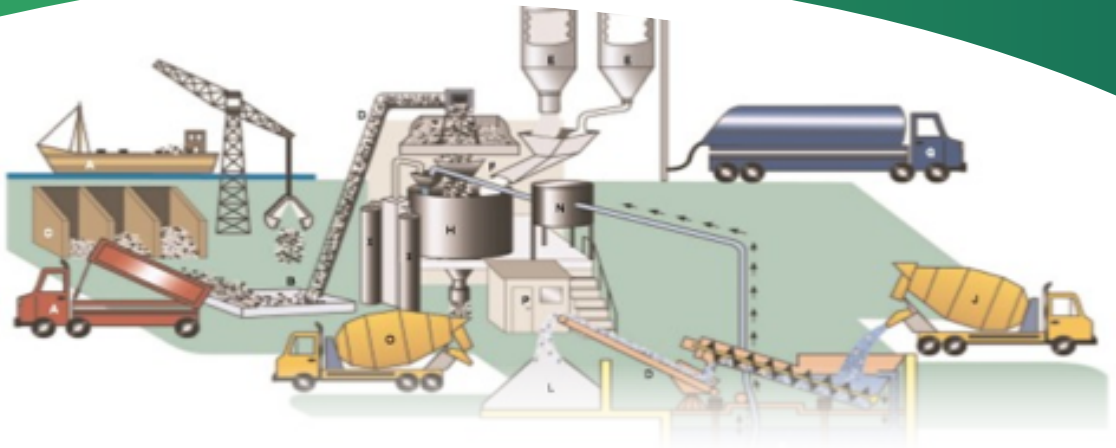


Issue 06

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Features

- Plant Specific QC Issues & Troubleshooting



Plant Specific QC Issues & Troubleshooting

Farhan J. Nawab - Area Technical Manager

Efforts to improve concrete structures through better concrete require research on practical concrete and on concrete practice. Of course, laboratory research is also required towards comparison and obtaining better raw materials particularly suitable for various purposes. We will learn more about concrete from sorting out problems at the batching plant than we will ever learn in the office doing new-mix designs.

It is not enough for a Technical Engineer to work-out his mixes in a laboratory and to be more interested in the underlying science. Working knowledge of plant operations and maintenance is also required to answer 'how' and 'why' when a problem strikes related to quality of concrete produced from the batching plant. Some may argue basic knowledge is available but the devil is in the detail.

This newsletter attempts to highlight some of the plant maintenance issues that have direct impact on the quality of concrete produced. Risk factors associated with human error are also discussed.

MIXER GATE LEAKAGES:

The discharge gate of a central mixer is made-up of two halves that opens and closes during concrete batching. In due course of its service period, it is subjected to mechanical wear & tear that reduces the steel area along the edges of the gate (Fig 01). Even though the mixer is in a closed position, the gaps due to reduced steel area allows the liquid/paste part to easily escape the mixer before a complete mixing is achieved (Fig 02).



Fig 1. Worn out mixer gate



Fig 02. Mortar spillage while mixer is running "closed"

Here is what happens practically;

- 1- Admixture component escapes. So, the mix has lower admixture/water component than the design during mixing in central mixer.
- 2- The ampere meter will show that the mix is stiff, so the operator tends to adjust the mix with some extra water or admixture equal to the

amount that has escaped the central mixer

3- As the mix is discharged into the truck mixer, the resulting mix looks completely different than the lab trial mix

4- Higher W/C as compared to design causing loss of strength

5- Segregation and bleeding

6- The very purpose of central mixing is lost

At a more more advance level of deterioration, sand & even 10mm aggregate are being forced out of the mixer while mixing (Refer Fig 03)



Fig 03. Sand spillage while mixer is running "closed"

Solution:

- 1- Repair/welding a temporary solution.
- 2- Mixer gate replacement.
- 3- Regular preventive maintenance

ADMIXTURE FILTER CLOGS:

This is applicable where flowmeters are used. There are filters installed before the flowmeter to ensure that the admixture is filtered for any foreign material before it moves forward in to the flow meter. In case the filters and admixture pipes are not regularly cleaned/flushed with water, the solid content of the admixture hardens inside the filter causing the blockages.



Fig 04. Poorly maintained filter



Fig 05. Well maintained in-use filter



Fig 06. Filter after cleaning

Effects of a clogged filter:

- 1- Obstructs admixture flow
- 2- Admixture input to the mixer delayed
- 3- Overmixing
- 4- Slump inconsistency
- 5- The flowmeter may continue to read the pulses even with a small amount of admixture in-flow and completes the batch with lower admixture dose than the design causing slump issues & increased water demand. **Caution! printouts will show correct quantities are batched.**

Solution:

- 1- Regular water flushing of admixture motors and pipes.
- 2- Replace damaged filters.
- 3- Periodic inspections.

MIXING ARMS:

Mechanical wear and tear of the mixing arms without proper maintenance causes damage/reduction in steel area of the mixer arms.



