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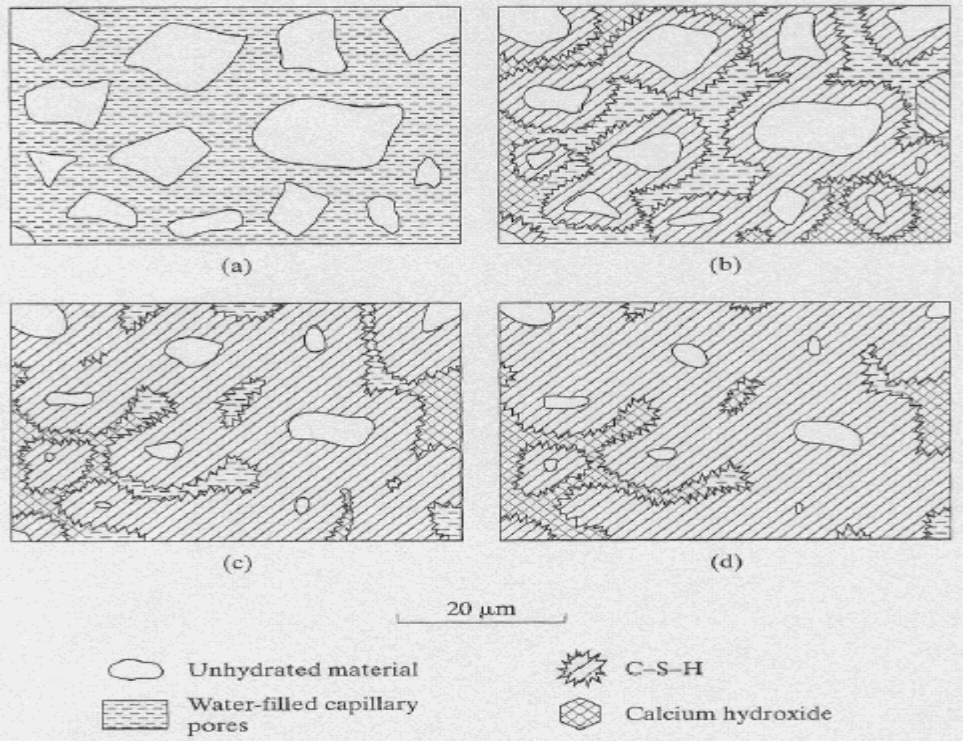
Appendixes

Appendix (A):

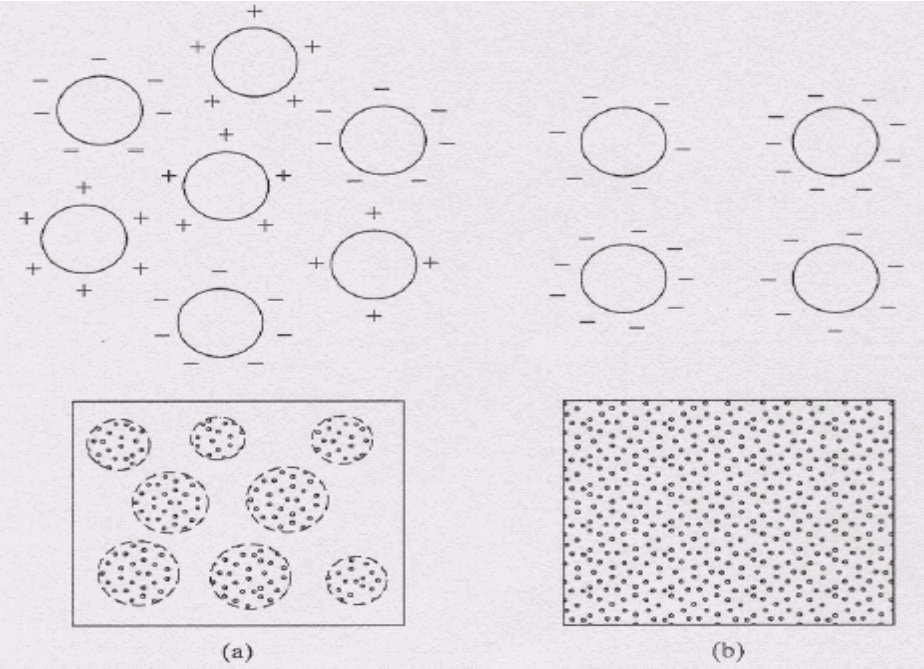
Appendix (A-I): Typical composition of ordinary Portland cement [Mindess et al., 2003].

