



## SADHANA EDUCATION SOCIETY'S

(Registered under society's act of 1860 & Bombay Public Trust Act 1950)  
Linguistic (Gujarati) Minority

# L. S. RAHEJA COLLEGE OF ARTS & COMMERCE

Estd : 1980

Relief Road, Santacruz (W), Mumbai - 400 054.

Tel.: 2660 9320 / 2661 4101 | E-mail: degree.office@lsraheja.org / principal@lsraheja.org

Website : www.lsraheja.org

### 6.2 Strategy Development and Deployment

#### 6.2.1 The institutional Strategic/ perspective plan is effectively deployed

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**Dr. Debajit N. Sarkar**

**(Principal)**





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## 6.2 Strategy Development and Deployment

### 6.2.1 The institutional Strategic/ perspective plan is effectively deployed

Sr. No.	Particulars	Reference Links
1.	Strategic Plan	<a href="https://www.lsraheja.org/wp-content/uploads/2022/01/Strategic-Plan.pdf">https://www.lsraheja.org/wp-content/uploads/2022/01/Strategic-Plan.pdf</a>
2.	Academic & Administrative Audit Report	<a href="https://www.lsraheja.org/wp-content/uploads/2021/05/Academic-and-administrative-Audit-for-2016-17-to-2018-19.pdf">https://www.lsraheja.org/wp-content/uploads/2021/05/Academic-and-administrative-Audit-for-2016-17-to-2018-19.pdf</a>
3.	Gender Audit Report	<a href="https://www.lsraheja.org/wp-content/uploads/2021/05/Library-Audit-for-2016-17-to-2018-19.pdf">https://www.lsraheja.org/wp-content/uploads/2021/05/Library-Audit-for-2016-17-to-2018-19.pdf</a>
4.	Green Audit Report	<a href="https://www.lsraheja.org/wp-content/uploads/2021/10/Green-Audit-2019-2020.pdf">https://www.lsraheja.org/wp-content/uploads/2021/10/Green-Audit-2019-2020.pdf</a>
5.	Energy Audit Report	<a href="https://www.lsraheja.org/wp-content/uploads/2021/10/Energy-Audit-2019-2020.pdf">https://www.lsraheja.org/wp-content/uploads/2021/10/Energy-Audit-2019-2020.pdf</a>
6.	Library Audit	<a href="https://www.lsraheja.org/wp-content/uploads/2021/05/Library-Audit-for-2016-17-to-2018-19.pdf">https://www.lsraheja.org/wp-content/uploads/2021/05/Library-Audit-for-2016-17-to-2018-19.pdf</a>

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**Work Order**

<b>M/s MasterSoft ERP Solutions Pvt. Ltd</b>	Order No:
Kind Attn. :- Ms. Poonam Nathani Contact no.:- +91 8888843104	Order Date: 08-06-2020
	E-Mail. <a href="mailto:poonam@iitms.co.in">poonam@iitms.co.in</a> , <a href="mailto:gaurav.somani@iitms.co.in">gaurav.somani@iitms.co.in</a>
Billing Address:	Quotation Date: 24-02-2020
SES L. S. Raheja College of Arts & Commerce, Relief Road, Santacruz (W), Mumbai - 400054	1456-A, Opp. Pandav Polytechnic College, New Nandanvan, Nagpur-440009 (MS) India
Sadhana Education Society.	Sanction:
Contact Person of SES :	Remarks :

**COMMERCIAL OFFER**

**OPEX MODEL: PER STUDENT BILLING WITH ONE TIME SETUP**

**Initial Setup Cost: One Time**

S.N.	Description	Amount (Rs.)
1.	<b>One Time Setup Cost</b> Society, Institute Creation & Reports Setup, Configuration & Implementation Functional Alignment Data Migration from Standard Excel Format (For Live Students Only) Integration of Payment Gateway SMS & Email Integration Onsite Training & Service Support 25,000 SMS Complimentary Mobile Application Integration with 3 <sup>rd</sup> Party – Tally Modules as mentioned Above 'In Scope'	2,50,000/- + Taxes (*)

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### Follow-on Billing: Per Student Per Annum

S.N.	Description & Billing Units	Cost (Rs.)
<b>2.</b>	Per Student Per Year Applicable from <b>Academic Session 2020-21</b>	
<b>a</b>	Online Application – per applicant	
	<b>For all Admitted Students and Faculty / Staff (Users)</b> <input type="checkbox"/> <b>Academic Management System</b> o Online Application and Fees Collection o MIS Reports o Students Administration(TC/LC) <input type="checkbox"/> <b>Timetable &amp; Student Attendance – App Based / Bio Metric Based</b> o Online Application and Fees Collection o Student Time Table o Teachers Time Table o Attendance – daily, monthly, teachers load <input type="checkbox"/> <b>Examination Management</b> o As per Mumbai University Examination– FY & SY o Junior College – As per board (HSC) <input type="checkbox"/> <b>Mobile Applications</b> <b>b.</b> o Students o Staff	<b>150/- +Taxes</b>
<b>c.</b>	<input type="checkbox"/> <b>Learning Management System (ITLE)</b> o Syllabus, Teaching Plan and Lecture Notes o Assignments & Announcements o MCQ and Descriptive Test o Assessments o E-Library and Discussion Forums <input type="checkbox"/> <b>Accreditation Data Management System</b> <input type="checkbox"/> For NAAC and IQAC	

#### Minimum Contract Period

- 12 Months from the month of On boarding the Users and renewal based on performance appraisal of the Software
- Exit Clause Minimum 6 month Notice period and Continued Service Support for the Period and smooth handover of data to the Institute.

#### PAYMENT MILESTONE

##### First Year

- **Initial Setup cost** with Purchase Order and Signing the Agreement
- Annual Advance Payments of Per Student Per Year
- Hardware Cost 50% Advance with Purchase Order and rest on delivery.
- All Payments to be released inclusive of Applicable Taxes (GST)

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### **Subsequent Years**

- Annual Payments of Per Student Per Year in the midterm ie month of December

### **Configurations & Changes**

- All changes like Configuration of Group/ Trust Logo, Reports like ID card, Students
- Sections like Certificate...
- E-Learning Video Lectures and all the attachment submitted by students will be saved on local static server of the Institute. The Cloud ERP will refer these videos whenever there will be lectures.
- The detailed training and deployment activities will be at Institute Central Location.
- Payment integration will be with Bill Desk / Tech Process / Atom / Razor pay Payment Gateway etc.
- All required configurations and customizations will be completed in 02-03 Months.
- Regular backup of data in desired format on their local servers
- Data Privacy will be respected by MasterSoft and Solution IPR will be respected by the Institute to be defined in SLA.
- Customizations in Cloud will be on-going and as per priorities set mutually.

### **PRICING ASSUMPTIONS**

- Any Hardware required for onsite support is not included in the proposed costs.
- Modules other than those mentioned in the Scope are not considered and will be quoted extra if required in future.
- IT infrastructure support for Onsite Team such as office space, workstations, servers, communication links, email, printing, faxing and scanning facilities etc. will be responsibility of Institute.
- Users will be given user training for their respective modules and to make them understand the processes. As per requirement we will also support through online tools from our Head Office for extending our best support.
- Institute will ensure that the key personnel are available during initial Demonstrations and Training Sessions at Unit Level to be organized Centrally and at Institute Level

### **Ship-to: L. S. RAHEJA COLLEGE OF ARTS AND COMMERCE**

### **GENERAL TERMS AND CONDITIONS**

**ESCALATION:** The prices are firm and fixed till the completion of entire work without any escalation due to any reason.

**MODIFICATION OF PURCHASE ORDER TERMS AND /OR AMENDMENTS:** The PO may only be Modified or amended upon mutual agreement of Sadhana Education Society and The Vendor Additional terms and conditions, which do not conflict with the Purchase Order, may be stated with in the Supplemental Purchase Order and given effect. Changes, modifications, waivers, additions or amendments to the terms and conditions of this Purchase Order shall be binding on Sadhana Education Society only if such changes, modifications, waivers, additions or amendments are in writing and signed by a duly authorized representative of Sadhana Education Society.

**TITLE, RISK OF LOSS:** Title shall pass to Sadhana Education Society only on the

Programmes Offered : Aided : F.Y.J.C. & S.Y.J.C. - Arts And Commerce, B.  
Self Finance : B.M.S., B.A.F., B.B.I., B.Sc. IT, B.F.M., B.M.M & M.Com. Research Centre For Comm

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receipt of goods at destination. Risk of loss of all goods shall remain in **MasterSoft ERP Solutions Pvt. Ltd.** (Hereinafter called the Vendor) until receipt by Sadhana Education Society at destination, unless otherwise specified in this Purchase Order.

**TERMINATION FOR CAUSE:** Sadhana Education Society may issue a written notice of default to the Vendor upon the occurrence of a material breach of any covenant, warranty or provision of this Purchase Order arising here under. If the Vendor fails to cure said default within the time frame allowed, the Sadhana Education Society may, at its option and in addition to any other remedies it may have available, cancel and terminate this Purchase Order.

If supplier fails to deliver the goods / services within the stipulated time, the buyer has the rights to cancel the purchase order.

**ENTIRE AGREEMENT:** This agreement shall include the Purchase Order, these General Terms and Conditions, and all attachments referred to in the Purchase Order or in these General Terms and Conditions, and it shall constitute the entire agreement of the parties with regard to the subject matter contained herein. All other prior or contemporaneous representations, warranties, covenants, or agreements between The Vendor and Sadhana Education Society, or their representatives, or any other document forming part of the solicitation of quotes, negotiations & discussions between the Vendor and Sadhana Education Society with respect to the subject matter are here by superseded. Unless superseded by a specific signed agreement between Sadhana Education Society and the Vendor and to the extent that such agreement specifically rejects any terms and conditions in a Purchase Order, the terms and conditions of such agreement shall prevail over this Purchase Order or these General Terms and Conditions.

