Case Study on Dubai Towers Doha

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Case Over View

- Employing the latest technology of high strength concrete, fast track construction methodology, and materials to ensure an efficient construction process.

- Elaborating on elements such as,

- high strength concrete, Use of high strength concrete of grade 75N and 90N in the super structure of Dubai Towers-Doha, and use of additives in concrete mix design.

- using jump formworks, composite concrete and steel elements, pre-cast floor planks on steel beams, post tensioned slabs.

- Use of advanced technology of material and equipments in the project.

- Over view on site management, manpower training and development of team management skills in the project

What is high strength concrete?

- According to BS EN 206 , High strength concrete ,any concrete with a specified compressive strength of 50 MPa.

- According to ACI 363 “High Strength Concrete,” any Concrete with a specified compressive Strength of 6000 psi (41 MPa) or greater is high strength concrete.

- The Canadian code currently defines high strength concrete as any concrete with a compressive strength exceeding 10,000 psi.(69 MP)

What is high strength concrete?

It is important to know two things about high-strength concrete.

- High strength concrete is just one type of high-performance concrete.

- high flexural strengths,
- high durability benefits,
- high skid resistance,
- high abrasion resistance,
- And super-flat characteristics

- The ability to produce this type of concrete without difficulty requires a higher level of sophistication and skill than is considered necessary for more conventional 3000-psi (20 MPa) and 4000-psi (25 MPa) concrete mixes.

Why do we need high strength concrete?

- To put the concrete in to service at much earlier age, such as open the concrete pavement for traffic at 3 days age.
- To build high rise buildings by reducing the columns sizes and increasing the available space
- To build the super structure of long span bridges and to enhance the durability of bridge decks.
- To satisfy the specific needs of special applications such as durability, modulus of elasticity and flexural strength

Design high strength concrete mixture.

- **The basic concepts that needed to be under stood for high strength concrete are;**

- The aggregate.
- The cementitious materials
- The Water Demand

The Aggregate.

The type of aggregate

- The type of aggregate must be assessed. Experience has shown that for high-strength concrete, well-washed, rounded gravels tend to work better than crushed coarse aggregates. I believe this is due to the fact that most crushed aggregates are stockpiled without being thoroughly washed. The crusher dust coats each rock particle provides a bond breaker between the cement paste and the rock it self. Although the crushed aggregate tend to give higher strength than rounded due to better mechanical bound due to its angular shape.

The Aggregate.

Aggregate compatibility

- Aggregates should be strong and durable. The need not necessarily be hard and of high strength but need to be compatible.

The Aggregate.

Aggregate size.

- Generally smaller maximum size aggregate is used for higher strength concrete (20 mm to 9 mm). The sand may have to be coarser than that permitted by ASTM C33 (fineness modulus greater than 3.2) because of the high fines content from the cementitious materials, By using a coarser sand and allowing the fines to come from the cementitious materials, high-strength mixes can be very effectively balanced. It is important to use as little sand as possible.

The cementitious materials.

Cement type

- Using cement from different sources will provide a level of variation far in excess of that which would come from a single source.
- High strength concrete mixture will have high cementitious materials content. That increases the heat of hydration and possibly higher shrinkage leading for the potential for cracking. Most mixtures contain one or more supplementary cementitious material such as fly ash (class C or F) ground granulated blast furnace slag, silica fume, metakaolin .

The cementitious materials.

Fly ash

- Fly ash is an important component of any high-strength concrete mix. Fly ash works as a water reducer. It also works to keep the ultimate heat of hydration down. Fly ash works to make the overall mix easier to batch, discharge, pump, and place. Normally.
- It is important to use a good quality fly ash to reduce mix variability and to ensure that the fresh properties of the concrete remain constant.

The cementitious materials.

Silica fume.

- Silica fume may be used in the mix. Typically, mixes that have strengths in excess of 15,000 psi (100 MPa), will have silica fume. Typical dosage rates range between 7% and 10%, by weight of cement.
- The total cementitious material content will be typically around 415 kg/m3 but should not be more than 650 kg/m3.

Water Demand.

Water Cement Ratio.

- The key to properly designing high strength concrete mixes is successfully lowering the water-cement ratio while still maintaining workable. W/C ratios can be in the range of 0.23 to 0.35. These low w/c ratios are only attainable with quite large doses of high range water reducing admixture (or super plasticizers) conforming to type F or G by ASTM C 494. A type water reducer may be used in combination.

Water Demand.

Surface area

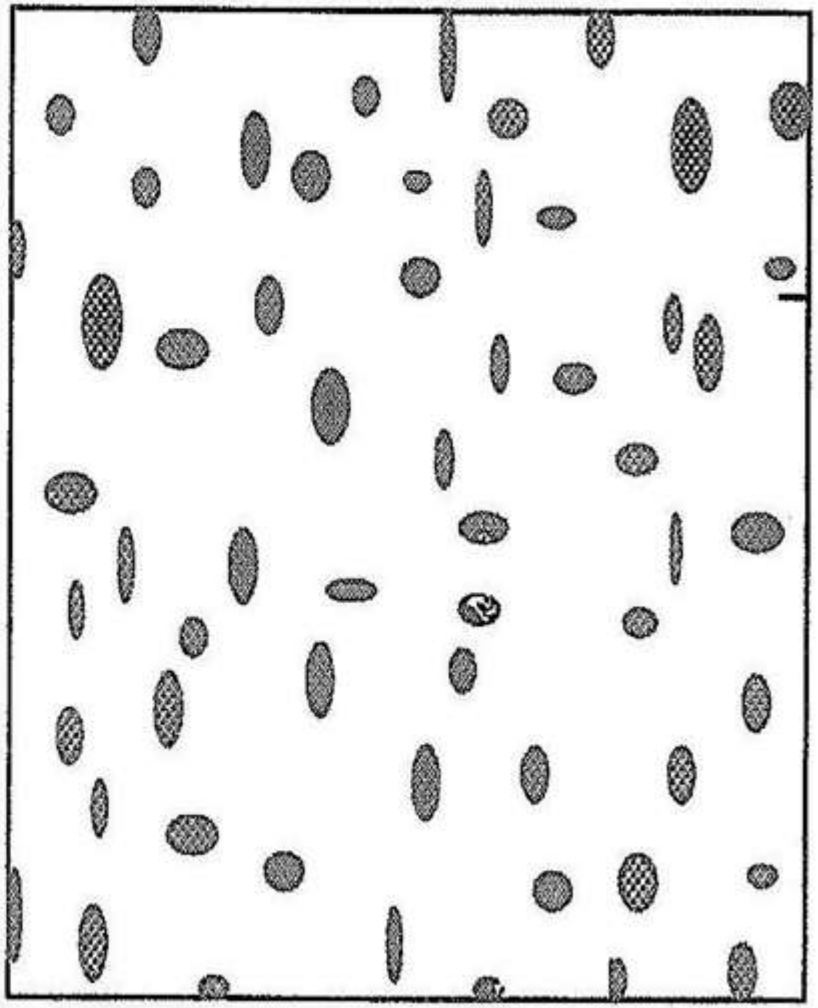
- The total surface area of the constituents and particle shape has a profound effect on the water demand. The sand has the greatest impact on the water demand of a concrete mix. This is because the total surface area of the sand particles is substantially greater than the other mix constituents. Additionally, sand with more fine particles will have substantially more total surface area than will coarser sand. Sand with a fineness modulus of 2.6 will have a significantly greater water demand than similar sand with a fineness modulus of 3.2

Water Demand.

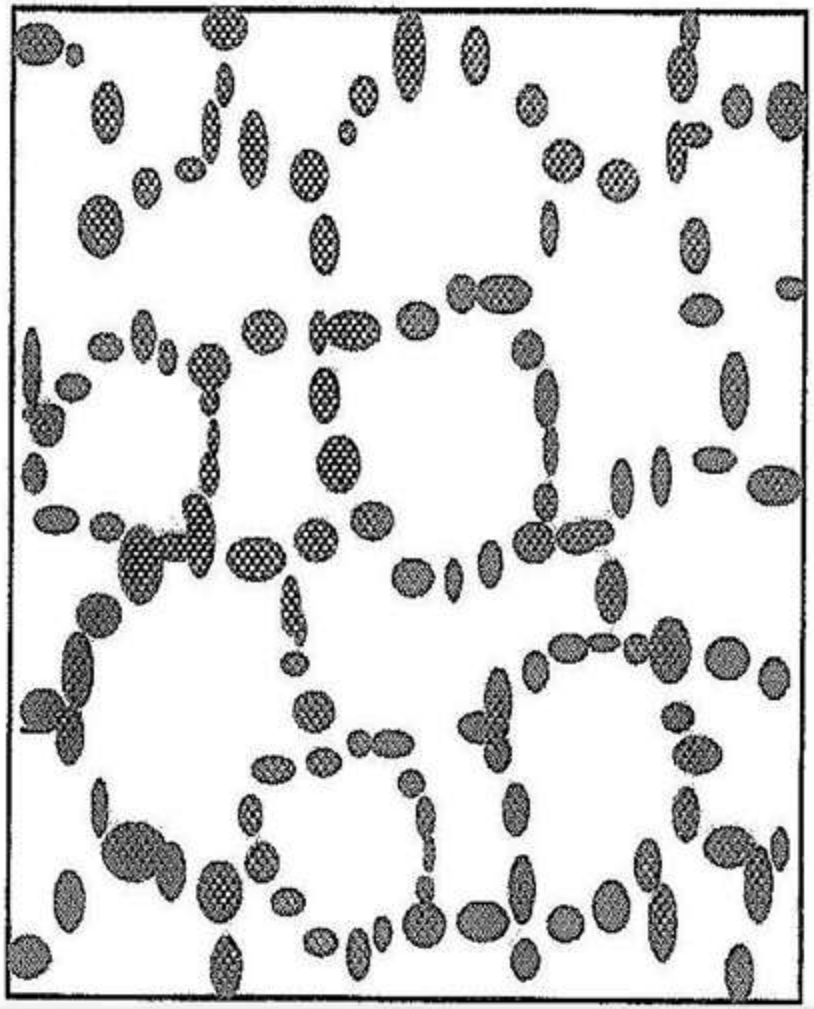
Particle shape.

- Particle shape also plays a significant role in water demand. A crushed material has much sharper edges than a rounded material. Consequently, the crushed aggregate particles will require more water than the rounded aggregate. Crushed aggregates are also normally covered with residue from the crushing process (crusher dust). This dust has a tendency to increase water demand and impairs the ultimate bonding between the cement paste and the aggregate particle.

Concrete chemical admixtures



cement molecules distribution when mixed with water and admixtures



cement molecules distribution when mixed with water only

Fosroc Structuro W450A

Superior high performance concrete hyperplasticiser based on polycarboxylate technology Self compacting concrete

- Pumped concrete
- Concrete requiring long workability retention
- High performance concrete
- Pre-cast concrete

Fosroc Conplast P505 High performance, slump retaining and water reducing admixture

- To improve the effectiveness of the water content of a concrete mix.
- At higher dosages to provide cost effective means of reducing concrete permeability and thereby reducing water penetration

Fosroc Conplast RP264
Retarding water reducing admixture

- To improve the effectiveness of the water content of a concrete mix.
- To help maintain the workability of ready mixed concrete deliveries in hot weather.
- To extend working times of concrete.
- Particularly suitable for use in mixes with low cohesion.

Fosroc Conplast SP430 High performance superplasticising admixture

- To provide excellent acceleration of strength gain at early ages and major increases in strength at all ages by significantly reducing water demand in a concrete mix.
- Particularly suitable for precast concrete and other high early strength requirements.
- To significantly improve the workability of site mixed and precast concrete without increasing water demand.
- To provide improved durability by increasing ultimate strengths and reducing concrete permeability.

Sikament®-R4QV High Range Water-Reducing and Slump Retaining Concrete Admixture

- highly effective liquid superplasticizer for the production of free flowing concrete.
- substantial water-reducing agent.
- promoting high strengths.
- excellent slump retention for prolonged periods.

Sika® ViscoCrete® 3110 Ultra High Range Superplasticiser and Self Compacting Concrete (SCC) Admixture

- high performance / high strength concrete
- retained workability for extended periods
- extremely high water-reducing capacity
- self-compacting concrete
- high standard of surface finish.

