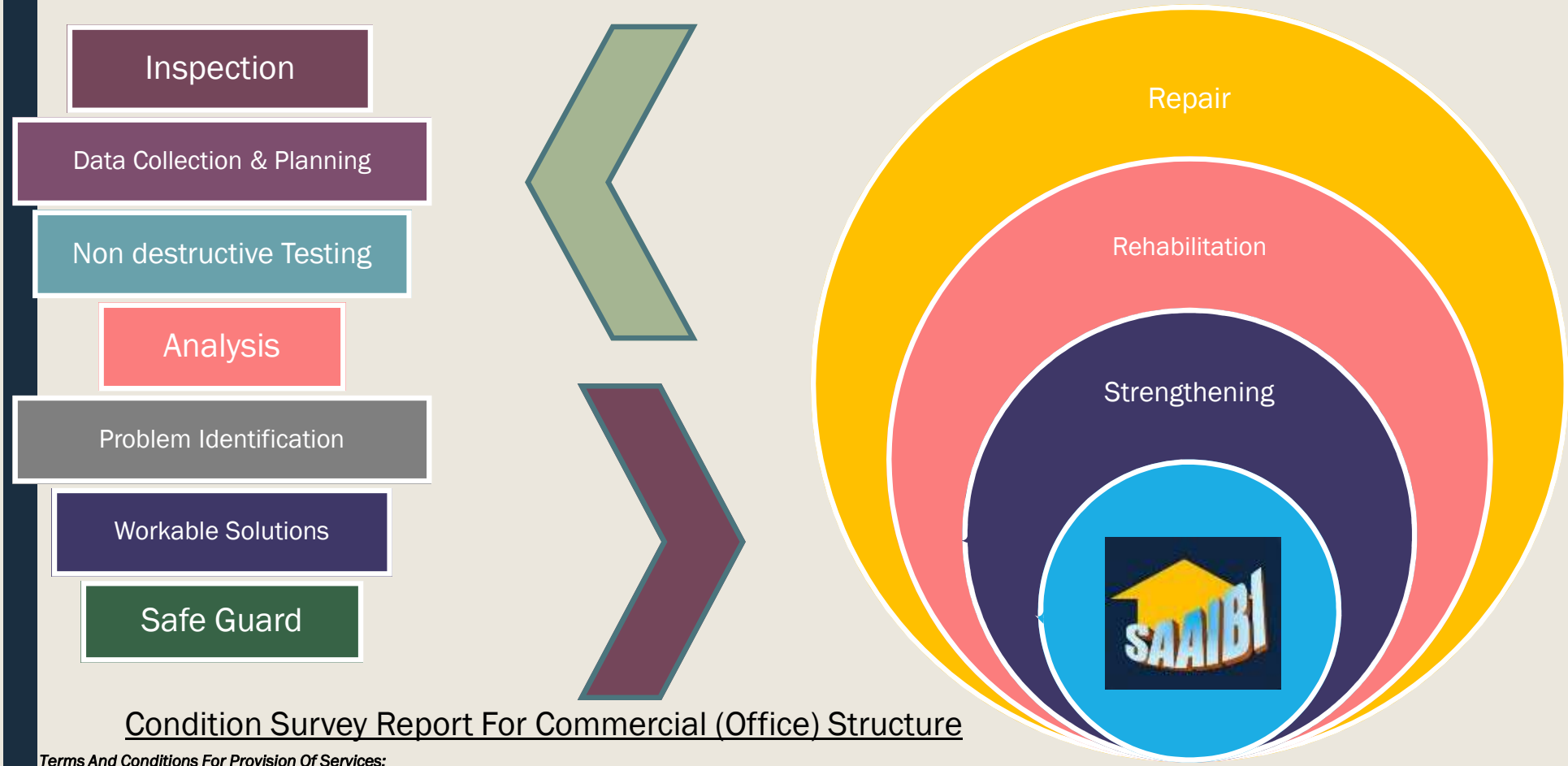


# Condition Survey Report For Commercial (Office) Structure

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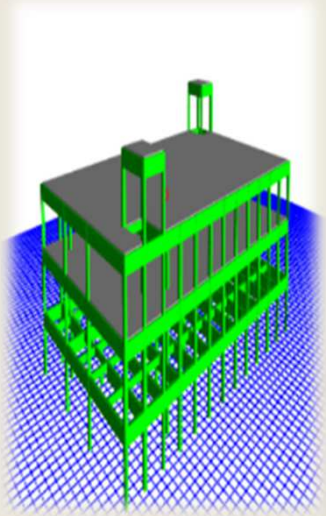
The Report contains information about Particular Structure, Structural element and reported portion only. Due to very nature of Structure all the Elements comprising structure are of different Type and hence No Reference shall be made with one to another. The information contained in the Report and any other advice are given in good faith based on Saaibi.com current knowledge and experience of the subject under normal conditions in accordance with Saaibi.com recommendations. The information only applies to the application(s) and Service(s) expressly referred to herein and is based on laboratory tests which do not replace practical tests. The final decision to implement the recommendation contained in the document is exclusively with client and/or their authorized appointees. Subject to what is stated above, any matters which may require the intervention or any determination by a Court, including any appointment of any arbitrators under Prevalent Section of the Arbitration and Conciliation Act, whether prior to, or during or after the aforesaid arbitration, shall be subject to the exclusive jurisdiction of the Courts in Mumbai in English Language only.

# Condition Survey Report For Commercial (Office) Structure

- Standard Disclaimer:
- The Report has been prepared to the Best of Practices in the Industry.
- Client Name and Address is not disclosed as part of Work Contracts Clauses.
- Documentation, Images, Analysis, Problem and Solution are part of Saaibi.com during its Association with DGC Pvt. Ltd
- Refer to Title Page for Terms And Conditions For Provision Of Services.



## *What Does Condition Survey Report reveals ?*

- An Overall Health Condition of Home / Building much like a Doctor examines a patient.
- After examining through Visual Inspection An Engineer may suggest for Non Destructive Test if required for complete Health Check Up much like Doctor prescribe for Body Check Up.