**ARBITRATION:** The parties shall make good faith efforts to first resolve internally any disputes by escalating it to higher levels of management. After thirty(30) days have elapsed from the initiation of such good faith efforts, any continuing dispute, controversy, or claim arising out of, relating to, involving, or having any connection with the Agreement or otherwise shall be exclusively and finally settled by arbitration in accordance with the Indian Arbitration and Conciliation Act 1996. It is agreed that in case of any dispute between Sadhana Education Society and the Vendor the Sadhana Education Society will nominate an Arbitrator with the mutual consent, and the matter shall be resolved in terms of the Arbitration and Conciliation Act 1996, including any modification or re-enactment there of enforce from time to time. The venue of Arbitration will be at Delhi and the decision of the Arbitrator shall be final and binding on both parties.

**JURISDICTION:** Parties agree to submit to exclusive jurisdiction of Courts at Mumbai only.

**CONFIDENTIALITY :** **DATA WILL BE THE SOLE PROPERTY OF SADHANA EDUCATION SOCIETY ON LOCAL SERVERS, CLOUD SERVER AND OR IN FORM OF MEDIA. MISUSE OF THIS DATA WILL BE PUNISHABLE UNDER IT ACTS.** Each party may be given access to information (intangible form, or which is demonstrated, displayed or disclosed orally) identified by the disclosing party as confidential information or reasonably understood to be of confidential or proprietary nature ("Confidential Information"). Confidential Information may only be used by the receiving party in connection with this Agreement and may not be copied or reproduced without the disclosing party's prior written consent. The receiving party agrees to protect the Confidential Information of the disclosing party in the same manner that it protects its own proprietary and confidential information of like kind, but in no event will it exercise less than reasonable care. Access to the Confidential Information shall be restricted to

  
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Buyer and the Vendor or personnel with a need to know and engaged in a use permitted hereby. The receiving party shall give prompt notice to the disclosing party of any unauthorized use or disclosure of Confidential Information. The restrictions set out above shall not apply to any Confidential Information (including, but not limited to, ideas, concepts, know-how, techniques, and methodologies) which is (i) previously known to it without an obligation of confidence, (ii) independently developed by or for it, (iii) acquired by it from a third party which is not, to its knowledge, under an obligation of confidence with respect to such information, or (iv) which is or becomes publicly available through no breach of this Agreement. If either party receives a validly issued administrative or judicial order or process demanding Confidential Information of the other party, it shall promptly notify the other of such receipt and tender to it the defense of such demand. After providing such notification, the party receiving the order or process shall be entitled to comply with it to the extent permitted by law.

The Vendor will not use the name, logo, mark, or other identifying marks of the Buyer without Buyer's prior written consent.

**ANALYTICAL REPORT:** - Specification book-let or test report is to be submitted for items, wherever applicable and approved by Chief Editor.

**FORCE MAJEURE:** Neither party shall be liable for the non-performance of its obligations under this Purchase Order where such failure is due to Force Majeure i.e., due or attributable to any Act of God, orders, restrictions or regulations of Government (Central or State), War, working conditions, hostilities, riots, civil commotion, strike, lockout, layoff, trouble, explosion, or any other cause or circumstances whatsoever which are beyond control. In case any Force Majeure event continues for more than 7 days, the Sadhana Education Society may terminate the Agreement forthwith without any charges or compensation

#### INDEMNIFY CLAUSE:

The Vendor here by indemnifies and undertakes to keep the Sadhana Education Society, its employees, directors and representatives at all times indemnified and compensated against any acts of omission, negligence, fraud, dishonesty, violation of or non-compliance with laws, breach of warranty or misconduct of itself or its personal deployed for providing services to the Sadhana Education Society. The Sadhana Education Society shall not be liable to pay any damages or compensation to such persons or to third party as a result of such acts. The Vendor shall bear all such claims, levies, penalties, damages, fines etc. that may arise due to accident or violation of any statutory provisions, whether due to negligence on the part of The Vendor or their authorized representative. The Vendor shall indemnify Sadhana Education Society and rendered harmless from any such liability or penalty that may arise.

**EXTRACHARGES:** No charges for extras or for cartage or boxing or storage will be allowed unless the same has been agreed upon in writing by Sadhana Education Society. All goods must be forwarded in accordance with Sadhana Education Society, shipping instructions; otherwise the difference in freight rate will be charged to the Vendor.

**SUBSTITUTIONS:** No substitution of materials or accessories may be made without written permission from Sadhana Education Society.

**INDEPENDENT CONTRACTOR:** Each party contracts as an independent contractor and nothing in this Agreement creates or shall be deemed to create partnership, joint venture or similar relationship between such parties.

The Vendor has to sign, date and stamp, copy of the Purchase Order as a token of his acceptance in entirety and returns the same to Sadhana Education Society within two

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days; else the same will be deemed to have been accepted and will become legal binding on either party. By accepting this Purchase Order, and / or performing here under, the Vendor agrees to comply fully with the terms and conditions of purchase set forth in this document. Acceptance of this Purchase Order is expressly limited to the terms and conditions of this Purchase Order and none of the Vendor terms and conditions shall apply in acknowledging this Purchase Order or in the acceptance of this Purchase Order.

In case of any violation or dispute with regard to the terms of this Purchase Order the Sadhana Education Society's decision shall be final.

**Shri. Shripad Tamhane**  
CAO

**Sadhana Education Society**

**(Dr. Debajit Sarkar)**  
Principal

**L. S. Raheja College of Arts  
& Commerce**

I / we accepts the above terms & conditions.



*P. Benale*



**(Name & SIGNATURE OF VENDOR)**



# Structural Audit Report

L.S.Raheja College of Arts & Commerce,  
Juhu Road,  
Santacruz (West),  
Mumbai 400054.

April -17



Raje Structural Consultants

PRECISE ENGINEERING. REMARKABLE STRUCTURES.

Job No.-  
HMR/NDT/17/21

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# INTRODUCTION

## INTRODUCTION

### 1.1 BACKGROUND

As per the work order ref No.SES/2016-2017/HMR we are appointed to carry out structural audit for Sadhana Education Society located at Santacruz, Mumbai-54

### 1.2 SCOPE OF WORK

The scope of work is summarized as follows.

#### 1. Non Destructive Tests includes the following

- a) **Rebound Hammer Test** – To Identify the Surface Characteristics with Guidelines on Strength.
- b) **Ultrasonic pulse velocity test** - To assess the Strength of Concrete, Honeycombing & the Cracking Pattern, etc.
- c) **Carbonation Test**- To Observe the Initiation process of Carbonation.
- d) **Corrosion Test**- To check the probability of corrosion in Reinforced Concrete Section.

#### B.] Carrying out Structural Audit- Visual Survey, NDT Test & Distress Mapping:

- a) Carrying out Visual Survey and preparing distress mapping drawings.
- b) Photograph of distress members.
- c) NDT test results.
- d) Conclusion & Recommendations.

### 1.3 FIELDWORK

The fieldwork was carried out on **23<sup>rd</sup> March 2017**. The work began with the marking of Column and beam positions on the copy of drawing sheet. This was necessary to divide the structure into a grid and facilitate ease in working.

## 1.4 OFFICE WORK

The office work comprised of the following works,

1. Design Engineers carried out the detailed and systematic analysis of the works being carried out on the field by NDT assistants and Site Engineers.
2. Compilation of all the data and preparing the report for the same.

## 1.5 HISTORY

The said structure is RCC framed structure ground plus two upper floors with part terrace constructed around **50years**. Approximately crossed life of fifty years. The said building is an educational institute.

The visual survey has been carried out for the following,

1. To observe the quality of concrete in columns, beams and slabs.
2. To observe the defects or distress occurred due to weathering conditions over the period.

  
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# METHODOLOGY

## METHODOLOGY

### 2.1 VISUAL SURVEY

The structure being a R.C.C. framed structure was investigated grid to grid for ease in observations. Each Column, Beam and Slab within the section was observed for a range of defects such as cracks, seepage. These defects were noted on the observation sheets, which formed the bulk of the data collected.

The basis on which the observations were made is given below.

1. The de-lamination that had taken place in the brick/ RCC walls and the R.C.C columns and beams.
2. The cracking pattern, was observed & its type – whether there were separation cracks between masonry walls and the columns.
3. Special attention was given towards the cracking pattern observed on Columns, Beams, and Slabs.

### 2.2 TAPPING

Column, Beam and Slab was subjected to tapping. This gave a clear picture about the status of the member subject to tapping. Members in sound condition gave a clear ringing sound while the member, which was in stage of deterioration, gave a hollow sound. The members, which gave hollow sound, were recorded and would be taken up for repairs.

### 2.3 INSTRUMENTATION

Three Tests were carried out on select Columns, Beams & Slab to get a clear picture about the strength of the RCC framework.

**REBOUND HAMMER TEST** to give a picture of the surface strength of the Reinforced Concrete section.

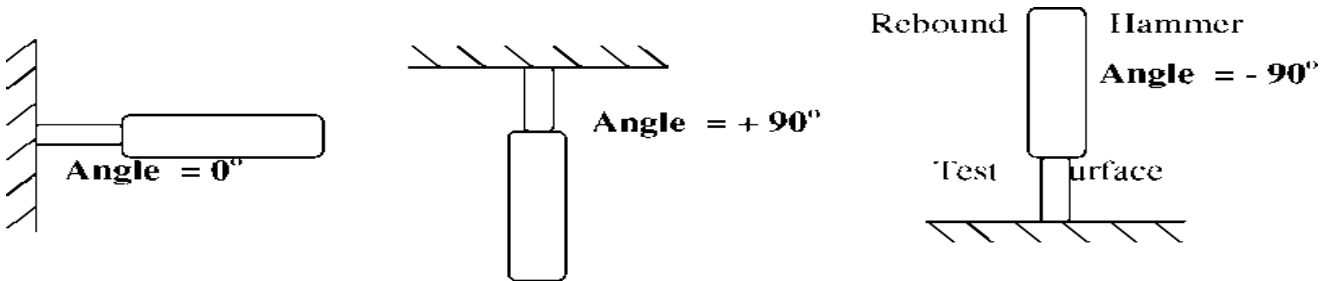
**ULTRASONIC PULSE VELOCITY METHOD (UPV)** to test the integrity and depth of defect in a Reinforced Concrete section.

