Structural Stability Assessment of the JIMMY PARK CO-OP Housing Society, Sector 17, Nerul, Navi Mumbai

STRUCTURAL AUDIT REPORT

SUBMITED BY

YASH ENGINEERING CONSULTANTS PVT LTD.

207, Foundation Tower, Sector-11, Plot No. 20, CBD Belapur,

Navi Mumbai - 400 614

FOR

Navi Mumbai Municipal Corporation, C.B.D Belapur, Navi Mumbai

JUNE 2022

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Structural audit report of residential building Jimmy Park

INTRODUCTORY REMARKS

On 11th of June 2022, in Navi Mumbai, a house ceiling slab of 6th floor collapsed, affecting all the floors up to ground of residential building M/s. Jimmy Park CHS Ltd., Plot No. 182-D, Sector 17, Nerul. One person died, six others sustained severe injuries and several people have been rescued. This was a disaster and in order to find out the cause of the failure of structure the City Engineer, NMMC approached M/s. Yash Engineering Consultants Pvt Ltd. (YECPL), CBD Belapur, Navi Mumbai for the structural audit of M/s. Jimmy Park CHS Ltd. dated 11-06-2022.

The Ceiling Slab of Flat No. 601, A-wing was collapsed, affecting all the floors up to ground.

B-Wing Structures have shown sign of distress in the reinforced concrete members. It was, therefore, decided to carry out detailed structural audit of the buildings to have an expert technical opinion on their current structural conditions.

In view of this, consultancy services for the structural audit of M/s. Jimmy Park CHS Ltd have been under-taken by the YECPL. This report is based on the Visual Observation Taken at site, field NDT, strength analysis in the laboratory (ALLIED RESEARCH CENTRE, GHANSOLI, NAVI MUMBAL & INDIAN MATERIAL RESEARCH CENTER, KHARGHAR) also intensity of corrosion of Exposed reinforcement.

METHODOLOGY

1. Study of plan, all Structural drawings, details.
2. Visual Inspection The building was investigated by Floor by Floor for observation and external area of the building some of the column, beam and slab within the structure were observed for a range of defects such as spalls, seepage cracks and crazing etc. All the defects were marked on the observation sheets with approximate repairs which formed the total data of the structure.

3. Tapping Observation Some of the column and beams inside the flats were subjected to Tapping by hammer. The hollow sound was recorded. This was evaluated for remedial measures.
4. Non-Destructive Testing [NDT] In addition to Visual Inspection and Tapping Observation the quality and strength of structural components can be determined by the use of various Non-Destructive Test. There are various NDT instrument used in concrete members which determines the present Strength and quality of concrete. The result of these is useful in finding out the treatment to be given to the structural members and various types of the test available in the market those are as below

a) Carry out the visual inspection of the building to see the extent of distress in the Reinforced Concrete members in accessible areas.
b) For RCC components, perform Non-destructive Testing as per relevant IS Codes through (i) Rebound hammer Test, (ii) Ultrasonic Pulse Velocity, (iii) Half Cell Potentiometer tests, (iv) Carbonation Test, (v) Core extraction with test, as necessary, for their soundness and to investigate corrosion of steel reinforcements.
c) Investigating the possible reasons for deterioration of the structural health of the building based on the above NDT Test and visual inspection and suggest suitable remedial measures.

1. SITE INSPECTION

The site of residential building M/s. Jimmy Park CHS Ltd., Plot No. 182-D, Sector 17, Nerul, Navi Mumbai was visited on 11th June 2022 to assess the current structural condition.

STRUCTURE DETAILS

SR NO.	DESCRIPTION	DETAILS
1	NAME &LOCATION	M/s. JIMMY PARK CHS LTD., SECTOR-17, NERUL, NAVI MUMBAI
2	Age of Building	Near about 28 years.
3	TYPE OF PREMISES	This is a G+7 (A & B Wings), Row House (G+1) RCC framed structure.
4	OCCUPATION CERTIFICATE BY CIDCO	15.12.1994
5	ADDITION& ALTERATION IF ANY	Architectural and structural drawings were not available at the time of inspection.

