BUREAU VERITAS

Ref. No: IND.B.7.2022.300DR-R3

SOUNDNESS ASSESSMENT OF EXISTING AWHO CLUB HOUSE BUIILDING IN THE PREMISES OF M/S ARMY WELFARE HOUSING ORGANIZATION, KOCHI, KERALA.

APRIL 2023

BUREAU VERITAS

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SOUNDNESS ASSESSMENT OF EXISTING AWHO CLUB HOUSE BUIILDING IN THE PREMISES OF M/S ARMY WELFARE HOUSING ORGANIZATION, KOCHI, KERALA.

General View of AWHO Club House Structure

General View of AWHO Club House Structure

ACKNOWLEDGEMENT

We are thankful to the concerned authorities of M/s Army Welfare Housing Organization, Kochi, for their kind co-operation during the assessment. We appreciate the courtesy & support extended to the Bureau Veritas auditors.

- Bureau Veritas (India) Pvt. Ltd.

DISCLAIMER

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Report on	:	Soundness Assessment of existing AWHO Club House Building in the premises of M/s Army Welfare Housing Organization, Kochi, Kerala.
Report for	:	M/s. Army Welfare Housing Organization C/o Prasanna Vihar, Marine Drive, Opp. High Court, Kochi – 682 031.
Reference	:	Meeting on 13-10-2022
Period of Assessment	:	18th March 2023 to 24th March 2023
Assessment carried out under the guidance of	:	Mr. Mohankumar General Manager-South Asia Region-NDT & RR Dr. Shantharaju K Technical Advisor - Design review, NDT & RR Mr. R N Ravishankar Senior Manager – NDT & RR Mr. Avinash J Technical Manager-NDT & RR (PAN INDIA) Mr. Vijay H V Manager – NDT & RR Mr. Girish R Manager – NDT (South) M/s Bureau Veritas (India) Pvt Ltd Bangalore.
Assessment carried out by	:	Mr. Manjunath B S Engineer – Design Mr. Harish M Achari Asst. Manager - NDT Mr. Chethan H R Engineer – NDT Mr. Bibin Joy Engineer – NDT Mr. Sreenivasa M T

Senior Executive - NDT

Mr. Ramesh Raju
Executive - NDT

Mr. Ranjith P Menon
Senior Technician

M/s Bureau Veritas (India) Pvt Ltd,
Bengaluru & Kochi.

Assessment carried out in the presence of	:	Lt. Col. Sidhartha Singhal Project Director Army Welfare Housing Organization Rear Admiral P Ashokan (Retd.) President Mr. Jaya Kumar Velloor Manager Residential Welfare Association (RWA) Managing committee, Chanderkunj Army towers, Kochi, Kerala.
Date of submission of final report	:	30th April 2023

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CONTENTS

1.0 INTRODUCTION

The "AWHO Club House" structure/building located in the premises of M/s Army Welfare Housing Organization Kochi District, Kerala, is a conventional reinforced cement concrete framed structure with infilled masonry walls. The building comprises of ground and first floor only. Building was reported to be constructed about 07 years back since then it is in service.

The concerned authorities of AWHO wanted to ascertain the soundness of the existing building. In view of this the concerned authorities made a reference to M/s. Bureau Veritas to evaluvate the soundness of the existing Club House building.

In response to this, a detailed investigative study involving visual inspection and various nondestructive and lab tests were carried out by us during 17th February 2023 to 18th February 2023 at site. This report, in brief, summaries the outcome of the test results, inference drawn, proposed restoration measures and conclusions made thereon.

2.0 PHYSICAL OBSERVATIONS

Following are the physical observations made consequent to detailed inspection of the above-mentioned building:

Ground Floor

- No signs of settlement in foundation system was observed in any part of the building.
- Minor separation cracks were observed at the junction of RC members and masonry wall at few locations.

(Refer Sketch DWG No. DM/ CH/ GF, 1F-01)

First Floor

- Peeling of paint, growth of fungus and damp patches were observed over the external masonry walls in staircase regions at several locations.
- Minor separation cracks were observed at the junction of RC members and masonry wall at several locations.

(Refer Sketch DWG No. DM/ CH/ GF, 1F-01)

Terrace Floor

- Cracks were observed in overhead tank wall at few locations.
- Stagnation of water were observed over the terrace flooring at few locations.
- Leakage of water was observed from RC overhead tank at isolated location.

(Refer Sketch DWG No. DM/ CH/ TF-02)

3.0 INVESTIGATIVE TESTS

In order to evaluate the soundness of the building, following investigative studies were resorted to:

1. Semi-Destructive Core test to assess the quality/ strength of in-situ concrete in identified RC members.
2. Non-destructive Ultrasonic Pulse Velocity test to assess the quality/ homogeneity of in-situ concrete.
3. Rebound Hammer test on RC members to assess the estimated strength of in-situ concrete nearer to the surface.
4. Cover meter studies to assess the cover provided to the rebars in RC members.

1. **Semi-destructive core test to assess the quality / strength of in-situ concrete in identified RC members.**

Semi-Destructive test such as core test was resorted to in order to assess the strength of in- situ concrete in first floor RC Column. One core sample was extracted from first floor RC Column.

The extracted core samples were subjected to compressive strength test after necessarytrimming and capping as per the guidelines in IS: 516 (Part-4) 2018.

The results of Semi-Destructive core test indicate that the compressive strength of concrete in tested core extracted from identified RC Column is **25.2 N/sq.mm.**

ACCEPTANCE CRITERIA:

As per the clause 17.4.3 of IS: 456-2000 (Reaffirmed 2016), concrete in the member represented by a core test shall be considered acceptable if the average equivalent cube strength of the cores is equal to at least 85% of the cube strength of the grade of concrete specified for the corresponding age and no individual core have a strength less than 75%.

2. **Non-destructive Ultrasonic Pulse Velocity test to assess the quality/ homogeneity of in-situ concrete.**

Ultrasonic Pulse Velocity test was conducted on RC members in order to assess the quality of in-situ concrete. The test was conducted using "**PUNDIT LAB+" (Portable Ultrasonic Non-Destructive Digital Indicating Tester)** equipment from M/s. Proceq, Switzerland, as per the guidelines in Indian Standards IS:516-(Part-5/sec-1)-2018. Direct & Semi-Direct method of probing was adopted during testing.

From the results of the Ultrasonic Pulse Velocity test, it is inferred that the quality of concrete in the tested regions of RC members is found to be **"Good Concrete"** as per **IS:516-(Part-5/sec-1)-2018**. Results of the tests & quality grading reference chart are furnished in **Test Report.**

3. **Rebound Hammer test on RC members to assess the estimated strength of in-situ concrete nearer to the surface**.

Rebound Hammer test was carried out on the RC slabs at random and accessible regions to assess the surface hardness and strength of in-situ concrete. The test was conducted using Schmidt Rebound Hammer from M/s. Proceq, Switzerland as per the guidelines in Indian Standard **IS: 516 (Part–5/ Sec–4) : 2020.** The results of the tests are tabulated in **Test Report** and corresponding strength chart reference.

The results of tests indicates that, the estimated compressive strength of in-situ concrete in the tested RC members at tested locations is in the range of **22 N/mm^2 to 34 N/mm^2**.

4. **Cover meter studies to assess the cover provided to the rebars in RC members.**

Cover meter studies were carried out on RC members at random, in order to assess the thickness of cover concrete. The test was conducted using **Profometer-5$^+$** from **M/s. Proceq, Switzerland** as

per the guidelines in **BS 1881-204:1988** & as per manufacturer's manual. The results of the test are tabulated in **Test Report.**

From the results of the test, it is found that cover concrete provided to the rebars is adequate in most of the tested RC members.

4.0 INFERENCES

Following are the inferences drawn, based on the detailed physical observations, results of various Non-destructive tests:

1. Dampness/ damp patches/ growth of fungus and peeling of paint in masonry wall are mainly due to the constant spilling of water from overhead tank.
2. Separation cracks observed are due to dissimilar materials, improper filling of joints / not provided with mesh between masonry and RC members during construction stages. Further, thermal effects caused by expansion and contraction of building have aggravated the cracks.
3. Stagnation of water over terrace is mainly due to inadequate slope provided in WPC.
4. Cracks in plaster might be due to shrinkage effect.
5. From the results of the non-destructive ultrasonic pulse velocity test & rebound hammer test, it is inferred that the quality/strength of concrete in tested regions of RC members is found to be satisfactory.
6. From the results of covermeter studies, the cover provided to the rebars is adequate in most of the tested RC members.

5.0 RESTORATION MEASURES

a) Treatment for debonded / dampness/deteriorated plaster in masonry walls.

1. The deteriorated /debonded plaster on masonry walls shall be totally removed by gentle chipping.
2. The mortar joints shall be deeply racked for about 10 to 15 mm & repointed using CM 1:4 as per standard practice.
3. Re-plastering to be carried out using 1:4 cement mortar as per specification added with polypropylene fibres and cured as per standard practice.

b) Treatment for separation cracks between masonry walls and RC members.

1. Existing plaster in the region about 20 mm on either side of the crack should be removed and loose particles shall be cleaned using wire brush.
2. 'U' groove of 12 mm wide 6 mm deep shall be made all along the crack at the interface of masonry wall and RC member junction and cleaned.
3. Groove shall be filled with flexible sealant line tackseal/ Polysulphate sealant/ silicon sealant or any other equivalent.
4. Treatment should be carried out as per sketch.

