بلدية الفجيرة FUJAIRAH MUNICIPALITY	**FUJAIRAH MUNCIPALITY CONSTRUCTION MATERIAL RESEARCH LABORATORY**	
	# Ready mix Plant & Truck Audit Checklist	REF. No. CMRL- RMPAC REV. No. 01 DATE: 1/9/2020

CLIENT INFORMATION		**CMRL INFORMATION**	
Client Name:		Sample ID / Reference Number	
Factory Address/ Location		Date of Audit:	
Principal Contract person		CMRL Audit Team	
Designation		Telephone / E-mail	

1. MATERIAL STORAGE AND HANDLING			
S.L. No.	**Points to be checked**	**Status**	**Remarks**
1.0	**MATERIAL STORAGE AND HANDLING :**		
1.1	**CEMENT AND CEMENTITIOUS MATERIALS**		
1.1.1	The silos of cement / Cementitious Materials shall be tight and provide free movement to discharge opening.		
a)	Silos are observed for any materials streaks on the external face	☐	
b)	If tanker is unloading, check for powder blowing from locations expected to be solid	☐	
c)	Bagged cementitious materials are stored in dry storage area and that opened bags are not retained overnight for future use.	☐	
1.12	Different cementitious materials are isolated to prevent intermingling or contamination		
a)	Each material shall be maintained in a separate silo or individual unopened bags	☐	
b)	Each blow pipe to fill a silo is clearly labeled and / or protected	☐	
1.2	**AGGREGATES**		
1.2.1	The procedures followed in the yard for unloading aggregate are such as to prevent harmful segregation and breakage of the aggregates.		
a)	Aggregates are not constantly dropped from excessive heights onto a concrete slab	☐	
b)	No signs of excessive aggregate segregation and breakage in the stock piles.	☐	
1.2.2	The procedures followed for building stockpiles are such as to prevent harmful segregation and breakage.		
a)	Stockpiling is done using front end loaders	☐	
b)	Stockpiles are not taller than the loader bucket will reach from the inclined slope of the aggregate pile.	☐	
1.2.3	Stockpiles are located in a way to prevent contamination and arranged to assure that each aggregate as removed from its stockpile is distinct and not intermingled with others.		

a)	Aggregate are not spilling over the tops of divider walls between stockpiles	☐	
b)	Aggregate stockpiles are not joining together at their bases	☐	
1.2.4	Handling and transportation of aggregates within the plant is such as to prevent harmful segregation.		
a)	Method of aggregate transfer from stockpiles to overhead bins is by front-end loader and/or conveyor belt.	☐	
1.2.5	Separate overhead bins are provided for each size of aggregate and properly constructed and labeled to prevent mixing of different.		
a)	Separate overhead bins are used for each size	☐	
b)	Overhead bins are properly labeled	☐	
1.3	**WATER:**		
a)	The plant has an adequate supply of water at sufficient regulated pressure to prevent interference with the accuracy of measurement. The safe working range	☐	
1.4	**ADMIXTURES:**		
1.4.1	Admixtures are stored in suitable tanks and protected to prevent damage from contamination.		
a)	Admixture tanks have enclosed tops to prevent trash or other contamination	☐	
b)	Tanks are properly labeled	☐	
c)	Tanks are provided with means of agitation or re-circulation of admixtures	☐	
d)	Verify line clean out procedure if one admixture dispenser is used for two different admixtures	☐	
e)	Sacked admixtures or fibers (if available) are stored in dry areas and in unopened bags. The shelf life and expiry date are still valid.	☐	
2.0	**BATCHING EQUIPMENT:**		
	This section covers type, size, operation, calibration, and accuracy of all batching equipment including material charging methods, scale types, weigh batchers, water meters, admixture dispensers, batching accuracy, control system and batch quantities recording.		

