



# STRUCTURAL AUDIT OF DR.JJMCOE, JAYSINGPUR (BUILDING A) AND SUGGESTING RETRO-FITTINGS.

**Mr.Pandare Suyash Subhash**  
(B.E Civil)

**Miss.Kulkarni Mrunmayee Prasad**  
(B.E Civil)

**Miss.Apte Aditi Kumar**  
(B.E Civil)

**Mr,Pushkarsingh Vikramsingh Rajput**  
(B.E Civil)

**Mr.Kumar Vishesh Tarang**  
(B.E Civil)

*abstract* – Structural audit is the technical survey of the building in order to check its strength and stability. Structural audit is the first step in repairing procedure of the building. Structural audit is generally recommended for older buildings. Structural audit was first introduced by Indian society of structural engineers. structural audit helps in improving the safety, efficiency and gives idea about the strength of the structure by detailed technical inspection. In present study attempt have been made to carry out structural audit of the old RCC building by carrying out site inspection, performing NDT on the structure.

**Key words:** Structural audit, NON-Destructive testing (NDT), Repair and retrofit.

## I. INTRODUCTION

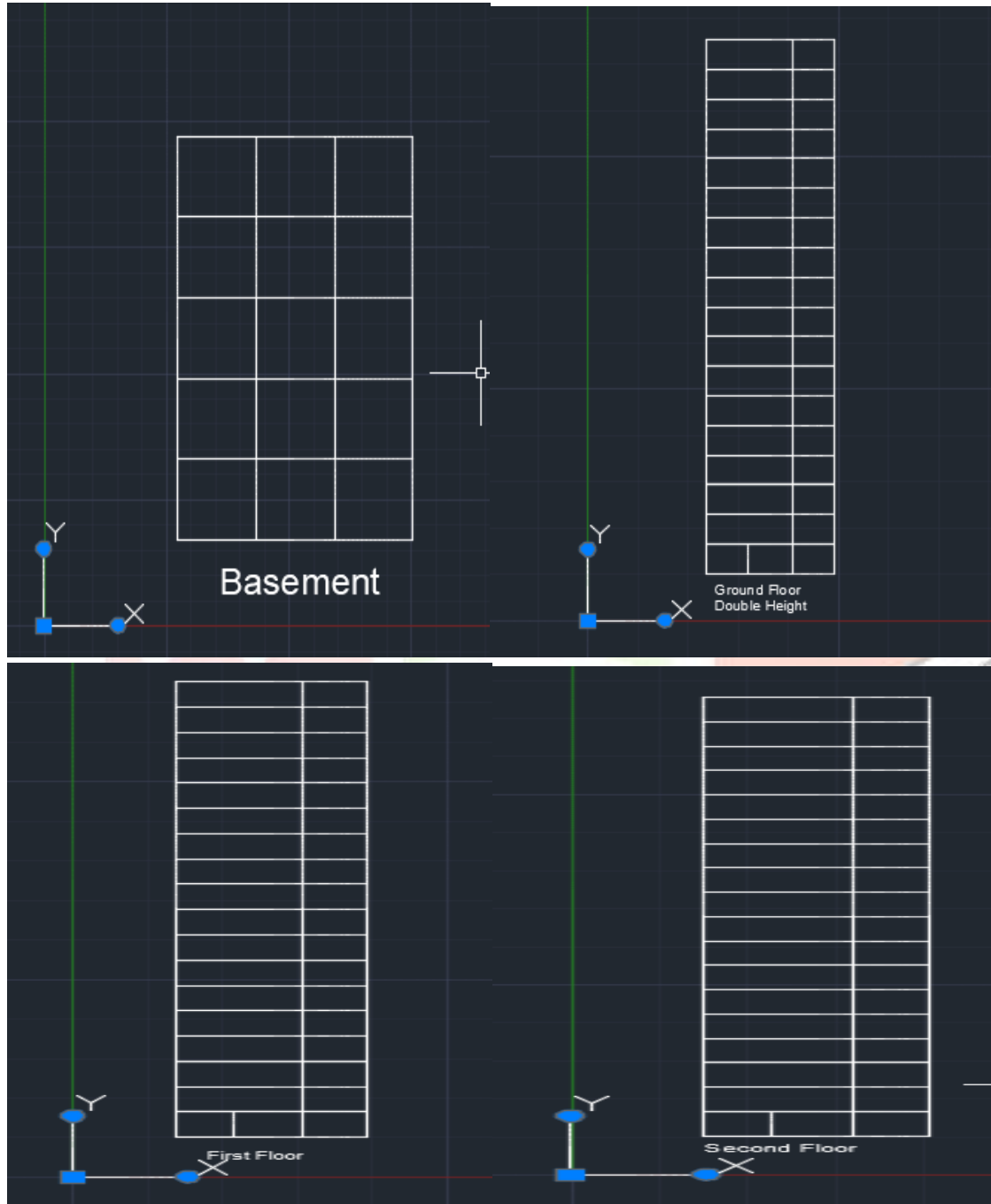
Structural audit is the overall health and performance checkup of the building like doctor check the patient. Structural audit helps to understand the status of the old building. The Audit helps to highlight & investigate all the risk areas, critical areas and whether the building. needs immediate attention. It cover the structural analysis of the existing frame and highlight the weak structural areas for static, wind & earthquake loads. If the bldg. has changed the user, from residential to commercial or industrial, this should bring out the impact of such a change.

