

Structural Audits of Framed Structure & Its Remedial Measures

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Abstract— The paper targets making mindfulness among the development partners (Governments, Architects, structural specialists, occupants and proprietors) in the structure business towards the wellbeing assessment of existing solid structures called Structural Audit. The need of primary review is regularly for support and fixes of existing designs whose lives have surpassed the age of 10 to 25 years to keep away from any disasters and save important human existence, anyway in instances of relentless breakdown of structures as has been the situation in Mumbai, underlying review gets obligatory. There are numerous structures during this period and prior have diminished strength at the appointed time of time in view of primary insufficiency, material crumbling, startling over loadings or actual harm. On the off chance that, further utilization of such disintegrated structure is proceeded with it might imperil the existences of tenants and encompassing residence. There is request of suitable activities and measures for all such structure designs to improve its presentation and reestablish the ideal elements of constructions which may prompts increment its practical life. The periodical underlying inspecting and determination for strength of existing structures is hence most extreme significant for tracking down the current workableness and primary suitability of constructions. The underlying review should be done after evaluating standards, techniques for non-dangerous testing and code arrangements. To the recommend medicinal allots and its conveyed right away.

Keywords: Structural Audit, Structural Engineering, NDT Methods, Remedial Measures, Maintenance & Repairs of the Structures

I. INTRODUCTION

Structural audit is the overall fitness and overall performance check-up of the building like health practitioner take a look at the affected person. Structural audit enables to understand the popularity of the old constructing. The audit enables to spotlight & look at all of the chance areas, critical areas and whether or not the constructing. Wishes immediate interest. It cover the structural evaluation of the present frame and highlight the vulnerable structural regions for static, wind & earthquake loads. If the bldg. Has changed the consumer, from residential to industrial or business, this have to deliver out the impact of one of these alternate. The general fitness and overall performance of constructing relies upon on its pleasant of upkeep. As a constructing grows antique growing older, use (misuse) an publicity to the environment can affect the health of constructing considerably. Consequently it's far advisable to screen it periodically via taking professional opinion structural audit is initial technical survey of building to assess its fashionable fitness as a civil engineering structure. It also includes initiated as the first step for restore that is similar to periodic health check-up endorsed for older

people. Structural audit is based on visual survey by means of equipped consultant who lists his observations and tips in form of structural audit file. The purpose of structural audit is to make sure regular assessment of buildings that the proprietors (coping with committee of corporative housing society) turns into privy to the structural deterioration of their buildings and they are able to make timely measures to restore or improve them. The important observation, possibly purpose of distress, statement on structure are made. Base on observation structural health & tips are given in the structural audit record.

II. REVIEW OF LITERATURE

A. Overview

1) *"A Brief Review on Health Monitoring of Structures"* (Asst. Prof.Khan Junaaid, Shaikh Md. Shakib, Shaikh Mohd. Kasheef, Adeel Ahmed, Humera Anjum) This paper deals to create awareness amongst the civil engineer related to residents, owner, bridge, building towards the health examination of concrete building are nothing but the structural audit. It is overall health performance checkup of building like a doctor examines a patient. It is important to the building to check their safety and they have no risk. Structural audit is important tool for knowing the real status of the old buildings, but the structural audit is for maintenance and repairs of existing structure whose life has exceeded the age of 30 years to avoid damages and save valuable human life. It should also cover the structural analysis of the existing frame and pinpoint the weak structural areas for static wind, & earthquake loads. Civil Engineering Industry is one of the oldest industries which provide a basic infrastructure to all the human beings. Structure can be any kind it can be Historical, Heritage Structure, Residential building, Commercial building or and Industrial building.

2) *"Structural Audit of Residential Building"* (Gourav Sanjay Shinde, Dr.S.J.Arwikar) This review paper covers the study of Structural Auditing of Residential Building .Now a days structural Auditing is necessary because of poor quality of construction , carelessness in supervision during construction ,use of poor quality of materials, carelessness by labours during work because of such reasons the quality of the building goes down and then automatically life of the building goes down.Now a days life of the building comes 60 years from 100 years because of such reasons we need to do Structural Auditing of the building after 15 years to check whether it is safe or not if not then remedial measures to be provided . Now while performing the audit of a residential building and we will conduct non destructive testing on this building like Rebound hammer and ultrasonic Pulse velocity meter test after getting test results we will decide the building is safe or not and if it

is not safe then remedial measures will be provided to increase life of the building.