GLENIUM® 110M
A high performance concrete superplasticiser based on modified polycarboxylic ether

- The excellent dispersion properties of GLENIUM® 110M make it the ideal admixture for precast and ready mixed concrete where low water cement ratios are required.
- allows the production of very high early and high ultimate strength concrete with minimal voids and therefore optimum density.

GLENIUM® 118
Polycarboxylic ether based superplasticizer for the production of high quality ready-mix concrete

- Delivering high performance concrete.
- Production of a concrete with low water cement ratios.
- Excellent workability retention properties.

performance requirement for Concrete Dubai Towers-Doha

High durability mix

Purpose	Piles	Raft, Diaphragm Walls, Pile Caps	Tower Columns /Tower Cores (lower levels)
Min CCS at 28 Days To BS8110 (MPa)	75	75	90
Concrete Mix	GGBS+OPC+SF/ PFA+OPC+SF	WPC	GGBS+OPC /PFA+OPC
Max Rapid Chloride Permeability to AASHTO T277 (Coulombs)	1000	800	1200
Max Water Permeability to DIN 1048 (mm)	10	8	10
Max Initial Surface Absorption to BS 1881 Part 208 (ml/m2/s)	0.15	0.02	0.15
30 min Water Absorption to BS 1881 Part 122 (%)	1.5	1.0	1.5
Max Drying Shrinkage to BS 812 Part120 (%)	0.04	0.04	0.04
Min Cement Content (kg/m3)	400	400	440
Max Water/Cement Ratio	0.38	0.38	0.38

75 MPa concrete mix Design for tower raft. Dubai Towers-Doha

75 MPa

CONCRETE MIX DESIGN

Contractor	M/s:	Al Jaber-Al Habtoor (J.V.)	Date :	09, April 2007
Consultant	M/s:	RMJM	Project :	Dubai Tower @ Doha
Designer	M/s:	Hyder	Mix Code :	JH07047C7520RPT5DC1
Client	M/s:	Sama Dubai	D.N. Mix Code:	
Q.C. Lab.	M/s:	A.C.T.S.	Item :	Raft Foundation

Mix Class :	75/20	450	kg/m3	Slump Flow :	600 +/- 50 mm			
Cement Type :	OPC+FA+MS			Add 1 :	RM 54	(	7	)+/- 1 Kg/m3
W/C :	0.25			Add 2 :	UW404	(	0	)+/- 1 Kg/m3

All in Fine Material Grading

Material	20-10 mm Cr. Agg.	10-5 mm Cr. Agg.	5-0 mm Nat. Sand	5-0mm Cr2. Sand	0.6-0 mm D. Sand	Calc. Line	Target Line	Upper Limit	Down Limit
Source	Fuj	Fuj	QNCC	Fuj	Sea Line	20-0 mm	20-0 mm	20-0 mm	20-0 mm
S.G	2.93	2.90	2.58	2.46	2.55	Comb.	BS 882 : 1992		
Sieve (mm.)									
38.1	100	100	100	100	100	100	100	100	100
25	100	100	100	100	100	100	100	100	100
20	95	100	100	100	100	98.5	97.5	100	95
14	44	100	100	100	100	83.2	0	0	0
10	14	92	100	100	100	72.0	71	78	64
5	3	13	100	91	100	46.5	45	55	35
2.36	0	2	99	35	99	42.1	0	0	0
1.18			92	7	92	38.6	0	0	0
0.6	0	0	70	4	70	29.4	22.5	35	10
0.3			30	2	30	12.6	0	0	0
0.15	0	0	7	1	7	2.9	5	10	0
0.075	1.2	0.8	1.4	0.8	1.4	1.2	2.5	5	0
Percentage	30	28	42	0	0	Total = 100			

Option Number (5) - (40% Fly Ash)

Option Number (5) - (40% Fly Ash)

75MPa

Selection of Concrete Mix Proportion

Material	Vol. lit/cbm	SSD Weight kg/cbm	Moist. %	Absorp. %	Correc. kg/cbm	Oven Dry Weight kg/cbm
Cement	74.6	235				235
Water	112.5	113				134
3/4" Cr. Agg.	208.5	611	0	0.89	-5.4	606
3/8" Cr. Agg.	194.6	564	0	0.8	-4.5	560
3/16" Natural Sand1	291.9	753	0	1.5	-11.3	742
3/16" Cr. Sand2	0.0	0	0	1.8	0.0	0
Dune Sand	0.0	0	0	0.55	0.0	0
Additives	5.8	7				7
M. Silica	15.9	35				35
Fly Ash 40%	81.1	180				180
FC30 (70%OPC + 30% FA)	0.0	0				0
Air Voids	15.0	0				0
Total	1000.0	2498			-21	2498

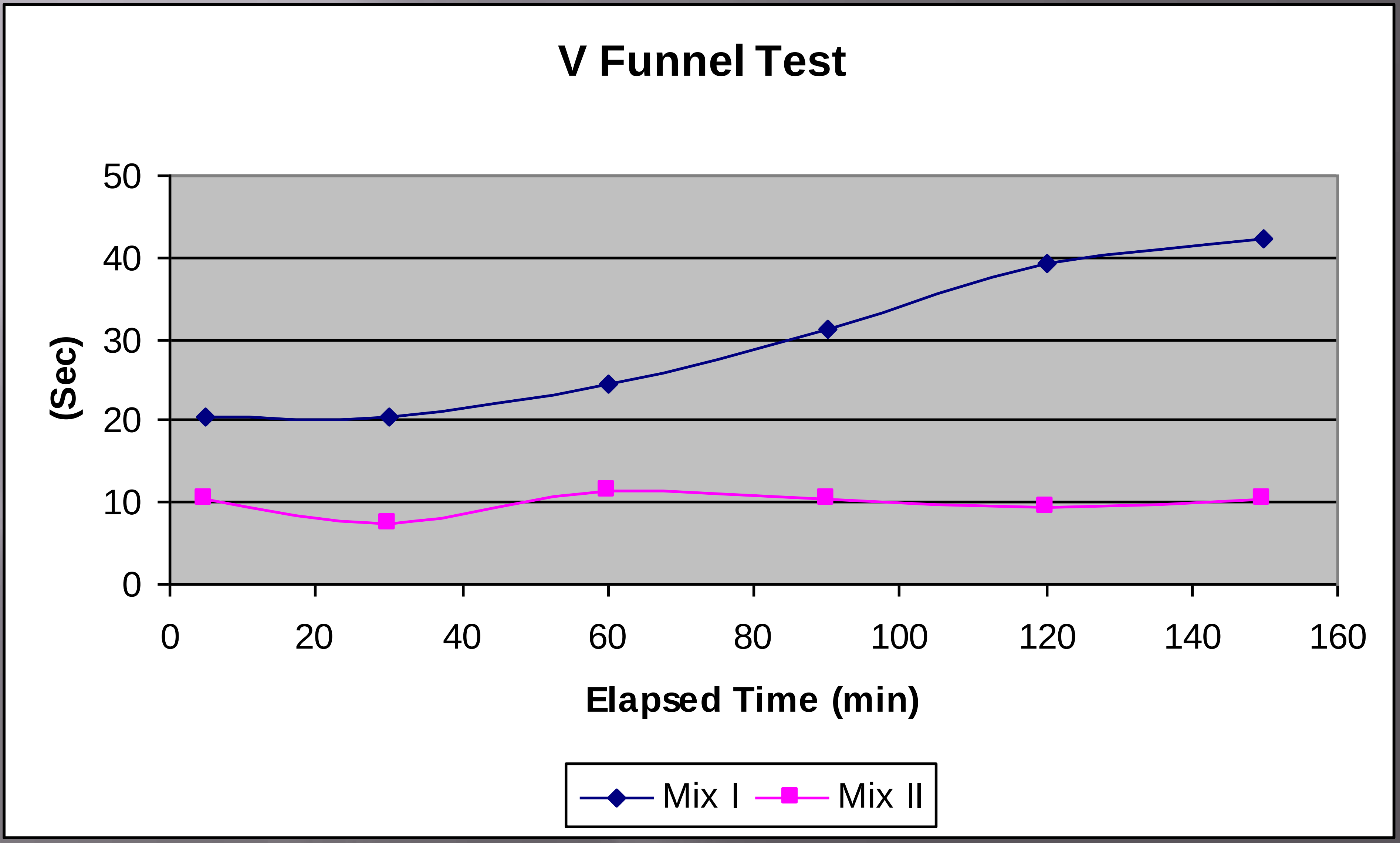
1. Concrete cube specimen to be sampled, made, water cured and tested as per the B.S specification
2. Concrete Specimens for strength to be evaluated @ 90 days ages.
3. Concrete temperature maxi. 32 °C at placement time.
4. Durability tests if required shoulb be at 56 days cubes age.

90 MPa concrete mix Design for vertical elements and core walls. Dubai Towers-Doha.

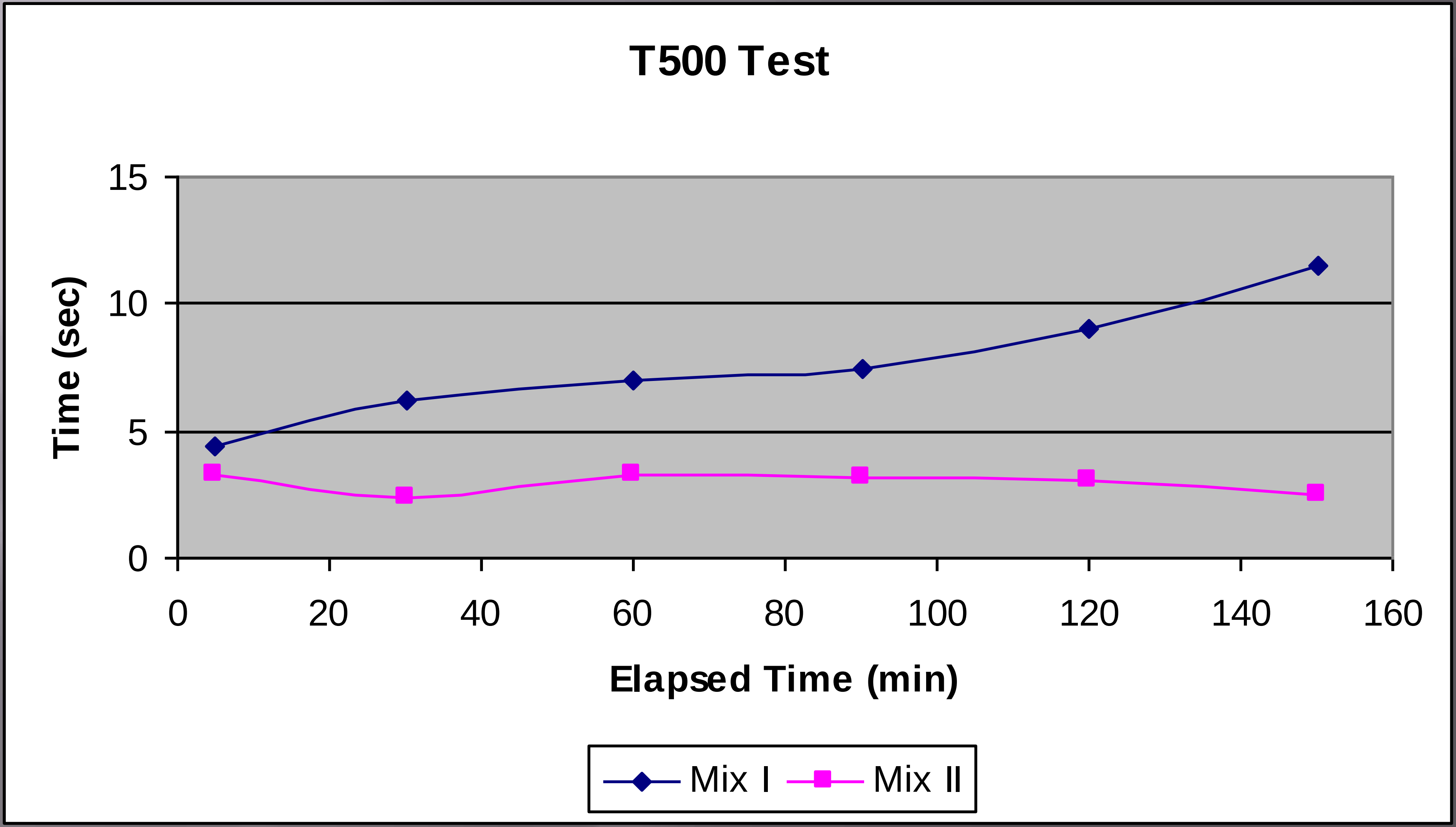
90 MPa Concrete mixes for different heights