- This Tests and Inspection will reveal whether the building is Safe or Require Repairs, Rehabilitation or Strengthening as the case may be.
- Suggest Repair and Retrofitting measures which needs to be taken as per building demand.

## *How does it Serves the Purpose ?*

- To Understand The General Condition of Home / building.
- Finding Area of Distress which requires Repairs, Rehabilitation or strengthening.
- To Enhance Life of Building and Save Lives of Humans and Building.

## Table of Contents

## 1) Introduction:

The PST Limited is a Office Property at Mumbai.

At present, the building comprises, Ground floor, First floor and Terrace. Above terrace slab, steel truss was observed, which is resting on columns at terrace level. It is reported that the building was constructed about 20-25 years ago and since then the building is in use.

In Lieu of the above Work order was awarded to carry out Condition survey report which includes, Visual Inspection, Non Destructive Testing at site, Analysis and giving out Recommendation based on Survey Report for Solutions and further Safe Guard of Structure.

## 2) General Information

| | |
|---|---|
| No. of levels (including ground floor and roof); | 3 levels = Ground Floor + 1 Upper Floor + Terrace Floor. |
| No. of basements | -NA- |
| Type of building | Commercial office Building |
| Type of construction | RCC Frame Structure with Infill Block and RCC Slab |
| Probable age of building | 24 – 25 years |
| Building Information | RCC Frame structure consists of ground + 1 upper storey |
| Dimensions | Length: 37 x Breadth: 21.5m |
| Foundation type / Depth | NA |
| Other information (if any) | |

## 3) Condition Survey

Definition:

Condition Survey is an examination of concrete for the purpose of identifying and defining of distress.

Objective:

The Objective of Condition Survey of a building structure is

a) To identify - cause of distress and their sources.

b) To assess - the extent of distress occurred due to corrosion, fire, earthquake or any other reason,

- the strength of the structure,

- its ability to rehab.

c) To prioritise the distressed elements according to seriousness for repairs and

d) To select and plan the effective remedy.

