



CERTIFICATE OF TECHNICAL APPROVAL

Dubai Central Laboratory Department (DCLD) of Dubai Municipality, hereby award this certificate to :

> DOKA GULF FZE For the product(s) CONCREMOTE

(As per the attached details)

Manufactured by : DOKA INDUSTRIES GmbH at Factory of BAS Research & Technology – Yenlo, the Netherlands

ENGR. AMIN AHMMED MOHAMMAD Director, Dubai Central Laboratory Department Dubai Municipality



TA Certificate No.: 157 Valid Until : 13-11-2017



Current Issue Date: 14-11-2016 Original Issue Date: 14-11-2016

The above product(s) have been assessed and found fit for their intended use, provided they are used according to the supplier instructions.

The attached details bearing the same Certificate No. forms an integral part of this certificate. This certificate is subject to the Terms and Conditions of the technical approval system

F-RS-007

Report on **VERIFICATION AND DEMONSTRATION** as part of TA 157-2016 Concremote – Concrete Maturity device used for determining early age concrete strength using weighted maturity method.

Date: July 26-2016

This report summarizes results for step 3 of TAR 157-2016 for Concremote. Concremote is a concrete maturity device used for determining early age concrete strength using weighted maturity method.

Background

The weighted maturity method uses the fundamental concept that concrete properties develop with time as the cement hydrates and releases heat. The maturity method is a technique to account for the combined effects of time and temperature on the compressive strength development of concrete. No matter how the maturity is reached; fast or slow, gradual or accelerated: equal maturity means equal compressive strength.

Concremote sensors measure concrete temperature and elapsed time (cumulative hours passed) of concrete hydration. To establish a direct relationship between compressive strength and the corresponding maturity a correlation curve is used. The correlation curve is an empirical relationship found when concrete of known maturity is laboratory tested for strength. This leads to a set of data points that correlate maturity to compressive strength. In step 2 of the TAR the production of the correlation curves used in verification and demonstration of Concremote have been inspected and evaluated.

Approval requirement

Concremote shall be verified and evaluated based on demonstration castings using 4 unique mix-designs.

The mix-designs selected for the verification and evaluation are:

- A. C40/20 with high GGBS no Microsilica
- B. C45/20 with low GGBS and 20 kg Microsilica
- C. C40/20 with low GGBS no Microsilica
- D. C45/20 with high GGBS and 20 kg Microsilica

For each of these unique mix-designs a unique correlation curve is produced according Concremote calibration process and installed in the Concremote web portal. For the verification and demonstration Concremote sensors will be applied on fresh concrete on 4 castings. Simultaneously 4 test cubes per casting will be produced for which 2 cubes are cured outdoor next to concrete structure and 2 cubes are cured in water tank of on-site laboratory. The test cubes will also be connected to Concremote sensors to measure the actual compressive strength gain and corresponding maturity of the test cubes. This allows comparison of Concremote compressive strength gain measurements with laboratory tested compressive strength results for the test cubes at identical time and under identical curing/hardening conditions. This makes also transparent the differences in maturity (curing/hardening conditions) between IN-SITU (IN-PLACE) concrete and test cubes.

The test cubes will be laboratory tested for compressive strength within 5 hours before or after the IN-SITU (IN-PLACE) Concremote sensors have reached their predefined compressive strength target value. The testing laboratory will be identical to test laboratory contracted for construction site.

The compressive strength test results of the cubes as reported by the laboratory will be compared to compressive strength results of test cubes measured by Concremote. Concremote measurement results on compressive strength calculations include a safety margin as defined in applicable standard EN-NEN-5970. As a consequence the compressive strength result of the cubes as calculated and published in Concremote web portal is intended to be lower than actual laboratory compressive strength test result.

Method statement demonstration castings

- 1. The defined job-site where demonstration castings took place is THE HILLS in Dubai. Main Contractor is CCC; Project manager is William Parker.
- 2. During July 17 to July 24 a total of 4 castings took place where Concremote sensors were installed and activated:
 - a. 2 castings for slab floors using Concremote slab sensors
 - i. Casting (1) using mix-design C45 with low GGBS content and MS (OPC+36% GGBS+20 kg MS)
 - ii. Casting (2) using mix-design C45 with high GGBS content and MS (OPC+68% GGBS+20 kg MS)
 - b. 2 castings on vertical structures using Concremote formwork Wall panel sensor plus Concremote cable sensor
 - i. Casting (3) using mix-design C40/20 with low GGBS (OPC+36% GGBS) and no microsilica
 - ii. Casting (4) using mix-design C40 with high GGBS (OPC+66% GGBS) and no microsilica

- 3. For all 4 castings concrete ready-mix was supplied by Ready Mix Beton (RMB) batching plant in Dubai. RMB holds a certificate of conformity from DCL and is registered with Dubai Municipality.
- 4. For all 4 RMB mix-designs, calibration according to Concremote calibration process had been conducted and correlation curves were available.
- 5. Casting took place after job-site had fulfilled pre-conditions set by Dubai legislation, permit specifications and consultant approval.
- 6. The cable sensor was placed by positioning the temperature probes on the rebar via tie-wraps prior to casting
- 7. The formwork Wall panel sensor was placed in the formwork panel prior to casting
- 8. After casting and surface operations the slab sensors were placed on top of the fresh concrete
- 9. All sensors were activated after casting had been completed
- 10. During casting Concremote concrete technologist has produced 4 test cubes placed under 2 predefined curing regimes:
 - a. 2 cubes were placed in outdoor conditions next to concrete structure
 - b. 2 cubes were placed directly in the water tank of the laboratory container available on the job-site at controlled temperature of 20° C 23° C
- 11. Minimum of 1 test cube per curing regime was connected to a separate Concremote sensor. This sensor did measure the compressive strength and maturity gain of the test cubes.
- 12. Based on the Concremote IN-PLACE strength gain results the test cubes were transported to testing laboratory contracted for construction project.
- 13. When Concremote IN-PLACE sensors compressive strength result achieved target value of 28 N/mm² to 38 N/mm² (in case of slabs) and 25 N/mm² to 35 N/mm² (in case of vertical elements), test cubes from both curing regimes (outdoor and water tank) were tested for compressive strength at the test laboratory
- 14. All test cubes were audited for weight, dimensions and quality according to applicable standard for the project. Cubes that did not fulfill standard were not tested
- 15. The compressive strength results for each test cube was registered including, ID of test cube, date & time of test, weight, dimensions, density kg/m³ ,quality of breakage, max load kN and stress N/mm². In addition the maturity per test cube was registered per curing regime.