Mix Description	Mix I (low level)	Mix II (high Level)
Total cementitious, (Kg)	500	550
W/C Ratio	0.25	0.27
Max. Aggregate (mm)	20	10
Type of Aggregate	Limestone	Limestone
Silica Fume, (Kg)	40	55
P.F.A, (Kg)	138	95
OPC, (Kg)	322	400
20 mm (kg)	528	0
10mm, (Kg)	473	892
Sand1, (Kg)	804	503
Sand2, (Kg)	0	310
PC	7.5	0
VMA110	0	8.0

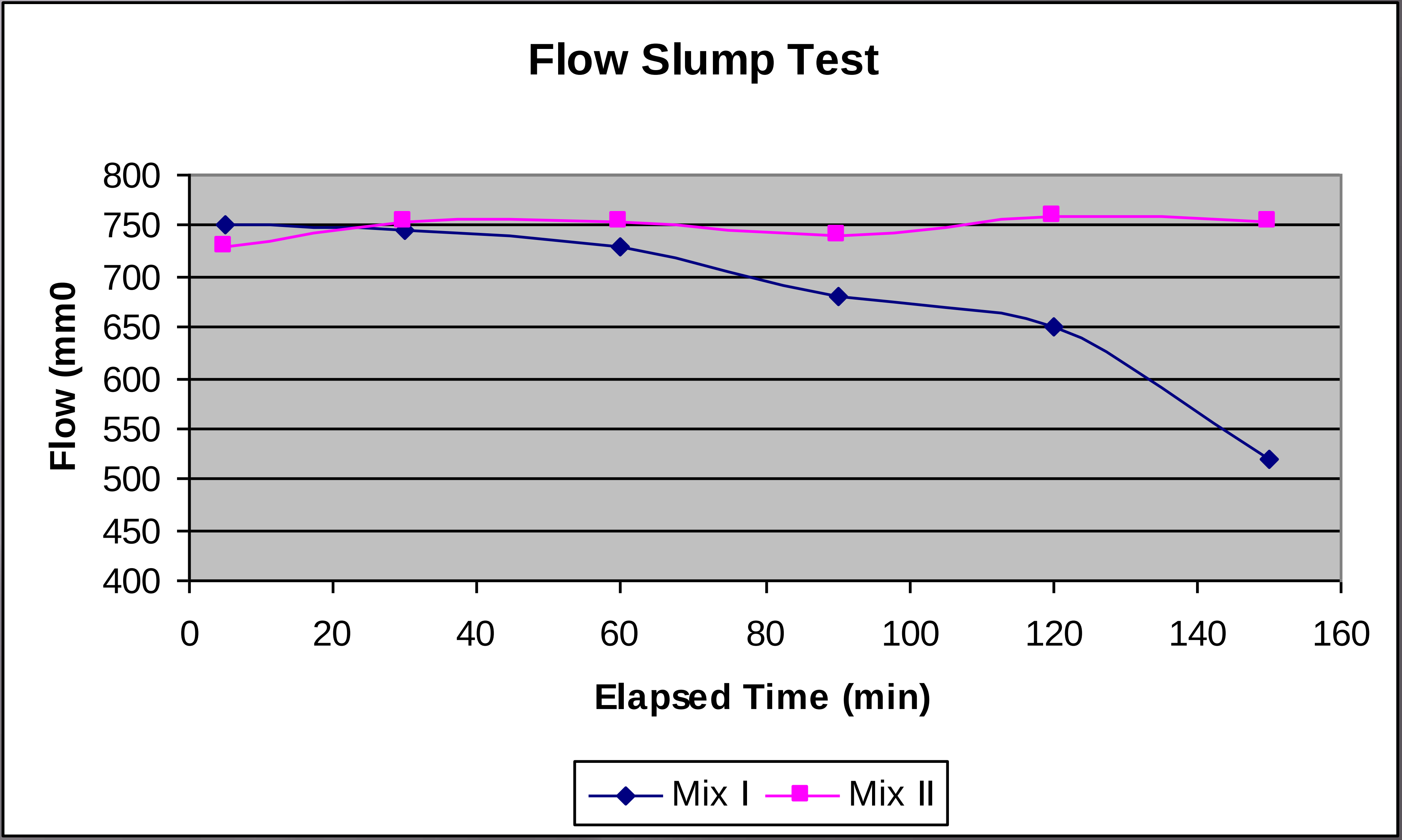
Tests on Fresh Concrete



Tests on Fresh Concrete



Tests on Fresh Concrete



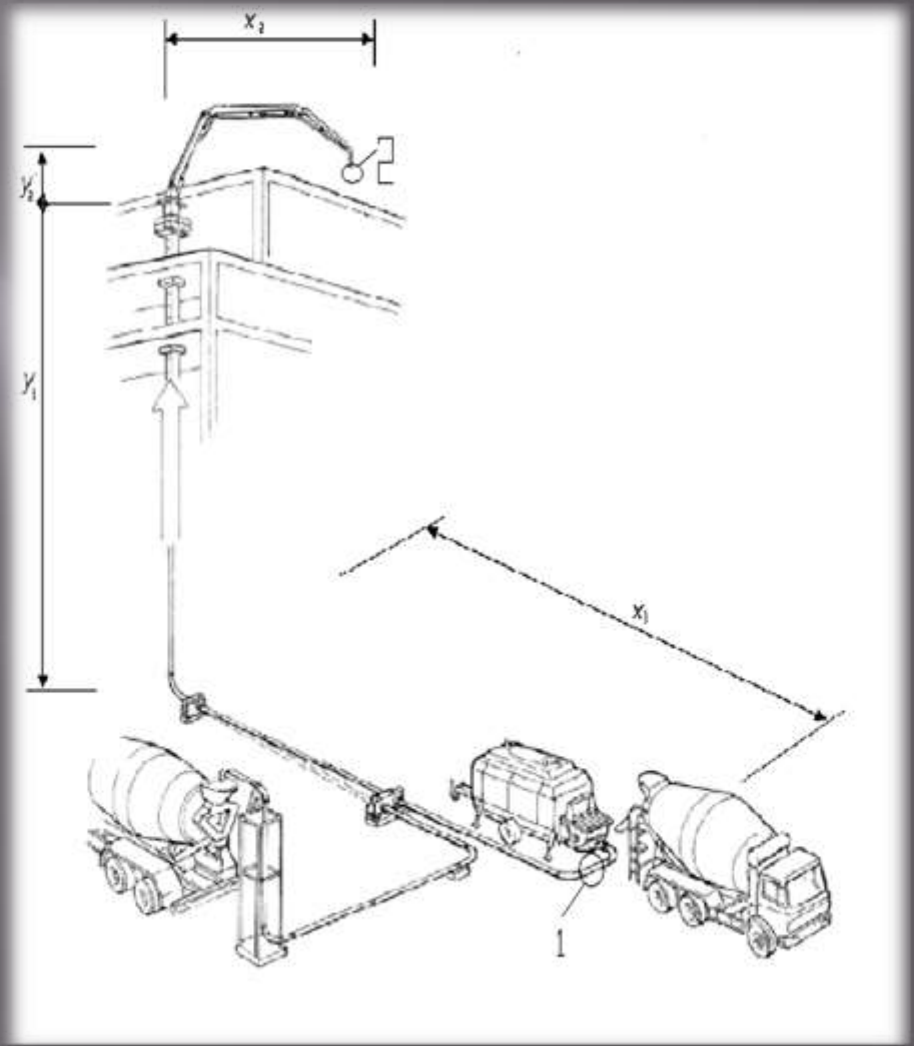
Concrete slump test

Concrete mix and pressure requirement

Note; pump max hydraulic capacity 350 Bars & Pipes max capacity 200 Bars	Mix I		Mix II	
	Pump output (Q)	Concrete Pressure	Pump output (Q)	Concrete Pressure
Values from trials at Height=113m	$32.1 m^3/hr$	155 bar	$55.4 m^3/hr$	92 bar
Calculated values for Height=250m	$30 m^3/hr$ (min. requirement)	*250 bar	$30 m^3/hr$ (min. requirement)	91.5 bar
Hydraulic Pressure required to pump $30 m^3/hr$ at Height=250m.	480 bar 37% more than pump maximum capacity		195 bar 75% of pump maximum capacity	

Pressure calculations

Pressure calculation is based on two positions of pumping system first position is current high (Y1+Y2 = 113m) second position is the target high (Y1+Y2 = 250m)



Concrete pumping station

90MPa Hardened Concrete Properties

TEST	STANDARD	RESULT
Strength at 1 Day (MPa)	BSEN	38.7
Strength at 7 Days (MPa)	BSEN	74.5
Strength at 28 Days (MPa)	BSEN	95
Strength at 56 Days (MPa)	BSEN	104
Flexural Strength at 28 days	BSEN	8
Chloride Content (%)	ASTM	0.01
Sulfate Content (%)	ASTM	0.39
Modulus of Elasticity at 7 Days	ASTM	42.0

90 MPa

CONCRETE MIX DESIGN

Contractor	M/s:	Al Jaber-Al Habtoor (J.V.)	Date	:	27, July 2008
Consultant	M/s:	RMJM	Project	:	Dubai Tower @ Doha
Q.C. Lab.	M/s:		Mix Code	:	
Client	M/s:	Sama Dubai	D.N. Mix Code:		
			Item	:	Columns and Core Walls Lower Level - Tower

Mix Class :	90/20	570 kg/m3	Slump :	Flow 600 +/- 50 mm		
Cement Type :	OPC +F.A. + M.Silica		Add 1 :	Stream 2	(1	)+/- 1 Kg/m3
W/C :	0.27		Add 2 :	SKY 504	(7	)+/- 1 Kg/m3

All in Fine Material Grading

Material	20-10 mm Cr. Agg.	10-5 mm Cr. Agg.	5-0 mm Nat. Sand	5-0mm Cr2. Sand	0.6-0 mm D. Sand	Calc. Line	Target Line	Upper Limit	Down Limit
Source	Limestone	Limestone	QNCC	L.S.	N/A	20-0 mm	20-0 mm	20-0 mm	20-0 mm
S.G	2.7	2.70	2.65	2.66	0	Comb.	BS 882 : 1992		
Sieve (mm.)									
38.1	100	100	100	100	0	100	100	100	100
25	100	100	100	100	0	100	100	100	100
20	84	100	100	100	0	100.0	97.5	100	95
14	24	100	100	100	0	100.0	0	0	0
10	2	86	100	100	0	93.4	71	78	64
5	0.3	10	100	99	0	57.7	45	55	35
2.36	0	2	97	60	0	52.4	0	0	0
1.18			92	35	0	48.8	0	0	0
0.6	0	0	74	22	0	39.2	22.5	35	10
0.3			27	14	0	14.3	0	0	0
0.15	0	0	4	9	0	2.1	5	10	0
0.075	0.2	0.4	0.4	6	0	0.4	2.5	5	0
Percentage	0	47	53	0	0	Total = 100			

90 MPa

Selection of Concrete Mix Proportion

laterial	Vol. lit/cbm	SSD Weight kg/cbm	Moist. %	Absorp. %	Correc. kg/cbm	Oven Dry Weight kg/cbm
ement	120.6	380				380
Vater	149.9	150				158
/4" Cr. Agg.	0.0	0	0	0.4	0.0	0
/8" Cr. Agg.	292.3	789	0	0.4	-3.2	786
/16" Natural Sand1	329.7	874	0	0.6	-5.2	868
/16" Cr. Sand2	0.0	0	0	4	0.0	0
une Sand	0.0	0	0	0	0.0	0
dditives	6.7	8				8
. Silica	22.7	50				50
ly Ash 25%	63.1	140				140
C30 (70%OPC + 30% FA)	0.0	0				0
ir Voids	15.0	0				0
otal	1000.0	2391			-8	2391

. Concrete cube strength,to be sampled, made,water cured and tested as per the B.S specification

. Concrete temperature maxi. 32 °C at placement time.

. Durability tests if required shoulb be at 56 days cubes age.

. Concrete Specimens for strength test to be evaluated @ 56 days ages.