(Refer Sketch DWG No. RM/01)

6.0 CONCLUDING REMARKS

The Existing "AWHO Club House" structure/building located at M/s Army Welfare Housing Organization Kochi District, Kerala, as it stands is structurally sound. However, minor distressed region of the building call for appropriate restoration measures as recommended above.

On carrying out the above-recommended restoration measures effectively under the guidance of experienced technical personnel and by an experienced agency, the distressed members of the structure will be rendered normal and serviceable.

Further, it is needless to emphasize that periodic maintenance of the structure should be strictly adhered to for effective functioning and life enhancement of the structure.

CHETHAN H R
Engineer- NDT

AVINASH J
Technical Manager-NDT & RR
(PAN INDIA)

ANNEXURES

TEST REPORTS

Bureau Veritas (India) Private Limited
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TC-6369

TEST REPORT

Test Order/Report No. BVIPL/CONCRETE CORE: KL/1907/4/2023 Date: 18/04/2023
Date of Receipt: 18-04-2023 Page 1 of 1
ULR-TC636923000001030F

ARMY WELFARE HOUSING ORGANIZATION
C/o Prasanna Vihar, Marine Drive,
Oppo.High Court, Kochi-682031

Mechanical Testing
Building Materials

TEST REPORT ON CONCRETE CORE TEST

Source Of Sample	:	Sample supplied by the Customer
Contract No/Proposal No	:	17671143/IND.B.7.2022.300DR-R3 DT.25.10.2022
Customers Reference	:	B/03029/SSI/job Work/CHN/AWHO Dated 30-12-2022
Project#	:	Structural Stability of Chanderkunj Residential Army Towers of Army Welfare Housing Organisation (AWHO) Located at Silver Sand Island, Vyttila, Kochi Kerala
Members tested	:	RC Columns
Date of Core Extraction	:	03.03.2023
Date of test	:	09.03.2023
Grade of Concrete#	:	M30
Reason for Testing	:	To ascertain the quality/ strength of in-situ concrete
Age of concrete	:	More than 28 days #
Capping Materials Used	:	EP10 Hardner (Part A) & EP10 Base (Part B) From M/s Fosroc Conbextra
Condition of Sample	:	Satisfactory
Test Method	:	IS: 516 Part 4: 2018

Sl. No	ID#	Core length (l) (mm) ##	Core diameter (d) (mm)	Core Weight (kg)##	Max. failure load (kN)	Corrected Core comp. strength (N/sq.mm) ###	l/d Ratio	Correction factor for (l/d) ratio+	Corrected cylinder comp. strength (N/sq.mm)	Equivalent cube strength++ (N/sq.mm)	Type of failure
1	Club House RC Column 1-2/E First Floor	110.0	68.0	0.924	72.2	21.06	1.618	0.958	20.18	25.2	**Typical Compressive Failure**

Core length and core weight after trimming and capping
###After applying correction factor for diameter of core which is less than 100 mm (i.e. Corrected Core Comp Strength, = Core Comp Strength * 1.06) IS:516-Part 4 :2018, Clause : 8.4.1
+ For l/d ratio, correction factor= 0.11(l/d)+0.78 as per IS:516-Part 4:2018, Clause 8.4.2
++ Equivalent cube compressive strength = 1.25 x corrected cylinder compressive strength as per IS:516-Part 4:2018, Clause 8.4.2

\# As furnished by the customer
Note: 1. Any correction invalidates this report.

602655

for BUREAUVERITAS (INDIA) PRIVATE LIMITED
Construction Services Laboratory

****

PRASANTHA KUMAR P.S
Manager-B&I

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TEST REPORT

TC-6006

Report No.:BVIPL:HC:KL/1218/3/2023/1a
Test order dated: 11.03.2023

Date:23.03.2023

ULR-TC600623100004614F

Army Welfare Housing Organisation
C/o Prasanna Vihar, Marine Drive,
Opp. High Court, Kochi – 682 031.

CHEMICAL TESTING
Building Materials

CHEMICAL TEST REPORT ON HARDENED CONCRETE SAMPLES

Source of Sample	:	Samples supplied by the customer
Customer's Reference	:	Letter No. B/03029/SSI/Job Work/CHN/AWHO dated 30.12.2022
Condition of samples	:	Satisfactory
UIN No.	:	23010898
No. of samples tested	:	1(One)
Project #	:	Carrying out structural Assessment and Consultancy for Analysis, NDT, Retrofitting Scheme at AWHO Project SSI, Kochi
Period of test	:	20.03.2023 to 23.03.2023
Test Method	:	IS: 14959 (Part II) 2001 (Reaffirmed 2021), BS:1881 (Part 124) – 2015

Sl. No.	Identification #	Name of Test		
		Chloride content - Acid Soluble		Sulphate as (SO_3) (% by mass of cement in concrete mix)
		(% by mass)	(kg/cu.m) $	
1	First Floor RC Beam (1-2/E) of Club House	0.0021	0.051	0.44
Requirements as per IS:456-2000 (Reaffirmed in 2021)		-------	**For reinforced concrete or plain concrete containing embedded metal, max. acid soluble chloride content in concrete should not exceed 0.6 kg/cu.m.**	**Total water-soluble sulphate content as SO_3 should not exceed 4% by mass of cement in the concrete mix.**

$ Chloride Content is Calculated by taking average density of Hardened Concrete as 2400 kg/Cu.m
As furnished by the customer

Note:
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2. Report shall not be reproduced, except in full, without the written approval of the lab.
3. Any correction invalidates this report.

for BUREAU VERITAS (INDIA) PRIVATE LIMITED
Construction Services Laboratory

****END OF THE REPORT****

23/03/2023
BHAGWAN. S
Assistant Manager - Chemical Lab

726872

Report No.:BVIPL:HC:KL/1218/3/2023/1b
Test order dated: 11.03.2023

Date:23.03.2023

Army Welfare Housing Organisation
C/o Prasanna Vihar, Marine Drive,
Opp. High Court, Kochi – 682 031.

CHEMICAL TEST REPORT ON HARDENED CONCRETE SAMPLES

Source of Sample	:	Samples supplied by the customer
Customer's Reference	:	Letter No. B/03029/SSI/Job Work/CHN/AWHO dated 30.12.2022
Condition of samples	:	Satisfactory
UIN No.	:	23010898
No. of samples tested	:	1(One)
Project #	:	Carrying out structural Assessment and Consultancy for Analysis, NDT, Retrofitting Scheme at AWHO Project SSI, Kochi
Period of test	:	20.03.2023 to 23.03.2023
Test Method	:	Laboratory Developed Method (BVIPL/CHEM/SOP/Concrete pH)

Sl. No.	Identification #	Name of Test
		pH
1	First Floor RC Beam (1-2/E) of Club House	13.54

As furnished by the customer

Note:
1. The results relate only to the items tested.
2. Report shall not be reproduced, except in full, without the written approval of the lab.
3. Any correction invalidates this report.

for BUREAU VERITAS (INDIA) PRIVATE LIMITED
Construction Services Laboratory

23/03/2023
BHAGWAN. S
Assistant Manager - Chemical Lab

725653

****END OF THE REPORT****

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TC-6006

TEST REPORT

Contract No – 17671143/1
Date of Receipt – 27/12/2022
M/s. Army Welfare Housing Organization
C/o Prasanna Vihar, Marine Drive,
Opp. High Court, Kochi – 682 031.

ULR No – TC600623200000115F
Date of submission – 25th April 2023

NDT
Building Materials
Reinforced Concrete Structures

RESULTS OF ULTRASONIC PULSE VELOCITY TEST

Project	:	Soundness Assessment of existing AWHO Club House Building in the premises of M/s Army Welfare Housing Organization, Kochi, Kerala.
Members tested	:	RC Columns, Beams & Slab
Period of test	:	17th February 2023 to 18th February 2023
Grade of concrete	:	M30*
Age of concrete	:	More than 28 days*
Test instrument	:	PUNDIT LAB+ (Portable Ultrasonic Non-destructive Digital Indicating Tester)
Make	:	M/s. Proceq, Switzerland
Test method	:	Direct & Indirect Method
Technical reference	:	a. Indian Standard IS: 516 (Part-5/Sec 1)-2018 b. Instrument manual furnished by M/s. Proceq, Switzerland

Sl. No.	Floor / Member Identification#	Grid Identification#	Average Pulse Velocity (Km/Sec)	Remarks
1	2	3	4	5
Ground Floor				**Refer quality grading chart for in-situ concrete**
1	**RC Column**	B2	3.75	
2		A4	4.45	
3		A6	5.15	
4		B7	4.22	
5		7C	4.47	
6		7D	4.83	
7		6E	4.91	
8		2D	4.91	
9		2C	4.54	
10		1D	3.80	

AVINASH, J
Technical Manager - NDT & RR

*Indicates information supplied by the customer for which the laboratory has no control. Sampling not done by laboratory, results relate to the sample tested only.