Need for Structural Audit Structural audit is carried out in order to increase life of property. To know the health of building and its expected life. To check actual reliability of the structure. In order to recommend rehabilitation techniques. In order to highlight the critical areas and repair them immediately. For structural audit certificate required by municipality and other authorities. Structural audit involves through examination of the building which involves: Noting all visible defects, highlighting critical area of defects. Diagnosis of damage. Carrying out necessary NDT, Suggesting remedial measures.

In order to carry out structural audit old Load bearing building is selected of age around 42 years.

**Steps involved in structural audit carried out is as follows:**

**Step 1:** Preparation of plan of the building, identifying or highlighting critical areas in the building.



**Step 2: Preliminary Inspection.**

Year of construction-2000

Age- 18 to 19 years

Name-Dr.JJMCOE,Jaysingpur (ETC and ETRX building)

Location- Jaysingpur,Shirol Road

Type of building- Educational

No of Stories- B+G+2

Stories ht- B=3,GF=8,FF=4,SF=4 (In meters)

Effects of monsoon- Yes

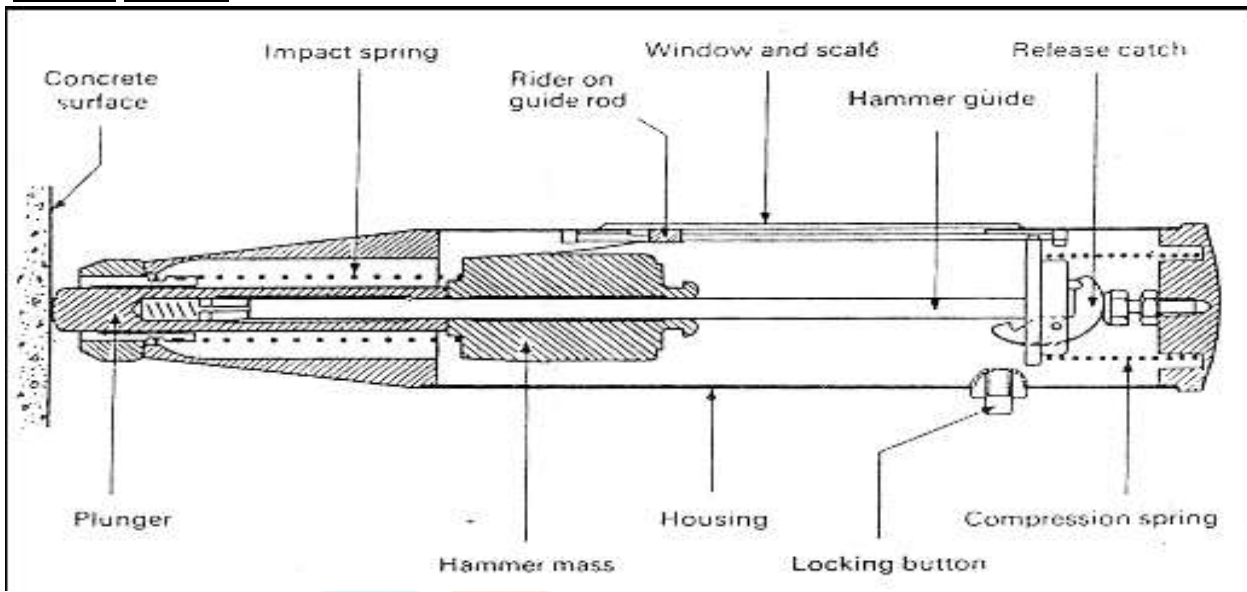
**Dampness due to effect of rainwater**



**Step 3. Visual inspection.**

**Visual Inspection Report.**

Room/Lab Name/Number	Structural Members	Non-structural members
CCF(Central computing facility ) room	Full sealing	-
Battery room	Crack beneath beam Crack to beam and reinforcing bars are exposed	-
Refrigeration and Air conditioning lab	Cracks near to column	Cracks to wall plaster
Machine measurement and control lab	Crack beneath beam Cracks near to column Crack to beam and reinforcing bars are exposed	Cracks to wall plaster
Heat transfer lab	Crack to beam and reinforcing bars are exposed	Cracks to wall plaster
Industrial hydraulics lab	Reinforcement of slab is exposed Leakage to beam and slab	Dampness to wall
Xerox room	Leakage to slab	-
Electronics lab	-	-
A-102	Crack to column	-
A-103	-	-
A-104	-	-
A-105	-	Dampness to external wall
A-106	-	-
A-107	-	-
A-108	-	Crack to plaster
A-109	-	Dampness to external wall
A-202	-	-
A-203	-	Cracks beneath beam
A-204	-	Cracks beneath beam
A-205	Slab leakage	Cracks beneath beam
A-206	Slab leakage Beam deflected	Cracks beneath beam