Chemical Name	*Chemical Formula*	*Shorthand Notation*	*Weight Percent*
Tricalcium silicate	$3CaO \cdot SiO_2$	C_3S	55
Dicalcium silicate	$2CaO \cdot SiO_2$	C_2S	18
Tricalcium aluminate	$3CaO \cdot Al_2O_3$	C_3A	10
Tetracalcium aluminoferrite	$4CaO \cdot Al_2O_3 \cdot Fe_2O_3$	C_4AF	8
Calcium sulfate dihydrate (gypsum)	$CaSO_4 \cdot 2H_2O$	$C\bar{S}H_2$	6

Appendix (A-2): Microstructure development in Portland cement pastes [Mindess et al., 2003].



Appendix (A-3): dispersing action of water-reducing admixtures: (a) flocculated paste; (b) dispersed paste [Mindess et al., 2003]



Appendix (B):

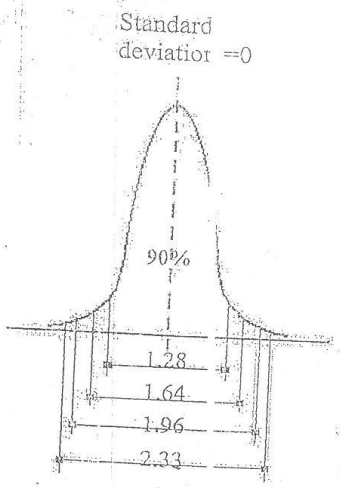


Table (0) multiples of standard deviation for deferent defective rates

Defective rate %	K
10	1.28
5	1.64
2.5	1.96
1	2.33

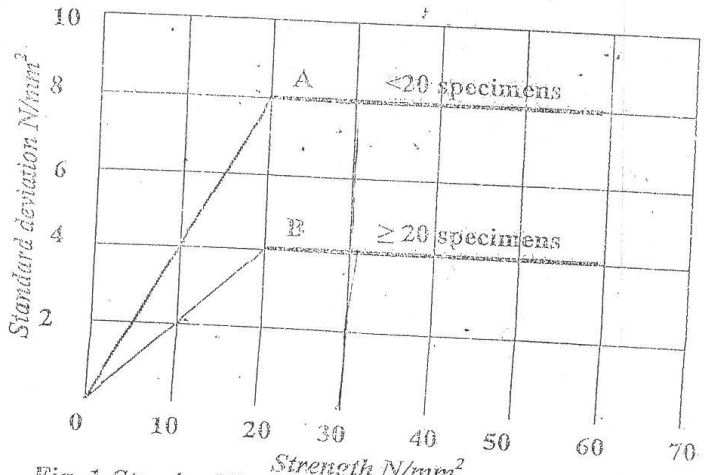


Fig. 1 ***Standard Deviation and Strength Relationship***

Table 1 approximate Compressive Strength of concrete Made with a Free Water /Cement Ratio of 0.5 According to the 1988 British Method

Type of cement	Type of coarse aggregate	Compressive strength* MPa at the age of days			
		3	7	28	91
OPC type I SRPC type V	uncrushed	22	30	42	49
	crushed	27	36	49	56
RHPC type III	uncrushed	29	37	48	54
	crushed	34	43	55	61

* Measured on cubes

Table 2 Approximate free water Contents Required to Give Various Levels of Workability Accordin to the 1988 British Method

Aggregate		Water content kg/m^3				
Max size (mm)	Type	Slump mm	0-10	10-30	30-60	60-180
		Vebe time s	>12	6-12	3-6	0-3
10	uncrushed		150	180	205	225
	crushed		180	205	230	250
20	uncrushed		135	160	180	195
	crushed		170	190	210	225
40	uncrushed		115	140	160	175
	crushed		155	175	195	205