<u>Results</u>

All 4 castings and corresponding measurements have taken place. The detailed measurement results per casting are shown in <u>Appendix 1</u>.

A summary of the measurement results is visualized in following 4 tables:

					End		
				Measurement	Measurement	Time	
mix				start	target value	elapsed	Lab
Code	Mix-design	Structure	Sensor type	IN-PLACE	IN-PLACE	HRS:MIN	testing
A	C40/20 high GGBS no MS	Column	Cable + Wall	July 17 - 23:58	July 19 - 21:00	45:02	July 19 - 15:10
В	C45/20 low GGBS 20 kg MS	Slab	Slab sensor	July 19 - 22:37	July 20 - 17:20	18:43	July 20 - 16:10
C	C40/20 low GGBS no MS	Column	Cable + Wall	July 17 - 23:46	July 19 - 08:20	32:34	July 19 - 05:10
D	C45/20 high GGBS 20 kg MS	Slab	Slab sensor	July 23 - 10:00	July 24 - 10:30	24:30	July 24 - 11:40

			IN-PLACE	IN-PLACE	Outdoor	Outdoor	Outdoor	Watertank	Watertank	Watertank
mix			Concremote	Concremote	Concremote	Concremote	lab	Concremote	Concremote	lab
Code	Mix-design		N/mm ²	Maturity	N/mm ²	Maturity	N/mm ²	N/mm ²	Maturity	N/mm ²
Α	C40/20 high GGBS no MS	1	29.1	3035	27.5	2700	30.5	14.3	1180	16.5
		2	28.8	3000	27.5	2700	32.0	14.6	1180	17.0
В	C45/20 low GGBS 20 kg MS	1	30.7	1090	29.2	1015	32.0	9.2	560	12.0
		2	30.9	1115	29.0	1015	31.5	9.5	560	12.5
C	C40/20 low GGBS no MS	1	27.8	1980	25.7	1760	32.0	12.0	900	16.0
		2	27.8	1980	25.4	1760	30.5	11.7	900	16.0
D	C45/20 high GGBS 20 kg MS	1	33.5	1830	26.1	1570	30.0	3.2	680	6.5
		2	37.1	2120	26.4	1570	30.5	3.2	680	6.5

			Start	Minimum	Maximum	Average
mix		Sensor	Measurement	Temperature	Temperature	Temperature
Code	Mix-design	Туре	Celsius	Celsius	Celsius	Celsius
Α	C40/20 high GGBS no MS	Cable sensor	30.1	30.1	54.3	46.9
		Wall Panel sensor	30.6	30.6	49.1	41.5
В	C45/20 low GGBS 20 kg MS	Slab sensor	30.6	30.6	54.5	44.3
C	C40/20 low GGBS no MS	Cable sensor	30.4	30.4	56.7	49.6
		Wall Panel sensor	32.1	32.1	51.4	43.0
D	C45/20 high GGBS 20 kg MS	Slab sensor	30.3	30.3	57.5	43.0

Overall we can draw following main conclusions from the measurement results:

- The IN-PLACE maturity gain in all measurements is higher than maturity gain of Outdoor test cubes or Water tank test cubes. This underpins the thesis that IN-PLACE hardening conditions are more in favor for faster compressive strength buildup compared to test specimens. This learning is common in all countries in the world where maturity method is applied.
- The compressive strength calculated by Concremote for the test cubes is in all 4 castings lower than laboratory tested compressive strength results for test cubes. This is the consequence of the safety factor which is included in applicable standard EN-NEN-5970 weighted maturity method and is therefore a desired consequence.
- The Water tank test cubes have significant slower compressive strength buildup compared to IN-PLACE and to Outdoor test cubes. This is a logical consequence of cooling concrete down to 20 Celsius and in addition the GGBS will further slowdown at hardening temperatures below 25 Celsius. The Water tank cubes harden under ideal (laboratory conditions) and will result in highest compressive strength possible however at a much lower pace of hardening compared to IN-PLACE strength gain performance.
- The Outdoor test cubes run significant risk of dehydration and reduction of final strength. In 3 from 4 castings the Outdoor cubes reach maximum temperature of 50 Celsius and above. Although from concrete technology standpoint this is acceptable for IN-PLACE concrete (large structure/volume) it is very questionable how this influences the strength gain in cubes with 150x150x150 dimensions. It is therefore not recommended to use Outdoor cubes under Dubai climatological conditions as a reliable method to define early age compressive strength gain in concrete structures.
- The IN-PLACE compressive strength results for all 4 castings is significantly faster than assumed by supervision consultant. For the slab floors Post Tensioning needs to take place. Utilizing the IN-PLACE measurement results on strength gain allows for time accurate PT operations.
- Concremote measurement results provide more detailed insight on hardening conditions (temperature concrete during placing, temperature curing profile, maximum temperature, influence of weather conditions and altitudes (high rise and civils work below ground level) and is real-time accessible for all stakeholders in construction process. The traditional test cube strength result report does not reflect the condition under which strength gain took place, nor does is refer to hardening condition of the concrete structure itself.

 The castings of 4 unique mix-designs, all utilizing green concrete alternative binder to OPC, demonstrate the importance of the C-Value per binder type in the <u>weighted</u> maturity method. The high GGBS mix-designs require more maturity per 1 N/mm² than lower GGBS mix-designs.

B|A|S Research & Technology Venlo. The Netherlands

Wilko van der Meer Managing Director Bastiaan Bos Concremote Product Manager



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The Formwork Experts.

