

**CONDITION ASSESSMENT OF BUILDINGS
FOR
REPAIR AND UPGRADING**



Building Inspected Address:
Dhanalakshmi Flats
No.28.Vegavathy Street, Rajaji Nagar,
Villivakkam, Chennai -600 049

Submitted to:
Mr.K.G.Janakiraman
Managing Director
Jayaswathy Constructions (P) Ltd.,
No.36.Kaveri Street, Rajaji Nagar, Villivakkam,
Chennai – 600 049

Prepared under:-
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No.25.Vandiamman Koil Street,
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Chennai – 600107

Introduction:

Mr.K.G.Janakiraman, Managing Director, Jayaswathy Constructions (P) Ltd., has requested for inspection and suggest repair & retrofitting of the building (Residential apartment) at Dhanlakshmi Flats, No.28.Vegavathy Street, Rajaji Nagar, Villivakkam, Chennai -600 049

The purpose of the inspection is to assess the damage and suggest the repair & retrofitting of the building. The site where the apartment located was inspected on 01.06.2018. The inspection of the building carried in the presence of Mr.G.Janakiraman MD, Mr.Jaysrinivasan Director M/s.Jayaswathy Constructions P Ltd., Chennai. Mr.Karthikeyan Retrofitting Contractor was with me during the inspection.

Scope:

The scope of work is to inspect the repairs and suggest the methods of repair and retrofitting the works at site.

About the Repair & as per standards:EXPECTED ECONOMIC LIFE

SNo	Description of Building	Life in Years
1	Monumental buildings	> 100 years
2	Framed Structure	60 Years
3	Load bearing structures	50 Years
4	Semi-permanent building	30 Years
5	Temporary structures	15 Years

CAUSES OF DISTRESS

- Poor workmanship
- Lack of maintenance
- Atmospheric effects abuses
- Accidents or natural calamities

DESIGN DEFICIENCIES

- Account of errors in designing
- Fundamental behaviour of structures
- Inadequate attention to accommodate movements i.e. shrinkage and thermal effects
- Neglecting load expected due to winds, earthquake etc.
- Improper detailing of reinforcements

CONSTRUCTION DEFICIENCIES

In general the construction deficiencies noticed due to the following

Errors in construction practices

Misalignment & misplacing of reinforcement,
inadequate cover during construction

Failure due to construction load

DISTRESS DUE TO CHEMICAL ATTACK

The construction distress may occur due to the following reason.

Alkali aggregate reaction

Sulphate attack

Sea water

attack Acid

attacks

Efflorescence

Corrosion of

reinforcement Freezing &

Thawing Biological

Corrosion

NEED FOR REPAIR, RESTORATION & RENEWAL ENGINEERING (3 R's)

Repair: Restoration of structure to good or sound conditions

Restoration: Returning to a normal or healthy conditions of concrete structure

Renewal: Renovation or restoration with the creative application of scientific principles

INVESTIGATIONS







VISUAL INSPECTION






We have carried out detailed visual inspection and investigation, the distressed structure inspected visually, specially the joints, nature of distress i. e. Cracking, deflection & other valuable information which may find relevance while going for NDT evaluation.







VISUAL OBSERVATION


The following observation noticed at site.

SNo	Photo Taken at site with remarks	
1		<p>Finding: Crack in south west corner of the building noticed – crack runs from window corner and runs to ground. Crack noticed on either side of the wall.</p> <p>Reason: May be due to column settlement due to improper filling in column sides or due to tree roots which is near to the compound wall.</p>

2		<p>Findings: No settlement Noticed at site. But horizontal cracks noticed. This may be due to corner settlement of column.</p> <p>Reason: This may be due to corner settlement of column.</p>
3		<p>Findings: No settlement noticed</p>
4		<p>Findings: Vertical cracks noticed in the window centre on both side of wall on the corner window only. Other windows no cracks not there.</p> <p>Reason: Corner column settlement, due to which it started giving open in the window bottom.</p>
5		<p>Findings: Vertical separation cracks noticed between column and wall. But the Crack width is less and repairable.</p> <p>Reason: This is only due to corner column settlement.</p>
6		<p>Findings: No settlement noticed.</p>
7		<p>Findings: Horizontal cracks noticed below lintel and runs through the half of the wall portion. Crack width is less and repairable.</p> <p>Reason: This is only due partial settlement of corner column.</p>

