

STRUCTURAL AUDIT REPORT

Of

KALA ACADEMY, GOA

Client: Kala Academy, Goa

**Implementing Agency: Goa State Infrastructure
Development Corporation Limited (GSIDC)**

By



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Note:

1. The reported results refer to the samples &/ or structures tested on site under stated conditions only and shall not be reproduced either in part or in full, nor be further interpreted without written permission of GEM Engserv.
2. This report pertains only to samples or onsite structures identified and provided for testing by Kala Academy.
3. The tests conducted are indicative & not definitive in nature. Hence Gem shall not depose as expert witness on this basis.
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1. Preamble:

Goa State Infrastructure Development Corporation Limited (GSIDC) is a wholly owned Company of the Government of Goa registered under the Companies Act, 1956, with the Registrar of Companies, Panaji-Goa. The GSIDC has constructed several infrastructure facilities like Bridges, Roads, Bus Stands and Jetties in the state of Goa. The Kala Academy has appointed **GEM Engserv Pvt. Ltd.** (hereafter referred as **GEM**) to carry out Structural Audit of Kala Academy Building, Campal, Panaji Goa.

2. Client's Input:

Following inputs were received from the client:

- a) Plan showing layout of various structures on site
- b) List of RCC & steel structures
- c) Architectural drawing of the facility

3. Site Work by GEM:

- a) GEM Team (consisting of 2 auditors) first undertook a site visit from 13th August 2019 to 15th August 2019 covering entire building and auditorium. Gem Team conducted a walk-through inspection to examine visible defects and distress in various structures. During this site visit, GEM Team examined whatever parts were visible; and inspected defects "within touching distance.
- b) For inspecting the objects or parts of the structures that are located high above the ground, GEM used a high-resolution camera.
- c) Evidences collected during the walk-through inspections are presented in **Annexure II**. The site observations were reviewed by the senior technical expert of GEM and the conclusion, recommendations addressing the distress noticed in various structures are presented in Para 5 & 6 below.



d) None of the foundations could be examined for all operational structures. However, there is no settlement is found in any foundation.

4. Site Observations:

Based on visual observations a list of distress has been prepared and summarized at **Annexure I**. Distress have been classified in three categories, which may be interpreted as under:

1. **Severe:** The distress is serious enough to warrant immediate action.
2. **Moderate:** Though there are clear indications of distress, repair can be taken up after planning in a time bound manner. If not attended, this can become serious in future.
3. **Mild:** Though the element shows signs of distress, there is no urgency to take repair action and these may be addressed through annual maintenance plan.

There are few types of distress which were observed at multiple locations. In order to use uniform language for the classification of defects and their corrective actions we have standardised their description as shown in Table 1below.

Table 1. Standardized Description

Sr. no.	Brief description of defect	Code for Defect	Standard Corrective Action (CA)
1	Surface crack on masonry	Type A	Carryout Caulking of crack in masonry after chasing.
2	Deep crack on masonry	Type B	Grout the deep crack in masonry.
3	Deep crack in concrete	Type C	Grout the crack in RCC
4	Surface crack on concrete	Type D	Treat crack by 'V' groove Patch up.
5	Small crack on plaster	Type E	Patch repairs the plaster.
6	Extensive crack on plaster	Type F	Replaster with water proofing chemical.
7	Concrete spalling in small patches	Type G	Patch repair the spalled concrete.
8	Concrete spalling in large area	Type H	Extensive repair of concrete with micro concrete, If the loss of rebar cross section is unacceptable, then provide and fix additional rebar.
9	Drainage Problem in Terrace	Type I	Repair/ improve drainage.
10	Leakages due to water proofing problem	Type J	Repair / redo the water proofing to avoid control leakages.
11	Masonry joint open and pointing disturbed	Type K	Clean the open joints and carry out pointing with approved materials.
12	Tress and vegetation on external wall of building	Type L	Remove vegetation & fill gap with repair mortar.
13	Algae growth on external wall	Type M	Remove algae and apply suitable paint to avoid vegetation and algae growth.
14	Peel off paint & plaster due to dampness inside and outside of wall	Type N	Replaster the affected area with water proofing material damp-proof chemicals.
15	Seepage and leakage in concrete from ground	Type O	XYPEX PATCH, N PLUG shall be used for the water leakages from the ground and the side wall
16	Major Spalling due and corrosion of rebar	Type P	Demolish and reconstruct
17	Honeycomb in concrete	Type Q	Repair with approved repaired mortar.
18	Level problem	Type R	Increase level by additional concrete
19	Special distress	Type S	'Structural design engineer to be consulted for design of retrofitting scheme'



Annexure I: Site observations

KALA ACADEMY BUILDING, PANAJI GOA.

Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
GROUND FLOOR OBSERVATIONS						
1	Ground Floor	2 sq. m	Room no. 11, Janitor room column found major crack having and spalling of concrete due to corrosion of rebar.	Type H	GF1	Severe
2		2 rm.	Room no. 11, Janitor room top beam bottom found deep crack in concrete due to corrosion of rebar.	Type C	GF2	Moderate
3		2 sq. m	Room no. 11b, Rest room male, top ceiling found marking of seepages from top due to W/F damaged	Type J	GF3	Moderate
4		2 sq. m	Room no. 11c, Rest room female, toilet no 1F found marking of seepages from top due to W/F damaged	Type J	GF4	Moderate
5		2 sq. m	Room no. 11c, Rest room female, top ceiling found marking of seepages from top due to W/F damaged	Type J	GF5	Moderate
6		36 sq. m.	Jury Preview Theater, storeroom no. 10 b ceiling found major spalling due to corrosion of rebar in entire room.	Type S	GF6,7,8	Severe
7		2 rm	1 st floor painting display room found crack on masonry wall.	Type A	GF9	Mild
8		2 sq. m	At the entrance of Projector room, at two locations, ceiling found spalling of concrete due to corrosion of rebar.	Type G	GF10	Moderate
9		160 sq. m	Art gallery, room no 4 ceiling found seepages of water from top ceiling due to gap found in kota flooring joints and damaged water proofing	Type J	GF11,12	Severe
10		2 sq. m.	Art gallery room no. 4 ceiling found spalling of concrete due to corrosion of rebar.	Type G	GF13	Moderate
11		2 sq. m.	Opposite Art gallery gate ceiling found spalling of concrete due to corrosion of rebar.	Type H	GF14	Severe



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
12		25 sq. m	Opposite Art gallery gate ceiling found seepages of water from top ceiling due to gap found in kota flooring joints and damaged water proofing	Type J	GF15,16	Severe
13		0.09 sq. m	Column no 1 at grid line 'L', near expansion joint, found hollow ness due to carrion of rebar at the bottom.	Type G	GF17	Moderate
14		0.09 sq. m	Column no. 2 at grid line 'I' near setting one, found hollow ness due to carrion of rebar at the bottom.	Type G	GF18	Moderate
15		0.09 sq. m	Column no 3. At grid line 'H', near entrance floor found hollow ness due to carrion of rebar at the bottom.	Type G	GF19	Moderate
16	Three level Auditorium	9 sq. m	Auditorium, Orchestra pit of stage found seepages of water from ground	Type O	GF20	Moderate
17		0.2 Cum	Auditorium south side entrance gate found level major level difference which lead entering of outside water.	Type R	GF21	Mild
18		5 sq. m	Auditorium wall of south side entrance gate found mark of seepages from top chajja.	Type J	GF22	Moderate
19		9 sq. m	North side wall found seepages of water form ground	Type O	GF23	Moderate
20		3 rm	Auditorium room no. 48 Passage to flyover gallery, found major crack in beam bottom due to corrosion of rebar	Type G	GF24	Moderate
21		2 sq. m.	Auditorium room no. 48 Passage to flyover gallery, found crack in staircase bottom slab due to corrosion of rebar	Type G	GF25	Moderate
22		3 rm.	Auditorium room no. 48 Passage to flyover gallery, found separation crack in wall	Type B	GF26	Mild



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
23		6 rm	Auditorium room no. 48 Passage to flyover gallery 1 st level beam found crack and staircase bottom slab found crack due to corrosion of rebar	Type C	GF27	Severe
24		1 sq. m	Auditorium room no. 48 Passage to flyover gallery staircase from 1 st to 2 nd floor beam found major crack and spalling of concrete due to corrosion of rebar	Type G	GF28	Severe
25		2 rm.	Auditorium room no. 48 Passage to flyover gallery staircase at 2 nd floor beam found surface crack	Type D	GF29	Severe
26		4 sq. m	Auditorium, room no. 48 Passage to flyover gallery at 2 nd floor south side cantilever slab found major spalling due to corrosion of rebar at two locations.	Type H	GF30,31	Severe
27		270 sq. m	Auditorium, room no. 48 Passage to flyover gallery at 2 nd floor west side wall found marking of seepage and leakage from three locations due to damaged water proofing of terrace of 2 nd floor	Type J	GF32	Moderate
28		270 sq. m	Auditorium, room no. 48 Passage to flyover gallery at 2 nd floor North side wall found seepage and leakage at one location due to damaged water proofing of terrace of 2 nd floor	Type J	GF33	Moderate
29		2 rm	Beside Auditorium at 2 nd floor lighting room found top beam found crack	Type D	GF34	Mild
30		Ground floor	1 sq. m	Ground floor Meeting room no. 52 found leakage at one location from ceiling due to damaged water proofing of terrace	Type J	GF35
32	0.5 sq. m.		Room no 53-rehearsal room found leakage from top at One location.	Type J	GF36	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
33		4 rm.	Room 55, Library, beam in front of entrance found spalling due to corrosion of rebar	Type G	GF37	Moderate
34		1 sq. m	Room 56, Library reading room, found seepages and leakages from ceiling at one location.	Type J	GF38	Moderate
35		4 sq. m	Room 57, Library last room, found seepages and leakages from ceiling at two locations	Type J	GF39	Moderate
36		12 sq. m	Black box room no. 19, found leakage from ceiling at three locations two are near DIAS and another is near entrance	Type J	GF40, 41 42	Moderate
37		4 sq. m	Room no.17 recording room entire ceiling found major seepage and leakage	Type J	GF43, 44	Moderate
38		12 sq. m	Room no. 8 repair room ceiling found spalling of concrete due to corrosion of rebar	Type S	GF45	Severe
39		18 sq. m	Corridor from Recording room no. 17 to Repair room no. 8 ceiling found delamination of concrete due to severe corrosion of rebar	Type S	GF46,47	Severe
40		16 sq. m	Room no 9 Storage area ceiling found delamination of concrete due to severe corrosion of rebar	Type S	GF48, 49	Severe
41		21 sq. m.	Room no. 9 B storeroom ceiling found delamination of concrete due to severe corrosion of rebar	Type S	GF50, 51	Severe
42		6 sq. m.	Ram from Black box to room no 18 found seepages and leakages from ceiling due to damaged water proofing	Type J	GF 52	Moderate
43		6 sq. m	Rest room no. 20 found dampness on east side wall	Type J	GF53	Mild
44		2 sq. m.	Kitchen room no. 29 found mark of seepages from top on beam above kitchen platform	Type J	GF 54	Moderate
45		2 sq. m.	Kitchen room no. 32 found mark of seepages from top on beam	Type J	GF 55	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
			above kitchen platform			
46		2 sq. m.	Kitchen room no. 30 beam bottom found hollowness due to corrosion of rebar	Type G	GF56	Severe
47		0.09 sq. m.	Room no. 18 Amphitheater, entrance beam bottom found spalling of concrete. Without repairing painting has done	Type G	GF57	Mild
48		0.09 sq. m.	Room no. 59 Air handling room circular column found crack due to corrosion of rebar	Type H	GF58	Moderate
49		0.09 sq. m.	Room no. 59 Air handling room ceiling found spalling of concrete due to corrosion of rebar	Type G	GF59	Moderate
50		0.09 sq. m.	Room no. 59 Air handling room ceiling found leakages from top due to damaged water proofing	Type J	GF60	Moderate
51		2 sq. m.	Room no. 69, Gust room no 3, found major spalling of concrete due to corrosion of rebar at the bottom of staircase slab	Type H	GF61	Severe
52		2 sq. m.	Room no. 69, Gust room no 3, found marking of seepages of water from top of the staircase	Type J	GF62	Severe



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
FIRST FLOOR OBSERVATIONS						
1	First Floor	0.09 Sq. m.	Grid no. 'P' column no. 1, near room no 123a from west side found major spalling at the bottom	Type H	FF1	Severe
2		0.18sq. m	Column outside the room no 121 and grid no. 'Q' column no. ,1 from west side found hollowness at the bottom	Type G	FF2,3	Moderate
3		99 sq. m	Terrace room no. 119 found Passage found rainwater is getting stagnant due to improper slope, this led to seepages of water to ground floor	Type J	FF4	Moderate
4		5 sq. m	Terrace room no. 119 column found height of water proofing is insufficient, this led to seepages of water to ground floor	Type J	FF5	Moderate
5		5 sq. m	Room no. 22 in Dept of western music found leakages from top	Type J	FF6	Moderate
6		6 sq. m.	Room no.14, 24 & 25 found marking of seepages from top ceiling	Type J	FF7,8	Moderate
7		6 sq. m.	Department of western music wall found dampness due to leakages from top terrace	Type J	FF9	Moderate
8		6 Sq. m.	Passage outside the room no. 98 and Void found spalling of concrete due to corrosion of rebar	Type G	FF10	Moderate
9		16 Sq. m.	Room no. 84 Entrance to the administration found covered by tarpaulin, this lead stagnation of water and seepages of water to Art gallery and passage	Type J	FF11	Moderate
10		2 rm.	Serve room found crack on wall	Type A	FF12	Mild
11		0.09 sq. m.	Ground floor column at the starting of ramp found hollowness	Type G	FF13	Severe



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12		50 Sq. m.	Ceiling of void above setting 4 found mark of spalling due to corrosion of rebar	Type G	FF14	Moderate
13		55 sq. m	1 st floor office found window towards east side Chajja got cracked at many locations and rainwater getting seepages in office at many locations	Type B	FF15,16	Moderate
14		0.09 Sq. m.	Cabin of Room no 89 found hollowness in column top near entrance door	Type G	FF17	Mild
15		2 sq. m.	Room no. 94, Ladies toilet found major spalling and water leaking from top due to damaged water proofing at terrace	Type J	FF18, 19	Severe
16		2 sq. m	Chairman's cabin, Room no. 96 found seepages of water form side wall due to crack in external wall	Type B	FF20	Moderate
17		6 Sq. m.	Principle cabin Room no. 92 found seepages from top due to damaged water proofing at terrace	Type J	FF21	Severe
18		2 Sq. m.	Column no. 1 of grid 'I' ceiling found leakages from top due to damaged water proofing at terrace	Type J	FF22	Moderate
19		2 sq. m.	Student activity room no 100 chajja expansion joint found spalling of concrete due to corrosion of rebar	Type H	FF23	Severe
20		1.5 rm	Column outside the department of western music fond crack	Type C	FF24	Moderate
21		1 rm.	Student activity room no 101, beam found crack at the bottom	Type C	FF25	Moderate
22		2 sq. m.	Department of western music fond marking of leakages from top due to damaged Water proofing	Type J	FF26	Moderate
23	First floor	0.18 Sq. m.	Column and staircase from ground floor to 1 st floor found	Type G	FF27	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
			spalling due to corrosion of rebar			
24		96 Sq. m	Water proofing Infront of faculty of Indian music & dance found crack room no. 11Bterrace	Type J	FF28,29,30	Moderate
25		2 sq. m	In Faculty of Indian Music & dance, Vocal Class A & SITAR classroom wall found dampness.	Type N	FF31	Mild
26		6 Sq. m	East side wall of Indian Music & dance room passage found leakages and seepages from terrace due to damaged water proofing	Type J	FF32	Moderate
27		32 Sq. m.	Outside chajja of Indian Music & dance room found delamination of concrete due to corrosion of rebar. Same problem is found on entire west side chajja 1 m from edge	Type H	FF33,34	Moderate
28		0.09 Sq. m.	Rainwater pipe is not kept outside of wall this lead seepages of water	Type J	FF35	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
SECOND FLOOR OBSERVATIONS						
1	SECOND FLOOR	1 Sq. m	Terrace above Music room found central outlet pipe choke up due to leaves of this led to stagnant of rainwater and seepages of water	Type J	SF1	Severe
2			Terrace above Music room found no proper slop is maintain towards east side this led to stagnant of rainwater and seepages of water	Type J	SF2	Severe
3		36 sq. m.	Terrace above Amphitheater found no proper slop is maintain during water proofing led to stagnant of rainwater and seepages of water	Type J	SF3	Severe
4		2 sq. m.	Terrace above Music room found damaged water proofing on vertical wall	Type J	SF4	Severe
5		900 sq. m.	Terrace above student activity room found many cracks on water proofing and covered by tarpaulin sheet to avoid leakages	Type J	SF5,6	Severe
6		30 rm	Parapet wall above office tower found major deep crack	Type B	SF7	Moderate
7		2 Sq. m.	Office tower Ladies toile terrace is covered by using PVC sheet. This led seepages problem form terrace	Type J	SF8	Moderate
8		8 Sq. m.	Terrace above cabins of office building found waterproofing damaged at three locations this may led seepages of water	Type J	SF9	Moderate
9		0.09 Sq. m.	North side wall at 2 nd floor found plaster damages for fitting of electrical connection this may led seepage of water from side wall	Type E	SF10	Moderate
10		1 Sq. m.	East side wall found deep crack at top corner of wall this may led seepage of water from side wall	Type B	SF11	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
11		18 Sq. m.	2 nd floor Chajja of room no. 142 found spalling of concrete due to corrosion of rebar	Type G	SF12,13	Moderate
12		2 Sq. m.	Kathak room no 142 found seepages from ceiling at one location	Type J	SF14	Moderate
13		1 rm	Katha room no 142, found crack in ceiling at one location	Type C	SF15	Moderate
14		2 sq. m.	Kathak room no 142, -staircase bottom slab found hollowness due to corrosion of rebar	Type G	SF16	Moderate
15		2 sq. m.	Entrance of Volk room no 146-passage found slab hollowness due to corrosion of rebar	Type G	SF17	Severe
16		1.5 Sq. m	Passage of country behavior room no 148 & 144 found major gap in beam and plaster	Type F	SF18	Moderate
17		2 sq. m	Room no. 154 reseal room found spalling of concrete above mirror and few locations found symptoms of spalling due to corrosion if rebar	Type G	SF19,20	Severe



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THIRD FLOOR OBSERVATIONS						
1	THIRD FLOOR	6 sq. m	Water proofing found damaged at the terrace of Auditorium	Type J	TF1	Moderate
2		16 sq. m	Water proofing found crack at few locations	Type J	TF2	Moderate
3		10 Sq. m	Water proofing found damaged at the terrace of Kathak room no. 142	Type J	TF3	Moderate
4		2 sq. m	Staircase steps found gap in joint which lead seepage of water in Auditorium	Type J	TF4	Moderate
5		4 sq. m	Water proofing found damaged at the terrace of Auditorium stage	Type J	TF5	Moderate
6		6 sq. m	First Water tank found seepages this lead seepages of water in Auditorium stage area	Type J	TF6	Moderate
7		0.09 sq. m.	Third water tank fund spalling of concrete rebar exposed	Type G	TF7	Moderate
8		0.09 sq. m.	Staircase bottom room found seepages and crack on slopping slab	Type G	TF8	Moderate
9		1 sq. m.	Staircase bottom room wall found crack	Type G	TF9	Moderate



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EXTERNAL SURFACESOBSERVATIONS						
		East Side				
1	External surfaces Observations	15 rm	At 2 nd floor level, East side wall, top 5 beams of pergola found cracked at the bottom.	Type D	EX1,2	Moderate
2		6 rm	Ground floor, East side wall beam bottom found cracked. Rebar Exposed throughout the length.	Type G	EX3,4	Severe
3		2 r.m	2 nd floor, East side outer most beam found major crack.	Type D	EX5	Moderate
4		15 sq.m.	At ground floor, East side art gallery room wall found seepage and leakage found from inside.	Type J	EX6	Moderate
5		10r.m	At ground floor, East side wall painting is removed, and algae formation observed on walls. This led seepages of water from external wall	Type M	EX7	Mild
6		390sq.m	Art Gallery flooring showing leakages at most of the places.	Type J	EX8	Moderate
7			Plastic cover on art gallery slab to avoid the seepages from top due to dammmged flooring and water proofing	Type J	EX9	Moderate
8		230 sq.m.	Art gallery, Kota flooring on steps found gap in joints. This lead major seepages of water from top.	Type J	EX10,11	Moderate
9		6 sq.m.	East side wall next to art gallery space found growth of plantation.	Type M	EX12	Moderate
10		4sq.m.	East side wall near to art gallery gate beam inside found major spalling due to corrosion of rebar	Type G	EX13	Mild
11		8sq.m.	East side wall near to art gallery, staircase painting not done and cracks are observed.	Type D	EX14	Mild
12		1.5 rm.	East side wall window, lintel damaged and reinforcement	Type G	EX15	Moderate



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)
			exposed.			
13		74.68 sq. m.	East side wall, excessive growth of plant and algae which leads to severe leakage.	Type M	EX16	Severe
North side						
14		4r.m	North side wall found spalling of concrete due to corrosion of rebar.	Type G	EX17	Moderate
15		3r. m	North side wall gate of Amphitheater found major crack.	Type B	EX18	Mild
16		70 sq. m.	North side wall in fort of gate of Amphitheater electric room found spalling of concrete in entire room.	Type H	EX19,20	Severe
17		2 rm.	Staircase From ground to 1 st floor north side found beam major spalling.	Type G	EX21	Moderate
West side						
18		4 sq. m.	West side cantilever ceiling found leakage at two location and beam bottom hollowness.	Type H	EX22,23	Moderate
19		6 sq. m.	West side staircase near mini amphitheater found major spalling and rebar exposed.	Type H	EX24	Severe
20		9 rm.	West side all beam bottom found spalling and hollowness.	Type G	EX25,26	Mild
21		2sq.m.	A C plant room exist chajja found rebar exposed.	Type G	EX27	Mild
22		2 sq. m.	A C plant ceiling shows concrete spalling.	Type G	EX28	Severe
23		2 rm. &5sq.m.	A C plant found column major crack and leakage from side wall.	Type C, Type J	EX29	Severe
24		2 rm.	Electrical sub- station to column found severely crack.	Type H	EX30	Severe
25		6 sq. m.	Electrical sub- station, Four beam found major crack and spalling of concrete in one.	Type H	EX31,32,33	Severe



