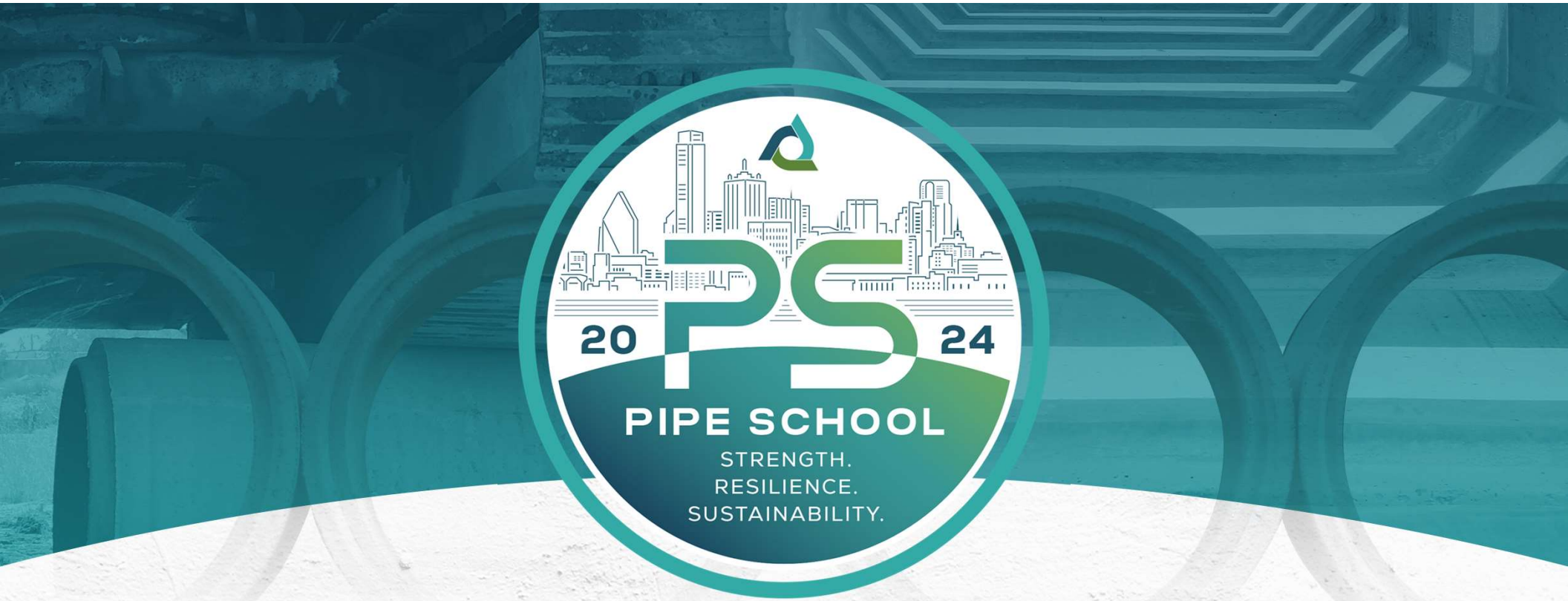


# Managing Your Batch Plant

**Archie Heikkila**
*Rinker Materials*

**Martin Wieland**
*Wiggert & Co. GmbH*

**William Felske**
*Rinker Materials*

# Overview

- Receiving and Storage of Raw Materials
- Batching Equipment
- Aggregate and Cement Scales
- Admix Dispensers
- Water Feed
- Concrete Mixers
- Concrete Transportation
- Maintenance Items

# Managing Raw Materials

- Receiving and Storage of Aggregates
  - Stock piles exposed to the elements
  - Sloping of the ground
  - Stock pile management
  - Prevent cross contamination