**CARBONATION TEST** to Observe the Initiation process of Carbonation.

**CORROSION TEST** to check the probability of corrosion in Reinforced Concrete Section.

### SURFACE STRENGTH PROFILE – REBOUND HAMMER METHOD

The hammer is principally a surface hardness tester. The principle is that when a spring-loaded shaft strikes a surface its rebound is a function of the hardness of the surface. The force on the shaft and its rebound are developed and measured by the hammer. The operations are very simple. They consist of releasing the plunger from locked position by pressing gently against the hard surface and check for zero setting of rebound number indicator on the graduated scale. The hammer is then strongly pressed against the surface under investigation this releases the spring load weight, which strikes the plunger and causes the impact.



### INTEGRITY TESTING; ULTRASONIC PULSE VELOCITY METHOD (UPV)

It is known that speed of a sound wave varies with the density of its propagation. Concrete it is a medium through which ultrasonic pulse is made to propagate. The pulse is sent through a transmitting transducer acoustically coupled with the surface and is received by a similar transducer placed in position. The time elapsed from transmittance to receipt of pulse is measured in microseconds and displayed on LCD display of ultrasonic pulse tester. The pulse velocity is calculated by expressions,

$$\text{Pulse Velocity} = \frac{\text{Pulse travel path}}{\text{Pulse travel time}}$$

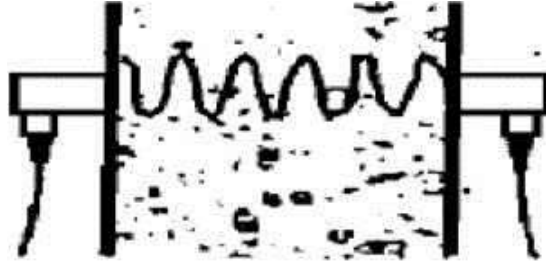
Is converted to m/sec or Km/sec

  
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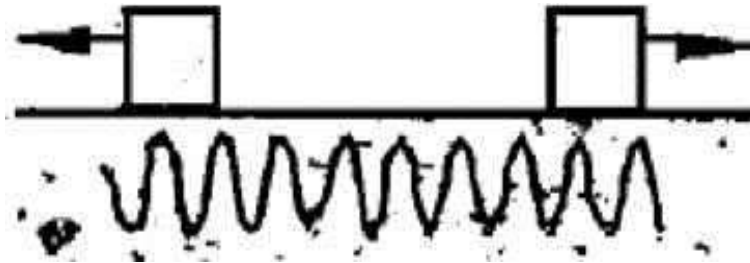




The UPV in concrete is a function of density and compactness of concrete, which limits bears a relationship with strengths and elastic properties of concrete. Beyond this limits, the relationship is very weak.



### Direct Transmission (Cross probing)



### Indirect Transmission (Surface probing)

**CALIBRATION:** - The equipment was calibrated before starting the observation and at the end of test to ensure accuracy of the measurement and performance of the equipment. It is done by measuring transit time on a standard calibration rod supplied along with the equipment.

As per IS 13311 (PART I): 1992

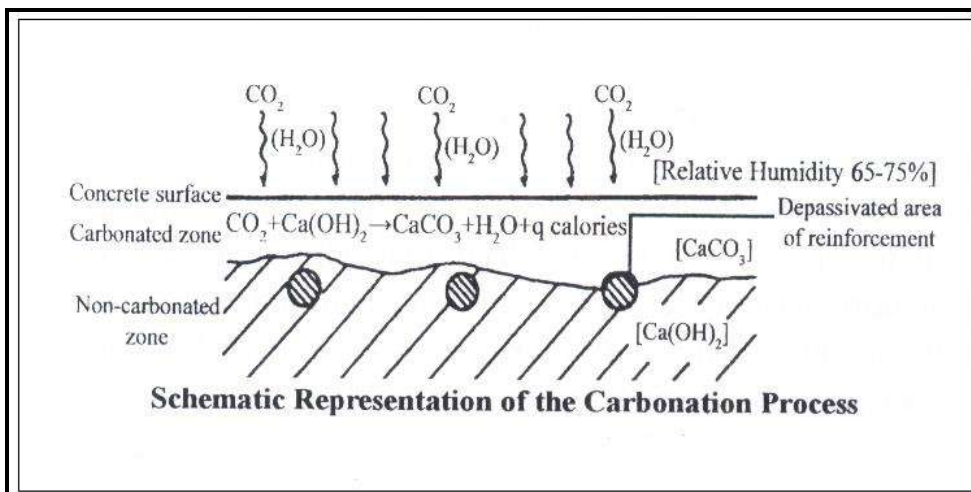
Table 1- Velocity criterion for concrete Quality grading

Sr. no.	Pulse Velocity By Cross Probing. (Km/Sec)	Concrete Quality Grading.
1	Above 4.5	Excellent.
2	3.5 To 4.5	Good.
3	3.0 To 3.5	Medium.
4	Below 3	Doubtful.

Note- In case of "doubtful" quality it may be necessary to carry out further test.

### CARBONATION TEST

This test was conducted by spraying phenolphthalein on the already expose concrete and observing the change in colour. The depth of carbonation is estimated based on the change in colour profile.



# OBSERVED DEFECTS AND DISTRESS SYMPTOMS WITH PHOTOGRAPHS

## INTERNAL OBSERVATION

LOCATIONS	STRUCTURAL DAMAGES	OTHER DAMAGES
<b>GROUND FLOOR</b>		
CANTEEN	Crack was observed on column C-53. De bonded concrete cover were observed on columns at various locations.	NO DISTRESS FOUND
COOKING	Crack was observed on column C-40. De bonded concrete cover were observed on columns at various location	NO DISTRESS FOUND
CHANGING ROOM	NO DISTRESS FOUND	NO DISTRESS FOUND
LADIES TOILET	NO DISTRESS FOUND	NO DISTRESS FOUND
GENTS TOILET	NO DISTRESS FOUND	Heavy Leakage marks observed on the slab portion in WC area.
STORE ROOM 06	De bonded concrete cover was observed on slab in patches.	NO DISTRESS FOUND
SPORT ROOM 07	De bonded concrete cover and Crack was observed on beam and C-35.	NO DISTRESS FOUND
AUDITORIUM 08	De bonded concrete cover and Crack was observed on beam and C-43.	NO DISTRESS FOUND
PASSAGE 09	De bonded concrete cover was observed on slab in patches at various locations.	NO DISTRESS FOUND
PASSAGE 10	De bonded concrete cover was observed on slab in patches at various locations. Structural crack and de bonded concrete cover were observed on column at many locations.(C-29,C-30,C-31)	NO DISTRESS FOUND
OFFICE NO 13	De bonded concrete cover was observed on beam in patches at various locations spanning between C-69&C-72	
OFFICE NO 14	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 15	De bonded concrete cover were observed on columns .Crack was observed on column C-70, C-73,C-74,C-76 at various location	NO DISTRESS FOUND
OFFICE NO 16	NO DISTRESS FOUND	NO DISTRESS FOUND



OFFICE NO 17	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 18	No distress found, complete slab was covered with false ceiling.	NO DISTRESS FOUND
OFFICE NO 19	No distress found, complete slab was covered with false ceiling.	NO DISTRESS FOUND
OFFICE NO 20		
OFFICE NO 21	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 22	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 23	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 24	De bonded concrete cover were observed on columns .Crack was observed on column C-97, C-101 at various location	NO DISTRESS FOUND
OFFICE NO 25	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 26	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 27	De bonded concrete cover were observed on columns – C-117,C-121,C-124,C-127,C-128 .Crack was observed on beam spanning between columns C-128&C-130 at various location	NO DISTRESS FOUND
OFFICE NO 28	NO DISTRESS FOUND	NO DISTRESS FOUND
OFFICE NO 29		
OFFICE NO 30	NO DISTRESS FOUND	NO DISTRESS FOUND
STAIRCASE NO 31	De-bonded concrete cover observed on waist slab. Cracks were observed on slab.	NO DISTRESS FOUND
OFFICE NO 32	De-bonded concrete cover observed on slab at various location.	NO DISTRESS FOUND
<b>FIRST FLOOR</b>		
ROOM NO F6	De bonded concrete cover was observed on column Cracks on column C-41 and C-42	NO DISTRESS FOUND
STAIRCASE NO 6	Cracks observed on waist slab.	NO DISTRESS FOUND
GENTS TOILET	Cracks observed on beam spanning between C45A & C-34	NO DISTRESS FOUND
LADIES TOILET	Cracks observed on beam spanning between C34 & C-35.Cracks observed on column C-41	NO DISTRESS FOUND
PASSAGE 01	De bonded concrete cover were observed on columns .Crack was observed on column C-20	NO DISTRESS FOUND
ROOM NO F12	De bonded concrete cover were observed on columns .Crack was observed on column C-19	NO DISTRESS FOUND
PASSAGE	De bonded concrete cover were observed on column C-	NO DISTRESS FOUND



02	29 .Crack was observed on column C-29.Cracks observed on beam spanning between C-30 & C-37	
PASSAGE IN FRONT OF F8/F9	De bonded concrete cover were observed on columns .Crack was observed on column C-22	NO DISTRESS FOUND
PASSAGE IN FRONT OF F-7	De bonded concrete cover were observed on columns .Crack was observed on column C-42	NO DISTRESS FOUND
ROOM NO F7	De bonded concrete cover were observed on columns .Crack was observed on column C-52	NO DISTRESS FOUND
STAIRCASE NORTH SIDE	De bonded concrete cover were observed on column C-65 .Crack was observed on column C-65	NO DISTRESS FOUND
ROOM NO F5	De bonded concrete cover were observed on column C-69 & C-74 .Crack was observed on column C-69 & C-74	NO DISTRESS FOUND
PASSAGE SOUTH END	Crack was observed on beam spanning between columns C-161,C-63 &C-64 at various locations	NO DISTRESS FOUND
ROOM NO F4	De bonded concrete cover were observed on columnsC-81,C-83.C-84,C-86,C-89&C-90 .Crack was observed on columns C-81,C-83.C-84,C-86,C-89& C-90	NO DISTRESS FOUND
ROOM NO F4	De bonded concrete cover were observed on columnsC-93,C-94,C-98.C-84,C-102 &C-106 .Crack was observed on columnsC-93,C-94,C-98.C-84,C-102 &C-106	NO DISTRESS FOUND
ROOM NO F2	De bonded concrete cover were observed on columnsC-112,C-115,C-118 &C-121 .Crack was observed on columnsC-112,C-115,C-118 &C-121	NO DISTRESS FOUND
ROOM NO F1	De bonded concrete cover were observed on columnsC-127 & C-129.Crack was observed on columnsC-127 & C-129	NO DISTRESS FOUND
PASSAGE WEST END	De bonded concrete cover were observed on columns C-113,C-116 & C-119.Crack was observed on columnsC-113,C-116 & C-119. Crack was observed on beam spanning between column C-113,C-116 & C-119 at various locations.	NO DISTRESS FOUND
STAIRCASE	Cracks observed on mid-landing beam.	