Stages:

Stages for carrying out Condition Survey, largely depend on field conditions, maintenance and have a direct relation with the pattern of distress, whether localised or spread over.

Condition survey of a building is generally in Seven different stages to identify the actual problem so as to ensure that a fruitful outcome is achieved with minimum efforts and at least cost. The Seven stages of Condition survey described are

a) Inspection b) Data Collection & Planning c) Non destructive Testing d) Analysis e) Problem Identification f) Workable Solutions and g) Safe Guard

## 4) Visual Inspection

Fig.7.; Internally every column,beam and slab is cladded with furniture

First Floor-

Fig. 8.; Major Cracks & Delamination of concrete

Fig.9.; Dampness was observed on Beams

Fig.10.; Dampness was observed on slab

Fig.11.; Major Delamination of Concrete & Major Corrosion of Bars was observed near staircase

Fig.12.; Bulging of Plaster was observed near Staircase

Fig.13 : Major disiamination of concrete & exposure of bars was observed near Staircase

Fig.14 : Cracks was observed in columns near Staircase

Fig.15 & 16 : Disiamination of slab concrete and leaks was observed at several locations in building leading to opening of false ceiling.

Fig.17: Opening of false ceiling was observed near column due to leaks beside column.

Fig.18 : Repair work of Major cracks was observed near the staircase.

# 5) Non Destructive Testing

## 8. NDT tests and results

On the basis Visual Inspection, following Non Destructive Testing (NDT) decided to carried out:-

**Purpose of NDT Test:-**

- To Determine the existing Compressive Strength of concrete.
- To Obtained the Quality of Concrete.
- To analysed the carbonation and oxidation of concrete and reinforcement.
- To check the reinforcement details of structural members as per provided in drawing.

**Based on that following tests carried out:-**

1. Quality of Concrete – ULTRASONIC PULSE VELOCITY (UPV TEST).
2. Corrosion/ Oxidation in Existing Reinforcement – HALF CELL POTENTIAL (HCP TEST).
3. Carbonation in Concrete Surface – CARBONATION TEST.
4. Reinforcement Analysed – REBAR MAPPING (As per drawing and site condition).
5. Hardness of Concrete – ( REBOUND HAMMER ).
6. Compressive Strength of Concrete – ( Core Testing ).

**Note:**

1. Above testing methodology are present in report along with results.
2. Results based on Quality, Strength, Corrosion Potential, Existing status of structures.

## 1. ULTRASONIC PULSE VELOCITY TEST

**Table for UPV Criteria**

| Sr.No. | Pulse velocity by Cross Probing (Km/sec) | Quality of Concrete |
|---|---|---|
| 1 | >4.5 | Excellent |
| 2 | 3.5-4.5 | Good |
| 3 | 3-3.5 | Medium |
| 4 | <3 | Doubtful |

| Sr. No. | Member ID | Level | | Element | v (km/s) | Quality of Concrete |
|---|---|---|---|---|---|---|
| | | | | | | |
| 1 | C1 | Ground | Top | Column | 2.55 | Doubtful |
| | | | | | | |
| 2 | C1 | Ground | Mid | Column | 2.15 | Doubtful |
| | | | | | | |
| 3 | C1 | Ground | Bot | Column | 2.61 | Doubtful |
| | | | | | | |
| 4 | C3 | Ground | Mid | Column | 2.27 | Doubtful |
| | | | | | | |
| 5 | C6 | Ground | Top | Column | 2.15 | Doubtful |
| | | | | | | |
| 6 | C6 | Ground | Mid | Column | 1.97 | Doubtful |
| | | | | | | |
| 7 | C6 | Ground | Bottom | Column | 2.01 | Doubtful |
| | | | | | | |
| 8 | C9 | Ground | Top | Column | 1.65 | Doubtful |
| | | | | | | |
| 9 | C9 | Ground | Mid | Column | 2.01 | Doubtful |
| | | | | | | |
| 10 | C9 | Ground | Bottom | Column | 1.93 | Doubtful |
| | | | | | | |
| 11 | C13 | Ground | Top | Column | 2.30 | Doubtful |
| | | | | | | |
| 12 | C13 | Ground | Mid | Column | 2.32 | Doubtful |
| | | | | | | |
| 13 | C13 | Ground | Bottom | Column | 2.14 | Doubtful |
| | | | | | | |
| 14 | C33 | Ground | Mid | Column | 1.97 | Doubtful |
| | | | | | | |
| 15 | C33 | Ground | Bottom | Column | 2.35 | Doubtful |
| | | | | | | |
| 16 | C34 | Ground | Mid | Column | 2.22 | Doubtful |
| | | | | | | |
| 17 | C34 | Ground | Bottom | Column | 2.35 | Doubtful |
| | | | | | | |
| 18 | C34 | Staircase | Mid | Column | 1.46 | Doubtful |
| | | | | | | |
| 19 | C35 | Staircase | Mid | Column | 1.25 | Doubtful |
| | | | | | | |
| 20 | C37 | Ground | Mid | Column | 2.15 | Doubtful |
| | | | | | | |