A-207	Reinforcement of slab is exposed Leakage to Slab deflected Cracks to column	-
A-208	Slab deflected Beam deflected Slab leakage	Cracks beneath beam
A-209	Slab deflected Beam deflected Slab leakage	Cracks beneath beam Dampness to wall
E&TC HOD cabin	-	Dampness

**Step 4.Rebound Hammer observation.(NON DESTRUCTIVE TESTING)****Rebound hammer-**

Components of rebound hammer

**Application of rebound hammer test:**

1. For determination of the compressive strength of the concrete.
2. Determine quality of the concrete.

**Method of testing:**

1. Remove plaster from the structural members.



2. Prepare the instrument for the test,remove the plunger from lock position by pushing the plunger on the surface and push it slowly against the surface.
3. Hold the plunger perpendicular to the testing surface.
4. As the body is pushed, the main spring connecting the hammer mass to the body is stretched. When the body is pushed to the limit, the latch is automatically released and the energy stored in the spring propels the hammer mass towards the plunger tip. The mass impacts the shoulder of the plunger rod and rebounds.
5. This rebound distance is measured on the graduated scale and is termed as rebound number.

**Rebound Hammer Readings-**

ROOM NAME	STRUCTURAL COMPONENT			HAMMER READINGS in M pa					MEAN
	Column	Beam	Slab	1	2	3	4	5	
<b>BASEMENT</b>									
Electronics Lab	1			49	50	51.5	34	48	46.5
	2			45.5	39	34	50.5	42	42.2
	3			44.5	31	47.5	39.5	52.5	43
	4			48	53	53	33	53	48
	5			36.5	40.5	35.5	57.5	49	43.8
	6			36	40	35	59.5	48	43.7
	7			47	62	40	42	43	46.8
	8			46	65.5	41	43	41.5	47.4
	9			45.5	43	45.5	49	53	47.2
	10			47	62	40	42	43	46.8
	11			53.5	65.5	41	43.5	41.5	49
	12			40	43	45.5	49	53	46.1
	13			19.5	18	22	34	23.5	23.4
	14			33	35	39	22.5	36	33.1
	15			46	33.5	40	52	29	40.1
	16			143.5	34	23.5	46	32.5	55.9
	17			47	43	40	36.5	46	42.5
	18			23.5	46	41	39	33	36.5
	19			46	23.5	25.5	42	41.5	35.7
	20			49	50	51.5	34	48	46.5
	21			33.5	37.5	43	50.5	59.5	44.8
	1		21.5	19.5	33.5	34	22	26.1	
	2		30.5	33.5	33.5	34.5	35	33.4	
	3		47.5	42.5	39.5	9.5	52.5	38.3	
	4		25	25.5	23.5	19	23.5	23.3	
	5		35	25	17.5	21.5	39.5	27.7	
	6		33	24.5	18	20	35.5	26.2	
	7		25	22.5	21	33.5	17.5	23.9	
	8		23.5	30	19	35	16	24.7	
	9		23	24	36	39	40	32.4	
	10		46	65.5	41	43	41.5	47.4	