Casting concrete Grade 75 MPa in piles

Potential Quality risks.

- **The Major Quality risks we faced to secure high Quality concrete in piles.**

1. To avoid the wash out of the concrete paste by the under ground water during casting process.
2. To avoid contamination of sediments material with fresh concrete.
3. Several casted piles did not meet the specified durability requirement.

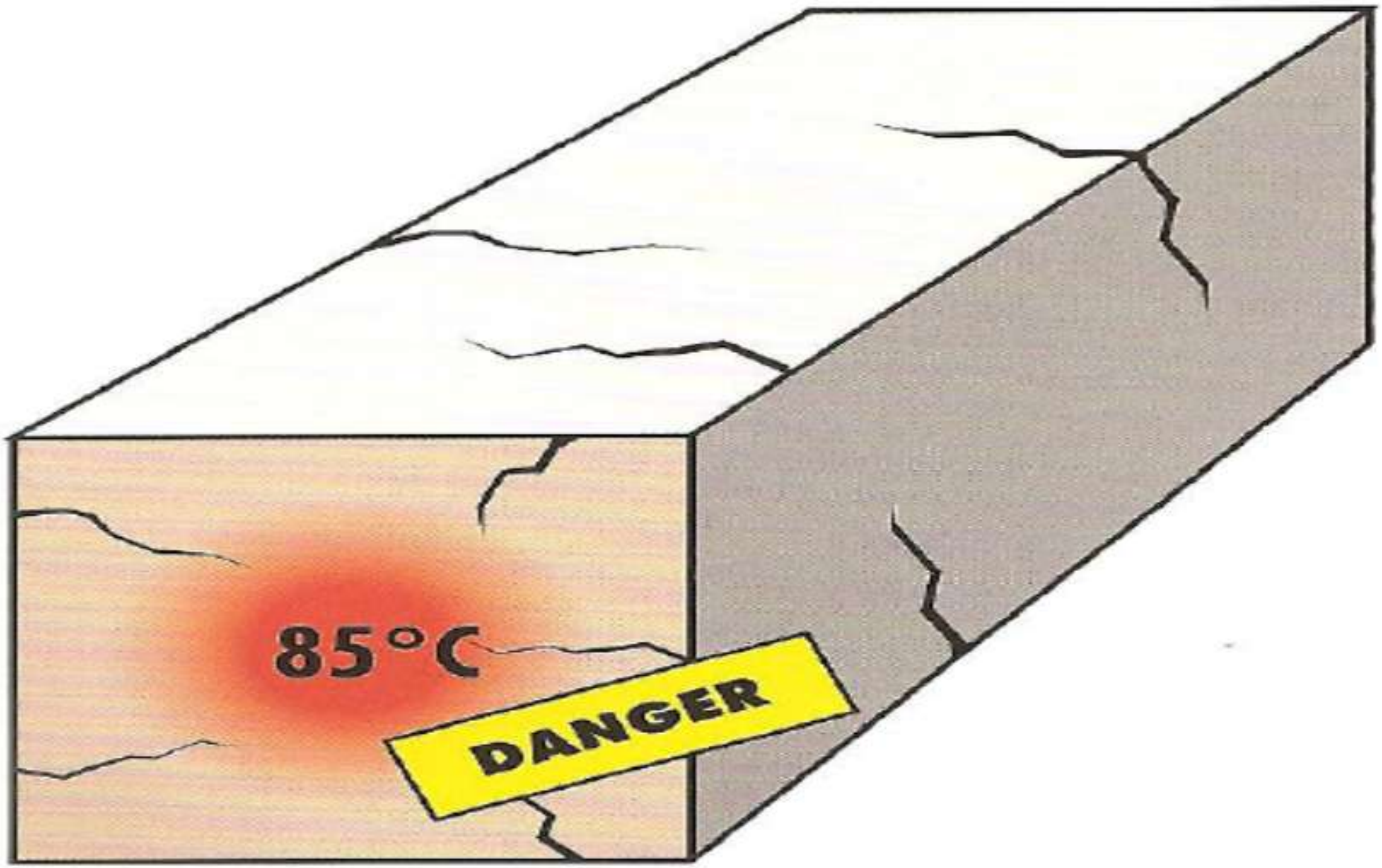

CAT

Cast of tower raft of 15000m3 continuous non stop in 90 hrs.

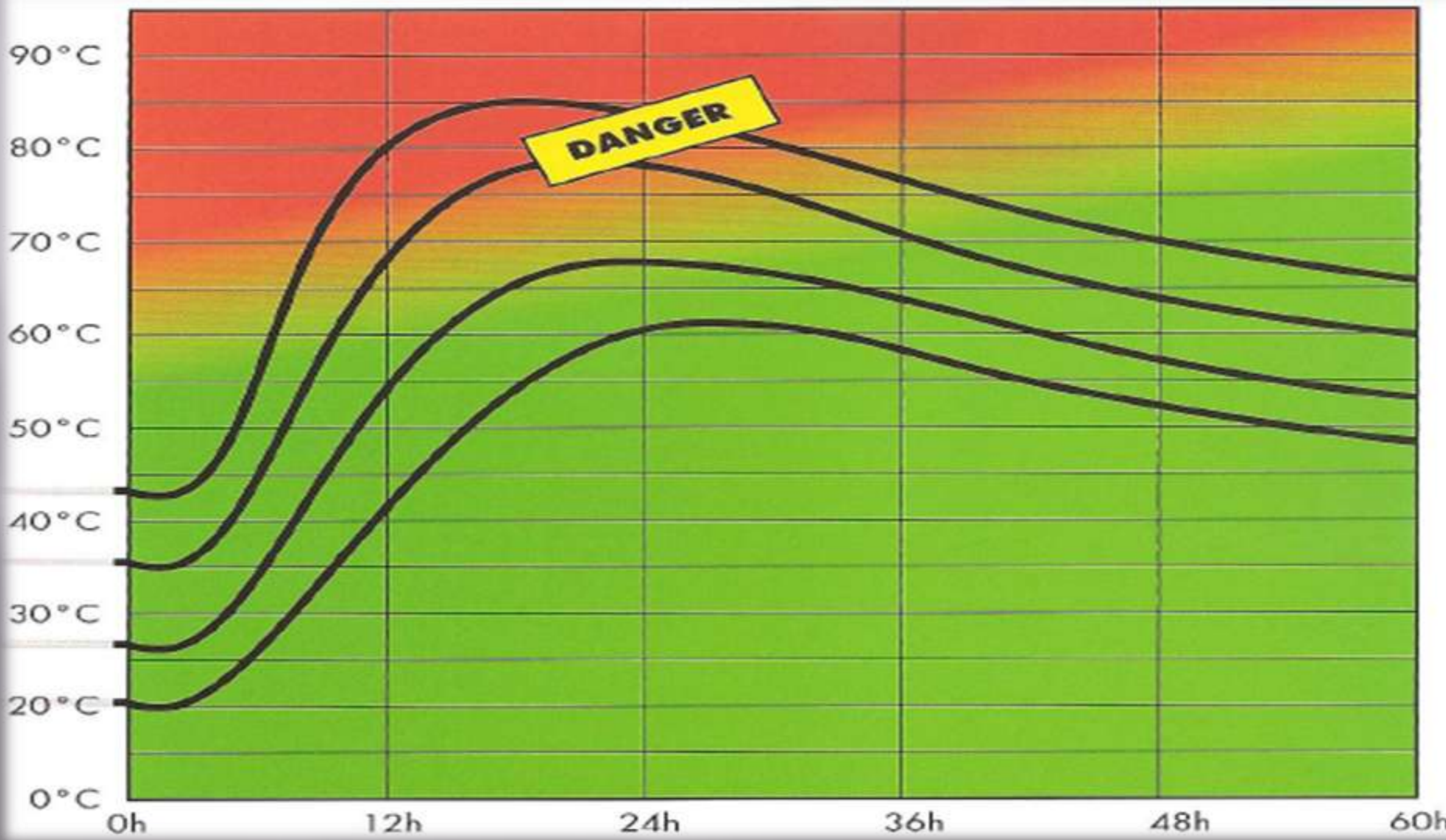
- **To insure high Quality fresh concrete all the time the following precautions had been adopted after intensive meetings with the client, the engineer and the contractor .**

1. The concrete mix slump was made to be colapsable,i.e the concrete is flowing during casting.
2. The concrete mix was made with high fly ash percentage (40%) to overcome with the heat of hydration.
3. Keep the concrete fresh all the time to avoid cold joints.

Heat of hydration in concrete



Typical heat of hydration for different cement content

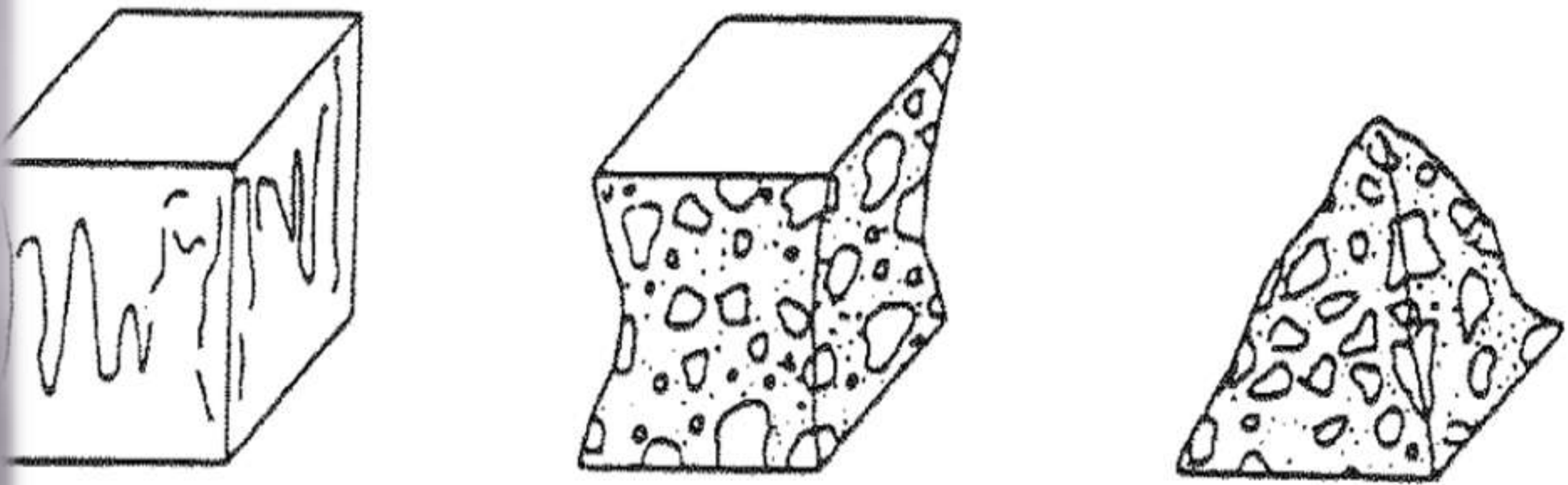


Quality control of concrete mixture Grade 90 MPa.