Doka Concremote Measurement results VERIFICATION AND

DEMONSTRATION as part of TA 157-2016 Concremote – July 2016



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Results Summary Verification & Demonstration

4 measurements; IN-PLACE – OUTDOOR cubes – WATERTANK cubes

mix				Measurement start	End Measurement target value	Time elapsed	Lab
Code	Mix-design	Structure	Sensor type	IN-PLACE	IN-PLACE	HRS:MIN	testing
Α	C40/20 high GGBS no MS	Column	Cable + Wall	July 17 - 23:58	July 19 - 21:00	45:02	July 19 - 15:10
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			IN-PLACE	IN-PLACE	Outdoor	Outdoor	Outdoor	Water tank	Water tank	Watertank
mix			Concremote	Concremote	Concremote	Concremote	lab	Concremote	Concremote	lab
Code	Mix-design		N/mm ²	Maturity	N/mm ²	Maturity	N/mm ²	N/mm ²	Maturity	N/mm²
А	C40/20 high GGBS no MS	1	29.1	3035	27.5	2700	30.5	14.3	1180	16.5
		2	28.8	3000	27.5	2700	32.0	14.6	1180	17.0
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Results Summary Verification & Demonstration

4 measurements; IN-PLACE – OUTDOOR cubes – WATERTANK cubes

			Start	Minimum	Maximum	Average
mix		Sensor	Measurement	Temperature	Temperature	Temperature
Code	Mix-design	Туре	Celsius	Celsius	Celsius	Celsius
Α	C40/20 high GGBS no MS	Cable sensor	30.1	30.1	54.3	46.9
		Wall Panel sensor	30.6	30.6	49.1	41.5
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		Wall Panel sensor	32.1	32.1	51.4	43.0
D	C45/20 high GGBS 20 kg MS	Slab sensor	30.3	30.3	57.5	43.0

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standard deviation:	1.94 MPa (N/mm ²)		overe	01618	01620	N9160	01602	0 ¹⁶ 0 ⁴	01606	01608	01610	01612	01614	
target value:	30.00 MPa (N/mm ²)		190 - 19	&ં &	N.	8. B	'ès	8.	S.	S,	S.	8	30	
Measurement:	0						time							
17-07-2016 - Water Tank Cul	bes C40/20 - High G 🔻													
Time period:						TEE					00			
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to: 7/19/2016	15:30 🔻				0									
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Projects:	compressive strength temperature maturity correlation curve data Appendix
340-046788 - AGCCIC - The Hills Project 🔹	
structure:	
Zone - 10 Columns B1 To Ground	<u>refresh graph</u> <u>Print</u> 🗩 🗩
Locations:	temperatura in 90
Dubai Hills 🔹	
part:	
Columns 🔹	32
View Sensors	28_1
044315 - Ambient Temperature	
044315 - T2	
I59546 - Ambient Temperature	
159546 - T3	
DMBD 04000 (CEV CODE as ME) 0.40 0 Value 4.50 kms	
2016	
Description	12
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Description. DMRD_C40/20 (65% GGRS) 0.40 Curing tank final version	4
1.50	
C-value: 1.50	
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standard deviation: 1.94 MPa (N/mm ²)	
target value: 30.00 MPa (N/mm ²)	time
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17-07-2016 - Water Tank Cubes C40/20 - High G 🔻	
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standard deviation:	1.94 MPa (N/mm ²)		1	AI07172	19107172	810112	8107122	18107172	18107172	1810712	8107122	19107122	1310112	(3)(7)[2]	(a)(7)172	In land	2
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to: 7/19/2016 15:30	T						R /			4							
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Projects:	i ninot T	compressive strength	temperature		maturity	correla	ation curve	data		Appendix			
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Locations:													
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Floor slabs	•	45											
View Sensors		45											
869792 - Concrete		40				_							
400366 - Concrete		Ba											
Measurements outside	e area correlation curve	≥ 35 N											
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DMBD C45/20 (36%GGBS 20kg MS) 28_2016	C-Value 1.35_june	25											
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DMBD C45/20 (36%GGBS 20kg MS) 28_2016	C-Value 1.35_june	월 15											
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standard deviation:	1 95 MPa (N/mm ²)	104	1201	12010	12010	12010	12010	12010	1201	1201	12010	12010	12010
target value:	22.50 MP2 (N/mm ²)	2002	20/07	20/07	20/07	20/07	20/07	20/07	20/07	20/07	20/07	20/07	20/07
argot valdo.	55.50 MFa (N/11111)						tim						
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to: 7/26/2016					CL		a4b		10				
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measurement completed:				I									



Projects:	0	compressive strength temperature maturity correlation curve data Appendix
340-046788 - AGCCIC - The	Hills Project 🔹	
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869792 - Concrete		
400366 - Ambient T	emperature	
400366 - Concrete		
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28 2016	kg IVIS) C-Value 1.35_june	
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	ka MCV C Value 1 25. june	
28_2016	ky Misy C-Value 1.35_june	
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	ka MS\ Collibration box final	
version	ky may canoration box final	
C-value:	1.35	
a constant:	1.00	Harrie Harrie Harrie Harrie
standard deviation:	1.95 MPa (N/mm ²)	
target value:	33.50 MPa (N/mm ²)	time
Measurement:	0	
19-07-2016 - Building A 1.1,	8th Floor - C45/20 - L 🔻	
Time period:		IN-PLACE measurement
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to: 7/26/2016	07:00	Tomporature evolution
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measurement completed.		———————————————————————————————————————

Projects:	0	compre	essive strend	ith terr	nperature	mat	turity	correlation cu	Irve	data	Append	lix	
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400366 - Concrete											1		
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DMBD C45/20 (36%GGBS 20kg MS) 28_2016	C-Value 1.35_june		2000									-	<u> </u>
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Projects:	compressive strength temperature maturity correlation curve data Appendix
340-046788 - AGCCIC - The Hills Project 🔹	
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Locations:	tomporature in ° C
Dubai Hills 🔹	
part:	60
Floor slabs 🔹	
View Sensors	
175930 - Ambient Temperature	50
175930 - LO2	
🗹 396093 - Ambient Temperature	
	40
concrete properties:	
DMBD C45/20 (36%GGBS 20kg MS) C-Value 1.35_june	
28_2010	
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DMBD C45/20 (36%GGBS 20kg MS) C-Value 1.35_june	20
28_2016	
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DMBD C45/20 (36%GGBS 20kg MS) Calibration box final	
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a constant: 1.50	² 0 ₀₂₀
standard deviation: 1.95 MPa (N/mm ²)	²⁰ 16 02:00 00 00 02:00 00 00 02:00 00 00 00 00 00 00 00 00 00 00 00 00 0
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19-07-2016 - Outside Cubes - C45/20 - Low GGBS •	
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to: 7/20/2016 16:00 🔻	Temperature evolution
measurement completed: 🖉 📄	remperature evolution