The Destructive and Non-Destructive (NDT) test of the RCC elements were carried out. The location of the points, where the NDT needed to be carried out was marked. The surface preparations at the selected locations were then carried out for testing. The details of various tests conducted, and their guiding principle are summarized below.

1.1 Rebound Hammer Test

Rebound hammer test is done to find out the likely compressive strength of concrete by using rebound hammer as per IS 13311 (part 2): 1992. The underlying principle of the rebound hammer test is “the rebound of an elastic mass depends on the hardness of the surface against which its mass strikes”. When the plunger of the rebound hammer is pressed against the surface hardness of the concrete: The surface hardness and therefore, the rebound are taken to be related to the compressive strength of the concrete. The rebound value is read from a graduated scale and is designated as the rebound number or rebound index. The compressive strength can be read directly form the graph provided on the body of the hammer.

1.2 Ultrasonic pulse Velocity Test (UPV)

This test helps in assessing the quality of concrete. The time of travel for an ultrasonic pulse through a given path length of concrete is measure. For this purpose, two probes (transducers) are used one transmitting and the other receiving. Thus,

Ultrasonic Pulse Velocity (UPV) = Path Length/ travel time

It is best to have the two probes on opposite faces of concrete members. Thus, the signal passes through the entire thickness of the member. This is the direct (D) method of the test and the same was used for the investigations of the RCC elements.

On the other hand, when only one face of the structural element is available the two probes are kept on the same inspected face. This is the indirect (ID) method and the same was used when both sides of the RCC member was not accessible. Indirect method is not as efficient as direct method due to reduced signal amplitude and the test results are greatly influenced by the surface layers of concrete which may have different properties form that of concrete inside the structural member. As per the IS 13311 (Part 1): 1992, the measured indirect velocity is invariably lower than the direct velocity on the same concrete element. This difference may vary from 5 to 20 percent depending largely on the quality of the concrete under test. The UPV depends on the quality of concrete and is affected by all its ingredients. The IS 13311 (Part 1): 1992 uses only qualitative interpretation as given in the Table 2.1.

Table 2.1 Concrete Quality Grading Based on Ultrasonic Pulse Velocity Measurements as per ID 13311 (part 1): 1992

Sr. No	Pulse velocity	Concrete Quality Grading
1	Above 4.5 km/s	Excellent
2	3.5km/s to 4.5 km/s	Good
3	3 km/s to 3.5 km/s	Medium
4	Below 3 km/s	Doubtful

1.3 Half-Cell Potentiometer Test

The instrument measures the potential and the electrical resistance between the reinforcement and the surface to evaluate the corrosion activity as well as the actual condition of the cover layer during testing. The electrical activity of the steel reinforcement and the concrete leads them to be considered as one half of weak battery cell with the steel acting as one electrode and the concrete as the electrolyte. The name half-cell surveying derives from the fact that the one half of the battery cell is considered to be the steel reinforcing bar and the surrounding concrete. The electrical potential of a point on the surface of steel reinforcing bar can be measured comparing its potential with that of copper-copper sulphate reference electrode on the surface. Practically, this is achieved by connecting a wire from one terminal of a voltmeter to the reinforcement and another wire to the copper sulphate reference electrode. This method may be used to indicate the corrosion activity associated with steel embedded in concrete and can be applied to members regardless of their size or the depth of concrete cover. It should be clearly noted that the test does not actual corrosion rate or whether corrosion activity has already started, but it indicates the probability of the corrosion activity depending upon the actual surrounding conditions.

This risk of corrosion is evaluated by means of the potential gradient obtained, the higher the gradient, the higher risk of corrosion. The test results can be interpreted based on the following table.