## SECOND FLOOR

### Common Passage Area

1. Structural crack and de bonded concrete cover were observed on column at many locations.
2. Crack was observed on beam at different locations.
3. Structural crack was observed on circular column at many locations.

### Staircase Area

1. Cracks were observed on beam at some locations.
2. Structural crack was observed on column at head room at various locations.

3. De bonded concrete cover was observed on slab in patches at different

### TERRACE

1. De bonded concrete cover and cracks were observed on pedestal column at terrace level at many locations.
2. De bonded and cracks were observed on IPS waterproofing at many locations.  
Overhead Tank
1. Surface crack and plaster de bonded was observed on external wall.
2. Crack was observed on water tank column at some locations.



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# DISTRESS PHOTOGRAPHS



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## INTERNAL DISTRESS PHOTOGRAPHS

### GROUND FLOOR



PH NO-01:-Photograph showing crack on beam bottom at staircase area.



PH NO-03 & 04:-Photograph showing crack on column bottom at office no-27.



PH NO-05 & 06:-Photograph showing cracks on beam at office no -27.



PH NO-07:-Photograph showing crack on slab.



PH NO-09:-Photograph showing crack on beam.



PH NO-10:-Photograph showing crack on beam at office no- 24.



PH NO-11:-Photograph showing crack on column at office no- 24.



PH NO-12:-Photograph showing crack on beam at passage.



PH NO-13:-Photograph showing crack on beam at passage.



PH NO-14:-Photograph showing crack on column at office no- 32.



PH NO-15 & 16:-Photograph showing crack on beam at office no- 32.



PH NO-17:-Photograph showing bulge concrete cover on slab at office no- 32.



PH NO-18:-Photograph showing crack on column.





PH NO-19:-Photograph showing crack on column and beam at various locations of passage.



PH NO-20:-Photograph showing crack on column at various locations of passage.



PH NO-21:-Photograph showing de bonded concrete cover on slab.



PH NO-22:-Photograph showing crack on lintel beam above window at office no-13.



PH NO-23:-Photograph showing crack on column.



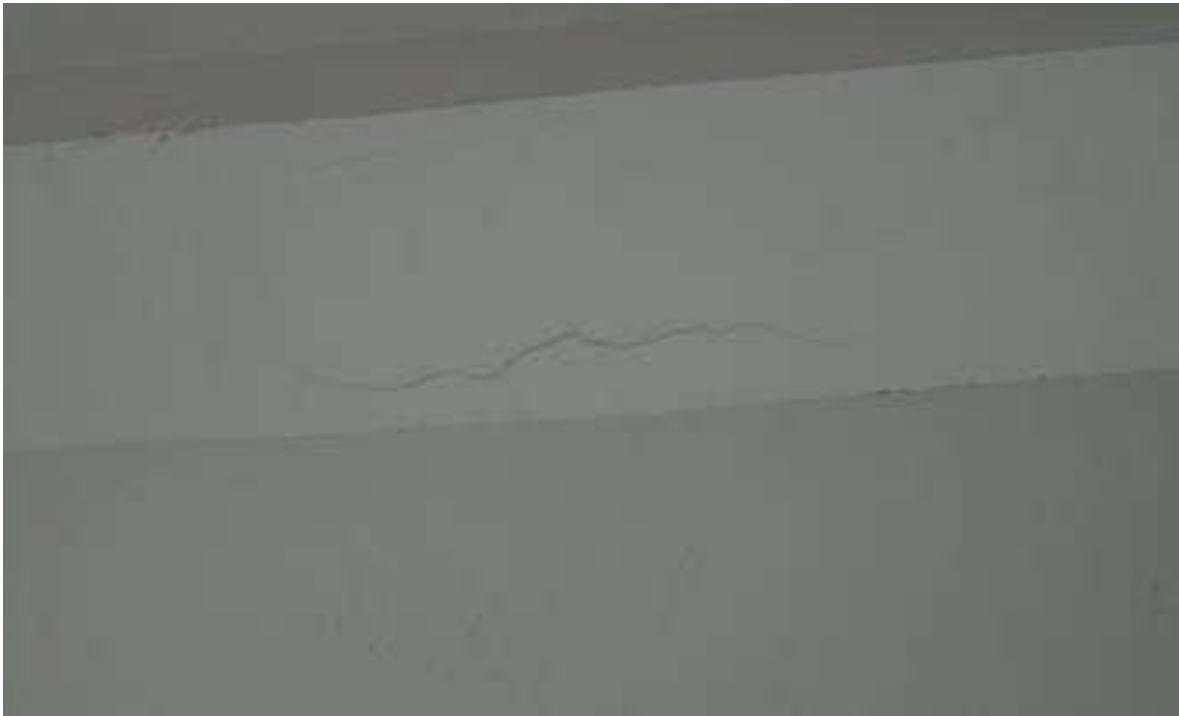
PH NO-24:-Photograph showing bulge concrete cover on beam bottom.



PH NO-25:-Photograph showing crack on column and beam at passage.



PH NO-26:-Photograph showing crack on column at passage.



PH NO-27:-Photograph showing crack on beam at passage.



PH NO-28:-Photograph showing leakage mark on column and wall at passage.



PH NO-29 & 30:-Photograph showing crack on column at various locations of auditorium.



PH NO-31:-Photograph showing crack on column at passage.



PH NO-32:-Photograph showing crack on beam at sports room.



PH NO-33:-Photograph showing bulge of concrete cover on slab at store room.



PH NO-34:-Photograph showing leakage mark and peeling of paint on sunken slab at gent's toilet.





PH NO-35 & 36:-Photograph showing crack on column at various locations of canteen.



PH NO-37:-Photograph showing crack on column at various locations of room no-9.



PH NO-38:-Photograph showing crack on beam at gents toilet.



PH NO-39:-Photograph showing crack on column at some locations of passage.



PH NO-40:-Photograph showing crack on beam at passage.



PH NO-41:-Photograph showing crack on beam at various locations of passage.



PH NO-42:-Photograph showing crack on column at various locations of passage.



PH NO-43 & 44:-Photograph showing crack on column at various locations of room no-21.



PH NO-45:-Photograph showing structural crack on column at various locations of room no-17.



PH NO-46:-Photograph showing structural crack on lintel beam above window room no-17.



PH NO-47:-Photograph showing structural crack on column room no-16.



PH NO-48:-Photograph showing structural crack on column room no-14.



PH NO-49:-Photograph showing structural crack on column room no-15.



PH NO-50:-Photograph showing structural crack on column at second floor staircase area.



PH NO-51:-Photograph showing de bonded concrete cover on beam at second floor staircase area.



PH NO-52:-Photograph showing de bonded concrete cover on slab at second floor.



## EXTERNAL OBSERVATION (Refer Drawing for face No.)

### EXTERNAL OBSERVATIONS.

#### NORTH -FRONT FACE

1. Crack was observed on column at ground floor and first floor level at various locations.
2. Crack was observed on RCC pardi at first floor level at various locations.
3. Surface crack and plaster de bonded were observed on external wall in patches at different locations.
4. Crack was observed on column at First floor to second floor level.
5. Surface crack and plaster de bonded were observed on external wall in patches at different locations.

#### WEST

1. Crack was observed on column at some locations.
2. De bonded plaster were observed on external wall in patches at different locations.

#### SOUTH

1. Crack was observed on column at various locations.
2. Crack was observed on beam at first floor level.

#### EAST

1. Crack was observed on column of First floor to second floor level at various locations.
2. De bonded plaster were observed on external wall in patches at different locations.
3. Cracks were observed on circular column at various location of ground floor to third floor level.

### EXTERNAL PHOTOGRAPHS

NORTH



PH NO-01:-Photograph showing the existing view of structure.



PH NO-02 & 03:-Photograph showing crack on column at various locations of existing structure.



PH NO-04:-Photograph showing separation crack between beam and wall.

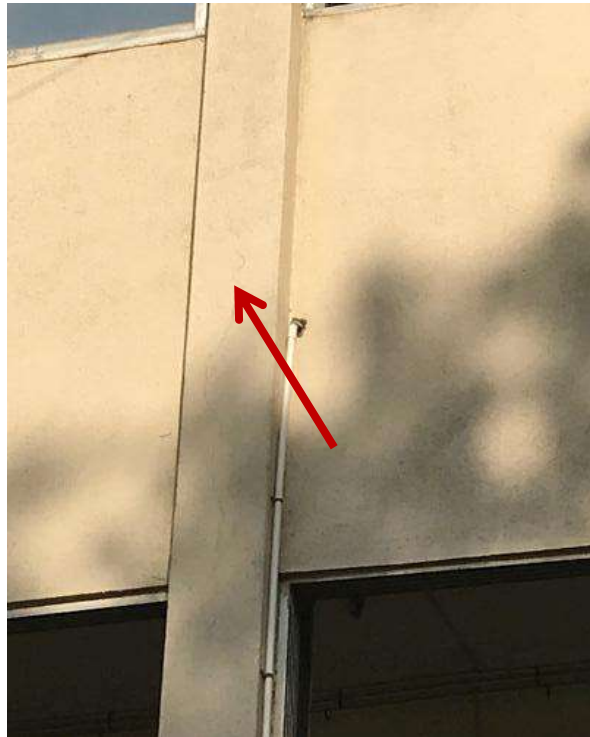


PH NO-05:-Photograph showing crack on RCC pardi at various locations.

