

Causes, Prevention And Repairing of Cracks In High Rise Building

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Abstract- Cracks are problems for any construction, any structure. cracks might be a minor or major cause to leads problems in well-functioning of building and some time it leads to major injury if we ignore such a crack in building or structure. In this project we have discussed various types of cracks which can be formed in building. This project also includes the new cause behind formation of cracks which was not mention before or if mention it consider as minor but nowadays it has converted it major causes to form cracks in structure or any building. In this project we have consider especially high rise building for project details, we have found new causes of cracks in high rise building such as ignorance towards working, specification, planning. Cracks are also formed due to miss perception and extra activity practice by non-technical persons. In this project we have discussed various latest materials and latest methods which is practice nowadays to treat various cracks and we have also discussed various prevention methods which must be practice before, while and after construction of buildings.

Keywords- Cracks, Prevention, repairing

I. INTRODUCTION

As basic needs of food, cloth and shelter, since shelter is one of the basic need of human being it is necessary to construct a house or various types of building for their survives as well as for living point of view. Any construction of building is said to be successful when its serviceability is good i.e. building should be serviceable. serviceability includes various terms such as its life in terms of its durability, its behaviour under various weather condition, its member deflection with respect to its original position, cracks in structural component, fire resistance etc. basically as per Indian standard of code practice for construction of building should be design for collapse point of view but it must be check for the serviceability .and according to is code 456-2000 (i.e. code of practice for design of reinforced concrete structure) serviceability includes deflection, cracks, durability, fire resistance, etc. even though they consider deflection control is major criteria but we cannot ignore the effect of cracks, especially in high rise building or any building where

cost of construction is little bit more as well as risk involvement is more.

Cracks are forms in structure by various reasons. Reason might be structural reason, or non-structural reasons. Structural reasons are generally due to faulty design, monitoring, controlling while construction stage. Whereas non-structural cracks might be form from any external reason such as earthquake, temp. Weather etc.

Cracks can be sever, minor. Anyhow cracks in structural components are not desirable it looks ugly, old, and risky. But now days as construction speed are increasing so that lacks attendance towards the design and construction operation activity structure becoming unserviceable soon. If we causes, so that prevention of cracks is somewhat possible. And now days with various chemical mixtures we can repairs are cracks as soon as possible.

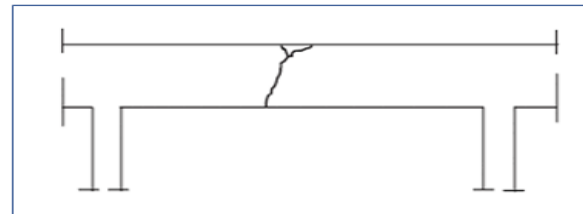


Fig 1. Diagonal crack in beam

A. Overview

it is important to study cracks and its normal now a days this project contains study on cracks, what are its cause and its effect on structure. Basically its causes includes every aspects that it will consider from the design stage of structure/ high rise building to know better about basic causes of cracks formations. So that we can suggest various preventive measures on crack formation and if any crack is present then how can we repair it without affecting other area of structure.

B. Aim

To study the Causes, Prevention and Repairing of Cracks in High Rise Building

C. Objectives

- Understand the effect of cracks, its causes and failures in structure due to cracks in high rise building.
- Study the various methods of prevention and various repair methods for cracks.
- Case study: To identify the cracks & understand the types of cracks formation, and find causes behind the cracks in building.
- Give suggestions to repairing and prevention of cracks observed in the case study.

II. MATERIALS & METHODOLOGY

A. General

- To achieve our first objective I will study the various cracks formation in high rise building, causes behind it, and its effects on building.
- To achieve our second objective I will study the various papers, theories, videos, reference books related to our topic to get better understanding about crack and causes of it which is observed, there suggested prevention and repair methods.
- To achieve our third objective I will visit any building where cracks are already formed so that we can observed cracks in reality, find out the probable causes which could be there behind crack formations. It will be our case study.
- To get our last objective what we observed in our case study we will analyse the causes and suggest the repair methods of cracks and in addition we will also suggest some preventive measures to cracks formation in building.

III. RESULTS AND OBSERVATIONS

A. Cracks Due To Disturbance Of Structural Components

It is normally form due to labours lack of knowledge about structural member's importance. Generally after construction of any new construction or in well-established building for electric wiring and for water pipe line purpose labours start scratching or digging structures walls and sometimes structural members such as column, beam and slab. Labours from do their work by chisels for scratching or digging which sometimes disturbs structural integrity, so that structure sometimes functions well because sometimes labours

does not complete their works of covering to their digging or scratching. By scratching it disturbs the cover of reinforcement inside the structural members, sometimes they disturbs the alignment of reinforcement which leads to cause to form cracks.

