HONG KONG CONSTRUCTION MATERIALS ASSOCIATION LIMITED

New Era of Ready Mixed Concrete Industry – Transform Challenges to Opportunities

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Transform Challenges to Opportunities

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Today's presentation will not have Engineering equations, calculations and results

$$s_{min} = (\pi\phi^2/4)(f_{ct}/\rho)/(\pi\phi)f_b = (f_{ct}/f_b)(\phi/4\rho)$$

where:

f_b = bond strength at [illegible]

ϕ = bar size

f_{ct} = tensile strength of concrete at age of cracking

ρ = reinforcement ratio ($\geq \rho_{crit}$)

???

In a fully developed crack system, the maximum crack spacing, $s_{max} = 2s_{min}$ and the maximum crack width due to strain ε is given by:

$$w_{max} = s_{max}\,\varepsilon = (f_{ct}/f_b)(\phi/2\rho)\varepsilon$$

We will introduce the latest Ready Mixed Concrete Industry development to let all of you have better understanding of the industry

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Ready Mixed Concrete Industry

Perception In the Past:

- Traditional industry
- Labour intensive
- Highly polluted
- Full of mud in the yard
- Noisy environment
- High carbon emission industry
- .....

Are these true ?

Concrete Batching Plant like?

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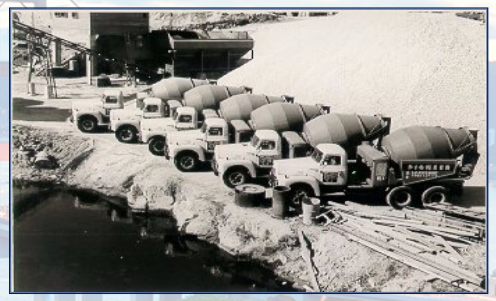
Ready Mixed Concrete Industry

In the old days:

First Pre-mix concrete plant in Hong Kong – Circa 1961



Modern Delivery Trucks Circa 1960's

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Ready Mixed Concrete Industry

In the old days:

A modern Skyline takes shape in the year of 1970 - 80

Concrete loading into the mixer truck in open area

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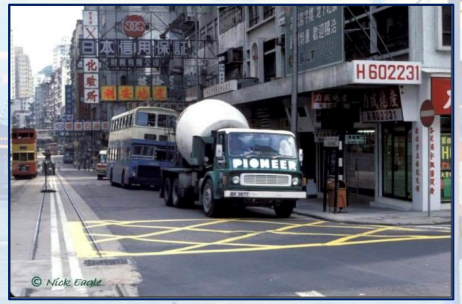
Ready Mixed Concrete Industry

In the old days:



Modern mixer truck in the Year of 198X

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Ready Mixed Concrete Industry

In the old days:

Drilling Techniques by manual hydraulic breaker without any PPE

Family Business for hammering into aggregate with suitable grading

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Ready Mixed Concrete Industry

In the old days:

Powder Monkey's for installation of explosive without any safety measures

Grading of Rock into aggregates manually

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Ready Mixed Concrete Industry

At Present:

Highly efficient, computerized process, modern plant design, environmental friendly, use of clean energy e.g. installation of solar panels

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Ready Mixed Concrete Industry

At Present:

Good housekeeping, highly energetic, good working environment

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Ready Mixed Concrete Industry

At Present:

- Implementing management system:
  - Product Certifications Scheme (QSPSC)
  - Certified to quality management system ISO9001
  - Certified to environmental management system ISO14001
  - Health and Safety management system ISO45001
  - Energy management system ISO50001
  - etc...
- Corporate social responsibility (CSR)

QSPSC : 2014
Certification No.: CC XXXX-P

ISO 9001 : 2015
Certificate No.: CC 7172

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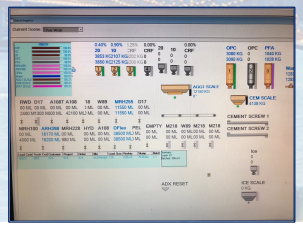
Ready Mixed Concrete Industry

At Present:

- Advance technology industry – fully computerized production process
- Highly automatic - all process controlled at control room
- Real time monitoring – installation of CCTV