3) *“Structural Audit: A Case Study of Nasik Residential Building, Maharashtra, India”*

(K.R.Sonawane, Dr.A.W.Dhawale) The life cycle of building can be broadly divide into four phases i.e. architectural planning, structural design ,construction ,maintenance. In most of building at most care is taken in first three cases but maintenance is forgotten. Ignorance to maintenance causes sever structural distress in building over period of time. Most of the building constructed in last 23 to 30 years is in severe structural distress and needs to repair, hence these building needs a periodical survey from structural point of view to asses from structural health. Based on this survey a decision regarding the structural health of building and repair required can be taken. This paper deals with methods of estimating the audit of existing structures whose life has crossed the age of 30 years. Such an investigation can be carried out using the following methods: a) Visual examination b) Non Destructive Testing c) Partial Destructive Testing.

4) *“Structural Audit of Buildings: Perspectives and Challenges in Kenya”*

(Moses Onyango Opiyo) This paper aims at creating awareness amongst the construction stakeholders (Governments, Architects, civil engineers, residents and owners) in the building industry towards the health examination of existing concrete buildings called Structural Audit. The need of structural audit is normally for maintenance and repairs of existing structures whose lives have exceeded the age of 30 years to avoid any mishaps and save valuable human life, however in cases of incessant collapse of buildings as has been the case in Kenya, structural audit becomes mandatory. Concrete is widely used as construction material, because it is cheap, easy to mould in plastic state and has a high strength-cost ratio. More than ever, the construction industry is concerned with improving the social, economic and environmental parameters of sustainability. Since independence, Kenya has witnessed tremendous growth of private investment and infrastructure in construction industry. However many of these buildings have been built without following the due processes. Whereas there are many high-rise buildings whose structural performance is questionable due to age, material deterioration, unexpected over loadings or physical damage some are due to impunity in the construction industry. If further use of such deteriorated structure is continued it may endanger the lives of occupants and surrounding habitation. There is demand of appropriate action on such building structures to improve their performance and restore the desired functions of structures which may lead to increase in their functional life. The periodical structural auditing and diagnosis for health of existing buildings is thus of utmost importance for determining the current serviceability and structural viability of structures. The structural audit should be carried out following standard norms, methods of non-destructive testing and code provisions. The structural auditing will help to weed out death traps in form of habitation and inform maintenance and repair work which will lead to prolonged life of the building and safety of the occupants.

5) *“Structural Audit of RCC Building”*

(Sanket Sanjay Suryawanshi, Vaibhav Vishnu Vishe, Deepak Premchand Sah, Reetika Sharan) Civil engineering is the foundations of all structure which made human life easy. Structure can be of any kind like residential building or non-commercial buildings or historical or ancient monuments had huge impact on human life because of their long life span which made them efficient structure, but this effectiveness of now-a-days structures can't be seen anywhere. Structure are getting older or weak before their design period. In this project where trying to root out faulty mechanism in structure to overcome the failure of structure.

6) *“Structural Audit”*

(Patil S.R, Prof. Sayyed G.A) Civil Engineering Industry is one of the oldest industries which provide a basic infrastructure to all the human beings. Structures can be any kind it can be Historical, Heritage Structure, Residential building, Commercial building or an Industrial building. Every structure has its own service life, and within this service life it should stand firmly on its position. Ex- A Taj Mahal in Agra in India which is one of the oldest structure and a Wonders of the World, and still stand on its position very efficiently. But this not a condition about the today's Structures. A collapsed mechanism has increased and today's Structures are getting collapsed before there service life is completed. Therefore, it is advisable to monitor it periodically by taking a professional opinion. Structural Audit is a preliminary technical survey of a building to assess its general health as a civil engineering structure. It is usually initiated as the first step for repair. In this Project a Root Cause of a faulty mechanism of structure and a preventive measures to overcome a failure of this structures.