B. Cracks Due To Quickness And Not Maintaining Specification Of Item Work, Material, And Method Of Work

Nowadays everyone wants their results, construction work very quickly for that if new and proper technology is adopted then it ok, but even with the old technology and old method of working operations some people wants their money output from construction as soon as possible. They just want to get reed of work anyhow, so that they are not adopting proper methods of construction and not allowing that much time which should have at least any structural member to gain sufficient strength for further constructions works. This practice is generally done by contractors and sometimes by owners, and if engineer ignore this thing then in future leads to cause of formations of cracks, leakages in structures.

C. Cracks Due To Fluctuations Of Water Level By Natural Or By Manmade Events

Actually, water for structure any way harmful because anyway it creates problems for structure it is necessary to take observation on water related items that might be anything such as foundations levels soil, etc. water level low as well as high creates problems. for example if structure is constructed on black cotton soil then it is very crucial to pay attention on water level below soil because black cotton soils bulkiness behaviour is very large means it change very drastically on water level high or low. Other observed cracks in building are normal and their reason to form is mention already in previous introduction chapter so one can prefer from there. In that chapter we clearly mention that what are the various causes of cracks in building, etc

D. Product selector chart

Area	Common visible problems	solution	Product choice
	Sever rising dampness at floor level	Injection grouting at floor level	Dr.fixitDampfree
	Damp spot on interior walls	Damp-proof coating on exposed plaster	Dr.fixitDampguard
	Cracks on	Crack filling	Dr.fixit

Area	Common visible problems	solution	Product choice
wall	wall (< 5 mm)	using shrink-free crack filler	crack-X paste/ crack-X powder
	Cracks on walls (< 10 mm)	Crack filling using shrink-free filler	Dr.fixitgap fill
	Cracks around door/ window frame joints	Crack filling flexible-acrylic crack filler	Dr.fixit magic mortar
	Cracks in separation joints of masonry/ RCC	Crack filling using polymer modified mortar	Dr.fixitpid icrete MPB/URP /Super Latex
	Spalling plaster	Re-plaster using polymer mortar additive	Dr.fixit Raincoat
	Protective coating for exterior façade	UV resistant, stretchable, weather - proof coating	Dr.fixitDampguard
Bathrooms	Dampness on outer face of bathroom wall	Damp-proof coating on exposed plaster	Dr.fixitKrystalline
	Mild dampness on ceiling	Damp-proof coating on exposed plaster	Dr.fixit PU foam/ plain injection
	Drip- leakage from ceiling	Injection grouting for ceiling	Dr.fixitfevimate TG
	Wearing out of tile joint filler	Re-fill the worn out tile joints with a tile grout	Dr.fixitpid igROUT 10 M
	Leakage from nahani trap	Re-install using non-shrink grout	Dr.fixitgap fill
	Sealing of sanitary joint fittings	Joint sealing using flexible-acrylic crack filler	Dr.fixitpid icrete MPB/URP /Super latex

Area	Common visible problems	solution	Product choice
	Sealing of drain pipes in walls	Seal the joint with mortar using polymer mortar additive	Dr.fixitpid icrete MPB/URP /Super latex
Roof/ Terrace	cracks on RCC slab	Crack-filling using polymer modified mortar	Dr.fixitpid icrete MPB
	loose mortar on RCC slab	Re-plaster using polymer modified mortar	Dr.fixit PU injection
	Dripping from ceiling below	Injection grouting for ceiling	Dr.fixitne wcoat
	Waterproofing of RCC slab (without screed/ plaster overlay)	Waterproof coating	Dr.fixit magic mortar
Basement	Cracks on RCC wall/ floor	Crack-filling using polymer modified mortar	Dr.fixit magic mortar
	Loose mortar on RCC slab	Re-plaster using polymer modified mortar	Dr.fixit magic mortar
	Drip leakage on RCC wall/ floor	Injection grouting for wall/ floor	Dr.fixit PU foam/ plain injection
	Dampness on RCC wall/ floor	Injection grouting for wall/ floor	Page1 ZS/ZL 10
	Damp-proofing of RCC wall/ floor	Damp-proofing using crystalline waterproofing system	Dr.fixitkrystalline
	Honey-	Injection	Page1