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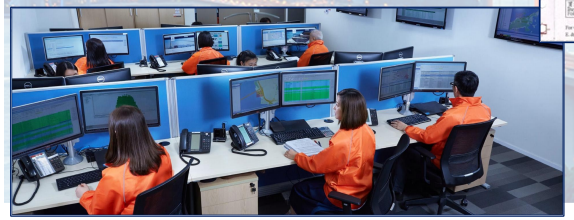
Ready Mixed Concrete Industry

At Present:

- Adoption of IT tools including:
  - Computerized dispatch process
  - GPS system for truck tracking
  - QR Code system



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Ready Mixed Concrete Industry

At Present:

- Sustainable industry – use of recycle materials, handling of surplus excavated materials to minimize the loading of landfill


Pulverized fuel ash


Ground granulated blast-furnace slag


Condensed silica fume


Recycled aggregates


Recycled glass


Recycled plastic

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Ready Mixed Concrete Industry

Challenges and Opportunities

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1. Human Resources

Challenges:

- Ageing problem like other industries – most of the operators are over 50 years old or even 60 years old
- Difficult to recruit and attract young talents like other industries
- Working hours (may need shift)
- Remote working locations

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1. Human Resources

Opportunities:

- Enhancement in staff development:
  - Develop the career development program and career path for the staff and operators
  - Provision of training program to staff
- Aims to recruit young talents
- Streamline process to minimize the workload:
  - Adopt computerized operation process – batching process, auto-data capture records
  - GPS truck tracking – minimize the customer calls
- Provision of reasonable working environment

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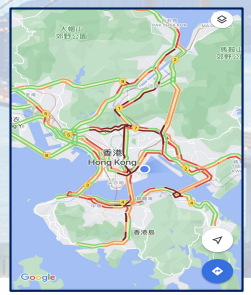
2. Equipment

Challenges:

- Limited construction site working hours (7:00 a.m. – 19:00 p.m.)
- Batching plants far away from construction sites
- Terrible traffic conditions



Section (s)	Type of offence	Maximum penalty
4,5	Noise from Domestic Premises and Public Place (neighbourhood noise)	$10,000
6, 7	Noise from construction sites	$100,000 on first conviction or $200,000 on second or subsequent conviction, plus $20,000 a day (where appropriate)
13	Noise from places other than Domestic Premises, Public Places or Construction Sites (industrial-type noise)	
14 to 17	Noise from products	
13A	Noise from Intruder Alarm System installed in any premises	$10,000 and imprisonment for 3 months
13B	Noise from Intruder Alarm System installed in any vehicle	$10,000

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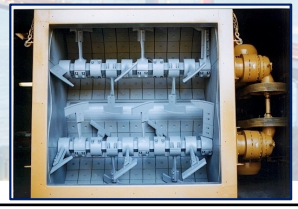
2. Equipment

Opportunities:

- Upgrade the production capacity with highly efficient equipment (up to more than 100m3/hr/ production leg)
- Computerized production process to improve the overall efficiency and consistency, minimize human error
- Increase the truckload size from 5m3 in the past to current 7 - 8m3 or even 10m3 to improve the delivery capability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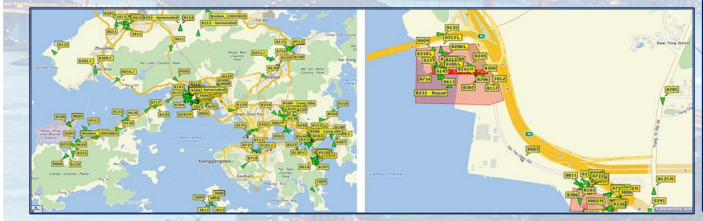
2. Equipment

Opportunities:

- Customer services to handle the delivery
- Automation including GPS system for truck tracking
- Realtime monitoring on delivery



混凝土級別	預訂數量	已送數量	已送車數	已送%	剩餘數量
35/20D/150	11.0	2.0	1	18.2	9
45/20D/150	290.0	79.0	10	27.2	211
Cement Mortar 1:3	1.0	1.0	1	100.0	0
No Fines 1:10	8.0	7.2	1	90.0	0.8

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3. Materials

Challenges:

- Unstable materials supply from the Region which was influenced by numerous unforeseeable factors including COVID-19, custom issues etc
- Government objective on carbon reduction
- Complicated approval process from Government Departments for new materials

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3. Materials

Opportunities:

- Partnership with reputable and reliable materials suppliers with high quality products to assure the sustainable materials supply

- Towards high quality constituent materials including the certification to Product Certification Scheme
  e.g. Aggregate Product Certification Scheme (APSC)

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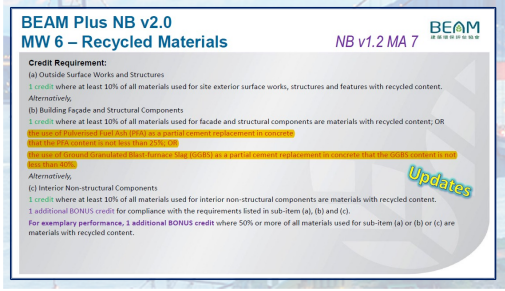
3. Materials

Opportunities:

- Use of sustainable constituent materials such as PFA, GGBS, CSF in the mix design
- Certified to environmental label products



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3. Materials

Opportunities:

- Develop high performance and green products to suit the latest market trend to meet the carbon neutrality objectives
- Sustainable use of surplus materials including the excavated rocks / aggregates from site formation and cavern projects.

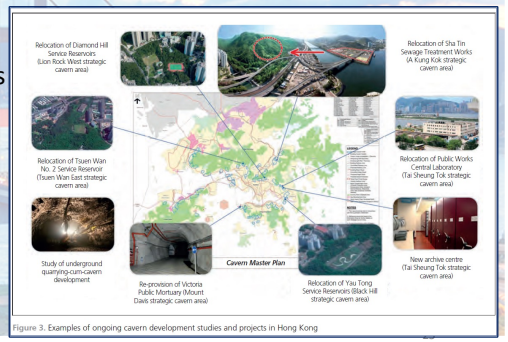

Figure 3. Examples of ongoing cavern development studies and projects in Hong Kong

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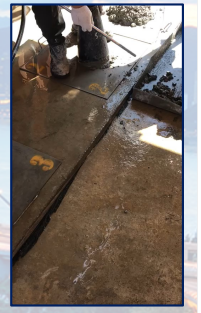
4. Specifications

Challenges:

- On site testing: Flow table test – longer testing time, long queue (3 min Vs 1 min)

Vs



What's the truck waiting for?

It's waste of productivity and resources!

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4. Specifications

Challenges:

- On site testing: Specification specified to use flow table test as acceptance test

GS Clause 16.55 is deleted and replaced by:

Testing : workability of concrete 16.55S (1) The workability of concrete is not specified but shall be proposed by the Contractor. Concrete workability of less than 75mm slump will not normally be acceptable. The Contractor will be required to demonstrate to the satisfaction of the Supervising Officer that the proposed workability will enable the concrete to be placed in the Works satisfactorily. Trial concrete shall be placed and compacted simulating the actual locations where the concrete is proposed to be used.

(2) Except for medium workability mixes (80-135mm slump) the Contractor shall not use the slump test as the sole means of measuring workability or deciding upon what level of workability to choose. An approved dynamic method for measuring and controlling the workability of concrete delivered to the Works shall also be used. Suitable methods of test are given in the Table below

Suitable Workability Test Methods		
Low Workability 0-75mm slump	Medium Workability	High Workability > 140mm slump
Vebe time or Compaction Factor	Slump	Flow Table

- Slump test only up to design slump of 135mm
- 140mm slump is commonly used in different nature of projects and shall not be categorized as high workability

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4. Specifications

Opportunities:

- Communicated with SCCT to amend the G.S. to incorporate slump test for high workability concrete to improve the on-site testing efficiency without sacrifice the concrete quality and improving the testing efficiency

Testing: workability of concrete 16.55 (1) Each sample of concrete taken as stated in Clause 16.54 shall be divided into two specimens. Each specimen shall be tested to determine the workability of the concrete in accordance with CS1. Selection of the testing method is given in the table below:

Normal Workability (designed slump value from 20 mm to 175 mm)	High Workability (designed flow value from 340 mm to 600 mm)
Slump Test	Flow Table Test (See Note below)

Amd 2/2008

Note: For concrete with a flow value greater than 600mm, the Engineer shall specify the workability testing method.