WEST



PH NO-06:-Photograph showing the existing view of structure.



PH NO-07 & 08:-Photograph showing crack on column at various locations of existing structure.

**SOUTH**



PH NO-09:-Photograph showing the existing view of structure.



PH NO-10:-Photograph showing crack on column at various locations of existing structure.



PH NO-11:-Photograph showing crack on beam.  
EAST



PH NO-12 & 13:-Photograph showing the existing view of structure.



PH NO-14 & 15:-Photograph showing crack on circular column at various locations of existing structure.



PH NO-16 & 17:-Photograph showing crack on column at various locations of existing structure

NORTH



PH NO-18:-Photograph showing the existing view of structure.



PH NO-19:-Photograph showing structural crack on column and surface crack on external wall in patches.



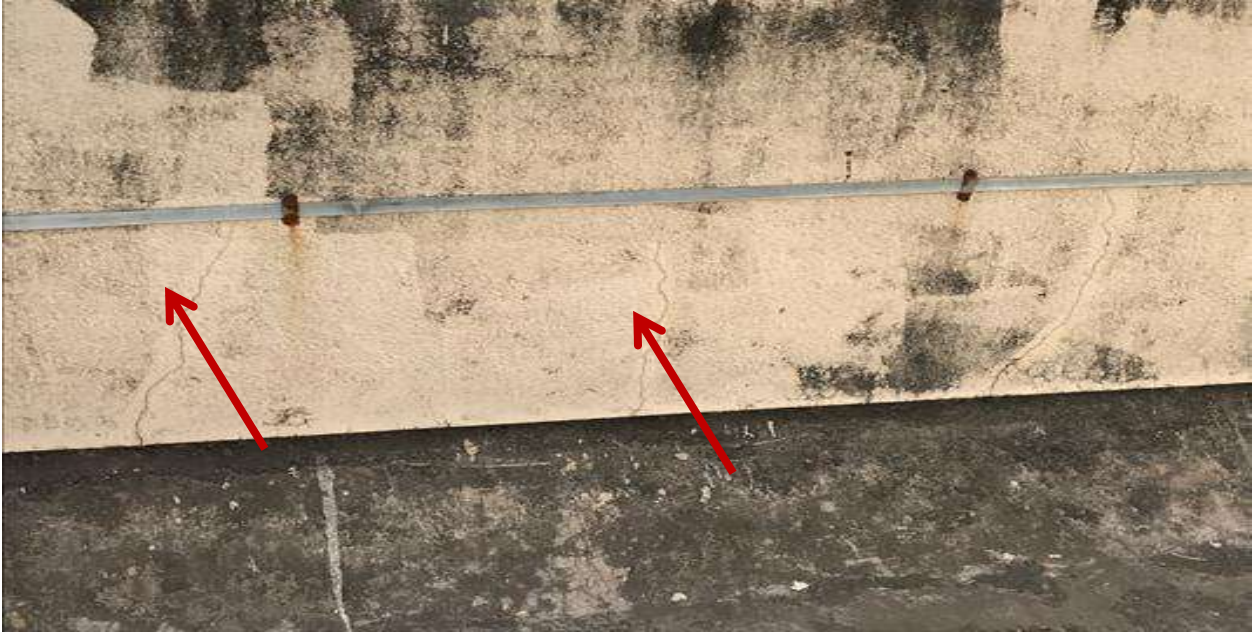
TERRACE



PH NO-19:-Photograph showing crack and de bonded concrete cover on pedestal column .



PH NO-20:-Photograph showing crack and de bonded concrete cover on IPS waterproofing.



PH NO-21:-Photograph showing plaster crack on parapet wall.



PH NO-22:-Photograph showing plaster crack on overhead tank wall.



PH NO-22:-Photograph showing crack on column overhead tank .



PH NO-23:-Photograph showing plaster crack on overhead tank wall.



PH NO-24 & 25:-Photograph showing crack on column overhead tank.

# NDT TEST RESULTS



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## L.S.RAJEJA COLLEGE SANTACRUZ (W)

GROUND FLOOR													
SR.NO	RCC MEMBER COLUMNS	ULTRASONIC PULSE VELOCITY TEST				REBOUND HAMMER TEST							
		VELOCITY 1 Km/Sec	VELOCITY 2 Km/Sec	AVERAGE VELOCITY Km/Sec	METHOD OF TESTING	R1	R2	R3	R4	R5	R6	AVERAGE READING	COMP. STRENGTH Kg/cm <sup>2</sup>
COLUMNS													
1	C-57	1.0	1.3	1.1	ID	20	20	20	20	20	20	20	100
2	C-33	0.6	0.7	0.7	ID	28	30	28	30	32	30	30	255
3	C-19	1.2	0.8	1.0	ID	20	20	20	20	20	20	20	100
4	C-13	2.7	0.9	1.8	ID	28	26	32	30	28	28	29	240
5	C-3	3.1	0.5	1.8	ID	22	20	22	20	22	20	21	120
6	C-9	2.3	0.9	1.6	ID	36	34	30	32	32	30	32	290
7	C-5	3.2	0.7	1.9	ID	30	32	30	32	30	32	31	270
8	C-29	3.7	1.3	2.5	ID	30	32	30	32	30	32	31	270

9	C-16	1.0	0.3	0.6	ID	30	28	26	30	28	26	28	220
10	C-6	2.0	0.9	1.4	ID	28	30	30	28	30	28	29	240
11	C-32	0.9	0.7	0.8	ID	30	32	30	32	30	32	31	270
12	C-52	1.4	0.8	1.1	ID	24	26	24	26	24	26	25	180
13	C-87	1.5	0.6	1.0	ID	22	24	22	24	22	24	23	140
14	C-106	2.2	0.8	1.5	ID	32	34	32	34	32	30	32	290
15	C-121	2.1	0.3	1.2	ID	28	30	28	30	28	30	29	240
16	C-64	1.2	0.6	0.9	ID	20	24	20	24	20	24	22	135
17	C-77	2.3	1.5	1.9	ID	30	32	30	32	30	32	31	270
18	C-89	1.9	0.6	1.3	ID	30	28	30	28	30	30	29	240
19	C-117	2.1	2.8	2.5	ID	30	32	32	34	32	34	32	290
20	C-123	0.8	0.9	0.8	ID	20	22	20	20	20	22	21	120
		NUMBER		20		NUMBER						20	
		AVERAGE		1.3		AVERAGE						214	
		STD. DEVIATION		0.5		STD DEVIATION						69	
		COE. OF VARIATION		35		COE OF VARIATION						32	

**CARBONATION TEST RESULT****CORROSION TEST:-**

SR. NO	STRUCTURE & RCC MEMBER	HALF CELL POTENTIAL -mV	AVG. HALF CELL POTENTIAL -mv	PROBABILITY OF CORROSION
1.	C-33	-232, -323, -311, -299, -191, -171	-255	>70%
2.	C-87	-787, -766, -789, -604, -415, -617	-663	>50%
3.	C-64	-768, -789, -714, -721, -757, -689	-740	>60%
4.	C-77	-799, -777, -711, -717, -722, -757	-747	>60%

Corrosion Risk	Potential
>95%	More Negative than -350mV
50%	-200 to -350Mv
<5%	More positive than -200mV



# ANALYSIS OF NDT RESULTS

**ANALYSIS OF NDT RESULTS- (IN AVERAGE)**

RCC Members	UPV result AVG in Km/sec (Integrity of concrete)	Hammer results AVG in Kg/cm <sup>2</sup> (Surface Hardness of concrete)
Columns	1.3 Km/sec	214Kg /cm <sup>2</sup>

Half-cell potential results indicate **corrosion** of existing RCC members in the range greater than 70%.

Carbonation test indicates that **carbonation** process has already started. Depth of carbonation on the surface is 10 mm to 20mm in average.

On RCC Members UPV reading is below 2.5 Km/sec in average.

At various locations rebound hammer readings are high due to carbonation effect.

As per the old code of practice (IS: 456 -1978) the strength required is minimum 150kg/cm<sup>2</sup>.

As per the new code of practice (IS: 456 -2000) the strength required is minimum 200kg/cm<sup>2</sup>.

# CONCLUSIONS & RECOMMENDATION

## CONCLUSIONS

The visual survey indicates that ground floor has more distress in the form of de-bonded concrete, corrosion cracks compared to other floors. First floor and Second floor have minimal distress. Non-Destructive test indicate that the quality of concrete has deteriorated over the years due to proximity of sea, as per the codal provisions the exposure conditions are considered to be severe. The carbonation process has occurred over the years resulting in amplifying the corrosion activity. This can be verified by observing the cracks on some columns on ground floor. Leakage marks were observed on slabs near south west side, this indicates that there is ingress of water through slabs which will eventually start corroding the reinforcement. The overall observations indicate that the structural repairs need to be carried out.

## RECOMMENDATION

1. As per internal observations members, structural cracks & corroded steel reinforcements. We found that internal leakages on walls at all floors from external wall distress in form of separation cracks & de bonded plaster, we recommend De-bonded external plaster should be removed properly and re do the same in two coats with proper bonding agent.
2. External RCC members like Columns & Beams damaged observed at few locations in form of structural cracks, we recommended damaged RCC members should be treated with jacketing M-25 grade concrete/Micro-concrete with proper anti-corrosion treatment.
3. As per internal visual survey detail observed that slab de-bonded in many rooms, we recommended de bonded slab should be treated with PMM- polymer modified mortar with proper anti-corrosion treatment.

