



**LYCÉE LOUIS
MASSIGNON**
ليسيه لوي مسينيون

ÉTABLISSEMENT
EN GESTION DIRECTE



aefe
Agence pour
l'enseignement français
à l'étranger

RENOVATION OF BLOCK B' FOR FRENCH SCHOOL (LYCEE LOUIS MASSIGNON)

CONCRETE REPAIRS AND STRUCTURAL REINFORCEMENT

**PLOT (26_27), SECTOR (E40)
ABU DHABI ISLAND
EMIRATE OF ABU DHABI
UNITED ARAB EMIRATES**

**VOLUME 5 – Part 1 of 7
M/s Apave International
Report Adh/B17.021a dated May 30th, 2017**

HP Project No. 1782

**Revision 1
April 18th, 2025**

Building Division.....

INSPECTION REPORT

« Technical Diagnosis »

**Lycée Louis-Massignon
Abu Dhabi**

Evaluation of Existing Structure of the Gymnasium

Report ref. Adh/B17.021a

Visit date: 25/02/2017 and 21/05/2017

Report date: 30/05/2017

Proposal Adh/PB16.08a

.....

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Dear Sirs,

Please find enclosed the technical diagnosis report regarding the evaluation of the existing structure at Lycée Louis-Massignon gymnasium building in Abu Dhabi.

This report consists of 36 pages numbered from 2 to 36.

Please feel free to contact us for any further information and/or comments.

Best Regards,

Address of the Visited Installation :

Lycée Louis-Massignon
Abu Dhabi, UAE

Inspector :

Patrick Tayah

Project Manager :

Georges RIZK

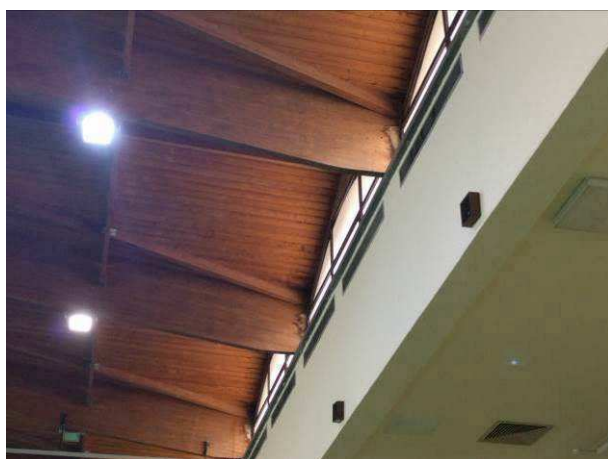
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1. PREFACE

Apave International – Abu Dhabi was assigned to evaluate the concrete and reinforcement conditions, as well as the wood condition, in the existing structural elements at the gymnasium of Lycée Louis-Massignon located in Abu Dhabi, UAE. The target of the investigation is to assess the corrosion in the reinforcement in the concrete beams and provide mitigation plan for the repair. The investigation aims also to assess the wood beams condition in the roof of the gymnasium. The mitigation plan will provide corrective measures to repair the elements and prevent future deterioration.

The report documents and interprets our visual examination and evaluation of the test results for the extracted concrete samples, as well as the test results on the wooden beams.



The inspection was conducted on the 25th of February 2017. During the inspection, Apave and Al Hoty-Stanger Laboratories were present.

2. VISUAL INSPECTION

The project consists of a gymnasium with a wooden roof ceiling. We took notice that the building was constructed in 1985 along with the swimming pool and the auditorium.

The location of the concrete cores and the wooden beams tested is shown in the drawing in Appendix A.

During our inspection, we noticed 3 main concerns:

- The concrete beams on the roof are deteriorated, steel bars are apparent and corroded;
- The wood beams seem to present some humidity traces;
- The roof waterproofing is in bad shape and does not protect properly the structure.

The dimensions of the elements were not recorded since the study does not cover any structural study for its serviceability and design verification.