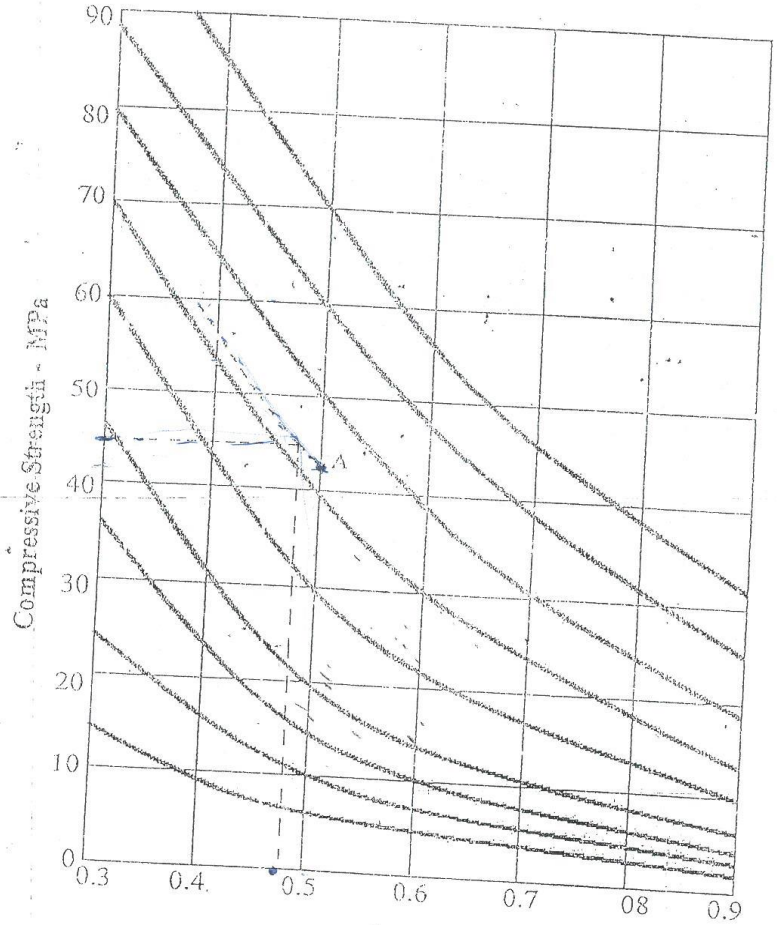
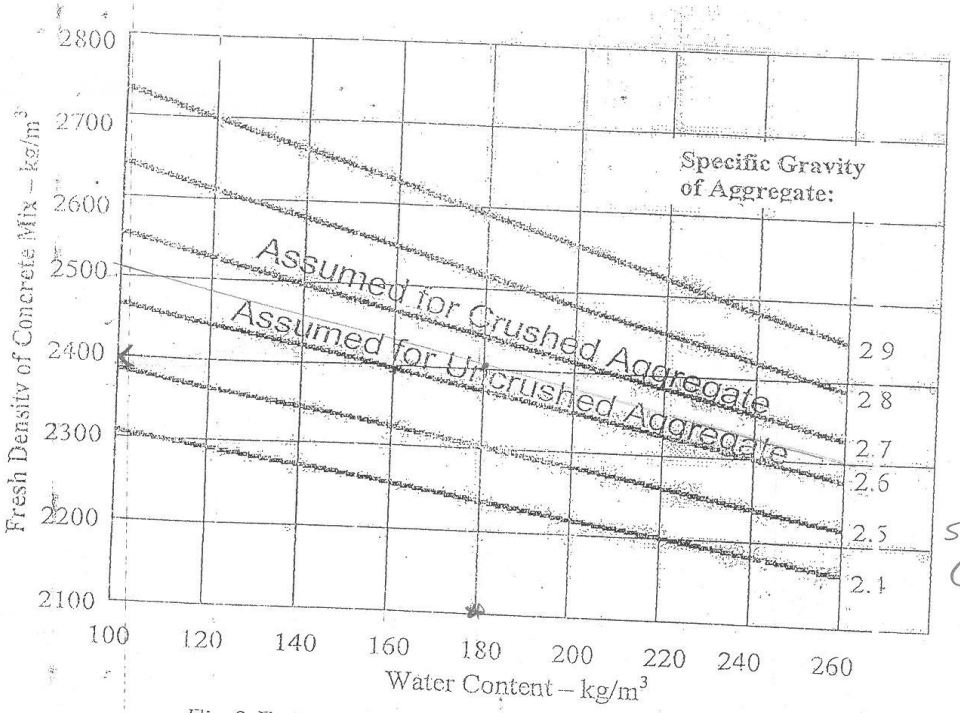