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Sr.no.	Item Description	Quantity of repair	Location of Defect	Code for defect	Photo number	Seriousness (Mild/Moderate/Severe)	
26		3sq.m.	Stabilizer room found lintel level beam severely crack and reinforcement corroded.	Type G	EX34	Moderate	
27		30 sq. m.	Consumer HT room and Supply CO HT room found all beam and slab severely damage.	Type H	EX35,36	Severe	
28		0.20sq.m	DG set room spalling the concrete in beam.	Type G	EX37	Severe	
		South Side					
29		2 rm.	South side, bottom slab of balcony at 2 nd floor level found crack	Type C	EX 38	Mild	
30		4sq.m.	South side entrance ceiling found major exposed seepage from top ceiling found rebar exposed.	Type H	EX39	Severe	
31		120sq.m	South side wall entire found crack throughout the leakage at the junction.	Type J	EX40,41	Mild	
32		3r.m	South/ East wall found crack.	Type B	EX42	Mild	



Annexure II: Site photographs

GROUND FLOOR:

GF1



GF2



GF3



GF4



GF5



GF6



GF7



GF8



GF9



GF10



GF11



GF12



GF13



GF14



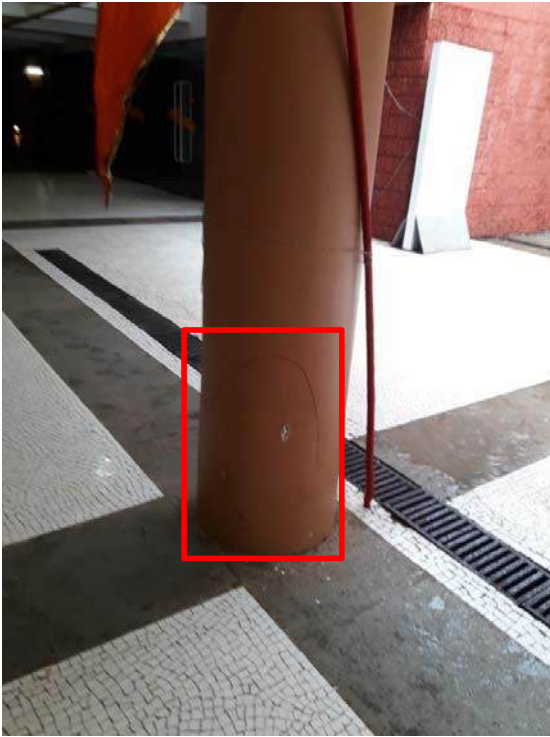
GF15



GF16



GF17



GF18



GF19



GF20



GF21



GF22



GF23



GF24



GF25



GF26



GF27



GF28



GF29



GF30



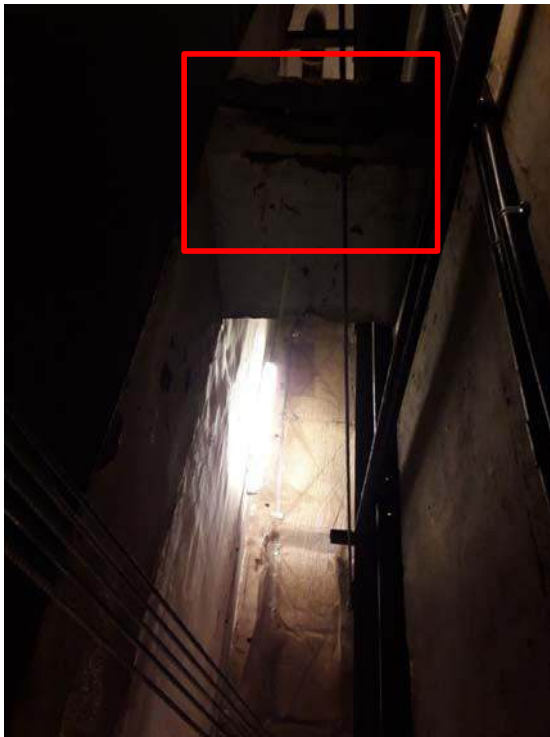
GF31



GF32



GF33



GF34



GF35



GF36



GF37



GF38



GF39



GF40



GF41



GF42



GF43



GF44



GF45



GF46



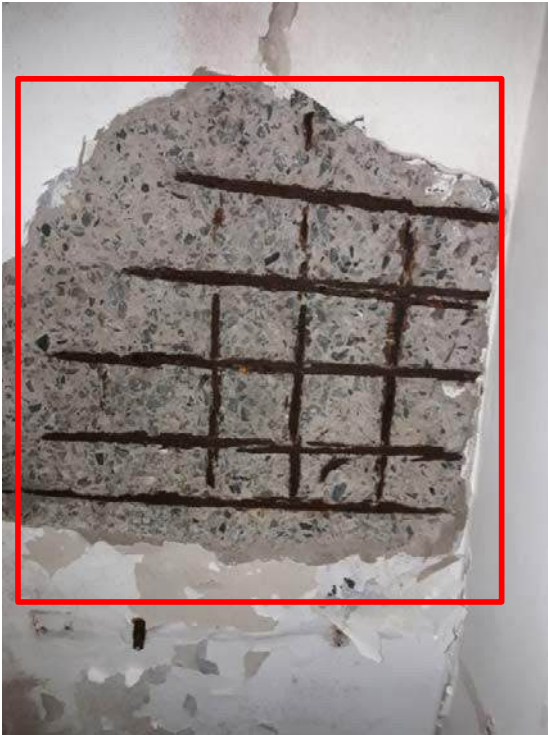
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GF48



GF49



GF50



GF51



GF52



GF53



GF54



GF55



GF56



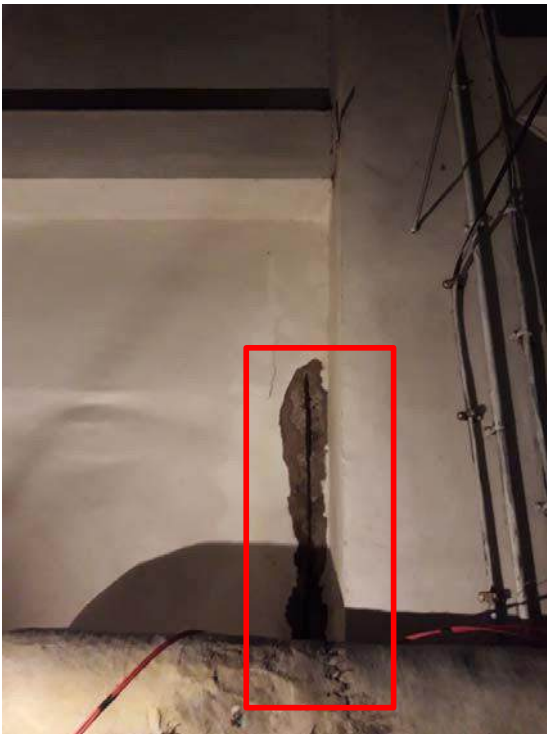
GF57



GF58



GF59



GF60



GF61



GF62



FIRST FLOOR:

FF1



FF2



FF3



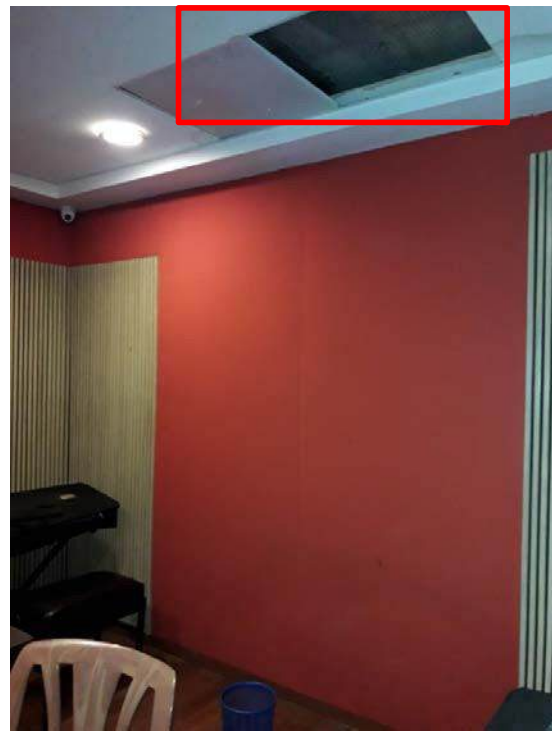
FF4



FF5



FF6



FF7



FF8



FF9



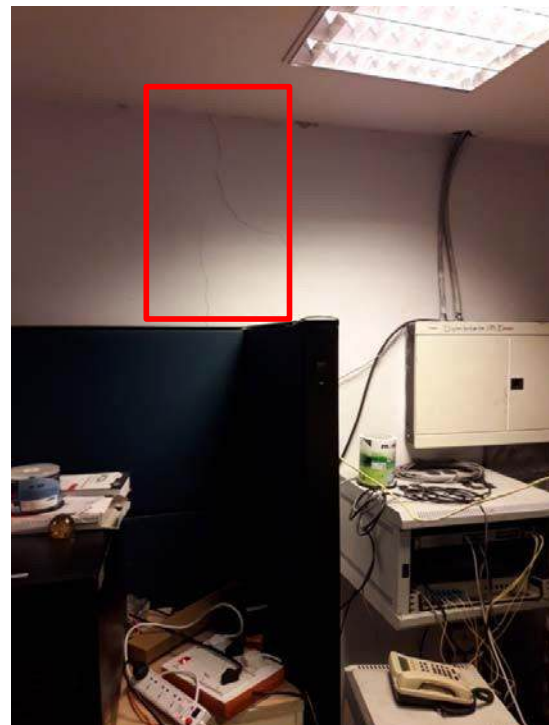
FF10



FF11



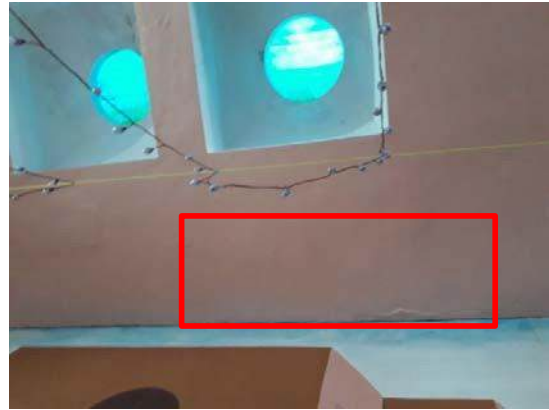
FF12



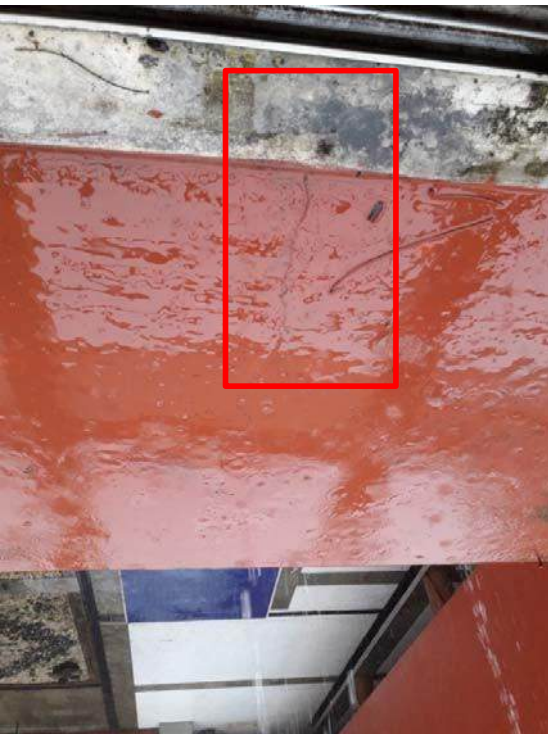
FF13



FF14



FF15



FF16



FF17



FF18



FF19



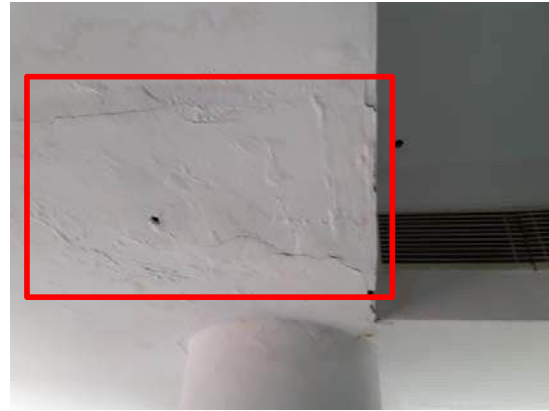
FF20



FF21



FF22



FF23



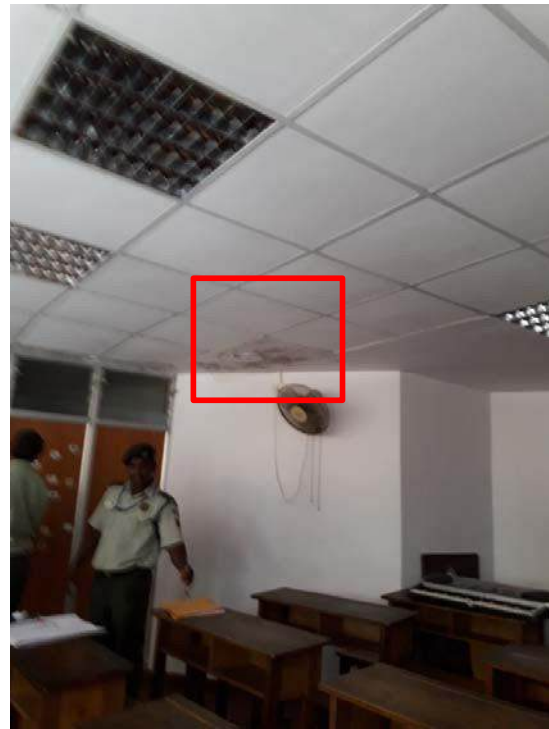
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FF25



FF26



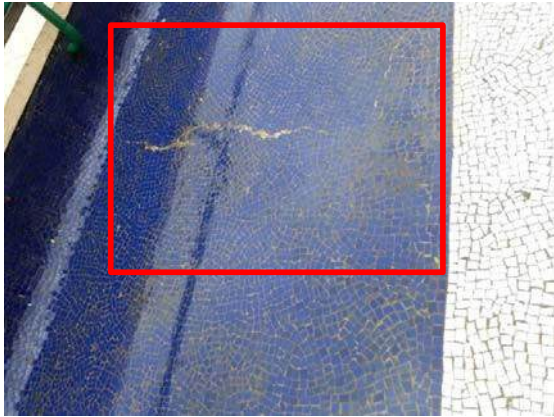
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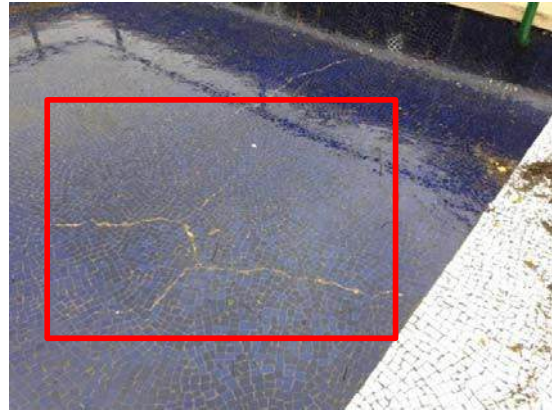
FF28



FF29



FF30



FF31



FF32



FF33



FF34



SECOND FLOOR:

SF1



SF2



SF3



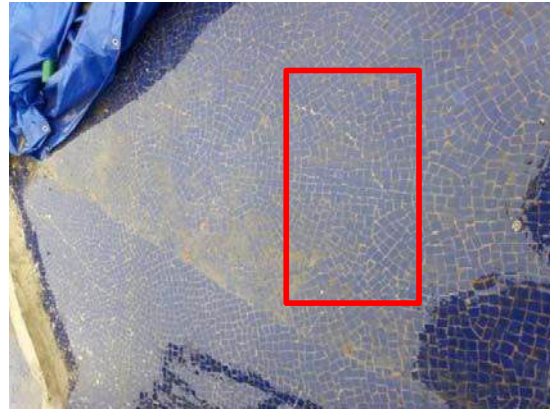
SF4



SF5



SF6



SF7



SF8



SF9



SF10



SF11



SF12



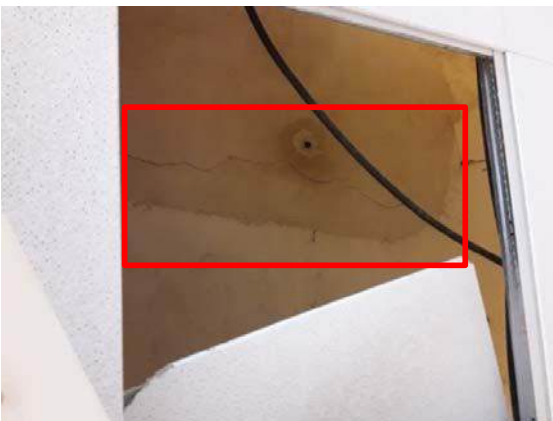
SF13



SF14



SF15



SF16



SF17



SF18



SF19



SF20



THIRD FLOOR:

TF1



TF2



TF3



TF4



TF5



TF6



TF7



TF8



TF9



EXTERNAL SURFACE OBSERVATION'S:

EX1



EX2



EX3



EX4



EX5



EX6



EX7



EX8



EX9



EX10



EX11



EX12



EX13



EX14



EX15



EX16



EX17



EX18



EX19



EX20



EX21



EX22



EX23



EX24



EX25



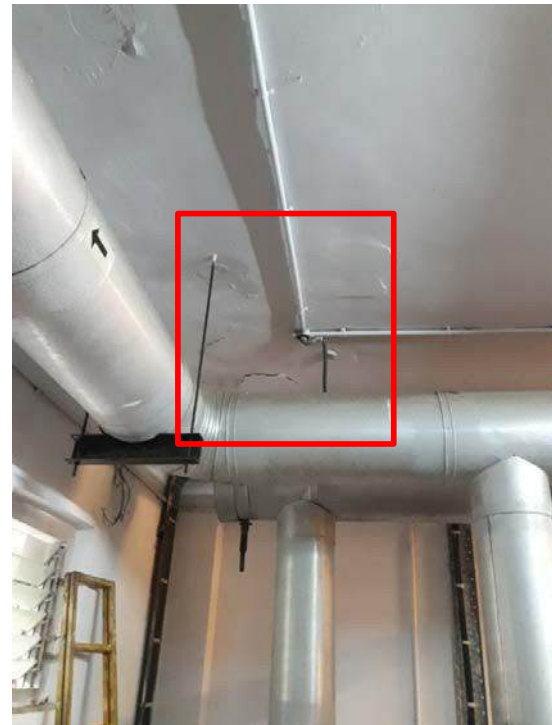
EX26



EX27



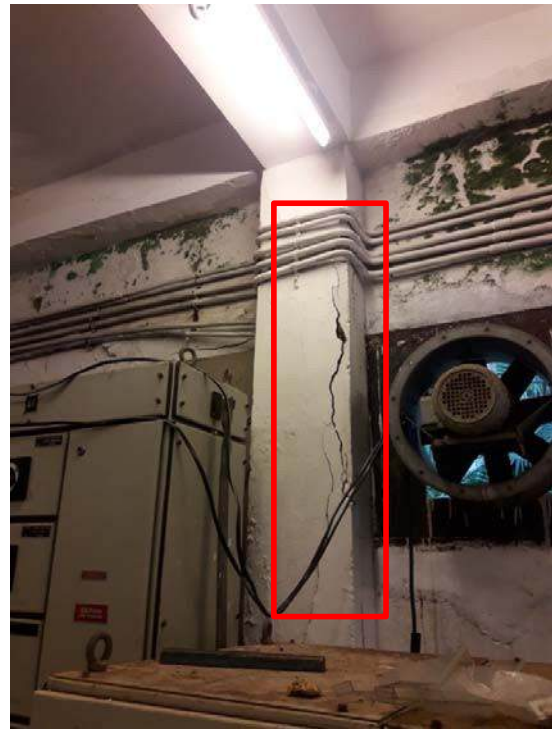
EX28



EX29



EX30



EX31



EX32



EX33



EX34



EX35



EX36



EX37



EX38



EX39



EX40



EX41



EX42



5. Recommendations of NDT:

- a) At many places, major & minor distress has been found in the RCC structure which will adversely affect the serviceability of the structure. These will also adversely affect the durability of the structure and deterioration will be accelerated if these are not repaired in time.
- b) Based on the above common observations, the type and extent of Non-destructive test required to be conducted on various structure was decided as presented in the table no 2 below.