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Projects: 340-046788 - AGCCIC - The Hills P structure: Building A 1.1	roject v	compressive strength	temperature	maturity correla	ation curve data	Appendix refre:	sh graph Print ,⊕ ,⊖
Locations:				compressive stre	enath in N/mm ² (MPa)		
Dubai Hills	Y	35					
part. Eloor slabs	▼	34				_	
View Sensors		32					
		30					
I75674 - LT3		28					
Measurements outsic	le area correlation curve	26				_	
concrete properties:	•	d 24 W 23 V 22					
DMBD C45/20 (36%GGBS 20kg MS) 28_2016) C-Value 1.35_june	E 21 Z 20 .E 19					
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DMBD C45/20 (36%GGBS 20kg MS) 28_2016) C-Value 1.35_june	10 15 					
Description: DMBD C45/20 (36%GGBS 20kg MS) version) Curing tank final	12 11 10 9 8					
C-value:	1.35	6					
a constant:	1.50	4					
standard deviation:	1.97 MPa (N/mm ²)	2					
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19-07-2016 - Water Tank Cubes -	C45/20 - Low G 🔻						
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340-046788 - AGCCIC - The Hil	lls Project 🔹	compres	3106 301	enga ter	nperature	maturi	uj con	inclation curve	,	iata	Аррени			
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I75625 - Ambient Ten	nperature		32+			_	_			_	-	<u> </u>	₩-	
I75625 - LT2			20										V	
I75674 - Ambient Ten	nperature		20 T											
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target value:	33.50 MPa (N/mm ²)			1622	1600	1602	1604	1606	1608	1610	1612	1614	1616	
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Projects:	0	compressive stren	oth temperature	r	naturity	correlation	curve	data	Appe	ndix			
340-046788 - AGCCIC - The H	Hills Project 🔹		3										
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View Sensors													
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Projects:	0	compressive strength temperature maturity correlation ourse data. Annandir
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I175948 - Wall Panel		
646714 - Ambient tempera	ature	40
646714 - Wall Panel		
414813 - Ambient tempera	ature	
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340-046788 - AGCCIC - The	Hills Project	compressive strength temperature maturity correlation curve data Appendix
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Projects:	0	compressive strength	temperature	n	naturity	correlatio	on curve	data	a	Арр	endix			
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Projects:	compressive strength temperature	maturity correlation curve data	Appendix
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part:	60		
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Projects:	0	compressive stre	ngth ti	emperature	mat	turity	correlation	curve	data		Appendix			
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Projects:	compressive strength temperature maturity correlation curve data Appendix						
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part:	00						
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I59546 - Ambient temperature							
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anger value. 33.50 MPa (N/mm-)	₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹ ₹						
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a constant:	1.50	200	
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I75674 - T3		28						
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to: 7/24/2016 12:34) T									
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Doka Gulf Jebel Ali Free Zone Dubai <u>emirates@doka.com</u> +971 4 870 8700 www.doka.com/concremote The Formwork Experts.

Measurement results VERIFICATION AND DEMONSTRATION as part of TA 157-2016 Concremote – July 2016 Appendix 2

Mix-design A C40/20 high GGBS no Microsilica

Arab Center

Report on compressive strength of concrete cubes

and the local division of the local division			
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032303
Contractor	: DOKA	Date Reported	: 20-07-16
Consultant	; DAR CONSULTANT	Request No.	: AQC16032303
Project No.	: 1178	Sample No.	: ASC16032303
Project Name	: Hills Development Buildings Project		
Structure Reference	; COLUMN ZONE-10 B1 TO GROUND		
Source of Material	: READY MIX BETON	No. of Cubes Tested	:1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	b. : N.P.
Sample Rovd. Date	: 19-07-16 Time : 08:00	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: Nil	Actual Test Age (Days)	: 2
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2
Moisture Condition	: Moist	Sample Brought In By	CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16
Test Method Var.	: NB	Tested By	: Harold

Sper.	Client Cube	Dime	nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
No. Reference L	L	W	Н	(kg)	(kg/m ³)	(kN)	(N/mm²)	Type of Fracture	
1	НОЗ	150	150	150	8.204	2430	688	30.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (15:08)

Spec. Strength (N/mm²) : C40/20-HIGH GGBS

Notes : The test results represent the submitted sample only.

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		and the second se	
Owner	: AL GHANDI & CCIC	Report No.	: ARC16031763
Contractor	: DOKA	Date Reported	: 20-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16031763
Project No.	: 1178	Sample No.	: ASC16031763
Project Name	: Hills Development Buildings Project		
Structure Reference	; COLUMN ZONE-10 B1 TO GROUND		
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	p. : N.P.
Sample Rcvd, Date	: 19-07-16 Time : 08:00	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	7 NII	Actual Test Age (Days)	: 2
Curing/Storage (Lab)	: B5 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	; 2
Moisture Condition	7 Moist	Sample Brought In By	CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spec.	Client Cube	Dime	nsions (t	m m)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
No. Reference	L	W	H	(kg)	(kg/m³)	(KN)	(N/mm²)	Type of Fracture	
1	HO2	150	150	150	8.326	2470	717	32.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TEST (15:04) Spec. Strength (N/mm²); C40/20-H1GH GGBS

Notes : The test results represent the submitted sample only.

Eng. Harees Sulaiman Laboratory Supervisor

Arab Center المركبة العبريكا For Engineering Studies

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NAME OF TAXABLE PARTY OF TAXABLE PARTY.		and the state of t	
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032301
Contractor	: DOKA	Date Reported	: 20-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032301
Project No.	: 1178	Sample No.	: ASC16032301
Project Name	: Hills Development Buildings Project		
Structure Reference	: COLUMN ZONE-10 B1 TO GROUND		
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	; Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	b. : N.P.
Sample Rcvd. Date	: 19-07-16 Time : 08:00	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	; Nil	Actual Test Age (Days)	: 2
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spac	Client Cube	Dimensions (mn		nm)	Mass as Received	Density as Received (kg/m ³)	Max. Load at Failure	Comp. Strength (N/mm²)	
No. Reference	L	W	H	(kg)	(kN)		Type of Fracture		
1	HT2	150	150	150	8.419	2490	367	16.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (15:19)

Spec. Strength (N/mm²) : C40/20-HIGH GGBS

Notes : The test results represent the submitted sample only.