# Managing Raw Materials

- Receiving and Storage of Cements
  - Clear marking of fill pipes


FLY ASH



ACPA


FLY ASH
CLASS F ASH


CEMENT

ACPA


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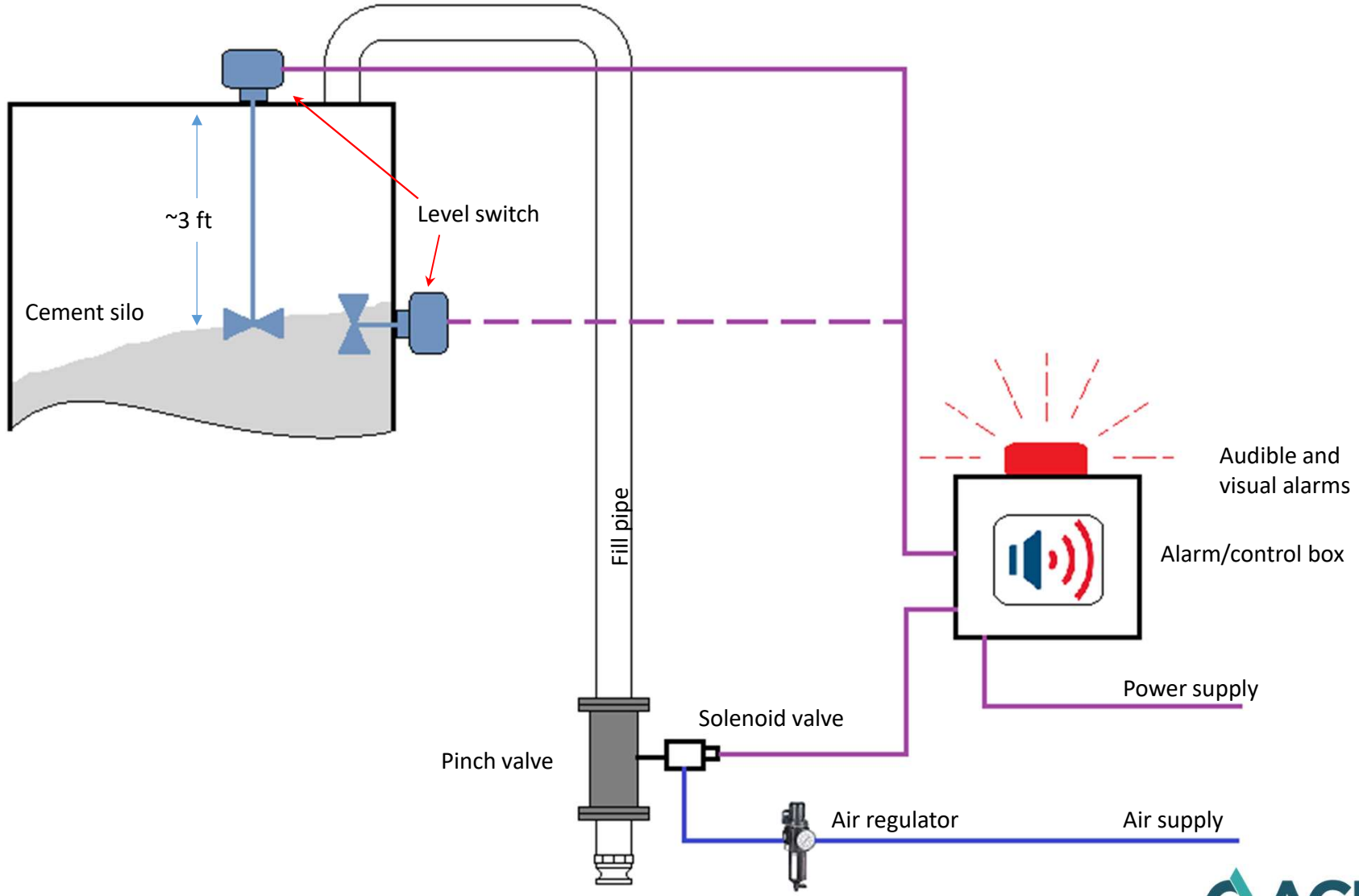
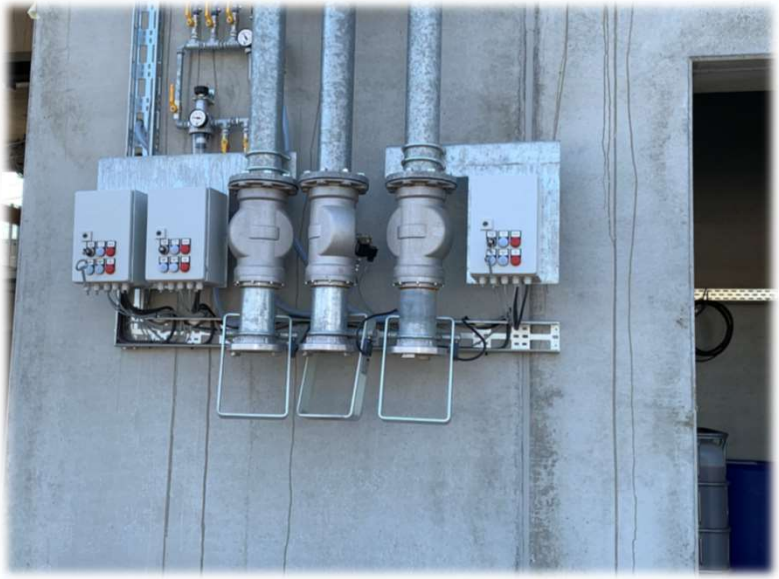
# Managing Raw Materials