Fig. 1- Corrosion and deterioration of concrete beam

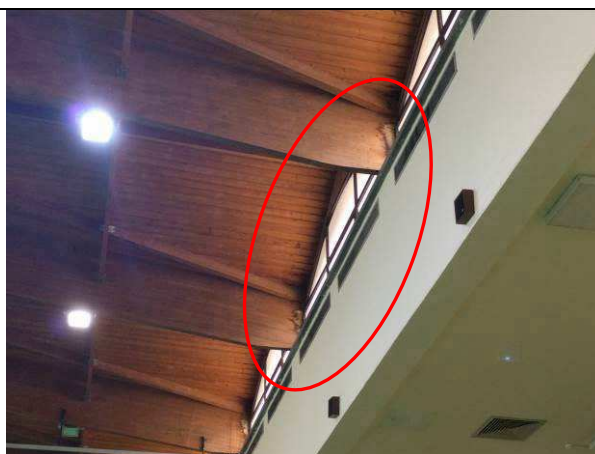


Fig. 2- Humidity traces on wood beams

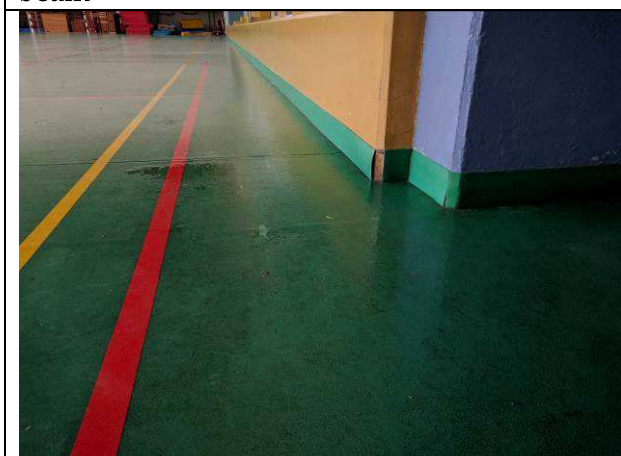


Fig. 3- Water observed on the floor

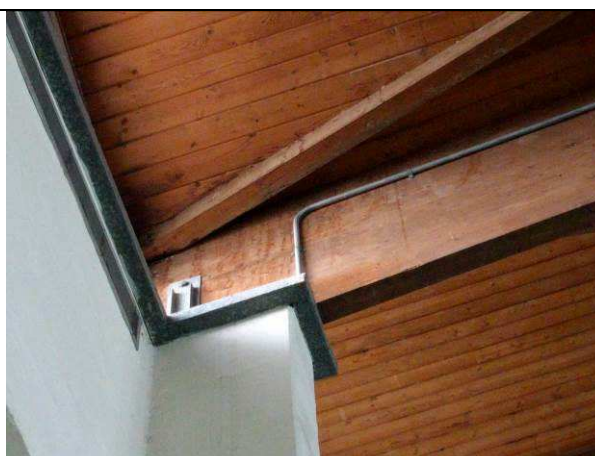


Fig. 4- Water infiltration from the roof



Fig. 5- Concrete testing



Fig. 6- Concrete sample extracted



Fig. 7- Wooden Beam Testing



Fig. 8- Concrete Testing Location



Fig. 9- Roof Waterproofing



Fig. 10- Water evacuation and wood beam protection defect

3. CONCRETE CORES TEST METHODOLOGY, RESULTS & ANALYSIS

Four (4) locations were spotted for extraction of concrete cores. The cores were extracted using impregnated diamond drilling bits of 100 mm diameter. The concrete cores were labelled at jobsite for identification. Apave has requested to perform the following tests on the concrete elements as listed in the below table. The tests results can be found in Appendix B.

Table 1: Summary of tests results

Core Ref.	Depth (mm)	Carbonation Depth (mm)	Chloride (% by weight)	Sulphate (% by weight)	Compressive Strength (MPa)
Beams					
Core 1	0 - 25	Nil	0.07	0.41	
	25 - 50		0.05	0.38	
	50 - 75		0.03	0.34	11
Core 2	0 - 25	Nil	0.06	0.40	
	25 - 50		0.04	0.39	
	50 - 75		0.03	0.36	8.5
Columns					
Core 1	0 - 25		0.04	0.37	
	25 - 50	30	0.03	0.34	
	50 - 75		0.03	0.32	14
Core 2	0 - 25	11	0.05	0.36	
	25 - 50		0.03	0.33	
	50 - 75		0.02	0.32	14

The strength results were variable between 8.5 and 14.0 MPa. All the results are considered to be very low.

The chloride ions are a major contributing factor in the corrosion of steel in concrete, provided sufficient moisture and oxygen are present. Sulphate salts enter the concrete and attack the cementing materials. If evaporation takes place from a surface exposed to air, the sulphate ions can concentrate near that surface and increase the potential for causing deterioration.

The test results from the laboratory provide us with the content as % by weight in the concrete. These values were converted to percentage by weight in the cement where all the reactions take place. The conversion was made by multiplying % in concrete results by the average density of the concrete samples (2290 kg/m³), then dividing them by the assumed cement content of (400 kg/m³).

The percentage by weight of chloride in cement was compared with a maximum acceptable limit of 0.2% set as per (Table 3.1, ACI 222).

The percentage by weight of sulphate in cement was compared with a maximum acceptable limit of 3%.

Table 2: Chloride & Sulfate tests results

Core ref.	Depth, mm	% in Concrete		% by wt of cement	
		Chloride	Sulphate	Chloride	Sulphate
Beam 1	0 - 25	0.07	0.41	0.40	2.35
	25 - 50	0.05	0.38	0.29	2.18
	50 - 75	0.03	0.34	0.17	1.95
Beam 2	0 - 25	0.06	0.40	0.34	2.29
	25 - 50	0.04	0.39	0.23	2.23
	50 - 75	0.03	0.36	0.17	2.06
Column 1	0 - 25	0.04	0.37	0.23	2.12
	25 - 50	0.03	0.34	0.17	1.95
	50 - 75	0.03	0.32	0.17	1.83
Column 2	0 - 25	0.05	0.36	0.29	2.06
	25 - 50	0.03	0.33	0.17	1.89
	50 - 75	0.02	0.32	0.11	1.83

4. CONCRETE CARBONATION DEPTH

Carbonation occurs when concrete is exposed to carbon dioxide (CO₂). Carbonation can result in deterioration and a decrease in the pH of the cement paste leading to corrosion of reinforcement near the surface.

The depth of carbonation test is important for old reinforced concrete structures. If carbonation is a contributing factor to the deterioration of a given structure and it is not accounted for, one can expect future premature damage after repairs are completed (ACI 222). Carbonation of concrete reduces concrete's alkalinity, thereby permitting corrosion of embedded steel.

The depth of carbonation in concrete is measured by applying a solution of phenolphthalein. The depth of carbonation is then compared to the minimum concrete cover for the different structural elements.

Table 3: Carbonation depth

Core Ref.	Concrete Cover (mm)	Depth of Carbonation (mm)
B1	50	Nil
B2	50	Nil
C1	50	30
C2	50	11

The carbonation results in the columns are moderate. No traces of carbonation in the beams, probably due to the spoiled concrete.

5. CONCLUSION FOR CONCRETE ELEMENTS

Based on the above tests results, the following interpretation can be concluded:

1. The diagonal beams are in bad shape, steel reinforcement are heavily corroded, concrete spoiled and high chloride content available. We recommend demolishing them and casting new beams instead.
2. For the columns and the horizontal elements:
 - a. The carbonation depth is found to be between 11 and 30 mm
 - b. The chloride and sulphate tests results showed high value to a depth of 25 mm
 - c. It is advisable to remove the concrete cover and replace it with durable concrete strength
3. It is highly advisable that the waterproofing of the whole concrete roof be redone with proper water evacuation points and slopes leading to these drainage points; along with a regular cleaning and maintenance of the roof.
4. The repair methodology will be as stated generally in Appendix C. However, the contractor shall submit his methodology and materials for approval. The repair shall be inspected by Apave.

6. CRACK AT THE EDGE OF THE BEAM

For the crack located at the edge of the beam on the roof, further investigation is needed in this area to evaluate the depth of crack (if it is a surface crack in the plaster or a deeper crack in the structural element), understand possible causes and provide adequate recommendation. The investigation will include chipping of the existing plaster at the location of the crack until reaching the element below and further investigating from there.



Fig. 11- Crack at the edge of the beam

Further to the above, we have investigated the status of the structure at the location of the crack on May 21, 2017 by performing a destructive test. The test showed 3 important points:

- The steel is greatly corroded, losing some part of its thickness as well
- The concrete is very weak and needs adequate repair in order to re-establish the elements' capabilities
- The crack is due to a gap between the masonry wall and the concrete columns.

