Structural Audit for Residential Building

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Abstract **Structural Audit is an overall health and performance checkup of a building like a doctor examines a patient. It ensures that the building and its premises are safe and have no risk. It analyses and suggests appropriate repairs and retrofitting measures required for the buildings to perform better in its service life. A structural audit is performed by structural engineers: To ensure safe working conditions, preventing injury and loss of life. To protect your brand's image and reputation. To comply with statutory requirements. It involves inspecting various structural elements, such as the foundation, columns, beams, walls, and slabs, to assess their condition and identify any potential defects or deficiencies.**

I. INTRODUCTION

Structural audit is an inspection of building. It is done to check the overall health and performance check up of a building. According to clause No. 77 of revised Bye-Laws of Co-operative Housing Societies, it is mandatory that if the age of a building is 15 to 30 years, a structural audit shall be carried out once in five years and for buildings older than 30 years it shall be carried out once in three years. In this paper the only three years old structure. The purpose of this study is different than above i.e. here is only ground floor construction is completed and the owner wants to increase two more floors on existing structure. In this paper rebound hammer and ultrasonic pulse velocity these two tests are carried out. And the entire building load calculation and analysis done by Build master software.

Methodology

The following stages are involved in the process of structural audit

a) Collection of general data of the building
b) Visual inspection
c) Non destructive testing
d) Chemical tests
e) Core testing

Visual inspection

1) To identify any signs of structural distress and deformation
2) To recognize the types of structural defect.
3) To identify any signs of material deterioration

Name and address of society:

Preamble: Structural Audit for Stability Certificate by Owner

Date of Inspection: 12 Dec. 2020

BASIC INFORMATION

Name & Address of society: Pune 412207

Developer: Owner Self

Audit Purpose: Stability Certificate for Increases No of Floor

Type of structure: Rcc framed structure Contractor: Mr. ---------- (Contractor)

Site Engineer: No Data Available. No of Stories: Ground Floor only.

Compound Wall: 1.2 M Available in Good Condition.

Foundation Settlement: No Settlement

Steel Exposed: At First Slab Level North Side slab Steel is exposed for Extension Purposes so, required Read Oxide Epoxy Paint DFT 35

Under Ground Water Tank: Already Available in 12,000 Lit.

Over Head Water Tank: Above Stair Case 10, 000 Lit. Only Client

DESCRIPTION OF BUILDING

Availability of drawing: Architectural Blue Print, Center Line Plan

Architectural: ASSOCIATES

Address: Pune, Maharashtra 411014.

Structural Consultant: Foundation Layout, Plinth Beam Design, First Slab Design

Building height: Ground to Plinth Level 0.6M, Above Plinth 3.0M, Parapet Height 0.750M

Building Type: RCC Framed Structure, Regular Red Brick wall ground floor only
External paints: Present Good quality
INFORMATION SUPPLIED BY SOCIETY
Construction Completion Date: Aug 2017 Year of construction Age: 03 Year Old
Effects of monsoon: At Heavy rainy season external wall Seepage, because external one side plaster is not available.
History of recent repairs: After Construction in 03 Year No Major repairing
MODE OF INSPECTION Mode:
Visual Inspection - Nature of existing Building RCC Framed Structure of Beam, Column, Slab are good Quality no any Type of Crack or Deflection for Structural Member
Instrument used: (NDT) Rebound Hammer, Ultrasonic Pulse Velocity, By using Compressive Strength on RCC

1) External faces of RCC Building Front View

2) External faces of RCC Building Side View

3) Top View of Terrace Level Without Water Proofing, No leaks Problem

4) Internal Brick Wall Cracks, not for Structural Cracks

NDT Testing By Rebound Hand Method
At Execution Time Actually Available Strata Images or Audit Visit Time From visual inspection of the strata of the pits The strata is of very good quality of hard murum. We feel that adopting the S.B.C of 35 to 45 tons per Sq.m is safe.(This is as per Table 2 (Cl.6.1.2.1) of N.B.C presumptive S.B.C)

At executing time available image for footing reinforcement compare to available structural engineer footing is correct.