8		<p>Findings: Ceiling Dampness noticed and plaster falling noticed</p> <p>Reason: This is may be due electrical pipe where exposed outside the building and rain water may enter through the pipe causing dampness or leakage from roof top due to wash water.</p>
9		<p>Findings: No settlement Noticed.</p>
10		<p>Findings: Minor surface cracks noticed</p> <p>Reason: This is only plastering surface cracks due to weather condition and quality of plastering but repairable.</p>
11		<p>Findings: Minor Arch surface cracks noticed</p> <p>Reason: This is only plastering surface cracks due to weather condition and quality of plastering but repairable.</p>
12		<p>Findings: Major surface cracks noticed in the wall corner with width of the crack is more.</p> <p>Reason: This is only due to improper joining in the wall and column joint but repairable with pressure grouting technique.</p>

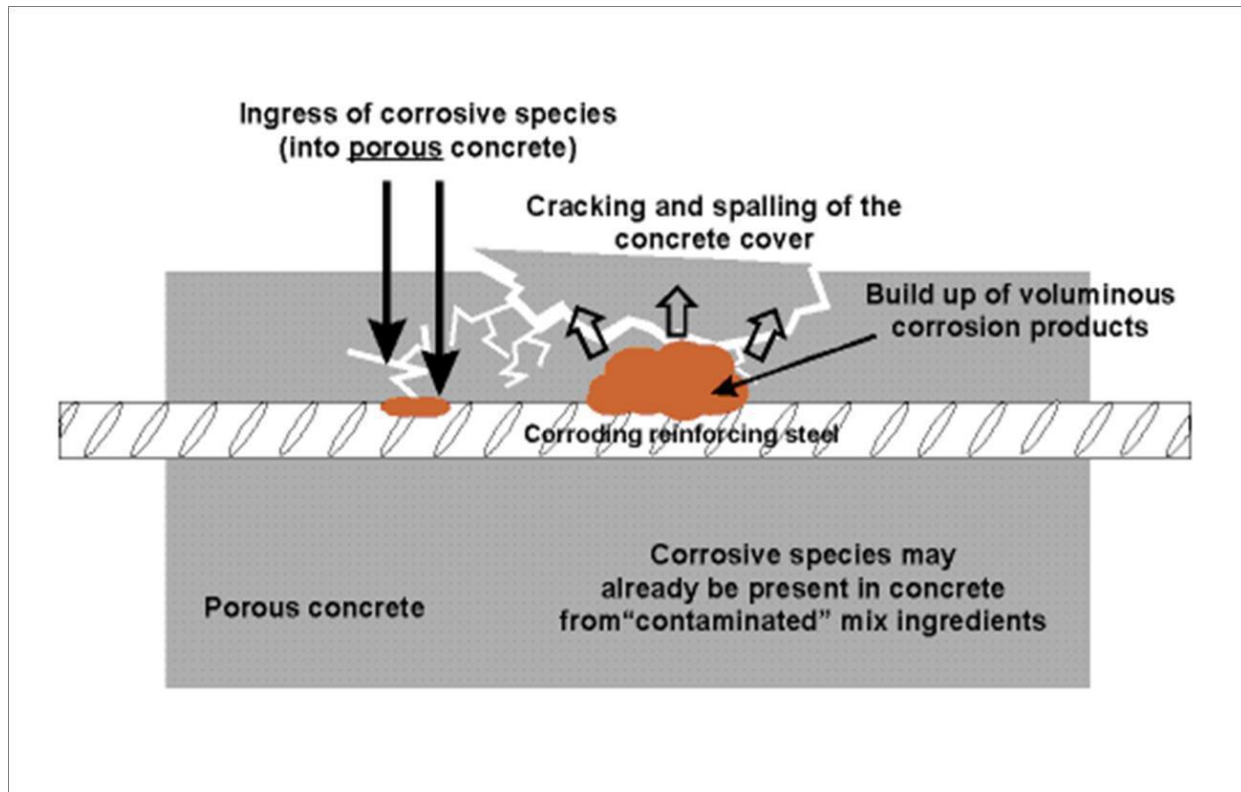
13		<p>Findings: Both ceiling and wall cracks noticed in one of the room inside.</p> <p>Reason: This is only due to improper joining in the wall and column joint but repairable with pressure grouting technique and ceiling after correcting the roof top portion suitably.</p>
14		<p>Findings: Lintel bottom horizontal cracks noticed in one of the room inside only.</p> <p>Reason: This is only due to improper joining in the wall and Lintel joint but repairable with pressure grouting technique and stitching method.</p>
15		<p>Findings: Ceiling Dampness noticed and plaster falling not noticed, plastering intact.</p> <p>Reason: This is may be due leakage from roof top due to wash water.</p>
16		<p>Findings: Ceiling Dampness noticed and plaster falling not noticed, plastering intact.</p> <p>Reason: This is may be due leakage from roof top due to wash water.</p>
17		<p>Findings: Wall cracks noticed in the 4 ½ “wall supported in rack in one of the room inside.</p> <p>Reason: This is only due to improper joining in the wall and slab joint but repairable with pressure grouting technique suitably.</p>
18		<p>Findings: Wall cracks noticed in the 4 ½ “wall supported in the room inside.</p> <p>Reason: This is only due to improper joining in the wall or construction of 4 ½ “wall joint but repairable with stitching grouting technique suitably.</p>