Area	Common visible problems	solution	Product choice
	combing in RCC	grouting for wall/ floor	ZS/ZL 10
Structural Repairs (Beam/ column/ slab)	Cracks in RCC wall/ floor	Crack-filling using polymer modified mortar	Dr.fixit magic mortar
	Loose mortar on RCC slab	Re-plaster using polymer modified mortar	Dr.fixit magic mortar
	Rusting of steel reinforcement	Epoxy- zinc protective coating	Dr.fixit Epoxy zinc primer
	Bonding adhesive for restraining mortar	Epoxy bonding adhesive	Dr.fixit Epoxy bonding agent
	Spalling plaster/ cover-concrete	Repair using polymer modified mortar	Dr.fixit magic mortar
	Severely damaged RCC sections	Repair using structural grade high-build PMM	Page U 40/U80
	General purpose patch repairing	Repair using polymer modified mortar	Dr.fixit magic mortar
	Reinstating mortar for jacketing application	Repair using structural grade micro-concrete	Dr.fixit micro concrete
	Pinholes/ honeycombs in concrete surfaces	Level the surface with a fairing putty	Dr.fixitfai oring mortar
*PMM- polymer modified Mortar			

E. Repairing Of Cracks By Considering Their Causes Of Formation Of Cracks In Building.

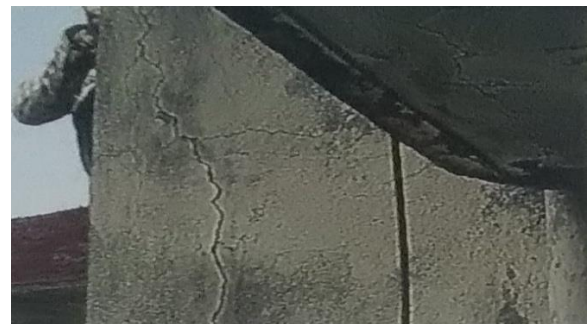
Buildings are exposed to salinity, natural calamities and environmental pollutants, especially in urban areas and industrial townships. These factor lead to concrete

deterioration and corrosion of steel bars resulting into fast reduction of load carrying capacity of the buildings. Indiscriminate alterations and modifications by residents add to these problems.

A step by step methodology on how to address different in the following manner

1) Common Visible Problems That Needs For Repair

Building like human beings tends to show sign of deterioration of their external surface. The common visual indicators are shown below



Cracking



Spalling



Corrosion

In addition to these visible signs there can be defects in the building which cannot be detected by surface examination. Only an experienced structural consultant can

recommend the repair methodology after using correct diagnostic techniques.

2) Treatment for Surface Crack On Plaster- Internal Or External

Cracks on plaster surface internal or external leading to dampness or seepage inside the building.

Repairing Surface Crack

1. Surface cracks must be free from dust, oil greese and loose particles etc.
2. Moisten the surface before applying crack-X series product.
3. If the crack is fine , open the crack with the help of spatula up to minimum width of 1mm.
4. Remove all the internal POP and painter's putty before applying crack-X series product.
5. If the width of crack up to 5mm then use Dr.Fixit Crack-X powder or paste as per the suitability and ease of application and fill the crack with the help of spatula in two coat application apply the second coat after 10-12 hours on the first coat.
6. External application must be over coated with paint.
7. If the thickness of the crack is 5mm to 10mm then use Dr.Fixit Crack-X shrink free in single application.
8. Allow it to dry for 6-7 hours it is ready for painting.
9. Care must be taken to avoid formation of cavity and air bubbles during application.



Treated Surface with Crack-X Paste

F. PREVENTIVE MEASURE THAT MUST BE TAKING AT LEAST TO MINIMISE THE CRACKS FORMATION

1. While planning we have to observe the all site. We have to investigate foundation soil very well. For foundation we have to take sufficient test pits of soil investigation and study the soil behaviour, its property, its formations so that in future any problem will not come except natural reasons.
2. Architecture or structural engineer should design the structure very well. They have to study all things for design process and consider all necessary things because sometimes cracks are form due to improper structural design of structure such as improper load estimation or improper design specification of any structural member. Which leads to stress on particular point in structure then in future it leads to cracks?
3. To earn money quickly nowadays at some places some people construct their buildings quickly without considering the sufficient times of hardening of buildings concrete components so that at early stages or sometimes while in construction times cracks forms.
4. Site engineer or consult engineer staff is play important roles behind structural behaviours, looks, strength. If consult engineer staff ignore their works or if they don't perform their responsibilities very well then it leads to fault in construction of building then in future this things will make the causes of cracks in building. Such as seepage, leakage from structures.
5. If consult engineering staff is not maintaining the specification of any item work of structure, if they not using well and good quality material, if are not following proper method of working that should be practice on site, if they are not taking testing of any material time to time, if they are not using design norms, rules and regulations all these things in future leads to various types of cracks in building or any other structures.
6. It has observed that after construction of building for electric wiring and for pipelines purposes normal labours start chiselled work on finished products and while chiselling as they are just a labour and don't know the structural importance of any structural member, they chiselled structural members along with the walls such as slabs, beams, columns which disturbs the uniformity of structural member and in addition it disturbs the design specification of members which is also leads to causes of cracks. To prevent such crack formations it is necessary to plan at initial stage itself. Engineer should make provision for all chisel work (i.e. for electric wiring and pipeline works) very well manner so that any

structural member should not disturb as far as possible. And if necessary then it should be cover properly so that members design specification should not change.