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TC-6006

Contract No – 17671143/1
Date of Receipt – 27/12/2022

ULR No – TC600623200000115F
Date of submission – 25th April 2023

1	2	3	4	5
11	**RC Column**	1E	3.65	**Refer quality grading chart for in-situ concrete**
12	**RC Beam**	C/2-4	3.82	
13		B/3-4	3.82	
14		B/7-6	3.91	
15		D/6-7	3.91	
16		5/D-E	3.65	
17		1/D-C	3.19	
18		D/5-6	3.91	
19	**RC Slab**	C-B/2-4	4.22+	
20		2-4/B-A	3.74+	
21		A-B/7-6	3.75+	
22		6-7/D-E	4.22+	
23		6-7/D-C	4.22+	
First Floor				
24	**RC Column**	7D	3.52	
25		6E	3.65	
26		2D	4.00	
27		1D	4.19	
28		E4	3.65	
29		2A	3.52	
30		6A	3.65	
31		B7	3.65	
32		C7	3.65	

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TC-6006

Contract No – 17671143/1
Date of Receipt – 27/12/2022

ULR No – TC600623200000115F
Date of submission –25th April 2023

1	2	3	4	5
33	**RC Column**	2B	3.65	**Refer quality grading chart for in-situ concrete**
34	**RC Beam**	D/7-6	4.32	
35		E/2-3	4.12	
36		C'/1-2	4.10	
37		D/1-2	4.10	
38		C/4-5	3.80	
39		C/2-3	3.59	
40	**RC Slab**	D-E/7-6	4.28+	
41		2-3/E-D	4.16+	
42		1-3/E-D	4.34+	
43		1-2/C'-D	3.81+	
44		2-1/A-B	3.79+	
Terrace Floor				
45	**RC Overhead Tank**	Column (left side)	4.23	
46		Beam (left side)	4.16	
47		Slab loc:1 (bottom)	3.70+	
48		Slab loc:2 (bottom)	3.84+	

*#Refer sketch **DWG.REF.No GL/ CH/ GF, 1F-01 & GL/ CH/ TF-02** for Floor / Member / Grid Identification.*
**As furnished by the customer.*

Note-1:

+As per *Clause 2.4.3.2.5* IS: 516 (Part-5/Sec1):2018, 0.5km/sec is been added to the reading above 3km/sec.

Note-2:

1. The results relate only to the sample tested.
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4. Any correction invalidate this report.

AVINASH. J
Technical Manager - NDT & RR

REFERENCE QUALITY GRADING CHART FOR (ULTRASONIC PULSE VELOCITY TEST)

Instrument : PUNDIT [Portable Ultrasonic Non-Destructive Digital Indicating Tester]

Make : M/s. Proceq, Switzerland

i) For Concrete (≤M25)

Pulse Velocity (Km/sec)	Concrete Quality Grading
Below 3.5	Doubtful
3.5 to 4.5	Good
Above 4.5	Excellent

ii) For Concrete (>M25)

Pulse Velocity (Km/sec)	Concrete Quality Grading
Below 3.75	Doubtful
3.75 to 4.50	Good
Above 4.50	Excellent

Note: Concrete quality grading for different velocity criterion as reproduced from Table-1 of IS 516 (Part 5/Sec1): 2018 Clause 2.5.2 Amendment November -2019.

In case of "Doubtful quality", it may be necessary to carry out further testing.

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TC-6006

TEST REPORT

Contract No – 17671143/2
Date of Receipt – 27/12/2022
M/s. Army Welfare Housing Organization
C/o Prasanna Vihar, Marine Drive,
Opp. High Court, Kochi – 682 031.

ULR No – TC600623200000116F
Date of submission – 25th April 2023

RESULTS OF REBOUND HAMMER TEST

Project	:	Soundness Assessment of existing AWHO Club House Building in the premises of M/s Army Welfare Housing Organization, Kochi, Kerala.
Members tested	:	RC Columns, Slab & RC wall.
Period of test	:	17th February 2023 to 18th February 2023
Grade of concrete	:	M30*
Age of concrete	:	More than 28 days*
Test instrument	:	Schmidt Hammer
Make	:	M/s. Proceq, Switzerland
Position of hammer	:	Vertically upwards
Technical references	:	1. Indian Standard IS: 516(Part 5/Sec 1):2020 2. Instrument manual furnished by M/s. Proceq, Switzerland

NDT
Building Materials
Reinforced Concrete Structures

Sl. No.	Floor / Member Identification#	Grid Identification#	Average Rebound Number+	Remarks
1	2	3	4	5
Ground Floor				**Refer reference chart for estimated compressive strength range of in-situ concrete**
1	**RC Column**	B2	22	
2		A4	24	
3		A6	24	
4		B7	22	
5		7C	24	
6		7D	24	
7		6E	24	
8		2D	22	
9		2C	24	
10		1D	30	
11		1E	36	

AVINASH. J
Technical Manager - NDT & RP

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TC-6006

Contract No – 17671143/2
Date of Receipt – 27/12/2022

ULR No – TC600623200000116F
Date of submission – 25th April 2023

1	2	3	4	5
12	**RC Slab**	C-B/2-4	26	**Refer reference chart for estimated compressive strength range of in-situ concrete**
13		2-4/B-A	26	
14		A-B/7-6	26	
15		6-7/D-E	30	
16		6-7/D-C	30	
First Floor				
17	**RC Column**	7D	24	
18		6E	26	
19		2D	24	
20		1D	30	
21		E4	26	
22		2A	28	
23		6A	26	
24		B7	26	
25		C7	26	
26		2B	24	
27	**RC Slab**	D-E/7-6	38	
28		2-3/E-D	34	
29		1-3/E-D	34	
30		1-2/C'-D	36	
31		2-1/A-B	28	
Terrace Floor				
32	**RC Overhead Tank**	Column (left side)	20	
33		Beam (left side)	30	

AVINASH. J
Technical Manager - NDT & RR

Bureau Veritas India Pvt. Ltd.
No.1030, 13th Cross, Attimabbe Road,
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TC-6006

Contract No – 17671143/2
Date of Receipt – 27/12/2022

ULR No – TC600623200000116F
Date of submission – 25th April 2023

*# Refer sketch **DWG.REF.No GL/ CH/ GF, 1F-01 & GL/ CH/ TF-02** for Floor / Member / Grid Identification.*
+ After applying necessary correction factor for impact position of Hammer.
**As furnished by the customer.*

Note-1:

The estimation of strength of concrete by rebound hammer method cannot be held to be very accurate and probable accuracy of prediction of concrete strength in a structure is ±25%. Depending upon correlation curve and methodology adopted for establishing correlation between rebound index and likely compressive strength as per clause 8.1 of IS 516 (Part5/Sec4):2000.

Note-2:

1. The results relate only to the sample tested.
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AVINASH. J
Technical Manager - NDT & RR

REFERENCE STRENGTH CHART
FOR REBOUND HAMMER TEST

Test instrument : Schmidt Hammer

Make : M/s. Proceq, Switzerland

Type : N-34

Technical reference : 1. IS 516 (Part 5/Sec4): 2020
2. Instrument manual furnished by M/s. Proceq, Switzerland

REBOUND NUMBER	ESTIMATED COMPRESSIVE STRENGTH RANGE (N/Sq.mm)
22 to 26	10 to 14
26 to 30	14 to 18
30 to 34	18 to 22
34 to 38	22 to 26
38 to 42	26 to 30
42 to 46	30 to 34

Note :

1. Estimated compressive strength is worked out based on the Calibration Chart developed for the above test instrument in our laboratory.

2. The estimation of strength of concrete by rebound hammer method cannot be held to be very accurate and probable accuracy of prediction of concrete strength in a structure is ±25%. Depending upon correlation curve and methodology adopted for establishing correlation between rebound index and likely compressive strength as per clause 8.1 of IS 516 (Part5/Sec4):2000.

****

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TC-6006

TEST REPORT

Contract No – 17671143/3
Date of Receipt – 27/12/2022
M/s. Army Welfare Housing Organization
C/o Prasanna Vihar, Marine Drive,
Opp. High Court, Kochi – 682 031.

ULR No – TC600623200000117F
Date of submission – 25th April 2023

RESULTS OF COVER METER STUDIES

Project : Soundness Assessment of existing AWHO Club House Building in the premises of M/s Army Welfare Housing Organization, Kochi, Kerala.
Members tested : RC Column, Beam & Slab
Period of test : 17th February 2023 to 18th February 2023
Test Instrument : Profometer 5+
Make : M/s Proceq, Switzerland
Technical Reference : BS: 1881-(Part 204)-1988 and Test Instrument Manual "Metal & Reinforcement Detector"from M/s Proceq, Switzerland

NDT
Building Materials
Reinforced Concrete Structures

Sl. No.	Member / Floor Identification#	Grid Identification#	Range of Cover Concrete(mm)+
1	2	3	4
Ground Floor			
1	**RC Column**	B2	34 to 55
2		A4	30 to 50
3		A6	39 to 45
4		B7	40 to 49
5		7C	40 to 52
6		7D	38 to 51
7		6E	39 to 53
8		2D	39 to 50
9		2C	42 to 51
10		1D	38 to 50
11		1E	39 to 52
12	**RC Beam**	C/2-4	30 to 40
13		B/3-4	30 to 35

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Technical Manager - NDT & RR

*Indicates information supplied by the customer for which the laboratory has no control. Sampling not done by laboratory, results relate to the sample tested only.