STRUCTURAL STABILITY CERTIFICATE

We have undertaken assignment as Structural Engineer for the Structural work of Mr. ------ (Owner) At Pune 412207. The following listed Firms / Persons are associated with the work.

Owner : Mr. --------

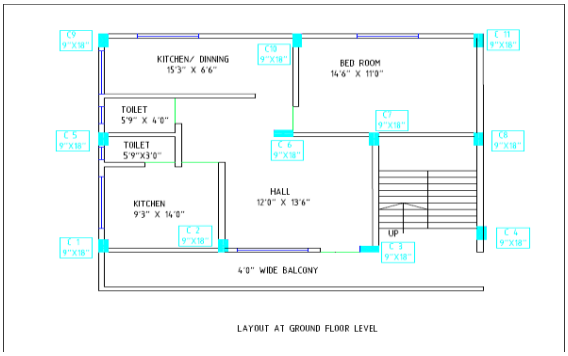
Address : Pune 412207

Architect : ASSOCIATES

Based on the reports subcontracted to M/s Hitech Construction Material testing laboratory, After observing the result of concrete received from laboratory, concrete is having present estimated compressive strength from 23 to 25 N/mm2, by Rebound hammer method and Quality of concrete is Good as all velocities in report are more than 4.3 km/sec, by Ultrasonic pulse velocity method (ref IS code, IS13311, p1 &2), and also site inspection carried out by me.

Also site inspection carried out by me. I certify that to the best of my knowledge the structural RCC building work is overall Strength & Condition of Concrete by the Structural Stability point of view it's found Satisfactory.

Yours Sincerely,
Structural Consultant
Registration No.



CONDITION - 01

LOADING CONDITION:

- (G+3)= 4 No of Slab i.e. 4th Slab is Terrace Slab Without Waterproofing
- Live Load = 2 KN/Sq.m,
- Floor Finish Load: 1 KN/Sq.m
- Dead Load: (0.115 X 25) = 2.875 KN/Sq.m
- Wall Load : (3.0 - 0.45)= 2.55 X 20 = 51 KN/m (Ground, First Floor Level)
- Wall Load : (3.0 - 0.45)= 2.55 X 7.5 = 19 KN/m (Second, Third Floor Level)
- Parapet Wall Load : 1 X 7.5 = 7.5 KN/m (Fourth Slab (Terrace) Floor Level)
- Above Stair Case over Head Water Tank 7000 Lit Capacity
- After Analysis Following Reaction is find out as per BUILD MASTER Software
- Column forces at footing Level for the Load Combination 1.5 (DL + LL)

Sr. No	Column No	Ultimate Load Pu in KN
1	C1	657
2	C2	1160.7
3	C3	1130.7+17.5 = 1148.2
4	C4	650.76+17.5 = 668.2
5	C5	795.5
6	C6	1012.6
7	C7	732.8+175.5 = 750.3
8	C8	550.95 + 17.5 =567.45
9	C9	701.10
10	C10	1352.5
11	C11	695.70
	TOTAL	1668.7

Note: COLUMN CAPACITY: PU=(0.4. Fck . BD) + (0.67. Fy .AST)

PU = (0.4 X 20 X 230 X450) + (0.67 X 500 X 8 X 113) = 1130 KN

Column C3, C10 Column is failed for load carrying capacity and Same footing is failed simultaneously C2, C5, C6, C9, C11 Column Number. Actual available footing Size is (3'0" X 4'0") these footing size load Carrying Capacity only for 670KN

CONDITION - 02

LOADING CONDITION:

- (G+3)= 4 No of Slab i.e. 4th Slab is Terrace Slab Without Waterproofing
- Live Load = 2 KN/Sq.m,
- Floor Finish Load: 1 KN/Sq.m