7) *“Literature Review on Structural Audit of Various Structures”*

(Yash Agarwal, Prem Upadhyay, Rohan Majgankar, Shubham Gaikwad, Vijay Wairagade) In the recent times, there has been incidents related to various collapse of bridges, buildings. This paper deals with the various factors related with the structural audit of the structures. It has been observed that the structural audit of various mega structures is carried out by the civil engineers. But the audit contains various factors which are not similar for every structure. There are some variations in the auditing process and redevelopment of the superstructure.

8) *“Structural Audit, Repair and Rehabilitation of Building”*

(Rohit Newale, Yogesh Sartape, Ashish Ramane, Shreya Telrandhe, Sachin Vairai, Prof. Girish Joshi) Civil Engineering Industry is one of the oldest industries which provide a basic infrastructure to all the human beings. Structures can be any kind it can be Historical, Heritage Structure, Residential building, Commercial building or an Industrial building. Every structure has its own service life, and within this service life it should stand firmly on its position. Ex- A Taj-Mahal in Agra in India which is one of the oldest structure and a Wonders of the World, and still stand on its position very efficiently. But this not a condition about the today's Structures. A collapsed mechanism has increased and today's Structures are getting collapsed before there service life is completed. Therefore, it is advisable to monitor it periodically by taking a professional opinion.

Structural Audit is a preliminary technical survey of a building to assess its general health as a civil engineering structure. It is usually initiated as the first step for repair. In this Project a Root Cause of a faulty mechanism of structure and a preventive measures to overcome a failure of this structures. The construction material mainly reinforced concrete is being used extensively for various types of construction projects. However, the deterioration of Reinforced Concrete structures is recognized as a major problem worldwide. Apart from requiring regular maintenance, many structures require extensive Repair, Rehabilitation & Retrofitting. Over a period of time, as these structures become older, we find in them certain degradation or deterioration with resultant distress manifested in the form of cracking, splitting, delaminating, corrosion etc. Such deteriorated structures can be rehabilitated and retrofitted by using various types of admixtures & modern repair materials. The paper brings out the present state of concrete structures & the major areas where improvement is needed during its service life stage for sustainable development & also the method of carrying out Repair, Rehabilitation & Retrofitting.

9) "Structural Audit of Buildings"

(A.B. Mahadik, and M.H. Jaiswal) This paper deals to create awareness amongst the civil engineers, residents and owners of building towards the health examination of existing concrete buildings called as Structural Audit. The need of structural audit is for maintenance and repairs of existing structures whose life has exceeded the age of 30 years to avoid any mishaps and save valuable human life. The concrete is widely used as construction material being inexpensive, easy for construction, applications and because of its high strength-cost ratio. More than ever, the construction industry is concerned with improving the social, economic and environmental parameters of sustainability. In India, from 1980 onwards the infrastructure industry witnessed stepping up of public investment and growth in infrastructure industry which results in construction of new multistory concrete apartments which are now in the age of thirty plus years. There are many buildings during this period and earlier have reduced strength in due course of time because of structural deficiency, material deterioration, unexpected over loadings or physical damage. If, further use of such deteriorated structure is continued it may endanger the lives of occupants and surrounding habitation. There is demand of appropriate actions and measures for all such building structures to improve its performance and restore the desired functions of structures which may leads to increase its functional life. The periodical structural auditing and diagnosis for health of existing buildings is thus utmost important for finding the present serviceability and structural viability of structures. The structural audit must be carried out following auditing norms, methods of non-destructive testing and code provisions.

10) "Study on Causes, Effects and Remedial Measures of Building Defects in Case of Public Building Project in Nekemte Town, Ethiopia"

(Ketama Fayera Tolera, M. Vignesh Kumar) Ethiopia was one of the developing countries and many projects are being implemented. Currently, building defects are very common and often arising or spot in the building project, especially in the project which has poor management or supervision in the

construction site This study was conducted to identify types, causes and effects of building defect problems in Nekemte Town. The research design was adopted both quantitative and qualitative framework and case study was used and The study also finds the Types, Cause, Effect and Remedial measure of Building defects in case of Public Building Project in Nekemte Town, In general, the study concludes based on findings in line with each specific objective to improve quality achievement levels in public building project in Nekemte Town. Finally based on the findings the researcher recommends that special attention need to be given to improve building defects in the Nekemte public building project Based on the findings of this study. In addition, the whole construction management process should be improved then cooperation between stakeholders, strict supervision of building projects must be provided and inspection of works executed should be practiced.