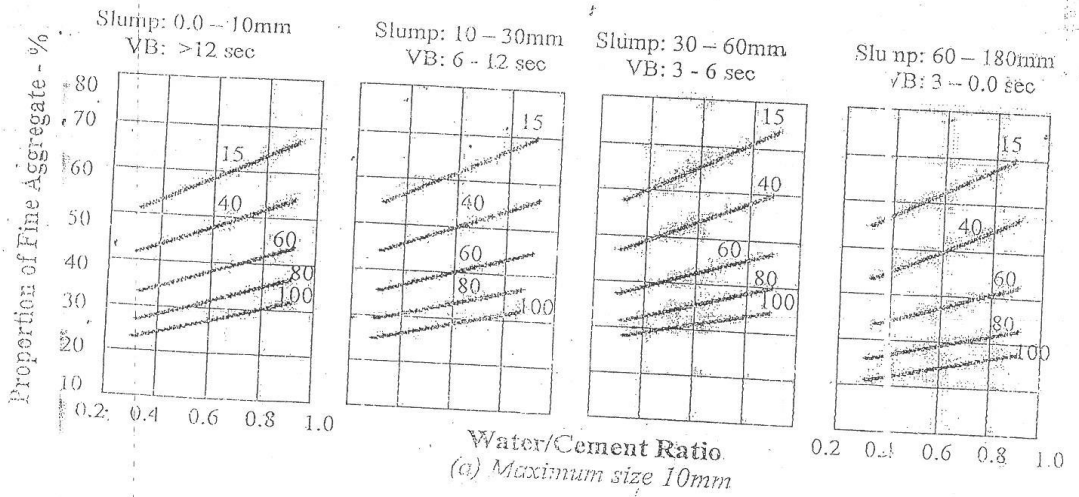