Table No. 2

Structures and Buildings at Kala Academy, Goa				
Sr.no.	Item Description	Rebound hammer test (RTH)	Carbonation (C)	Core for compressive Test (CST)
	Ground Floor NDT Location.			
1	Room No- 01 Entrance Room.	1	3	
2	Room No- 2b AHU Room.	1	2	
3	Room No- 3 PLAZA (With Pergola Above).	1	2	
4	Room No- 4 Art Gallery Lounge.	2	4	
5	Room No- 6 Art Gallery lobby.	1	2	
6	Jury Preview Theater.	1	1	
7	Room No- 10 Preview Theater.	1	1	1
8	Room No- 10a Projector.	1	1	
9	Room No- 11b,11c,11d Rest Room.	3	3	
10	Room No-13 Lobby.	1	1	
11	Room No- 16 Projection.	1	1	



Structures and Buildings at Kala Academy, Goa

Sr.no.	Item Description	Rebound hammer test (RTH)	Carbonation (C)	Core for compressive Test (CST)
12	Room No- 18 Black box Lobby. 19 Black Box/press.	3	4	
13	Room No- 18a Amphitheater.	2	2	
14	Room No- 20 Make Up Room.	1	2	
15	Room No- 23,25,27 Make Up Room.	2	3	
16	Room No- 24 Back Stage.	1	1	
17	Room No- 29,30,32 Kitchen.	3	3	
18	Room No- 35 Foyer.	1	2	
19	Room No- 36 Cafe.	1	1	
20	Room No- 44a.	1	2	
21	Room No- 45 Auditorium, 47 Stage, 48 Passage 3E To Fly Over Gallery.	6	10	
22	Room No- 52 Conference.	1	1	1
23	Room No- 53 Rehearsal/Seminar.	1	1	
24	Room No- 54,55,57 Library.	2	4	
25	Room No- 59 Air Handling unit for DMKM.	1	1	
26	Room No- 60 &72 Dress Room, 63 Green Room, 62 VIP Room.	2	4	1
27	Room No-65,67,68,69 Guest Room.	2	4	
28	Room No-70 Air Handling Unit for DMKM.	1	1	
29	Room No-71 Loading Unloading Bay.	1	1	
	First Floor NDT Location.			
1	Room No-85 & 86 Office Area.	3	3	

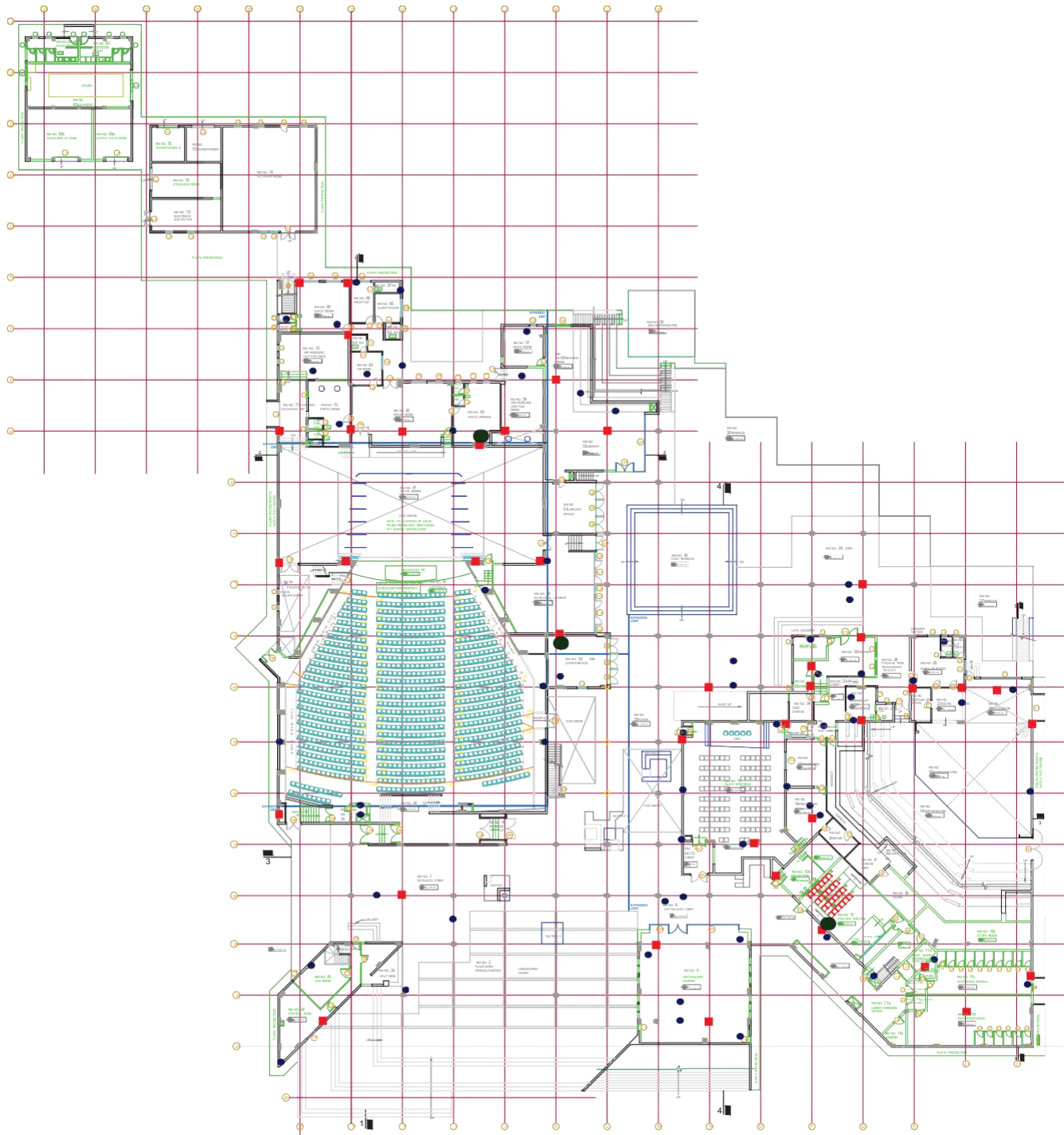


Structures and Buildings at Kala Academy, Goa				
Sr.no.	Item Description	Rebound hammer test (RTH)	Carbonation (C)	Core for compressive Test (CST)
2	Room No. 98 Student activity	1	2	1
3	Room No-100 Student Activity.	2	2	1
4	Room No-103.	1	1	
5	Room No-104 to 111 Music room	3	3	
6	Room No-119 to 129.	3	3	
7	Room No-135 & 133a Office Area.	2	3	1
	Second Floor NDT Location.			
1	Auditorium 2nd floor slab & beam	4	6	
2	Room No-143, Kathak room		3	
3	Room No-148, Practice room		3	
4	Room No-154, Practice room.		2	
5	Room No-155 Storeroom.		2	
	Total	65	101	6

6. Drawings Shows NDT:

As per above Table no. 2 type and number of Nondestructive testing has been marked on drawings of each floor.

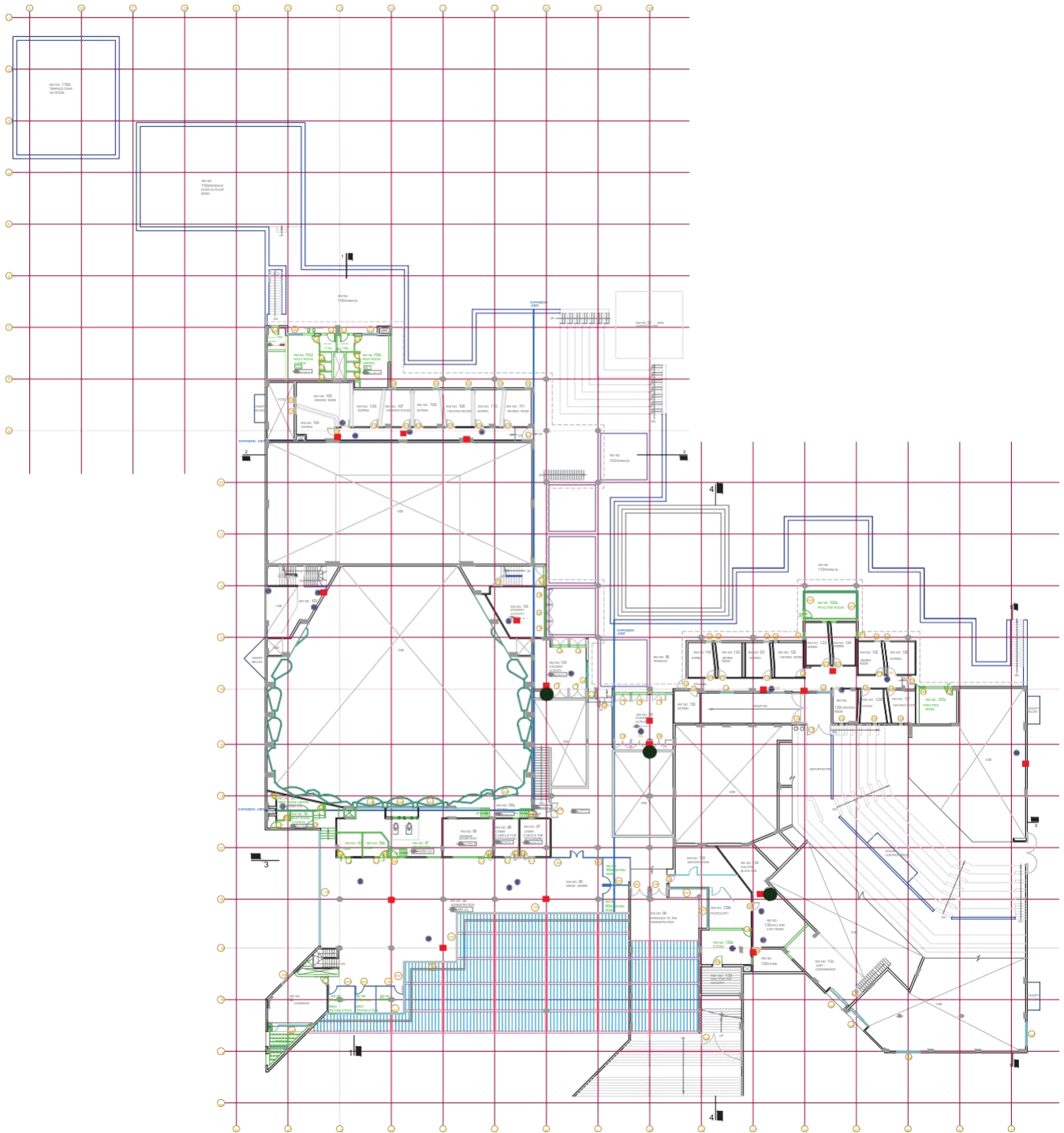
- a) Ground floor Drawing 1:
- b) First floor Drawing 2:
- c) Second floor Drawing 3:



GROUND FLOOR PLAN

LEGEND

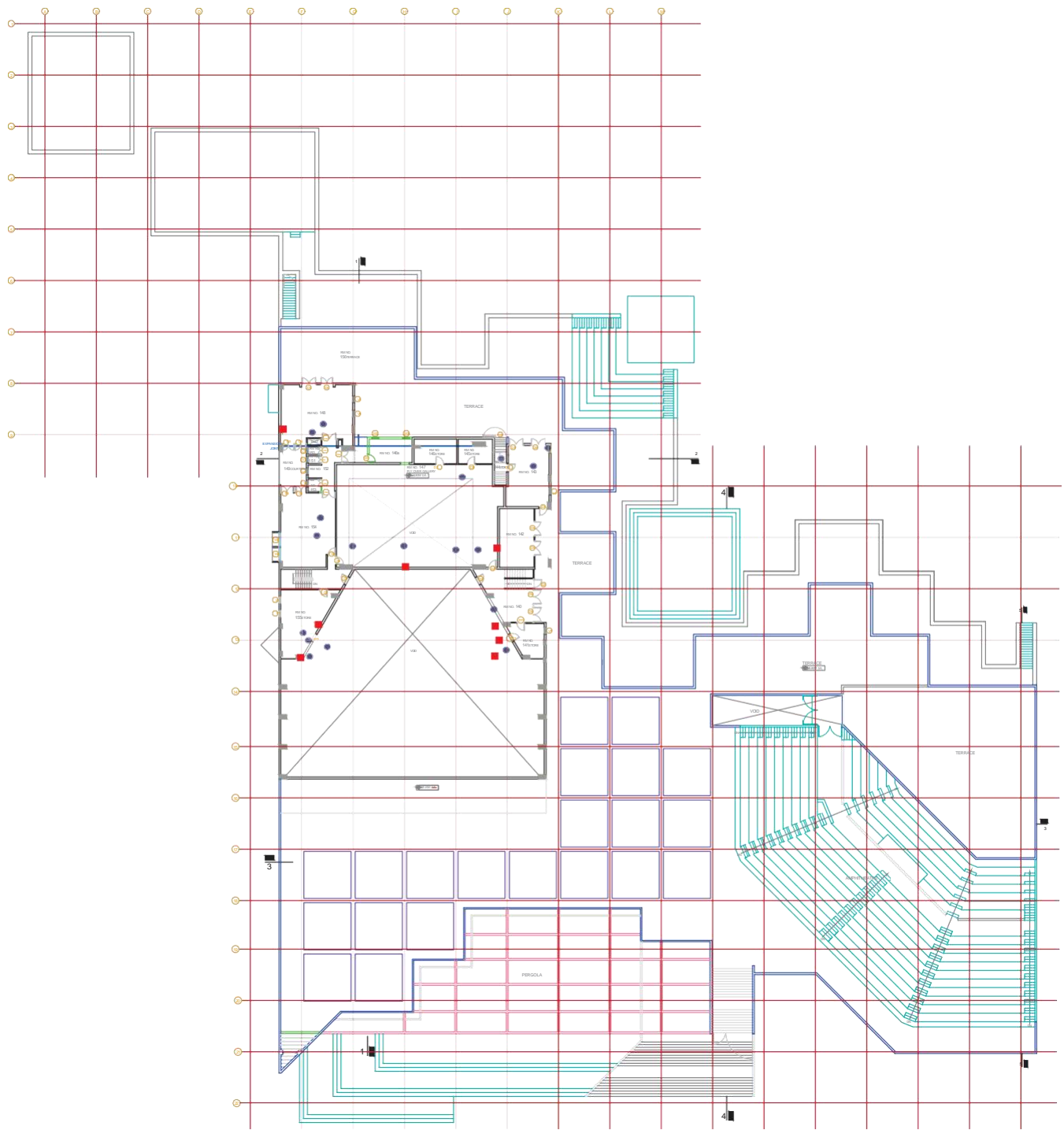
- Carbonation Test
- Rebound Test
- Core Test



FIRST FLOOR PLAN

LEGEND

- Carbonation Test
- Rebound Test
- Core Test



N
SECOND FLOOR PLAN

LEGEND

- Carbonation Test
- Rebound Test
- Core Test



7. Non-Destructive Test:

- a) As per above list various NDT tests were carried out from 19th August 2019 to 22nd August 2019 by NDT team at a few chosen locations to assess the condition of concrete & rebar. All Non-destructive tests are reviewed by the senior technical expert of GEM.
- b) All NDT test report have been provided in **Annexure III**. Based on findings of Non-destructive test results for the structures with mild and moderate distress is attached in **Annexure I**.
- c) From the NDT reports, suggested corrective action are compiled in **Annexure I**



Annexure III: NDT Reports

Rebound Hammer Test

Test Data Sheet (Hammer Test)

IS Codes applicable: IS 13311, (Part 2): 1992.

References: IS 516: 1959 Test for strength of concrete

IS 8900: 1978 Criteria for rejection of outlying observations.

Applications of the test:

- Assessing the Compressive Strength of Concrete
- Assessing the Uniformity of Concrete.
- Applicable for new concrete. Applicable for old concrete only with special techniques.

Equipments Used:

- Rebound Hammer

Test basis:

Harder the rebound. In new concrete, as it gains strength, hardness increases and as a result, the readings increase. The hammer can be used in 3 orientation, Vertical up or down (typically used for slab), horizontal (for columns). Depending on the orientation used and age of concrete, the results are interpreted for strength.

Methodology:

- Identify test Locations.
- Clean the concrete surface thoroughly (remove plaster, if present).
- Press hammer and release.
- Note down the reading.
- Take an average of multiple readings.
- Repeat the test on multiple areas of the element if necessary.
- Test at different members of the structure.

Influencing factors for readings:

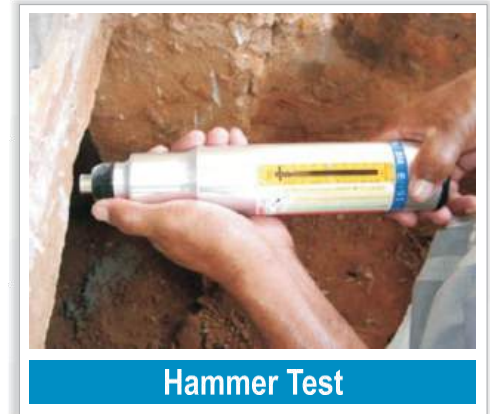
- Readings taken on directly concrete.
- New/old construction in elements.
- New + old material (e.g. jacketed columns where new and old concrete coexist).
- Carbonation of surface.
- Condition of the surface.
- Moisture content.
- Curing and age of concrete.
- Cement and aggregates (detailed mix design) used.

Understanding results:

- The Rebound Hammer test measures surface hardness only (upto about 50 mm depth).
- In order to assess continuity inside the element, UPV test is recommended.
- The estimated strength may vary from actual strength about +/- 10%.
- In order to confirm the findings of tests, core tests may be conducted on a select sample of element.

Limitations:

- In the case of old concrete the surface layer is carbonated, resulting in higher surface hardness. So the rebound number is on the higher side than warranted by the strength of concrete.
- The interpretation of this higher number in terms of strength is therefore misleading, unnecessarily giving an impression of better quality concrete, which is not correct.
- Therefore it is better to rely on the strength as estimated based on the UPV



The information contained here is for educational purposes and should not be taken as a definitive guide of conducting and interpreting test results.

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NEAR SHIV SAGAR HOTEL, ANDHERI (E), MUMBAI 400072
Format No. : ASPL/NABL/TRF/03

TEST REPORT - REBOUND HAMMER TEST - Test Report No.: 9919-0143-03

CUSTOMER NAME & ADDRESS	Gem Engserv Private Limited A-103, The Great Eastern Chambers, Plot No. 28, Sector - 11, CBD-Belapur, Navi Mumbai- 400614	CUSTOMER CONTACT PERSON	Mr.Hemant Sonawane	REFERENCE CODE / TEST METHOD	IS : 13311 (Part 2) : 1992, IS 516 : 1959
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ISO CERTIFICATE NO: 1025-QMS-0125	SITE NAME & ADDRESS	Kala Academy Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001
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PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh	Note: 1) Strength estimation is on the basis of calibration for new concrete. 2) For old concrete - The actual strength may be much lower than that for new concrete for the same Rebound Number.
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER	
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	22-Aug-2019	
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	24-Aug-2019	
EQUIPMENT USED	REBOUND HAMMER	EQUIPMENT ID	10T-HT20180410-03			

JOB NO 9919-0143 TEST REPORT - REBOUND HAMMER TEST

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY			ELEMENT IDENTIFICATION					REBOUND HAMMER TEST		
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
1	Ground Level	Entrance Room	19-Aug-2019	G-1	C	H18	Room No 1	30	Horiz	25
2	Ground Level	AHU Room	19-Aug-2019	G-1	C	F21	Room No2	27	Horiz	19
3	Ground Level	Art Gallery Lounge	19-Aug-2019	G-1	C	M19	Room No4	21	Horiz	12
4	Ground Level	Art Gallery Lounge	19-Aug-2019	G-1	C	M20	Room No 4	21	Horiz	10
5	Ground Level	Art Gallery Lobby	19-Aug-2019	G-1	C	M18	Room No 6	22	Horiz	12
6	Ground Level	Jury Preview Theater	19-Aug-2019	G-1	C	Q'19'	-	29	Horiz	24
7	Ground Level	Preview Theater	19-Aug-2019	G-1	C	P'18'	Room No 10	25	Horiz	18

JOB NO 9919-0143

TEST REPORT - REBOUND HAMMER TEST

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED
SITE NAME: KALA ACADEMY

			ELEMENT IDENTIFICATION				REBOUND HAMMER TEST			
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
8	Ground Level	Projector	19-Aug-2019	G-1	C	O'17'	Room No 10a	31	Horiz	27
9	Ground Level	Rest Room	19-Aug-2019	G-1	C	S20'	Room No 11b,11c 11d	28	Horiz	22
10	Ground Level	Rest Room	19-Aug-2019	G-1	C	R'19'	Room No 11b,11c 11d	28	Horiz	22
11	Ground Level	Rest Room	19-Aug-2019	G-1	C	T'19'	Room No 11b,11c 11d	21	Horiz	12
12	Ground Level	Projection	22-Aug-2019	G-1	C	P16'	Room No 16	23	Horiz	13
13	Ground Level	Black Box Lobby, Black Box/Press	22-Aug-2019	G-1	C	M'15	Room No 18,19	22	Horiz	12
14	Ground Level	Black Box Lobby, Black Box/Press	22-Aug-2019	G-1	C	O'14'	Room No 18,19	24	Horiz	16
15	Ground Level	Black Box Lobby, Black Box/Press	22-Aug-2019	G-1	C	O17	Room No 18,19	29	Horiz	22
16	Ground Level	Amphitheater	22-Aug-2019	G-1	C	T'14'	Room No 18a	28	Horiz	22
17	Ground Level	Amphitheater	22-Aug-2019	G-1	B	T'14'-T'16'	Room No 18a	31	Horiz	25
18	Ground Level	Make Up Room	22-Aug-2019	G-1	C	Q14'	Room No 20	22	Horiz	13
19	Ground Level	Make Up Room	22-Aug-2019	G-1	C	R14	Room No 23,25,27	24	Horiz	16
20	Ground Level	Make Up Room	22-Aug-2019	G-1	C	S14	Room No 23,25,27	29	Horiz	22
21	Ground Level	Back Stage	22-Aug-2019	G-1	B	S14-T14	Room No 24	21	Horiz	10
22	Ground Level	Kitchen	21-Aug-2019	G-1	C	Q13	Room No 29,30,32	29	Horiz	24
23	Ground Level	Kitchen	21-Aug-2019	G-1	C	P14	Room No 29,30,32	25	Horiz	18
24	Ground Level	Kitchen	22-Aug-2019	G-1	B	P'13- P14	Room No 29,30,32	24	Horiz	16

JOB NO 9919-0143			TEST REPORT - REBOUND HAMMER TEST							
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY			ELEMENT IDENTIFICATION				REBOUND HAMMER TEST			
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
25	Ground Level	Foyer	19-Aug-2019	G-1	C	N14	Room No 35	21	Horiz	12
26	Ground Level	Café	19-Aug-2019	G-1	C	Q12	Room No 36	23	Horiz	13
27	Ground Level	-	22-Aug-2019	G-1	C	E'16'	Room No 44a	24	Horiz	16
28	Ground Level	Auditorium, Stage, 3E Fly Over Gallary	19-Aug-2019	G-1	C	E'11'	Room No 45,47,48	28	Horiz	21
29	Ground Level	Auditorium, Stage, 3E Fly Over Gallary	19-Aug-2019	G-1	C	G'11'	Room No 45,47,48	34	Horiz	30
30	Ground Level	Auditorium, Stage, 3E Fly Over Gallary	19-Aug-2019	G-1	C	I'11'	Room No 45,47,48	31	Horiz	27
31	Ground Level	Auditorium, Stage, 3E Fly Over Gallary	22-Aug-2019	G-1	C	I'12'	Room No 45,47,48	24	Horiz	16
32	Ground Level	Auditorium, Stage, 3E Fly Over Gallary	22-Aug-2019	G-1	C	E'15'	Room No 45,47,48	28	Horiz	21
33	Ground Level	Conference	21-Aug-2019	G-1	C	K13	Room No 52	34	Horiz	30
34	Ground Level	Rehearsalsal Seminaar	19-Aug-2019	G-1	C	J'11'	Room No 53	28	Horiz	22
35	Ground Level	Library	19-Aug-2019	G-1	C	K8	Room No 54,55,57	28	Horiz	21
36	Ground Level	Library	19-Aug-2019	G-1	C	L9	Room No 54,55,57	29	Horiz	22
37	Ground Level	Air Handling Unit For DMKM	19-Aug-2019	G-1	C	J9	Room No 59	22	Horiz	13
38	Ground Level	Dress,Green VIP	19-Aug-2019	G-1	C	H9	Room No 60& 72,63,62	23	Horiz	15
39	Ground Level	Dress,Green VIP	19-Aug-2019	G-1	C	G9	Room No 60& 72,63,62	26	Horiz	18
40	Ground Level	Dress,Green VIP	22-Aug-2019	G-1	C	I'9'	Room No 60& 72,63,62	30	Horiz	24
41	Ground Level	Guest Room	21-Aug-2019	G-1	C	F6	Room No 65,67,68 69	25	Horiz	18

JOB NO 9919-0143			TEST REPORT - REBOUND HAMMER TEST							
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY			ELEMENT IDENTIFICATION				REBOUND HAMMER TEST			
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
42	Ground Level	Guest Room	21-Aug-2019	G-1	C	G6	Room No 65,67,68 69	31	Horiz	27
43	Ground Level	Air Handling Unit For DMKM	19-Aug-2019	G-1	C	G7	Room No 70	27	Horiz	21
44	Ground Level	Loading Unloading Bay	19-Aug-2019	G-1	C	F9	Room No 71	24	Horiz	16
							Average	26		19
*** END OF TEST REPORT ***										
NOTE: 1) The reported results refers to the samples &/ or structures tested on sites under stated conditions only and shall not be reproduced except in full, without written permission frm the Managing Director. 2) These reports pertain to sample or onsite structure identified and provided for testing by the customer .										