Fig.34 : Rebound Hammer Testing on Beam

Fig.35 : Rebound Hammer Testing on Circular Column

Fig.36 : Ultrasonic pulse velocity testing on beam

Fig.37 : Ultrasonic pulse velocity Testing on slab

Fig.38 : Half Cell Potential Testing on Column

Fig.39 : Half Cell Potential Testing on slab

# 6) Problem Identification

**Conclusions-**

1. There are signs of distress and deterioration in structural member such as Beams, Columns and Slabs
2. NDT and subsequent results shows the quality of concrete is doubtful and range of corrosion between 30% to 70%.
3. From NDT test concrete grade is between 10 to 20 MPa, so for analysis we have assumed that grade of concrete is M10.
4. Analysis shows major of columns and beams along grid No 3 & 5 required strengthening. Staircase headroom slab need to be strengthened.

**Recommendations for Structural Members-**

Following table shows strengthening scheme for structural members-

| Member ID | Strengthening Scheme |
|---|---|
| **Column** | |
| C1,C2, C3, C4, C5, C6, C7, C8, C9, C10, C11, C12, C13, C16, C22, C29, C33, C34, C35, C36, C37, C38, C39, C40, C41, C42, C43, C44, C45 | Column Jacketing ("C" Type jacketing from external side) |
| C14, C15, C17, C18, C19, C20, C21, C24, C25, C26, C27, C28, C30, C31 | 1 PLY 400 GSM CFRP WRAPPING |
| **Beam** | |
| **At First floor slab level** | |
| B25, B26, B27, B28, B29, B30, B43, B44, B45, B46, B47, B48 | 100/1.4 Non Prestressed Laminate and 1 PLY 400 GSM at L/3 |
| **At Terrace slab level** | |
| B25, B26, B27, B28, B29, B30, B43, B44, B45, B46, B47, B48 | 100/1.4 Non Prestressed Laminate and 1 PLY 400 GSM at L/3 |
| **Slab** | |
| STRHI | PMM |

Based on STAAD Pro analysis statement was prepared between assumed and required reinforcement based on that deficiency is found.