11	41	43	39.8	40	41	40.96
12	40.5	36.5	31.5	39.5	38	37.2
13	51.5	41	19.5	29	26	33.4
14	46	65.5	41	43	41.5	47.4
15	50.5	52	52.5	50.5	51.5	51.4
16	48	53	52.5	33	50.5	47.4
17	45.5	41.5	41	54	58	48
18	44	42	40	50	55	46.2
19	47.5	42.5	39.5	9.5	52.5	38.3
20	46	43	40	26	53	41.6
21	33	24	35	23	17	26.4
22	51.5	41	19.5	29	26	33.4
23	44.5	31	47.5	39.5	52.5	43
24	27	21.5	45.5	40	40	34.8
25	36	25	27	34	19	28.2
26	48	53	52.5	33	50.5	47.4
27	43.5	40	45.5	38	53	44
28	26	37.5	45.5	48.5	31	37.7
29	42	40.6	41	37	41	40.32
30	15.5	37	23	40	39	30.9
31	40.5	36.5	31.5	39.5	38	37.2
1	14	39	36	33.5	31	30.7

**GROUND FLOOR**

<b>Exam Office</b>	1	46	48	41	43	41.5	43.9
	2	51.5	41	31	29	26	35.7
	3	26.5	30.5	20.5	28.5	29	27
	4	47	43	40	39	46	43
	5	31	30	37.5	36	30	32.9
	6	49	34	35	46	32.5	39.3
	7	21.5	19.5	33.5	34	22	26.1
	8	30.5	33.5	33.5	34.5	35	33.4
	9	36	25	27	34	19	28.2
	10	45	49.5	42	39.4	45	44.18
	11	35.5	17	13	41	22	25.7
	12	36	43	37.5	37	38.5	38.4
	13	33.5	37.5	43	50.5	59.5	44.8
	14	17	21	21	18	16	18.6

1	46	51	41	43	41.5	44.5
2	22	39	37	35	32.5	33.1
3	37.5	33.5	18.5	36.5	31	31.4
4	36	25	27	34	31	30.6
5	46	39	41	43	41.5	42.1
6	38.5	34	35	35.5	37	36
7	15	16	14.5	16.5	18	16
8	33.5	37.5	43	50.5	59.5	44.8
9	44	34.5	26	34.5	33	34.4
10	45	36	41	43	42	41.4
11	46	50	55	43	41.5	47.1
12	40.5	36.5	31.5	39.5	38	37.2
13	51.5	41	19.5	29	26	33.4
14	46	52	41	43	41.5	44.7
15	46	56	41	45.5	41.5	46
16	30	39	37	35	32.5	34.7
17	30.5	52	37.5	49	31	40
18	30	32	52.5	33	50.5	39.6
19	32.5	33.5	30	41.5	47	36.9
20	26	35	24	41.5	47	34.7
21	24	23.5	30	36	49	32.5
22	23.5	30	30	36	49	33.7
23	22	25.5	26	33.5	20	25.4
24	20	32	52.5	33.5	50.5	37.7
25	32.5	32.5	44	52	46	41.4
26	18	32	26	23.5	46	29.1
27	26.5	26.5	53	34	50	38