4. Chajja top waterproofing de bonded from RCC chajja at all floor level all sides, we recommended existing waterproof layer should be removed up to RCC and re do new waterproofing with chemical coating & brick bat coba.
5. Damaged RCC members (Internal & External) should be treated with polymer modified mortar with proper anticorrosive treatment of exposed steel reinforcement.
6. Terrace waterproofing IPS layer de bonded observed, we recommend re do new IPS in patches with bonding agent and applying a waterproofing coat.
7. External painting is required after structural repair & plastering wok done.

We recommend carrying out urgent repairs (internal & external) of building on priority according to the specifications given under the guidance of certified structural engineer.

# DISTRESS MAPPING DRAWINGS



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# BILL OF QUANTITIES

  
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B.O.Q FOR STRUCTURAL REPAIRS, WATERPROOFING & CIVIL WORKS FOR L.S.RAHEJA COLLEGE OF ARTS & COMMERCE, SANTACRUZ (W) MUMBAI.					
SR.NO	ITEM DESCRIPTION	UNIT	QTY	RATE	AMOUNT
A	<b>ENABLING WORKS</b>				
1	<b>Steel scaffolding</b>				
	Providing and erecting safe, secure and rigid Steel "H" Frame scaffolding by using H frames including all accessories e.g. ropes, bracings, MS props etc. complete for safe execution of work including removing the same after completion of work and taking away all material to contractor's own dump and making good damages.				
a	External	Sq.mt	1500	170	255,000.00
b	Internal	Sq.mt	2500	170	425,000.00
2	<b>Vertical mesh/curtain</b>				
	Providing securing and fixing the continuous vertical curtain / covering on the outer periphery of the scaffolding with thick gunny cloth / fine HDPE mesh or with other approved material for complete prevention from dust / mortar / damages etc., taking all measures for prevention of scattering of the falling debris, construction materials, mortar etc., including continuous repairs & maintenance of screening / curtain for keeping it in good condition till removal of the scaffolding.	Sq.mt	1370	35	47,950.00





3	<b>Safety Net- Horizontal</b>				
	Providing erecting maintaining and removing temporary protective screens of NETLON NET with all necessary fixing arrangement to ensure that it remains in position for the entire work duration. Nylon safety net shall be made with 12mm nylon rope all-round, with 6mm Nylon rope tied to 12mm rope both ways at 100 mm distance apart, Providing HDPE Safety Net over it with tying the same to 6mm nylon rope firmly etc. complete as directed.	Sq.mt	1500	250	375,000.00
4	<b>Supporting system</b>				
	Providing and erecting steel props to support the structure provisionally during repair and jacketing etc. and maintaining them in position till required as directed by the consultant. (Mode of measurement: Per prop per repetition)	Nos	500	200	100,000.00
5	<b>Working platform (1.50 M wide)</b>				
	Providing & fixing a covering platform made of ply, GI patra, wooden planks, supported over vertical wooden pros/ bamboos etc. so as to prevent debris from falling down. Measurement shall be taken as the area covered by the patra.	Sq.mt	800	450	360,000.00
6	<b>Removing of Flooring</b>	Sq.mt	QRO	250	#VALUE!
7	<b>Breaking of RCC up 150 mm thickness.</b>				
	Breaking of any part of RCC members of any thickness including removing and cutting of reinforcement bars carefully to avoid any damage to structure and carting away debris to contractor's own dump out side the compound complete as directed.	Sq.mt	QRO	150	#VALUE!

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<b>8</b>	<b>Breaking Of Plaster</b>				
	Breaking/ chipping out cement plaster of any thickness internal/external carefully by mechanical chipper to avoid any damage to brick wall including cleaning the surface with wire brush and washing the surface & disposing off debris to contractor's own dump out side the compound.				
<b>a</b>	External Plaster 25 mm thick	Sq.mt	1800	100	180,000.00
<b>b</b>	Internal plaster 12-15 mm Thick	Sq.mt	2200	90	198,000.00
<b>9</b>	<b>Demolition of Brick work.</b>				
	Dismantling of brick walls near existing columns during Jacketing of Columns.				
<b>a</b>	150 MM	Sq.mt	QRO	250	-
<b>b</b>	230 MM	Sq.mt	QRO	300	-
<b>10</b>	<b>Barrication of working area.</b>				
	Providing barricade along the demarked periphery of site using bamboos posts upto 2.0m. Height temporarily with all warning signs and removing the same after the completion of job. Complete including all necessary fitting as per specifications /instructions of the consultant.	RMT	QRO	120	-
<b>##</b>	<b>Siporex Block Walls</b>				-
	Providing siposerx wall below beam bottom at all floors. Including joint filling , curing etc.				-
<b>a</b>	150 MM	Sq.mt	QRO	1600	-
<b>b</b>	230 MM	Sq.mt	QRO	2000	-
<b>12</b>	<b>Chipping of RCC</b>				

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	Chipping of existing loose and damaged cover concrete on existing RCC members up to the concrete core with chisel and hammer, cleaning the surface with wire brush and washing concrete surface with water including covering building faces with gunny cloth etc.	Sq.mt	2750	120	330,000.00
<b>SUB TOTAL (A) RS</b>					<b>#VALUE!</b>
<b>SR.NO</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>RATE</b>	<b>AMOUNT</b>
<b>B</b>	<b>STRUCTURAL REPAIRS</b>				
<b>1</b>	<b>TMT Steel Bar</b>				
	Providing and fixing in position TMT steel bar reinforcement of various diameters RCC slab, beams, columns, canopies, staircases, chajjas, lintels, pardies, coping, fins, arches etc. as per instructions of Engineer in charge including cutting, bending, hooking the bars, binding with wires etc. complete. (New main bars actual length will be paid)	Kg	1000	80	80,000.00
<b>2</b>	<b>Shear key connector</b>				
	Shear key connector: Drilling straight of inclined holes upto 100 mm deep and upto 20 mm dia on concrete using electrically operated drilling machine including fixing shear key connectors 8 mm dia fixed in concrete using epoxy putty, etc complete.	Nos	250	150	37,500.00
<b>3</b>	<b>Re-baring</b>				
	Reinforcement for rebaring including anchoring with Fisher FIS-360: Providing and fixing in position TISCO/SAIL any other approved ISI make reinforcement of any dia. For rebaring including cutting, bending, binding with steel binding wire, bending, hooking,	Kg	200	250	50,000.00

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	anchoring etc. and fixing in concrete by making drilling in RCC minimum 10 times the diameter of bars, cleaning the holes, injecting FISHER FIS-360 for fixing of reinforcement rebars including all T&P all complete as directed.				
<b>4</b>	<b>Treatment to existing reinforcement</b>				
<b>a</b>	<b>Cleaning of Reinforcement Bar</b>				
	Clean existing reinforcement with wire/ rotary wire brush, making the surfaces free from loose material dirt etc. complete, Applying two coats of alkaline rust converting primer-FEOVERT confirming to ASTM-B-117, on the rebars, including cleaning the reinforcement, wire brushing to remove loose rust spalls, with time interval of 1 hour between the coats. Complete.	Sq.mt	3000	100	300,000.00
<b>b</b>	<b>Anticorrosive Treatment to Reinforcement</b>				
	Anticorrosive Treatment to Reinforcement by IPNET RB Application of two coats of IPNET RB (CBRI Know how) on expose reinforcement in two coats with time interval of minimum 4 hours between each coat. The application shall be by brush.	Sq.mt	3000	300	900,000.00
<b>c</b>	<b>Epoxy Bond Coat</b>				
	Providing and applying structural grade epoxy bond coat prior to building up of section with any type of mortar/ concrete to ensure bond between old concrete & new concrete by brush application as per the manufacturer's specifications. (Mode of measurement- per sqmt of application of concrete surface and applicable where-ever item no. is applicable.)	Sq.mt	3500	250	875,000.00

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<b>5</b>	<b>Polymer Modified Mortar</b>				
	Applying polymer Modified Mortar to R.C.C. surface duly treated as above by trowel and finishing & curing etc. Rate excluding scaffolding.				
<b>a</b>	Internal ( 0 mm - 25 mm )	Sq.mtr	1400	1400	1,960,000.00
	Internal ( 25mm - 50 mm )	Sq.mtr	850	1400	1,190,000.00
<b>b</b>	External ( 0 mm - 25 mm )	Sq.mtr	1000	1400	1,400,000.00
	External( 25mm - 50 mm )	Sq.mtr	450	1400	630,000.00
<b>6</b>	<b>Microconcrete</b>				
	Providing and laying Super fluid Microconcrete in beam bottoms, columns, slabs etc. including mixing with 5mm to 10mm size aggregates, pouring, temping, Consolidating, curing etc complete as per Manufacturer's specification and Consultants Instructions.The item shall be paid on actual consumption of Micro concrete.	Kg	8000	65	520,000.00
<b>7</b>	<b>PLY SHUTTERING FOR MICRO</b>				
	Centering, shuttering including strutting, propping etc. including shuttering for curved portion and removal of form work of columns, beams, slabs, chajjas or any other place by using 12mm thick waterproof ply, coated with shuttering oil for pouring micro concrete or new RCC etc. complete. Shuttering shall be slurry tight.	Sq.mt	100	1500	150,000.00
<b>8</b>	<b>Fixing of grouting Nozzles in R.C.C members</b>				
	Drilling and fixing Teflon nozzles in RC members, including,	Nos	5000	75	375,000.00