Testing: workability of concrete 16.55 (1) Each sample of concrete taken as stated in Clause 16.54 shall be divided into two specimens. Each specimen shall be tested to determine the workability of the concrete in accordance with CS1. Selection of the testing method is given in the table below:

Normal Workability (designed slump value from 20 mm to 200 mm)	High Workability (designed flow value from 340 mm to 600 mm)
Slump Test (For designed slump value ≥ 175 mm and ≤ 200 mm, see the Note to Clause 2.1.1 of CS1)	Flow Table Test (See Note below)

Note: For concrete with a flow value greater than 600mm, the Engineer shall specify the workability testing method.

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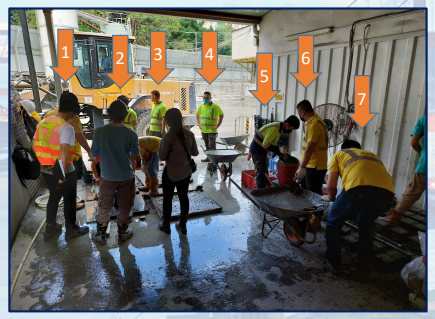
4. Specifications

Challenges:

- Complicated plant trial requirements



How many technicians are doing the trial mix?

Plant Trials 16.24

(2)A Mixing shall be completed without delay as soon as possible after the cement is added to the batch and initial discharge shall commence immediately after the batch has been thoroughly mixed. The batch shall be discharged in six approximately equal portions at equal intervals over a total period equal to the maximum time between completion of mixing and discharge of the last of any batch of the concrete at the point of place as estimated by the *Contractor* (see PS Clause 16.18(1)(d)S).

(3)S Three samples of concrete shall be provided from the batch at approximately 1/6, 1/2, and 5/6 of the discharge from the mixer. Each sample shall be of sufficient size to perform a slump test and make two 100 mm test cubes. The method of sampling shall be as stated in CS1.

(4)S Samples shall be taken from each of the six discharges and tested as follows:

(a) Workability

Each sample shall be tested for slump in accordance with CS1, Section 2 and BS EN 12350 immediately upon discharge and at 15 minutes and 30 minutes after discharge. The average value of two valid slumps taken from the same sample at the same time shall be taken as the result of that test. Ambient temperature shall be recorded at each time one of the above tests is made.

(b) Bleed

The second, third and fifth samples shall be tested for bleed of concrete in accordance with ASTM C232/C232M-14 and readings taken at 15 minutes intervals after discharge until cessation of bleeding.

(c) Setting Time

Concrete from the third discharge shall be tested for initial and final set in accordance with ASTM C403/C403M-16.

(d) Temperature

The temperature of the fourth sample from each trial batch shall be measured in accordance with BS8500-2.

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4. Specifications

Challenges:

- Complicated plant trial requirement
  - Consume more resources
  - Require longer time for trial
  - Higher cost

Item	Test	Particular Specification Requriements	General Specification Requirements
1	Workability CS1	6 samples Workability tests upon discharge and at 15 minutes and 30 minutes after discharge of each sample Total 36 workability test PS16.24(4)a	3 samples at 1/6, 1/2 and 5/6 Workability test upon discharge of each sample Total 6 workability test G.S.16.24(3)
2	Cube Casting CS1	2 numbers of cubes casted for Sample 1, 3 and 5 respectively Total 6 cubes G.S.16.24(5)	2 numbers of cubes casted for each sample Total 6 cubes G.S.16.24(5)
3	Bleeding Test ASTM C232-87	Tests conduct at 2, 3 & 5 samples upon discharge PS16.24(4)b	Not required
4	Setting Time Test ASTM C403-90	Concrete sample from 3rd discharge shall be tested for initial and finial set PS16.24(4)c	Not required
5	Fresh concrete temperature BS5328: Part 4 Cl3.4	Temperate of the fourth sample from each trial batch shall be measured PS16.24(4)d	Not required
6	Other Test	6 nos. of 150mm dia. cyclinder casted at first day trial for chloride penetration profile at 56, 84 and 182 days PS16.32B	Not required
7	Number of trial per day	2 mixes per day	6 mixes per day
8	No of technicians required	5 nrs	3 nrs
9	Cost per concrete mix	5 technicians@$1,800/day = $1,800 x 5 = $9,000/day OT for 1 technician for conducting setting time and bleeding test: = $200/hr x 4hr (18:00 - 22:00p.m.) + $300/hr x 8 hr (22:00p.m. - 06:00a.m.) + $200 x 2 hr (06:00 - 08:00a.m.) = $3,600 / day Total trial: 9 days Total Cost = ($9,000 + $3,600) x 9 days = $113,400 Cost per mix = $113,400 / 6 = **$18,900/mix**	3 technicians@$1,800/day = $1,800 x 3 = $5,400/day 3 days trial is required = $5,400 x 3 = $16,200 Cost per mix = $16,200 / 6 = **$2,700/mix**
10	Extra time required	Total 9 trial days to complete 6 mixes compared with normal 3 trial days Extra 6 trial days required **For example: 10 mixes per project with 1 main plant and 1 backup plant** **Time required for trial: 6 weeks**	Nil **Time required for trial: 2 weeks**

