APPLICATION NO.: _____

CLIENT INFORMATION:

_____
Client ID Number

_____
Client Name

_____
Factory Address/Location

_____
Principal Contact Person

_____
Designation

_____
Telephone / E-mail

DATE OF AUDIT

_____
DD/MM/YY

PLANT INFORMATION

_____
Plant ID Number

_____
Plant Location

_____
Plant Manufacturer

_____
Control System

_____
Year Manufactured

DCLD AUDIT TEAM

Name	Designation	Telephone/E-mail
_____	_____	_____
_____	_____	_____
_____	_____	_____

Revision History:

Rev No	Date	Clause(s) Amended	Description/Remarks
2	13/11/2013	[3.1], [5.2.7]	Amended criteria for uniformity, results Tables amended, “No of agitators” requirement deleted.
3	11/09/2014	[several clauses indicated by shaded text]	Amendments implemented based on actual situations encountered during the audits.
4	02/01/2019	[several clauses]	Amendments implemented based on actual situations encountered during the audits.
5	25/02/2019	Header	New DM logo

1. MATERIAL STORAGE AND HANDLING

1.1 Cement and Cementitious Materials (Including Blended Cements, Fly Ash, GGBS, Silica Fume…)

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 material streaks on the external face ☐

b. If tanker is unloading, check for powder blowing from locations expected to be solid ☐

c. With a split silo (2 discharge gates on 1 silo), observe the lower vent holes between silo segments for a tell-tale trail of powder indicating an internal leak between the double wall safety zone ☐

d. Bagged cementitious materials are stored in dry storage area (preferably lifted from the ground) and that opened bags are not retained overnight for future use. ☐

e. Silica Fume Slurry is agitated regularly to maintain the homogeneity. ☐

Notes:

_____

_____

1.1.2 Different cementitious materials are isolated to prevent intermingling or contamination.

a. Split silos with solid walls between compartments are acceptable if the separating wall is continuous to the top. Records for maintenance are kept available. ☐

b. Each blow pipe to fill a silo is clearly labeled and/or protected. ☐

Notes:

_____

_____

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. Unloading that is done by end dump trailers is satisfactory ☐

b. Aggregates are not constantly dropped from excessive heights onto a concrete slab ☐

c. Track-mounted front end loader or dozers are not used to push up aggregate ☐

stockpiles

d. No signs of excessive aggregate segregation and breakage in the stock piles ☐

Notes:

_____

_____

1.2.2 The procedures followed for building stockpiles are such as to prevent harmful segregation and breakage.

a. Stockpiles are done using front end loaders and not taller than the loader bucket will reach from the inclined slope of the aggregate pile. In case the aggregate stockpile is built two or more tiers tall by the use of front - end loader or dump trucks, a ramp should be built and the aggregate should be placed atop the ramped tier and not shoved up from the edges of the lower tier and not allowed to roll off the upper tier edges to the lower tier. ☐

Notes:

_____

_____

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. Aggregates are not spilling over the tops of divider walls between stockpiles ☐

b. Aggregates stockpiles are not joining together at their bases ☐

Aggregate stockpiles do not show any sign of contamination

c. Floor material beneath stockpiles is concrete slab or several inches of the stockpiled material extending below the ground elevation at which the loader bucket appear to operate (native soils are not acceptable) ☐

Notes:

_____

_____

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 is satisfactory (receiving hoppers are not narrower than the front end loader bucket; conveyors are not undersized and do not spill aggregate during their transport) ☐

Notes:

_____

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 and type of aggregate, properly labeled and do not show any sign of contamination. ☐

c. An effective method for checking the level of material inside the bins is in place in order to prevent under-filled (empty) bins and overfilled bins which may lead to cross contamination (such as level indicators, TV monitor…) ☐

Notes:

1.3 Water

1.3.1 The plant has an adequate supply of water at sufficient regulated pressure to prevent interference with the accuracy of measurement. The safe working range for most meters is 0.4 to 8.6 bars. ☐

Notes:

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. Records for manual agitation are kept available ☐

d Records are maintained for changing admixtures tanks and agitation pumps ☐

e. Verify line clean out procedure if one admixture dispenser is used for two different admixtures. Records for changing are kept available. ☐

f. Sacked admixtures or fibers (if available) are stored in dry areas and in unopened bags. The shelf life and expiry date are still valid. ☐

Notes:

2. 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.