Half-cell potential (mv) relative to Cu-Cu sulphate Ref. electrode	**% Chance of corrosion activity**
Less than- 200	10%
Between – 200 to – 350	50% (uncertain)
Above - 350	90%

1.4 Carbonation Test (CT)

The measurement of carbonation depth in the cover zone of concrete is standard procedure in assessing reinforced concrete deterioration, particularly in respect of reinforcement corrosion problems. The carbonation test is carried out to determine the depth of concrete affected due to

combined attack of atmospheric carbon dioxide and moisture causing a reduction in level of alkalinity of concrete. A spray of 0.2 % solution of phenolphthalein is used as pH indicator of concrete. The change of color of concrete to pink indicates that the concrete is in the good health, and where no changes in color take place, it is suggestive of carbonation-affected concrete. The test is conducted by drilling a hole on the concrete surface to different depths up to cover concrete thickness, removing dust by air blowing, spraying phenolphthalein with physician's injection syringe and needle on such freshly drilled broken concrete and observing changes in color. The depth of carbonation is estimated based on the change in color profile. \

1.5 Core Extraction Test:

Whereas UPV gives indirect evidence of Concrete quality, a more direct assessment on Strength of Concrete can be made by Core Sampling & Testing. Cores are usually cut by means of rotary cutting tools with diamond bits. In this manner a cylindrical specimen is obtained, usually with ends being uneven, parallel and square and sometimes with embedded pieces of reinforcement. The core is soaked in water, capped with molten sulphur to make its ends plane, parallel at right angles and then tested for compression in moist condition as per IS.

The strength of Test Specimen depends on shape, proportion, and size i.e., H/D ratio. The H/D ratio should preferably 2. For values between 1 & 2, correction factor must be applied. As per Standard practice, specimen shall be 150 mm or 100 mm cores.

2. OBSERVATIONS

The probable causes of deterioration / fatigue failure of structure are as follows:

Observation of Wing 'A': -

1. Low moisture and water coming in contact with the structural members which is a conducive environment for steel corrosion. The reinforcing steel present in the RCC members is affected. The reinforcing steel corrosion leads to cracking.
2. Major Crack are observed on column & beam in several area internally & externally.
3. Major undulation observed of flooring.
4. Hammer tests are showing non uniform strengths. (10 to 20 mpa).
5. USPV test is showing values around 3.50 to 5.00 km/s indicating doubtful to Excellent grading.
6. The staircase is minor distressed at ground floor & 7^{th} Floor.
7. Ground floor to 7^{th} floor column, beam & slab is showing minor cracks.
8. Columns are the most critical components in a structural system. The hammer is giving low values due to local dampness of surfaces. Considering all the factors it is suggested to provide encasing of concrete to the severely affected columns**. (Critical)**
9. Heavily collapsed the slab from 6^{th} floor to ground floor.
10. Leakages & Seepages marks were observed on RCC slab internally. Immediate attention is necessary to avoid the further deterioration.

Observation of Wing 'B': -

1. Major undulation observed of flooring.
2. Ground floor to 7^{th} floor column, beam & slab is showing minor crack.
3. Columns are the most critical components in a structural system. The hammer is giving low values due to local dampness of surfaces. Considering all the factors it is suggested to provide encasing of concrete to the severely affected columns**. (Critical).**
4. Hammer tests are showing non uniform strengths. (10 to 20 mpa).
5. USPV test is showing values around 3.60 to 5.00 km/s indicating Good to Excellent grading.
6. Low moisture and water coming in contact with the structural members which is a conducive environment for steel corrosion. The reinforcing steel present in the RCC members is affected. The reinforcing steel corrosion leads to cracking.