- **To obtain high Quality concrete Grade 90 MPa and avoid fluctuation of strength, the following actions should be strictly implemented.**

1. use only one source of cement that used in the mix design.
2. Insure the aggregate are compatible and free of dust.
3. Use dry sand as the wet sand will influence the W/C ratio .
4. Use compatible admixtures and from one source.
5. Use good quality fly ash.
6. Make sure using only calibrated moulds for each major casts

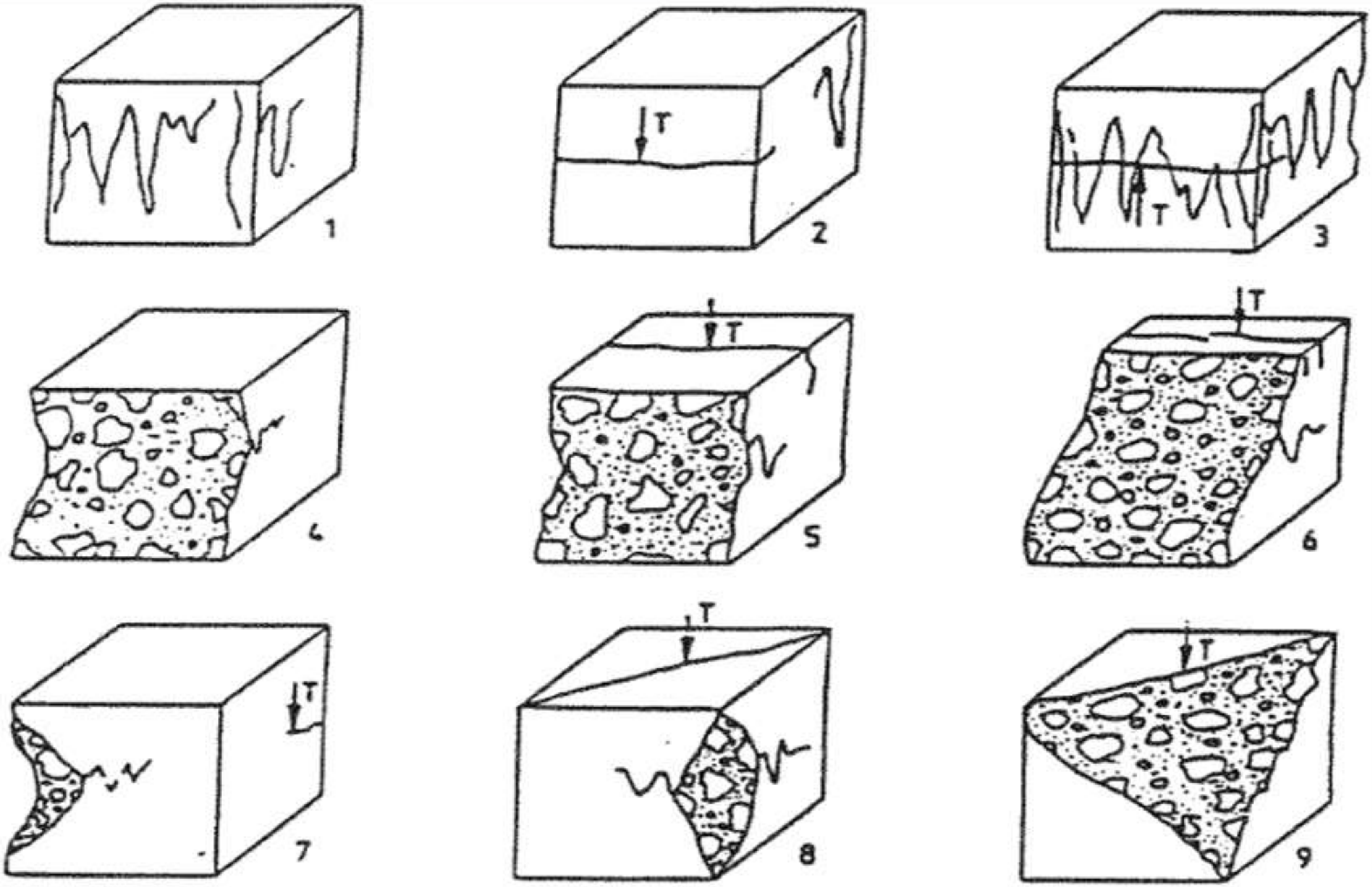
Un Satisfactory Fracture of Cubes



Explosive failure

TE All four exposed faces are cracked approximately equally, generally with little damage to faces in contact with the
ens.

Figure 1 — Satisfactory failures of cube specimens



T = tensile crack

Figure 2 — Some unsatisfactory failures of cube specimens

Cube Calibration

Cube Calibration

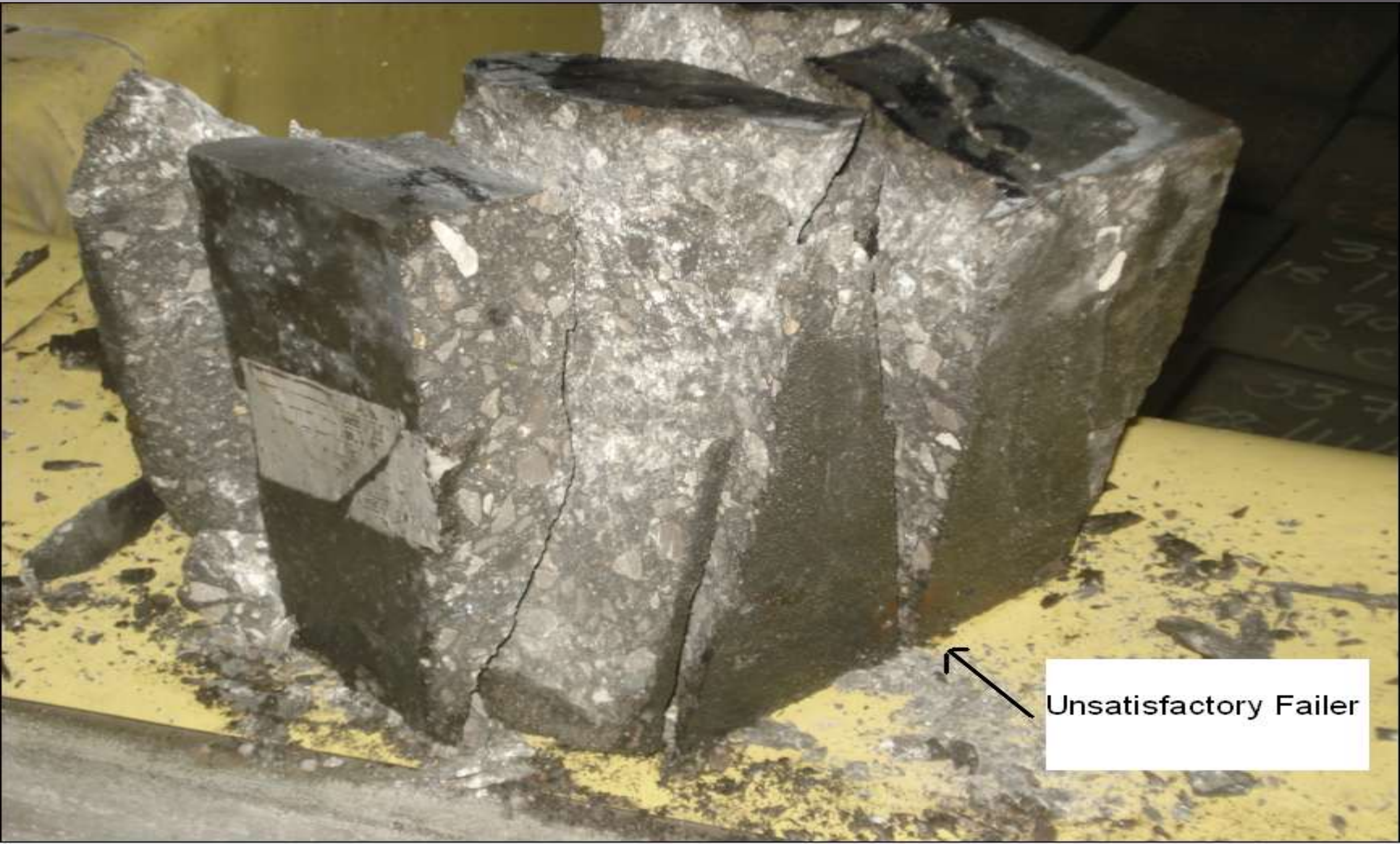
Satisfactory failure

Satisfactory failure

Satisfactory failure

Unsatisfactory failure

Unsatisfactory failure



Test Results for not calibrated cube

Contractor Cube No.	3362	3363	3364
QIL Test No.	DT - 22108	DT - 22109	DT - 22110
Delivery Ticket No.	60070	60070	60070
Time Cast	22:10	22:10	22:10
Cast Date	21.11.2009	21.11.2009	21.11.2009
Test Date	19.12.2009	19.12.2009	19.12.2009
Test Time	09:15	09:20	09:25
Age (days)	28 Days	28 Days	28 Days
Weight (g)	8262.0	8287.0	8371.0
Surface Condition	Satisfactory	Satisfactory	Satisfactory
Width (mm)	150.3	150.2	150.2
Height (mm)	151.0	150.3	149.3
Length (mm)	149.9	149.8	150.6
Grinding / Capping	No	No	No
Density (Kg/m3)	2429	2451	2479
Load (kN)	2144.0	1100.0	2004.0
Type of Failure	Unsatisfactory	Unsatisfactory	Unsatisfactory
Strength (Mpa)	95.0	49.0	88.5

Note: Surface Condition: e.g. satisfactory - damp, undamaged; unsatisfactory - dry, damaged

Remarks: Unsatisfactory (03),Cube # 3362
Unsatisfactory (03),Cube # 3363
Unsatisfactory (03),Cube # 3364

Test results for calibrated cube

Contractor Cube No.	**3386**	**3387**	**3388**
QIL Test No.	DT - 22169	DT - 22170	DT - 22171
Delivery Ticket No.	68812	68812	68812
Time Cast	22:00	22:00	22:00
Cast Date	23.11.2009	23.11.2009	23.11.2009
Test Date	21.12.2009	21.12.2009	21.12.2009
Test Time	09:15	09:20	09:25
Age (days)	**28 Days**	**28 Days**	**28 Days**
Weight (g)	8277.0	8321.0	8280.0
Surface Condition	Satisfactory	Satisfactory	Satisfactory
Width (mm)	150.0	149.9	150.1
Height (mm)	150.0	150.0	150.0
Length (mm)	150.1	150.0	149.9
Grinding / Capping	No	No	No
Density (Kg/m3)	2451	2467	2453
Load (kN)	2455.0	2542.0	2376.0
Type of Failure	Satisfactory	Satisfactory	Satisfactory
Strength (Mpa)	**109.0**	**113.0**	**105.5**

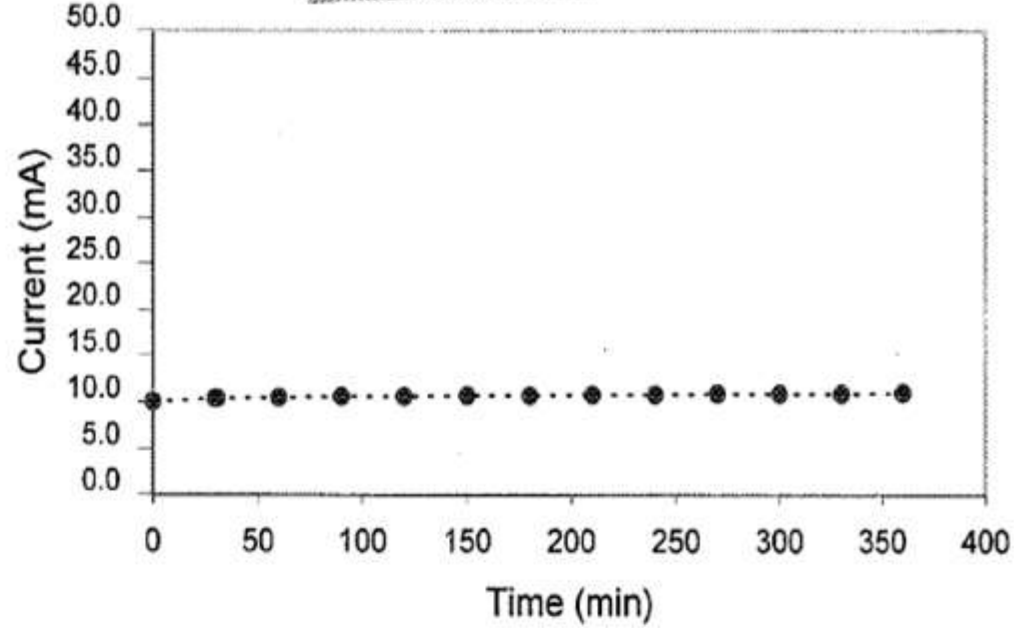
Note: Surface Condition: e.g. satisfactory - damp, undamaged; unsatisfactory - dry, damaged

Concrete Durability test results for 90 MPa Mix

ELECTRICAL INDICATION OF CONCRETE'S ABILITY TO RESIST CHLORIDE ION PENETRATION

(A.S.T.M. C-1202)

Cube Ref.	TM - 1	
ACTS Ref.	OC25164	
Time (min)	Current (mA)	Temperature ^0C
I_0	10.0	23.6
I_{30}	10.4	23.9
I_{60}	10.5	24.1
I_{90}	10.6	24.2
I_{120}	10.6	24.4
I_{150}	10.7	24.5
I_{180}	10.7	24.6
I_{210}	10.8	24.7
I_{240}	10.8	24.8
I_{270}	10.9	24.9
I_{300}	10.9	25.0
I_{330}	10.9	25.1
I_{360}	11.0	25.2
Charge passed in Coulombs	231	
Charge passed in Coulombs (95 mm Dia.)	**236**	



Charge passed (Coulombs)	Chloride Ion Penetrability
> 4000	High
2000-4000	Moderate
1000-2000	Low
100-1000	Very low
<100	Negligible

WATER ABSORPTION OF CONCRETE (BS1881: Part 122)

Cube Reference	TM - 1	TM - 1	TM - 1
ACTS Reference	OC25167	OC25168	OC25169
Test Date	29-Oct-09	29-Oct-09	29-Oct-09
Age	28 days	28 days	28 days
Sample weight-Oven Dry (g)	1482.6	1498.9	1517.7
Sample weight- after 30 min. soaking (g)	1492.1	1508.5	1526.9
Sample Diameter (mm)	74.0	74.0	74.0
Sample Thickness (mm)	137.2	137.1	139.7
Oven Dry Density (kg/m^3)	2510	2540	2530
Measured water Absorption (%) @ 30 min. soaking	0.6%	0.6%	0.6%
Correction Factor	1.20	1.20	1.20
Corrected water Absorption (%) @ 30 min. soaking	**0.8%**	**0.8%**	**0.7%**

WATER PERMEABILITY OF CONCRETE

(BS EN 12390 - 8 : 2000)

Cube Reference	TM - 1	TM - 1	TM - 1
ACTS Reference	OC25170	OC25171	OC25172
Cast Date	01-Oct-09		
Test Date	29-Oct-09		
Age (Days)	28		
Max. depth of penetration (mm)	**3.0**	**3.8**	**3.9**

: Specimens were exposed to a water pressure of 0.5 N/mm^2 for 72 hours.