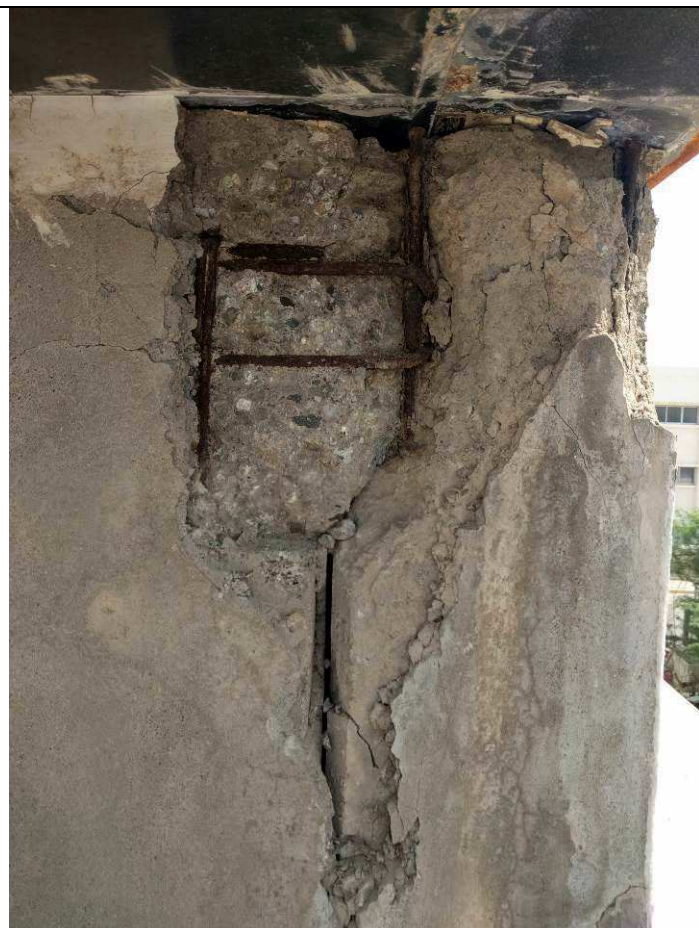


Fig. 12- Limit between hollow blocks and concrete elements



Fig. 13- Steel elements lost part of their section

We recommend that this element be repaired as per the recommended methodology stated in Appendix C for the columns and horizontal beam.

Moreover, since corrosion, high sulphate and chloride content values and carbonation depths have been noticed in different elements on the roof, we recommend further investigations to be done on all the gymnasium structural elements to assess its condition.

7. CRACKS ON THE SEATING AREA

Cracks are observed on the seating area, at the location that is supposed to be in compression. Investigating under this area, we found some hair cracks which are not alarming yet. We suggest doing some destructive test in one area, by widening the crack and reaching the reinforcement under it to determine the possible causes of the cracks. We also recommend monitoring these cracks to check their evolution with time.



Fig. 14- Cracks on the seating area

Following our first inspection, additional and wider cracks were noticed. We carried an additional inspection on May 21, 2017 where we checked the seating area with the new cracks, and we carried a destructive test to check the origin of the cracks.

Few notes from our visit:

- The cracks are mostly on the first and second row
- The 3rd row is supported by a steel structure from below (blue arrow below)
- The 2nd row vertical part is a wall going down to foundation (red arrow below)
- Following chipping at the location of the crack, we noticed that the cracks are due to a gap between the plaster and the concrete below. No mesh or any other material has been used for proper grasping between the 2 elements.
- The ventilation in the gymnasium was turned off. We took notice that the ventilation is turned on only when in use.

We believe that the detachment of the plaster from the concrete is due to the constant change in room temperature and humidity, which leads to a differential movement and extension of the plaster relative to the concrete, with no mesh to hold both of the components together. We recommend removing the plaster completely and redoing it properly with a mesh, and keeping the ventilation on as to avoid future similar problems from arising.



Fig. 15- Gym seating area



Fig. 16- Steel structure below seating area



Fig. 17- New seating area cracks



8. WOOD BEAMS

Four (4) beams were tested for moisture. The results obtained and summarized below are the average of 3 or 4 measures on each beam (tests results can be found in Appendix D).

Beam Ref.	Moisture Content (%)
1	11.7
2	11.9
3	11.8
4	11.6

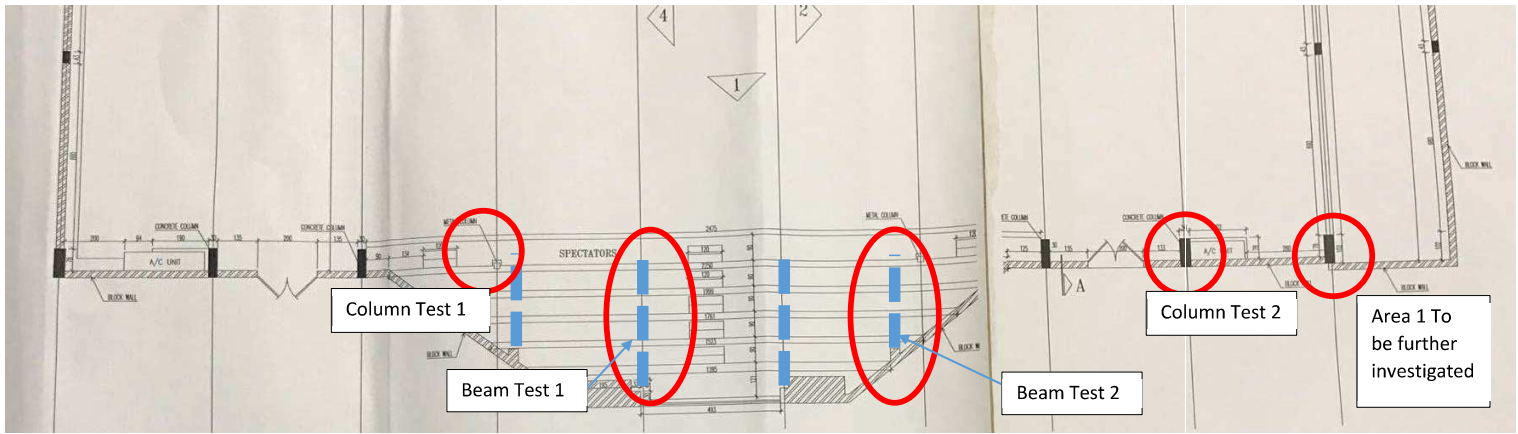
The percentage of moisture content was compared with the average moisture content required of 12% for internal uses (BS 5268). As indicated from the above results, the moisture content is in the acceptable range.