Fig. 2 Relation between compressive strength and free water/cement ratio for use in the British mix selection method.

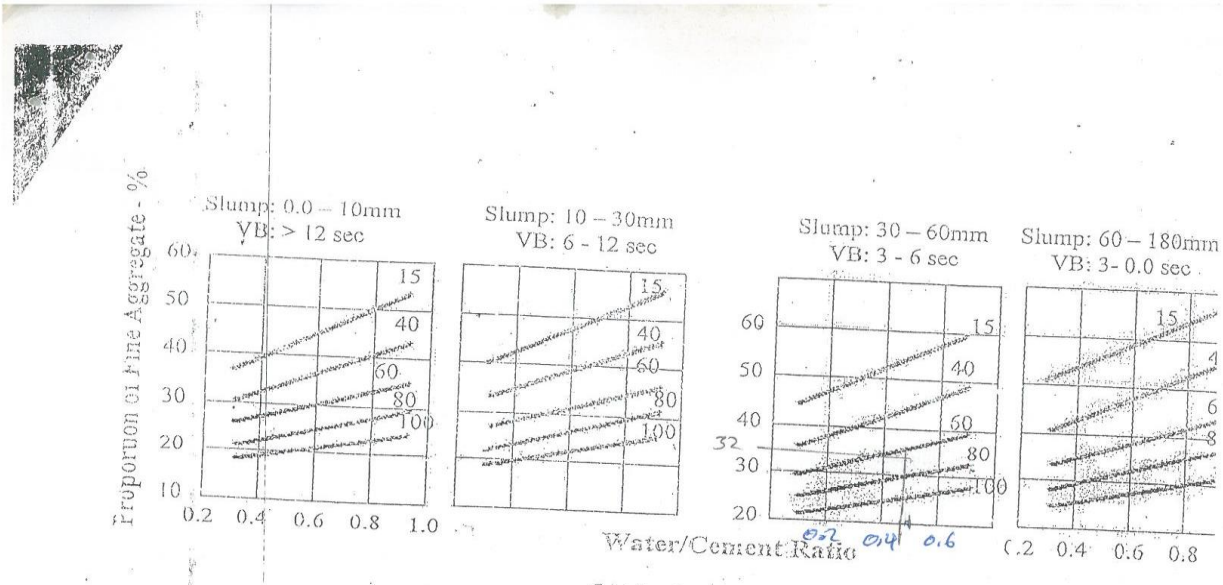


2.64 specific Gravity

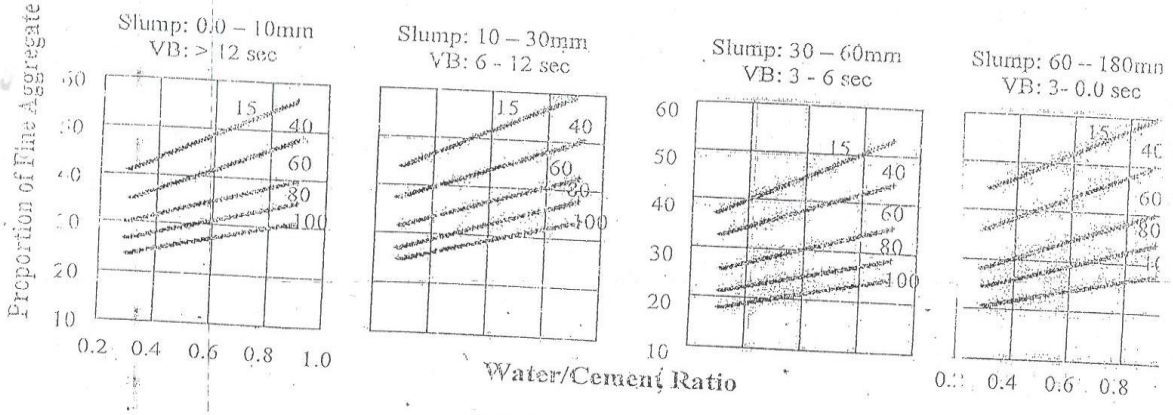
Fig 3 Estimated wet density for fully compacted concrete (Specific gravity is given for saturated and surface-dry aggregate)



(a) Maximum size 10mm



(b) Maximum size 20mm



(c) Maximum size 40mm

Fig. 4 Recommended proportion of fine aggregate (expressed as % of total aggregate) as a function of free water/cement ratio for various workabilities and maximum sizes (numbers refer to percentage of fine aggregate passing 600μm sieve)

Appendix (C)

Appendix (C-1)

Table M5 SCC (SP) (Hameed (2012))

SER NO	SP Trail dosage (%)	Slump flow (mm)
TR1	0.5	470
TR2	1	631
TR3	1.5	674
TR4	2.5	680
TR5	3	814