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Contract No – 17671143/3
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1	2	3	4
14	**RC Beam**	B/7-6	28 to 32
15		D/6-7	26 to 37
16		5/D-E	23 to 37
17		1/D-C	26 to 40
18		D/5-6	29 to 39
19	**RC Slab**	C-B/2-4	18 to 28
20		2-4/B-A	18 to 26
21		A-B/7-6	18 to 28
22		6-7/D-E	16 to 24
23		6-7/D-C	16 to 26
First Floor			
24	**RC Column**	7D	39 to 49
25		6E	38 to 50
26		2D	39 to 48
27		1D	35 to 45
28		E4	32 to 40
29		2A	32 to 59
30		6A	33 to 51
31		B7	31 to 57
32		C7	30 to 51
33		2B	35 to 55
34	**RC Slab**	D-E/7-6	15 to 20
35		2-3/E-D	16 to 20
36		1-3/E-D	15 to 24
37		1-2/C'-D	18 to 26
38		2-1/A-B	16 to 24

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Date of submission – 25th April 2023

1	2	3	4
39	**RC Beam**	E/2-3	24 to 37
40		C'/1-2	25 to 40
41		D/7-6	27 to 37
42		D/1-2	26 to 39
43		C/4-5	26 to 37
44		C/2-3	27 to 40

*# Refer sketch **DWG.REF.No GL/ CH/ GF, 1F-01 & GL/ CH/ TF-02** for Floor / Member / Grid Identification*
+ Inclusive of Plaster.
**As furnished by the customer.*

Note:

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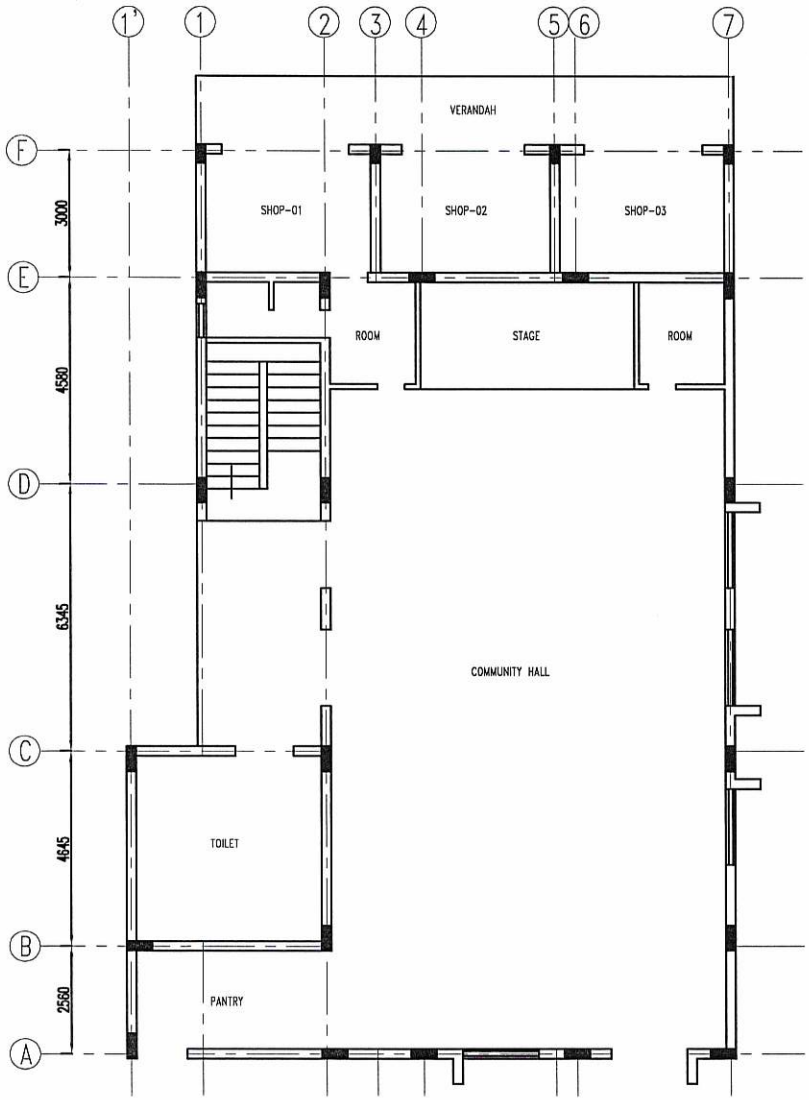
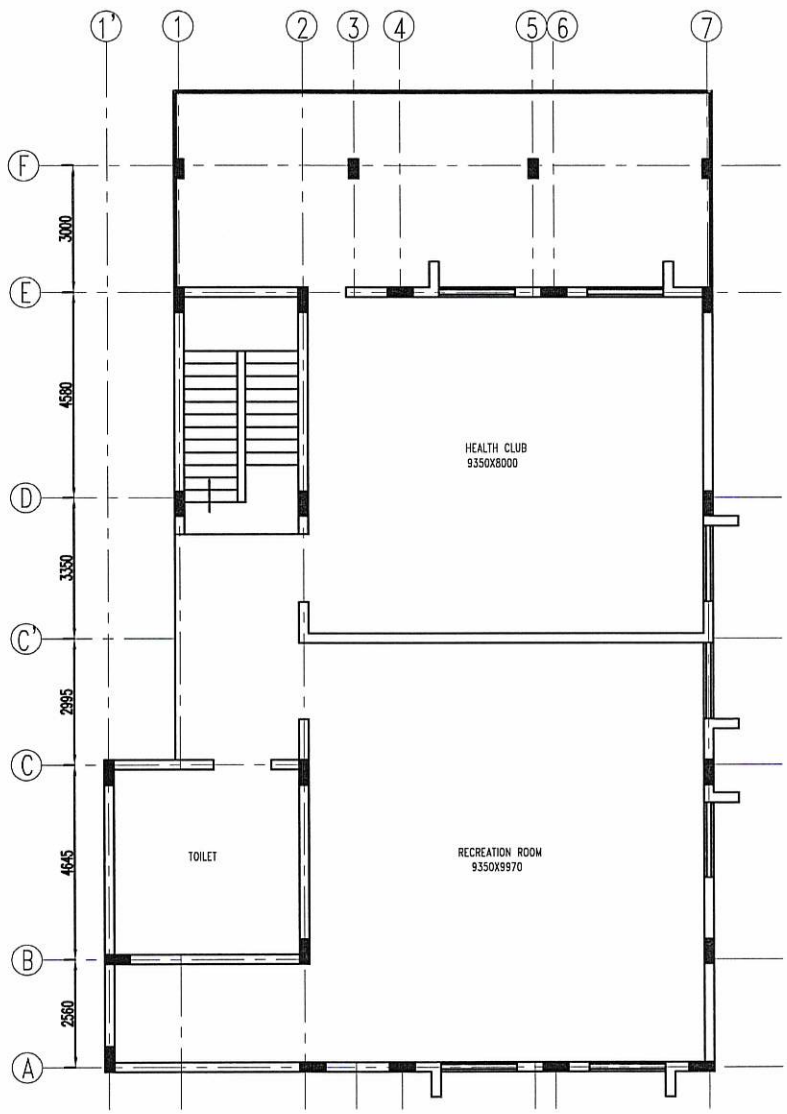
SKETCHES