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2.1	**SCALES:**		
2.1.1	Each scale is accurate to within ±0.15 percent of scale capacity or ±0.4 percent of net applied load, whichever is greater, throughout the range of use. Scale accuracy shall be verified through a combination of test weights, substitute loads, and strain loads.		
a)	Loads are indicated by means of digital read-out or monitor display	☐	
b)	Batch man is able to read the load indicating devices from his normal position	☐	
2.1.2	Each scale is accurate to within ±0.15 percent of scale capacity or ±0.4 percent of net applied load, whichever is greater, throughout the range of use. Scale accuracy shall be verified through a combination of test weights, substitute loads, and strain loads.		
a)	All scales are accurate to within ±0.15 percent of scale capacity or ±0.4 percent of net applied load, whichever is greater	☐	
b)	Accuracy of each scale is checked throughout the range of its use	☐	
c)	Test weights used are certified and accurate to ±0.01 percent of indicated value	☐	
d)	Test weights used are verified at least once every two years	☐	
e)	Scale accuracy is verified using certified test weights to not less than 10% of the scale capacity, substitute loads to not less than 50% of scale capacity, and combination of test weights, substitute loads or strain loads in not less than each of the upper two quarters of the scale up through the normal range of use	☐	
f)	The scales are verified for accuracy (calibrated) not less frequently than every 6 months and whenever the plant is moved or noncompliance is indicated.	☐	
2.1.3	Suitable test weights are readily available for checking accuracy of scales. The availability of test weights is considered essential to ensure continuous monitoring of weighing accuracy. This requirement is to serve as a quick check of scale accuracy and does not replace the requirement for the more thorough scale accuracy verification (calibration) once every 6 months in 2.1.2. Test weights used for this purpose do not need to be certified for accuracy as in 2.1.2.		
a)	At least 250 kg of test weights are readily available to check the scales. These may be the property of others and need not be at the plant. Scale companies typically have their own test weights which are routinely checked. Readily available can mean an agreement with a scale company to check batch plant scales upon demand.	☐	

2.1.4	Weighing Containers: The weighing container or hopper shall be designed such that the center of gravity of gross load always lies between load supports. A weigh batcher manufactured by reputable plant manufacturers will meet this requirement. The only way a weigh batcher can obtain an unsatisfactory configuration is for it to be extended (enlarged) by the producer in attempt to increase its capacity.		
a)	Aggregate Weighing Container: (No. ____)	☐	
b)	Cement / Cm Weighing Container: (No. ____)	☐	
c)	Water Weighing Container: (No. ____)	☐	
d)	Ice Weighing Container: (No. ____)	☐	
e)	Admixture Weighing Container: (No. ____)	☐	
2.1.5	Load-cell Scales: They shall be arranged to transmit load to one or more cells, directly or through a system of levers, in such a way that the cell system registers the entire load accurately on the load indicating device; load cells indicated by the manufacturer to be accurate throughout the range of temperatures to which normally exposed during plant operation.		
a)	The location of load-cells is properly arranged to accurately display the actual load being supported by the weigh batchers.	☐	
b)	Each load-cell in the system is of the same type and same capacity.	☐	
	Aggregates: (No. of load cells ____) / (Capacity _____)	☐	
	Cement: (No. of load cells ____) / (Capacity _____)	☐	
	Cementitious Materials: (No. of load cells ____) / (Capacity _____)	☐	
	Water: (No. of load cells ____) / (Capacity _____)	☐	
	Ice: (No. of load cells ____) / (Capacity _____)	☐	
	Admixtures: (No. of load cells ____) / (Capacity _____)	☐	
c)	Compensated temperature range of load cells covers the range of temperatures to which the load cells are normally exposed during plant operation (Check manufacturer's specification sheet)	☐	

2.1.6	This section is the applicable read-out system when load-cells are used to measure the load.		
2.1.7	Equipped with a digital indicator or display protected from dust with numbers large enough for good readability; minimum numerical increment equal to or less than 0.1 percent of scale capacity.		
a)	Be protected from dust by a well fitted metal or plastic cabinet	☐	
b)	Numbers large enough for good readability	☐	
c)	Minimum numerical increment equal to or less than 0.1% of scale capacity (a simple method is to review the batched quantities for several batches as recorded by the digital recorder.)	☐	

Materia	Capacity	0.1%	Display	Monitor	Ticket
Aggregates					
Cement					
Cem. Materials					
Water					
Ice					
Admixture					

2.2	**WEIGH BATCHERS**: Weigh batchers include all containers used to proportion ingredients by weight.		
2.2.1	Batchers (containers) for weighing cement, aggregates, and also water or admixtures (if measured by weight) are freely suspended from a scale and equipped with necessary charging and discharging mechanisms.		
a)	Containers are water tight for liquid and tight enough to retain the product for cement, cementitious materials and aggregate.	☐	
b)	Containers for cementitious materials are completely enclosed with an air vent to prevent finely ground powder from being blown away while being weighed	☐	
c)	Batchers are freely suspended from scales	☐	
d)	Necessary charging mechanisms are available (augers for cement, over heads bins for aggregates, pipe systems for water and admixtures)	☐	
e)	Discharging mechanism shall be gates or valves arranged to ensure that the entire weighed quantity reaches the mixing unit.	☐	