III. OBJECTIVES

- 1) To study the types of structural defects.
- 2) To identify any signs of material deterioration.
- 3) To identify any signs of structural distress and deformation.
- 4) To identify any alteration and addition in the structure.
- 5) The Remedies for the restoration of the structure.
- 6) To Repairs & Maintenance of the Structure.

IV. METHODOLOGY

- 1) The Performing preliminary inspection of the residential building.
- 2) The Preparation of architectural, structural plan of the residential building.
- 3) The Visual inspection to highlight critical area.
- 4) The Performance of NDT tests.
- 5) The Finding actual strength of the building.
- 6) The Suggesting remedial measures.

V. DETAILED STUDY

A. General Information of Building –

Name of the Building: " Building No. 1 to 11"

Address: Rajgad Dnyanpeeths Technical Campus, Hostel Building,

Age: about 20-25 years old (as per residents).

Mode of use - Original use and Present use - The said buildings were originally constructed and are presently used as a Hostel Buildings.

B. Site Observation and Photographs

1) Foundation –

Uneven settlement in foundation of the building under reference at ground level is not noticed. Hence, inspection of foundation is not considered necessary and exposing foundation is not insisted. Hence any of the distresses of foundation with respect to following points could not be verified at the time of site inspection.

- 1) Failure of load bearing strata
- 2) Soil consolidation
- 3) Effect of Variation in Moisture Content
- 4) Slope Instability

- 5) Soil shrinkage and swelling
- 6) Settlement due to cavities, vibration and excavation close to foundation
- 7) Soil erosion
- 8) Ground movement or liquefaction of soil (earthquake)
- 9) Plinth Overall condition

2) *Settlement in ground floor flooring*

Settlement in ground level flooring of the building under reference is not noticed.

3) *Condition of surrounding plinth protection*

Plinth protection along all the sides of the said building is not provided.

4) *Structural Members -*

a) *Columns*

Minor and major cracks are noticed in some of the external columns at all the floors. These deteriorated columns shall be repaired by replacing damaged cover by polymer modified mortar.

b) *Beams*

Minor and major cracks are noticed in the deteriorated external beams at all the floors. These deteriorated beams shall be repaired by replacing damaged cover by polymer modified mortar.

c) *Chhajjas*

Chhajjas above the windows are damaged at some locations. It should be replaced by the FRP Chhajjas.

5) *Masonry & Plaster*

Cracks are observed in plaster few locations. The plaster is observed loose at some locations. Hence removal of entire external plaster wherever either algae formation / cracks is noticed or seepage and/or dampness is noticed is recommended. Vegetation growth shall be removed and chemical treatment is to be provided to ensure no recurring vegetation menace.

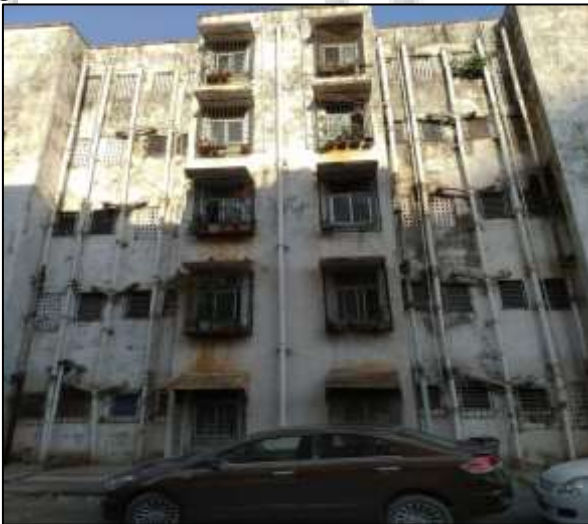


Fig. 1: Distresses in External area, column crack & Plumbing line.

6) *Plumbing -*

Joints / fittings of drainage line and plumbing lines are in damaged condition. The outlet service pipes are damaged at many locations. All the fittings shall be removed and replaced by new ones. Joints in fittings should be properly sealed.

a) *Overloading & Impact*

Water Tanks are provided on the terrace causing ill effects due to overloading & impact.