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Owner	: AL GHANDI & CCIC	Report No.	: ARC16032302
Contractor	: DOKA	Date Reported	: 20-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032302
Project No.	: 1178	Sample No.	: ASC16032302
Project Name	: Hills Development Buildings Project		
Structure Reference	: COLUMN ZONE-10 B1 TO GROUND		
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Arnd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	; N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	a. : N.P.
Sample Rcvd. Date	: 19-07-16 Time : 08:00	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: Nil	Actual Test Age (Days)	: 2
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd, 9387-97)	Rord Test Age (Days)	: 2
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spec. No.	Client Cube Reference	Dime	nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
		L	W	Н	(kg)	(kg/m³)	(kN)	(N/mm ²)	Type of Fracture
1	НТ3	150	150	150	8.671	2570	379	17.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (15:21)

Spec. Strength (N/mm²) : C40/20-HIGH GGBS

Notes : The test results represent the submitted sample only.

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Appendix 2

Mix-design B C45/20 low GGBS 20 kg Microsilica

Arab Center

Report on compressive strength of concrete cubes

And the second se		CALIFORNIA CONTRACTOR OF A CONTRAC	
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032297
Contractor	: DOKA	Date Reported	: 22-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032297
Project No.	: 1178	Sample No.	: ASC16032297
Project Name	: Hills Development Buildings Project		
Structure Reference	: BUILDING A 1.1, 8TH FLOOR SLAB		
Source of Material	READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 19-07-16 Time : 21:30	Method of Compaction	: MANUAL
Date of Casting	: 19-07-16 Time : 21:30	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd, 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	b. : N.P.
Sample Rcvd. Date	: 20-07-16 Time : 15:30	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: NI	Actual Test Age (Days)	: 2
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rord Test Age (Days)	: 2
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 21-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spec. No.	. Client Cube Reference	 Dime	nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
		L	W.	н	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1,	LO2	150	150	150	8.434	2500	721	32.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (16:04)

Spec. Strength (N/mm²) : C45/20-LOW GGBS

Notes : The test results represent the submitted sample only.

Eng. Harees Sulaiman Laboratory Supervisor المركز العربي **Arab Center** 1 For Engineering Studies

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Resident in the second s		A STREET, SALES AND				
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032298			
Contractor	: DOKA	Date Reported	: 22-07-16			
Consultant	: DAR CONSULTANT	Request No.	: AQC16032298			
Project No.	: 1178	Sample No.	: ASC16032298			
Project Name	: Hills Development Buildings Project					
Structure Reference	: BUILDING A 1.1, 8TH FLOOR SLAB					
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1			
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm			
Date of Sampling	: 19-07-16 Time : 21:30	Method of Compaction	: MANUAL			
Date of Casting	: 19-07-16 Time : 21:30	Equip.of Compaction	: COMPACTING BAR			
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.			
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.			
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No. : N.P.				
Sample Rovd. Date	: 20-07-16 Time : 15:30	Dimensions	: Checked			
Condition of Cube	: Good	Volume Determination	: By Calculation			
Removal of Fins	: Nil	Actual Test Age (Days)	: 2			
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2			
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.			
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 21-07-16			
Test Method Var.	: Nil	Tested By	: Harold			

Spec. No.	Client Cube Reference	Dime	nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
		L	W	Н	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1	LO3	150	150	150	8.432	2500	705	31.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (16:07)

Spec. Strength (N/mm²) : C45/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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sumption of the local design of the second sec						
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032300			
Contractor	: DOKA	Date Reported	: 22-07-16			
Consultant	: DAR CONSULTANT	Request No.	: AQC16032300			
Project No.	: 1178	Sample No.	: ASC16032300			
Project Name	: Hills Development Buildings Project	1.				
Structure Reference	: BUILDING A 1.1, 8TH FLOOR SLAB					
Source of Material	: READY MIX BETON	No. of Cubes Tested	÷1			
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm			
Date of Sampling	: 19-07-16 Time : 21:27	Method of Compaction	: MANUAL			
Date of Casting	: 19-07-16 Time : 21:27	Equip.of Compaction	: COMPACTING BAR			
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.			
Curing/Storage (Site)	: N.P.	Cubes Prepared By	; CONTRACTOR'S REP.			
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No. : N.P.				
Sample Rcvd. Date	: 20-07-16 Time : 15:30	Dimensions	: Checked			
Condition of Cube	: Good	Volume Determination	: By Calculation			
Removal of Fins	: Nil	Actual Test Age (Days)	: 2			
Curing/Storage (Lab)	ab) : BS 1881:P 111:1983 (Amd. 9387-97) Rgrd Test Age (Days)	Rgrd Test Age (Days)	: 2			
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.			
Test Method	: BS 1881:1983 PT 116 Amd: 6720-91	Date Tested	: 21-07-16			
Test Method Var.	: Nil	Tested By	: Harold			

Spec. No.	Spec. Client Cube		nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
	Reference	L	w	H	(kg)	(kg/m³)	(KN)	(N/mm ²)	Type of Fracture
1	LT3	150	150	150	8,518	2520	275	12.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (16:13)

Spec. Strength (N/mm²) : C45/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Property and the second s		and the second				
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032299			
Contractor	: DOKA	Date Reported	: 22-07-16			
Consultant	: DAR CONSULTANT	Request No.	: AQC16032299			
Project No.	: 1178	Sample No.	: ASC16032299			
Project Name	: Hills Development Buildings Project					
Structure Reference	: BUILDING A 1.1, 8TH FLOOR SLAB					
Source of Material	: READY MIX BETON	No. of Cubes Tested	:1			
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm			
Date of Sampling	: 19-07-16 Time : 21:27	Method of Compaction	: MANUAL			
Date of Casting	: 19-07-16 Time : 21:27	Equip.of Compaction	: COMPACTING BAR			
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.			
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.			
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No. : N.P.				
Sample Rovd. Date	: 20-07-16 Time : 15:30	Dimensions	: Checked			
Condition of Cube	* Good	Volume Determination	: By Calculation			
Removal of Fins	: Nil	Actual Test Age (Days)	: 2			
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2			
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP,			
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 21-07-16			
Test Method Var.	: Nil	Tested By	: Harold			