1 32 52 36 35 45 40

**CCF Lab (with Sealing)**

15	39.5	20	32	52.5	25	33.8
16	34.5	34	43	36	34	36.3
17	46	50	41	43	41.5	44.3
18	39.5	25.5	32.5	21.5	27	29.2

**Refrigeration Lab**

17 c	46	48	41	43	41.5	43.9
18 C	39.5	25.5	32.5	36	27	32.1
19	46	51	41	43	41.5	44.5

20		38.5	34	35	35.5	37	36
21		15	16	14.5	16.5	18	16
22		33.5	37.5	43	50.5	59.5	44.8
23		44	34.5	26	34.5	33	34.4
24		46	51	41	43	41.5	44.5
25		35.5	52	41	25	26	35.9
28		33.5	24	26	32	25	28.1
29		25	33.5	36	36.5	12	28.6
30		36.5	25	26.5	45	56	37.8
31		21	35	23.5	12.5	45	27.4
32		26.5	25.5	26.5	45	23.5	29.4
33		25	42	23.5	52.5	45.5	37.7
34		26.5	26	32	35	14.5	26.8
35		12	22.5	36	53	34.5	31.6
	2	32	23.5	25.5	26.5	12.5	24
26	Measurement lab	16.5	45	52	42	23.5	35.8
27		21.5	23.5	36.5	25	23	25.9
28		32	52	52	42.5	53	46.3
29		23	26.5	23.5	22	25	24
30		25	45	25.5	32.5	23	30.2
31		16.5	15	22.5	13	32.5	19.9
36		25.5	23.5	36.5	42.5	23.5	30.3
37		26	23.5	45	23.5	46	32.8
38		25.5	35	31	32.5	32	31.2
39		43.5	23	52.5	26.5	23	33.7
40		23	42.5	23.5	22	21	26.4
41		42	32	52.5	42.5	21	38
42		16.5	18.5	19	28.5	25	21.5
43		25	42	23.5	46	38.5	35
	3	26.5	23	36	28.5	23.5	27.5
32	Heat Transfer Lab	52.5	21.5	23.5	45	52	38.9
33		45	52.5	23.5	23	43	37.4
34		30.5	23.5	23	25	23.5	25.1
35		22.5	24	25.5	33.5	22.5	25.6
36		25.5	50	51.5	34	48	41.8



37		45.5	32.5	34	50.5	42	40.9
44		23.5	31	47.5	35.5	32.5	34
45		48	25	26	33	53	37
46		36.5	40.5	35.5	57.5	49	43.8
47		65	40	35	59.5	52.5	50.4
48		41	33	22.5	31.5	29.5	31.5
49		21.5	32	27	32	22	26.9
50		32	52.5	52	36.5	53	45.2
51		23	26.5	23.5	22	25	24
	4	56	56	25.5	21	23	36.3

**Hydraulics and Pneumatic Lab**

38		44	31	53.5	39.5	33.5	40.3
39		23.5	30.5	28	32.5	23.5	27.6
40		46	51	33.5	43	41.5	43
41		23.5	36	22	21.5	23.5	25.3
42		31.5	25	23.5	33.5	14.5	25.6
43		23	25	22.5	34	19	24.7
52		26.5	51	41	23.5	40	36.4
53		51.5	41	45.5	29	26	38.6
54		23	30.5	22.5	43.5	12	26.3
55		32.5	43	33	39	36.5	36.8
56		25	30	37.5	23.5	32	29.6
57		49	25.5	23	46	45.5	37.8
58		45.5	33	33.5	33.5	33.5	35.8
59		32.5	33.5	25.5	34.5	35	32.2
	5	36	25	23	34	19	27.4

**Thermodynamics Lab**

44		46	39	41	43	41.5	42.1
45		22.5	17	13	27.5	24	20.8
46		36	43	37.5	37	38.5	38.4
47		33.5	37.5	43	50.5	45.5	42
48		23.5	36	23.5	43	25.5	30.3
49		25	25	19.5	25.5	26.5	24.3
60		25.5	33.5	34	21.5	27.5	28.4
61		36	24.5	27	25.5	18.5	26.3
62		46	41	41	43	41.5	42.5