	<p>Drilling Holes: Drilling 12 mm dia., 50 to 75 mm deep holes in structural members at the intervals of 350 mm in staggered manner or as directed by the consultants in RC structural element.</p> <p>Cleaning of holes: Clean the holes by air blower prior to fixing nozzles.</p> <p>Fixing of Nozzles: Insert 12 mm dia. Teflon nozzles in cleaned holes. External end of nozzles to be machine to receive outlet of grouting gun. Fix it inside the holes by applying thixotropic epoxy putty to ensure complete sealing. Cure the system for min. 12 hrs. Cutting of Nozzles: Cut the nozzles by chisel after completion of grouting without damaging structural elements.</p>				
9	<b>Grouting</b>				-
	<p>Grouting/ Flooding Injecting low viscosity high molecular weight thermosett polymer Monopol by pressure and using injector with accessories till nozzles refused to accept the grout, Including, Mixing of materials: Mixing material components part a and part b in required quantities as per mfg instruction by weigh batching</p> <p>Grouting: Fill the grouting gun with monopol .Maintain desired pressure in the gun by air compressor maintain the pressure at exit (3 to 4 kg/Cm<sup>2</sup>) by monitoring pressure gauge at exit. Grout the material through prefixed nozzles in the structural elements still its refusal. Seal the nozzle with EPCO 1010 putty after the refusal. Monitor leakages through other nozzles while grouting and seal them as per the</p>	Kg	2000	500	1,000,000.00



	requirement.				
10	<b>Corrosion Inhibitor</b>				
10a	Providing and applying Elastomeric, Anti carbonation, Anti corrosive, UV resistant, Solvent based Pure Aliphatic Acrylate System- MONOPOL 456 on the exterior faces of Buildings conforming to ASTM D 4541-02 having Electrochemical impedance of 107 $\Omega$ and achieving dry film thickness of minimum 200 microns in a primer coat followed by two top coats using brush or spray after complete cleaning & removal of oil, grease or loose particles from the surface	Sq.mt	4000	200	800,000.00
10b	Insertion of POWRTHROW, sustained release Corrosion inhibiting caplets which protect both anodic & cathodic sites and reduces Corrosion potential Ecorr by minimum 80 mV in conductive medium, by drilling 20 mm dia holes into the concrete at a depth of 75 mm and inserts to be filled by EPCO-PC-Putty. Caplets shall inhibit corrosion inhibition efficiency of 98% (when added 0.03 % by weight) against control sample evaluated by Tafel polarization method. Depth of penetration for effective corrosion protection shall be 120mm & film formation of 20 Microns as evaluated by CSIR-CECRI Karaikudi Spacing of Powrthrow shall be- a) For RCC Columns- 2 Units in a single drilled hole at a spacing of 400mm c/c from two opposite faces in staggered fashion b) For RCC Beams- 2 Units in a single drilled hole at a spacing of	Nos	3000	150	450,000.00

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	400mm c/c from two opposite faces in staggered fashion C) RCC Slab- 2 Units in a single drilled hole at a spacing of 400mm c/c in a grid pattern				
	<b>SUB TOTAL (B) RS</b>	<b>10,717,500.00</b>			
<b>SR.NO</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>RATE</b>	<b>AMOUNT</b>
<b>C</b>	<b>CIVIL WORK</b>				
<b>1</b>	<b>External Plaster</b>				
	Providing and applying 25 mm thk plaster to concrete members- brick work etc.of External wall facades using approved screened and Pre washed River sand including base coat of 12-18mm thick in C.M. 1:4 and curing the same for not less than three days and keeping the surface of base coat rough to receive the sand face treatment 6 to 8 mm thick of C. M 1:3 finishing the surface by taking out grains and curing for 7- 10 days, providing and mixing approved waterproofing compound @ 160ml per bag of cement and Poly Proylene fibre @ 125 gms per bag of cement in the second coat of plaster etc. complete.	Sq.mt	2500	700	1,750,000.00
<b>2</b>	<b>Internal Plaster (Patch Work)</b>				
	Providing & applying internal cement plaster 12 to 15 mm thick in single coat with CM 1:4 incl. integral waterproofing compound including applying bonding coat of cement & polymer between old and new surface including curing etc. complete and as directed.Complete.	Sq.mt	1400	500	700,000.00
<b>3</b>	<b>Dummy Coat plaster</b>				



	Applying dummy coat with broken bricks in cement mortar having ratio 1:4 with where the brick masonry is extensively damaged and the thickness of plaster exceeds 25 mm or as per instructions of consultant.	Sq.mt	250	700	175,000.00
4	<b>Seperation joints sealing</b>				
	Providing & sealing separation cracks between RCC and brick work by cutting groove on both sides crack along the length by electrically operated groove cutter Breaking / removing plaster & loose mortar (up to 75mm depth) in the area between two grooves by chiseling . washing by drinking water to make it dust free surface. Hammering 10 to 20mm size aggregates in the crack as directed. sealing the crack with polymer modified cementations. Mortar Up to 50mm depth in two layers 1:5.15.	RMT	650	175	113,750.00
	<b>SUB TOTAL (C) RS</b>			<b>2,738,750.00</b>	
<b>SR.NO</b>	<b>ITEM DESCRIPTION</b>	<b>UNIT</b>	<b>QTY</b>	<b>RATE</b>	<b>AMOUNT</b>
D	<b>WATERPROOFING</b>				
1	<b>Terrace</b>				
a	Providing & applying new terrace waterproofing by application of three coats of polymer-cement slurry in the ratio of 1:1 and testing the terrace by ponding for 3 days, P/L brickbat coba maximim depth of in the ratio of 1:4 CM including waterproofing compound @ 1 packet per bag with w/p compound giving required slope and testing the terrace for 3 days, P/L mortar in the ratio of 1:4 including waterproofing compound etc complete as per instructions of	Sq.mt	1370	1100	1,507,000.00

	engineer in charge.				
2	<b>Chajja &amp; Canopy Tops W/P</b>				
	waterproofing the existing chajjas, kaddappa chajja & Balcony tops level by breaking the existing waterproofing treatment of any thickness upto slab level, applying two coats of polymer-cement slurry & redoing the same with brickbat coba in the ratio of 1:4 with w/p compound giving required slope, complete with ponding test for 7 days. watta not paid extra.	Sq.mt	300	1400	420,000.00
3	<b>External Waterproofing Coating</b>				
	Providing and applying Monobond WF high performance latex based waterproof coating (conforming to DIN1048) with a standard proportion i.e. 1 part Monobond WF : 1.25part cement by weight in 2 coats.	Sq.mt	650	1400	910,000.00
	<b>SUB TOTAL (D) RS</b>			<b>2,837,000.00</b>	
SR.NO	ITEM DESCRIPTION	UNIT	QTY	RATE	AMOUNT
E	Plumbing Work (EXTERNAL PVC)				
1	PVC LINE				



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	Removing of the old cement plumbing & sanitary pipes & fittings & providing & fixing new PVC pipes & fittings as per the standard specification or as instructed by the Engineer at specific location & of specific sizes 2"/3"/4"/6" complete with all the fittings such as bends, tees, 'Y', connectors, including keeping the lines 2"-3" away from the wall by providing MS brackets & 'U' clamps of the required size & shape, including testing, filling the holes with concrete, finishing etc.				
	a) 4" WC	RMT	QRO	700	-
	b) 3" BATH/ KITCHEN	RMT	QRO	500	-
2	<b>TEMPORARY PVC LINES</b>				
	a) 4" WC	RMT	QRO	200	-
	b) 3" BATH/ KITCHEN	RMT	QRO	200	-
	<b>SUB TOTAL (E) RS</b>				<b>-</b>
SR.NO	ITEM DESCRIPTION	UNIT	QTY	RATE	AMOUNT
F	<b>GENERAL ITEMS OF WORK</b>				
1	<b>REMOVING &amp; RE FIXING MS GRILLS</b>				
	removal & refixing of MS grills complete with filling the gaps & sealing the joints including minor repairing of the grills by welding wherever required.				
	a) Medium	Nos	90	700	63,000.00
2	<b>REMOVAL &amp; REFIXING OF WINDOWS</b>				-
	Removing existing windows & refixing with the same after completing structural repair of existing RCC members.	Sq.mt	250	860	215,000.00
3	<b>POP floor protection</b>				
	Providing POP protection on platform & flooring & removal of same after completion of work.	Sq.mt	2400	150	360,000.00
4	<b>Painting</b>				

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	External Painting	Sq.mt	QRO	165	#VALUE!
	Internal Painting	Sq.mt	QRO	150	#VALUE!
	SUB TOTAL (F) RS				#VALUE!
	SUB TOTAL (E) RS				-

Note: - The quantities are based on visual observation/distress. The results of NDT are indicating that the damage has occurred in form of cracks. It is recommended that once the contractor is onboard it is essential to carry out tapping and marking the areas. This will give a better picture for estimate purpose. This is required as it appears that building is well maintained by painting and white wash camouflaging the actual distress.

# REPAIR PHILOSOPHY



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## Repair Methodology for Excessively damaged RCC Section

### 1. Enabling Works:

#### a) Scaffolding Erection :

Erecting bamboo/steel scaffolding to access the damaged part of structural elements.

#### b) Supporting the structure:

Supporting the structure by using steel props prior to breaking loose damaged concrete.

### 2. Chipping:

Chip off loose and infected concrete from surface of existing structural elements with help of chisel and hammer till sound concrete is encountered. Remove laitance, oil etc. present on concrete surface by grinding/ sand blasting. De-scale the surface of exposed reinforcement with help of brush to remove the rust scales. Carbonated concrete if left in structure shall initiate deterioration process.

### 3. Corrosion Treatment:

#### a) Treatment to corrosion damaged existing steel reinforcement.

##### i) Application of rust converting alkaline primer:

Thoroughly clean the corroded reinforcement/ steel rebar by wire brush or rotary grinder. Remove all the corrosion scales present on the bare and reach up to sound steel. Apply of rust converting alkaline primer on corrosion affected steel bars after removing all the scales. It is alkaline in nature and convert both hematite & magnetite compounds in to stable compounds. The material shall pass minimum 400 alternate immersion cycles of 2 minutes in 3.5% NaCl solution at room temperature.