**LOWER GROUND FLOOR LEVEL**

| Column ID | f'ck | Column Sectional Property | | | fy | Assumed Pmax= 1% | Pumax (kN) | Pu (From analysis) | SAFE/UNSAFE | Deficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | B | D | Ac (mm²) | | | | | | |
| C1 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 422 | SAFE | 0.41 |
| C2 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 702 | SAFE | 0.69 |
| C3 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 790 | SAFE | 0.77 |
| C4 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 751 | SAFE | 0.73 |
| C5 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 818 | SAFE | 0.80 |
| C6 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 744 | SAFE | 0.73 |
| C7 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 395 | SAFE | 0.39 |
| C8 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 1030 | UNSAFE | 1.01 |
| C9 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1133 | SAFE | 0.94 |
| C10 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1213 | UNSAFE | 1.01 |
| C11 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1097 | SAFE | 0.91 |
| C12 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1173 | SAFE | 0.97 |
| C13 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1041 | SAFE | 0.87 |
| C14 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 607 | SAFE | 0.59 |
| C15 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1447 | UNSAFE | 1.20 |
| C16 | 15 | 230 | 600 | 136620 | 415 | 1380 | 1203 | 1163 | SAFE | 0.97 |
| C17 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 1082 | UNSAFE | 1.06 |
| C18 | 15 | 200 | 800 | 160380 | 415 | 1620 | 1413 | 1065 | SAFE | 0.75 |
| C19 | 15 | 230 | 840 | 191268 | 415 | 1932 | 1685 | 1185 | SAFE | 0.70 |
| C20 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 760 | SAFE | 0.74 |
| C21 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 476 | SAFE | 0.47 |
| C22 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 976 | SAFE | 0.95 |
| C23 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 935 | SAFE | 0.91 |
| C24 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 962 | SAFE | 0.94 |
| C25 | 15 | 230 | 620 | 141174 | 415 | 1426 | 1244 | 869 | SAFE | 0.70 |
| C26 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 520 | SAFE | 0.51 |
| C27 | 15 | 230 | 510 | 116127 | 415 | 1173 | 1023 | 678 | SAFE | 0.66 |

**GROUND FLOOR LEVEL**

| Column ID | f'ck | Column Sectional Property | | | fy | Assumed Pmax= 1% | Pumax (kN) | Pu (From analysis) | SAFE/UNSAFE | Deficiency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | B | D | Ac (Sq.mm) | | | | | | |
| C1 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 355 | SAFE | 0.50 |
| C2 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 560 | SAFE | 0.79 |
| C3 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 602 | SAFE | 0.85 |
| C4 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 580 | SAFE | 0.82 |
| C5 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 630 | SAFE | 0.89 |
| C6 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 576 | SAFE | 0.81 |
| C7 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 310 | SAFE | 0.44 |
| C8 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 896 | UNSAFE | 1.26 |
| C9 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 917 | UNSAFE | 1.10 |
| C10 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 996 | UNSAFE | 1.19 |
| C11 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 894 | UNSAFE | 1.07 |
| C12 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 958 | UNSAFE | 1.14 |
| C13 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 830 | SAFE | 0.99 |
| C14 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 473 | SAFE | 0.66 |
| C15 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 1256 | UNSAFE | 1.77 |
| C16 | 15 | 160 | 600 | 95040 | 415 | 960 | 837 | 930 | UNSAFE | 1.11 |
| C17 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 888 | UNSAFE | 1.25 |
| C18 | 15 | 200 | 800 | 160380 | 415 | 1620 | 1413 | 786 | SAFE | 0.56 |
| C19 | 15 | 230 | 840 | 191268 | 415 | 1932 | 1685 | 936 | SAFE | 0.56 |
| C20 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 563 | SAFE | 0.79 |
| C21 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 368 | SAFE | 0.52 |
| C22 | 15 | 160 | 510 | 80784 | 415 | 816 | 712 | 832 | UNSAFE | 1.17 |

## 7) Workable Solution

Workable Solutions are offered in the form of Repair, Rehabilitation or Strengthening Scheme in the form of Methodologies of Work to be adopted for Safety, Durability of Structure.

After the removal of the loose mass of concrete for surface preperation the existing reinforcement is exposed to the atmosphere which is treated with the anticorrosive treatment to avoid corrosionin the steel.

**Step-4: Drilling and fixing of Shear Connectors**

After the application of the bond coat the drilling is carried out, after the drilling the drill hole is cleaned with blower and the shear connectors are fixed with the help of epoxy. The depth of the drill hole and the spacing depends on the design of jacketing.

**Step-4: Application of Bond Coat**

After anticorrosive treatment to existing reinforcement, the bond coat is applied to the surface followed by application of cement slurry to avoid hamper in bonding due to delay because of reinforcement steel fixing and fixing of shuttering.

**Step-5: Shuttering to Column**

After the bond coat iimediately shuttering is fixed, the shuttering is carried out to provide the desiered shape and size to the structure after jacketing.