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4. Specifications

Challenges:

- Unrealistic slump acceptance requirements e.g. +/- 25mm for all design slump
  - Impractical to achieve with the tolerance of just an aggregate size tolerance
  - Difficult to meet in mass production
  - Materials are extracted from nature with variations in grading
- OPC mixes for superstructures (higher carbon footprint)
  - Specifier decision on selection of products e.g. OPC mix for superstructures
  - Cannot lower the carbon footprint without choice
- Use of sustainable materials e.g. GGBS, recycle aggregates
  - Some Particular Specification only mention to use PFA while not GGBS which limit the choice of SCM

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4. Specifications

Opportunities:

- Establish the communications channel with stakeholders / specifiers to have mutual understanding
- Willing to proactively participate in earlier stage e.g. project design stage to provide advice to the Architects / Consultants / Engineers on selection of appropriate RMC products
- Aims to establish a **reasonable**, **practicable** and **achievable** specifications without sacrificing the quality
- Common goal not to jeopardize the project progress to meet the project milestone

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5. Environment

Challenges:

- More stringent AQO requirements
- Perception of stakeholders (not in my back yard)
- Repeatedly complaints from the public (some are unrealistic)

AQO Review

- New AQOs launched
- Relevant change: PM 2.5 tightened
- Next AQO review: 2025

Hong Kong Air Quality Objectives (AQOs) *vs.* World Health Organization (WHO) Air Quality Guidelines (AQGs)

Pollutants	Averaging Time	WHO AQGs (μg/m³)				No. of Exceedances Allowed in Hong Kong's Prevailing AQOs	
		IT-1[1]	IT-2[1]	IT-3[1]	Ultimate Target		
Sulphur Dioxide (SO_2)	10-minute	-	-	-	500	3	
	24-hour	125	50	-	20	3	
Respirable Suspended Particulates (RSP/PM_{10})	Annual	70	50	30	20	Not applicable	
	24-hour	150	100	75	50	9	
Fine Suspended Particulates (FSP/$PM_{2.5}$)	Annual	35	25	15	10	Not applicable	
	24-hour	75	50	37.5	25	9	35
Nitrogen Dioxide (NO_2)	Annual	-	-	-	40	Not applicable	
	1-hour	-	-	-	200	18	
Ozone (O_3)	8-hour	160	-	-	100	9	
Carbon Monoxide (CO)	1-hour	-	-	-	30,000	0	
	8-hour	-	-	-	10,000	0	
Lead (Pb)	Annual	-	-	-	0.5	Not applicable	

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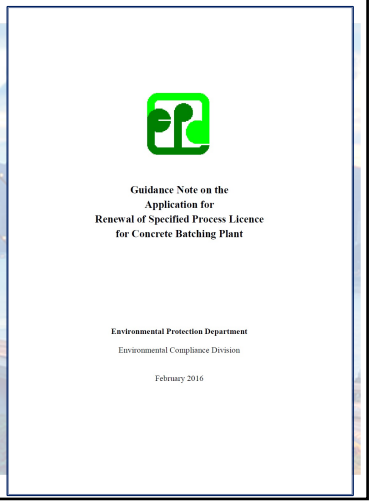
5. Environment