2.1 Scales

2.1.1 Each scale consists of suitable mechanical or electronic (load cells) devices which weigh constantly within the tolerances given 2.1.2, with loads indicated by either by means of a full-reading dial, or a digital read-out or display. For all types of batching systems, manual through automatic, the batch man must be able to read the load indicating devices from his normal station.

Notes:

_____

_____

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 for internal verification are certified and accurate to ±0.01 percent of indicated value ☐

d. Test weights used for internal verification 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 12 months and whenever the plant is moved, load cells are changed or noncompliance is indicated. ☐

Notes:

_____

_____

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. ☐

Notes:

_____

_____

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(s): (No. ____) ☐

b. Cement / Cm Weighing Container(s): (No. ____) ☐

c. Water Weighing Container(s): (No. ____) ☐

d. Ice Weighing Container(s): (No. ____) ☐

e. Admixture Weighing Container (s): (No. _____). Dispenser(s) (No. _____). ☐

Notes:

_____

_____

2.1.6 *Digital-Indicating Scales:*

This section is the applicable read-out system when load-cells are used to measure the load.

2.1.9.1 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.

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.) ☐

Material	Capacity	0.1%	Display/Monitor
Aggregates			
Cement			
Cem. Materials			
Water			
Ice			
Admixture			

Notes:

_____

_____

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 ☐

Notes:

_____

_____

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. ☐

Notes:

_____

_____

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 ☐

d. It has a vibrator to ensure complete discharge of material ☐

Notes:

_____

_____

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). ☐

Notes:

_____

_____

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 ☐

Notes:

_____

_____

2.2.7 *Notes:*

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 5 liters or a register capable of being read to 5 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 ☐

Notes:

2.4 Dispensers for Liquid Admixtures

2.4.1 Separate dispenser with appropriate markings 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. ☐

Notes:

2.4.2 Dispensers are calibrated and Piping is free of leaks and properly valved to prevent backflow

a. Each dispenser of liquid admixture is calibrated ☐

b. Admixtures are interjected independently to prevent mixing of incompatible admixtures ☐

c. Admixture lines do not leak ☐

Notes:

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%. ☐

Notes:

_____

_____

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. ☐

Notes:

_____

_____

2.5.3 Water measured by volume or weight within ± 1.5 percent of the desired amount, or ± 5L, whichever is greater. ☐

Notes:

_____

_____

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. ☐

Notes:

_____

_____

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		*Intermediate*	*5 liters*	*Minimum*

	and cumulative		*and cumulative*		*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. ☐

Notes:

_____

_____

2.6 Recorders

Devices that provide a permanent record of the quantity of materials measured into a particular batch of concrete.

2.6.1 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. ☐

Notes:

_____

_____

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 and 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 another 70% of the load (85 % total) do not differ more than the following:

Slump:	25mm if average slump is 100mm or less
	40mm if average slump is 100 to 150mm
Coarse Aggregate Content:	6 % by weight of concrete
7-Day Compressive Strength:	7.5%

Sampling Procedure:

1. Load the mixer with a capacity batch.
2. Mix 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 is discharged into the truck.
4. Discharge 15% of the concrete batch in the truck into a front-end loader bucket.
5. Discharge sample A into wheel barrow.
6. Discharge 70 % of batch (85 % total) into loader bucket
7. Discharge sample B into another wheel barrow.
8. The total sampling process shall not exceed 15 minutes from beginning of discharge to beginning testing.
9. Process samples A and B independently for slump and coarse aggregate content tests

Notes:

_____

_____

Testing Procedure:

- **Slump test** shall be performed in accordance with ASTM C 143 (or its equivalent, when using other standard specifications).
- **Coarse Aggregate Content** is determined by taking 18 to 30kg of each concrete sample and then washing each sample on a No. 4 sieve (75 microns). The retained material on the sieve is the coarse aggregate which may be weighed wet.