19		<p>Findings: Wall cracks noticed in the 4 ½ “room wall.</p> <p>Reason: This is only due to improper construction but repairable with stitching or grouting technique suitably.</p>

Note: No testing equipment used to test the defects, as the repair noticed are common in nature. Also the life of the building served more than 20 years. All these defects are not sudden or new all are old and happens in the years passed. Now this is required to be repaired to strengthen the structure.

No corrosion of rods noticed except in column in the south west corner and the suggested treatment to be done during repair. But the building repair needs to be periodically checked and repaired once in 5years regularly to increase the life of the structure.

Corrosion due to reinforcement is shown below.



Repair Methodology:

Restoring & preserving Passivity.

Restoration of damaged reinforced concrete Consolidation of columns, beams by pressure grouting low viscous epoxy.

Jacketing of columns using micro concrete Wrapping & coating with carbon fibre.

Finally protective coating on the surface.

PRODUCTS USED

Rust converter / cleaner: Converts the rust on the reinforcement to a protective chemical barrier & dissolve the ferric oxide.

Corrosion inhibitor: Slows down the corrosion reaction in the concrete & help in regain its alkalinity by creating a passive film Zinc rich epoxy coating: Two component system used as an inhibitive epoxy primer used in coating of reinforcement.

Low viscous epoxy for grouting: For dandify the concrete; consolidate the structure by filling up the voids, fissures & capillaries.

EPOXY BASED BONDING AGENT: For bonding between Old & New Concrete. MICRO CONCRETE: High strength self-levelling free flowing concrete used for strengthening by Jacketing various places to minimize the porosity & Enhancing the density. ACRYLIC POLYMER:

CURING COMPOUND: FOR COLUMNS

POLYURETHANE BASED CLEAR COATING: TO MITIGATECORROSION

MICRO CONCRETE

Characteristics

W/p ratio 0.14 -0.16

10mm down size 25% (Max)

Comp strength 2

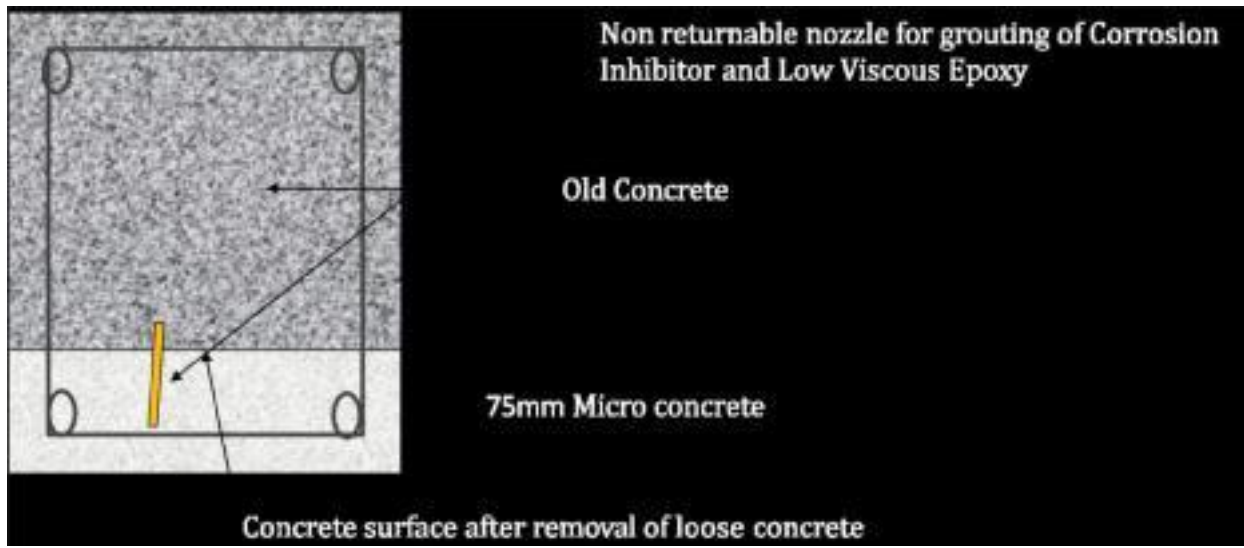
24 hrs

220kg/cm

380kg/cm²

REPAIRS TO COLUMNS

In case the distress at the location is restricted to single face no jacketing will be required. Repair be carried out as given in sketch