Opportunities:

- Upgrade the industry environmental standard beyond legal compliance
- Upgrade to Euro 6 Mixer trucks to minimize emission
- Establish communications with stakeholders like task force



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5. Environment

Opportunities:

In Yau Tong District

Totally enclosed during loading and wheel washing prior leave the plant

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6. Products Development

Challenges:

- Technical submission too transparent, easily to be copied by others
- Difficult for the propriety product development

Material	Type	Source
OPC	Cement	ORDINARY PORTLAND CEMENT / GREEN ISLAND CEMENT CO LTD
PFA	Supplementary Cementitious	PULVERIZED FLY ASH / GREEN ISLAND CEMENT CO LTD
CRF	Fine Aggregate	CRUSHED ROCK FINES / ALLIANCE CONSTRUCTION MATL LTD
WATER	Water	WATER / WATER SUPPLIES DEPT
D17	Admixture	DARATARD 17 / GCP (HK) LTD

Mix Description	Batch Proportions (kg/cubic metre - SSD Weights)
	CEMENT MORTAR 1:3
Plant	Sai Tso Wan
OPC	300 KG
PFA	150 KG
CRF	1350 KG
WATER	320 KG
D17	900 - 900 ML
W/C	0.71
A/C	3.00

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6. Products Development

Opportunities:

- Awareness on the Intelligent Property (IP)
- Think about the Patent products
- Establish the communications channel with stakeholders to have mutual understanding on their requirements to develop propriety products

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7. Quality

Challenges:

- The specifiers and users not fully understand the scope of RMC quality.
- Perception only limited to workability and compressive strength – compliance in accordance to 28 days compressive strength only

Table 16.10: Compliance criteria for compressive strength of designed mix concrete

Grade strength (MPa)	Compliance criteria	Column A		Column B	
		Maximum amount by which each test result may be below the grade strength (MPa)		Minimum amount by which the average of any four consecutive test results shall be above the grade strength (MPa)	
		100 mm cubes	150 mm cubes	100 mm cubes	150 mm cubes
20 or greater	C1	2	3	7	5
	C2	2	3	5	3
below 20	C3	2	2	3	2

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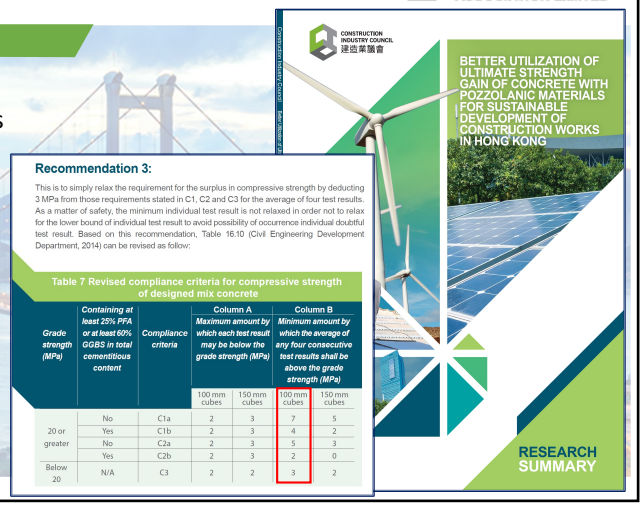
7. Quality

Opportunities:

- Establish the communications channel with stakeholders to have mutual understanding on their requirements
- Compliance not only limited to 28 days compressive strength (long term strength to minimize the over-design)



Recommendation 3:

This is to simply relax the requirement for the surplus in compressive strength by deducting 3 MPa from those requirements stated in C1, C2 and C3 for the average of four test results. As a matter of safety, the minimum individual test result is not relaxed in order not to relax for the lower bound of individual test result to avoid possibility of occurrence individual doubtful test result. Based on this recommendation, Table 16.10 (Civil Engineering Development Department, 2014) can be revised as follow:

Table 7 Revised compliance criteria for compressive strength of designed mix concrete