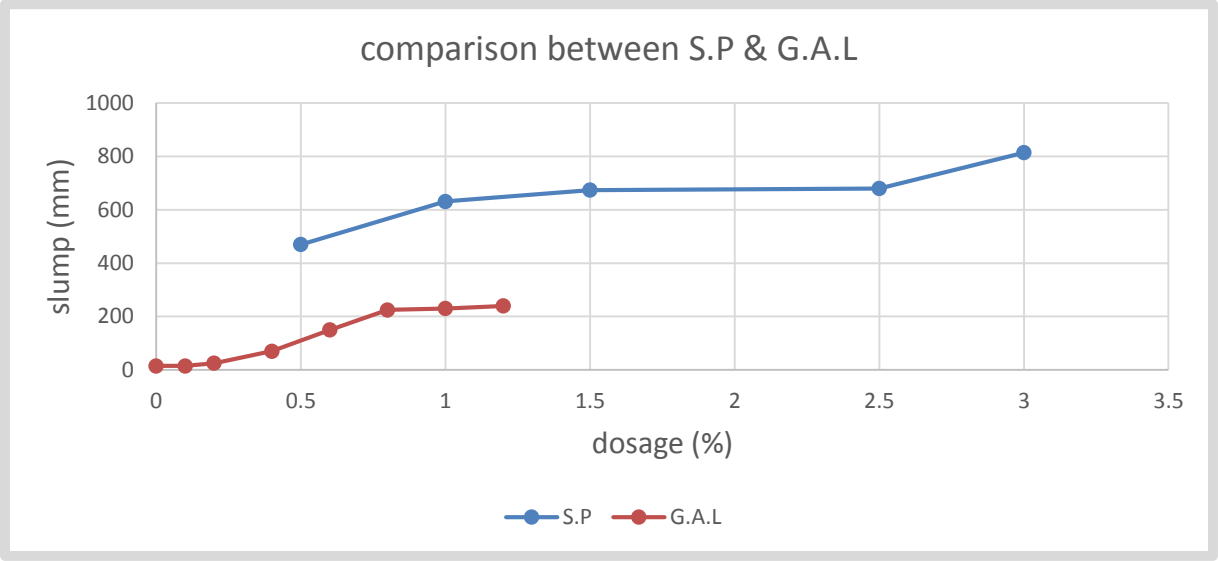


Fig Effect of super plasticizer & Gum Arabic liquid on slump

Appendix (C-2) :Table (M6) Gum Arabic Liquid Additive [AbdelJaleel et.al (2012)]

%G.A liquid	Compressive strength (N/mm2) 7days	Compressive strength (N/mm2) 21days	Compressive strength (N/mm2) 28days	Slump (mm)
0	30.5	34.7	36.8	15
0.1	30.5	34.5	36.5	15
0.2	30.2	34.2	36	25
0.4	27.5	32	34	70
0.6	27	31	33	150
0.8	26	30	31.5	225
1	22.13	26	28	230
1.2	17.3	24	26	240

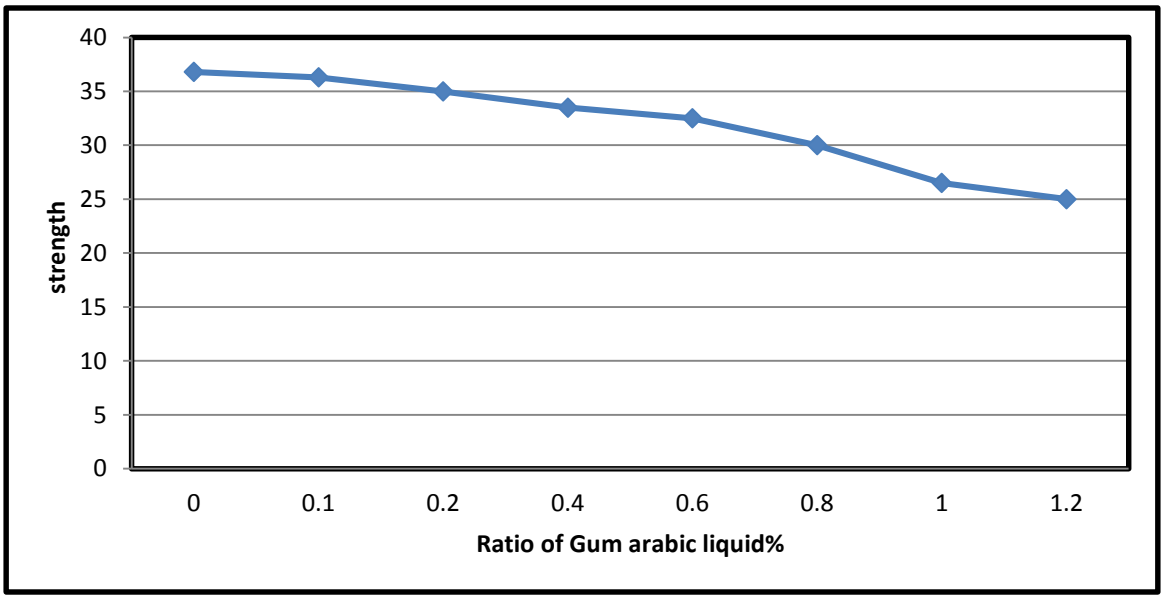


Fig (4.10): Relation between Gum Arabic liquid & strength

Appendix (D)

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Certificate of Crushing Strength for Concrete Cubes

Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-353
Date Report	5/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 0	6/2/2016	5/3/2016	150*150*150	8.431	966.3	42.95	40.22	specimen tested 28 days after casting
2	2	Mix 0	6/2/2016	5/3/2016	150*150*150	8.376	909.9	40.44		
3	3	Mix 0	6/2/2016	5/3/2016	150*150*150	8.723	838.7	37.27		