Fig 06. Worn out mixing arms

Effects of damaged mixing arms:

- 1- Improper mixing of concrete esp. in high admixture mixes like flow concrete or when PC based admixtures are used.
- 2- May not meet Concrete Uniformity Requirements per Annex A1 ASTM C94

Solution

- 1- Regular inspection & maintenance of mixing blades.
- 2- Replace worn out arms

LOAD CELL INSPECTIONS:

Rust & fatigue of steel causes sudden failure of load cell support system that leads to imbalance of the aggregate weighing system.



Fig 07. Aggregate Load Cell Support System

The side effects of failure of load cell support system are:

- 1- Load cell malfunction
- 2- Inaccurate aggregate measurements
- 3- Change in mix properties, fresh and hardened
- 4- Yield issues

Solution:

- 1- Regular inspection & maintenance of steel support
- 2- Immediate replacement of rusty parts

ICE DISCHARGE AND MANUAL USAGE:

Ice plants:

Malfunction of compressor(s) at an ice plant leads to melting of ice increasing water content in flaked ice. During pumping/transport of such ice flakes from ice plant to mixer, the line blocks causing delays of ice discharge in to the mixer. This leads to,

- 1- Overmixing
- 2- Higher concrete temperature
- 3- Reduced slumps
- 4- Crushing of soft aggregate, change in mix gradation

Manual Usage:

During breakdown of ice plants, ice is purchased from outside ice factories in bags. Without a proper conveyor & weighing system, many factories discharge the ice sacks manually in to the central mixers. This involves high risk of the following:

- 1- Safety hazard for labors feeding the ice with an open mixer gate. Highly unsafe practice & must be stopped.
- 2- Human error in counting number of sacks per batch, therefore, inconsistent W/C of batches.
- 3- Slump variations and rejections
- 4- Higher standard deviations of all measured concrete properties

Solution:

- 1- Proper maintenance of ice plants
- 2- Installing ice feed conveyor systems with weighing balance

PLANT AGGREGATE BINS INSPECTION:

Erosion of steel divider walls of plant aggregate bins (esp. old plants) leads to formation of cavities/openings thereby mixing of different sizes of aggregate takes place inside the plant bins. Change in mix gradation and properties are most common effects in such situations.

Regular inspections of divider walls of plant bins from inside is a must.

RISKS ASSOCIATED WITH HUMAN ERROR:

The below scenarios have higher risk of human error:

Manual Operation of Batching Plant:

During manual operations, in absence of a highly alert batcher the following may go wrong;

- 1- Plant operator may mistake one material for another.
- 2- Material outside batching tolerances

Consequences:

Late setting, inconsistent batches, loss of reputation.

Solution:

Competent batcher to run the plant and to be monitored by concrete specialist.

Open Water Valve:

This is applicable to old truck models. (which are in-use in significant numbers. The new model trucks have air valve on each truck tank so there is no return of water from tank to drum unless it is manually kept open) Drivers may keep the water valve 'open' during truck washing. While the truck water tank is filled under the batch plant, water directly escapes in to the drum mixer along with the batched concrete.

Consequences:

Rejections & dumped concrete.

Solution:

- 1- Plant operator & helper to ensure that water valve is closed before the batch is started.
- 2- Air valve/non-return valve to be installed in all older model trucks.

Aggregate Mixing – The Loader Operator:

Mixing of different aggregate sizes in the plant bins happens when the loader operator forgets to move the feed conveyor to the bin carrying respective aggregate type.

Consequences:

Change in mix gradation, Coarse/Sandy mixes, rejections.

Solution:

Outgoing concrete to be inspected the plant, training of loader operator and routine checks.

Admixture Unloading Process:

This operation requires high supervision due to the risk of mixing between different types of admixtures during manual unloading process.

Consequences: Disastrous

Solution:

Very high supervision by material receiver. This job should not be left to any helper or admixture truck driver.

Dispatcher-Plant Operator Communication:

Communication gap/ Mis-understanding between dispatcher and plant operator can result in dispatching a wrong mix.

Consequences:

Loss of reputation, financial implications

Solution:

Automation of process, Daily shipping sheet to be made available to plant operator

The Plant Operator or The Batcher:

Given all the variables at a ready-mix factory, a plant operator is an important person who must ensure consistent batching. Under similar conditions and given set of resources, it is a fact that no two operators will batch the concrete with the same consistency. There are batchers who “feel” the concrete and there are the ones who knows only to “press buttons”.

CONCLUDING REMARKS:

A quality product is a result of joint efforts of all departments put together in steps. Good execution of every step is essential and none can be dismissed as being of minor importance.

Any one flaw will mar the end product. Sometimes the defect is visible, but at other times it is hidden and no one knows about it until something happens so that an investigation and testing follow.

Regular maintenance and inspection is as important as safety, quality, production or service. With time pressure or occasional manpower shortages, there is sometimes a tendency to concentrate on what are perceived to be the ‘essentials’ at the expense of quality. This tendency should be resisted.