Spec. No.	Client Cube Reference	Dimensio		nsions (1	ns (mm) Mass as Received		Density as Received	Max. Load at Failure	Comp. Strength	
		L	W	Н	(kg)	(kg/m ³)	(kN)	(N/mm ²)	Type of Fracture	
1	LT2	150	150	150	8.661	2570	280	12.5	Satisfactory	

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (16:11)

Spec. Strength (N/mm²) : C45/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Appendix 2

Mix-design C C40/20 low GGBS no Microsilica

Arab Center

Report on compressive strength of concrete cubes

and the second					
Owner	: AL GHANDI & CCIC	Report No.	: ARC16031725		
Contractor	: DOKA	Date Reported	: 20-07-16		
Consultant	: DAR CONSULTANT	Request No.	: AQC16031725		
Project No.	: 1178	Sample No.	: ASC16031725		
Project Name	: Hills Development Buildings Project				
Structure Reference	: COLUMN ZONE-10 B1 TO GROUND				
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1		
Place of Sampl,/Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm		
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL		
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction Sampled By	: COMPACTING BAR		
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91		: CONTRACTOR'S REP. : CONTRACTOR'S REP.		
Curing/Storage (Site)	: N.P.	Cubes Prepared By			
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	ь. : N.P.		
Sample Rcvd. Date	: 18-07-16 Time : 19:45	Dimensions	: Checked		
Condition of Cube	: Good	Volume Determination	: By Calculation		
Removal of Fins	: Nil	Actual Test Age (Days)	: 2		
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	:2		
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.		
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16		
Test Method Var.	: Nil	Tested By	Harold		

Spec. No.	Client Cube Reference	c. Client Cube Dimensions (mm)		Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength		
		L	w	н	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1	L02	150	150	150	8,605	2550	719	32.0	Satisfactory

Remarks

; Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (5:11 AM)

Spec. Strength (N/mm²) : C40/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Owner Contractor Consultant Project No. Project Name Structure Reference	: AL GHANDI & CCIC : DOKA : DAR CONSULTANT : 1178 : Hills Development Buildings Project : COLUMN ZONE-10 B1 TO GROUND	Report No. Date Reported Request No. Sample No.	: ARC16032306 : 20-07-16 : AQC16032306 : ASC16032306		
Source of Material	 READY MIX BETON Site 17-07-16 Time : 23:20 17-07-16 Time : 23:20 BS 1881:1983 PT 101 Amd. 6728-91 N.P. Sampling(NP), Making(NP), Curing(NP) 	No. of Cubes Tested	: 1		
Place of Sampl./Cast.		Nominal Size	; 150 x 150 x 150 mm		
Date of Sampling		Method of Compaction	: MANUAL		
Date of Casting		Equip.of Compaction	: COMPACTING BAR		
Sampling Method		Sampled By	; CONTRACTOR'S REP.		
Curing/Storage (Site)		Cubes Prepared By	: CONTRACTOR'S REP.		
Certificate Attached		Sampling Certificate No	. : N.P.		
Sample Rcvd. Date	: 18-07-16 Time : 19:45	Dimensions	: Checked		
Condition of Cube	: Good	Volume Determination	: By Calculation		
Removal of Fins	: NII	Actual Test Age (Days)	: 2		
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2		
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.		
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16		
Test Method Var.	: NII	Tested By	: Harold		

Spec. No.	Client Cube	Dime	nsions (I	nm)	Mass as Received	Density as Received	Max. Load at Fallure	Comp. Strength	
	Reference	L	W	H	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1	LO3	150	150	150	8.570	2540	683	30.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (5:12 AM)
Spec. Strength (N/mm²) : C40/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Completion of the local data and the	and all services and all shares of the service of the	And the second	
Owner	: AL GHANDI & CCIC	Report No.	: ARC16031724
Contractor	: DOKA	Date Reported	: 20-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16031724
Project No.	; 1178	Sample No.	: ASC16031724
Project Name	: Hills Development Buildings Project		
Structure Reference	: COLUMN ZONE-10 B1 TO GROUND		
Source of Material	: READY MIX BETON	No. of Cubes Tested	; 1
Place of Sampl./Cast.	; Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	; BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	; N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	a. ; N.P.
Sample Rcvd. Date	: 18-07-16 Time : 19:45	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: NII	Actual Test Age (Days)	12
Curing/Storage (Lab)	; BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 2
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 19-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spec. No.	Client Cube	Dimensions (mm)			Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
	Reference	L	w	н	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture Satisfactory
1	LT1	150	150	150	8.584	2540	362	16.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (5:16 AM)

Spec. Strength (N/mm²) : C40/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Owner Contractor Consultant Project No. Project Name Structure Reference	: AL GHANDI & CCIC : DOKA : DAR CONSULTANT : 1178 : Hills Development Buildings Project : COLUMN ZONE-10 B1 TO GROUND	Report No. Date Reported Request No. Sample No.	: ARC16032304 : 20-07-16 : AQC16032304 : ASC16032304
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 17-07-16 Time : 23:20	Method of Compaction	: MANUAL
Date of Casting	: 17-07-16 Time : 23:20	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	: N.P.
Sample Rcvd. Date	: 18-07-16 Time : 19:45	Dimensions	 Checked By Calculation 2 2 CONTRACTOR'S REP. 19-07-16 Harold
Condition of Cube	: Good	Volume Determination	
Removal of Fins	: NII	Actual Test Age (Days)	
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	
Moisture Condition	: Molst	Sample Brought In By	
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	
Test Method Var.	: Nil	Tested By	

Spec. No:	Client Cube	Dime	nsions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
	Reference	L	W	H	(kg)	(kg/m³)	(kN)	(N/mm ²)	Type of Fracture Satisfactory
1.	LT2	150	150	150	8.580	2540	355	16.0	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TESTING (5:17 AM)

Spec. Strength (N/mm²) : C40/20-LOW GGBS

Notes : The test results represent the submitted sample only.