7. It has observed that if any pipeline is pass through any structural member and previous provision are not made before then labours chiselled the structural member such as column

IV. CONCLUSION

1. Cracks are not a major criteria behind failure of structure if it is within limit, which is suggested by Indian standard code IS 456-2000 (i.e. plain and reinforced concrete- code of practice)
2. Any structure or building should be design for limit state of collapse but it must be check against limit state of serviceability which includes cracking of structure also. And cracks can reduce its appearance, durability, and some time cause failure of structure.
3. Cracks are classified into structural and non-structural categories. The structural ones are due to faulty design, faulty construction or overloading which may endanger safety of buildings. The non-structural cracks are due to internally induced stresses, and environment surrounded the structure or building.
4. Depending on width of crack, these are classified in to thin (<1mm), medium (1mm to 2mm) and wide (>2mm wide).
5. In hot region water evaporates from soil which causes shrinkage or settlement of soil. Shrinkage of soil or settlement of soil cause foundation cracks in plinth beam which is not desirable as results in collapse of any component of building or whole structure and appearance point of view it is not good as well as it does not perform well function to transformation of structural load to soil beneath structure.
6. By observing case study on crack treatment it is important to keep maintaining structure time to time or else leads to injury and in addition cost will increase for future problems in structures that might be come.
7. Cracks are repaired on the basis of its extend of formation and its cause behind formation on that basis we select the method of repairing crack and selection of crack repair product are choose.
8. Cracks are formed due to fluctuation of water level and type of soil which is present on site, these two combinations depend on situation crates problems and can be a cause of cracks sometimes major and sometimes minor, i.e. black cotton soil and water level fluctuations.

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REFERENCES

- [1] Jailakshmi G Karri, Dr. P.S.Lanjewar, Mayuri H Kanekar, Priya D Dhok, "**Prevention and Repair Of Cracks In Buildings**" International Journal of Research In Science & Engineering, Volume: 3 Issue: 2 March-April 2017, pp 45-57.
- [2] AkandeBasirat F., Debo-Saiye B., Akinjobi Samuel D., Alao Timothy O. &AkinrogundeOluwatoyin. "**Causes, Effects and Remedies to the incessant Building Collapse in Lagos State, Nigeria**" International Journal of Basic & Applied Sciences IJBAS-IJENS Vol: 16 No: 04, August 2016
- [3] RishabhPathak, Deepak Rastogi "**Case Study on Cracks in Public Buildings and their Remedies**" International Journal of Science and Research (IJSR) ISSN (Online): Volume 6 Issue 5, May 2017
- [4] KishorKunal, NameshKillemsetty "**Study on control of cracks in a Structure through Visual Identification & Inspection**" IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) Volume 11, Issue 5 Ver. VI (Sep-Oct. 2014), PP 64-72
- [5] Chetan J. Chitte, Yogesh N. Sonawane "**Study on Causes and Prevention of Cracks in Building**" International Journal for Research in Applied Science & Engineering Technology (IJRASET) Volume 6 Issue III, March 2018
- [6] Rajveer Singh Narwaria, ArchanaTiwari, "**Development of cracks in concrete, preventive measures and treatment methods: A review**" International Research Journal of Engineering and Technology (IRJET) Volume: 03 Issue: 09 | Sep -2016, Page 671
- [7] Shivani More, TejasHirlekar, "**A REVIEW ON CAUSES, PREVENTION, REPAIR AND MAINTENANCE OF CRACKS IN BUILDING (RESIDENTIAL AND COMMERCIAL)**" InternationalResearch Journal of Engineering and Technology (IRJET) Volume: 04 Issue: 11 | Nov -2017, Page 1339
- [8] Ajagbe W.O., Ojedele O. S., "**Structural Investigation into the Causes of Cracks in Building and Solutions: A Case Study**" American Journal of Engineering Research (AJER) 2018 , Volume-7, Issue-8, pp-152-160
- [9] PoojaNama, Ankush Jain, RajatSrivastava and Yash Bhatia, "**Study on Causes of Cracks & its Preventive Measures in Concrete Structures**" RajatSrivastava et al.

Int. Journal of Engineering Research and Applications,
Vol. 5, Issue 5, (Part -2) May 2015, pp.119-123

- [10] Kazem Reza Kashyzadeh , NedaAghiliKesheh "***Study type of Cracks in construction and its controlling***"
International Journal of Emerging Technology and
Advanced Engineering, Volume 2, Issue 8, August 2012.