2.2.2	Cement and other cementitious materials are weighed independently from non-cementitious materials. In cumulative weighing of cementitious materials, the Portland cement is weighed before the supplementary cementitious materials.		
a)	Confirm the number of scales for cementitious materials and aggregates. i. Number of Scales for Aggregates: _____ ii. Number of Scales for Cement/Cm: _____	☐	
b)	Portland cement should be weighed first when cementitious materials are weighed cumulatively	☐	
2.2.3	Batchers are capable of being loaded without causing the weighed material contact the charging mechanism.		
a)	Cement batcher is large enough for the batch (if it is not large enough, cement will pileup in the flexible feed boot or flow out the air vent). Check the volume of the batcher and compare it to the batch quantities.	☐	
b)	Aggregate batchers can be checked by loading it to the maximum capacity and observing the aggregate behavior for touching the gates of the overhead bins or spilling out of the batcher.	☐	
2.2.4	Cement batchers		
a)	Cement batchers have flexible connection (dust tight) between charging mechanism and hopper. The connection is tightly connected at both ends and is slightly longer than necessary to prevent pressure on scales	☐	
b)	The batcher is vented to permit escape of air during charging of weigh batcher	☐	
c)	Bottom and sides of batcher are shaped (smooth) and sloped (50 degrees from horizontal or more).	☐	
d)	It has a vibrator to ensure complete discharge of material	☐	
2.2.5	Batcher charging mechanism is capable of stopping flow of material within batching tolerances and preventing loss of material when closed.		
a)	Observe recorded batch weights to determine that target weights of cementitious materials are being achieved (or allow the batched cementitious material to remain in the hopper for several minutes and observe digital weight display for changing readings which may indicate leaking gates).	☐	

2.2.6	Vibrators connected to batchers are installed in such a way as not to affect accuracy of weighing.		
a)	Vibrator connections to their controls are flexible and not taut	☐	
	Note:		
2.2.7	The batchers are protected from wind to prevent interference with the weighing accuracy.		
a)	If the plant is located in an area that might create wind tunnels and operator notices changes of more than three minimum increments during windy conditions; then the wind protection is required.	☐	
	Note:		
2.3	**VOLUMETRIC BATCHING DEVICES FOR WATER (WATER METERS):**		
a)	Water meter is accompanied with a cut-off device capable of stopping the flow within the required tolerances; cut-off device is free from leaks when closed.	☐	
b)	It is equipped with a volume-setting device capable of being set to increments at least as small as 3.9 liters or a register capable of being read to 3.9 liters.	☐	
c)	The water meter register displays the quantity of water going into a batch and is visible to the batch man at the batching station	☐	
2.4	**DISPENSERS FOR LIQUID ADMIXTURES:**		
2.4.1	Separate dispenser is used for each liquid admixture in regular use. More than one admixture can be batched through a single dispenser if the admixtures are compatible or if the dispenser is flushed with water after each cycle.	☐	
	Note:		
2.4.2	Dispensers are calibrated and Piping is free of leaks and properly valued to prevent backflow.		
a)	Each dispenser of liquid admixture is calibrated	☐	
b)	Admixtures are interjected into water line downstream from the meter	☐	
c)	Admixtures are interjected independently to prevent mixing of incompatible admixtures	☐	
d)	Admixture lines do not leak	☐	

2.5	**BATCHING ACCURACY:** For weighed ingredients, accuracy of batching is determined by comparison between desired weight and the actual scale reading. Batching control equipment, currently available, will not batch each ingredient, in every load, within the prescribed tolerances. The average of all ingredients within any 10 consecutive loads should be within the prescribed tolerances.		
2.5.1	Cement and cementitious materials measured by weight are batched within ± 1 percent of the desired weight in individual batchers, or ±1 percent of the desired intermediate and final cumulative weights in cumulative batchers. For small batches (less than 30 percent of scale capacity), the required accuracy is -0% and +4%.	☐	
2.5.2	Aggregate measured by weight are batched within ± 2 percent of the desired weight in individual aggregate batchers, or ±1 percent of the desired intermediate and final cumulative weights in cumulative aggregate batchers. For small loads (weights below 15% and 30% of scale capacity respectively), the required accuracy of batching is ± 0.3 percent of scale capacity.	☐	
2.5.3	Water measured by volume or weight within ± 1.5 percent of the desired amount, or ± 3.9 L, whichever is greater.	☐	
2.5.4	Admixtures measured to within ± 3 percent of the desired amount or ± the minimum dosage rate per 100 kg of cement, whichever is greater.	☐	