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Appendix 2

Mix-design D C45/20 high GGBS 20 kg Microsilica

Arab Center

Report on compressive strength of concrete cubes

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Report on Compressive Strength of Concrete Cubes

Production of the Control of the Con			
Owner	: AL GHANDI & CCIC	Report No.	: ARC16032520
Contractor	; DOKA	Date Reported	: 25-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032520
Project No.	: 1178	Sample No.	: ASC16032520
Project Name	; Hills Development Buildings Project		
Structure Reference	: BUILDING A 2.3 PODIUM SLAB		
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 23-07-16 Time : 10:50	Method of Compaction	: MANUAL
Date of Casting	: 23-07-16 Time : 10:50	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	5. : N.P.
Sample Rcvd. Date	: 24-07-16 Time : 09:15	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: Nil	Actual Test Age (Days)	: 1
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	: 1
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 24-07-16
Test Method Var.	: Nil	Tested By	: Harold

Spec. No.	Client Cube	Dime	nsions (I	m m)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
	Reference	L	W	H	(kg) (kg/m ³)	(kg/m³)	(kN)	(N/mm ²)	Type of Fracture Satisfactory
1	HO4	150	150	150	8.465	2510	670	30.0	Satisfactory

Remarks

; Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TEST (11:49)

Spec. Strength (N/mm²) : C45/20 HIGH GGBS

Notes : The test results represent the submitted sample only.

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Report on Compressive Strength of Concrete Cubes

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Owner	: AL GHANDI & CCIC	Report No.	: ARC16032519
Contractor	: DOKA	Date Reported	: 25-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032519
Project No.	: 1178	Sample No.	: ASC16032519
Project Name	Hills Development Buildings Project		
Structure Reference	: BUILDING A 2.3 PODIUM SLAB		
Source of Material	: READY MIX BETON	No. of Cubes Tested	; 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 23-07-16 Time : 10:50	Method of Compaction	; MANUAL
Date of Casting	: 23-07-16 Time : 10:50	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd, 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	o, ∶ N.P.
Sample Rcvd. Date	: 24-07-16 Time : 09:15	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: Nil	Actual Test Age (Days)	:1
Curing/Storage (Lab)	: BS 1881:P 111;1983 (Amd. 9387-97)	Rqrd Test Age (Days)	:1
Moisture Condition	: Moist	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 24-07-16
Test Method Var.	: NII	Tested By	: Harold

Spec.	Client Cube	Dime	ensions (r	nm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
No. F	Reference	Ĺ	W	H	(kg)	(kg/m³)	(kN)	Comp. Strength (N/mm ²) Type of Fracture 30.5 Satisfactory	
1	НОЗ	150	150	150	8.372	2480	691	30.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TEST (11:45)

Spec. Strength (N/mm²) : C45/20 HIGH GGBS

Notes : The test results represent the submitted sample only.

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للدراسات الهندسية For Engineering Studies

Report on Compressive Strength of Concrete Cubes

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Owner	: AL GHANDI & CCIC	Report No.	: ARC16032522
Contractor	: DOKA	Date Reported	: 25-07-16
Consultant	: DAR CONSULTANT	Request No.	: AQC16032522
Project No.	: 1178	Sample No.	: ASC16032522
Project Name	: Hills Development Buildings Project		
Structure Reference	: BUILDING A 2.3 PODIUM SLAB		
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm
Date of Sampling	: 23-07-16 Time : 10:50	Method of Compaction	: MANUAL
Date of Casting	: 23-07-16 Time : 10:50	Equip.of Compaction	: COMPACTING BAR
Sampling Method	: BS 1881:1983 PT 101 Amd, 6728-91	Sampled By	: CONTRACTOR'S REP.
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No	•, : N.P.
Sample Rcvd. Date	: 24-07-16 Time : 09:15	Dimensions	: Checked
Condition of Cube	: Good	Volume Determination	: By Calculation
Removal of Fins	: Nil	Actual Test Age (Days)	: 1
Curing/Storage (Lab)	: BS 1881:P 111:1983 (Amd. 9387-97)	Rqrd Test Age (Days)	; 1
Moisture Condition	: Molst	Sample Brought In By	: CONTRACTOR'S REP.
Test Method	: BS 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 24-07-16
Test Method Var.	: Níl	Tested By	: Harold

Snec	Client Cube	Dime	ensions (I	mm)	Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	
No. Referen	Reference	L	w	Н	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1	HT2	150	150	150	8.318	2460	149	6.5	Satisfactory

Remarks

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TEST (11:52)

Spec. Strength (N/mm²) : C45/20 HIGH GGBS

Notes : The test results represent the submitted sample only.

Eng. Harees Sulaiman Laboratory Supervisor

المركز المرباجا س **Arab Center** For Engineering Studies ات الملد

P.O. Box : 60823, Dubai - UAE Tel. : +971-4-8856466 Fax : +971-4-8856460 E-mail : aces3@emirates.net.ae Website : www.aces-int.com

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Owner	: AL GHANDI & CCIC	Report No.	: ARC16032523			
Contractor	: DOKA	Date Reported	: 25-07-16			
Consultant	: DAR CONSULTANT	Request No.	: AQC16032523			
Project No.	: 1178	Sample No.	: ASC16032523			
Project Name	: Hills Development Buildings Project					
Structure Reference	: BUILDING A 2.3 PODIUM SLAB					
Source of Material	: READY MIX BETON	No. of Cubes Tested	: 1			
Place of Sampl./Cast.	: Site	Nominal Size	: 150 x 150 x 150 mm			
Date of Sampling	: 23-07-16 Time : 10:50	Method of Compaction	: MANUAL			
Date of Casting	: 23-07-16 Time : 10:50	Equip.of Compaction	: COMPACTING BAR			
Sampling Method	: BS 1881:1983 PT 101 Amd. 6728-91	Sampled By	: CONTRACTOR'S REP.			
Curing/Storage (Site)	: N.P.	Cubes Prepared By	: CONTRACTOR'S REP.			
Certificate Attached	: Sampling(NP), Making(NP), Curing(NP)	Sampling Certificate No. : N.P.				
Sample Rcvd, Date	: 24-07-16 Time : 09:15	Dimensions	: Checked			
Condition of Cube	: Good	Volume Determination	: By Calculation			
Removal of Fins	: Nil	Actual Test Age (Days)	: 1			
Curing/Storage (Lab)	: BS 1881;P 111;1983 (Amd. 9387-97)	Rord Test Age (Days)	: 1			
Moisture Condition	: Malst	Sample Brought In By	: CONTRACTOR'S REP.			
Test Method	: B5 1881:1983 PT 116 Amd. 6720-91	Date Tested	: 24-07-16			
Test Method Var.	+ Nil	Tested By	: Harold			

Sper. No.	Client Cube Reference	Dimensions (mm)			Mass as Received	Density as Received	Max. Load at Failure	Comp. Strength	and an address for the second s
		L	W	H	(kg)	(kg/m³)	(kN)	(N/mm²)	Type of Fracture
1	НТЗ	150	150	150	8.496	2520	147	6.5	Salisfactory

Remains

: Dimensions of cubes (Spec# 1) were within 1% of nominal size.