7) *Abrasion, Wear & tear and fatigue*

The said building is about 40- 45 years old and is poorly maintained. The visible distresses in the said building may be result of wear & tear. Continuous deterioration may be indicating signs of fatigue.

8) *Staircase - Structural Member*

Staircase - Some major spalling in columns and beams are noticed. Major cracks observed on the structural members are showing major distress. The distressed portion of the distressed RCC members shall be repaired by replacing damaged cover by polymer modified mortar. Unevenness in flooring is noticed at some locations. If core spalling of minor surface area (25% or lesser) is noticed, the same shall be repaired by micro-concreting. Otherwise, distressed portion of the slab shall be repaired by replacing damaged cover by PMM. The flooring shall be replaced by new one.



Fig. 2:

VI. TESTS DONE ON THE STRUCTURE TO KNOW THE STRENGTH

- 1) Rebound hammer test.
- 2) UPV (Ultrasonic pulse velocity) test.
- 3) Concrete core test
- 4) Carbonation test.
- 5) Chemical analysis test.
 - a) Chloride test
 - b) Sulphate attack test.
 - c) pH measurement test.

A. *Rebound Hammer Test*

Rebound hammer test is used to check the strength of the structure such as column, beam, etc



Fig. 3: Testing of Rebound Hammer

B. Ultrasonic Pulse Velocity Test (UPV)

Ultrasonic pulse velocity test is used to check the cracks and voids in the concrete structure.



Fig. 4: Testing of UPV

1) Rebound Hammer Test

This test was carried out on 15 points. Out of the same, compressive strength of all samples was found to be more than 10 MPa. The surface compressive strength of these columns is found out to be within a range of 21.60 MPa and not more than 36.30 MPa and the average strength is found out to be about 27.58 MPa.

2) Ultrasonic Pulse Velocity Test

This test was carried out on 15 samples. Out of the same, surface of 2 samples were found to be poor. The ultrasonic pulse velocity of these columns is found out to be within a range of 0.50 Km/S and 2.73 Km/S and the average Ultrasonic Pulse Velocity is found out to be 1.29 Km/S. Due to site conditions, test on all the samples had to be carried out to be by Indirect Method.

Rebound hammer		UPV	
Maximum =	36.30	Maximum =	2.73
Minimum =	21.60	Minimum =	0.50
Average =	27.58	Average =	1.29

Results of Rebound Hammer Test & UPV

C. Concrete Core Test



Sr No	Location	Diameter of core (mm)	Length of core (mm)	Weight (kg)	Crushing load(kN)
1	BN-1-C1	68.00	117.00	1.060	75.60
2	BN-2-C2	68.00	120.00	1.120	68.90
3	BN-3-C1	68.00	123	1.080	42.40
4	BN-4-C2	68.00	125.00	1.096	60.00

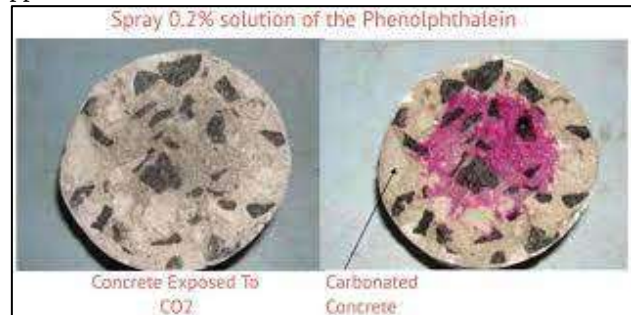
5	BN-5A-Right	68.00	114.00	1.014	49.00
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1) REMARK:

The reference to IS 456-2000, clause 17.4.3, concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 85 percent of the cube strength of the grade of concrete specified for the corresponding age & no individual core has a strength less than 75%.

2) CARBONATION TEST:

Carbonation testing provides a means with which the inspector can determine the extent of carbon dioxide infiltration into the concrete. The process is similar to chloride ion testing where a sample is either removed, either by coring or drilling and the sample is tested by the application of a spray of a revealer.