Summary of Requirements for Accuracy of Batching

Material	*Cementitious Materials*	*Aggregates*		*Water (Vol. or Wt.)*	*Admixtures*
		Individual Batchers	*Cumulative Batchers*		
Basic Tolerance	*± 1% of desired weight*	*± 2% of desired weight*	*± 1% of desired weight*	*± 1.5% of desired weight or*	*± 3% of desired value or*
	Intermediate and cumulative		*Intermediate and cumulative*	*3.9 liters (4.5 kg)*	*Minimum dosage rate per 100 kg of cement*
Small Batch Tolerance	*-0 to +4% of desired weight*	*± 0.3% of scale capacity for loads below 15% of scale capacity*	*± 0.3% of scale capacity for loads below 30% of scale capacity*	*Whichever is greater*	*Whichever is greater*

2.5.5	**MOISTURE CONTENT OF AGGREGATES AND SLUMP CONTROL**		
2.5.5.1	Suitable methods of maintaining consistent moisture content of the aggregates and measuring the aggregate moisture is in place. The procedure is capable of detecting changes of 1% by weight of dry aggregate. If automated system (moisture probes) is used, it is calibrated not less frequently than every 3 months.	☐	
2.5.5.2	Suitable procedures are followed to maintain control of slump (slump meters on mixer truck or plant mixer, visual observation, physical measurement…)	☐	
2.6	**BATCHING SYSTEMS:** A Batching System is a combination of batching controls necessary to proportion the ingredients for concrete."		
2.6.1	Weigh Batcher Controls (Cementitious materials and aggregates are batched by weight; water and admixtures may be batched in a weigh batcher or by volume. Automatic Control – When actuated by a single starting signal, an automatic weigh-batcher control shall start the weighing operation of cementitious materials, aggregate, water, or admixture, and stop the flow automatically when the designated weight has been reached.	☐	
a)	The charging gate or valve cannot be opened until the scale has returned to zero balance within ±0.3% of the scale capacity	☐	
b)	The charging gate or valve cannot be opened if the discharge mechanism is open	☐	
c)	The discharge mechanism cannot be actuated if the charging gate or valve is open	☐	
d)	The discharge mechanism cannot be actuated until the weight of material is within the tolerance specified above	☐	

Note : That the system must be capable of functioning as defined and not necessarily operated that way. For example, an operator may over-ride certain controls to continue batching in which case he will be operating in a manual mode.

Material	Scale Capacity	0.3%	- Zero Balance	+ Zero Balance
Cement				
Cem. Materials				
Aggregates				

Water				
Ice				
Admixture				

2.6.2	Automatic System: A combination of the necessary individual weigh-batchers and volumetric batching devices (if water or admixture is measured volumetrically in the plant), the controls of which are all automatic		
a)	All batching equipment activated by a single starting mechanism, except that a separate starting mechanism is permitted for volumetric batching of water and/or admixture not batched at the time of weighing the other ingredients.	☐	
b)	The discharge of any weighed ingredient in the system may not start unless batching controls for all weigh batchers have been cleared of the previous batch, with scales returning to zero tolerance, and until all weighed ingredients have been weighed within the required tolerances.	☐	
C)	Volumetric admixture dispenser controls (if any) interlocked with volumetric water batching controls or the controls of at least one weigh batcher to prevent the discharge of both admixture and the interlocked ingredient(s) unless both the admixture dispenser and the interlocked batching device(s) have been cleared of the previous batch.	☐	
2.7	**Recorders :** Devices that provide a permanent record of the quantity of materials measured into a particular batch of concrete.		
2.7.1	A digital recorder provides a printed record (batch ticket) of the quantity of material weighed or measured. It registers the scale readings within ±0.1% of scale capacity	☐	

Material	Scale Capacity	0.1%	Actual Weight	Ticket Recording	Difference
Cement					
Cem.Materials					
Aggregates					
Water					
Ice					
Admixture					

2.7.2	Digital recorders are properly protected, i.e., provided with effective security to prevent tampering with records. Ensure that a simulated ticket, for such purposes as training, indicates it is a simulated ticket and does not leave a question to the authenticity of the ticket.	☐	
2.7.3	Digital recorders provide proper identification of a particular batch with the corresponding delivery ticket. This is verified by checking that digital recorded batch quantities and delivery tickets each include ticket number, date and time of loading and batch quantities.	☐	
2.7.4	Recorder registers empty balance or tare to within 0.3% of scale capacity for weighed ingredients.	☐	