9. CONCLUSION FOR WOOD ELEMENTS

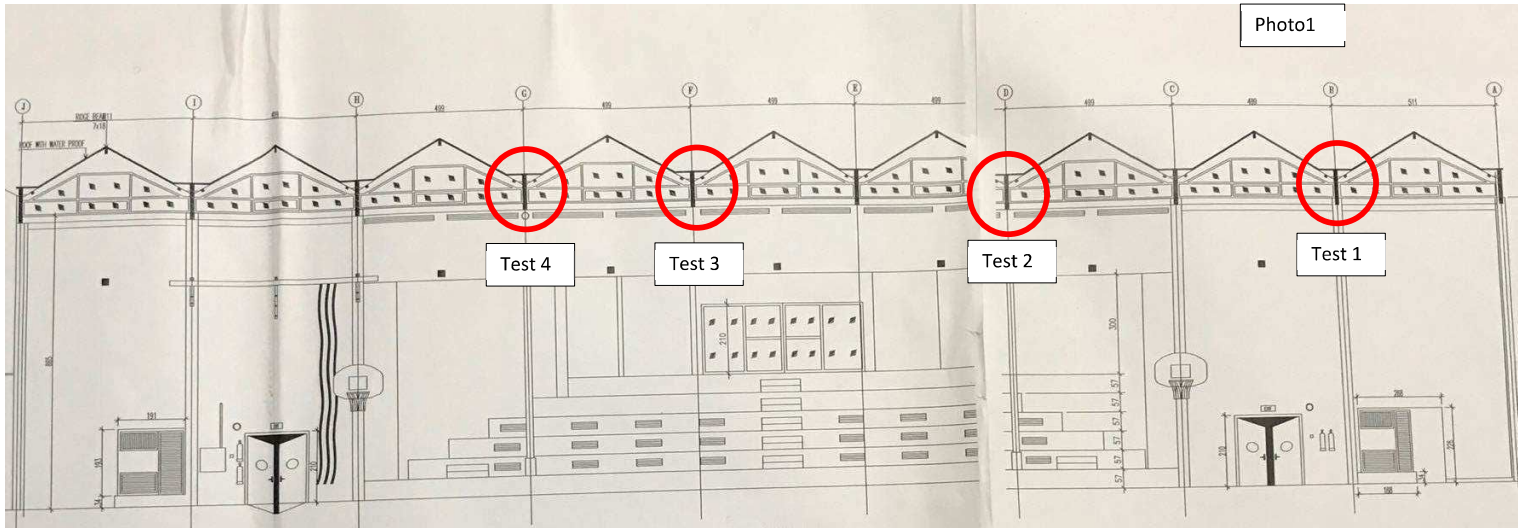
Based on the test results and our observations on site, we recommend the following for the wooden elements of the roof structure:

1. The roof waterproofing shall be entirely redone, with the removal of the existing waterproofing membrane and the application of suitable membrane.
2. Proper water evacuation shall be considered for the entire roof, with water from the roof evacuated properly.
3. Wood beams to be coated with a special protection coat, i.e. a primer coat and a varnishing coat, which will protect from rot and provide a water-repellent effect.
4. Outside part of the wood beam shall be properly protected, similar to the currently defective aluminium protection box.
5. Beams should be monitored on a monthly basis for traces of humidity expansion and other damages.

APPENDIX A – CORE LOCATIONS



Concrete Test Location



Wood beam tests location

Area 1



APPENDIX B – CORE LOGS AND TESTS RESULTS

TEST REPORT

APAVE INTERNATIONAL ABU DHABI
COMPRESSIVE STRENGTH OF CONCRETE CORES
BS EN 12504: PART 1 : 2000

Report Date: 01.03.17

Report no. : A17-352920-1
Project no. : Not Applicable
Project name : Lycee Louis Massignon Gymnasium
Project location : Abu Dhabi
Project client : Lycee Louis -Massignon
Consultant : APAVE
Contractor : Not Applicable
Client ref./request : Adh/PB16.08a
Coring date : 25.02.17
Date received : 25.02.17
Sampled by : AHSL Rep.
Date of test : 01.03.17
Sample description as identified by the client : Concrete Core
Sample location : GYM Building, Column#1
Tested by /Location : MPM – AUH

AHSL REFERENCE NUMBER	7054	-	-	-
STRUCTURE CORED	Column	-	-	-
DIRECTION OF CORING	Horizontal	-	-	-
POSITION OF REINFORCEMENT	Nil	-	-	-
(a) as received from nearest end (mm)	Nil	-	-	-
(b) after preparation from nearest end (mm)	Nil	-	-	-
BAR DIA. (mm)	Nil	-	-	-
CONDITION OF CORE AS RECEIVED	Satisfactory	-	-	-
APPEARANCE OF CONCRETE	Normal	-	-	-
DISTRIBUTION OF AGGREGATES	Normal	-	-	-
NOMINAL SIZE OF COARSE AGG. (mm)	20	-	-	-
LENGTH AS RECEIVED max./ min (mm)	185/155	-	-	-
DIAMETER (mm)	100	-	-	-
LENGTH AFTER TRIMMING (mm)	100	-	-	-
MASS, (kg)	1.732	-	-	-
VISUAL ASSESSMENT OF VOIDS (%)	Nil	-	-	-
PRESENCE OF CRACKS	Nil	-	-	-
DURATION IN WATER	40 Hrs.	-	-	-
END PREPARATION	Grinding	-	-	-
DENSITY (Saturated), kg/m ³ (Based on measured dimensions)	2210	-	-	-
MAXIMUM LOAD, kN	108.2	-	-	-
COMPRESSIVE STRENGTH, N/mm ²	14.0	-	-	-
TYPE OF FRACTURE	Satisfactory	-	-	-

Remarks : None.
Test method variation : None.

AHSL certifies that the above tests were carried out in accordance with BS EN 12504 Part 1 : 2000

This report relates only to the sample tested and shall only be reproduced in full and with the written approval of AHS Laboratories.