**Step-7: Pouring of Micro-concrete**

Pouing of Micrococrete is carried as per required thickness based on design aspect, and proper part that pouring should be done and also to be compacted preperly by manual condition.

**Step-8: De-shuttering**

Once the pouring done after period it should be deshutter the joints of the shuttering occurs in column it should be filled with cement mortar layer .

**Step – 9: Curing to Casted Surface**

For imparting durability water should be properly cured to casting surface that it should achieve strength. At suitable intervals curing of the surface to be done.

pressure is must so that the fiber should get properly embedded in the epoxy for superior bonding with concrete which results in developing a better strength.

**Step-7: Drilling for Anchors**

After completing the grinding work, the next step is to go for the drilling, for which marking has to be done at the centre of the overlapping distance as specified (or) given in the drawing. The depth of the drilling is as per the size of fiber anchors which is almost 50mm to 60mm long. Thereafter, the fiber anchor is inserted inside the drilled area and fiber is spread in such a way that it locks the joint of overlap.

**Step-8: Fixing of Fiber anchors**

After completing the wrapping work fiber anchors are applied at specified spacing on structural element. The anchor is inserted in the drilled hole as shown in the figure and then protruding fibres are manually spread in circular shape so that it should give a locking effect from all 360°.The purpose of placing fiber anchor is to hold the ends & joints of the wrap so that it should not peel off from the ends in any circumstances and it provides a long lasting life to the fiber wrapping system.

**Step – 9: Application of fire protective coating**

It is advised to provide fire protection coat post strengthening on the structural member to fire proof the members.

**9.4 Methodology for Strengthening of Structural Element with RC Jacketing**

**Step-1: Removal of loose concrete**

Removal of loose concrete from the member so as to prevent from the deterioration or de-bonding issues that entire loose particle from the concrete should remove. After removal of loose concrete entire surface should be wetted by spraying water.

**Step-2 : Additional Reinforcement**

Based on the design aspect additonal reinforcement is added to concrete with maintaining of proper alignment and cover.

**Step-3: Application of Anticorrosion to Reinforcement.**

After the removal of the loose mass of concrete for surface preparation the existing reinforcement is exposed to the atmosphere which is treated with the anticorrosive treatment to avoid corrosionin the steel.

**Step-4: Drilling and fixing of Shear Connectors**

After the application of the bond coat the drilling is carried out, after the drilling the drill hole is cleaned with blower and the shear connectors are fixed with the help of epoxy. The depth of the drill hole and the spacing depends on the design of jacketing.