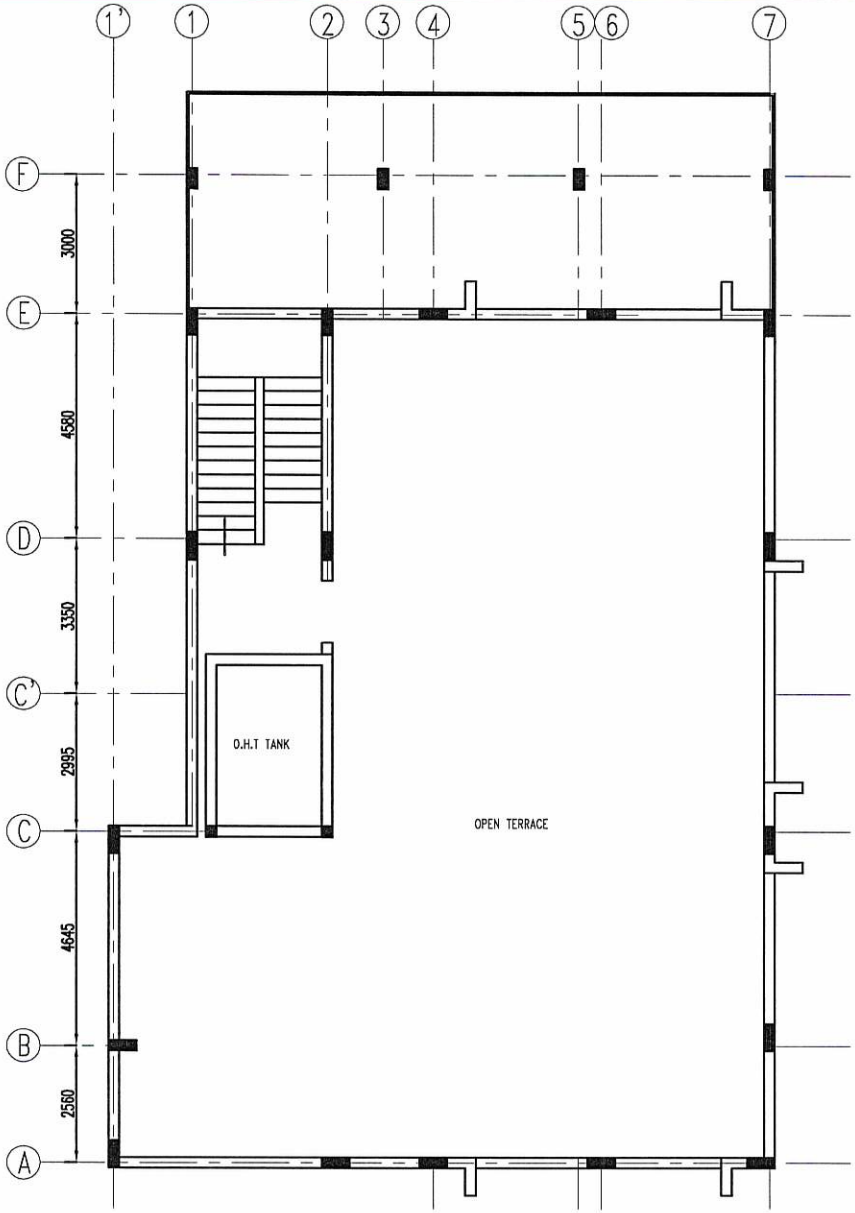


AWHO CLUB HOUSE-GROUND FLOOR



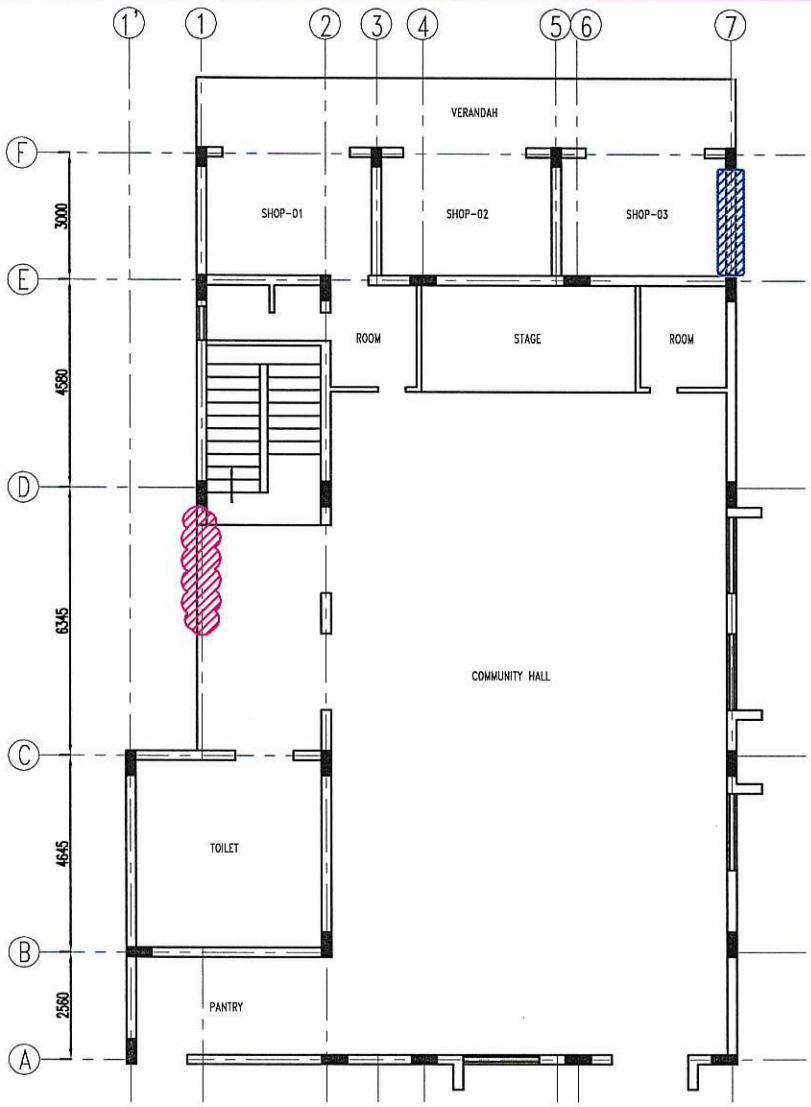
AWHO CLUB HOUSE-FIRST FLOOR

CLIENT: M/s ARMY WELFARE HOUSING ORGANISATION (AWHO) VYTILLA, KOCHI, KERALA	TITLE: **EXISTING GROUND AND FIRST FLOOR RC COLUMNS, BEAMS AND MASONRY WALLS**	DRAWN: RSKK / CHECKED: CHR/MBS / APPROVED: AJ/Dr.KS	SCALE: NTS / DATE: 24-03-2023 / DWG. REF. No: GL/CH/GF,1F-01 / REV.No. R0
PROJECT: STRUCTURAL EVALUATION OF AWHO CLUB HOUSE AT ARMY WELFARE HOUSING ORGANISATION "CHANDERKUNJ ARMY TOWERS" AT SILVER SAND ISLAND, VYTILLA, KOCHI, KERALA		CONSULTANTS: BUREAU VERITAS (INDIA) PVT. LTD. # 1030, 13th Cross, Banashankari 2nd Stage, Bengaluru - 560 070. Tel. : 080-26980200	CONTRACT NO: 17671143

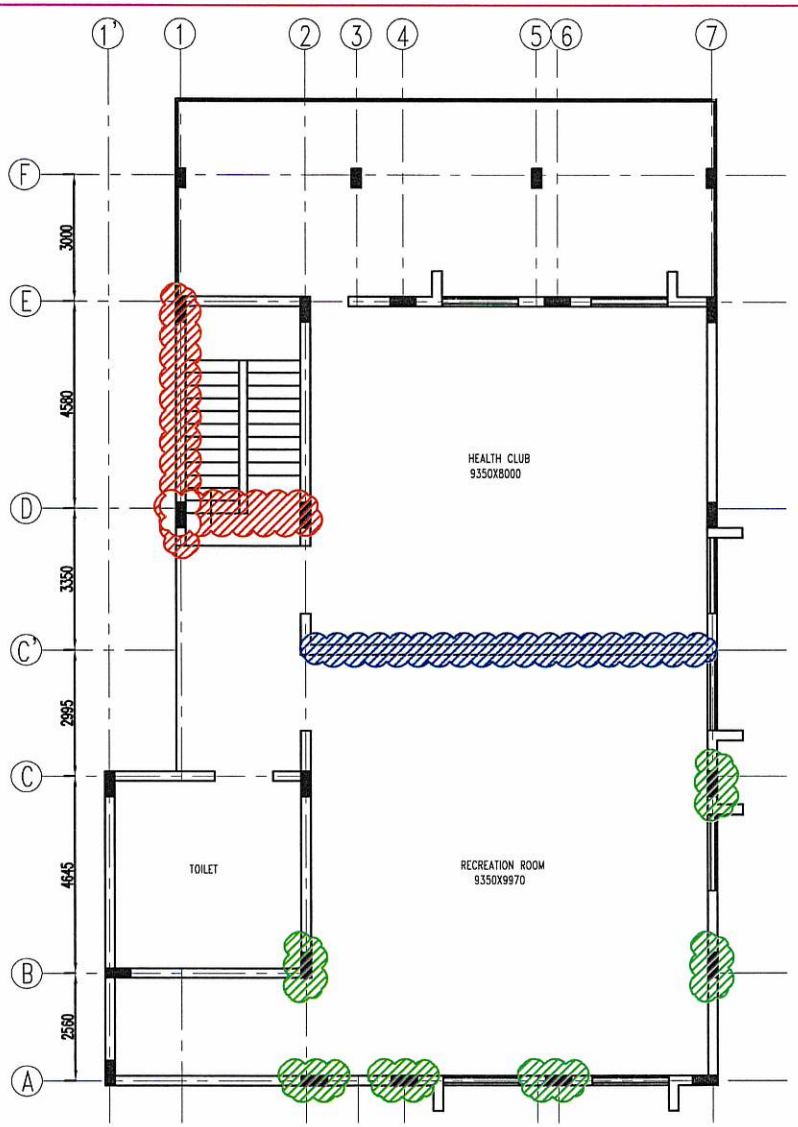


AWHO CLUB HOUSE-TERRACE FLOOR

CLIENT: M/s ARMY WELFARE HOUSING ORGANISATION (AWHO) VYTILLA, KOCHI, KERALA	TITLE: **EXISTING TERRACE FLOOR PLAN**	DRAWN: RSKK	CHECKED: CHR/MBS	SCALE: NTS	DATE: 24-03-2023
			APPROVED: AJ/Dr.KS	DWG. REF. No :GL/CH/TF-02	REV.No. R0
PROJECT: STRUCTURAL EVALUATION OF AWHO CLUB HOUSE AT ARMY WELFARE HOUSING ORGANISATION "CHANDERKUNJ ARMY TOWERS" AT SILVER SAND ISLAND, VYTILLA, KOCHI, KERALA		CONSULTANTS: BUREAU VERITAS (INDIA) PVT. LTD. # 1030, 13th Cross, Banashankari 2nd Stage, Bengaluru – 560 070. Tel. : 080-26980200		CONTRACT NO: 17671143	