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ISO CERTIFICATE NO: 1025-QMS-0125	SITE NAME & ADDRESS	Kala Academy Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001
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PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh	Note: 1) Strength estimation is on the basis of calibration for new concrete. 2) For old concrete - The actual strength may be much lower than that for new concrete for the same Rebound Number.
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER	
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	22-Aug-2019	
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	24-Aug-2019	
EQUIPMENT USED	REBOUND HAMMER	EQUIPMENT ID	10T-HT20180410-03			

JOB NO 9919-0143 TEST REPORT - REBOUND HAMMER TEST

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY			ELEMENT IDENTIFICATION					REBOUND HAMMER TEST		
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
1	First Floor	Office Area	21-Aug-2019	1-2	C	I19	Room No 85 & 86	31	Horiz	25
2	First Floor	Office Area	21-Aug-2019	1-2	C	H18	Room No 85 & 86	27	Horiz	21
3	First Floor	Office Area	21-Aug-2019	1-2	C	K18	Room No 85 & 86	27	Horiz	19
4	First Floor	Student Activity	21-Aug-2019	1-2	C	M15	Room No 98	24	Horiz	15
5	First Floor	Student Activity	21-Aug-2019	2	B	M14-M15	Room No 98	23	Horiz	15
6	First Floor	Student Activity	21-Aug-2019	1-2	C	K14	Room No 100	33	Horiz	30
7	First Floor	Student Activity	21-Aug-2019	2	B	J12'-K12'	Room No 100	23	Horiz	13

JOB NO 9919-0143			TEST REPORT - REBOUND HAMMER TEST							
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY			ELEMENT IDENTIFICATION				REBOUND HAMMER TEST			
Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
8	First Floor	Auditorium	21-Aug-2019	1-2	C	F12	Room No 103	27	Horiz	21
9	First Floor	Western Music	22-Aug-2019	1-2	C	I9'	Room No 104 to 111	31	Horiz	27
10	First Floor	Western Music	22-Aug-2019	1-2	C	G9'	Room No 104 to 111	30	Horiz	24
11	First Floor	Western Music	22-Aug-2019	2	S	H9'-I9	Room No 104 to 111	25	V Up	11
12	First Floor	Indian Music	21-Aug-2019	1	S	P13-Q14	Room No 119 to 129	34	V Up	25
13	First Floor	Indian Music	21-Aug-2019	1-2	C	P14	Room No 119 to 129	25	Horiz	18
14	First Floor	Indian Music	21-Aug-2019	2	B	O14-P14	Room No 119 to 129	32	Horiz	29
15	First Floor	Office Area	21-Aug-2019	1-2	C	O'18	Room No 135 & 133a	27	Horiz	21
16	First Floor	Office Area	21-Aug-2019	1-2	C	O19	Room No 135 & 133a	28	Horiz	21
							Average	28		21
*** END OF TEST REPORT ***										
NOTE: 1) The reported results refers to the samples &/ or structures tested on sites under stated conditions only and shall not be reproduced except in full, without written permission frm the Managing Director. 2) These reports pertain to sample or onsite structure identified and provided for testing by the customer .										



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LABORATORY :

K-218, ANSA J & K INDUSTRIAL PREMISES CHS LTD., SAKIVIHAR ROAD, NEAR
SHIV SAGAR HOTEL, ANDHERI (E), MUMBAI 400072

Format No. : ASPL/NABL/TRF/03

TEST REPORT - REBOUND HAMMER TEST - Test Report No.: 9919-0143-03

CUSTOMER NAME & ADDRESS		Gem Engserv Private Limited A-103, The Great Eastern Chambers, Plot No. 28, Sector - 11, CBD-Belapur, Navi Mumbai- 400614		CUSTOMER CONTACT PERSON	Mr.Hemant Sonawane	REFERENCE CODE / TEST METHOD IS : 13311 (Part 2) : 1992, IS 516 : 1959
ISO CERTIFICATE NO: 1025-QMS-0125		SITE NAME & ADDRESS		Kala Academy Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001		
PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh	
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER	
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	22-Aug-2019	
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm ²	N.G.	DATE OF REPORTING	24-Aug-2019	
EQUIPMENT USED	REBOUND HAMMER	EQUIPMENT ID	10T-HT20180410-03			

Note:

- 1) Strength estimation is on the basis of calibration for new concrete.
- 2) For old concrete - The actual strength may be much lower than that for new concrete for the same Rebound Number.

JOB NO 9919-0143

TEST REPORT - REBOUND HAMMER TEST

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED
SITE NAME: KALA ACADEMY

ELEMENT IDENTIFICATION

REBOUND HAMMER TEST

Sr No	Structure NAME/ID	Building	Date of Testing	Level	Element Type	Identification Number	Location	R No	Direction	N/mm ²
1	Second Floor	Auditorium, Slab & Beam	21-Aug-2019	3	B	I12'-J12'	-	34	Horiz	32
2	Second Floor	Auditorium, Slab & Beam	21-Aug-2019	3	S	J12'-I13'	-	27	V Up	13
3	Second Floor	Auditorium, Slab & Beam	21-Aug-2019	3	B	I13'-J13'	-	26	Horiz	19
4	Second Floor	Auditorium, Slab & Beam	21-Aug-2019	3	S	F'12-E'13'	-	25	V Up	10
5	Second Floor	Auditorium, Slab & Beam	22-Aug-2019	3	B	I'11'-I11	-	22	Horiz	12
6	Second Floor	Auditorium, Slab & Beam	22-Aug-2019	2-3	C	H11'	-	24	Horiz	15
7	Second Floor	Practice Room	21-Aug-2019	2-3	C	E9	Room No 148	24	Horiz	16
8	Second Floor	Store Room	21-Aug-2019	2-3	C	F'12'	Room No 155	29	Horiz	22
Average								26		17

*** END OF TEST REPORT ***

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- 2) These reports pertain to sample or onsite structure identified and provided for testing by the customer .

Half Cell Potential and Carbonation Depth Tests

Test Data Sheet (HCP and Carbonation Test)

Codes applicable: ASTM - C -876, 1991.

Applications of the test:

- Assessment of probability of corrosion being present.

Equipments Used:

- HCP Kit.
- Carbonation Measurement Kit.

Test basis:

Half Cell Potential

- The potential in millivolts decrease with the increase in probability of corrosion in the steel reinforcement.

Carbonation

Concrete, being basically a porous material, undergoes carbonation process with ageing. As the protective cover of the concrete carbonates completely, the corrosion reaches the steel reinforcement, rapidly accelerating the process of corrosion in steel.

Methodology:

Half Cell Potential

- Identify test locations.
- Drill hole with a electric drill machine to reach the steel reinforcement rod.
- Establish electric contact to the reinforcement.
- Measure voltage in millivolts, on the surface of concrete at multiple locations of the member.
- Test at different members of the structure.

Methodology:

Carbonation

- Identify test locations.
- Drill hole with a electric drill machine to reach the steel reinforcement rod.
- Inject indicator chemical & insert steel rod.
- Indicator chemical determines at what depth the color changes.

Influencing factors for readings :

Extent of corrosion.

Understanding results:

- The HCP test gives probability of corrosion and not the actual corrosion. For better understanding, ASTM have classified this into 3 categories as 10%, 50% and 90% probability.
- It is to be noted however, that a probability of corrosion of 50% or 90% does not indicate that the diameter of the embedded steel has reduced by 50% or 90% respectively. It only refers to the probability of corrosion activity taking place at that location

Range	Probability of corrosion
Over -200mv	10%
-200 mv to -350 mv	50%
Below -350mv	90%

- Carbonation test gives the depth in mm to which the carbonation has taken place in the concrete cover.



Carbonation



Half cell potential test

The information contained here is for educational purposes and should not be taken as an definitive guide of conducting and interpreting test results.

To know more visit: www.aaryans.in

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NEAR SHIV SAGAR HOTEL, ANDHERI (E), MUMBAI 400072
Format No. : ASPL/NABL/TRF/02

TEST REPORT - HALF CELL POTENTIAL & CARBONATION - Test Report No.: 9919-0143-02

CUSTOMER NAME & ADDRESS
Gem Engserv Private Limited
A-103, The Great Eastern Chambers, Plot No. 28, Sector -
11, CBD-Belapur, Navi Mumbai- 400614

CUSTOMER CONTACT PERSON Mr.Hemant Sonawane

ISO CERTIFICATE NO:
1025-QMS-0125

SITE NAME & ADDRESS
Kala Academy
Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001

PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh		
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER		
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	19-Aug-2019		
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	26-Aug-2019		

JOB NO 9919-0143

TEST REPORT HALF CELL POTENTIAL & CARBONATION

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED
SITE NAME: KALA ACADEMY

ELEMENT IDENTIFICATION

SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	DEPTH FROM SURFACE	TOTAL DEPTH MM	CARBONATION DEPTH MM	WITH PLASTER Y/N
1	Ground Floor	Room No- 01 Entrance Room.	19-Aug-2019	1	S	H20-G19			40	10	YES
2	Ground Floor	Room No- 01 Entrance Room.	19-Aug-2019	1	B	J18-I19			55	0	YES
3	Ground Floor	Room No- 01 Entrance Room.	19-Aug-2019	1	B	H18-G18			55	0	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
4	Ground Floor	Room No- 2b AHU Room.	19-Aug-2019	1	B	F21-E'21'		60	0	YES
5	Ground Floor	Room No- 2b AHU Room.	22-Aug-2019	G-1	C	F'19'		40	40	YES
6	Ground Floor	Room No- 3 PLAZA (With Pargola Above)	22-Aug-2019	2	B	K18-K19		55	0	YES
7	Ground Floor	Room No- 3 PLAZA (With Pargola Above)	22-Aug-2019	2	B	L18-L19		50	0	YES
8	Ground Floor	Room No- 4 Art Gallary Lounge.	19-Aug-2019	1	S	M19-L'20		50	10	YES
9	Ground Floor	Room No- 4 Art Gallary Lounge.	19-Aug-2019	1	S	N20'-O21		70	10	YES
10	Ground Floor	Room No- 4 Art Gallary Lounge.	19-Aug-2019	1	S	N19-018		55	10	YES
11	Ground Floor	Room No- 4 Art Gallary Lounge.	19-Aug-2019	1	B	M'20-M'21		60	60	YES
12	Ground Floor	Room No- 4 Art Gallary Lounge.	19-Aug-2019	1	B	M20'-N20'		50	50	YES
13	Ground Floor	Room No- 6 Art Gallary lobby.	19-Aug-2019	1	B	N18-018		45	35	YES
14	Ground Floor	Room No- 6 Art Gallary lobby.	19-Aug-2019	1	S	M18-N19		40	40	YES
15	Ground Floor	Room No- 10 Preview Theater.	19-Aug-2019	1	S	P18-Q19		55	0	YES
16	Ground Floor	Room No- 11b,11c, 11d Rest Room.	19-Aug-2019	G-1	C	T'19'		60	10	YES
17	Ground Floor	Room No- 11b,11c, 11d Rest Room.	19-Aug-2019	1	B	R'19-R19'		45	10	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
18	Ground Floor	Room No-13 Lobby.	22-Aug-2019	G-1	C	M'17		60	0	YES
19	Ground Floor	Room No- 16 Projection.	22-Aug-2019	1	B	P16'-P'16'		50	50	YES
20	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	G-1	C	M'15		65	0	YES
21	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	G-1	C	M'16		60	0	YES
22	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	1	B	O'14'-P14'		45	10	YES
23	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	G-1	C	N'20		60	10	YES
24	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	1	S	P14'-Q14'		45	0	YES
25	Ground Floor	Room No- 18 Black box Lobby. 19 Black Box/press.	22-Aug-2019	1	B	N17-O17		45	0	YES
26	Ground Floor	Room No- 18a Amphitheater.	22-Aug-2019	1	S	S15-T16		40	0	YES
27	Ground Floor	Room No- 18a Amphitheater.	22-Aug-2019	1	B	T'14'-T'16		55	0	YES
28	Ground Floor	Room No- 18a Amphitheater.	22-Aug-2019	G-1	C	T'16		50	0	YES
29	Ground Floor	Room No- 20 Make Up Room.	22-Aug-2019	1	B	P14'-Q14'		35	35	YES
30	Ground Floor	Room No- 20 Make Up Room.	22-Aug-2019	1	S	Q14'-P14		35	35	YES
31	Ground Floor	Room No- 23,25,27 Make Up Room.	22-Aug-2019	1	S	R13-S14		45	0	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
32	Ground Floor	Room No- 23,25,27 Make Up Room.	22-Aug-2019	1	B	S13-S14		60	0	YES
33	Ground Floor	Room No- 24 Back Stage.	22-Aug-2019	G-1	C	S14'		60	0	YES
34	Ground Floor	Room No- 29,30,32 Kitchen.	21-Aug-2019	1	S	O'13-P14		35	35	YES
35	Ground Floor	Room No- 29,30,32 Kitchen.	21-Aug-2019	1	S	P14-Q13		35	35	YES
36	Ground Floor	Room No- 29,30,32 Kitchen.	21-Aug-2019	1	B	P13-Q13		50	50	YES
37	Ground Floor	Room No- 35 Foyer.	19-Aug-2019	1	S	N13-O14		35	35	YES
38	Ground Floor	Room No- 35 Foyer.	19-Aug-2019	1	B	N14-O14		55	55	YES
39	Ground Floor	Room No- 36 Cafe.	19-Aug-2019	1	B	P12-Q12		55	55	YES
40	Ground Floor	Room No- 36 Cafe.	19-Aug-2019	1	S	P12-Q13		35	35	YES
41	Ground Floor	Room No- 44a.	22-Aug-2019	1	B	G16'-H16'		45	20	YES
42	Ground Floor	Room No- 44a.	22-Aug-2019	G-1	C	G'16'		60	0	YES
43	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over	19-Aug-2019	1	B	E'12-E'13		50	50	YES
44	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over	19-Aug-2019	1	B	F'11'-F'12		50	50	YES
45	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over	19-Aug-2019	1	B	G12-F13		45	45	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
46	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over Gallery.	22-Aug-2019	G-1	C	I12		60	60	YES
47	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over Gallery.	22-Aug-2019	G-1	C	E'15		60	0	YES
48	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over Gallery.	22-Aug-2019	G-1	C	J'15		55	0	YES
49	Ground Floor	Room No- 45 Auditorium, 4/ Stage, 48 Passage 3E To Fly Over Gallery.	22-Aug-2019	G-1	C	J'14		60	0	YES
50	Ground Floor	Room No- 52 Conference.	20-Aug-2019	1	S	K13-L14		35	0	YES
51	Ground Floor	Room No- 53 Rehearsal/Seminaar.	19-Aug-2019	G-1	C	J'11'		60	0	YES
52	Ground Floor	Room No- 54,55,57 Library.	19-Aug-2019	1	B	L8'-M8'		70	0	YES
53	Ground Floor	Room No- 54,55,57 Library.	19-Aug-2019	1	S	J7-K8		45	10	YES
54	Ground Floor	Room No- 54,55,57 Library.	19-Aug-2019	1	B	K'7-K'8		45	45	YES
55	Ground Floor	Room No- 59 Air Handling unit for DMKM.	19-Aug-2019	1	S	J8-K9		35	10	YES
56	Ground Floor	Room No- 60 &72 Dress Room, 63 Green Room, 62 VIP Room.	19-Aug-2019	1	B	F'8-F'9		55	45	YES
57	Ground Floor	Room No- 60 &72 Dress Room, 63 Green Room, 62 VIP Room.	19-Aug-2019	1	S	G7-H8		35	0	YES
58	Ground Floor	Room No- 60 &72 Dress Room, 63 Green Room, 62 VIP Room.	19-Aug-2019	G-1	C	I9		60	0	YES
59	Ground Floor	Room No- 60 &72 Dress Room, 63 Green Room, 62 VIP Room.	19-Aug-2019	1	B	H7-H8		40	40	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
60	Ground Floor	Room No-65,67, 68,69 Guest Room.	19-Aug-2019	1	B	H6-H7		55	55	YES
61	Ground Floor	Room No-65,67, 68,69 Guest Room.	19-Aug-2019	1	B	G6-H6		60	60	YES
62	Ground Floor	Room No-65,67, 68,69 Guest Room.	19-Aug-2019	1	S	E'6-F7		45	35	YES
63	Ground Floor	Room No-65,67, 68,69 Guest Room.	19-Aug-2019	1	S	F6-G7		30	30	YES
64	Ground Floor	Room No-70 Air Handling Unit for DMKM.	19-Aug-2019	1	S	G7-F8		40	0	YES
							Average		17	

*** END OF TEST REPORT ***

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ROAD, NEAR SHIV SAGAR HOTEL, ANDHERI (E), MUMBAI 400072
Format No. : ASPL/NABL/TRF/02

TEST REPORT - HALF CELL POTENTIAL & CARBONATION - Test Report No.: 9919-0143-02

CUSTOMER NAME & ADDRESS		Gem Engserv Private Limited A-103, The Great Eastern Chambers, Plot No. 28, Sector -11, CBD-Belapur, Navi Mumbai- 400614		CUSTOMER CONTACT PERSON		Mr.Hemant Sonawane	
ISO CERTIFICATE NO: 1025-QMS-0125		SITE NAME & ADDRESS		Kala Academy Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001			
PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh		
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER		
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	19-Aug-2019		
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	26-Aug-2019		

JOB NO 9919-0143 TEST REPORT HALF CELL POTENTIAL & CARBONATION

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTER Y/N
1	1st Floor	Room No-85 & 86 Office Area.	22-Aug-2019	1	S	G17-H18		45	10	YES
2	1st Floor	Room No-85 & 86 Office Area.	22-Aug-2019	1	S	H18-I19		50	30	YES
3	1st Floor	Room No-85 & 86 Office Area.	21-Aug-2019	2	B	F16'-G16		50	50	YES
4	1st Floor	Room No-85 & 86 Office Area.	21-Aug-2019	2	B	J17'-K17		40	40	YES
5	1st Floor	Room No-85 & 86 Office Area.	21-Aug-2019	2	S	J17-K18		50	50	YES
6	1st Floor	Room No. 98 Student activity	20-Aug-2019	2	S	L14-M15		40	0	YES
7	1st Floor	Room No-100 Student Activity.	20-Aug-2019	2	S	K13-L14		35	0	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATION DEPTH MM	WITH PLASTER Y/N
8	1st Floor	Room No-100 Student Activity.	20-Aug-2019	2	S	J12'-K12		40	20	YES
9	1st Floor	Room No-102	21-Aug-2019	2	S	K9-L10		35	0	YES
10	1st Floor	Room No-103.	21-Aug-2019	2	B	F'12'-F'12'		50	50	YES
11	1st Floor	Room No-104 to 111 Music room	21-Aug-2019	2	B	H'9'-H'8		50	50	YES
12	1st Floor	Room No-104 to 111 Music room	21-Aug-2019	2	S	G9'-H9		35	35	YES
13	1st Floor	Room No-104 to 111 Music room	21-Aug-2019	2	B	G9-G8		65	65	YES
14	1st Floor	Room No-104 to 111 Music room	21-Aug-2019	2	S	I9'-J9		45	10	YES
15	1st Floor	Room No-119 to 129.	20-Aug-2019	2	S	O13-P14		45	45	YES
16	1st Floor	Room No-119 to 129.	20-Aug-2019	2	S	Q13-R14		35	35	YES
17	1st Floor	Room No-119 to 129.	20-Aug-2019	2	B	P14-Q14		50	0	YES
18	1st Floor	Room No-135 & 133a Office Area.	20-Aug-2019	2	B	O'18'-O'19		45	20	YES
19	1st Floor	Room No-135 & 133a Office Area.	20-Aug-2019	2	S	O18-O'19		40	40	YES
20	1st Floor	Room No-135 & 133a Office Area.	20-Aug-2019	2	B	N19-O19		45	10	YES
							Average		20	

*** END OF TEST REPORT ***

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Format No. : ASPL/NABL/TRF/02

TEST REPORT - HALF CELL POTENTIAL & CARBONATION - Test Report No.: 9919-0143-02

CUSTOMER NAME & ADDRESS		Gem Engserv Private Limited A-103, The Great Eastern Chambers, Plot No. 28, Sector -11, CBD-Belapur, Navi Mumbai- 400614		CUSTOMER CONTACT PERSON		Mr.Hemant Sonawane	
ISO CERTIFICATE NO: 1025-QMS-0125		SITE NAME & ADDRESS		Kala Academy Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001			
PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh		
AMBIENT TEMP. DEG C	29	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER		
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40 +Years	DATE OF TESTING	19-Aug-2019		
TEST ITEM PHY. CONDITION	N.A.	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	26-Aug-2019		

JOB NO 9919-0143 TEST REPORT HALF CELL POTENTIAL & CARBONATION

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATION DEPTH MM	WITH PLASTER Y/N
1	2nd Floor	Auditorium 2nd floor slab & beam	20-Aug-2019	3	B	I12'-J12'		45	0	YES
2	2nd Floor	Auditorium 2nd floor slab & beam	20-Aug-2019	3	S	J12'-I13'		30	30	YES
3	2nd Floor	Auditorium 2nd floor slab & beam	21-Aug-2019	3	B	F13'-G13'		50	50	YES
4	2nd Floor	Auditorium 2nd floor slab & beam	21-Aug-2019	3	S	F'13-G13'		50	0	YES
5	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	3	B	I11'-I11		40	0	YES
6	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	3	B	H11'-H11		45	45	YES
7	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	3	B	G11'-G11		45	45	YES

JOB NO 9919-0143				TEST REPORT HALF CELL POTENTIAL & CARBONATION						
CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED SITE NAME: KALA ACADEMY				ELEMENT IDENTIFICATION				DEPTH FROM SURFACE		
SR NO	STRUCTURE NAME/ID	Building	DATE OF TESTING	LEVEL	ELEMENT TYPE	IDENTIFICATION NO	LOCATION	TOTAL DEPTH MM	CARBONATI ON DEPTH MM	WITH PLASTE R Y/N
8	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	3	S	I11'-H11		40	0	YES
9	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	3	B	I'11'-I'11		45	45	YES
10	2nd Floor	Auditorium 2nd floor slab & beam	22-Aug-2019	2-3	C	H'9'		55	10	YES
11	2nd Floor	Room No-143, Kathak room	21-Aug-2019	3	S	J9-K10		35	35	YES
12	2nd Floor	Room No-143, Kathak room	21-Aug-2019	3	B	J9'-K9'		55	55	YES
13	2nd Floor	Room No-143, Kathak room	22-Aug-2019	3	S	I'9-I10		35	10	YES
14	2nd Floor	Room No-148, Practice room	21-Aug-2019	3	B	F9-G9		50	50	YES
15	2nd Floor	Room No-148, Practice room	21-Aug-2019	3	S	F8-G9		40	40	YES
16	2nd Floor	Room No-154, Practice room.	21-Aug-2019	3	B	F11-G11		45	45	YES
17	2nd Floor	Room No-154, Practice room.	21-Aug-2019	3	S	F10-G11		40	40	YES
18	2nd Floor	Room No-155 Store Room.	21-Aug-2019	3	B	F'12'-E'12'		45	45	YES
19	2nd Floor	Room No-155 Store Room.	21-Aug-2019	3	S	F'12'-E'13		30	0	YES
							Average		29	

*** END OF TEST REPORT ***

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Core Compression Test

Test Data Sheet (Core Test)

IS Codes applicable: IS : 456 / IS : 516 / IS : 1199

Applications:

- Assessment of strength.
- Study of aggregates used in the mix design.
- Assessing probable causes of failures/problems.