Tested By :

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Certificate of Crushing Strength for Concrete Cubes

Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-355
Date Report	5/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 1	6/2/2016	5/3/2016	150*150*150	8.166	747.9	33.24	37.55	specimen tested 28 days after casting
2	2	Mix 1	6/2/2016	5/3/2016	150*150*150	8.767	964.0	42.84		
3	3	Mix 1	6/2/2016	5/3/2016	150*150*150	8.366	823.0	36.58		

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Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-370
Date Report	7/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 2	8/2/2016	7/3/2016	150*150*150	8.324	929.3	41.30	42.74	specimen tested 28 days after casting
2	2	Mix 2	8/2/2016	7/3/2016	150*150*150	8.813	976.0	43.38		
3	3	Mix 2	8/2/2016	7/3/2016	150*150*150	8.315	980.0	43.56		

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Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16- 413
Date Report	15/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 3	8/2/2016	15/3/2016	150*150*150	8.376	946.3	42.06	40.91	specimen tested 36 days after casting
2	2	Mix 3	8/2/2016	15/3/2016	150*150*150	8.351	922.6	41.01		
3	3	Mix 3	8/2/2016	15/3/2016	150*150*150	8.439	892.5	39.67		

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Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-226
Date Report	13/2/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 0	6/2/2016	13/2/2016	150*150*150	8.419	732.4	32.55	34.05	specimen tested 7 days after casting
2	2	Mix 0	6/2/2016	13/2/2016	150*150*150	8.456	769.1	34.18		
3	3	Mix 0	6/2/2016	13/2/2016	150*150*150	8.264	797.2	35.43		

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Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-225
Date Report	13/2/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 1	6/2/2016	13/2/2016	150*150*150	8.399	793.3	35.26	35.83	specimen tested 7 days after casting
2	2	Mix 1	6/2/2016	13/2/2016	150*150*150	8.328	841.0	37.38		
3	3	Mix 1	6/2/2016	13/2/2016	150*150*150	8.399	784.0	34.84		

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Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-243
Date Report	15/2/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 2	8/2/2016	15/2/2016	150*150*150	8.247	680.0	30.22	37.10	specimen tested 7 days after casting
2	2	Mix 2	8/2/2016	15/2/2016	150*150*150	8.413	929.9	41.33		
3	3	Mix 2	8/2/2016	15/2/2016	150*150*150	8.495	894.6	39.76		

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Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-244
Date Report	15/2/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 3	8/2/2016	15/2/2016	150*150*150	8.360	674.2	29.96	26.19	specimen tested 7 days after casting
2	2	Mix 3	8/2/2016	15/2/2016	150*150*150	8.275	472.5	21.00		
3	3	Mix 3	8/2/2016	15/2/2016	150*150*150	8.486	620.8	27.59		

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Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-285
Date Report	23/2/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix T4	15/2/2016	23/2/2016	150*150*150	8.255	519.5	23.09	22.56	specimen tested 8 days after casting
2	2	Mix T4	15/2/2016	23/2/2016	150*150*150	8.410	522.8	23.24		
3	3	Mix T4	15/2/2016	23/2/2016	150*150*150	8.425	480.2	21.34		

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Name of Client	طارق أحمد
Project Name	بحث ماجستير
Location	الخرطوم
Report No.	ESD C16-355
Date Report	5/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 1	6/2/2016	5/3/2016	150*150*150	8.166	747.9	33.24	37.55	specimen tested 28 days after casting
2	2	Mix 1	6/2/2016	5/3/2016	150*150*150	8.767	964.0	42.84		
3	3	Mix 1	6/2/2016	5/3/2016	150*150*150	8.366	823.0	36.58		

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Location	الخرطوم
Report No.	ESD C16-353
Date Report	5/3/2016
Test Method	BS 1881 :Part 116 : 1983

Specimen Identification (ID)		Specimen Data					Failure Load (KN)	Compressive Strength (N/mm²)		Remarks
Lab. ID	Client ID	Specimen Location	Date of Cast	Date of Test	Dimensions (mm)	Weight (kg)		Specimen	Sample (Aver.)	
1	1	Mix 0	6/2/2016	5/3/2016	150*150*150	8.431	966.3	42.95	40.22	specimen tested 28 days after casting
2	2	Mix 0	6/2/2016	5/3/2016	150*150*150	8.376	909.9	40.44		
3	3	Mix 0	6/2/2016	5/3/2016	150*150*150	8.723	838.7	37.27		