AWHO CLUB HOUSE-GROUND FLOOR

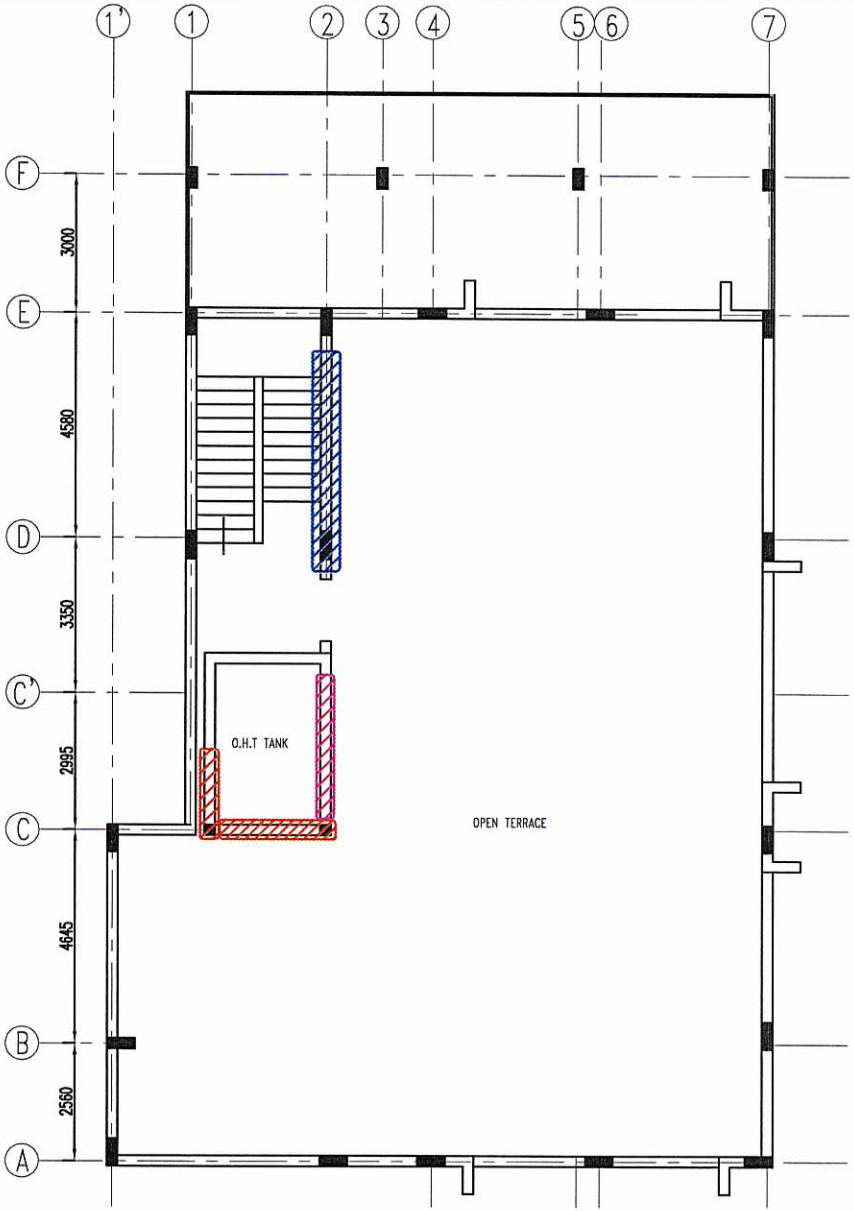


AWHO CLUB HOUSE-FIRST FLOOR

LEGEND:

- EFFLORESCENCE/DAMPNESS/DAMP PATCHES/PEELING OF PAINT.
- PLASTERING CRACKS IN RC BEAM/RC WALL
- SEPERATION CRACKS BETWEEN RC BEAM AND MASONRY WALL
- SEPERATION CRACKS BETWEEN RC COLUMN AND MASONRY WALL

CLIENT: M/s ARMY WELFARE HOUSING ORGANISATION (AWHO) VYTILLA, KOCHI, KERALA	TITLE: **DISTRESS LAYOUT OF GROUND AND FIRST FLOOR**	DRAWN: RSKK / CHECKED: CHR/MBS / APPROVED: AJ/Dr.KS	SCALE: NTS / DATE: 24-03-2023 / DWG. REF. No: DM/CH/GF,1F-01 / REV.No. R0
PROJECT: STRUCTURAL EVALUATION OF AWHO CLUB HOUSE AT ARMY WELFARE HOUSING ORGANISATION "CHANDERKUNJ ARMY TOWERS" AT SILVER SAND ISLAND, VYTILLA, KOCHI, KERALA		CONSULTANTS: BUREAU VERITAS (INDIA) PVT. LTD. # 1030, 13th Cross, Banashankari 2nd Stage, Bengaluru – 560 070. Tel. : 080-26980200	CONTRACT NO: 17671143

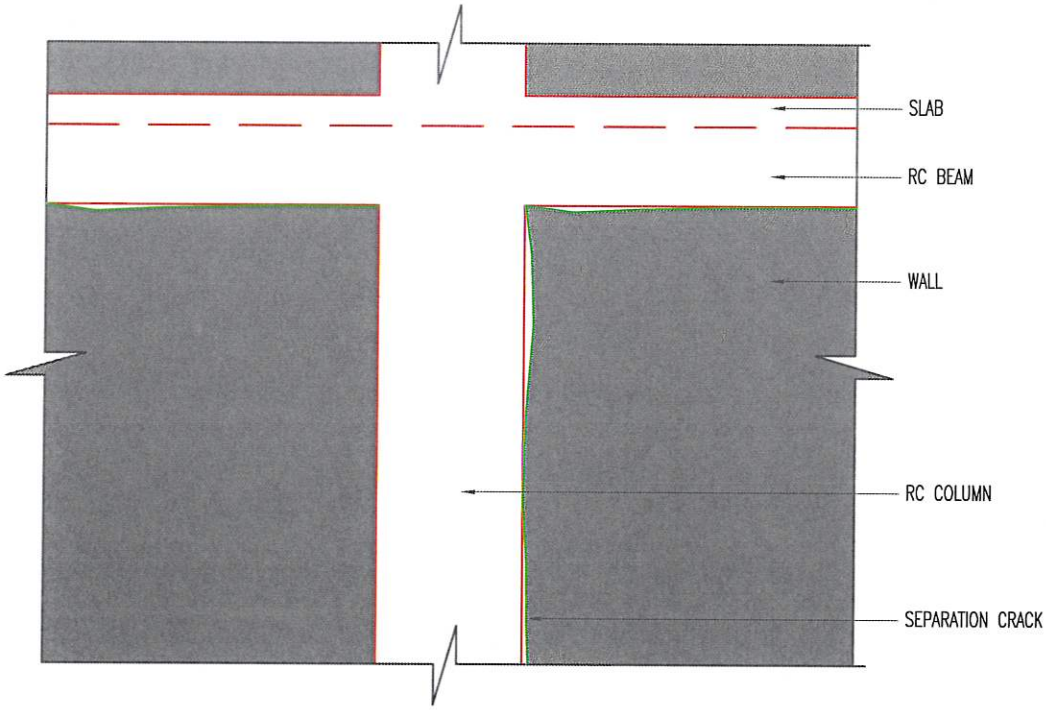


AWHO CLUB HOUSE-TERRACE FLOOR

LEGEND:

- EFFLORESCENCE/DAMPNESS/DAMP PATCHES/PEELING OF PAINT.
- PLASTERING CRACKS IN RC BEAM/RC WALL
- SEPERATION CRACKS BETWEEN RC BEAM AND MASONRY WALL
- SEPERATION CRACKS BETWEEN RC COLUMN AND MASONRY WALL

CLIENT: M/s ARMY WELFARE HOUSING ORGANISATION (AWHO) VYTILLA, KOCHI, KERALA	TITLE: **DISSTRESS LAYOUT OF TERRACE FLOOR**	DRAWN: RSKK	CHECKED: CHR/MBS	SCALE: NTS	DATE: 24-04-2023
			APPROVED: AJ/Dr.KS	DWG. REF. No : DM/CH/TF-02	REV.No. RO
PROJECT: STRUCTURAL EVALUATION OF AWHO CLUB HOUSE AT ARMY WELFARE HOUSING ORGANISATION "CHANDERKUNJ ARMY TOWERS" AT SILVER SAND ISLAND, VYTILLA, KOCHI, KERALA		CONSULTANTS: BUREAU VERITAS (INDIA) PVT. LTD. # 1030, 13th Cross, Banashankari 2nd Stage, Bengaluru – 560 070. Tel. : 080-26980200		CONTRACT NO: 17671143	