Equipment Used:

- Core cutter.
- Core compression testing machine.

Test basis:

A core sample is the actual representation of the material used in the structural element. When processed and subjected to load, it fails at a particular load, giving a fair idea of its compressive strength.

Methodology:

Step 1: Reinforcement Mapping.

By using a special instrument, based on eddy currents, the reinforcements are mapped in the structural member.

Step 2: Core cutting.

Cores are taken using special diamond cutters of 75 mm, 100 mm or 150 mm diameter. Locations are selected to avoid steel so as to minimize the damage to the structure.

Step 3: Dressing.

The edges of the core are smoothed using grinding and cutting wheels and epoxy mortar is applied on both sides for capping. This ensures that the ends are approximately at 90° to the axis and are within 0.05 mm plane ness.

Step 4: Immersion in water

The core samples are immersed in water for 48 hours. The cores are weighed before and after immersion.

Step 5: Compression testing.

The cores are then subjected to compression forces on compression testing machine. The breaking point is observed.

Step 6: Reporting.

Based on the lab report, sizes of the core etc. an equivalent cube strength is calculated for the concrete applying necessary correction factors. The density, core strength and equivalent cube strength are reported.

Influencing factors:

- Core diameter and length (h/d ratio)
- Proper capping and hydration of the cores as per IS code.
- Old/new/Mixed (jacketed) concrete.

Understanding results:

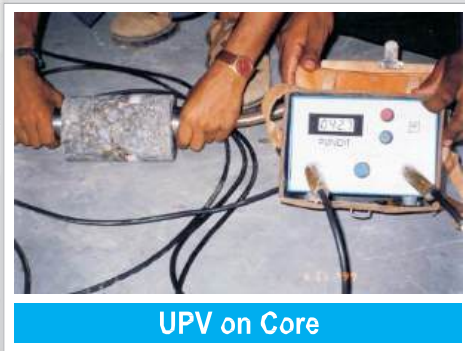
- The result is normalized for comparison with compressive test results of a standard cube. This is done so that the cube results can be compared with the core results. Standard correction factors as per IS code are used for this purpose. This value may not be the same as the core strength.
- We report results as per IS code. IS code does not take into account the core cutting effect. When accounted for, the results can be higher than those reported. Discussion on this can be taken up with consultants as a separate assignment.
- Visual observations of the aggregate, failure pattern and probable causes of failure and suitable remedies can be discussed separately and are not a part of the scope of conducting the test and reporting results.



Core cutting



Core Dressing



UPV on Core



Compression Testing

The information contained here is for educational purposes and should not be taken as a definitive guide of conducting and interpreting test results.

To know more visit: www.aaryans.in

Call us : +91-9820141715
+91-9930264726



Certificate No.
T-2993

AARYAN STRUCTCON PVT. LTD.

Corporate Office : 515A, Sagartech Plaza, Andheri Kurla Road, Sakinaka, Andheri E, Mumbai - 400072.

LABORATORY :

K-218, ANSA J & K INDUSTRIAL PREMISES CHS LTD., SAKIVIHAR ROAD, NEAR SHIV SAGAR HOTEL, ANDHERI (E), MUMBAI 400072
Format No. : ASPL/NABL/TRF/04 Revision NO 1 Revision Date 24/07/2019

TEST REPORT - COMPRESSIVE STRENGTH OF CEMENT CONCRETE (CUBES & CORE) TESTING - Test Report No.: 9919-0143-04

CUSTOMER NAME & ADDRESS

Gem Engserv Private Limited
A-103, The Great Eastern Chambers, Plot No. 28, Sector -11, CBD- Belapur, Navi Mumbai- 400614

CUSTOMER CONTACT PERSON

Mr.Hemant Sonawane

REFERENCE CODE / TEST METHOD
IS: 516 (Part 4):2018

ISO CERTIFICATE NO:
1025-QMS-0125

SITE NAME & ADDRESS
Kala Academy
Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001

Note:
Individual core can be up to 0.75 of required characteristic strength provide average is at least 0.85. Corrections applied for h/d & shape effect as per IS-516.

PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh
AMBIENT TEMP. DEG C	33	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40+ Years	DATE OF TESTING	28-08-2019
TEST ITEM PHY. CONDITION	N.A	GRADE OF CONCRETE: N/mm2	N.G.	DATE OF REPORTING	28-08-2019
EQUIPMENT USED	COMPRESSION TESTING MACHINE	Aggregate Size	N.G.	EQUIPMENT ID	19A - H 041150

Acceptance Criteria : Concrete in the member represented by a core test shall be considered accepted 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 has a strength less than 75 percent as per IS- 456:2000 Clause 17.4.

Test results indicated above for the Core sample collected from site.
Sample tested as per relevant BIS

TEST WITNESSED BY CLIENT (YES / NO)		Name & contact no of Person witnessing test
Specimen Preparation	Cutting and capping	

JOB NO 9919-0143

TEST REPORT - COMPRESSIVE STRENGTH OF CEMENT CONCRETE (CUBES & CORE) TESTING

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED
SITE NAME: KALA ACADEMY

ELEMENT IDENTIFICATION

CORE TESTING RESULTS

SR. NO	STRUCTURE	LEVEL	MEMBER IDENTIFICATION	DATE OF TESTING	DIA,D,MM	LENGTH, H, MM	H/D	Area, sqmm	Dry wt.kg	Dry Density gms/cc	Wet wt, Kg	Voids %age	WET DENSITY GMS/CC	FAILURE LOAD Kn	Measured CORE STRENGTH MPa	CORR. FACTOR AS PER IS-516 part 4-2018	Corrected Compressive Strength (Mpa)	Eqv. 150mm cube Strength, Mpa	Concrete Appearance after fracture
1	Room No-10 Preview Theater	G-1	P-18	28-08-2019	69	135	1.96	3739	1.168	2.31	1.210	3.60	2.40	91.4	24	1.05	25.79	32.23	Satisfactory
2	Room No-52 Conference	G-1	K-13	28-08-2019	69.5	140	2.01	3794	1.240	2.34	1.275	2.82	2.40	82.6	22	1.06	23.12	28.90	Satisfactory
3	Room N-60 & 72 Dress room,63 Green Room, 62	G-1	I-9	28-08-2019	69.5	139.5	2.01	3794	1.202	2.27	1.239	3.08	2.34	98.7	26	1.06	27.60	34.50	Satisfactory
Average																		31.88	

*** END OF TEST REPORT ***

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Format No. : ASPL/NABL/TRF/04 Revision NO 1 Revision Date 24/07/2019

TEST REPORT - COMPRESSIVE STRENGTH OF CEMENT CONCRETE (CUBES & CORE) TESTING - Test Report No.: 9919-0143-04

CUSTOMER NAME & ADDRESS

Gem Engserv Private Limited
A-103, The Great Eastern Chambers, Plot No. 28, Sector -11, CBD-
Belapur, Navi Mumbai- 400614

CUSTOMER CONTACT PERSON

Mr.Hemant Sonawane

REFERENCE CODE / TEST METHOD
IS: 516 (Part 4):2018

ISO CERTIFICATE NO:
1025-QMS-0125

SITE NAME & ADDRESS
Kala Academy
Dayanand Bandodkar Marg, Campal, Panaji, Goa 403001

Note:
Individual core can be up to 0.75 of required characteristic strength provide average is at least 0.85. Corrections applied for h/d & shape effect as per IS-516.

PHYSICAL CONDITION OF TEST		STRUCTURAL INFORMATION		NAME OF TEST ENGINEER	Rakesh
AMBIENT TEMP. DEG C	33	REPAIRS STAGE	N.A.	DESN. OF TEST ENGINEER	ENGINEER
CONCRETE SURFACE	Dry	AGE OF STRUCTURE (years)	40+ Years	DATE OF TESTING	28-08-2019
TEST ITEM PHY. CONDITION	N.A	GRADE OF CONCRETE: N/mm ²	N.G.	DATE OF REPORTING	28-08-2019
EQUIPMENT USED	COMPRESSION TESTING MACHINE	Aggregate Size	N.G.	EQUIPMENT ID	19A - H 041150

Acceptance Criteria : Concrete in the member represented by a core test shall be considered accepted 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 has a strength less than 75 percent as per IS- 456:2000 Clause 17.4.

Test results indicated above for the Core sample collected from site.
Sample tested as per relevant BIS

TEST WITNESSED BY CLIENT (YES / NO)		Name & contact no of Person witnessing test
Specimen Preparation	Cutting and capping	

JOB NO 9919-0143

TEST REPORT - COMPRESSIVE STRENGTH OF CEMENT CONCRETE (CUBES & CORE) TESTING

CUSTOMER NAME: GEM ENGSERV PRIVATE LIMITED
SITE NAME: KALA ACADEMY

ELEMENT IDENTIFICATION

CORE TESTING RESULTS

SR. NO	STRUCTURE	LEVEL	MEMBER IDENTIFICATION	DATE OF TESTING	DIA,D,MM	LENGTH, H, MM	H/D	Area, sqmm	Dry wt.kg	Dry Density gms/cc	Wet wt, Kg	Voids %age	WET DENSITY GMS/CC	FAILURE LOAD Kn	Measured CORE STRENGTH MPa	CORR. FACTOR AS PER IS-516 part 4-2018	Corrected Compressive Strength (Mpa)	Eqv. 150mm cube Strength, Mpa	Concrete Appearance after fracture
1	Room No-135 & 133a Office Area.	1-2	O-18	28-08-2019	69.5	112.5	1.62	3794	0.953	2.23	0.993	4.20	2.33	41.5	11	1.02	11.11	13.89	Satisfactory
2	Room No-100 Student Activity.	1-2	K-14	28-08-2019	69	138.5	2.01	3739	1.166	2.25	1.211	3.86	2.34	41.4	11	1.06	11.75	14.68	Satisfactory
3	Room No. 98 Student activity	1-2	M-15	28-08-2019	69.5	98.5	1.42	3794	0.865	2.32	0.891	3.01	2.39	53.1	14	0.99	13.89	17.36	Satisfactory
																	Average	15.31	

*** END OF TEST REPORT ***

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8. Detailed Methodology of Repairs:

Detailed Methodology of Repairs

Type A: Surface crack on masonry or plaster: Carryout sealing of crack in masonry after chasing.

- a) Make sure Joint surfaces are clean and dry
- b) Apply the sealant in a continuous operation using a caulking gun or pump. A positive pressure, adequate to fill the entire joint width, should be used. This can be accomplished by “pushing” the sealant against the backing material forcing the sealant to the joint walls. Care must be taken to ensure complete fill of the sealant cavity.
- c) Excess material can be removed by back tooling with a spatula or tuck pointer (of proper size) or tooling against the masking tape and pulling the tape immediately thereafter.
- d) Tooling achieves a visually satisfactory finish. Sealants in rough or exposed aggregate panels are best applied and finished with a slight recess.
- e) After tooling, be sure the minimum depth of sealant is in accordance with the sealant manufacturer’s recommendations.
- f) Cure by sprinkling water for 2 to 3 days. Direct splashing of water should not be allowed

Type B Deep crack in masonry or concrete: Grout the crack

- a) Provide scaffolding if required for accessing the crack location.
- b) Remove any loose material completely by using a long sharp chisel and hammers up to 1 kg weight from both side of the wall.
- c) Make sure Joint surfaces are clean and dry from both sides.



- d) Drill and insert 12mm dia aluminium grouting multiperforated nipples up to 30mm to 40mm depth. Seal the space between the crack and the nipple using `M Seal. cutting of nipples after curing, cleaning etc. complete.
- e) Inject cement with conbex- 100/ intraplast N-200grout into the crack by suitable gun/ pump at required pressures.
- f) Cure by sprinkling water for 2 to 3 days. Ensure that there is no direct splashing of water

Type C: Deep crack in concrete: Grout the crack in RCC

- a) Provide scaffolding if required for accessing the crack location.
- b) Remove any loose material completely by using a long sharp chisel and hammers up to 1 kg weight from both side of the wall.
- c) Make sure Joint surfaces are clean and dry from both sides.
- d) Drill and insert 12mm dia aluminium grouting multiperforated nipples up to 30mm to 40mm depth. Seal the space between the crack and the nipple using `M Seal. cutting of nipples after curing, cleaning etc. complete.
- e) Inject cement with conbex- 100/ intraplast N-200grout into the crack by suitable gun/ pump at required pressures.
- f) Cure by sprinkling water for 2 to 3 days. Ensure that there is no direct splashing of water

Type D: Surface crack on concrete: Treat crack by 'V' groove Patch up.

- a) Prepare a 'V' groove in the concrete surface ranging in depth, typically from 6 to 25 mm. Use concrete saw, hand tools or pneumatic tools for groove cutting.
- b) Clean the groove by air blasting or water blasting and dry it.
- c) Apply priming cum bonding coat of Polymer / cement slurry, in proportion 1:1 by weight with a brush to the grooved surface. Immediately thereafter, fill the groove with polymer modified mortar, which is prepared by mixing: 1 kgs of Polymeric mortar modifier + 5 kgs. of fresh cement + 15 kgs of quartz sand (graded).



- d) After 15 -20 minutes level the surface with a steel trowel.
- e) Cure by sprinkling water for 2 to 3 days. Direct splashing of water should not be allowed.

Type E: Small crack on plaster: Same as Type A

Type F: Extensive crack on plaster: RePlaster with Waterproofing Chemical

- a) Remove any loose material completely by using wire brush and blower.
- b) Make sure that the cracked surfaces are clean and dry from both sides.
- c) Apply sand faced plaster using approved screened sand in all positions including base coat of 15mm thick in CM 1:4 using approved brand of waterproofing compound at 200gm / cement bag
- d) Cure the same for not less than 3 day and keeping the surface of base coat rough to receive the next coat.
- e) Apply sand face treatment up to 8mm thick in CM 1:3 finishing the surface by taking out grains and cure it for minimum 14 days.
- f) Apply paint of approved brand on the plaster.

Type G: Concrete spalling in small patches: Patch repairs the spalled concrete.

- a) Remove the spalled/loose concrete completely. Use long sharp chisels and hammers up to 1 kg weight.
- b) Clean the corroded of reinforcement with wire brushes (preferably mechanical type). Remove all the loose and damaged concrete particles till sound concrete of uniform texture is visible.
- c) Take care to remove dust around the application area with the help of vacuum cleaners as the entire efficacy of the application of epoxy is depending on the surface preparation.
- d) Apply approved brand of bond coat in specified proportion on the concrete surface.



- e) Mix Polymer mortar in a mixer and apply the mortar in layers of 10mm thickness by pressing to compact it. Apply the mortar to match the existing surface.
- f) If the 2nd layer of mortar is applied within 4 hours no bonding coat is required between successive layers of mortar.
- g) Cure by sprinkling water for 2 to 3 days. Direct splashing of water should not be allowed.
- h) Apply Concrete Penetrating Corrosion Inhibitor from the bottom of the sable to avoid the further corrosion.

Type H: Concrete spalling in large area: Extensive repair of concrete with micro concrete, if the loss of rebar cross section is unacceptable, then provide and fix additional rebar

- a) Remove the spalled/loose concrete completely. Use long sharp chisels and hammers up to 1 kg weight.
- b) Clean the corroded of reinforcement with wire brushes (preferably mechanical type). Remove all the loose and damaged concrete particles till sound concrete of uniform texture is visible
- c) Take care to remove dust around the application area with the help of vacuum cleaners as the entire efficacy of the application of epoxy is depending on the surface preparation
- d) After cleaning, check the diameter of the rebar and compare with the diameter of the original rebar. If the loss of rebar cross section is unacceptable, then follow the **methodology of providing and fixing of additional Rebar. (Part I)**
- e) Apply approved brand of bond coat in specified proportion on the concrete surface.
- f) Mix Polymer mortar in a mixer and apply it in layers of 10mm thickness by pressing to compact it. Apply the mortar to match the existing surface.
- g) If the 2nd layer of mortar is applied within 4 hours no bonding coat is required between successive layers of mortar.



- h) Cure by sprinkling water after 48 hours. Direct splashing of water should not be allowed
- i) Apply Concrete Penetrating Corrosion Inhibitor from the bottom of the slab to avoid the further corrosion.

Part I: Providing and fixing of additional Rebar:

- a) Remove the rebar having unacceptable cross section.
- b) Clean the corroded rebar with wire brushes (preferably mechanical type). Remove all the loose and damaged concrete particles till sound concrete of uniform texture is visible
- c) Place IS standard clean additional rebar in position, maintain spacing of rebar as per drawings.
- d) Use spacers to maintain cover to keep the steel at the required distance from the face of the concrete.
- e) Fix the steel reinforcing bars so that they stay in the correct place and relative to each other. Use Tie-wire at the junctions of bars to hold them together.
- f) Provide sufficient lapping with original undamaged part of the rebar.
- g) Erect form works and supporting system as required as per the existing shape of the structure and pour micro concrete of approved brand within 1 hrs of application of bond coat. The grade of micro concrete should be either same as that of original concrete.

Type I: Drainage Problem in Terrace: Repair/ improve drainage.

- a) Measure the slope provided to the terrace and identify the drainage path for the rainwater.
- b) Ensure that the slope provided is adequate. If the slope is not adequate, improve it by either placing a layer of screed concrete or by chipping excess concrete suitably.
- c) Ensure that the inlet of the drainpipe is provided with a trash grill.



- d) Fix the pipes on walls such that the lower end of the pipe discharges into the chamber at ground level.
- e) Following sizes of pipes are suggested for different applications.

(a) 100 mm dia. soil pipe
(b) 150 mm dia. Rainwater pipe
(c) 50mm dia. vent pipe

Type J: Leakages due to water proofing problem: Repair / redo the terrace water proofing.

- f) Remove the existing waterproofing to expose the bare RCC slab.
- g) Conduct ponding test and identify the area of leakages and dampness from the bottom of slab if site conditions permit.
- h) Treating the construction joints, honeycombs, crack and the undulations as per methodology.
- i) Apply two coats of a Polymer waterproofing coating of approved brand and cement in 1:1.25 ratio at an interval of 24 hours on the chajjas and extending it up to 30cm over the side walls.
- j) Air cure the same for 24 hours and damp cure for next 4-5 days.
- k) Apply a single coat of bonding agent of approved brand on the Polymer waterproofing coating by spray and providing a chat/dash coat of 1:4 cement mortar in 10-12 mm thickness.
- l) Add expanding grout admixture pouch of approved brand per 50 Kg bag of cement in mortar mix.
- m) Inspect coat of Polymer waterproofing by visually to ensure pinhole free coating.
- n) Stirrers Polymeric waterproofing and cement slurry by using mechanical mixing and check that cement particles do not settle down in the prepared mix. Consume the prepared mix within 30 minutes.



- o) Lay small size well soaked brick bat metal cube in cement mortar 1:3 to proper level and slope as per requirement. Add expanding grout admixture pouch of approved brand per 50 Kg bag of cement in the mortar mix.
- p) Fill the joints and lay I.P.S adding expanding grout admixture pouch of approved brand per 50 Kg bag of cement to the cement mortar 1:3 mixed and finish smooth with neat cement on top so as to drain water smoothly.
- q) Make chequered markings with a grid of 24"X 24".
- r) Cure by providing about 9" to 12" watta along the walls with cement mortar 1:3 small brick bats and IPS finish on the top for seven days.
- s) If required applying china mosaic chips over the surface of approved make and selected design over the I.P.S surface, vatas etc in cement mortar bedding including cleaning, acid washing etc.

Type K: Masonry joint open and pointing disturbed:Pointing with approved materials.

- a) Cleaned of all foreign matter, namely, fungus, moss and dust, by wire brushing and dusting from all open joints.
- b) Fill the gap with approved high strength Cement mortar.
- c) Do the raking of all exposed joints proper by cement mortar by first up to a depth of about 2 cm.
- d) All the joints in masonry are raked down to a depth of 20mm while the mortar is still soft.
- e) Clean the walls and leave them in a neat condition after the pointing of stone masonry work is completed and the mortar is set.
- f) In stone masonry construction keep expansion joint at 15 m interval in case of a compound wall.

TYPE L: Tress and vegetation on external wall of building:Remove vegetation & fill gap with repair mortar.

- a) Remove existing plants growth on the external walls / in joints of wall by hack -saw.



- b) Open out the wall up to about 50mm from the surface and remove roots of the plants up to 50mm.
- c) In case the roots have caused the concrete/masonry to crack, grout the crack as per the methodology at type X above.
- d) Fill the opened-out portion with approved epoxy mortar.

Type M: Algae growth on external wall: Remove algae and apply suitable paint to avoid vegetation and algae growth.

- a) Rinse the surface algae off the cement or concrete with a water hose.
- b) Use bleaching powder for cleaning. Mix 1 cup of bleaching powder in 1 litre of water in a bucket.
- c) Use a scrub brush to remove algae
- d) Rinse the cement or concrete with a water hose and let it dry.
- e) Apply suitable paint to avoid vegetation and algae growth.