Grade strength (MPa)	Containing at least 25% PFA or at least 60% GGBS in total cementitious content	Compliance criteria	Column A: Maximum amount by which each test result may be below the grade strength (MPa)		Column B: Minimum amount by which the average of any four consecutive test results shall be above the grade strength (MPa)	
			100 mm cubes	150 mm cubes	100 mm cubes	150 mm cubes
20 or greater	No	C1a	2	3	7	5
	Yes	C1b	2	3	4	2
	No	C2a	2	3	5	3
	Yes	C2b	2	3	2	0
Below 20	N/A	C3	2	2	3	2

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Transform Challenges to Opportunities

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7. Quality

Opportunities:

- On top of the project specification requirements, works together with Contractors and Consultants to tailor design to fit their project application requirements including:
  - Durability performance including the design life over 100 years under severe exposure conditions
  - Rheology (low viscosity, low shear stress etc)
  - High elastic modulus for high rise building
  - Extra workability retention e.g. marine transportation
  - Early strength development for demoulding
  - Long pumping ability
  - etc

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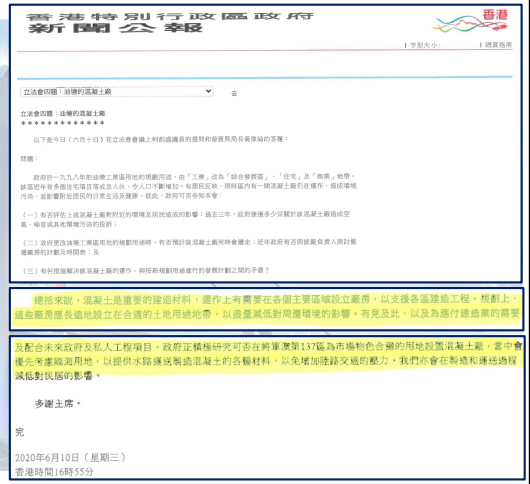
8. Government Support

Challenges:

- Inadequate long term planning
- Land support and planning
- Sustainable constituent materials supply
- Transportation strategic plan (traffic control for heavy vehicles) in different districts


香港特別行政區政府
新聞公報

立法會四題：油塘的混凝土廠

以下是今日（六月十日）在立法會會議上柯創盛議員的提問和發展局局長黃偉綸的答覆：

問題：

（一）有否評估上述混凝土廠對附近的環境及居民造成的影響；過去三年，政府接獲多少宗關於該混凝土廠造成空氣、噪音或其他環境污染的投訴；

（二）政府更改油塘工業區用地的規劃用途時，有否預計該混凝土廠何時會關走；近年政府有否與該廠負責人商討期滿搬遷的計劃及時間表；及

（三）有何措施解決該混凝土廠的運作，與按新規劃用途進行的發展計劃之間的矛盾？

總括來說，混凝土是重要的建造材料，運作上有需要在各個主要區域設立廠房，以支援各區建造工程，規劃上，這些廠房應長遠地設立在合適的土地用途地帶，以盡量減低對周遭環境的影響。有見及此，以及為應付建造業的需要，

及配合未來政府及私人工程項目，政府正積極研究可否在將軍澳第137區為市場物色合適的用地設置混凝土廠，當中會優先考慮鄰海用地，以提供水路運送製造混凝土的各類材料，以免增加陸路交通的壓力，我們亦會在製造和運送過程減低對民居的影響。

多謝主席。

完

2020年6月10日（星期三）
香港時間16時55分

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8. Government Support

Opportunities:

- Regular communicate with Development Bureau to update the industry status
- Proactively update the materials supply status to Government Departments for advance project planning and arrangement
- Actively participate in various consultative working groups to provide recommendations to the Government from supplier perspective


與政府部門之聯繫
GOVERNMENT LIAISON

碎石物料供應短缺

Aggregate Supply Shortage Crisis

船員檢染疫留內地過年 粵港擬建封船停航

全港地盤恐停工一個月

內地船員「坐足全年水監」

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Conclusion:

- Ready mixed concrete industry is one of the core industry supporting the Hong Kong infrastructure development
- Ready mixed concrete industry has upgraded to Version 2.0 with higher standards by implementing relevant management systems to align with the Construction Industry development
- Ready mixed concrete industry has equipped ourselves to work together with the Government and all stakeholders continuously contribute to the sustainable development of Hong Kong

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Thank you