: The above mentioned structure reference was given by the customer.

: The standard requires that the test shall be started when the specimen is at least 28 days old.

DETERMINATION OF INITIAL SURFACE ABSORPTION OF CONCRETE
(BS1881: Part 208: 1996)

Cube Reference	**TM - 1**		
ACTS Reference	**OC25173**		
Surface description	Smooth		
Orientation of test area	Horizontal		
Preparation of specimen	Oven dried		
Conditioning prior to test	48 hours at room temperature		
Cap Dia. (mm)	80		
Area of water contact of the Cap (mm^2)	5026		
Length of Capillary tube (mm)	455		
Time Intervals	**10 min.**	**30 min.**	**60 min.**
Period during which movement is measured (s)	**120**	**120**	**120**
No. of Divisions (a)	**16**	**7**	**3**
Multiplication Factor (b)	**0.5**	**0.5**	**0.5**
Initial Surface Absorption, ml/(m^2.s) - (ab0.01)	**0.08**	**0.04**	**0.02**
Temperature of the Concrete Surface (^0C)	**24**	**24**	**24**
Temperature correction factor	**0.93**	**0.93**	**0.93**
Corrected Initial Surface Absorption at 25 ^0C, ml/(m^2.s)	**0.07**	**0.03**	**0.01**

Remarks : The above mentioned structure reference was given by the customer.

: The standard requires 3 specimen to be tested and the average determ

Construction of tower core walls

Hydraulic Climbing System

DUBAI TOWER CLIMBING SYSTEMS

JV AL HABTOOR - AL JABER

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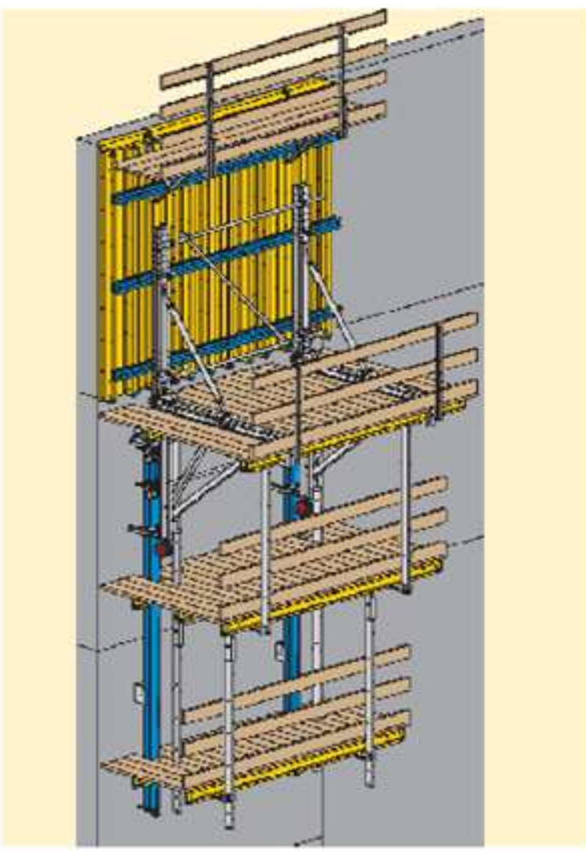
The Formwork Experts

Self climbing system form work

System Properties

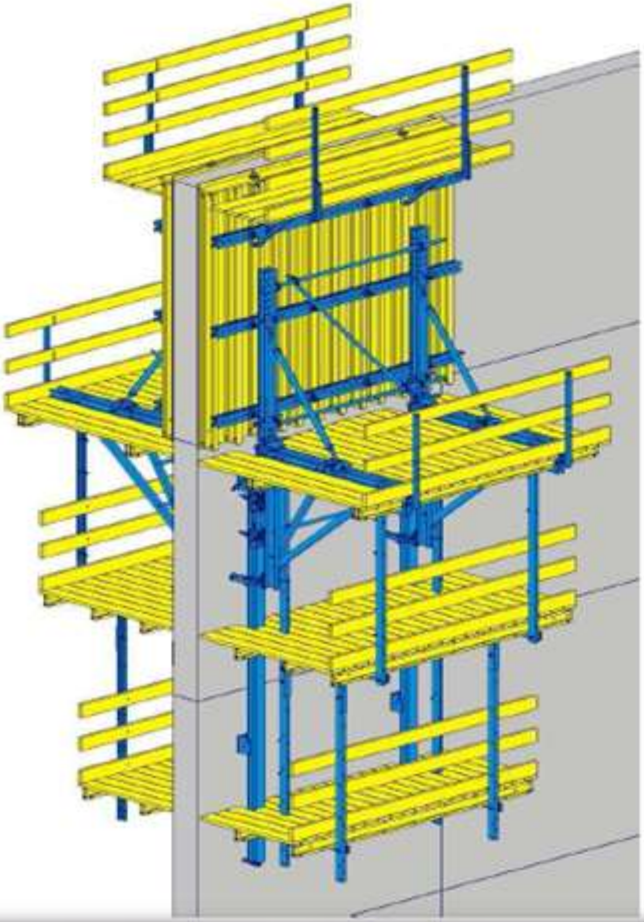
SKE 50 – system properties



Drive	hydraulic
Lifting capacity	50 kN
Casting height	2,0 – 5,5 m
Max. wind speed system in operation	72 km/h
Climbing speed	5 min/m
Inclination	+/- 15 degree
Formwork shutter	beam/ waler panel with 18mm plywood sheet

Doka SKE 50

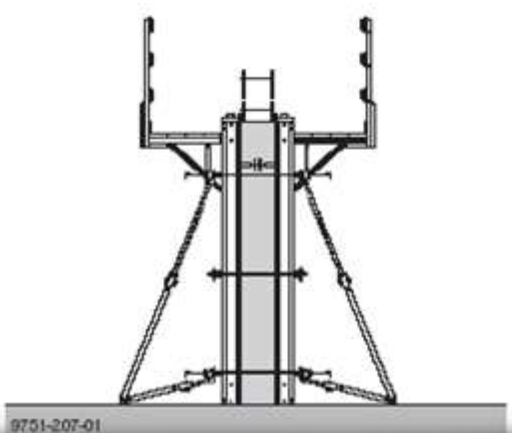
Doka SKE 50 Automatic Climbing System



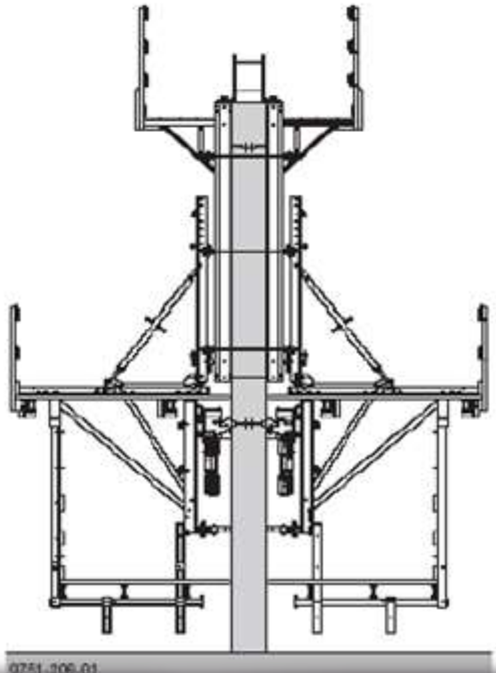
SKE50 exterior climbing platform
with roll back Formwork Panels