Observation of Row House: -

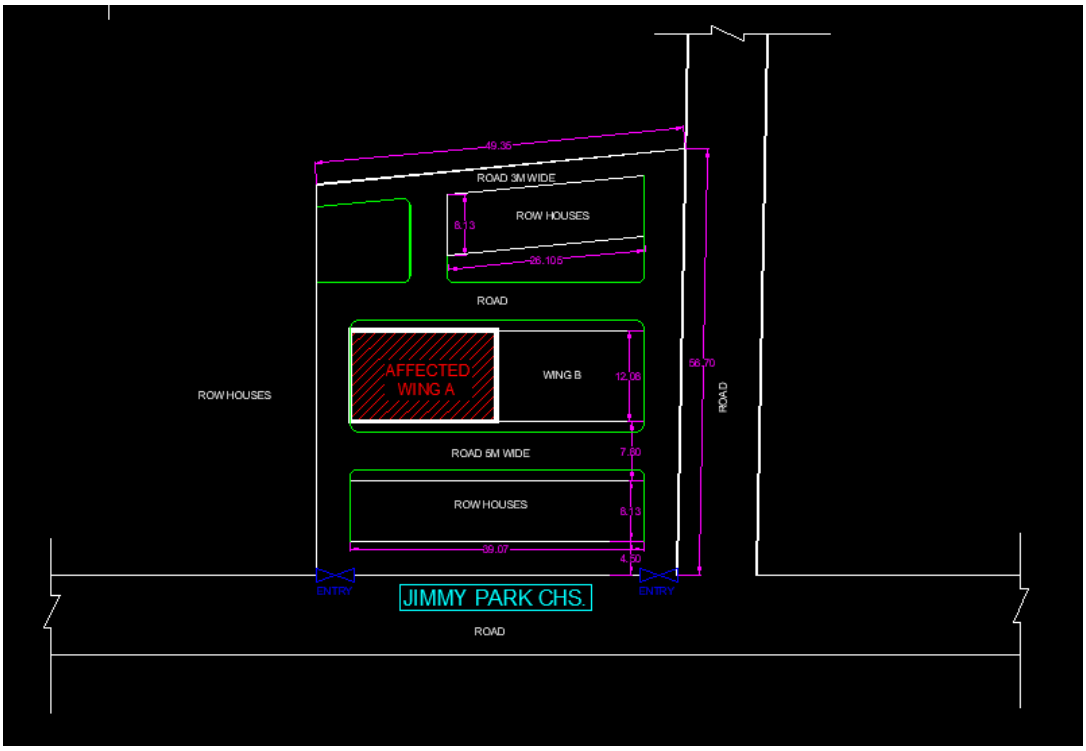
1. Slab concrete collapsed in bedroom area in 2nd floor.
2. Leakages & Seepages marks were observed on RCC slab internally. Immediate attention is necessary to avoid the further deterioration.
3. Hammer tests are showing non uniform strengths. (10 to 20 mpa).
4. USPV test is showing values around 3.60 to 4.93 km/s indicating doubtful to Excellent grading. Heavy plants around the structure of building.

Report on Non-Destructive Tests Carried

Methodology & Observations –

1) The aim of testing was to arrive at the general quality of concrete, rather than evaluating each RCC members in details. Hence, a few RCC members at random were tested & Ultra Sonic Pulse Velocity (USPV) measurement were taken on RCC members i.e., Column, Beam & Slab. The pulse velocity observations on relevant members are included in the report.
2) Rebound Hammer Test reading were taken on Columns, Beam etc. to assess the compressive Strength of these RCC members. Both horizontal and vertical up directions of testing were used. Accuracy of prediction of concrete strength by this method is + / - 25 % vide IS 13311 (part – 2) 1992. The Rebound reading observations on relevant members are also included in the report enclosed.
3) Half Cell Test of embedded reinforcement was taken to identify the corrosion in reinforcement steel. The HCT reading observations are included in the report enclosed.
4) Carbonation Test of concrete was taken to assess the quality of concrete and carbonation at cover. The carbonation Test observations on relevant members are included in the report enclosed

Google Location of Jimmy Park CHS Ltd.



General Layout of Affected Wing of Jimmy Park CHS Ltd.

Rebound Hammer Test

Rebound Hammer Test

Ultrasonic Pulse Velocity Test (UPV)

Ultrasonic Pulse Velocity Test (UPV)

Collapse of Slab

Cracks in Slab

Collapse of Slab

Cracks in Beam and Slab

Cracks in Beam and Slab

Cracks in Beam and Slab

Placing of Concrete on 6th Floor A-Wing

Placing of New Reinforcement on 6th Floor

Witness of Concrete Core Test At Lab

Rebound Hammer test for determinate compressive strength, uniformity & quality of concrete.

