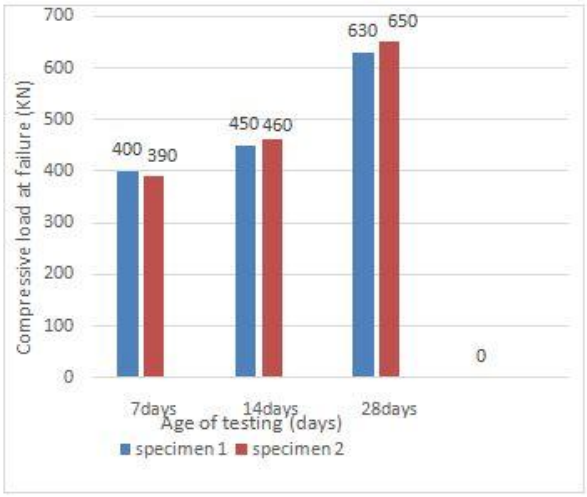

Figure 2. Compression test of cube

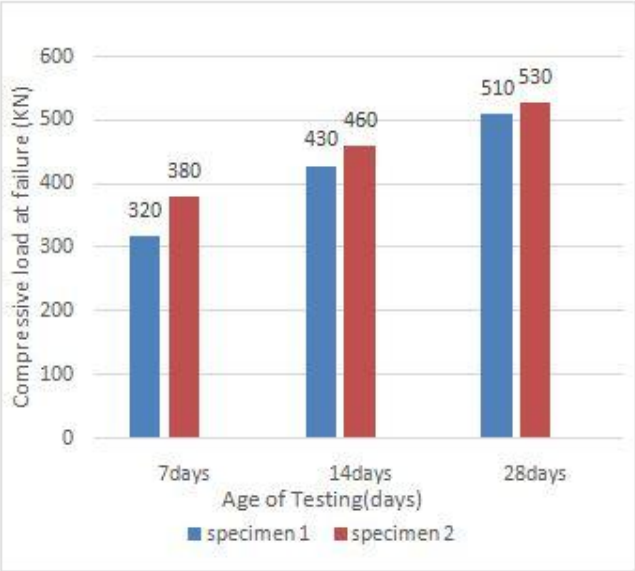

Figure 3.Compression test after formation of cracks

Table-5 Flexural Test of Slab

S.NO	Crack width	Loading span (mm)	Ultimate Load (KN)	Failure mode
1.	0.52	900	16.79	Vertical crack
2.	0.73	900	21.90	Diagon al crack
3.	1.05	900	29.98	Vertical cracks
4.	0.31	900	22.26	Horizontal crack
5.	0.02	900	23.87	Diagonal crack

Table– 6 Shear Test of Slab

S.NO	Crack width	Loading span (mm)	Ultimate Load (KN)	Failure mode
1.	0.08	900	17.19	Diagonal crack
2.	0.34	900	22.12	Vertical crack
3.	0.14	900	13.64	Vertical crack
4.	1.05	900	19.55	Horizontal crack
5.	0.16	900	18.17	Diagonal crack

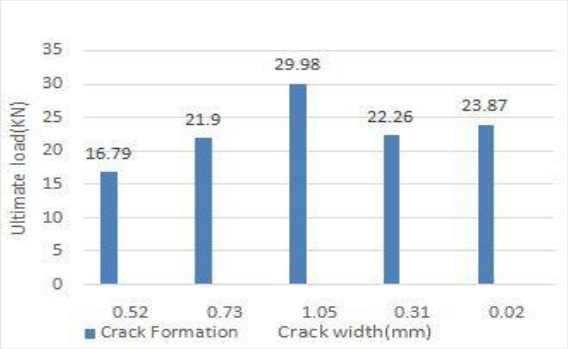

Figure 4. Flexural test of slab

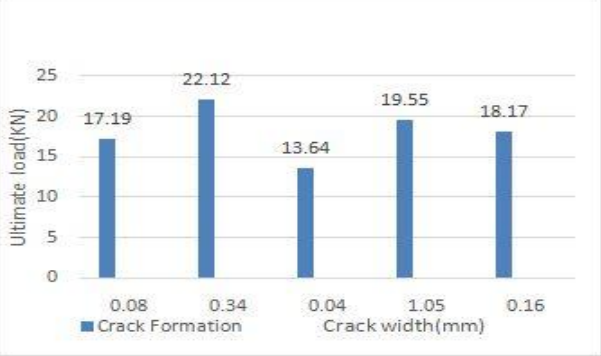

Figure 5. Shear test of slab

TABLE -7 INITIAL CRACKING TEST

S.NO	Crack width	Loading span (mm)	Ultimate Load (KN)	Failure mode
1.	0.31	900	7.22	Horizontal crack
2.	0.42	900	10.34	Diagonal crack
3.	0.08	900	9.87	Vertical crack
4.	0.35	900	10.29	Diagonal crack
5.	0.24	900	8.26	Vertical cracks

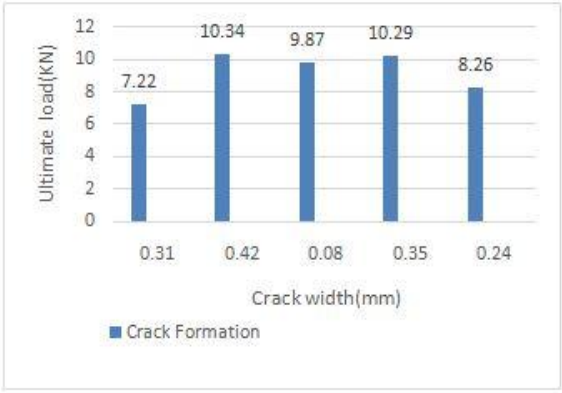

Figure 6. Initial cracking test

VI. CONCLUSION

This paper is divided into four parts. First part comprises the study of cracks and about the previous attempts which are made by the research scholars, second part contains the case study, visual identification of cracks and causes with preventive measures and third part contains techniques to cure crack. The potential causes of crack can be controlled if proper consideration is given to construction material and technique to be used. The purose of the projects to evaluate the performance of epoxy injection crack repaire of conrete slab for different loading conditions,crackwidth,repaire stategies .If we focus on the major causes to cracks in our building and take theirpreventive measures initially, we will able to minimise the problem of cracking in our structure.

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