Zubair Ahmad
Head of Physical / Mechanical Department
/ms



-End of Report-

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
COMPRESSIVE STRENGTH OF CONCRETE CORES
BS EN 12504: PART 1 : 2000

Report Date: 01.03.17

Report no. : A17-352920-2
Project no. : Not Applicable
Project name : Lycee Louis Massignon Gymnasium
Project location : Abu Dhabi
Project client : Lycee Louis Massignon
Consultant : APAVE
Contractor : Not Applicable
Client ref./request : Adh/PB16.08a
Coring date : 25.02.17
Date received : 25.02.17
Sampled by : AHSL Rep.
Date of test : 01.03.17
Sample description as identified by the client : Concrete Core
Sample location : GYM Building, Column #2
Tested by /Location : MPM - AUH

AHSL REFERENCE NUMBER	7055	-	-	-
STRUCTURE CORED	Column	-	-	-
DIRECTION OF CORING	Horizontal	-	-	-
POSITION OF REINFORCEMENT	Nil	-	-	-
(a) as received from nearest end (mm)	Nil	-	-	-
(b) after preparation from nearest end (mm)	Nil	-	-	-
BAR DIA. (mm)	Nil	-	-	-
CONDITION OF CORE AS RECEIVED	Satisfactory	-	-	-
APPEARANCE OF CONCRETE	Normal	-	-	-
DISTRIBUTION OF AGGREGATES	Normal	-	-	-
NOMINAL SIZE OF COARSE AGG. (mm)	20	-	-	-
LENGTH AS RECEIVED max./ min (mm)	173/156	-	-	-
DIAMETER (mm)	100	-	-	-
LENGTH AFTER TRIMMING (mm)	100	-	-	-
MASS, (kg)	1.797	-	-	-
VISUAL ASSESSMENT OF VOIDS (%)	0.5	-	-	-
PRESENCE OF CRACKS	Nil	-	-	-
DURATION IN WATER	40 Hrs.	-	-	-
END PREPARATION	Grinding	-	-	-
DENSITY (Saturated), kg/m ³ (Based on measured dimensions)	2290	-	-	-
MAXIMUM LOAD, kN	118.5	-	-	-
COMPRESSIVE STRENGTH, N/mm ²	14.0	-	-	-
TYPE OF FRACTURE	Satisfactory	-	-	-

Remarks : None.
Test method variation : None.

AHSL certifies that the above tests were carried out in accordance with BS EN 12504 Part 1 : 2000

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Head of Physical / Mechanical Department
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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
COMPRESSIVE STRENGTH OF CONCRETE CORES
BS EN 12504: PART 1 : 2000

Report Date: 01.03.17

Report no. : A17-352920-3
Project no. : Not Applicable
Project name : Lycee Louis Massignon Gymnasium
Project location : Abu Dhabi
Project client : Lycee Louis -Massignon
Consultant : APAVE
Contractor : Not Applicable
Client ref./request : Adh/PB16.08a
Coring date : 25.02.17
Date received : 25.02.17
Sampled by : AHSL Rep.
Date of test : 01.03.17
Sample description as identified by the client : Concrete Core
Sample location : GYM Building, Beam #1
Tested by /Location : MPM - AUH

AHSL REFERENCE NUMBER	7056	-	-	-
STRUCTURE CORED	Beam	-	-	-
DIRECTION OF CORING	Horizontal	-	-	-
POSITION OF REINFORCEMENT	Nil	-	-	-
(a) as received from nearest end (mm)	Nil	-	-	-
(b) after preparation from nearest end (mm)	Nil	-	-	-
BAR DIA. (mm)	Nil	-	-	-
CONDITION OF CORE AS RECEIVED	Satisfactory	-	-	-
APPEARANCE OF CONCRETE	Normal	-	-	-
DISTRIBUTION OF AGGREGATES	Normal	-	-	-
NOMINAL SIZE OF COARSE AGG. (mm)	20	-	-	-
LENGTH AS RECEIVED max./ min (mm)	151/115	-	-	-
DIAMETER (mm)	100	-	-	-
LENGTH AFTER TRIMMING (mm)	100	-	-	-
MASS, (kg)	1.614	-	-	-
VISUAL ASSESSMENT OF VOIDS (%)	0.5	-	-	-
PRESENCE OF CRACKS	Nil	-	-	-
DURATION IN WATER	40 Hrs.	-	-	-
END PREPARATION	Grinding	-	-	-
DENSITY (Saturated), kg/m ³ (Based on measured dimensions)	2060	-	-	-
MAXIMUM LOAD, kN	86.1	-	-	-
COMPRESSIVE STRENGTH, N/mm ²	11.0	-	-	-
TYPE OF FRACTURE	Satisfactory	-	-	-

Remarks : None.
Test method variation : None.

AHSL certifies that the above tests were carried out in accordance with BS EN 12504 Part 1 : 2000

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Zubair Ahmad

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Head of Physical / Mechanical Department

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
COMPRESSIVE STRENGTH OF CONCRETE CORES
BS EN 12504: PART 1 : 2000

Report Date: 01.03.17

Report no. : A17-352920-4
Project no. : Not Applicable
Project name : Lycee Louis Massignon Gymnasium
Project location : Abu Dhabi
Project client : Lycee Louis -Massignon
Consultant : APAVE
Contractor : Not Applicable
Client ref./request : Adh/PB16.08a
Coring date : 25.02.17
Date received : 25.02.17
Sampled by : AHSL Rep.
Date of test : 01.03.17
Sample description as identified by the client : Concrete Core
Sample location : GYM Building, Beam #2
Tested by /Location : MPM – AUH

AHSL REFERENCE NUMBER	7057	-	-	-
STRUCTURE CORED	Beam	-	-	-
DIRECTION OF CORING	Horizontal	-	-	-
POSITION OF REINFORCEMENT	Nil	-	-	-
(a) as received from nearest end (mm)	Nil	-	-	-
(b) after preparation from nearest end (mm)	Nil	-	-	-
BAR DIA. (mm)	Nil	-	-	-
CONDITION OF CORE AS RECEIVED	Satisfactory	-	-	-
APPEARANCE OF CONCRETE	Normal	-	-	-
DISTRIBUTION OF AGGREGATES	Normal	-	-	-
NOMINAL SIZE OF COARSE AGG. (mm)	20	-	-	-
LENGTH AS RECEIVED max./ min (mm)	193/175	-	-	-
DIAMETER (mm)	100	-	-	-
LENGTH AFTER TRIMMING (mm)	100	-	-	-
MASS, (kg)	1.679	-	-	-
VISUAL ASSESSMENT OF VOIDS (%)	Nil	-	-	-
PRESENCE OF CRACKS	Nil	-	-	-
DURATION IN WATER	40 Hrs.	-	-	-
END PREPARATION	Grinding	-	-	-
DENSITY (Saturated), kg/m ³ (Based on measured dimensions)	2140	-	-	-
MAXIMUM LOAD, kN	66.6	-	-	-
COMPRESSIVE STRENGTH, N/mm ²	8.5	-	-	-
TYPE OF FRACTURE	Satisfactory	-	-	-

Remarks : None.