Table 3.1 Rebound hammer Testing

TEST REPORT		
Certificate No.	:	**ARC/143/14.06.2022/TC-659**
Client Name	:	**Navi Mumbai Municipal Corporation.**
Consultant Name		**M/s Yash Eng. Consultancy Pvt Ltd.**
Project/Site	:	Jimmy Park I ("A" Wing) Sec-17, Nerul ,Navi mumbai.
Description	:	Rebound Hammer
Quantity	:	09
Specification followed	:	IS 13311 part I
Date of Testing	:	14.06.2022

SCHMIDT REBOUND HAMMER TEST

Sr. No.	Location	Member	Position of the Hammer	Rebound No.	Average Compressive Strength (N/mm2)
1	Ground Floor (Room No:A001)	Beam	Horizontal	16	10
2	Ground Floor (Room No:A002)	Column	Horizontal	18	10
3	First Floor (Room No:A102)	Column	Horizontal	16	10
4	Second Floor (Room No:A202)	Column	Horizontal	18	10
5	Third Floor (Room No:A302)	Column	Horizontal	22	15
6	Fourth Floor (Room No:A402)	Column	Horizontal	26	20
7	Fifth Floor (Room No:A502)	Column	Horizontal	12	10
8	Sixth Floor (Room No:A602)	Column	Horizontal	22	15
9	Seventh Floor (Room No:A702)	Column	Horizontal	14	10

TEST REPORT		
Certificate No.	:	**ARC/143/14.06.2022/TC-659**
Client Name	:	**Navi Mumbai Municipal Corporation.**
Consultant Name		**M/s Yash Eng. Consultancy Pvt Ltd.**
Project/Site	:	Jimmy Park I (Row House) Sec-17, Nerul, Navi mumbai.
Description	:	Rebound Hammer
Quantity	:	04 nos
Specification followed	:	IS 13311 part I
Date of Testing	:	14.06.2022

SCHMIDT REBOUND HAMMER TEST

Sr. No.	Location	Member	Position of the Hammer	Rebound No.	Average Compressive Strength (N/mm2)
1	Row House No: 3	Column	Horizontal	26	20
2	Row House No: 4	Column	Horizontal	26	20
3	Row House No: 8	Column	Horizontal	20	10
4	Row House No: 10	Column	Horizontal	18	10

TEST REPORT

Certificate No.	:	**ARC/143/14.06.2022/TC-659**
Client Name	:	**Navi Mumbai Municipal Corporation.**
Consultant Name		**M/s Yash Eng. Consultancy Pvt Ltd.**
Project/Site	:	Jimmy Park I ("B" Wing) Sec-17, Nerul Navi mumbai.
Description	:	Rebound Hammer
Quantity	:	07
Specification followed	:	IS 13311 part I
Date of Testing	:	14.06.2022

SCHMIDT REBOUND HAMMER TEST

Sr. No.	Location	Member	Position of the Hammer	Rebound No.	Average Compressive Strength (N/mm2)
1	First Floor (Room No:B101)	Column	Horizontal	22	15
2	Third Floor (Room No:B301)	Column	Horizontal	20	10
3	Third Floor (Room No:B302)	Column	Horizontal	28	20
4	Fourth Floor (Room No:B401)	Column	Horizontal	22	15
5	Fifth Floor (Room No:B502)	Column	Horizontal	16	10
6	Sixth Floor (Room No:B602)	Column	Horizontal	20	10
7	Seventh Floor (Room No:B701)	Column	Horizontal	20	10

Ultrasonic pulse velocity Test for determinate the quality and homogeneity of concrete materials

Table 3.2 Ultrasonic Pulse Velocity Testing

TEST REPORT

Certificate No.	:	**ARC/143/14.06.2022/TC-658**
Client Name & Address	:	**Navi Mumbai Municipal Corporation.**
Consultant Name	:	**M/s Yash Eng. Consultancy Pvt Ltd.**
Site/Project	:	Jimmy Park I ("A" Wing) Sec-17, Nerul, Navi mumbai.
Description	:	Ultrasonic Pulse Velocity Test
Quantity	:	08 nos
Specification followed	:	IS 13311 Part I
Period of Testing	:	14.06.2022

ULTRA SONIC PULSE VELOCITY TEST

Sr. No.	Location	Member	Method	Distance (mm)	Time (ms)	Longitudinal Pulse Velocity (Km/s)	Remark
1	Ground Floor (Room No:A002)	Column	Indirect	300	67.8	4.42	Good
2	First Floor (Room No:A102)	Column	Indirect	300	70.0	4.29	Good
3	Second Floor (Room No:A202)	Column	Indirect	300	55.8	5.38	Excellent
4	Third Floor (Room No:A302)	Column	Indirect	300	72.0	4.17	Good
5	Fourth Floor (Room No:A402)	Column	Indirect	300	76.2	3.94	Good
6	Fifth Floor (Room No:A502)	Column	Indirect	300	63.2	4.75	Excellent
7	Sixth Floor (Room No:A602)	Column	Indirect	300	78.1	3.84	Good
8	Seventh Floor (Room No:A702)	Column	Indirect	300	82.7	3.63	Doubtful