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Technical Datasheet

SeraPlast SP901

Superplasticizer and high range water reducer for the production of superior strength concrete

Product Description

SeraPlast SP901 is a napthalene sulphonate based liquid superplasticizer for high performance concrete. SP901 is specially formulated to impart high workability to concrete mixes. SP901 converts stiff concrete to flowable concrete due to its high workability. Performances of SP901 also gives excellent slump, retention properties without effecting the final setting time. Hence use of SP901 gives high workability, good slump retention. SP901 thus could effectively be used for hot weather concreting.

SP901 could be used to affect considerably water reduction resulting high performances both in plastic and hardened state of concrete.

SP901 is a powerful dispersant and the deflocculating action helps to produce high performing concrete where durability and high strength are the major requirement. High dispersing action of SP901 produces high flow concrete, which will reduce the need for compaction. SP901 can be used for self-compacting concrete very effectively.

Areas of Application

- When high flow concrete is required.
- Production of durable and low permeable concrete.
- Fumed silica and PFA modified concrete.
- Concrete with GGBS (Ground Granulated Blast Furnace Slage).
- Hot weather concreting.
- Long haul concrete.
- For high workability, super flow with pumping

Benefits

- High workability and superior flow properties reduce the need for compaction.
- Workability retention for longer period helps hot weather and long haul concreting.
- Suitable for highly reinforced and Precast Prestressed Concrete duo to the high flow characteristics and also it is chloride free.
- Low water cement ration results in high ultimate

Compatibility

SP901 is compatible with all types of portland cements, SRC cements and other cementations materials including PFA, GGBS and Microsilica.

SP901 is compatible with all SERAPHIM concrete admixtures. The admixture should be added separately to the concrete mix. Do not mix different admixtures prior to addition.

Technical Properties

Specific Gravity	1.22 ± 0.03 @25°C
Appearance	Dark Brown Liquid
Air Entrainment	Does not entrain air voids
Chloride Content	Nil - Tested to B.S 5075
Freezing	0°C, Mix Prior to Use

Specification Type

SP901 confirms to ASTM C-494- Type F & G, B.S 5075 – Part 1 ASTM C 1017

Dosage

Recommended dosage range is 0.2 - 2.5 % of mass cement. The actual dosage rate applied can exceed the recommended dosage range on common mix designs and should be determinated in preliminary tests.

Method of Addition

SP901 is supplied as a ready to use brown liquid. SP901 can be added to concrete in the mixing cycle after the addition of 90% water – or can be added along with the gauging water. Care must be taken not to add SP901 to dry mix. SP901 can also be added a few minutes before the actual pouring concrete.

Effects of Overdose

Results in increased workability, Slightly higher entrainment, Delayed setting.

Reason for over dosage must be ascertained to avoid recurrence. Anyway, over dosing will not adversely affect the overall performance of the concrete mix, provided proper curing to be done. Also form work removal should be delayed to allow the setting. In most cases the compressive strength is more than compared to the normal concrete.

SP901 preferably dispensed by using automatic dispensing equipment.

Health and Safety

SP901 is non-hazardous. It is always advisable to avoid contact with skin or eyes. If contact with skin wash with water. Wear protective goggles and hand gloves while handling. If swallowed seek immediate medical attention.

Packaging and Storage

SP901 is available in 210 Litre and in bulk to site installed storage tanks. SP901 should be stored in cool, shaded ware houses. Shelf life is 12 months.

Before using, homogenize sample by shaking or mixing with a mixer.

After thawing, the product must be used after mixing.

Appendix(E)

(a)Weight of sp901 (b) Weight of aggregate

Appendix(E.1):Weight of concrete mix components

Appendix (E.2): Mixing of concrete components

Appendix (E.3): Slump test

Appendix (E.4)a: measure of diameter

Appendix (E.4)b: measure of diameter in other direction

Appendix (E.5)a: Cube test

Appendix (E.5)b: Compressive strength test