  Compute the percentage of the C/A for each sample by dividing the wet weight of aggregates retained on the sieve by the original weight of concrete.

  If the test results are very close to the specification limit (6.0%), the coarse aggregate shall be

wiped dry and the SSD weights shall be used in the computation.

Tests Results:

Slump

SLUMP (mm)				
Sample 'A'	Sample 'B'	Average Slump	Difference	Limit
				25mm / 40 mm
Pass/Fail				

Notes:

_____

_____

Coarse Aggregate Content

COARSE AGGREGATE CONTENT		
Sample	Sample 'A'	Sample 'B'
Weight of Concrete (Kg)		
Weight of Retained Aggregate (Kg)		
% of C/A		
Difference (%)		
Limit (less than)	6.0%	
Pass/Fail		

Notes:

_____

_____

_____

Compressive Strength @ 7 Days

COMPRESSIVE STRENGTH @ 7 DAYS						
Sample	Sample 'A'			Sample 'B'		
Cube No.	A1	A2	A3	B1	B2	B3
Density (kg/m3)						
Strength (MPa)						
Average Strength (MPa)						

% of Strength (individual / average)							
Difference (%)							
Limit (%)	7.5 %						
Pass/Fail							

Notes:

_____

_____

4. TICKETING SYSTEM

Provision on delivery ticket for the following information:

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. Time when batch was loaded ☐

k. Weight/volume of all materials batched (target and actual) in addition to the batching error of each material ☐

Notes:

_____

5. DELIVERY FLEET

5.1 Agitators

5.1.1 Interior condition satisfactory ☐

No appreciable accumulation of concrete. The interior of the mixing vessel must have more

than a majority of the skin clean. The acceptable build-up of hardened concrete is typically confined to less than 680 kg. This quantity of concrete should be confined to rather small area than spread throughout the vessel to be acceptable.

If the empty weight of the unit is known, it can be weighed on truck scales to determine the quantity of build-up. The most likely spot for the larger accumulations of hardened concrete is near the front of the vessel. It is also the most acceptable in this location.

Blades are free of excessive wear (blade wear shall not exceed 10% of the original radial height when measured at the point of maximum drum diameter nearest to the drum head). No blade sections should be missing or have holes worn in them, or are loose and flopping.

Notes:

_____

_____

5.2.2 Charging and discharge openings and chute in good condition: free from appreciable accumulations of concrete; hopper and chute surfaces clean and smooth.

- Charging hopper ☐
- Discharge opening ☐
- Discharge chute ☐

A lack of any accumulation of concrete on a portion of these surfaces is unusual. The allowed build-up of concrete shall not include surfaces typically covered by fresh concrete. Hardened concrete that is thick enough to cause flaking off into the fresh concrete should not be immediately adjacent to surfaces that carry fresh concrete.

Notes:

_____

_____

5.2.7 Summary of Fleet Operating from Plant

Number of units available for use _____

Number of units certified or submitted for certification _____

6. Provision for Hot Weather Concrete

6.1 Materials Stock and Plant Facilities are arranged in such a way to produce temperature controlled concrete with the following measures that might be taken:

a. Aggregate stock piles are shaded. ☐

b. Cement silos, admixture tanks, water tanks and aggregate bins are painted white or light color. ☐

c. Transit mixers are painted white or light color. ☐

6.2 Water and Ice

6.2.1 Plant is equipped with water chiller of adequate cooling. ☐

Temperature of chilled water: _____

6.2.2 Plant is equipped with ice plant of adequate capacity ☐

Ice plant production capacity: _____

Ice plant storage capacity: _____

6.2.3 Concrete temperature is regularly checked at the plant prior to dispatch of the concrete load ☐

Concrete temperature at time of inspection of a random sample of concrete is recorded as: _____, and meets the project specifications limit.

7. CEMENT AND CEMENTIOUS MATERIALS CONSUMPTION

7.1 Theoretical consumption of all cements and cementitious materials matches the actual consumption being extracted from the plant. ☐

7.2 Implementation of the latest DM-Building Department circulars with regards to the use of green concrete wherever applicable. ☐

Additional Notes

_____

_____

_____

_____

_____

_____

_____

_____

_____

_____