D. Carbonation Test Result:

SR NO	Location	Member	Observation (Depth in mm)	Method of test/ Reference
1	BN-1A-C1	Column	Surface carbonation found	BS:1881
2	BN-1A-C2	Column	Surface carbonation found	BS:1881
3	BN-2-C1	Column	Surface carbonation found	BS:1881
4	BN-2-C2	Column	Surface carbonation found	BS:1881
5	BN-3-C1	Column	Surface carbonation found	BS:1881
6	BN-3-C2	Column	Surface carbonation found	BS:1881

1) REMARK:

Carbonation depth is accessed by using a solution of phenolphthalein indicator that appears pink in contact with alkaline concrete with pH value in excess of 9 when the concrete is not carbonized.

E. Chemical Analysis Test

1) CHLORIDE TEST

2) SULPHATE ATTACK TEST.

3) PH MEASUREMENT TEST.

- 1) The sulphate attack cause expansion, cracks, strength loss.
- 2) When sulphur enters into concrete, it combines with C-S-H (Carbon-Sulphate-Hydrogen) with concrete paste & begins to destroy concrete.
- 3) Chloride test is used to know the chloride content in concrete which become very significant as when chloride is present in concrete.

- 4) pH measurement test is an important parameter to indicate the alkalinity level of concrete.



A) CHLORIDE TEST



B) SUPHATE ATTACK TEST



C) PH MEASUREMENT TEST

VII. CHEMICAL ANALYSIS OF CONCRETE TEST RESULT:

SR NO	Location	Member	Test Parameter	Unit	Result
1	Bldg A	Column	pH	-	10.25
		Column	Chloride	Percent	0.0141
		Column	Sulphate (SO4)	Percent	0.058
2		Column	pH	-	10.46
Column		Chloride	Percent	0.0171	
Column		Sulphate (SO4)	Percent	0.081	
3		Column	pH	-	9.90
		Column	Chloride	Percent	0.0139
		Column	Sulphate (SO4)	Percent	0.091
4		Column	pH	-	10.61
		Column	Chloride	Percent	0.0123
		Column	Sulphate (SO4)	Percent	0.043
5		Column	pH	-	10.41
		Column	Chloride	Percent	0.0132
	Column	Sulphate (SO4)	Percent	0.071	

A. Test remarks

- 1) Total Chloride contents expressed as Chloride ion content shall not be more than 0.06 % by weight.
- 2) % by weight.
- 3) Total Sulphate contents expressed as SO₃ ion content shall not be more than 0.25 % by weight.
- 4) This certificate should not be reproduced in Part, without permission of M/S. Subduction Zone Consultants.
- 5) The certificate is valid at the time of and under the conditions specified herein

B. Remedial measures

Columns - If surface area of columns is deteriorated more than 30% or the exposed reinforcement show reduction in diameter by more than 25%, the same should be repaired by jacketing, starting from foundation level. Jacketing treatment will have to be carried out right up to footing level. It will be necessitate demolishing adjoining walls up to 1mts to facilitate shuttering and 1sft of adjoining slabs will have to be removed to facilitate proper lapping of reinforcement. Remaining deteriorated columns shall be repaired by replacing damaged cover by PMM. During repairs, column core if found showing major cracks or damaged, shall be made good by using micro- concreting.



Fig. 5: Column Jacketing

C. Beams or lintel

Beams, having spalling of more than 50% surface area, or showing heavy corrosion of main reinforcement such that the diameter of reinforcement area is reduced by more than 1/3rd of its original area or more than 10% of end stirrups are snapped off, the beams should be repaired by jacketing. Jacketing of the beams by micro-concrete is recommended as the same involves minimum invasion in original RCC members. Other deteriorated beams can be repaired by replacing damaged cover by PMM.



D. SLABS

Slabs having exposed area more than 40% or having exposed corroded reinforcement whose diameter is reduced by 20% should be re-cast. If spalling pockets in slabs are noticed (surface lesser than 40%) the same shall be made good using micro-concrete. Other deteriorated slabs can be repaired by replacing damaged cover by PMM.



E. Chhajjas -

Almost all the chhajjas are deteriorated. Those showing minor cracks or spalling shall be repaired by replacing damaged cover by PMM and waterproofing shall be redone. Those chhajjas which are damaged beyond repair shall be carefully removed and replaced by FRP chhajjas.

F. External Paradi -

Some of the external RCC paradi are cracked. If major spalling is noticed i.e. more than 30% of surface, the said paradi shall be carefully removed and replaced by 150mm thick AAC block-work. If minor spalling is noticed i.e. lesser than 40% of surface, the deteriorated portion shall be filled using micro-concrete, else the deteriorated paradi can be repaired by replacing damaged cover by PMM.