Type N: Peel off paint & plaster due to dampness inside and outside of wall: Replaster the affected area with water proofing material damp-proof chemicals.

- a) Remove paint and plaster by using long sharp chisels and hammers form affected area.
- b) Clean the surface by water jetting till sound plaster of concrete of uniform texture is visible
- c) Apply approved brand of damp-proof chemical on the wall as per manufactures recommendation.
- d) After completion of one day curing apply bonding coat of hack - aid plast to the RCC members if required.
- e) Applying sand faced plaster using approved screened sand base coat of 15mm thick with CM 1:4
- f) Do the curing the same for not less than 3 day
- g) Apply one coat of putty.



- h) Apply final two coat of approved shade plastic paint.

Type O: Seepage and leakage in concrete from ground: Carry out grouting.

- a) Cut open a cavity at the point of greatest water flow with a concrete chisel and hammer.
- b) Place a stiff section of hose pipe into the cavity and secure in place with Patch n plug (Xypex Chemical) to force water through the hose. This relieves the pressure so that the area can be patched. Allow a minimum of 24hrs for hardening.
- c) Remove hose and plug remaining hole if necessary, reduce water flow by inserting steel wool or wooden plug in the remaining hole before patching.
- d) XYPEX PATCH, N PLUG shall be used for the for the water leakages from the ground and the side wall.

Type P: Major Spalling due and corrosion of rebar: Demolish and reconstruct

- a) Mark the slab area of demolishing as per audit report
- b) Cut the required size and shape of slab by breaker with proper safety precaution.
- c) Remove all metal scrap, concrete particles and excess rebar from slab.
- d) Clean the area after demolishing by water getting.
- e) Prepare form work and supporting as per pour plan
- f) Clean the corroded rebar with wire brushes (preferably mechanical type). Remove all the loose and damaged concrete particles till sound concrete of uniform texture is visible
- g) Place IS standard clean additional rebar in position, maintain spacing of rebar as per drawings.
- h) Use spacers to maintain cover to keep the steel at the required distance from the face of the concrete.
- i) Fix the steel reinforcing bars so that they stay in the correct place and relative to each other. Use Tie-wire at the junctions of bars to hold them together.
- j) Provide sufficient lapping with original undamaged part of the rebar.



- k) Erect form works and supporting system as required as per the existing shape of the structure and pour M 20 grade of concrete. The grade of concrete should be either same as that of original concrete.
- l) Do 7 days curing of slab by ponding method.
- m) Do the water proofing as per **TYPE 'J'**
- n) Apply Concrete Penetrating Corrosion Inhibitor from the bottom of the slab to avoid the further corrosion.

Type Q: Honeycomb in concrete: Repair with approved repaired mortar.

- a) Remove all the loose and damaged concrete particles till sound concrete of uniform texture is visible. Use long, sharp chisels of about 16-20 mm dia and hammers up to 1 kg weight
- b) Remove all rust from the reinforcement by wire brushes (preferably mechanical type). Apply rust remover of approved brand to the reinforcement in order to remove traces of rust, if any.
- c) Clean the reinforcement once again with wire brush. Wash the complete concrete surface including the reinforcement with air blasting or water blasting and dry it to remove the traces of rust remover. Apply a coat of approved brand of rust passivator and cement as per manufacturer's recommendations.
- d) Patch up the concrete surface with the approved brand of Polymer Mortar as per the manufacturer's recommendations.
- e) Apply Concrete Penetrating Corrosion Inhibitor from the bottom of the slab to avoid the further corrosion.

Type R: Level problem: Increase level by additional concrete

- a) Clean the area where the concrete is needed to place.
- b) Place IS standard clean additional rebar in position, maintain spacing of rebar as per drawings.



- c) Use spacers to maintain cover to keep the steel at the required distance from the face of the concrete.
- d) Fix the steel reinforcing bars so that they stay in the correct place and relative to each other. Use Tie-wire at the junctions of bars to hold them together.
- e) Provide sufficient lapping with original undamaged part of the rebar.
- f) Erect form works and supporting system as required as per the existing shape of the structure and pour M 20 grade of concrete. The grade of concrete should be either same as that of original concrete.
- g) Do 7 days curing of slab by ponding method.

Type S: Special distress: Do the retrofitting

- a) Structural design engineer to be consulted for design of retrofitting scheme.
- b) Retrofitting to be executed under supervision of structural consultant



LIST OF CHEMICALS FOR TREATMENT

Type of chemicals with three equivalent suppliers				
Sr. No.	Type of Chemical	Name of Sunanda Chemical	Name of Fosroc Chemical	Name of Sika Chemical
1	Bonding coat of polymer	Polyalk EP	Nitobond PVA	Sika Top 122
2	Polymer mortar	Polyalk EP	Nitobond PVA	Sika Top 122
3	Rust removers.	Rusticide SS	Acid Etc	Rustoff 100
4	Rust Passivator	Fixoprime	Conplast CN	Sika Top 122 Armatec 108 (PC)
5	Injecting cement	Polyexpanse	conbex- 100	Intraplast N-200
6	Concrete surface exposed to chemical attack	SUNPUGARD	Nitocoat UR 512	Sikafloor 31N Purcem
7	Elastomeric acrylic crack filler	POLYFILL-AR	-	-
8	External Acrylic coat	SUNEXT-8	Brush Bond	Sika top 67
9	Polymeric Waterproofing Coat	POLYALK WP	Brush Bond RFX	Sika Guard
10	Bonding agent	HACK-AID-PLAST	Nitobond EP	Hibond
11	Expanding grout admixture	SUNPLEX	Cebex 100	Intraplast® NN
12	Patch N Plug	XYPEX PATCH,N PLUG		
13	Concrete Penetrating Corrosion Inhibitor	POLYALK CP 113	EPCO®-KP-100 of Krishna Conchem	Sika® FerroGard® 903+

9. Summary of Recommendations:

Part 1: Auditorium:

- a) The main columns of the building are found to be in good condition.
- b) Water proofing over the terrace is found damaged and needs to be repaired as per detail methodology of repair.
- c) There is no access close to the hanging structure supporting the false ceiling and the top slab of the Auditorium. These structures could therefore be inspected only from a distance. The hangers carry large tensile loads and therefore to improve the reliability of inspection, it is desirable that these elements are periodically inspected from close quarters. Provisions may be made to access the hanging structure to facilitate such inspections.
- d) At a few places major defects has been found in RCC structural which will adversely affect the serviceability of the building in long run. These will also adversely affect the durability of the structure and deterioration will accelerate if not repaired immediately.

Part 2 Main building:

- a) Major distress, in the form of spalling of concrete from the slab, has been found at many places in this building. The distress is of severe nature and safety and serviceability of the building is affected. These defects need to be addressed urgently. It is possible to repair these slabs; however, the extent of repairs would be very extensive, requiring significant time and cost.

Till such time the strength of the slabs is restored no loads shall be permitted on it. In case loading following slabs is unavoidable, they may be fully propped from below. It is recommended that the necessary retrofitting work on following slabs be designed by a structural consultant and execution under their supervision.

1. Jury Preview Theatre, storeroom no. 10 b.
 2. Corridor from Recording room no. 17 to Repair room no. 8.
 3. Room no. 8 repair room.
 4. Room no 9 Storage area.
 5. Room no. 9 B storeroom.
- b) Water proofing over the terrace is ineffective and needs to be completely re-done on the first, second, third floors levels and above Art gallery room no. 4. To avoid future deterioration of structure and to stop the seepage of rainwater, it is advisable to cover all terraces open to sky.
- c) The practice of periodic painting without repairs to underlying defects only results in covering up the defects and gives a false sense of well-being of the structure. This practice should therefore be stopped. As a good practice it is recommended that all structures should be periodically inspected for any defects and these should be assessed before applying any paint or surface coating. Long-term corrective action may be taken as per our broad recommendations.
- d) The extent of distress varies from place to place and these are graded and summarised in Annexure I. Generic solutions to the common distress is also recommended in Annexure I, which may be implemented.
- e) Wherever the distress is categorised as 'serious' these should be attended immediately.
- f) No distress found was observed in the Amphitheatre.

Part 3 External surface of all buildings:

- a) There is no sign of distress in the masonry load bearing walls.
- b) In the main building, at ground and 1st floor level, reinforcement in all the chajjas on the west side were found be severely corroded. This is attributed to aggressive



environment (sea facing) and possible poor quality of construction. These should be repaired on priority as per the recommendations in Annexure I.

- c) Algae growth on external wall was observed at East and South side of the building. The algae may be removed, and the surface painted with a suitable paint. Necessary measures have to be taken to stop ingresses of rainwater from external walls which are showing sign of seepage needs necessary protection from direct rain.

Part 4 AC Plant and DG Set Room:

- a) Sign of major distress is observed in the roof slab, beams and few columns in AC Plant & DG set room. These should be repaired as per our broad recommendations.
- b) To avoid further deterioration, all structures must be audited at an interval of every 4 years.



No. GEC/CIVIL/CONS/

/19/ Final report

Date: 07-02-19

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Name and Address of the Party : Member Secretary, Kala Academy, Panaji, Goa

Reference Letter : No.1. Letter No: KA/Tech/Kala Academy-Building/2018-19/1118 and subsequent site visit on 30/07/2018
2: Letter No: GEC/CIVIL/KGG/GH/Consultancy/KalaAcad/2018-19/11/3258

Name of Work

: Health Assesment of Kala Academy Building

POST NDT REPORT OF ASSESSMENT OF HEALTH STATUS OF STRUCTURAL MEMBERS OF KALA ACADEMY BUILDING AT CAMPAL

This report shall be read in conjunction of the report issued by GEC

1. Introduction

Kala Academy is the monumental structure with recreational facility situated at Campal in the city of Panaji, Goa on the banks of river Mandovi. It was designed by Architect Charles Correa and built by CPWD in the year 1980. The controlling authority of this structure is Department of Art and Culture, Government of Goa. Kala Academy is the prime institution for promotion of art and culture in Goa and variety of cultural programs held in its premises. The total site area is around 6.3 acres with plinth area of 4020m². The building comprises of facilities like auditorium, art gallery, amphitheatre, black box and canteen along with academic and administrative facilities. It houses School of Western Music, School of Drama, Repertory Company and School of Indian Music and Dance. Three groups of people use this building: viz., staff, students, and audience. The structure is in the heart of city and has good scenic view along with unique facilities under one roof.

Several issues with respect to strength of structural members, residual strength of identified structural members, elements, water proofing issues, possible solutions pros and cons and testing members with NDT and reporting is the scope of this work

2. The GEC team visited the site on the following days and the information is collected as follows

Dates of Visit	Information Collected
30 th July 2018	Site was inspected along with the Kala Academy officials and reconnaissance survey was conducted and problems faced were recorded.
28 th September 2018	Corridor along with the black box was inspected for cracks, leakages and other damages and visual observations were recorded
5 th October 2018	Store Room 10B, Dariya Sangam block and open area of first floor were inspected for visual observations
11 th October 2018	Open area of 1 st and 2 nd floors and OAT was inspected for the cracks and leakages
19 th October 2018	Open area of 2 nd and 3 rd floor along with the auditorium area was inspected for cracks, leakages and other damages
1 st June 2019	Rebound Hammer test, Ultrasonic Pulse Velocity test was conducted on the selected points of the structure
8 th June 2019	Carbonation test, Half Cell Potential test and Cores extraction test was conducted on the selected points of the structure
	Visual observations were recorded and Inspection report was sent to Member secretary
	Discussions

3. Visual Observation (Report Appended)

4. Tests Conducted

A. Ultrasonic Pulse Velocity (IS 13311 (Part 1): 1992)

A pulse of longitudinal vibrations is produced by an electro-acoustical transducer, which is held in contact with one surface of the concrete under test. When the pulse generated is transmitted into the concrete from the transducer using a liquid coupling material such as grease or cellulose paste, it undergoes multiple reflections at the boundaries of the different material phases within the concrete. A

complex system of stress waves develops, which both longitudinal and shear waves, and propagates through the concrete. The first waves to reach the receiving transducer are

the longitudinal waves, which are converted into an electrical signal by a second transducer. Electronic timing circuits enable the transit time T of the pulse to be measured. This test was used to estimate the integrity of the concrete in the structural members.

B. Rebound Hammer (IS: 13311 (Part 2): 1992)

Rebound hammer test method is based on the principle that the rebound of an elastic mass depends on the hardness of the concrete surface against which the mass strikes. When the plunger of rebound hammer is pressed against the surface of the concrete, the spring to control mass rebounds and the extent of such rebound depends upon the surface hardness of concrete. The surface hardness and therefore the rebound indices taken shall be related to the compressive strength of the concrete. The rebound distance is measured along a graduated scale and is designated as the rebound number or rebound index. A concrete with low strength will absorb more energy to yield in a lower rebound value. In case of good quality, higher rebound values are obtained. This test was conducted to estimate residual Compressive strength.

C. Carbonation of Concrete (ASTM C 1202)

Carbonation of concrete is a process by which carbon dioxide from air penetrates into the concrete and reacts in presences of moisture to form dilute carbonic acid which reacts with reinforcement and also reduces the alkalinity of concrete. Carbonation of concrete is one of the main reasons for corrosion of reinforcement. The pH value of pore water in hardened concrete is generally between 12.5-13.5 depending on the alkali content of cement. The high alkalinity forms a thin passive layer around steel reinforcement and protects it from water and oxygen. When the pH value is reduced to as low as 8.5 the protective layer gets destroyed and the steel reinforcement is exposed to corrosion. The extent of carbonation can be determined by spraying a freshly exposed surface of the concrete with 1% phenolphthalein solution. The calcium hydroxide is coloured while the carbonated portion is left uncoloured. This test was used to estimate the extent of corrosion as the structure is close to the Arabian Sea.

D. Half-Cell Electrical Potential Method (ASTM C876 – 91)

The method of half-cell potential measurements normally involves measuring the potential of an embedded reinforcing bar relative to a reference half-cell placed on the concrete surface. The

half-cell is usually a copper/copper sulphate or silver/silver chloride cell but other combinations are used. The concrete functions as an electrolyte and the risk of corrosion of the reinforcement in the immediate region of the test location may be related empirically to the measured potential difference. This also estimates the extent of corrosion of Reinforcement.

E. Core Cutting Test (IS 516 (1959) and IS 1199 (1959))

A direct assessment on strength can be made by core sampling and testing. Cores are usually cut by means of a rotary cutting tool with diamond bits. Most concrete core drills are connected to a stand that is secured to a wall or floor with concrete anchor. A solid cylindrical core of concrete is removed from the hole after the drilling is complete. In this manner, a specimen is obtained, usually with its ends being uneven, parallel and square and sometimes with embedded pieces of reinforcement. The core test provides a visual inspection of interior of the concrete. The compressive test on drilled concrete core is required to determine the strength of hardened concrete in structure. This test presents first hand information of the selected areas on the strength of the structural members.

5. Test Results

A. Columns

i. Ground Floor

Total no of columns in the structure : 193

Columns tested 17

Test s	Value Range
Rebound Hammer	Shows compressive strength of concrete as 21-30 N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality of concrete

ii. First floor

Total no of Columns : 148

Columns tested : 13

iii. Second Floor

Total no of columns 37

Columns tested 11

B. Beams

i. Ground floor.

Beams tested: 16

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 23-29 N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality of concrete
Carbonation Test	Depth of carbonation is 5cm from either end
Core	Shows compressive strength of concrete as 11N/mm ²

ii. First floor

Beams tested:

1

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 32N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality of concrete
Carbonation Test	Depth of carbonation is 5.5 cm from either end
Core	Shows compressive strength of 16N/mm ²

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 22-29 N/mm ² approx.
Ultrasonic Pulse Velocity	Poor to medium quality of concrete
Half Cell Potential	50% probability of corrosion being active

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 29-34N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality of concrete

iii. Second floor

Beams tested: 2

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 33N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality of concrete

C. Slabs

Slab portion tested: 13

Tests	Value Range
Rebound Hammer	Shows compressive strength of concrete as 26-33 N/mm ² approx.
Ultrasonic Pulse Velocity	Poor quality concrete, Fractured concrete
Carbonation	Depth of carbonation was measured between 2-5cm
Half Cell Potential	More than 95% of probability of corrosion being active
Cores	Shows compressive strength of concrete as 19-28N/mm ²

6. Recommendations

Based on the analysis of the results of non-destructive tests conducted on the structure following recommendations are laid below:

A. Structural

Restoration of the strength and improvement in the load carrying capacity of the structural members viz. columns, beams and slab can be achieved by

1. carbon fibre wrapping technique
2. steel bonding technique
3. RCC jacketing.

B. Non-structural

1. Masonry walls can be strengthened by stitching of cracks along with grouting, filling of expansion joints with flexible materials like poly-sulphides, bituminous fillers.
2. For the protection of the terraces and easy drainage of water from each floor, corrugated GI roofing sheets to be used after determination of the concrete strength for withstanding additional loads.
3. In case of excess load due to corrugated GI roofing sheets on the concrete slab, the already existing load in the form of multiple layers of waterproofing to be removed with expertise agency and/or equipment.
4. The existing alignment of drainage of water from terraces to be rectified by maintaining proper slope along the terrace surface.

6.7 Analysis of Slabs

Citing the report of visual observation carried out during the preliminary examination of the structure and the subsequent NDT testing carried out on structural members following is inferred.

The overall stability of the structure due to loading, age of the structure, environmental aggressive conditions acting on the members and residual structural strength present in the members is evaluated and analyzed as follows

1. **Figures** show the cores extracted from the slabs
2. It is very clear from the Figure that the slab thickness is 120 mm originally provided. However, over a period of time, several layers (3-4 layers) of waterproofing is provided on the structure taking overall thickness 330 to 350mm.
3. As per IS 875, part-2, Live Load suggested range from 2KN/m^2 to 5KN/m^2 for various components of the recreational building. Additional layers added undesirable Dead Load on the structure

It is clear from the Figure that, the thickness of the accumulated waterproofing layer on the existing slab is 210 mm. Going by an average density of the material of waterproofing it is found varying between 18000 N/m^3 to 20000 N/m^3 . In view of this, the existing additional dead load to the tune of almost 4KN/m^2 is undesirable. The building as a whole is experiencing the very critical condition of bearing the load. Due to this overburden, no further load to be imposed on the structure. Under these conditions, providing any additional load is dangerous on the structure. In addition to this, there are several units where live load is concentrated at certain specific timings.

Under these circumstances, the options open are:

1. Removal of existing waterproofing layers and level the surface and then finish with M30 screed supplemented with waterproofing compounds from top
2. Due to overloading for a long period, at several places the slab has cracked and showed distress. This can be rectified by injection grouting with non shrink grouts. To retrieve strength, old ceiling material is to be removed and epoxy mortar/micro concrete shall replace the ceiling along with abonding agent. Carbon strips shall be provided at the

soffit of the slab to achieve the required strength.(Design of all these is beyond the scope of the work)

3. New gen seamless continuous waterproofing layer with glass fiber sandwiched having minimum 2MPa pull out strength is advised and preferred on the screed on the top of slab
4. GEC team is of the opinion that for an economical solution certain architectural aesthetics have to be compromised marginally. It is proposed to provide galvalume sheeting of 0.5mm thick for better drainage with a suitable arrangement to hold the sheets. This prompts rising of the parapet wall to hide the provided sheeting system. Even this operation requires removal of the existing waterproofing layers and finished with a screed of 50-75 mm.(May be considered as a last option if architectural restrictions permit)

Table in Appendix 6 shows the result of compressive strength recorded of the extracted cores at various locations of the building. Cores extracted from the first floor (S1, S2) showed a compressive strength of 15MPa on an average. Equivalent cube strength shows about 20-29 MPa. Higher values are attributed to the effect of carbonation. However, safely one can go with a compressive strength of 15MPa, taking the age of concrete into consideration. Concrete in second-floor slabs (S3, S4, S5, S6) appears to be better than the first and third floor. This is natural due to the protection of the slab from above. The strength achieved is around 30MPa. Once again higher values are attributed to carbonation which was recorded to a depth of almost 60mm from bottom. Otherwise concrete possesses a grade of safely M25. In the case of third- floor cores (S7, S8) have shown with an extremely poor value of residual strength in them. The values range from 20-30MPa. Higher values once again indicate the effect of carbonation. The encountered steel in the slab has shown corrosion to the extent of almost 90-95%. This is further supported by half-cell potentiometer which has indicted corrosion to an extent of 95%. **Table in Appendix 5** shows the results of the half-cell potentiometer test.



Fig. Core extracted from first floorslab



Fig.: Core extracted from third floor



Fig.6.23: Core extracted from first floor beam (source: group clicked image)



Fig.6.22: Core extracted from ground floor beam (source: group clicked)



Fig.6.24(a): Core extracted from third



floor (source: group clicked)

**Fig.6.21: Core extracted
from second floor slab
(source: group clicked image)**

Visual observation clippings are attached in **Figure 6.1(e), 6.1(h), 6.3(a), 6.3(h), 6.6(c) and 6.8(b), 6.8(e)** to represent the extent of corrosion.

Area of the slab below the OAT is severely affected due to corrosion of the reinforcement which made the entire slab fractured in nature. This is due to continuous seepage of rainwater for the entire monsoon period. No structural repairs were carried out and continued corrosion during several monsoons made concrete fractured due to expansion of steel. It was impossible to take any cores for testing. From visual observation, no treatment is possible except for demolition of the entire affected area almost to the width of 2m. **Figures** show the distress in the slab below OAT.



(c) Spalled concrete with R/f exposure and loose cover in beam at next to store room(9) and light control



(h) Spalled concrete with exposed R/F in room (9)



(g) Delamination in beam located in room(9)



(d) Hole in ceiling outside of Store room(9)



(f) Delamination at store room(9)(f) (f)
Delamination of slab at store room(9)



(h) Spalled concrete with exposed R/F in room(9)



(a) Spalled concrete with R/f exposed in slab at the entrance of black box



(j) Presence of moisture, blisters and leakage on beam in recording room(17)

Second and Third-floor slabs are also affected by corrosion in general. At places where there are leakage and dampness due to failure of waterproofing layers the slab is weak. Residual strength could be improved as suggested earlier

Dariya Sangam Block

These are isolated blocks from the main Kala academy building as service blocks. It appears no repair to the slab has been carried out in the recent past. Reinforcement is totally corroded and exposed. This is due to improper drainage of water from the roof and age. As the structure is very small, external steel columns can be erected and sloped roof with galvalium sheets (of 0.5mm

thick) can solve this problem permanently. The slab can be treated with guniting or pressure grouting from the soffit of the slab.