Test method variation : None.

AHSL certifies that the above tests were carried out in accordance with BS EN 12504 Part 1 : 2000

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Zubair Ahmad

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Head of Physical / Mechanical Department

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-End of Report-

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TEST REPORT

CLIENT

APAVE INTERNATIONAL

**ACID SOLUBLE CHLORIDE & SULPHATE SALTS
IN CONCRETE SAMPLES
BS 1881: PART 124: M.10.2 & 10.3: 1988**

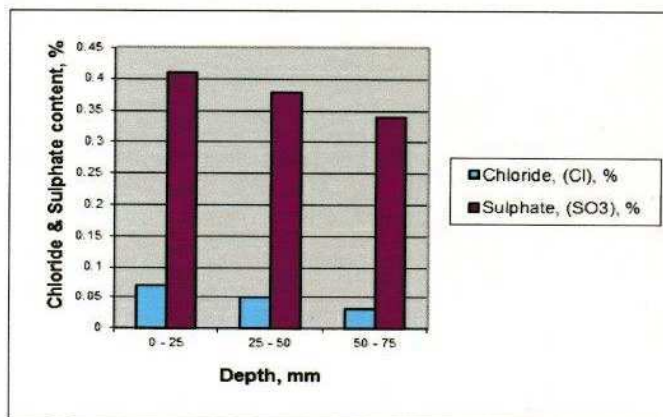
Report date: 28.02.17

Report number	: A17 - 352960 - 1A ~ 1C	Source	: Site
Project number	: Not specified	Sample location	: Lycee Lovis Massiguon School, Gym Building
Project name	: Lyée Louis Massignon Gymnasium	Sampled by	: AHSL Rep
Project client	: Lyée Louis - Massignon	Sampling date	: 25.02.17
Project location	: Abu Dhabi	Sampling method	: Not Specified
Coordinates	: Not specified	Sample delivered by	: AHSL Rep
Consultant	: Apave International Abu Dhabi	Date/time sample received	: 26.02.17
Contractor	: Not specified	Date tested	: 26.02.17 ~ 28.02.17
Client ref./request no.	: Adh/PB16.08a	Tested by/Location	: SP - AUH
Sample description as identified by the client	: Concrete Dust Beam 1		

Sample preparation method: BS 1881: Part 124; Clause 4.5: 1988

Results:

Depth in mm	Chloride (Cl)	Sulphate (SO ₃)
	% by weight	
0 - 25	0.07	0.41
25 - 50	0.05	0.38
50 - 75	0.03	0.34

**Remarks:** Chloride & Sulphate content are not reported in % by weight of cementitious material.**Test method variation:** None

AHSL certifies that the above test was carried out in accordance with Part 124 of BS 1881: 1988.

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Amish Mathew

Head of Chemistry Department
For Al Hoty Stanger Laboratories



-End of report-

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TEST REPORT

CLIENT

APAVE INTERNATIONAL ABU DHABI

**ACID SOLUBLE CHLORIDE & SULPHATE SALTS IN
CONCRETE SAMPLES
BS 1881: PART 124: M.10.2 & 10.3: 1988**

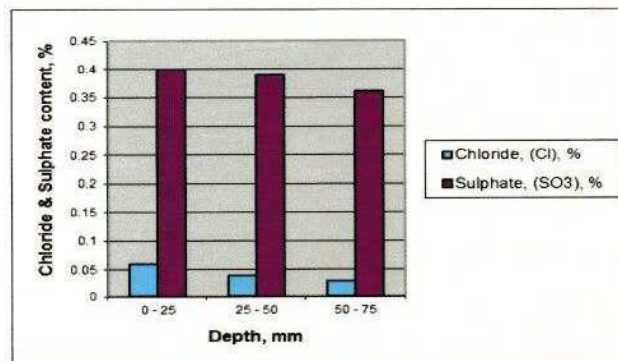
Report date: 28.02.17

Report number	: A17 - 352960 - 2A ~ 2C	Source	: Site
Project number	: Not specified		
Project name	: Lycée Louis - Massignon Gymnasium	Sample location	: Lycée Louis - Massignon School, Gym Building
Project client	: Lycée Louis - Massignon		
Project location	: Abu Dhabi	Sampled by	: AHSL Rep
Coordinates	: Not specified	Sampling date	: 25.02.17
		Sampling method	: Not Specified
Consultant	: Apave International Abu Dhabi	Sample delivered by	: AHSL Rep
Contractor	: Not specified	Date/time sample received	: 26.02.17
Client ref./request no.	: Adh/PB16.08a	Date tested	: 26.02.17 ~ 28.02.17
Sample description as identified by the client	: Concrete Dust Beam 2	Tested by/Location	: SP - AUH

Sample preparation method: BS 1881: Part 124; Clause 4.5: 1988

Results:

Depth in mm	Chloride (Cl)	Sulphate (SO ₃)
	% by weight	
0 - 25	0.06	0.40
25 - 50	0.04	0.39
50 - 75	0.03	0.36

**Remarks:** Chloride & Sulphate content are not reported in % by weight of cementitious material.**Test method variation:** None

AHSL certifies that the above test was carried out in accordance with Part 124 of BS 1881: 1988.

This report relates only to the sample tested and shall only be reproduced in full and with the written approval of AHS Laboratories.

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For Al Hoty Stanger Laboratories

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TEST REPORT

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APAVE INTERNATIONAL ABU DHABI