REPAIR TO COLUMNS

If the distress is more than on face of a column and reinforcement is corroded less than 20% no new reinforcement is needed only Jacketing is required.

JACKETING OF COLUMNS



TREATMENT OF COVER & REINFORCEMENT IN PROGRESS



TREATMENT WITH CORROSION INHIBITOR IN PROGRESS



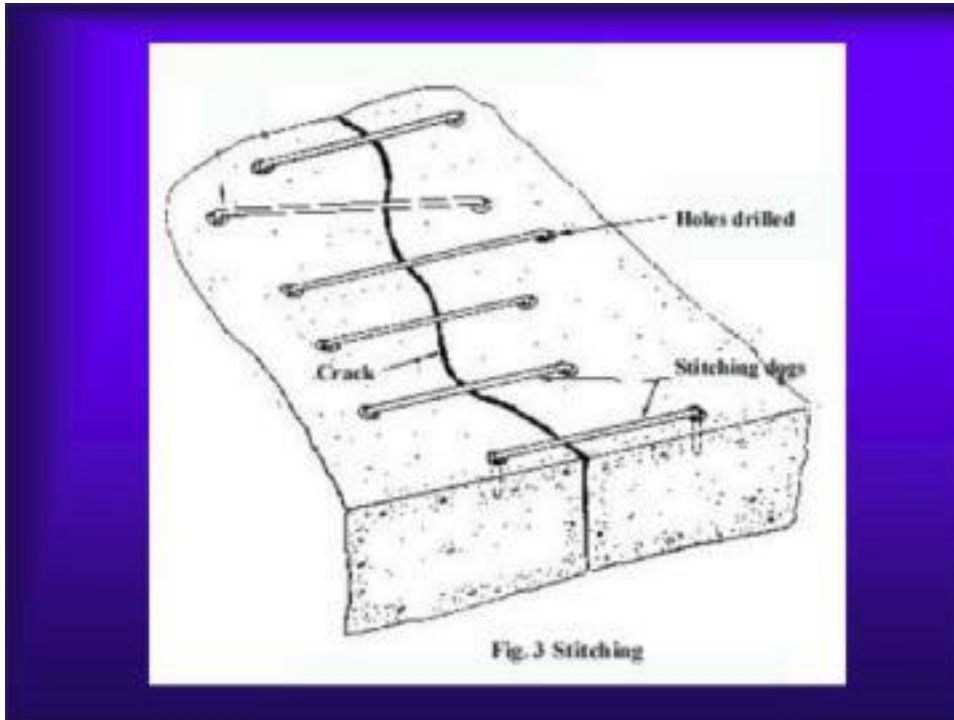
REBARING IN PROGRESS



CONSOLIDATION OF COLUMNS, BEAMS BY PRESSURE GROUTING LOW VISCIOUS EPOXY.



Stitching Method of repair:



- if necessary, strengthen adjacent areas of the construction to take the additional stress
- The stitching dogs should be of variable length and/or orientation and so located that the tension transmitted across the crack does not devolve on a single plane of the section, but is spread out over an area
- In order to resist shear along the crack, it is necessary to use diagonal stitching
- The lengths of dogs are random so that the anchor points do not form a plane of weakness

Large cracks and crushed material

Groove joints Cement mortar — and flat stone chips

Cement mortar and flat-stone chips placed as filler in wide cracks

For cracks wider than 6mm and where brickwork or concrete is crushed, the following procedure is suitable:

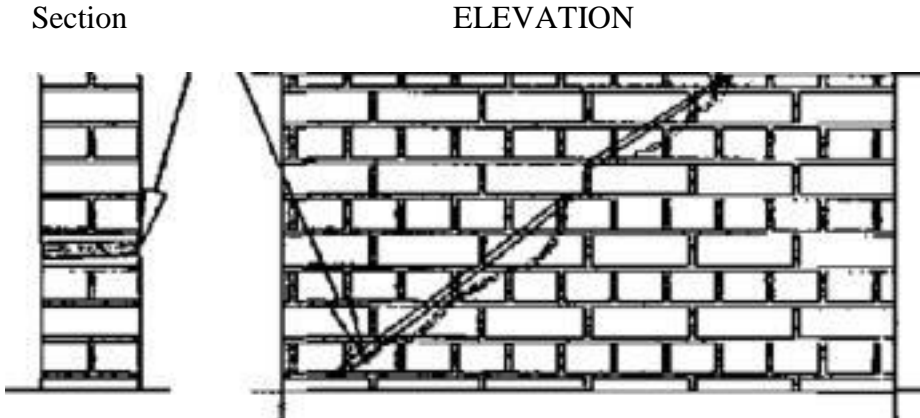
- (a) Loose material in the crack is removed and any of the repair mortar mentioned in Table 2 is filled.
- (b) If necessary the crack is dressed to have a "V-groove" at both faces.
- (c) A places where cracks are wide fillers like flat stone chips can be used
- (d) Additional shear and/or flexural reinforcement are provided in the location of the repairs based on structural necessity.
- (e) The added steel has to be protected properly by sufficient polymer mortar to prevent it from

Corrosion.

(f) In case of walls or roof slabs additional mesh reinforcement is included either on one or Both sides. This mesh reinforcement is generally nailed, tacked and tied by binding wire.

(g) To prevent widening of the cracks they can be stitched

Groove joints Cement mortar — and flat stone chips



Cement mortar and flat-stone chips placed as filler in wide cracks

Conclusion & Recommendation:

- The structure is not in distress condition. It has served the life of around 20 years and since it was not maintained regularly the repair work has got increased. But now this required to be addressed immediately.
- The tree roots may cause damage to the structure near to the compound wall – this may be removed and re plant suitable plant which is not affecting the wall near to the structure.
- The present condition is repairable subject to use of above methods for correction and rectification suitably at site.
- The south west corner floor to be grouted with lime mortar injection to avoid further settlement near the column or 2 pile required to be driven diagonally and 'I' beam to be supported below the plinth beam but this is very difficult to execute as the pile driving is difficult. Hence lime power grouting is sufficient to stop further settlement any in the south west corner.
- In arch crack suggested to insert lintel with 'C' channel horizontal in the roof bottom or the arch may remove and regular entry is advised.
- The quantum of material required and estimate for the work is difficult as the cracks and settlement area to be addressed based on the site condition.
- It is suggested to do the work with your labour and mason but under the guidance and supervision of any applicator / repair contractor at site to economise the cost of repair.
- Mr.Karthikeyan who has visited to your site has worked with many repair work as contractor and engineer, he has also agreed to assist you in completing the work. You may also contact him for further discussions to start the work at site immediately.
- The different materials required is given in the annexure for the repair works for ready reckoner.

K.Sundarapandian
Chartered Engineer & Valuer
Project Management Consultant

Different types of hand applied mortars

Si. No.	Defect	Repair mortar type	Properties
1	Minor surface Defect	A two pack polymers modified cementitious screed.	Gives a fair face finish. Good water proffing properties. Resist acids and gases.
2.	Surface cavities and honeycombed concrete	Highly adhesive, thixo-tropic mortar	Water proof and anti-carbonation finish. Good resistance to pollution. ,
3.	Powdery surfaces	A two components surface stabilizer	Binds powdery surfaces and evens out absorption characteristic.
4.	Surface protection	Resin rich water based elastic co-polymer	Highly resistant to CO2 diffusion and self cleaning.
5.	Surface barrier	A water based co-polymer	Resistant to fungal attack. Easily applied elastic compound and
6.	Non-structural cracks	Non shrinking polyol filler	cures at low temperature
7.	Minor voids of approximate size 50 X 50 X 50 mm	Rapid curing polymer modified cementitious co-polymenr	High Strength when compacted in layers
8.	<i>Major voids approximate size 100x100x100mm</i>	<i>Heavy duty thixotropic fiber reinforced polymer modified cementitious mortar.</i>	<i>Can be applied up to 100mm thick. Easy to mould.</i>
9.	<i>Bonding agent</i>	<i>Polymer modified cementitious surface impregnant.</i>	<i>High penetration into porous concrete creating enhanced adhesion</i>
10.	Protection of steel reinforcement	A highly alkaline two component system of cementitious powder and polymer dispersion which react chemically to passivate steel	