Erecting Sequence

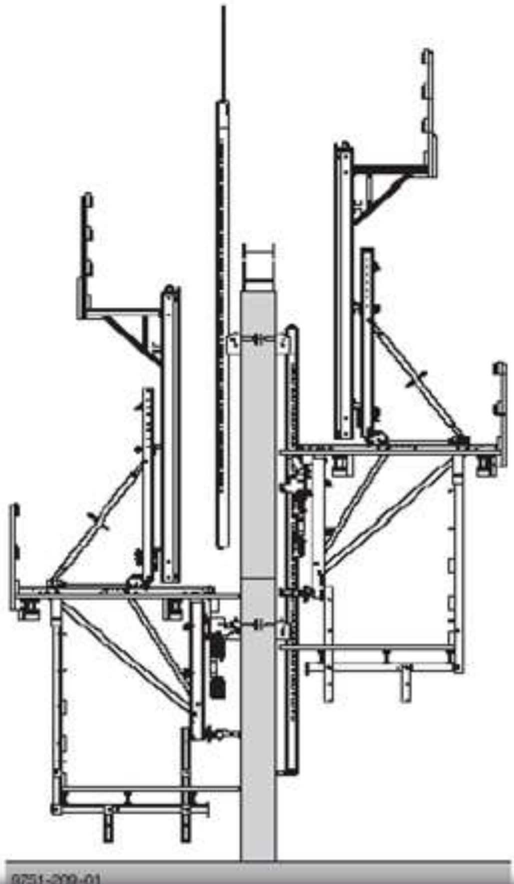
1st Pour
conventional crane
set forms



2nd Pour
platforms in place to
support formwork

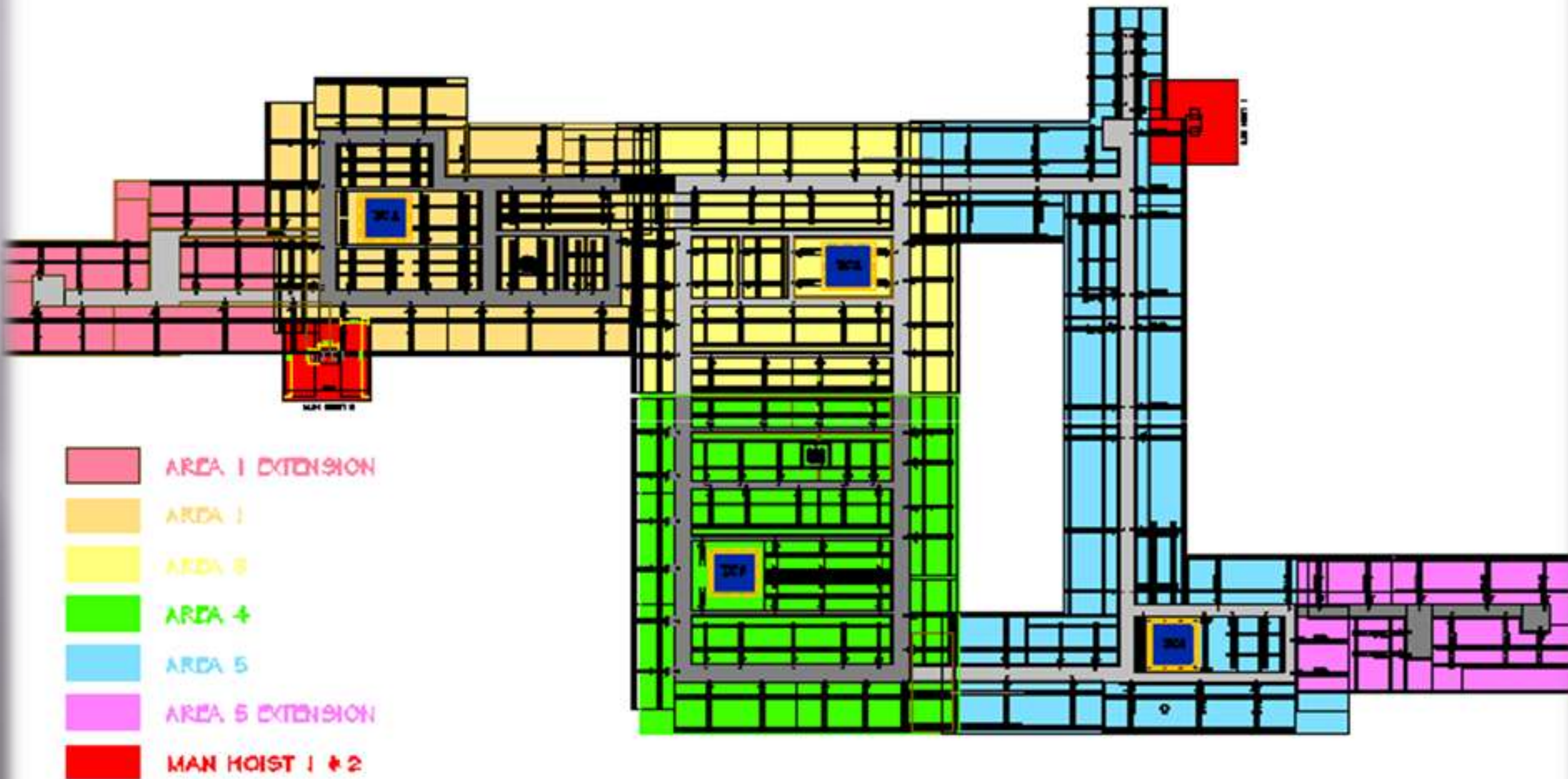


lifting profiles in place
automatic climbing to
the next level



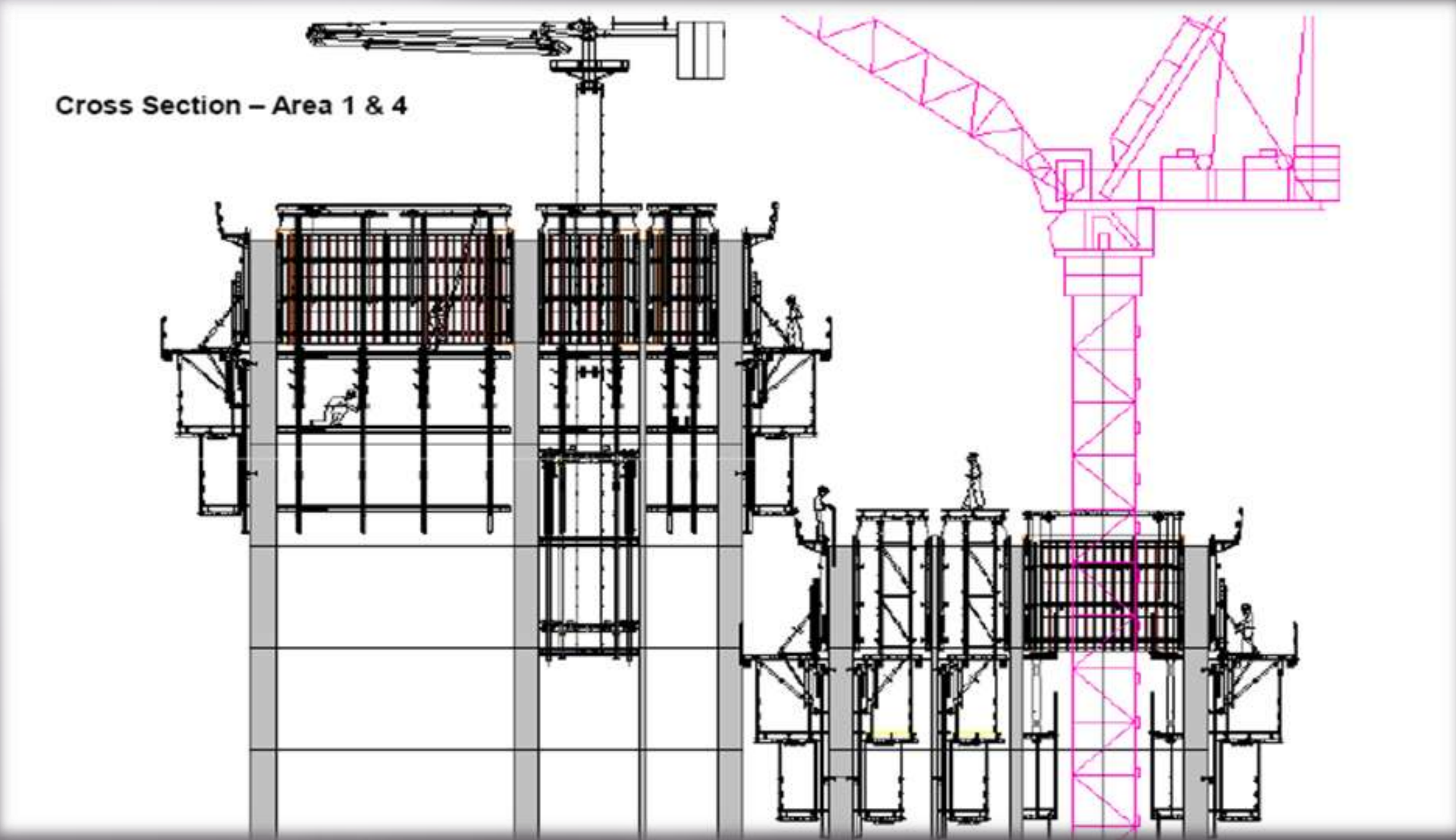
First pour complete and jumped to the second

Core walls six sections



Dubai towers central cores

Positioning of crane and placing boom

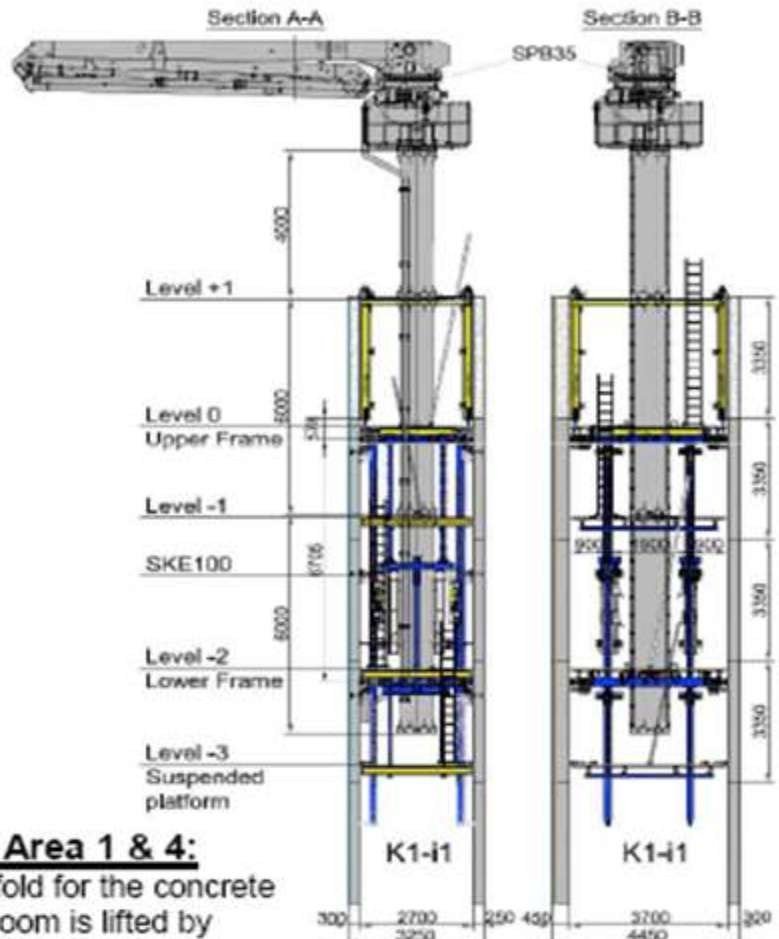


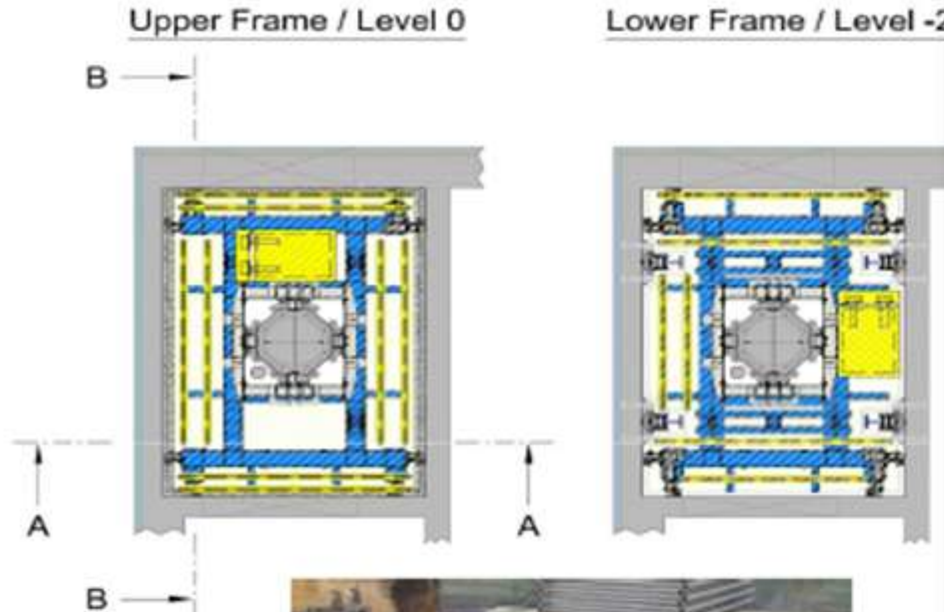
Positioning of crane and placing boom

Positioning of crane and placing boom

SKE100 – Scaffold for concrete placing boom MX28/MX32

Section

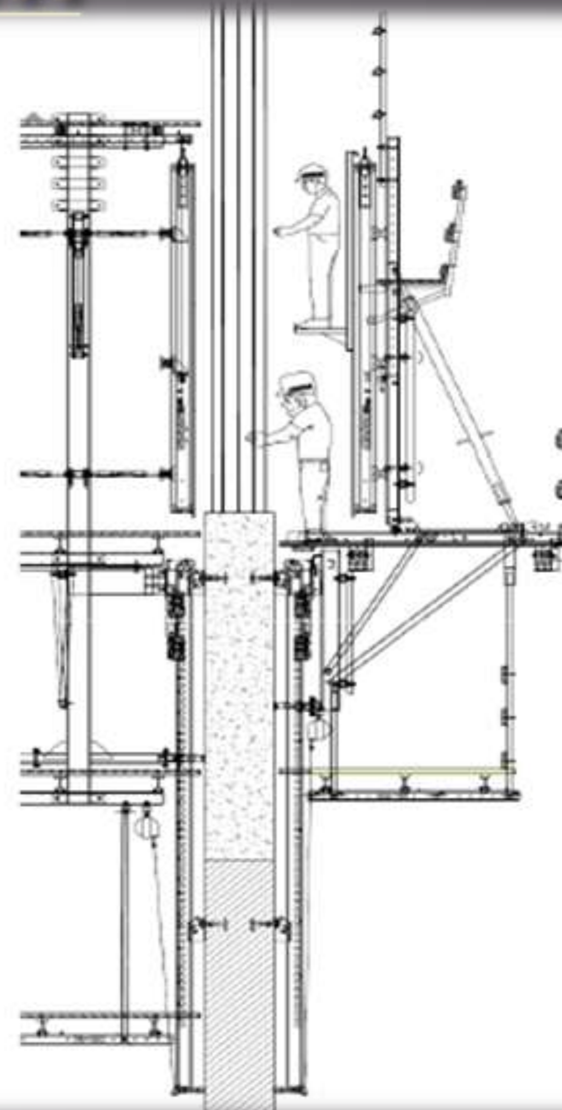




CPB in Area 1 & 4:

The scaffold for the concrete placing boom is lifted by 4 units SKE100.