##### ii) Application of two coats of IPNet- RB anticorrosive epoxy coating on steel rebars:

Application of primer shall be followed with application of two coats of IPNet- RB (confirming to CBRI requirement) anticorrosive epoxy coating for bar protection against future corrosion. Coating is for old as well as newly provided



steel. This system (Interpenetrating polymer network system for rebar's: IPNet-RB) once applied on steel shall provide extended protection against future carbonation and chloride attack. The material shall pass minimum 720 hours as per ASTM- B- 117 and shall confirm to IS 2770 PART I and ASTM 3963-86.

#### b) Application of Concrete penetrating corrosion inhibitor on concrete surface

Carry out application of 'Bi-polar migratory corrosion inhibitor on concrete surface by brush in two coats. This inhibitor has migratory kind of property which permits the material to migrate to a virtual extent of 60 mm, through pores of concrete, inhibiting the corrosion and de-passivating the Electro-chemical reaction. It has property to attack anode as well as cathode, which is purely alkaline in nature (pH-9.5).

Material shall have evaluated test reports indicating significant reduction in corrosion rate after minimum 90 thermal cycles at 60° Centigrade followed by 8 weeks of accelerated corrosion indicative of it's suitability for tropical applications.

Grout the corrosion inhibitor in case of excessively damaged RC sections by drilling 50 to 75 mm deep holes at the spacing of 350mm c/c with the dosing of 100ml per hole in concrete body.

#### **4. Making up of lost steel area due to corrosion by additional steel:**

Makeup lost steel area due to corrosion by providing additional steel reinforcement. The steel shall confirm to IS 1786 grade Fe 415/ Fe 500. Anchor the steel rebar in sound concrete body up to desired depth by structural GRADE adhesive. Fixing of rebar's is to be with pre left binding wires with existing steel at regular grid after aligning concrete profile with new mortar up to existing steel face.

#### **5. Sectional reconstruction in excessively damaged concrete in structural elements:**

##### i) Bonding Coat:

Bond between new and old concrete is important aspect for effective participation of total cross sectional area of concrete. Selection of type of bond

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coat is based on, type of stresses bond strata is expected to go and prevailing area where application is to be carried.

After the various pre-treatment apply liberal quantity of bond coat on cleaned concrete surfaces as per the detailed manufacture's procedure. Ensure that the application of new concreting is carried out during the pot life of material.

ii) Making up lost –section with free flow micro concrete.

For replacing the carbonated part of concrete and repairing the damaged surface of concrete, fix the form work across the profile of damaged structural element. Pour the free flow concrete mix in the form work. Makeup concrete is based on type of structural element and its location.

iii) Making up lost –section with latex modified mortar

Makeup mortar is based on type of structural element and its location. Here following type of modified mortars are recommended.

Modified mortar:

For replacing the carbonated part of concrete and repairing the damaged surface of concrete usage of following formulated mortar is recommended.

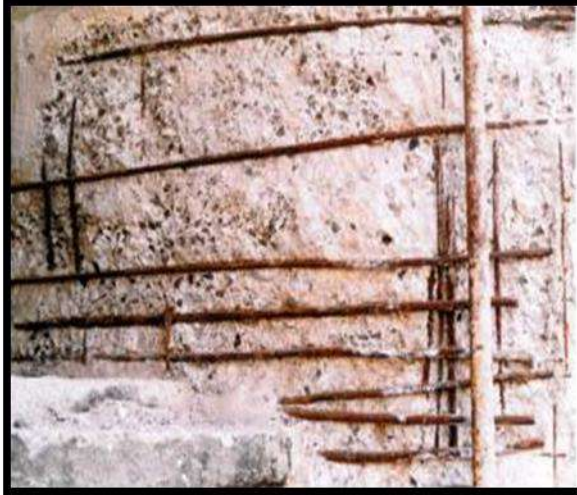
Mix:

- Cement: 50KG
- Sand: 150KG
- MONOBOND: 2.5 to 5KG
- Water: 15-20 Ltrs.





## STEPS FOLLOWED FOR REPAIRS TO CORROSION DAMAGED RCC STRUCTURAL ELEMENTS



### 1. Corrosion of steel reinforcement in Concrete

- Due to water Entry through Cracks, Pores, etc. Excessive Corrosion due to Chloride, CO<sub>2</sub> from Atmosphere, SO<sub>2</sub>, HCL from Acid Rain. Chloride removes passivity obtained from concrete Induces Acid Formation.
- Its conversion into a porous Non-Protective scale. Excessive corrosion/Rust formation induces stresses that crack concrete making it unsafe.

## TREATMENT TO STEEL REINFORCEMENT



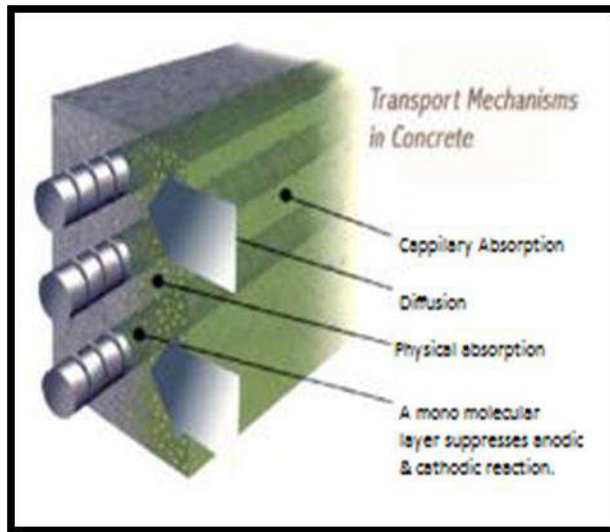
### 2. Cleaning of steel reinforcement & application of alkaline rust converting primer

1. Removing loose rust on steel by wire brush and cleaning surface of reinforcement.
2. Application of alkaline rust converting primer on cleaned steel reinforcement by brush.
3. Alkaline in nature hence safe to use does not damage parent concrete convert both



### 3. Application of IPN protective coating on steel reinforcement

4. For protection of steel reinforcement from future corrosion.
5. Two component system applied by brush in two coats.



**4. Protection of unexposed steel reinforcement inside concrete by migratory corrosion inhibitor (MCI)**

- 6. Due to high vapor pressure, the inhibitor evaporates and vapors penetrate the porous concrete to reach the steel surface.
- 7. Due to its affinity and being an organic material the vapors form an insulating layer on steel surface.
- 8. Applied on concrete surfaces or grouted inside concrete

**TREATMENT TO CONCRETE CORE FOR STRENGTH IMPROVEMENT**



- 9. Improving core concrete strength by pressure resin grouting
- 10. Drilling holes & fixing nozzles in design grid.
- 11. Pressure grouting of resin, monomer of polymer cement slurry as per requirement.
- 12. Advantages: Penetrates even in fine cracks, Seals cracks, restores structural integrity. Good mechanical and durability properties

**SECTIONAL RECONSTRUCTION OF DAMAGED RCC ELEMENT**

**1. Application of structural bond coat to ensure good bond between old concrete and new repair system**

- 13. 3 component system to be applied by brush on old concrete surface.
- 14. Ensures good bond between old concrete and repair mortar increased durability of repairs, Non re-emulsifiable, Compatible with cement.



**2. Sectional reconstruction by micro concrete**

- 15. MICROCONCRETE is supplied as a ready to use dry powder.
- 16. Only specified amount of water is to be added to produce a free – flow non – shrink mix.
- 17. Advantages: Super fluidity reaches to all complex areas, ensure complete filling of cavities and cracks in concrete, lesser demoulding time.

**3. Sectional reconstruction by Polymer Modified Mortar**

- 18. Latex polymer is used as an additive to rich cement sand mortar to reconstruct damaged surface by hand packing or trowelling.
- 19. Advantages: Improves mechanical resistance (Tensile & Flexure) of modified mortar which is essential in repairs
- 20. Render the mortar impermeable, waterproof & impact resistance

*S. Pawar*  
Principal





Drill 12 mm diameter., 40 mm deep holes in structural members at the intervals of 600 mm in staggered manner or as directed by the consultants in RC structural element.

***STEP 2- Cleaning of Holes: -***

Clean the holes by air blower prior to fixing nozzles.

***STEP 3- Fixing of Nozzles: -***



Insert 12 mm diameter Teflon nozzles in cleaned holes, External end of nozzles to be machine to receive outlet of grouting gun. Fix it inside the holes by applying Epoxy putty to ensure complete sealing. Cure the system for min. 12 hrs.

***STEP 4- Mixing of materials: -***

Mixing material components (part A & B) in required quantities as per manufacturer's instruction by weigh batching.

#### STEP 5- Grouting:-



Fill the grouting gun with epoxy resin. Maintain desired pressure in the gun by air compressor; maintain the pressure at exit (3 to 5 Kg/ cm<sup>2</sup>) by monitoring pressure gauge at exit or as per consultant's instruction. Grout the material through prefixed nozzles in the structural elements still its refusal. Seal the nozzle with Epoxy putty after the refusal. Monitor leakages through other nozzles while grouting and seal them as per the requirement. Repeat the process for all the nozzles. Complete the operation within pot life of the material.

#### STEP 6- Cutting of Nozzles:-

Cut the nozzles by chisel after completion of grouting without damaging structural elements.

Ref: RSC/SD/COL/2021/01

Date : 26 August 2021

**TO WHOMSOEVER IT MAY CONCERN**

**CERTIFICATE FOR STRUCUTRAL CONDITIONS OF THE STRUCTURE**

Sub: Existing L.S. Raheja College Building at Santacruz West for M/s Sadhna Educational Society

Undersigned had visited the above said building on request from trustee for inspection and assessment of structural stability condition of building. Existing building is Gr + 2 storied RCC framed structure around 35 years old.

Structural repairs were carried out as per our specifications. The said structure is safe and stable for the purpose intended.

Thanking you,

Yours faithfully,

For H.M.Raje Structural Consultants Pvt Ltd

Dr. H.M Raje

Consulting Structural Engineer

Reg. No.: BMC/STR/R/25

**DR. H. M. RAJE**  
Ph. D. (I.I.T.) M.E.(STR)  
B.M.C. STR/R/25

Principal



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