- Dead Load: (0.115 X 25) = 2.875 KN/Sq.m
- Wall Load : (3.0 - 0.45)= 2.55 X 20 = 51 KN/m (Ground, First Floor Level)
- Wall Load : (3.0 - 0.45)= 2.55 X 7.5 = 19 KN/m (Second, Third Floor Level)
- Parapet Wall Load : 1 X 7.5 = 7.5 KN/m (Fourth Slab (Terrace) Floor Level)
- After Analysis Following Reaction is find out as per BUILD MASTER Software
- Column forces at footing Level for the Load Combination 1.5 (DL + LL)

Sr. No	Column No	Ultimate Load Pu Kn
1	C1	578.7
2	C2	1046.1
3	C3	1024.0
4	C4	584.0
5	C5	708.3
6	C6	917.4
7	C7	670.5
8	C8	504.3
9	C9	629.6
10	C10	1221.4
11	C11	616.8
	TOTAL	14052.1

Note:
COLUMN CAPACITY: PU=(0.4. Fck. BD) + (0.67. Fy .AST)
PU = (0.4 X 20 X 230 X450) + (0.67 X 500 X 8 X 113) = 1130 KN
Column C10 is failed for load carrying capacity and same footing is failed simultaneously C2, C3, C5, C6, Column Number. Actual Available Footing Size is (3'0" X 4'0") these footing size load Carrying Capacity only for 670KN as per Safe Bearing Capacity (SBC) Assumed 450KN/Sq.

CONDITION - 03
LOADING CONDITION:

- (G+2)= 3 No of Slab i.e. 3rd Slab is Terrace Slab Without Waterproofing
- Live Load = 2 KN/Sq.m,
- Floor Finish Load: 1 KN/Sq.m
- Dead Load: (0.115 X 25) = 2.875 KN/Sq.m
- Wall Load: (3.0 - 0.45)= 2.55 X 20 = 51 KN/m (only Ground Floor Level)
- Wall Load: (3.0 - 0.45)= 2.55 X 7.5 = 19 KN/m (First, Second Floor Level)
- Parapet Wall Load: 1 X 7.5 = 7.5 KN/m (Terrace Floor Level)
- After Analysis Following Reaction is find out as per BUILD MASTER Software
- Column forces at footing Level for the Load Combination 1.5 (DL + LL)

Sr. No	Column No	Ultimate Load Pu
1	C1	381
2	C2	738.4
3	C3	719.4
4	C4	379.4
5	C5	487.7
6	C6	650.5
7	C7	461.1
8	C8	334.9
9	C9	427.4
10	C10	873.3
11	C11	416.5
	TOTAL	5869.6

Note:
Column of C8 Footing is Failed, Footing Size Required for Ultimate loading 874 KN is 1.15X 1.25M i.e. (3'10" X 4'3") And Steel Required 10mm @5" C/C actual Available Footing Size is (3'0" X 4'0") these footing size load Carrying Capacity only for 670KN as per safe bearing capacity (SBC) assumed 450KN/Sq.m.

CONCLUSION

1. THIS REPORT MAKES THE STABILITY OF STRUCTURAL AUDIT .
2. SEISMIC ASSESSMENT ARE BEYOND THE SCOPE OF STRUCTURAL AUDIT.
3. WE CANT BUILTUP OVER HEAD WATER TANK ON THESE BUILDING.
4. IN FUTURE EXPANSITION OF STRUCTURE ONLY FOR TWO FLOOR i.e. (G +2)
5. EXPANSITION OF FIRST, SECOND FLOOR IN SIPOREX BRICK.
6. AT TERRACE LEVEL PARAPET WALL IS 1M HEIGHT IN SIPOREX WALL.
7. PREPAR TERRACE WITHOUT WATERPROOFING.
8. THIS REPORT VALID NEXT 05 YEAR'S