63		49	36	37.5	49	31	40.5
64		48	53	52.5	33	50.5	47.4
65		23.5	33	24	21	47	29.7
66		25.5	54.5	24	41.5	33.5	35.8
67		33	25.5	30	33	49	34.1
	6	35.5	21.5	30	23	15.5	25.1

**FIRST FLOOR****Programming  
Lab 1**

1		14	29.5	32.5	32	33	28.2
2		23.5	30	17.5	21.5	39.5	26.4
3		14	25.5	27.5	21	30.5	23.7
4		20	35	47.5	21.5	35.5	31.9
5		23	45	46	20	37	34.2
6		49.5	53.5	61	39	52	51
7		46	41	41	43	41.5	42.5
8		33.5	37.5	43	50.5	59.5	44.8
9		34	38	40	47	54	42.6
10		48	53	50	35	50	47.2
	1	31	42.5	24.5	46.5	44.5	37.8
	2	32	43	25	33	40	34.6
	3	31	42.5	24.5	25.5	44.5	33.6
	4	33.5	38.5	37.5	34	28.5	34.4
	1	36	25	27	34	19	28.2
A-108	11	51	51.5	48.5	53	50.5	50.9
	12	50.5	52	52.5	50.5	51.5	51.4
	13	48	53	52.5	33	50.5	47.4
	14	45.5	41.5	41	54	58	48
	15	44	42	40	50	55	46.2
	5	47.5	42.5	39.5	9.5	52.5	38.3
	6	46	43	40	30	53	42.4
	2	33	24	35	23	17	26.4
A-107	16	51	51.5	48.5	53	50.5	50.9
	17	50.5	52	52.5	50.5	51.5	51.4
	18	14	45	47.5	21.5	35.5	32.7
	19	48	53	52.5	33	50.5	47.4
	20	45.5	41.5	41	54	58	48
	21	46	40	43	55	55	47.8

	7		47.5	42.5	39.5	9.5	52.5	38.3
	8		46	42	40	10	50	37.6
		3	36	25	27	35	19	28.4
<b>A-106</b>	22		45.5	53	52.5	33	50.5	46.9
	23		43	44.5	43.5	28.5	42.5	40.4
	24		35	32	33.5	49	47	39.3
	25		21.5	52	50	32	50	41.1
	26		27	21.5	45.5	40	40	34.8
	27		48	53	52.5	33	50.5	47.4
	9		35.5	38	40.5	43	60	43.4
	10		35.5	39	40	40	55	41.9
		4	36	25	27	34	19	28.2
<b>A-105</b>	28		48	53	52.5	33	50.5	47.4
	29		53.5	40	45.5	38	53	46
	30		26	37.5	45.5	48.5	31	37.7
	31		48	53	52.5	33	50.5	47.4
	32		21.5	37	23	40	39	32.1
	33		29	37	23	40	39	33.6
		11	14.5	16	28.5	18	13.5	18.1
		12	24.5	16	25.5	12	15	18.6
		5	36	24	27	32	21	28
<b>A-104</b>	34		21.5	53	52.5	33	50.5	42.1
	35		23	25.5	42.5	43.5	37	34.3
	36		49	36	37.5	49	31	40.5
	37		48	53	52.5	33	50.5	47.4
	38		25.5	10	24	41.5	47	29.6
	39		25.5	54.5	24	41.5	47	38.5
	13		49	49	30	36	49	42.6
	14		49	21.5	30	36	49	37.1
		6	35	25	26	34	20	28
<b>A-103</b>	40		48	53	52.5	33	50.5	47.4
	41		17.5	27.5	44	52	46	37.4
	42		42.5	45	44	52	46	45.9
	43		48	52	53	34	50	47.4
	44		31.5	42.5	44	47	44	41.8
	45		31.5	40	42	42	43	39.7
	15		35	25	17.5	21.5	39.5	27.7

	16	36.5	24.5	18	20	40	27.8
	7	36	24	28	33.5	21	28.5
<b>A-102</b>	46	49	50	51.5	34	48	46.5
	47	45.5	39	34	50.5	42	42.2
	48	44.5	31	47.5	39.5	52.5	43
	49	48	53	53	33	53	48
	50	36.5	40.5	35.5	57.5	49	43.8
	51	36	40	35	59.5	48	43.7
	17	41	33	36.5	31.5	29.5	34.3
	8	30	32	27	32	22	28.6