**ACID SOLUBLE CHLORIDE & SULPHATE SALTS
IN CONCRETE SAMPLES
BS 1881: PART 124: M.10.2 & 10.3: 1988**

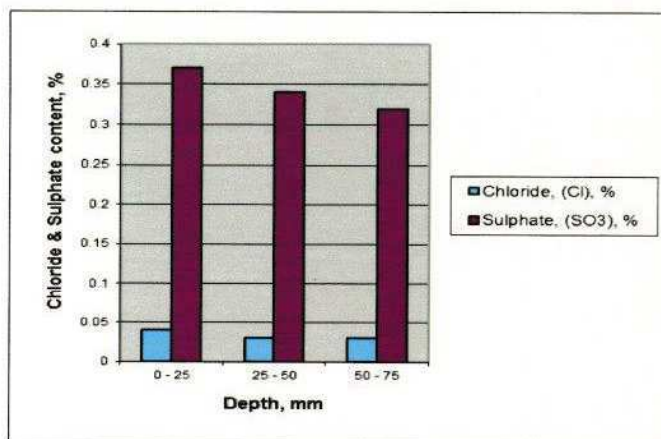
Report date: 28.02.17

Report number	: A17 - 352960 - 3A ~ 3C	Source	: Site
Project number	: Not specified	Sample location	: Lycée Louis - Massignon School, Gym Building
Project name	: Lycée Louis - Massignon Gymnasium	Sampled by	: AHSL Rep
Project client	: Lycée Louis - Massignon	Sampling date	: 25.02.17
Project location	: Abu Dhabi	Sampling method	: Not Specified
Coordinates	: Not specified	Sample delivered by	: AHSL Rep
Consultant	: Apave International Abu Dhabi	Date/time sample received	: 26.02.17
Contractor	: Not specified	Date tested	: 26.02.17 ~ 28.02.17
Client ref./request no.	: Adh/PB16.08a	Tested by/Location	: SP - AUH
Sample description as identified by the client	: Concrete Dust Column 1		

Sample preparation method: BS 1881: Part 124; Clause 4.5: 1988

Results:

Depth in mm	Chloride (Cl)	Sulphate (SO ₃)
	% by weight	
0 - 25	0.04	0.37
25 - 50	0.03	0.34
50 - 75	0.03	0.32

**Remarks:** Chloride & Sulphate content are not reported in % by weight of cementitious material.**Test method variation:** None

AHSL certifies that the above test was carried out in accordance with Part 124 of BS 1881: 1988.

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APAVE INTERNATIONAL ABU DHABI

**ACID SOLUBLE CHLORIDE & SULPHATE SALTS IN
CONCRETE SAMPLES
BS 1881: PART 124: M.10.2 & 10.3: 1988**

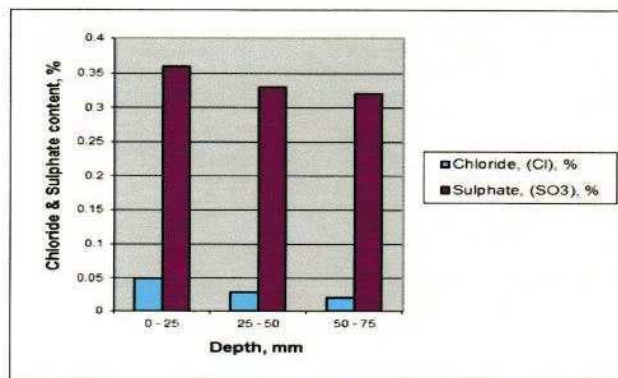
Report date: 28.02.17

Report number	: A17 - 352960 - 4A ~ 4C	Source	: Site
Project number	: Not specified		
Project name	: Lycée Louis - Massignon Gymnasium	Sample location	: Lycée Louis Massignon School, Gym Building
Project client	: Lycée Louis - Massignon		
Project location	: Abu Dhabi	Sampled by	: AHSL Rep
Coordinates	: Not specified	Sampling date	: 25.02.17
		Sampling method	: Not Specified
Consultant	: Apave International Abu Dhabi	Sample delivered by	: AHSL Rep
Contractor	: Not specified	Date/time sample received	: 26.02.17
Client ref./request no.	: Adh/PB16.08a	Date tested	: 26.02.17 ~ 28.02.17
Sample description as identified by the client	: Concrete Dust Column 2	Tested by/Location	: SP - AUH

Sample preparation method: BS 1881: Part 124; Clause 4.5: 1988

Results:

Depth in mm	Chloride (Cl)	Sulphate (SO ₃)
	% by weight	
0 - 25	0.05	0.36
25 - 50	0.03	0.33
50 - 75	0.02	0.32

**Remarks:** Chloride & Sulphate content are not reported in % by weight of cementitious material.**Test method variation:** None

AHSL certifies that the above test was carried out in accordance with Part 124 of BS 1881: 1988.

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI

DETERMINATION OF DEPTH OF CARBONATION
CONCRETE SOCIETY TECHNICAL REPORT NO. 38 CLAUSE 4.8

Report date: 28.02.17

Report number	: A17-352949-1
Project number	: Not Applicable
Project name	: Lycee Louis- Massignon Gymnasium
Project client	: Lycee Louis- Massignon
Consultant	: APAVE
Project location	: Abu Dhabi
Contractor	: Not Applicable
Client Ref no.	: Adh/PB16.08a
Sample description as identified by client	: Concrete Column
Date of test	: 25.02.17
Test location	: GYM Building , Column # 1
Tested by, name / location	: KA - AUH

Results :

Depth of carbonation, mm : 30

Remarks : None.

This report relates only to the sample tested and shall only be reproduced in full and with the written approval of AHS Laboratories.



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Head of Physical / Mechanical Department
/AS



---End of Report---

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI

DETERMINATION OF DEPTH OF CARBONATION
CONCRETE SOCIETY TECHNICAL REPORT NO. 38 CLAUSE 4.8

Report date: 28.02.17

Report number	: A17-352949-2
Project number	: Not Applicable
Project name	: Lycee Louis- Massignon Gymnasium
Project client	: Lycee Louis- Massignon
Consultant	: APAVE
Project location	: Abu Dhabi
Contractor	: Not Applicable
Client Ref no.	: Adh/PB16.08a
Sample description as identified by client	: Concrete Column
Date of test	: 25.02.17
Test location	: GYM Building , Column # 2
Tested by, name / location	: KA - AUH

Results :

Depth of carbonation, mm : 11

Remarks : None.

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI

**DETERMINATION OF DEPTH OF CARBONATION
CONCRETE SOCIETY TECHNICAL REPORT NO. 38 CLAUSE 4.8**

Report date: 28.02.17

Report number	: A17-352949-3
Project number	: Not Applicable
Project name	: Lycee Louis- Massignon Gymnasium
Project client	: Lycee Louis- Massignon
Consultant	: APAVE
Project location	: Abu Dhabi
Contractor	: Not Applicable
Client Ref no.	: Adh/PB16.08a
Sample description as identified by client	: Concrete Beam
Date of test	: 25.02.17
Test location	: GYM Building , Beam # 1
Tested by, name / location	: KA - AUH

Results :

Depth of carbonation, mm	:	Nil
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Remarks : None.