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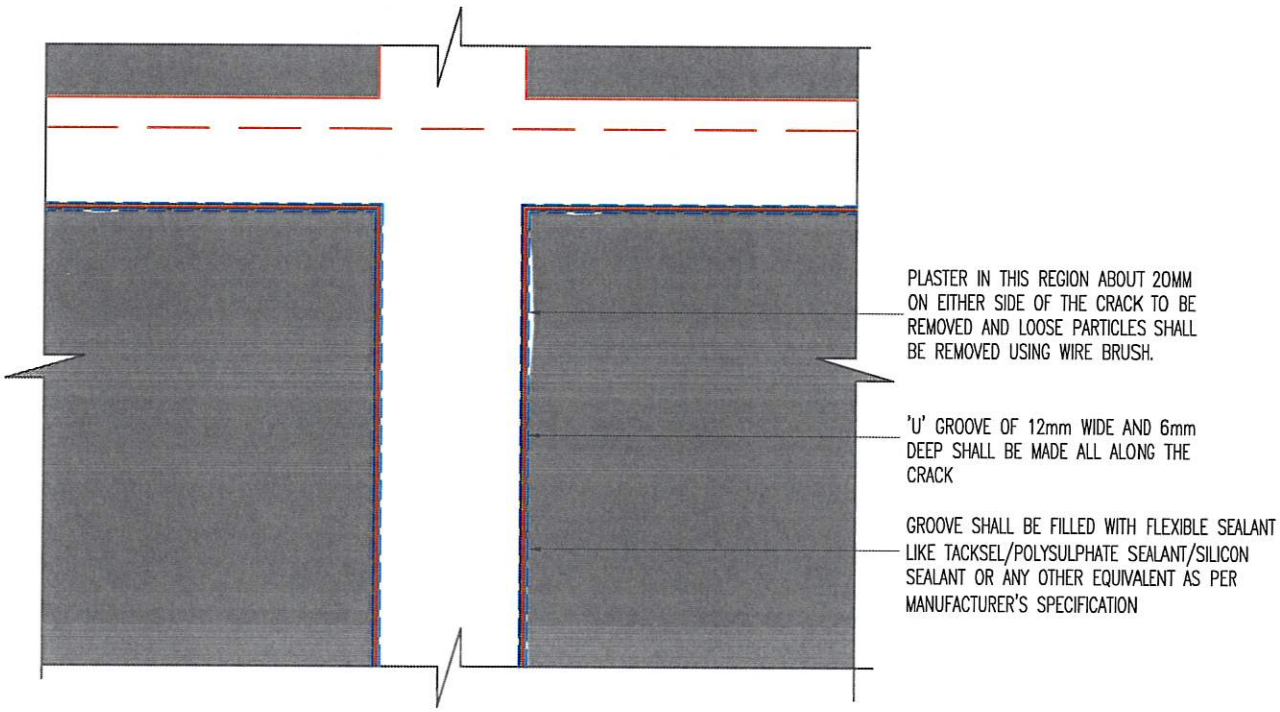

STAGE-1

TITLE	**TREATMENT FOR SEPARATION CRACK**					
		DATE	REV	DESCRIPION		
CLIENT	M/S ARMY WELFARE HOUSING ORGANISATION (AWHO) VYTILLA, KOCHI, KERALA	DRAWN: RSKK	CHECKED: CHR/MBS	SCALE: NTS	DATE: 24-04-2023	
		DESIGNED:	APPROVED: AJ	DWG. REF. No.: RM/01	REV.No.: R0	
PROJECT	SOUNDNESS ASSESSMENT OF EXISTING AWHO CLUB HOUSE BUILDING IN THE PREMISES OF M/S ARMY WELFARE HOUSING ORGANIZATION, KOCHI, KERALA.	CONSULTANTS: BUREAU VERITAS (INDIA) PVT. LTD. # 1030, 15th Cross, Banashankari 2nd Stage, Bangalore - 560 070. Tel. : 080-26980200		CONTRACT NO: 17671143		

SPECIFICATIONS

SPECIFICATION FOR ELASTOMERIC SEALANT FOR SEPARATION CRACK

Type of sealant	:	Two part elastomeric waterproof sealant
Tensile strength	:	1.50 to 1.70 N/sq.mm
Elongation	:	600 to 700 %
Movement accommodation	:	±25 to 40%
Pot life	:	Not less than 30 minutes
Full cure	:	7 to 10 days max. (as per manufacturer's specification)
Shore A hardness	:	18 to 23 at 25° C
Pressure resistance	:	6 to 8 m hydrostatic head
Application temperature		
Range	:	10° C to 50° C
Density	:	1.60 to 1.70 Kgs / litre
Solid content	:	100% (Max.)
Resistance of exposure	:	Shall not degrade when exposed to Ultra-Violet radiation and weathering
Service condition	:	i) Shall be resistant to abrasion ii) Shall be impermeable to water when sealed iii) Shall be non-corrosive type iv) Shall be non-toxic and food grade
Life	:	Shall be durable for a minimum period of 5 years (Guarantee period)
Technical reference	:	BS - 4254 - 1983 or equivalent
Available sources	:	**"Masterflex 472/474"** from M/s. BASF India Ltd., Bangalore **"Dr. Fixit PU Sealant"** M/s. Pidilite Industries Ltd. **"Nitoseal PU – Polyurethen selant"** **"Thioflex 600 – Polysulphide sealant"** **"Nitoseal MS 600 – Hybrid Silyl Modified Polyether** M/s. Fosroc Chemicals (India) Pvt. Ltd., Bangalore **or any equivalent**

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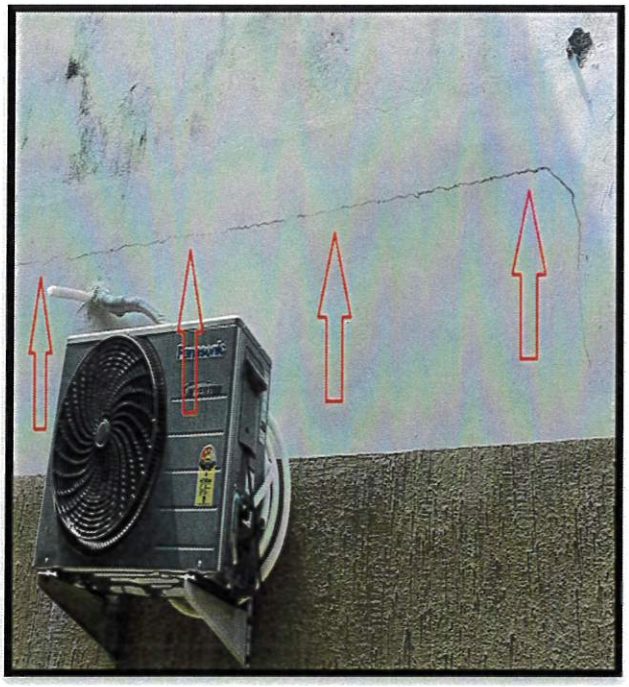
PHOTOGRAPHS

PHOTOGRAPHS

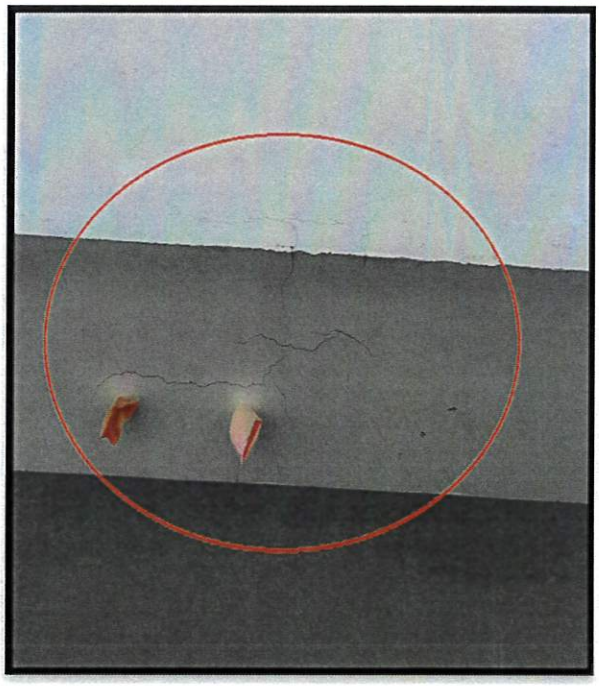
General View of Building

General View of Building

PHOTOGRAPHS



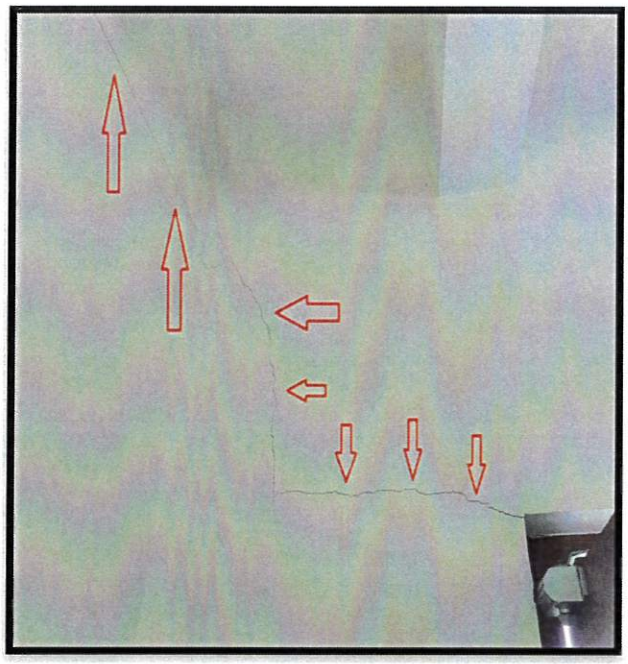
View of Separation Cracks Between Masonry Walls and RC Members