**SECOND FLOOR**

**Embedded  
Micro-controller  
Lab**

1	47	41	40	42	43	42.6
2	46	40.5	41	43	41.5	42.4
3	40	43	45.5	46.5	53	45.6
4	19.5	18	39	32.5	29.5	27.7
5	33	35	39	42	36	37
6	46	42	41	23.5	29	36.3
7	45.5	34	35	46	32.5	38.6
8	47	43	40	25.5	46	40.3
9	23.5	46	41.5	32.5	33	35.3
10	46	55	41	42	41.5	45.1
1	12.5	52.5	21	33.5	17.5	27.4
2	23	52	19	35	16	29
3	33.5	24	36	39	40	34.5
1	36	25	27	32.5	19	27.9

**Programming  
and Network  
Lab**

11	45	46.5	44.5	38	37	42.2
12	53.5	38	34	54.5	25.5	41.1
13	46	49	41	43	41.5	44.1
14	45.5	46.5	44.5	38	37	42.3
15	38	46	45	56.5	39	44.9
16	23.5	42	43	38	36	36.5
17	46	41	41	54.5	41.5	44.8
18	39.5	25.5	32.5	36	27	32.1

19		34.5	34	43	23.5	34	33.8
20		46	42	41	43	41.5	42.7
21		39.5	25.5	32.5	36	27	32.1
22		43	44	46	45.5	39	43.5
23		46	52.5	40	41	41.5	44.2
24		43	50	42	39	33	41.4
	4	29.5	39	21	27.5	30.5	29.5
	5	44	44.5	32.5	38.5	44.5	40.8
	6	46.5	25	34	31.5	22	31.8
	2	25	23	20	22.5	19	21.9

**TAM Analog Lab**

25		41.5	36.5	22.5	27	22.5	30
26		33.5	32	38.5	37	38.5	35.9
27		40	34	25.5	30	26	31.1
28		45.5	39	34	50.5	42	42.2
29		46	39.4	41	43	41.5	42.18
	7	25	29.5	19.5	25.5	26	25.1
	8	32.5	33	34	20	27.5	29.4
	3	36	25	27	34	30	30.4

**Advance Communication Lab**

30		46	41	41	43	41.5	42.5
31		35	35.5	37	38	31	35.3
32		27	25.5	30	35	29.5	29.4
33		44.5	31	47.5	39.5	52.5	43
34		27.5	30.5	28	32.5	30	29.7
35		46	43	50	43	41.5	44.7
	9	38.5	36	22	21.5	30.5	29.7
	10	31.5	25	23.5	34	14.5	25.7
	4	36	25	27	34	19	28.2

**Digital Communication Lab**

36		46	39	41	43	41.5	42.1
37		51.5	41	19.5	29	26	33.4
38		26.5	30.5	20.5	28.5	29	27
39		47	43	40	39	46	43

	40		25	30	37.5	25.5	25.5	28.7
	41		49	34	35	46	32.5	39.3
	11		21.5	19.5	33.5	34	22	26.1
	12		30.5	33.5	33.5	34.5	35	33.4
		5	36	25	27	34	19	28.2
<b>Optical and Microwave Lab</b>	42		46	48	41	43	41.5	43.9
	43		28	17	13	27.5	36	24.3
	44		36	43	37.5	37	38.5	38.4
	45		33.5	37.5	43	50.5	59.5	44.8
	46		17	21	21	18	16	18.6
	47		46	43	41	43	41.5	42.9
		13	22	39	37	35	32.5	33.1
		14	37.5	33.5	18.5	36	19	28.9
		6	36	25	27	34	19	28.2
<b>A-202 (POP)</b>	48		46	42.6	41	43	41.5	42.82
	49		38.5	34	35	35.5	37	36
	50		15	16	14.5	16.5	18	16
	51		33.5	37.5	43	50.5	59.5	44.8
	52		44	34.5	26	34.5	33	34.4
	53		46	44.2	41	43	41.5	43.14
	54		46	41	41	43	41.5	42.5
	55		40.5	36.5	31.5	39.5	38	37.2
	56		51.5	41	19.5	29	26	33.4
	57		46	45	41	43	41.5	43.3
<b>STAIRCASE</b>								
<b>GF TO FF</b>			35	32.5	42	43	44.5	39.4
<b>FF TO SF</b>			23.5	53.5	36.5	29	30	34.5
<b>SF TO TERRACE</b>			33.5	23.5	25	26	33	28.2