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TEST REPORT

APAVE INTERNATIONAL ABU DHABI

DETERMINATION OF DEPTH OF CARBONATION
CONCRETE SOCIETY TECHNICAL REPORT NO. 38 CLAUSE 4.8

Report date: 28.02.17

Report number	: A17-352949-4
Project number	: Not Applicable
Project name	: Lycee Louis- Massignon Gymnasium
Project client	: Lycee Louis- Massignon
Consultant	: APAVE
Project location	: Abu Dhabi
Contractor	: Not Applicable
Client Ref no.	: Adh/PB16.08a
Sample description as identified by client	: Concrete Beam
Date of test	: 25.02.17
Test location	: GYM Building , Beam # 2
Tested by, name / location	: KA - AUH

Results :

Depth of carbonation, mm	:	Nil
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Remarks : None.

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APPENDIX C – REPAIR METHODOLOGY

The below are recommended methodologies; alternatives such as reinforcement using steel elements or carbon fiber can be considered. For any adopted repair methodology, justification, method statement and details are to be provided by the contractor.

For Columns and Beam linking Columns: Remove the concrete cover and replace it, increase columns' dimensions

This is applicable for the part of the columns that are exposed on the roof terrace and the beam running along the length of the gymnasium linking the columns together:

1. The contractor shall provide the materials for approval before proceeding with any work. The materials shall have at least 25MPa compressive strength or the design strength whichever is greater.
2. The contractor shall take care of probing and providing enough scaffolds before the shipping of concrete. The contractor shall remove the concrete cover.
3. The steel reinforcement shall be exposed. All corroded rebars shall be removed and replaced. Remove all loose surface rust / oxidation by means of wire brushing, grit blasting or high water pressure or dry ice blasting. Wipe surfaces down with a wetted cloth to remove any final traces of oxidation (dust)
4. Columns' dimensions shall be increased by jacketing and addition of steel and ties, as well as providing adequate distribution of the load of the beams on the new dimensions of the columns. Execution details and drawings including the steel reinforcement needed, columns sizes, etc. shall be provided for Engineer's approval prior to execution of works.
5. The prepared surface shall be saturate surface dry. It is at the Engineer recommendation during inspection to request for bonding agent.
6. The Contractor shall follow the materials supplier recommendation and the Engineer requirements for batching, mixing and placing concrete.
7. The application shall follow the form and place technique. The placement can be via pouring, pumping or placing the concrete at different levels
8. The contractor shall obtain samples from each day of application for strength verification. The samples shall be tested at 7 and 28 day
9. The contractor shall provide his methodology for final approval
10. Curing of repaired area shall be continuous using plain, clean and potable water for at least 7 days

For the Diagonal Beams: Removal of beams and replacement

This applies for the 4 diagonal beams:

1. The contractor shall take care of probing and site safety management.
2. The contractor shall present method statement and drawings; including reinforcement, connection with existing structural elements, casting procedure, curing, etc. for engineer's approval.
3. The contractor shall provide test samples for all structural components: steel, sand, cement, etc.
4. The contractor shall obtain samples from each day of casting for strength verification.

APPENDIX D – WOOD TEST RESULTS

TEST REPORT

APAVE INTERNATIONAL ABU DHABI
DETERMINATION OF MOISTURE CONTENT OF WOOD
ASTM D 4442-92

Report Date: 28.02.17

Report number : A17-352950-1	Supplier / Source : Not Given
Project number : Not Applicable	Sample location : GYM Building Test # 1
Project name : Lycee Louis- Massignon Gymnasium	Sampled by : AHSL Rep.
Project client : Lycee Louis- Massignon	Date tested : 25.02.17
Project location : Abu Dhabi	Tested by / location : KA / AUH
Consultant : APAVE	
Contractor : Not Applicable	
Client ref. / req. no. : Adh/PB16.08a	
Sample description as identified by client : Wood	

Test Results:

Test location	Moisture content (%)
1	11.7

Remarks : Test witnessed by Consultant Rep.
Test method variation : None

AHSL certifies that the above test was carried out in accordance with ASTM D 4442-92
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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
DETERMINATION OF MOISTURE CONTENT OF WOOD
ASTM D 4442-92

Report Date: 28.02.17


Report number : A17-352950-2	Supplier / Source : Not Given
Project number : Not Applicable	Sample location : GYM Building Test # 2
Project name : Lycee Louis- Massignon Gymnasium	Sampled by : AHSL Rep.
Project client : Lycee Louis- Massignon	Date tested : 25.02.17
Project location : Abu Dhabi	Tested by / location : KA / AUH
Consultant : APAVE	
Contractor : Not Applicable	
Client ref. / req. no. : Adh/PB16.08a	
Sample description as identified by client : Wood	

Test Results:

Test location	Moisture content (%)
2	11.9

Remarks : Test witnessed by Consultant Rep.
Test method variation : None

AHSL certifies that the above test was carried out in accordance with ASTM D 4442-92
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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
DETERMINATION OF MOISTURE CONTENT OF WOOD
ASTM D 4442-92

Report Date: 28.02.17


Report number : A17-352950-3	Supplier / Source : Not Given
Project number : Not Applicable	Sample location : GYM Building Test # 3
Project name : Lycee Louis- Massignon Gymnasium	Sampled by : AHSL Rep.
Project client : Lycee Louis- Massignon	Date tested : 25.02.17
Project location : Abu Dhabi	Tested by / location : KA / AUH
Consultant : APAVE	
Contractor : Not Applicable	
Client ref. / req. no. : Adh/PB16.08a	
Sample description as identified by client : Wood	

Test Results:

Test location	Moisture content (%)
3	11.8

Remarks : Test witnessed by Consultant Rep.
Test method variation : None

AHSL certifies that the above test was carried out in accordance with ASTM D 4442-92
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TEST REPORT

APAVE INTERNATIONAL ABU DHABI
DETERMINATION OF MOISTURE CONTENT OF WOOD
ASTM D 4442-92

Report Date: 28.02.17


Report number : A17-352950-4	Supplier / Source : Not Given
Project number : Not Applicable	Sample location : GYM Building Test # 4
Project name : Lycee Louis- Massignon Gymnasium	Sampled by : AHSL Rep.
Project client : Lycee Louis- Massignon	Date tested : 25.02.17
Project location : Abu Dhabi	Tested by / location : KA / AUH
Consultant : APAVE	
Contractor : Not Applicable	
Client ref. / req. no. : Adh/PB16.08a	
Sample description as identified by client : Wood	

Test Results:

Test location	Moisture content (%)
4	11.6

Remarks : Test witnessed by Consultant Rep.
Test method variation : None

AHSL certifies that the above test was carried out in accordance with ASTM D 4442-92
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