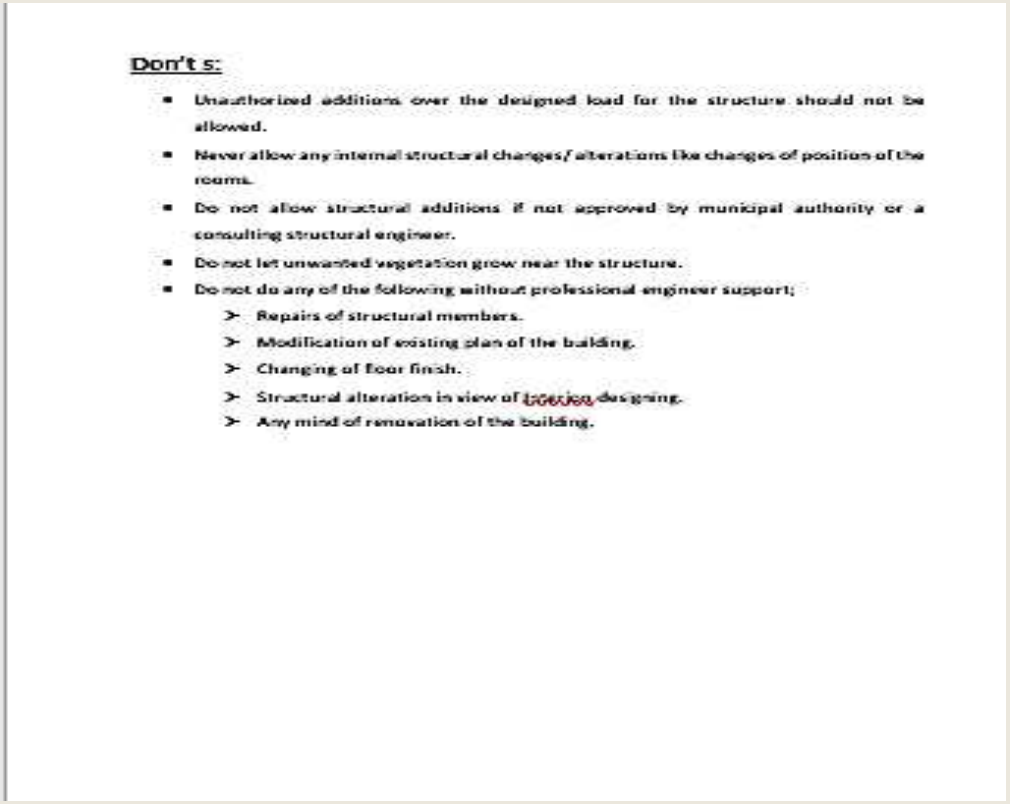
## 8) Safe Guard

To Safe Guard Wealth Of Nation it is of utmost importance that proper Maintenance is taken throughout the Years so that our structures remain Usable for their intendent life and longer. Below is the list of Do's and Don'ts for Structures

For proper maintenance of any RCC Structure, following are to be followed:

**Do s:**

- Thorough Structural Audit should be done every 5 years for the buildings aging between 15 to 30 years and at every 3 years for building aging beyond 30 years.
- In case of any of the following concerns, bring to the notice of consulting Structural Engineer;
  - Cracks in Columns, Beams or Slabs.
  - Swelling in Columns.
  - Visible deflection in the Beams/Slab.
  - Vibration noticed while moving or shifting any equipment in the slab.
- Carry out timely repairs of any parts of the building under the advice and supervision of consulting Engineer.
- Provide water proof cement coating on the exterior faces of the building regularly.
- Ensure the maintenance of the false ceiling at regular intervals.
- Checking all drainage and water supply service pipe lines and its connections at every 2 years and replace the defective ones.
- Checking up internal plumbing lines and joints to trace leakage if any from a licenced plumber.
- Getting the house drains cleaned once in every 2 years or anytime when there is a choke up or overflow of drain waters from the manholes.
- Checking of waterproofing on the terrace and checking for repairs to prevent any leakages.
- Common service areas and common compound areas should be kept in good condition.
- Underground and Overhead tanks should me checked and maintained properly.
- Keep the terrace clean and maintain especially before, during and after monsoon.



**Don't s:**

- Unauthorized additions over the designed load for the structure should not be allowed.
- Never allow any internal structural changes/ alterations like changes of position of the rooms.
- Do not allow structural additions if not approved by municipal authority or a consulting structural engineer.
- Do not let unwanted vegetation grow near the structure.
- Do not do any of the following without professional engineer support;
  - Repairs of structural members.
  - Modification of existing plan of the building.
  - Changing of floor finish.
  - Structural alteration in view of [illegible] designing.
  - Any mind of renovation of the building.

Safe Building SAFE YOU.

# STRUCTURAL AND ARCHITECTURAL INFORMATION BASED INSPECTION (SAAIBI)

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**Why Building Inspection:**

- Due to Bad Workmanship, NO Quality Control, Weathering, NO Maintenance, Deterioration, Over loading, Structural cracks are observed on Buildings.
- These need to be addressed and repaired to maintain Building Structural Integrity and to prevent potential Failure.
- Regular Inspection and Timely Repairing is the key to Long lasting Buildings.

**How can we help:**

- We Conduct Inspection, Do Non Destructive Tests .
- Detect Structural defects and Potential hazards to Structure and Recommend Repairs, Retrofit and Strengthening.
- We take Building inspection for Residential, Commercial and Industrial structures.

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