Table 2 : Velocity Criteria For Concrete Quality Grading

As per Table 2 of IS 13311 (Part 1) : 1992

Sr. No.	Pulse Velocity by Cross Probing (km/sec)	Concrete Quality Grading
1	Above 4.40	Excellent
2	3.75 to 4.40	Good
3	3.0 to 3.75	Doubtful
4	Below 3.0	Poor

TEST REPORT

Certificate No.	:	**ARC/143/14.06.2022/TC-658**
Client Name & Address	:	**Navi Mumbai Municipal Corporation.**
Consultant Name	:	**M/s Yash Eng. Consultancy Pvt Ltd.**
Site/Project	:	Jimmy Park I ("B" Wing) Sec-17 ,Nerul Navi ,mumbai.
Description	:	Ultrasonic Pulse Velocity Test
Quantity	:	07 nos
Specification followed	:	IS 13311 Part I
Period of Testing	:	14.06.2022

ULTRA SONIC PULSE VELOCITY TEST

Sr. No.	Location	Member	Method	Distance (mm)	Time (ms)	Longitudinal Pulse Velocity (Km/s)	Remark
1	First Floor (Room No:B101)	Column	Indirect	300	83.3	3.60	Good
2	Third Floor (Room No:B301)	Column	Indirect	350	68.2	5.13	Excellent
3	Third Floor (Room No:B302)	Column	Indirect	340	78.2	4.35	Good
4	Fourth Floor (Room No:B401)	Column	Indirect	300	66.8	4.49	Good
5	Fifth Floor (Room No:B502)	Column	Indirect	350	72.8	4.81	Excellent
6	Sixth Floor (Room No:B602)	Column	Indirect	300	70.0	4.29	Good
7	Seventh Floor (Room No:B701)	Column	Indirect	300	77.2	3.89	Good

Table 2 : Velocity Criteria For Concrete Quality Grading

As per Table 2 of IS 13311 (Part 1) : 1992

Sr. No.	Pulse Velocity by Cross Probing (km/sec)	Concrete Quality Grading
1	Above 4.40	Excellent
2	3.75 to 4.40	Good
3	3.0 to 3.75	Doubtful
4	Below 3.0	Poor

TEST REPORT

Certificate No.	:	**ARC/143/14.06.2022/TC-658**
Client Name & Address	:	**Navi Mumbai Municipal Corporation.**
Consultant Name	:	**M/s Yash Eng. Consultancy Pvt Ltd.**
Site/Project	:	Jimmy Park I (Row House) Sec-17, Nerul, Navi mumbai.
Description	:	Ultrasonic Pulse Velocity Test
Quantity	:	04 nos
Specification followed	:	IS 13311 Part I
Period of Testing	:	14.06.2022

ULTRA SONIC PULSE VELOCITY TEST

Sr. No.	Location	Member	Method	Distance (mm)	Time (ms)	Longitudinal Pulse Velocity (Km/s)	Remark
1	Row House No: 3	Column	Indirect	350	96.5	3.63	Doubtful
2	Row House No: 4	Column	Indirect	300	60.8	4.93	Excellent
3	Row House No: 8	Column	Indirect	340	71.4	4.76	Excellent
4	Row House No: 10	Column	Indirect	300	69.9	4.29	Good

Table 2 : Velocity Criteria For Concrete Quality Grading

As per Table 2 of IS 13311 (Part 1) : 1992

Sr. No.	Pulse Velocity by Cross Probing (km/sec)	Concrete Quality Grading
1	Above 4.40	Excellent
2	3.75 to 4.40	Good
3	3.0 to 3.75	Doubtful
4	Below 3.0	Poor