TIME OF TEST (11:55)

Spec. Strength (N/mm²) : C45/20 HIGH GGBS

Notes : The test results represent the submitted sample only.

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CERTIFICATE OF TECHNICAL APPROVAL

Dubai Central Laboratory Department (DCLD) of Dubai Municipality, hereby award this certificate to :

DOKA GULF FZE

For the product(s)

(As per the attached details)

Manufactured by : DOKA INDUSTRIES GmbH at Factory of BAS Research & Technology - Venlo, the Netherlands

Director, Dubai Central Laboratory Department

Current Issue Date: 14-11-2016 Original Issue Date: 14-11-2016

The above product(s) have been assessed and found fit for their intended use, provided they are used according to the

Valid Until

: 13-11-2017

TA Certificate No.: 157

supplier instructions.

The attached details bearing the same Certificate No. forms an integral part of this certificate. This certificate is subject to the Terms and Conditions of the technical approval system

F-RS-007

- 1) The company: Doka Gulf FZE
- 2) Product trade name: "Concremote"
- 3) Manufacturers: Doka Industries GmbH
- 4) Factory: BAS Research & Technology located in Venlo City, Netherlands
- 5) Product Description: "Concremote" is a digital temperature measurement system, GPRS network based, which provides real-time insight in the temperature profile of early age, Concremote determines the actual compressive strength gain of the concrete structure by converting concrete maturity. Concremote is an alternative to early age laboratory and field cured test specimens,
- 6) Product Intended use: The products is intended to be used for estimation of early age concrete strength based on the maturity concept for various structural elements

7) Product identification

Concremote slab sensor shall be identified as follows

- The letters ""Concremote""
- DCL TA mark –DCL -157
- Running number

8) Product characteristics

Remote digital temperature sensor devices specially designed for usage in and on wet concrete.

- GSM GPRS machine to machine communication between sensor and data server via internet data protocol
- Robust construction site capable outer form and battery. Operating climatological conditions minus 50 Celsius up to plus 95 Celsius.
- Sensor measures concrete and outdoor temperature every 10 minutes including unique time-stamp and sensor identification number. The measurement data are submitted every 60 minutes (6 measurement results) to central located data server facility.
- Data server facility is located in Amsterdam the Netherlands at a special data service provider. In case data server facility in Amsterdam cannot be reached a fallback data server facility in Venlo (150 kilometer away from Amsterdam facility) is active.
- In case sensors are not successful in transferring measurement data each sensor includes a memory function with a capacity of minimum 3 days of measurement results. Sensor will automatically retry to connect to data server facility every 60 minutes.

DUBAI MUNICIPALITY DUBAI CENTRAL LABORATORY DEPARTMENT CERTIFICATE OF TECHNICAL APPROVAL

- Sensors are activated at job-site by placement (slab-floor sensor) or connecting plug to outer form once concrete has been placed.
- After receiving measurement results, sensor ID and time-stamp data is processed. Maturity results are defined and corresponding compressive strength to maturity is computed. Concremote software uses NEN 5970 weighted maturity method to define (cumulated) maturity

9) Tests conducted

The calibration for each concrete mix design shall be conducted as per Doka Concremote procedures. Concrete technologists from Doka shall simulate expected compressive strength gain per curing regime and ensure that a certified laboratory will test specimens at correct timings. After acceptance of the test results Concremote concrete technology center defines the correlation curves of maturity and strength.

10)Scope of approval

The Concremote slab sensor approved for determines the actual compressive strength using the weighted maturity method)

Exclusions:

 Types other than "Concremote slab sensor" shall <u>not be</u> covered in the scope of this approval.

11)Conditions of Approval

- a) This approval is granted only to Doka Gulf FZE, no other company, firm or person may hold or claim any entitlement to this technical approval.
- b) This Technical Approval will remain valid for the period shown on the Approval Certificate provided that:
 - i) The characteristics of the product are unchanged,
 - ii) Surveillance checking and/or testing by Dubai Municipality shows compliance with the requirements of this technical approval.
- c) In granting this technical approval, Dubai Municipality makes no representation as to:
 - The presence or absence of patent or similar rights subsisting in "Concremote slab sensor ",
 - ii) The legal right of Doka Gulf FZE to market in the emirate of Dubai.
- d) The Technical Approval shall not be used in such manner as to bring Dubai Municipality into disrepute and Doka Gulf FZE shall not make any statement which Dubai Municipality may consider as misleading.
- e) Surveillance

A

i) Inspection and testing

Dubai Municipality maintains the right to inspect the product at any time without prior notice and to collect samples from the product available at client's stores, warehouses or at any building site within Dubai Emirate, for the purpose of verification and/or testing.

ii) Declarations of shipments

Doka shall keeps records of all deliveries to customers in Dubai. These records shall be open to examination by Dubai Central Laboratory personnel.

DUBAI MUNICIPALITY DUBAI CENTRAL LABORATORY DEPARTMENT CERTIFICATE OF TECHNICAL APPROVAL

iii) Cost of sampling and testing

Doka Gulf FZE shall bear the cost of all surveillance visits, sampling and testing of the product either at Dubai Central Laboratory or at any other laboratory approved by Dubai Central Laboratory. The testing laboratory may be any local, regional or international laboratory.

iv) TA mark shown in the following image shall be part of the labeling/marking of each sensor to show the required basic information in Arabic and/or English language

v) Failing to satisfy the conditions of this Technical Approval Certificate may be grounds for terminating the Technical Approval.

12)Disclaimer

- a) The Dubai Municipality Dubai Central Laboratory Department shall not be held liable for installation and use the product in the site.
- b) The Dubai Municipality Dubai Central Laboratory Department shall not be held liable for any action (legal or otherwise) raised by any party on matters resulting from implementation of the technical approval.

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