From above readings of Rebound Hammer we conclude that highlighted beams Columns and slabs seems weak due to the combined effects of carbonation, corrosion & effect of continuous drying and wetting and harsh weather condition building structure is in really bad condition.

#### Recommendations-

1. Re-plastering with new fibro plaster is suggested.
2. Grouting is carried out where steel is exposed due to disintegration of concrete.
3. Re-reinforce the member where the rusting is severe(chajjas and slab corners)

4. Filling of cracks with cement mortar to reduce leakage.
5. From above observation of the building we conclude that:

Due to combined effects of carbonation, corrosion & effect of continuous drying and wetting and harsh weather condition building structure is in really bad condition and should be subjected to the repair immediately. Structural building appears to be unsound due to external and internal defects. Structural members shows cracks due to corrosion of the RCC members. Major cracks observed accelerate the passage of water through the wall resulting in leakage of the water. Looking at the aspect of building maintainance it is recommended to repair the building in planned manner. In RCC framed structure ,RCC members are the major load taking elements so they cannot be left unattended for long period of time. Original strength of the RCC members can be restored by polymer modified mortar method

### Conclusion-

1. The building is having damages and deterioration which are curable and necessary repair are to be taken up as recommended to restore the livability in the building.It is repairable and livable building.
2. The structure of the building when undergoing repairs,the student can continue occupies the premises. The repair to be carried out in phases in co-ordination with students of occupations during repair.
3. The proposed repairs will add life to the structure. The frequent repair to the building is to be taken up to every 3-5 years or as and when there is any kind of damage noticed in the building.The occupants should also take active in the same.

### ACKNOWLEDGMENT

First of all I would like to thank Prof.G.M.Malu,Prof.K.G.Ghodake who is presently working as a professor of Civil Engineering department, Dr.JJMCOE,Jaysingpur for guiding me through this project work. I am extremely grateful to him for all his invaluable guidance and kind suggestions during all the phases of my project/seminar work. His ever encouraging attitude, guidance and whole hearted help were biggest motivation for me in completing this project work.

I am thankful to the Chairman Mr. Veejhay J. Magdum of Dr. J. J. Magdum Trust, Jaysingpur, for their encouragement. I am very grateful to Dr.D.N.Mudgal Principal of Dr. J. J. Magdum College of Engineering, Jaysingpur for motivating me for this work. Also I am thankful to Prof.J.S.Lambe Head of Department of Civil Engineering for providing necessary facilities for completion of this project work.

I am also thankful to Kulkarni Mrunmayee Prasad,Apte Aditi Kumar,Pushkarsingh Vikram Singh Rajput ,Kumar Vishesh Tarang. for supporting me in completion of this project/seminar work.

### ACKNOWLEDGMENT FOR PLAGIARISM

**Copied content in this paper is from my previous paper of same kind that is STRUCTURAL AUDIT Paper id is IJSRDV8/10523.**

Lastly I thank all the persons who have guided and helped me directly or indirectly.

### REFERENCES

#### Journal reference:

Saiesh.L.Naik , Basavraj Saunshi, IRJET May 2017, “*Structural Audit of RCC buildings*”, Volume No.04, Issue No. Volume: 04 Issue: 05, May -2017.

Patil S.R., Prof. Sayyed G.A” *Structural Audit* ”IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE), e-ISSN : 2278-1684, p-ISSN : 2320–334X.

Swapnil U Biraris “*Structural Audit of Old Structures*” International Journal of Engineering Trends and Technology (IJETT) – Volume-43 Number-3 -January2017.

#### Book reference:

Impact energy of Rebound Hammer for different applications and velocity criteria for concrete quality grading of UPV from IS 13311-1992 Part 1.