Half-cell potentiometer test for detect the corrosion of reinforcement

Table 3.3 Half Cell Potentiometer

TEST REPORT		
Certificate No.	:	**ARC/143/13.06.2022/TC-659**
Client Name	:	**Navi Mumbai Municipal Corporation.**
Consultant Name	:	**M/s Yash Eng. Consultancy Pvt Ltd.**
Project/Site	:	Jimmy Park I (wing "A") Sec-17, Nerul, Navi mumbai.
Description	:	Half Cell Potential Meter
Quantity	:	2 No.
Specification followed	:	ASTM C876
Date of Testing	:	13.06.2022

HALF CELL POTENTIOMETER TEST					
Sr.No.	**Location/ID**	**Reading in (mv)**			**Average (mv)**
		1	2	3	
1	Slab	-230	-212	-178	-207
2	Slab	-243	-222	-208	-224

Half – cell potential (mv) relative to Cu-Cu sulphate Ref. electrode	***% chance of corrosion activity***
Less than - 200	10%
Between – 200 to – 350	50% (uncertain)
Above – 350	90%

The results show more than 50% corrosion in steel.

Chemical Analysis test for detect the Quality of Concrete

Table 3.4 Chemical Analysis of Concrete

Test Report

Certificate No.	**:ARC/143/14.06.2022/TC-659**	Sheet 1 of 1
Client name and address	: **Navi Mumbai Municipal Corporation.**	
Contractor Name	**M/s Yash Eng. Consultancy Pvt Ltd.**	
Project/Site	: Jimmy Park I Sec-17, Nerul, Navi mumbai.	
Description	: Concrete Material	
Quantity	: 2kg	
Specification followed	: IS 3025	
Date of Testing	: 14.06.2022	

Sr. No.	Test	Unit	Results	Requirement as per IS 456 - 2000	TEST METHOD
1	pH value	--	6.80	Not Less than 6	IS 3025 1983 Part 11 R-2012
2	Chlorides as Cl^-	mg/L	40	max. 2000 for concrete not containing embedded steel and Max. 500 for reinforced concrete work	IS 3025 1988 part 32 R-2014
3	Sulphates as SO_4	mg/L	35	Maximum 400 mg/L	IS 3025 1986 Part 24 R-2014

Tested By **Authorized by**

Note
- This certificate is valid at the time and under conditions specified herein.
- This certificate refers only to the sample submitted for testing.
- Report on tests samples will be preserved with us for one year from the date of testing.
- Any correction invalidates this certificate
- This report shall not be reproduced except in full without written approval from **M/s. Allied Research Centre**

Table 3.5 Concrete Core Test

INDIAN MATERIAL RESEARCH CENTER

IMRC

TC-8232

Expert Analyst for Geotechnical/ Geological Investigation (Land and Marine), Surveying work, Concrete, Asphalt, Reinforcement, Cements, NDT and Other Engineering Material

Email: imrc.analysis@yahoo.in

Location-1 : Plot No. G-75/76, Sector-12, Kharghar, Navi Mumbai - 410210.

Location-2 : Shop No. 13, Shiv Chatrapati Mini Market Association, Plot No. G-41, Sec.-12, Kharghar, Navi Mumbai- 410210.

ISO/IEC 17025 Accredited Testing Laboratory by National Accreditation Board For Testing and Calibration Laboratories (NABL) Vide Certificate Number TC-8232

TEST REPORT

ULR NO.	:	**TC08232220000004277F**
Test Report No. & date	:	**IMRC/TR/220613001-1 to 10 17-06-2022**
Name of customer & address	:	Yash Engineering Consultants Private Limited Plot No.27, Hemsudha, Tilak Nagar, Aurangabad, Maharashtra-431005
Name & Address of project	:	NMMC Projects.
Name of Contractor	:	--
Customer reference No.	:	Letter Dated -13-06-2022
Nature/Source of the sample	:	**Concrete Core**
Quantity	:	10 Nos
Condition of sample	:	Acceptable
Test Method	:	IS 516 Part 4 : 2018
Date of receipt of sample	:	13-06-2022
Date of start of analysis	:	14-06-2022
Date of completion of analysis	:	16-06-2022
MECHANICAL TESTING BUILDING MATERIALS		
Sample tested at	:	**Location 1**
Environmental Condition		
Temperature (^{0}C)	:	**Ambient**
Relative Humidity(%)	:	NA