3.	**CENTRAL MIXER**		
3.1	Central Mixing Operations Complete mixing in the plant's stationary mixer qualifies a plant to be classified as a Central Mixing Operation. **Type of Mixer:** _____ **Capacity of Mixer**: _____		
3.1.1	The central mixer is capable of producing uniform concrete in the mixing time regularly employed at the plant or in the time designated in the relevant concrete standard specifications, whichever is less, when operated with a capacity batch in accordance with the method regularly employed in the operation of the plant.	☐	
	Example: Mixing time specified in ASTM C 94 is 1 minute for mixers with capacities of 0.76m3 or less, plus 15 seconds for each additional cubic meter or fraction thereof. If the facility has a regularly employed mixing time that is shorter than the mix cycle defined in ASTM C 94, then mixing uniformity evaluation should have been performed to qualify that shorter mixing time. The producer should provide the necessary documentation. The concrete is considered uniform if samples taken after discharge of approximately 15% and 85% of the load do not differ more than the following: **Slump:** 25mm if average slump is 100mm or less 38mm if average slump is 100 to 150mm **Coarse Aggregate Content:** 6% by weight of concrete Density: 16 kg/m3 **Air Content:** 1% **7-Day Compressive Strength:** 7.5%		
	SAMPLING PROCEDURE: 1. Load the mixer with a capacity batch. 2. the concrete in the stationary mixer using pre-set mixing time established by the plant. 3. Discharge the batch into a truck hauling unit and stop the drum rotation once all the concrete 4. discharged into the truck. 5. Discharge 15% of the concrete batch in the truck into a front-end loader bucket. 6. Discharge sample A into wheel barrow. 7. Discharge 65% of batch (80% total) into loader bucket 8. Discharge sample B into another wheel barrow. 9. total sampling process shall not exceed 15 minutes from beginning of discharge to beginning testing.		

10. Process samples A and B independently for slump and coarse aggregate content tests

Weight of Concrete		
Volume of Bucket		
Density		
Limit		

Air Content:

Air Content		
	Sample 'A'	Sample 'B'
Air Content (%)		
Limit	1.0%	

Compressive Strength @ 7 Days:

COMPRESSIVE STRENGTH @ 7 DAYS						
Sample	Sample 'A'			Sample 'B'		
Cube No.	A1	A2	A3	A1	A2	A3
Density (kg/m3)						
Strength (MPa)						
Average Strength (MPa)						
% of Strength (individual / average)						
Difference (%)						
Limit (%)	7.5 %					

☐

3.1.2	Central mixer is equipped with a timing device that will not permit the batch to be discharged before the predetermined mixing time has elapsed.	
3.1.3	The mixture prepared for the purpose of quality control allows the company to hold the cube. No other required cubes are allowed in the lab of the prepared mix company	☐

4.0	**PROVISION FOR HOT WEATHER CONCRETE**		
4.1	Materials Stock and Plant Facilities		
b)	Aggregate stock piles are shaded	☐	
c)	Cement silos, admixture tanks, water tanks and aggregate bins are painted white or light color	☐	
d)	Transit mixers are painted white or light color	☐	
4.2	**WATER AND ICE**		
4.2.1	Plant is equipped with water chiller of adequate cooling. Temperature of chilled water: _____	☐	
4.2.2	Plant is equipped with ice plant of adequate capacity Ice plant capacity: _____	☐	
4.2.3	Concrete temperature is regularly checked at the plant prior to dispatch of the concrete load	☐	
5.0	**TICKETING SYSTEM**		
a)	Name of ready-mixed concrete company	☐	
b)	Plant designation where batched if company operates more than one plant	☐	
c)	Serial number of ticket	☐	
d)	Truck number or designation	☐	
e)	Name of contractor or other purchaser	☐	
f)	Specific designation of job (name and location)	☐	
g)	Specific class or designation of concrete identifiable with terminology employed in the job specs.	☐	
h)	Amount of concrete in cubic meters	☐	
i)	Date	☐	
J)	Extra water added at the request of the receiver of the concrete and his signature or initials	☐	
k)	Time when batch was loaded	☐	

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ADDITIONAL NOTES

Prepared by	Reviewed & Approved by
Designation: Technical Manager	Designation: Quality Manager / Chief of Lab

مختبرات بحوث المواد الإنشائية
CONSTRUCTION MATERIALS RESEARCH LABORATORY