Utilizing the working platform



Self climbing system form work

Self climbing system form work

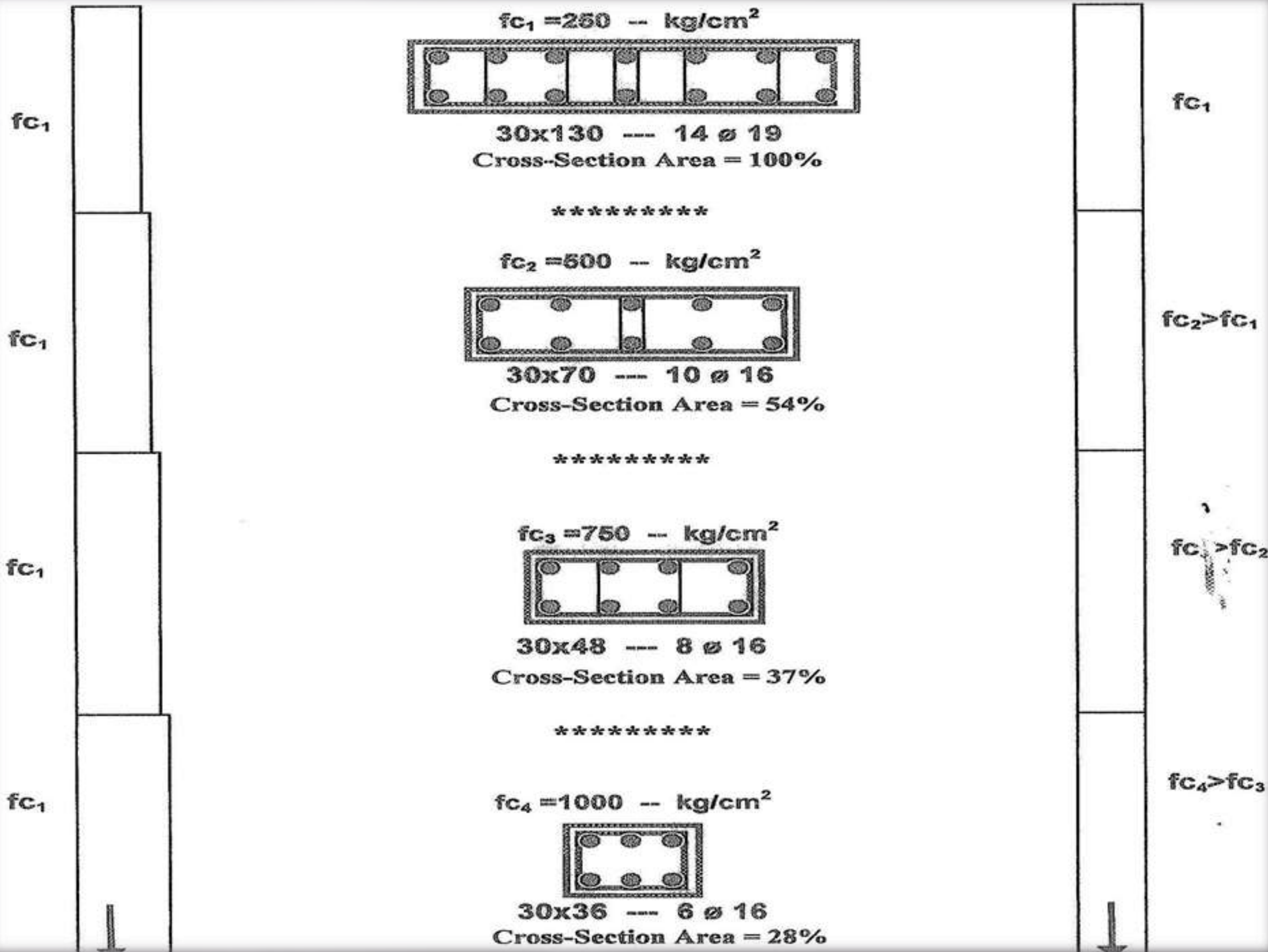
USE OF COMPOSITE STRUCTURE IN HIGH RISE BUILDINGS.

Benefits of composite structure of concrete and steel in high rise buildings

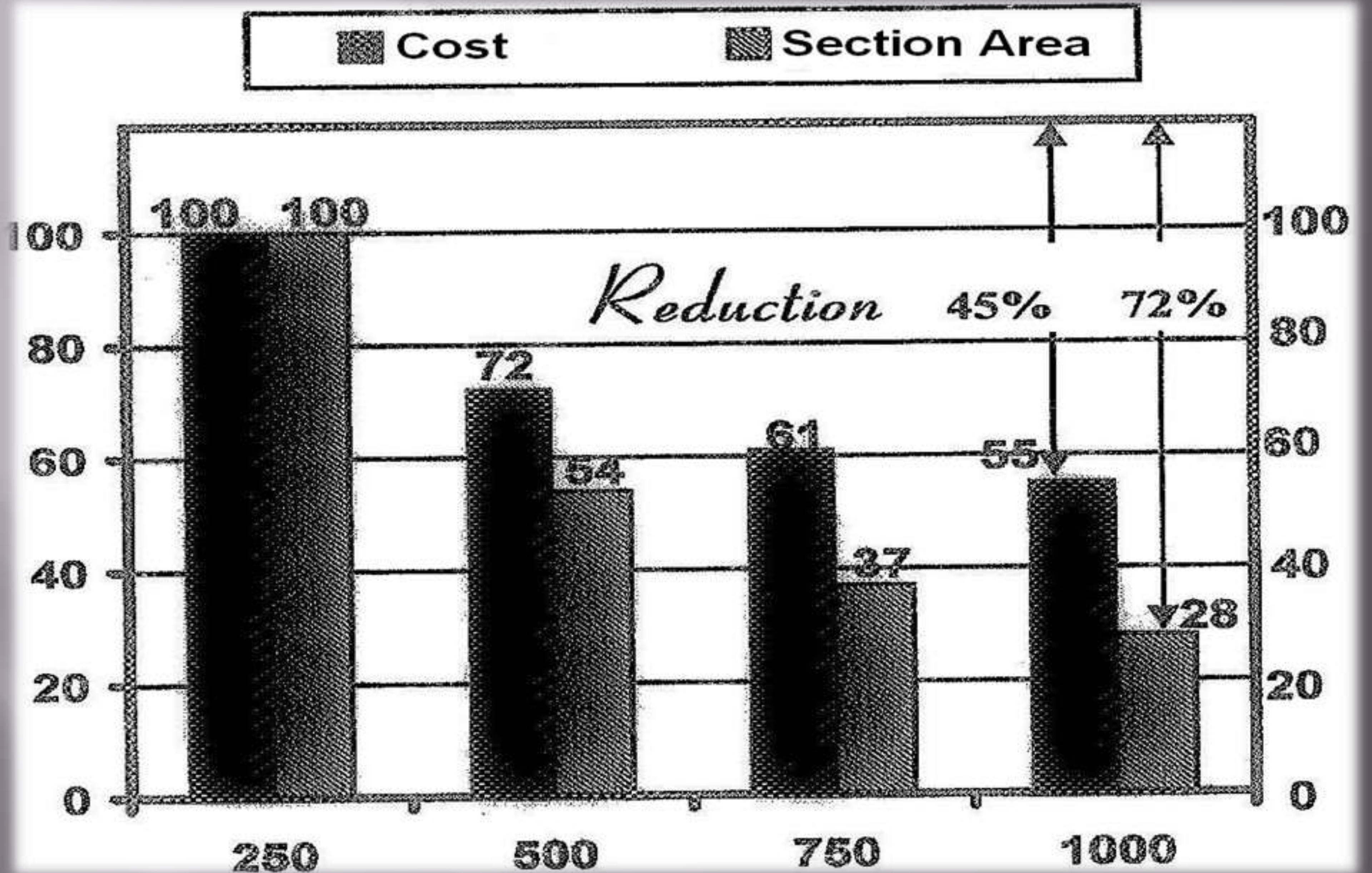
- Reduce the size of the structural elements.
  - Allows to use larger space in floor area.
  - Allows to build higher sky scrapers.

- Accelerates construction methodologies and reduce construction period.

- Cost effective
  - Reduce steel reinforcement area of formwork and saves labour costs.



$fc_1 = 250$ -- kg/cm^2
30x130 --- 14 ø 19
Cross-Section Area = 100%
****
$fc_2 = 500$ -- kg/cm^2
30x70 --- 10 ø 16
Cross-Section Area = 54%
****
$fc_3 = 750$ -- kg/cm^2
30x48 --- 8 ø 16
Cross-Section Area = 37%
****
$fc_4 = 1000$ -- kg/cm^2
30x36 --- 6 ø 16
Cross-Section Area = 28%
fc_1
fc_1
fc_1
fc_1
fc_1
$fc_2>fc_1$
$fc>fc_2$
$fc_4>fc_3$



Concrete strength

Major composite elements in high rise buildings

- Concrete filled steel tube columns,(CFT).
- Concrete filled Steel out riggers and steel trusses.
- Concrete deck slabs

Concrete filled steel tube, CFT

- Figure.1 shows typical connections between a CFT column and H-shaped beams.
- The connection is fabricated by shop welding, and the beams are bolted to the brackets on-site. In the case of connections using inner and through-type diaphragms, the diaphragm plates are located inside the tube, and a hole is opened for concrete casting.
- Concrete casting is usually done by Tremie tube or the pump-up method. High strength and ductility can be obtained in the CFT column system because of the advantages will be mentioned below.
- To create a good bond between steel tube inner surface and concrete, high-quality concrete with a low water-content and a super plasticizer for enhanced workability is used in construction.

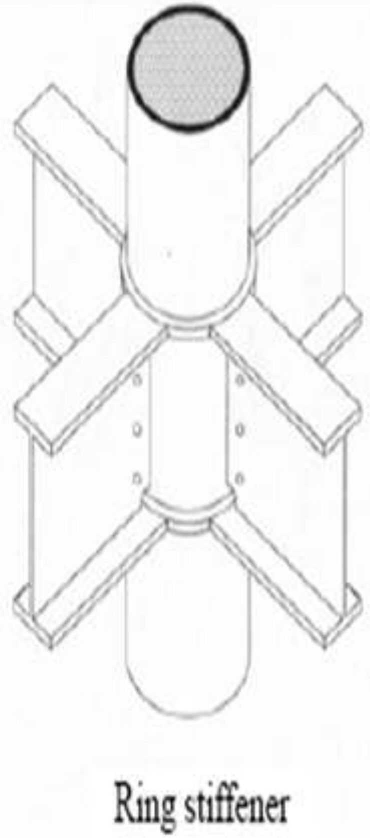


Fig. 1 Beam-to-column connections

Advantages of Concrete filled steel tube , CFT

- The CFT column system has many advantages compared with ordinary steel or reinforced concrete systems.

- Interaction between steel tube and concrete. Local buckling of the steel tube is delayed, the strength of the concrete is increased due to the confining effect provided by the steel tub.

- Fire resistance: Concrete improves fire resistance so that fireproof material can be reduced or omitted.

- Cross-sectional properties. The steel ratio in the CFT cross section is much larger than in reinforced concrete and concrete-encased steel cross sections Construction efficiency.

- Labor for forms and reinforcing bars is omitted, and concrete casting is done by Tremie tube or the pump-up method.

Composite truss structure

Dubai towers-Doha Site management & training

Site manpower training

- Start to communicate with the manpower effectively.
- Establish a trust relation ship.
- Provide the manpower essential needs.
- Site trade training .
- Improve personal and team productivity.

Construction Management
Team building & improvement

- Identify authorities and responsibility.
- Set monthly plane and daily execution schedule according to the projects targets.
- Manpower distribution and daily productivity requirement.
- Encourage team communication and interface .
- Encourage solving the interface problems.
- Continuous performance measurement and improvement.
- Improve management & leadership skills.


The End