SR. No.	ID. Marks	Diameter mm	Height mm After Capping & Dressing	Weight kg	Crushing Load kN	Compressive Strength N/mm^2	Corrected Compressive Strength for Dia. Less than 70 mm (IS : 516 Part : 4)	Corrected Compressive Strength (for Height and Dia. Ratio) N/mm^2	Equivalent Cube Strength as per IS 516 of size 150mm x 150mm x 150 mm N/mm2	Required Strength (As per IS 456 Clause No 17.4.3) N/mm^2	
									Individual		
1	A-1 RH	68.66	130.83	1.081	35.61	9.62	10.19	10.09	12.61	Individual (75%)	Average (85%)
2	A-2 RH	68.67	101.06	0.771	26.41	7.13	7.56	7.12	8.90		
3	B-1 RH	68.61	138.31	1.158	31.8	8.60	9.12	9.13	11.41		
4	B-2 RH	68.66	116.24	0.942	63.41	17.12	18.15	17.54	21.92		
5	G-1 AW	68.70	110.55	0.945	49.78	13.43	14.23	13.62	17.03		
6	G-2 AW	68.67	81.17	0.702	59.63	16.10	17.07	15.53	19.41		
7	G-1 BW	68.58	78.03	0.657	51.97	14.07	14.91	13.50	16.87		
8	S-2 BW	68.62	105.61	0.883	40.52	10.96	11.61	11.02	13.78		
9	S-1 AW	68.51	83.81	0.719	68.95	18.70	19.82	18.13	22.66		
10	S-2 AW	68.57	92.83	0.789	65.94	17.85	18.93	17.58	21.98		
							Average		**16.66**		

Note : This test report is valid at the time and under conditions specified herein.
This test report refers only to the sample submitted for testing.
Report of tests samples will be preserved with us for two years from the date of testing.
Any correction invalidates this test report.
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INDIAN MATERIAL RESEARCH CENTER IMRC

Authorised Signatory
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3. CONCLUDING REMARKS AND RECOMMENDAITONS

The structural audit of Jimmy Park CHS Ltd. was carried out. Based on the visual inspection and NDT results, recommendations for various structures that were audited are provided as under.

In a structural frame building the load transfer happens from Slab to Beam and Beam to Columns and ultimately the load is transferred to the foundations.

In present case of the building, based on the investigation and various tests carried out it is observed that all the components of structural frame are weak.

It has been observed and noted that there was structural alteration work was going on the 6th floor, additional slab was being casted on the existing slab. The existing slab itself was weak in strength and could not take the load resulting collapse of slab.

This collapse of slab at 6th floor on lower floor resulting additional impact load on lower floor slab which also collapsed. This sequence went up to ground floor.

This is a case where already weak RCCC frame structure and non-engineered structural alteration work which changes the behaviour of original frame structure resulting undesirable mishap.

1. The A & B Wing is structurally distressed and dilapidated and not recommended for habitation.
2. Rebound Hammer Test results of the Columns and beams of the A and B wings indicate the average concrete strength of the structure is not adequate (10-20 MPA).
3. Average UPV results of A & B wing indicate that most of the concrete has average structural integrity.
4. Average Carbonation test results shows more than 50% corrosion in reinforcement.
5. The structure failed in shear as the reinforcement is seen minimal in slab.

For Row Houses

1. Slab concrete collapsed in bedroom area in 2nd floor.
2. Leakages & Seepages marks were observed on RCC slab internally. Immediate attention is necessary to avoid the further deterioration.
3. Hammer tests are showing non uniform strengths. (10 to 20 mpa).
4. USPV test is showing values around 3.60 to 4.93 km/s indicate that most of the concrete has average structural integrity.

5. Core Tests shows average compressive strength of 16.66 N/mm^2 which is on lower side to current standards.
6. Based on the carbonation test results more than 50% corrosion in reinforcement it's an alarming situation. The Concrete strength is also on lower side as compared to current standards. The repairs to structure may not guarantee the future strength and life of structure. It will be prudent to Demolish these buildings.

4. REFERENCES

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