Figure below show the distress and exposed reinforcement in the slab.of DariaSangam



(a) Spalled concrete with exposed R/f in slab at ladies toilet of Dariya Sangam



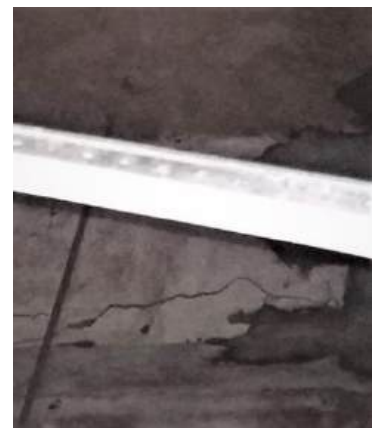
(b) Presence of loose cover & a part of concrete is missing.



(d) Spalled concrete with R/f exposed along the side of beam of generator room(81)



(c) Spalled concrete with R/f exposed in the ventilation projection of Generator room(81)



(e) Longitudinal crackin

**beam, in ladies toilet
of Dariya Sangam.**

6.8 Analysis of Beams

Beams are an integral part of the building and carry the load from slab and transfer to columns. The architecture of the building did not allow the access of certain beams for conduction of NDT tests on them. Altogether, 27 beams were selected out of which No Results could be determined from 7 beams. The data collected from 20 beams at various floors from UPV, RBH, and other possible tests (see Appendix 2 to 5 for details) were considered for analysis and conclusions are drawn as follows:(See typical beams in the figures referred above)

1. The compressive strength of the beams is around M25 grade at places where concrete is extremely good and is not affected by moistures. However, cores randomly taken at different floors have shown the strength as low as 10-15 MPa..
2. The poor strength is attributed in beams exposed to the marine environment directly. Careful observations showed the rebars in beams have corroded from 60-80% in all the floors.
3. Certain places (beams below OAT, fly over gallery and stage area of OAT) have shown mild to moderately visible deflections. Main reinforcement in the beams have lost their load carrying capacity due to corrosion.
4. It is to be noted as the building is around 40 years and steel used was mild steel. Required reinforcement shall be replaced by providing temporary supports wherever required and suitably grouted.
5. All beams, in all floors general, are weak and hence need strengthening

Method of Strengthening Proposed: Loose plaster etc shall be removed from the beams. Loose reinforcement shall be removed. Surface shall be cleaned. Pressure grouting with expanders inherited shall be used to seal all cracks. Epoxy mortar or micro concrete shall be used for plaster. Carbon strips shall be used as reinforcement along with wrapping will improve the strength of the beams. It is to be noted that, all beams shall be properly propped before carrying out repair work.

Design of retrofitting is out of the scope of the work

6.9 Analysis of Columns

Ground Floor Columns

Columns transfer the load from the beams to the foundation. Columns act as supporting structure. The ground floor altogether has 193 columns in total, out of which 32 columns sampled for testing depending upon the severity of the damages in the columns identified during visual observation/inspection. But constraints at the site allowed for NDT assessment of only 17 columns. The data collected from 17 columns at ground floor from UPV, Rebound Hammer and other possible tests (see Appendix 2 and 3 for details) were considered for analysis and conclusions are drawn as follows:

1. 12 columns are very close to the sea by about 80m and show maximum compressive strength around 21-23MPa by rebound hammer test and the concrete quality is very poor as indicated by UPV test. The concrete in the columns show an average grade around M15. The marine conditions have played a crucial role in the weakening of the columns.
2. The columns which are in the interior of the structure has shown much higher strength around 28-31MPa by rebound hammer test. The concrete of the beams show an average grade as M25.
3. The columns which are below OAT have shown buckling and cracks and tending to lose their strength gradually due to corrosion in the lower part of columns.
4. The careful observations have shown the corrosion in the reinforcement is around 60%. The visual inspection concluded that the bottom of the columns was damaged critically.
5. The civil engineering concept is to have strong columns and weak beams. However, in the present case due to weakening of columns at the base the structure is likely to lose integrity with the foundation part.
6. In view of the above, all columns on the ground floor need strengthening. This indicates columns supporting only ground floor (Cafeteria side) need to be grouted and strengthened. However, the main columns need to be jacketed.



(c) Drainage pipe provided in the circular column is sealed with filling material at 1st floor level.



(d) Bulging of the column at second floor

First Floor Columns

This building accommodates Administrative block, Western music classes, Indian music classes with a circulation space as a corridor of width 3m. Care was taken to identify the columns affected maximum, moderate and least by environment aggression during visual inspection time for testing.. Altogether 13 columns were selected as a sample to serve in the quality assessment programs in evaluating their residuals strength using NDT

Although the structure appears to be cosmetically good but structurally weak as their carrying more load than it is designed for. With the increasing age of the structure, it has shown moderately poor integrity from UPV test. This account to almost 80% of columns appears to be weak. Corresponding compressive strength indicated by the rebound hammer test is varying from 20-34 MPa. More accurately, going by IS stipulations safely one can presume its prevailing strength as M22.

It is observed that due to weakening of ground floor columns which are already showing distress in form of crack, that continued even in the first floor which appears to be superficial in the plaster and likely to damage first floor columns as seen ground floor columns.

Periodic cosmetic finishes have been carried out by Kala academy authorities. However, it is not touched by any strength repairs right from its inception. Since ground floor column needs strengthening/jacketing depending upon their stress level. So also, proportionally first-floor column also needs strengthening may not be jacketing. This will ensure the concept of strong column-weak beams. (Detailed Design is not in the present scope of work)

Second Floor Columns

The building houses Kathak classes, school of drama and control room of the main auditorium on the second floor. Care was taken to identify the columns affected by environmental aggregation during visual inspection time for testing them using NDT. Altogether 11 columns were selected looking at the severity of the damages as samples to serve in the quality assessment program. Around 75% of columns appeared to be weak. Corresponding compressive strength of concrete from Rebound Hammer test ranges from 25-45MPa. Higher values can be attributed to the carbonation of the concrete. However, the prevailing strength in the concrete safely can be taken around M28. The columns of this floor showed distresses in the form of bulging, cracks in the bottom portion. While the columns on the first floor appear to have superficial distresses but second-floor columns have shown much severe distress. It is necessary to treat the columns on the second floor otherwise distresses may continue down to the lower floor and damage the integrity of the columns. The columns need to be strengthened..

APPENDIX 1 DATA

SHEET

For proper investigation and selection of correct repair systems, it is desirable to note all possible information in detail as correctly as possible.

A. DATA

1. Name of the Project : Non-Destructive study on Kala Academy
- a. Estimated cost : Not Available
- b. Location : Campal, Panaji
- c. Plinth area of Building : 5101.5 m²
2. Year of Construction : 1980
3. Use of the Building :Recreational
- a. Designed Use : Institution and Recreational purpose
- b. Present Use : Institution and Recreational Purpose
- c. Any other change in Bldg. use : No
- d. Brief background history,
if change in building use is involved : No
4. a. Structural changes made in the past : No
- b. If so, details of Changes carried out :
5. Year of first distress noticed : Not recorded
6. Nature of distress noticed : Spalled concrete, water leakage.
- a. Any previous investigation done in the past: Not known
- b. If so, copy of results of such investigation: -
7. Any repair to concrete undertaken in the past: Yes- Cosmatic
- a. If so, provide details
 1. Year of carrying out repairs : 2004
 2. Type of repairs: Replacement of waterproofing layer,
non-structural changes
 3. Efficacy of repair : Poor
 4. Cost of repairs : Not Available

8. Any investigation done in past
a) If so, copy of the results of such investigation
: No
9. Type of cement used (OPC/PPC)/SRC/
any Other in original construction) : Not Available
10. Type of steel reinforcement used
(Mild steel/Cold twisted
steel/TMT/
any other steel) : Fe 250
11. Source of water used for
originalConstruction (Municipal
water/
Local bore well / Any other source) : Not available
12. Chemical analysis results of water used
for construction : Not Available
pH Value : Not Available
Chloride ppm : Not Available
Sulphate ppm :Not Available
13. Source of sand and chemical analysis,
if any, in regard to Chloride/Sulphate
contents : Not Available
14. Source of coarse aggregate including
type of rock : Not Available
15. Photo of defective portions, if any : Attached
16. Set of architectural drawings
(to be enclosed) : Attached
17. Set of structural drawings
(to be enclosed) : Not attached
18. Details of any protective treatment used
(during or after construction) : Addition of waterproofing layer at terrace level
(China Chip layer)

APPENDIX 2 REBOUND**HAMMER TEST****Table A2.1: Compressive strength of columns on ground floor using Rebound Hammer test**

Sr. No	Member	Orientation of hammer	Average Rebound Number	Compressive strength(N/mm ²)
1	C1	0	21.29	21.29
2	C2	0	23.33	23.33
3	C3	0	30.40	30.40
4	C4	0	21.37	21.37
5	C10	0	22.25	22.25
6	C13	0	22.00	22.00
7	C24	0	36.64	36.64
8	C52	0	35.63	35.63
9	C149	0	28.57	28.57
10	C153	0	28.33	28.33
11	C157	0	28.57	28.57
12	C169	0	31.59	31.59
13	C175	0	28.86	28.86
14	C181	0	21.00	21.00
15	C184	0	28.00	28.00
16	C188	0	28.33	28.33
17	C189	0	38.00	38.00

TableA2.2: Compressive strength of columns on first floor using Rebound Hammer test

Sr. No.	Member	Orientation of hammer	Average Rebound Number	Compressive Strength(N/mm ²)
1	C45	0	28.66	28.66
2	C69	0	33.61	33.61
3	J8 DUMMY	0	34.79	34.79
4	C95	0	29.86	29.86
5	C96	0	29.14	29.14
6	C98	0	26.67	26.67
7	C105 DUMMY	0	22.10	22.10
8	C106	0	29.10	29.10
9	C108	0	27.10	27.10
10	C109 DUMMY	0	26.70	26.70
11	C 154	0	32.00	32.00
12	C 166	0	32.20	32.20
13	C 176	0	28.80	28.80

TableA2.3: Compressive strength of columns on the second floor using Rebound Hammer test

Sr. No,	Member	Orientation of hammer	Average Rebound Number	Compressive strength(N/mm ²)
1	C20	0	36.58	36.58
2	C21	0	25.83	25.83
3	C23	0	45.44	45.44
4	C24	0	29.45	29.45
5	C42	0	34.99	34.99
6	C45	0	38.79	38.79
7	C50	0	33.39	33.39
8	C51	0	29.21	29.21
9	C51A	0	29.77	29.77
10	C68	0	36.10	36.10
11	C76	0	34.14	34.14

TableA2.4: Compressive strength of beams on the ground floor using Rebound Hammer test

Sr. No.	Member	Orientation of Hammer	Average Rebound Number	Compressive strength(N/mm ²)
1	B2	0	26.43	26.43
2	B3	0	24.25	24.25
3	B4	0	28.77	28.77
4	B5	0	30.08	30.08
5	B6	0	27.25	27.25
6	B7	0	29.59	29.59
7	B14	0	29.25	29.25
8	B15	0	23.75	23.75
9	B17	0	25.50	25.50
10	B18	0	28.14	28.14
11	B19A	0	29.25	29.25
12	B20	0	28.56	28.56
13	B23	0	36.89	36.89
14	B26	0	36.58	36.58
15	B27	0	27.00	27.00
16	B30	0	36.73	36.73

Table A2.5: Compressive Strength of beams of the first floor and second-floor using Rebound Hammer test

Sr. No.	Member	Orientation of hammer	Average Rebound Number	Compressive Strength (N/mm ²)
First Floor				
1	B26	90	32.06	32.06
Second Floor				
1	B28	0	31.19	31.19
2	B29	0	31.83	31.83

Table A2.6: Compressive Strength of slabs of the ground floor and second-floor using Rebound Hammer test

Sr. No.	Location	Orientation of Hammer	Average Rebound Number	Compressive Strength (N/mm ²)
Ground Floor				
1	Store Room 9B	90	26.41	26.41
Second Floor				
1	Landing Area	90	33.27	33.27
2	Ceiling	90	32.95	32.95

APPENDIX 3 ULTRASONIC PULSE

VELOCITY TEST

TableA3.1: Quality of Concrete of columns of the ground floor using UPV test

Sr. No.	Member	Method	Velocity (Km/sec)	Quality of Concrete	Remark
1	C1	Indirect	2.69	Poor	
2	C2	Direct	No Reading		
3	C3		Discarded		
4	C4	Direct	3.69	Good	
5	C10	Direct	2.18	Poor	
6	C13	Indirect	2.56	Poor	
7	C24	Indirect	2.29	Poor	
8	C52	Indirect	No Reading		Due to mid landing
9	C149	Indirect	2.29	Poor	
10	C153	Direct	1.86	Poor	
11	C157	Indirect	3.27	Poor	
12	C169	Indirect	4.52	Good	
13	C175	Direct	4.26	Good	
14	C181	Indirect	No Reading		
15	C184	Direct	3.61	Good	
16	C188	Indirect	2.69	Poor	
17	C189	Indirect	3.66	Medium	

TableA3.2: Quality of concrete of columns of the first floor using UPV test

Sr. No.	Member	Method	Velocity(km/sec)	Quality of Concrete	Remark
1	C45	Indirect	2.07	Poor	

2	C69	Direct	2.98	Poor	
3	F J8 DUMMY	Direct	3.36	Medium	
4	C95	Direct	3.62	Good	
5	C96	Direct	3.62	Good	
6	C98	Direct	5.09	Excellent	
7	C105 DUMMY	Direct	No Reading		
8	C106	Direct	3.60	Good	
9	C108	Direct	0.79	Poor	
10	C109 DUMMY	Direct	No Reading		Drainag epipe is present
11	C 154	Direct	4.32	Good	
12	C 166	Direct	4.55	Excellent	
13	C 176	Direct	3.53	Good	

TableA3.3: Quality of concrete of columns of the second floor using UPV test

Sr. No.	Member	Method	Velocity (Km/sec)	Quality of Concrete	Remark
1	C20	Indirect	2.80	Poor	
2	C21	Direct	0.81	Poor	
3	C23	Indirect	2.98	Poor	
4	C24	Indirect	2.93	Poor	
5	C42	Direct	3.33	Medium	
6	C45	Indirect	2.56	Poor	
7	C50	Direct	2.17	Poor	
8	C51	Indirect	2.11	Poor	R. No. 148
9	C51A	Indirect	1.87	Poor	Room next R.No. 148
10	C68	Direct	3.24	Medium	
11	C76	Direct	3.31	Medium	

TableA3.4: Quality of concrete of beams of the ground floor using UPV test

Sr. No.	Member	Method	Velocity (Km/sec)	Quality of Concrete	Remark
1	B2	Indirect	No Reading		
2	B3	Direct	2.56	Poor	
3	B4	Direct	2.46	Poor	
4	B5	Direct	2.40	Poor	
5	B6	Indirect	2.81	Poor	
6	B7	Indirect	No Reading		
7	B14	Indirect	3.40	Poor	
8	B15	Direct	3.86	Medium	Danger Zone
9	B17	Indirect	No Reading		
10	B18	Indirect	2.42	Poor	
11	B19A	Indirect	3.33	Poor	
12	B20	Indirect	3.66	Medium	
13	B23	Indirect	2.36	Poor	
14	B26	Indirect	2.66	Poor	
15	B27	Direct	3.41	Medium	
16	B30	Indirect	2.62	Poor	

TableA3.5: Quality of concrete beams of the first floor and second-floor using UPV test

Sr. No.	Member	Method	Velocity (Km/sec)	Quality of Concrete	Remark
First Floor					
1	B26	Indirect	2.07	Poor	
Second Floor					
1	B28	Direct	3.55	Good	
2	B29	Indirect	1.74	Poor	

Table A3.6: Quality of concrete of slabs of the ground floor and second floor using UPV test

Sr. No.	Member	Method	Velocity (Km/sec)	Quality of Concrete	Remark
Ground Floor					
1	Store Room 9B	Indirect	No Reading		Fractured Concrete
2	Store Room 9B	Indirect	No Reading		Fractured Concrete
3	Store Room 9B	Indirect	No Reading		Fractured Concrete
4	Store Room 9B	Indirect	No Reading		Fractured Concrete
5	Store Room 9B	Indirect	No Reading		Fractured Concrete
6	Store Room 9B	Indirect	No Reading		Fractured Concrete
7	Store Room 9B	Indirect	No Reading		Fractured Concrete
8	Store Room 9B	Indirect	No Reading		Fractured Concrete
Second Floor					
1	Landing area	Indirect	1.55	Poor	
2	Ceiling	Indirect	3.33	Medium	

APPENDIX 4 CARBONATION

TEST

Table A4.1: Depth of carbonation on beams of the structure

Sr. No.	Core Sample No.	Test location	Depth of carbonation(cm)	Height of core(cm)
Ground Floor Level				
1	B2	Outside library	6 and 5.5 from either end	15
Second-floor level				
2	B1	Outside Room No. 98	5 from either end	16

Table A4.2: Depth of carbonation on slab portion of the structure.

Sr. No.	Core Sample No.	Test location	Depth of carbonation(cm)	Height of core (cm)	Remark
First Floor Level					
1	----	Storeroom 9B	Entire slab thickness	16	Hole
2	S1	Open terrace opposite to RoomNo. 127A	4	9.5	
3	S2	Open terrace outside Room No.98	5	12	
Second Floor Level					
4	S3	Open terrace opposite to RoomNo. 142	1.5	10	
5	S4	Open terrace opposite to RoomNo. 143	1.5	10	
6	S5	At pergola (open terrace near OAT)	4.5	11	
7	S6	At pergola (open terrace near OAT)	2	11	
Third Floor Level					
8	S7	Open terrace opposite to RoomNo. 140	2.5	11	
9	S8	Open terrace opposite to RoomNo. 148A	2.5	8	

APPENDIX 5

HALF CELL POTENTIOMETER TEST

Table A5.1: Extent of corrosion in columns and slabs.

Sr. No.	Member	Average Reading	Probability of active corrosion	Remark
Columns (First Floor)				
1	C154	-210	50%	
Slab (Ground Floor)				
2	Store Room 9	-858	Greater than 95%	Hole

APPENDIX 6 CORES

TEST

Table A6.1: Water Absorption values of cores extracted from the structure

Sr. No.	Sample no.	Initial weight(g)	Final Weight(g)	Water Absorption(%)
1	S1	1312	1353	3.13
2	S2	1693	1740	2.78
3	S3	992	1002	1.01
4	S4	1461	1494	2.26
5	S5	1569	1610	2.68
6	S6	1477	1633	3.55
7	S7	678	690	1.77
8	S8	1036	1052	1.54
9	B1	1980	2078	4.95
10	B2	1969	2052	4.57

Table A6.2: Compressive strength of cores extracted from the structure

Sr. No.	Core Sample No.	Height of Concrete portion	Compressive Strength(N/mm ²)	Equivalent Cubic strength(N/mm ²)
1	S1	82	23.43	29.29
2	S2	105	17.15	21.44
3	S3	62	28.57	35.71
4	S4	92	28.40	35.50
5	S5	93	23.02	28.77
6	S6	98	15.47	19.34
7	S7	45	25.57	31.97
8	S8	65	16.03	20.03
9	B1	128	8.84	11.04
10	B2	118	13.14	16.43

**APPENDIX 7 CRITICAL
AREAS**

Following figures shows the critical areas of the structure:

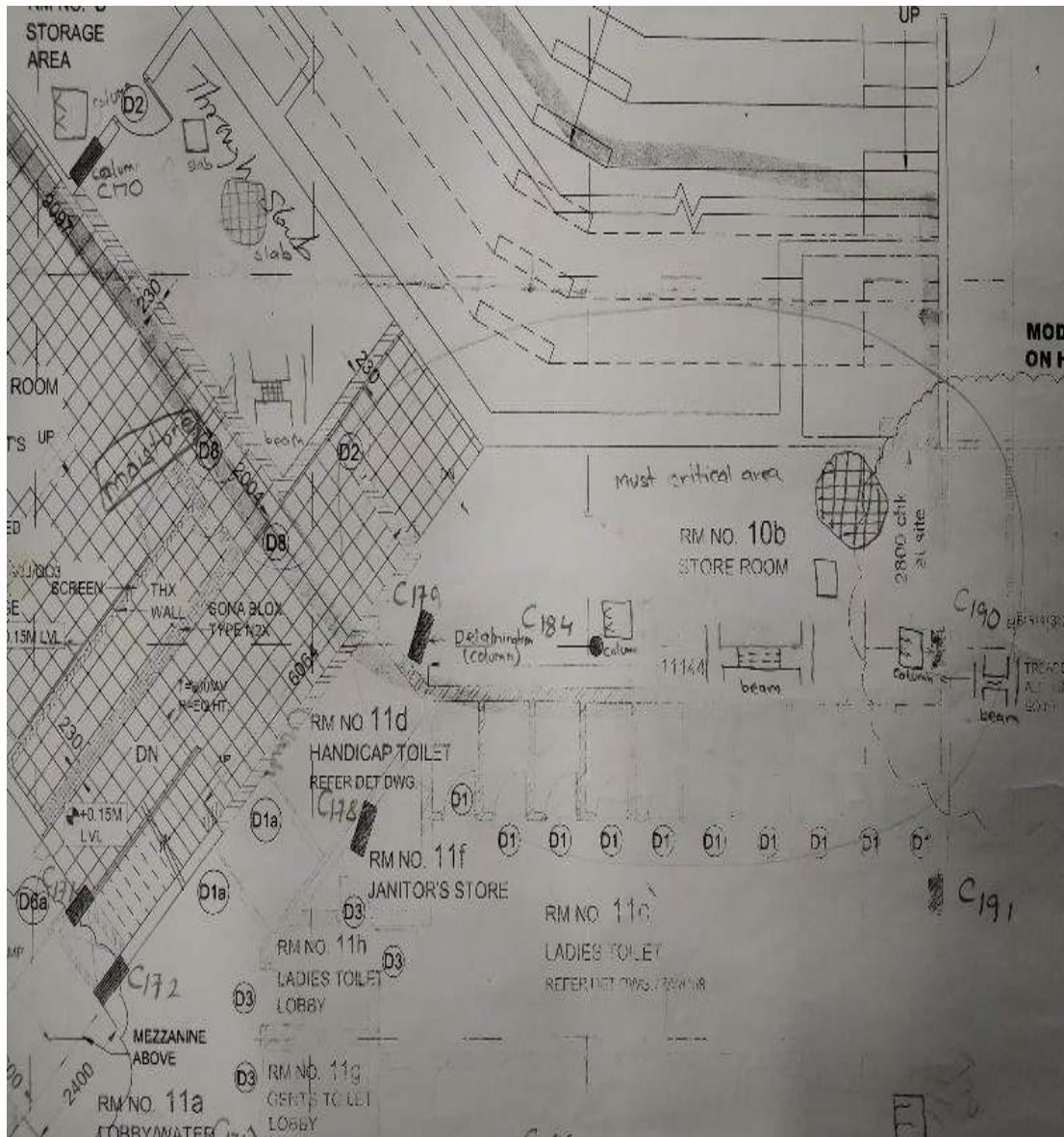


Fig.A5.1: Storeroom (10b) located at ground floor near toilet block

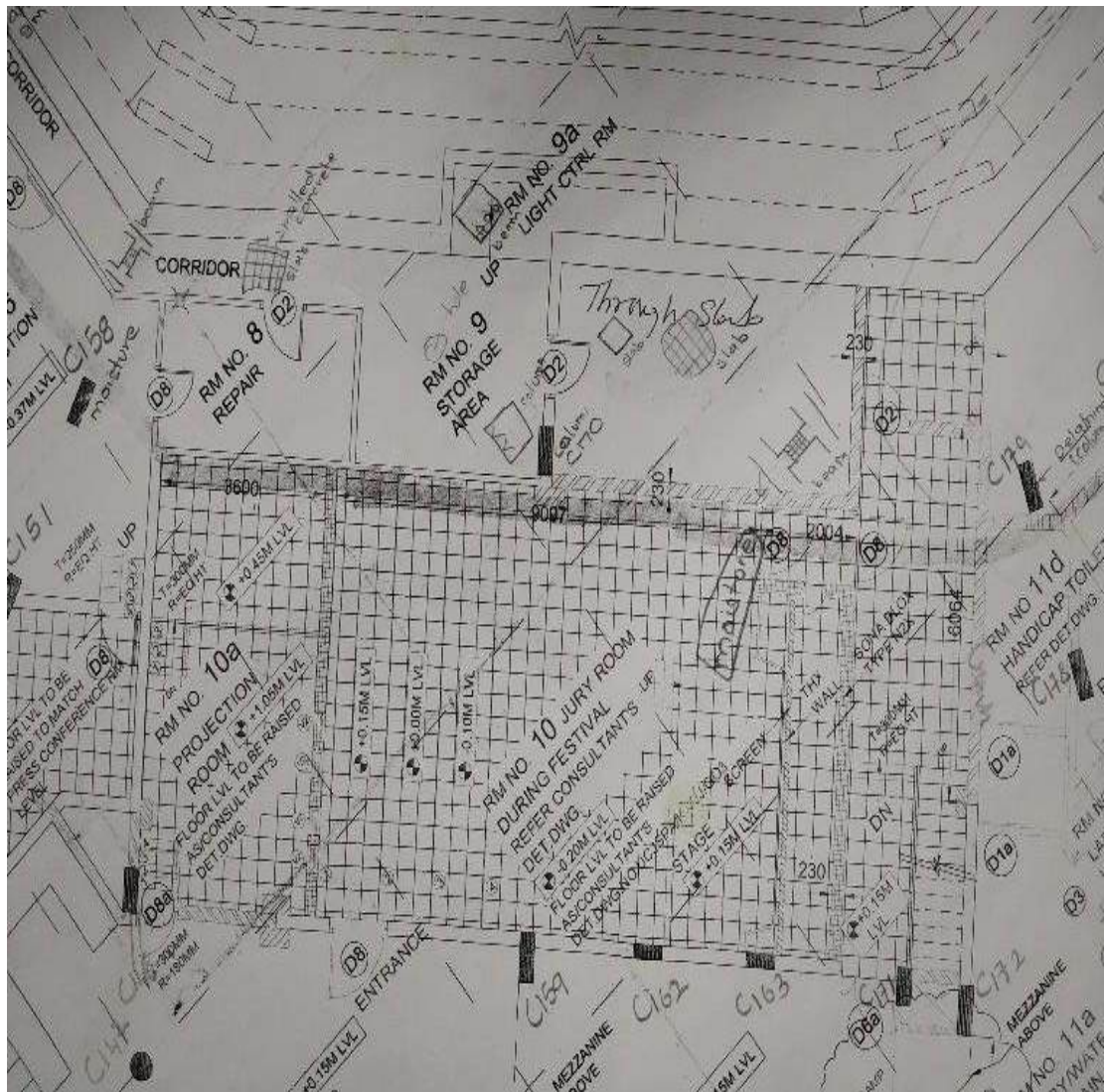


Fig.A5.3: Corridor near the black box and rooms neighboring the corridor

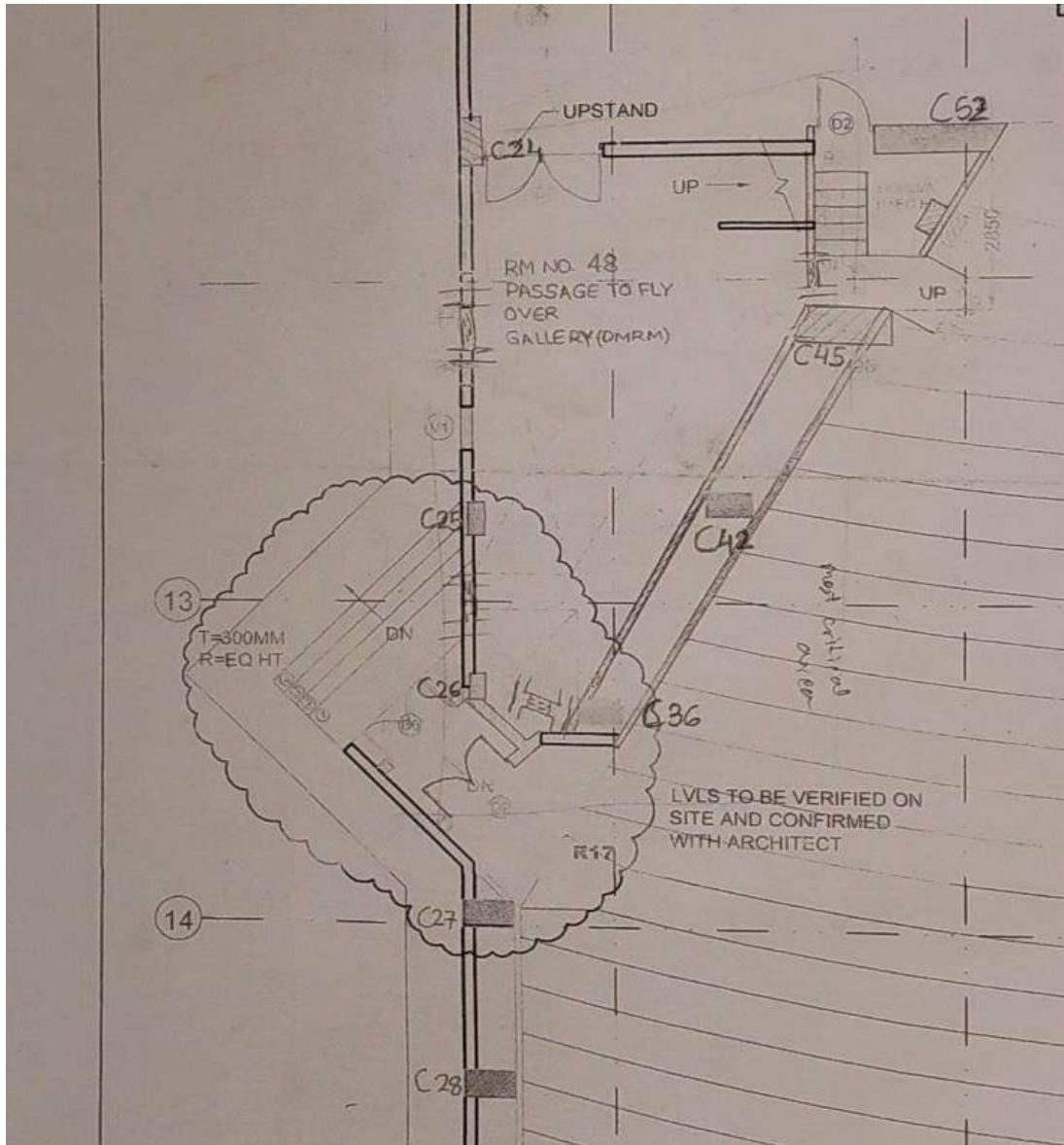


Fig.A5.4: Back stage area of the Auditorium

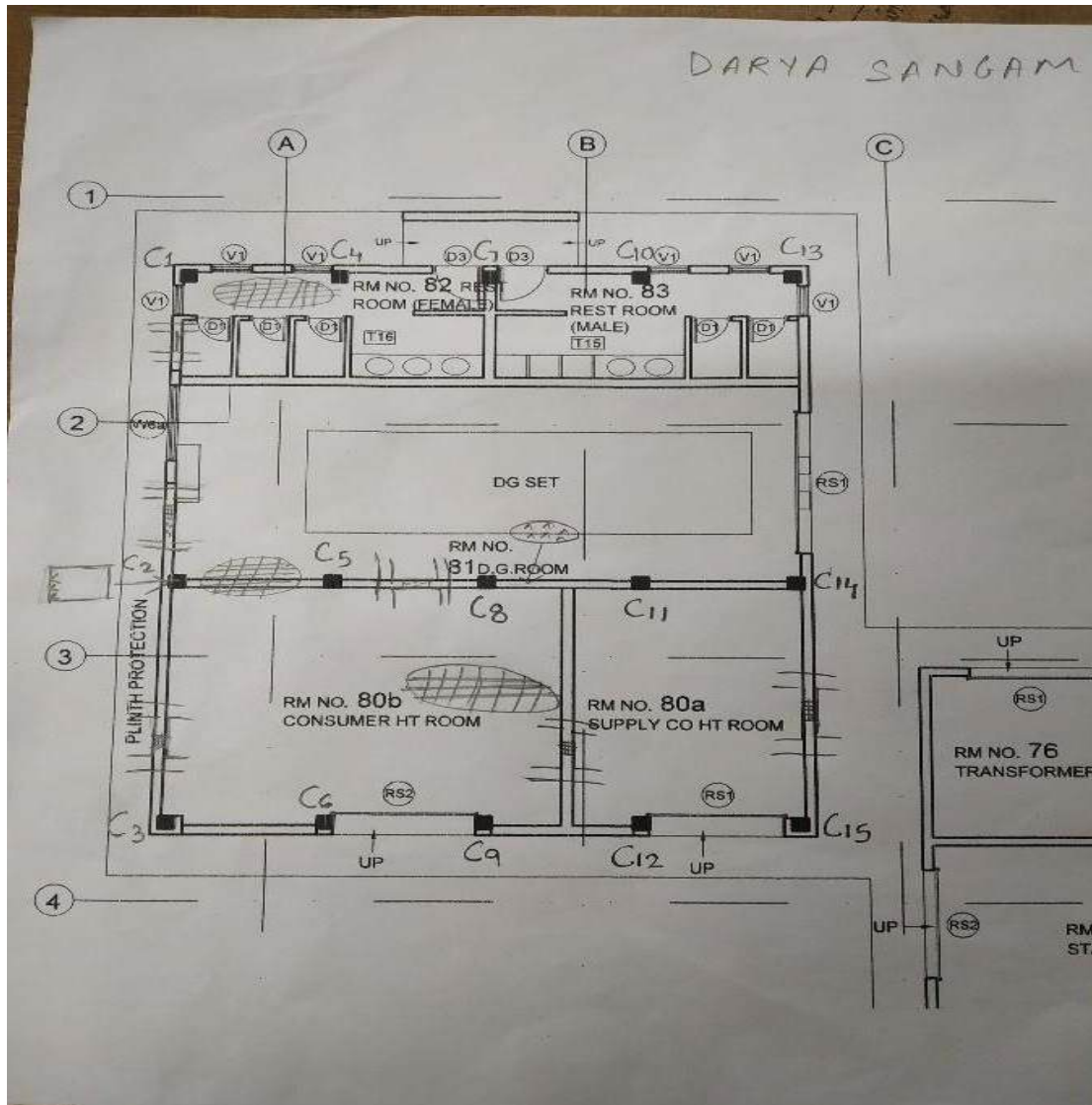


Fig.A5.5: Dariya Sangam Block

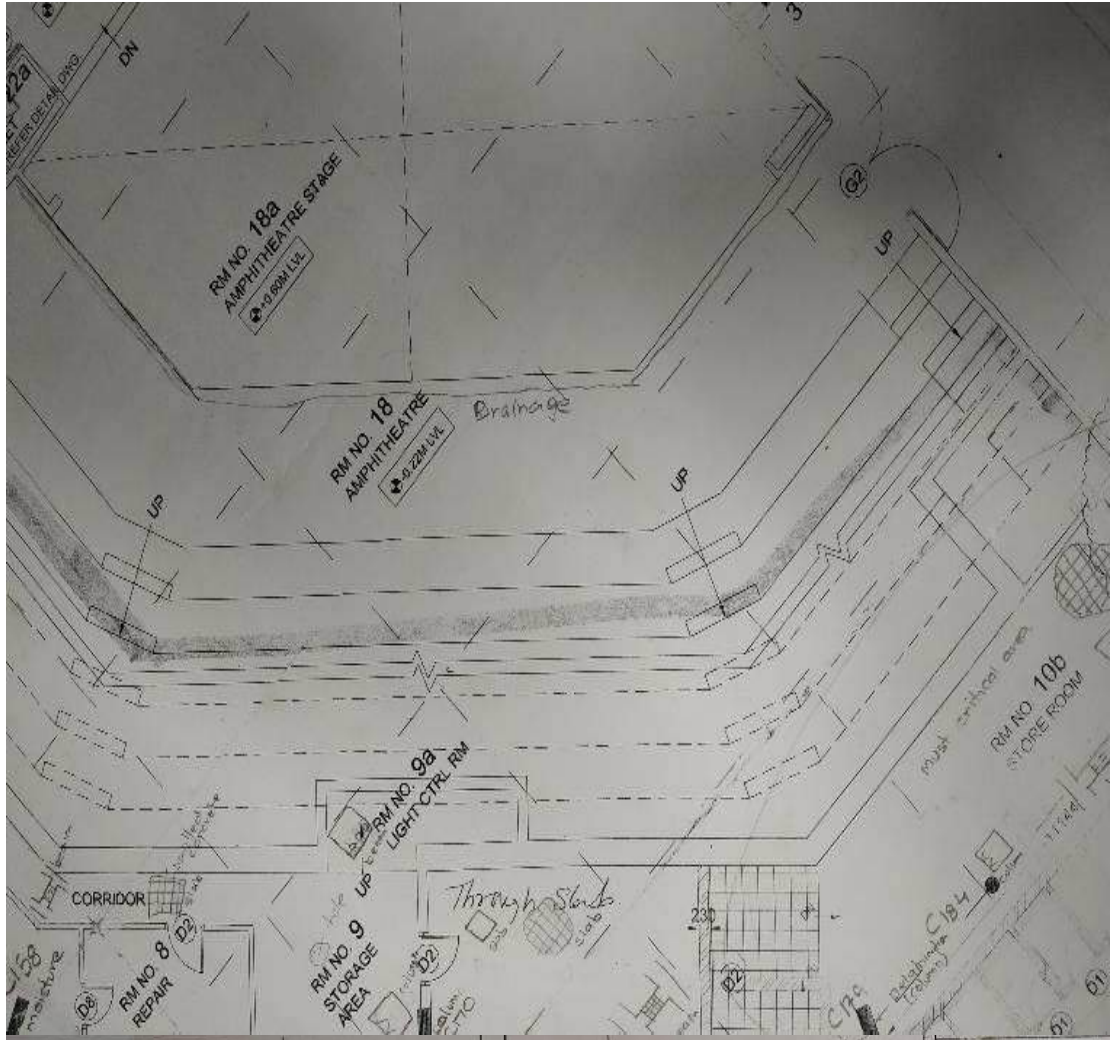


Fig.A5.6: Drainage system at Open Air Amphitheatre

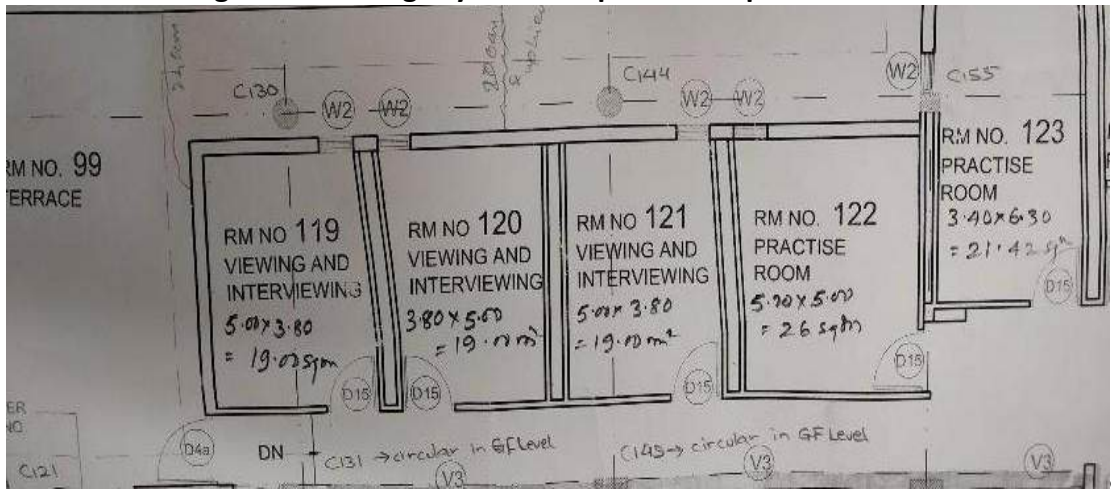


Fig.A5.7: Upheaval of waterproofing layer provided at first floor level

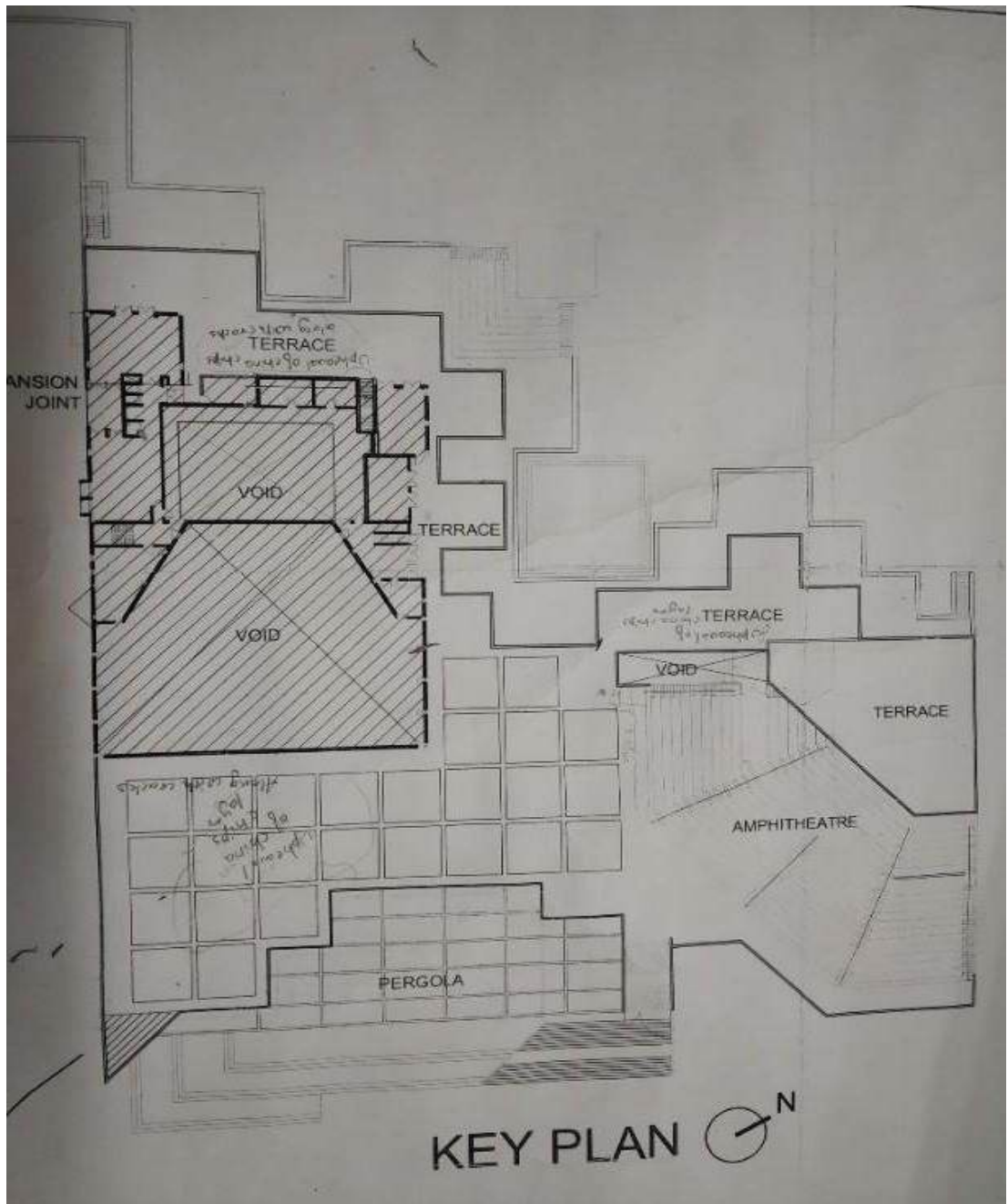


Fig.A5.8: Upheaval of waterproofing layer provided at second floor level

CONCLUSIONS

Suggestions

Immediate attention required:

1. Portions below the Open amphitheater are very weak and precariously standing as the slab concrete is fully fractured and reinforcement is corroded. Temporarily steel sections may be used to support the existing slab to avoid any untoward incidents.
2. The flyover gallery and room adjacent to fly over gallery also need similar treatment.
3. Backstage area of open amphitheater also experiencing a similar situation. Hence needs similar supporting structure.
4. Floor-wise rainwater to be collected and disposed of.
5. It appears the arrangement provided beside the main stage to collect seeped rainwater into a sump. This system is however not satisfactorily working. Release of choked nozzles shall be taken on priority for the time being

Recommendations

1. The building is a heritage building and showing the residual strength in the members considerably fair enough also structure has received regular cosmetic repairs need to be protected. Hence the structure need not be demolished. However, the structure requires strengthening.
2. Immediate attention is required to all points covered in suggestion.
3. No load to be allowed on to the open amphitheater strictly.
4. Dariya Sangam area needs immediate attention steps may be taken as suggested. otherwise it may hamper

electrical safety.

5. Sump besides the main auditorium provided a system to be restored.
6. Slabs, beams and columns shall be strengthened as outlined in the report.
7. Measures need urgent attention