G. External Paradi Repairs -



H. Repair of cracked beam / beam showing bulging -

- Remove the cracked concrete cover.
- Clean reinforcement using wire brush, apply "RUSTICIDE" using cotton swab. Remove "RUST" after 24 hours using wire brush.
- Apply rust passivated to reinforcement to arrest further corrosion.
- Remaining distressed beams should be repaired by polymer modified mortar treatment.

I. Internal / External plaster wherever required should be redone.

- Remove existing plaster using electrical chisels to minimise damage to existing wall.
- Brick joints if gets removed should be flush pointed and raked using CM. RCC
- brickwork joint if gets removed, should be packed using metal no. 2 & hand- packed by CM.
- This should be cured for at least 3 days and then let be dried for a day.
- First coat of plaster 12 to 15mm in thickness, in CM 1:4 with water proofing admixture should be applied to the surface. It shall be cured for at least 8 days.
- Sand faced finish shall be provided in second coat 6 to 8 mm in thickness with waterproof admixture, in CM 1:3. It shall be cured for at least 8 days. Scaffolding shall be removed.
- Same procedure for internal plaster is followed except for the same is carried out in single coat of 12 to 15mm thick in C.M. 1:4.

J. Waterproofing of toilet blocks should be removed and redone:

- Existing waterproofing should be removed & cleaned carefully.
- The slab surface should be cement grouted. After saturation, apply base coat of cement: W.P. in (2.5:1) by weight proportion in two coats.
- Brickbats to be used for waterproofing should be pre-wetted for at least 3 days. The pre-wetted brickbats should be fixed in CM 1:4, using waterproof admixture in proper slopes.
- Water permeability is checked by ponding the brickbat surface for at least 7 days. Brickbats cracked / dissolved due to water should be immediately replaced.

K. Cracks in plaster (For minor cracks surface area lesser than 10%)

- The cracked shall be opened in 'V' shape & cleaned properly.

- Apply bond coat of Cement: WP: 1.5:1 by weight.
- Fill the crack using putty like mixture of cement and WP.
- Cure the same for at least 3 days.

L. For repairing major cracks redo plaster

- Remove damaged plaster carefully such that minimum bricks are damaged.
- Bricks should be cleaned properly and watered for at least 24 hours.
- Mortar joints removed if any shall be flush pointed, raked properly. Joint at RCC junction shall be hand-packed using metal no. 2 wedges and mortar.
- The same shall be cured for at least 3 days and allowed to dry for at least 1 day.

M. Repair of Leakage from outside –

- Generally, leakage from outside occurs due to failure of external plaster. Methodology –
- Provide ‘ H’ frame scaffolding.
- Remove external plaster using electrical chisels (It avoids removal of masonry layer).
- If the mortar joints are not properly filled, remove existing joints. Fill the voids by hand-packing cement mortar (C.M. 1:4). If joints between RCC members and masonry are opened, provide metal no. 2 / concrete wedges and hand- pack the same.
- Cure the surface for at least 3 days and allow it to stand for at least 24 hours.
- Apply plaster in two coats, 1st coat 15mm thick, in C.M. 1:4 and 2nd coat up to 8mm thick in C.M. 1:4, using waterproof admixture.
- plaster coat should be cured for at least 10 days.

VIII. CONCLUSION

- The Building is plagued by category four harm.
- The Principle repairs area unit needed at numerous levels
- The repair work ought to begin earliest to avoid more deterioration of the structure.
- All the vegetation ought to be removed at earliest.
- Any delay in structural repair work can end in additional deterioration and amount of labor can become additional.
- Slabs containing fine dormant cracks should be repaired by applying and overlay like chemical compound changed hydraulic cement mortar or concrete or by oxide fume concrete.
- unsound steel should get replaced wherever ever necessary, if steel can't be take awayd then it ought to be clean for remove oxidisation and extra reinforcement is to be provided.
- Minor cracks ought to be repaired by injection of epoxy or by victimization grouting methodology.
- Deteriorated plaster surface should be removed and application ought to be through with mortar proportions 1:4

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