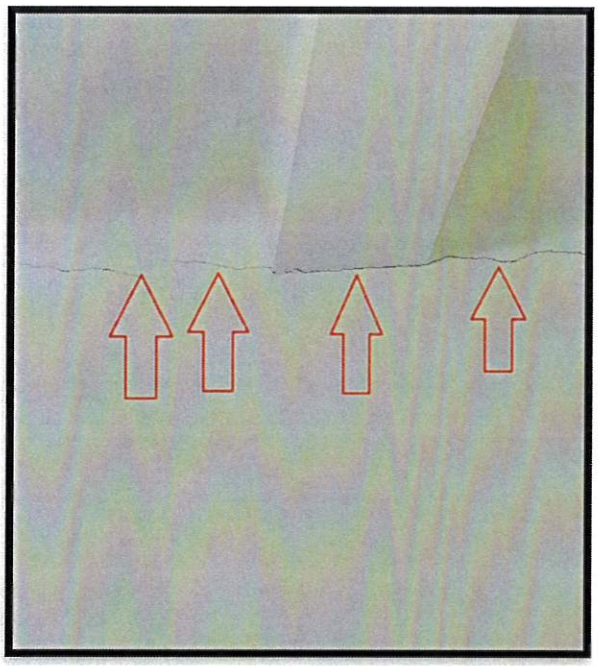


View of Plaster Cracks in RCC beam along grid 1/C-D

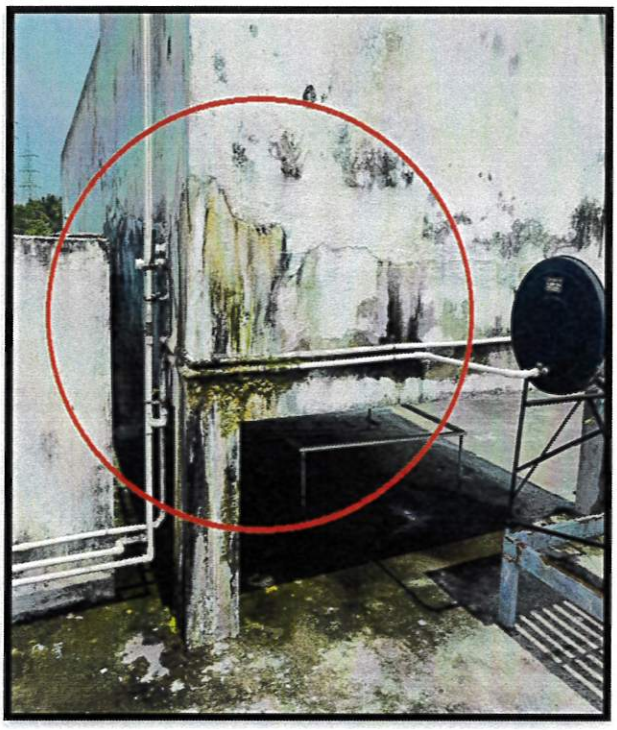
View of Peeling of paint and damp patches in masonry wall at stair case regions

PHOTOGRAPHS

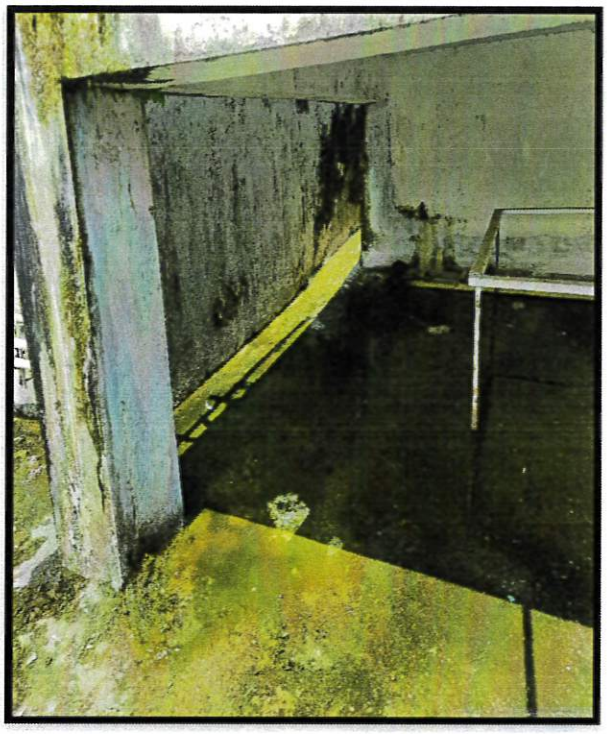




View of Separation Cracks Between Masonry Walls and RC Members

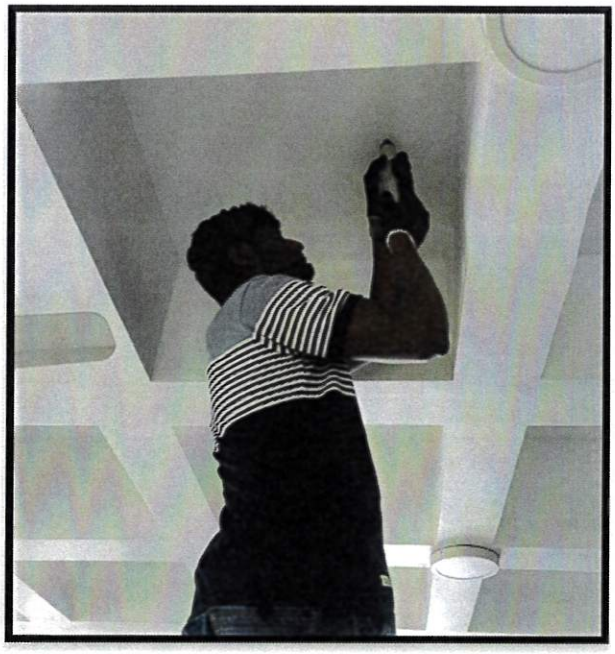


View of Cracks in OHT tank wall

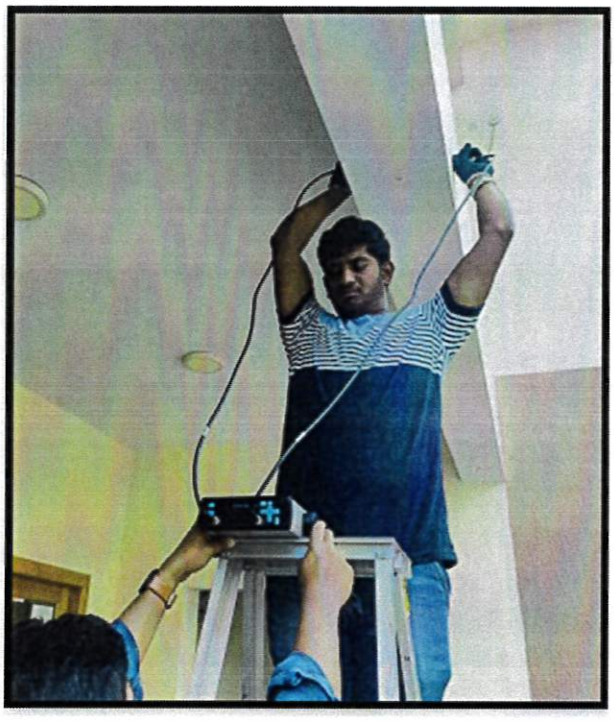


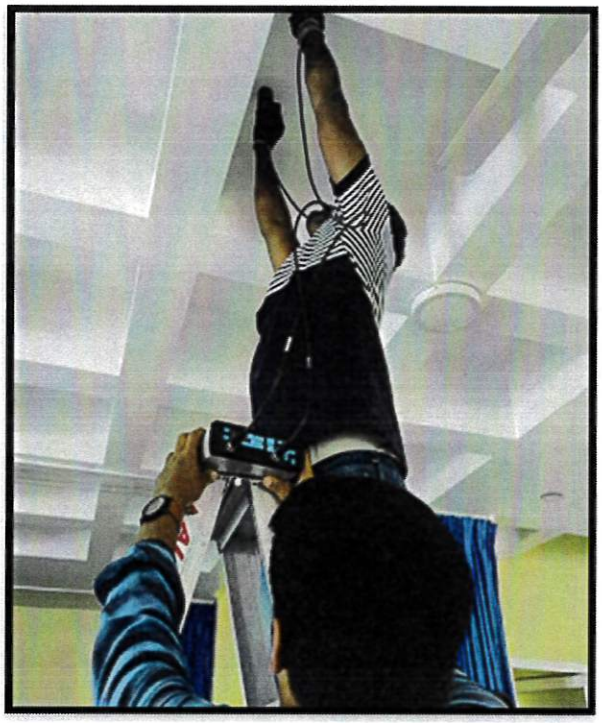
View of Stagnation of water over the terrace flooring

PHOTOGRAPHS



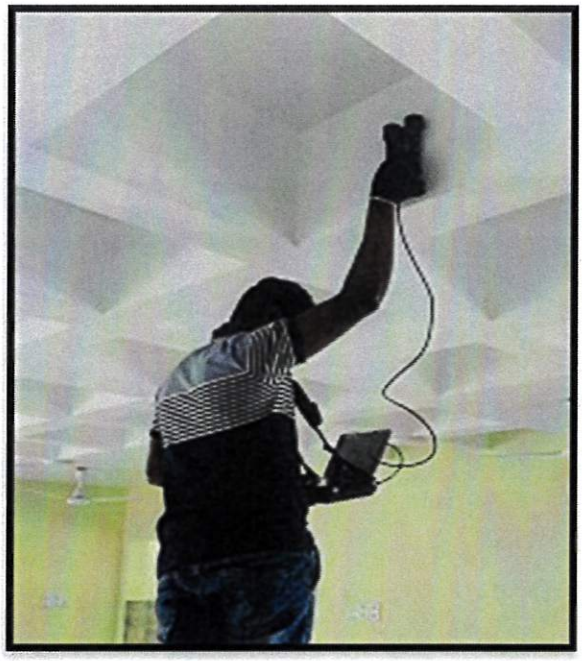
View of Rebound Hammer test in progress





View of Ultrasonic Pulse Velocity test in progress

PHOTOGRAPHS



View of profometer (cover meter) test in progress