- Receiving and Storage of Cements
  - Clear marking of fill pipes
  - Function of anti-overfill system
    - Overfill limit switch
    - Pinch valve control

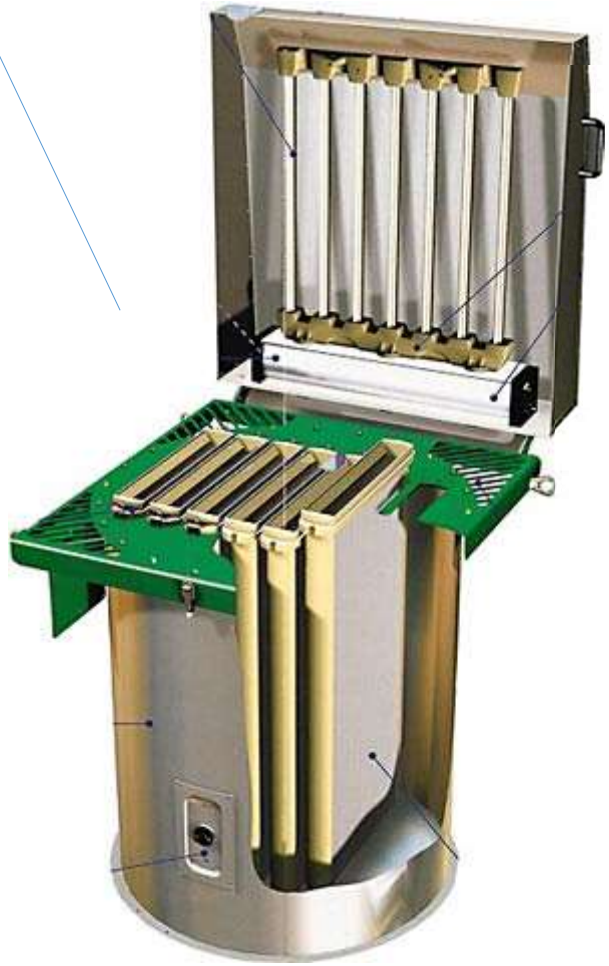

~3 ft
Level switch
Cement silo
Fill pipe
Audible and
visual alarms
Alarm/control box
Power supply
Solenoid valve
Pinch valve
Air regulator
Air supply



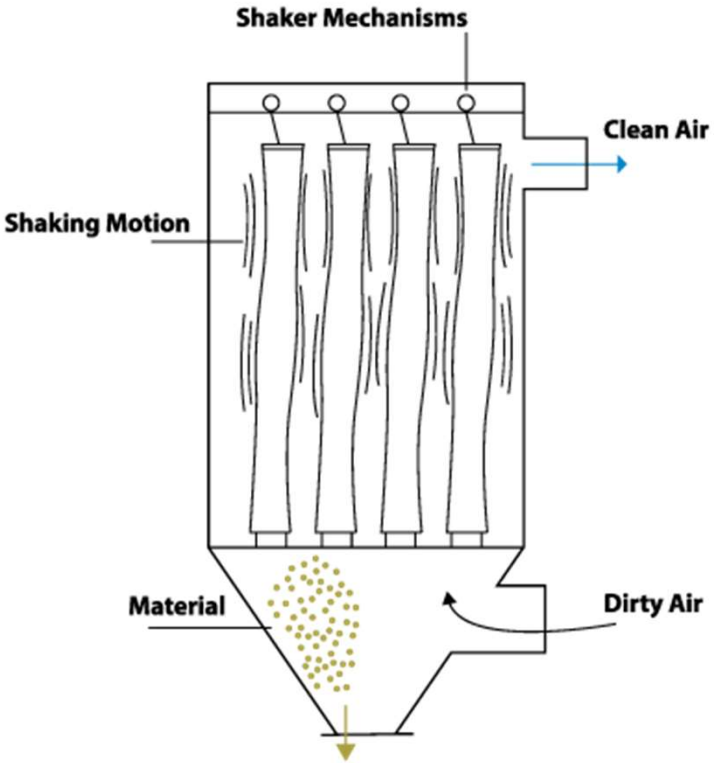
# Managing Raw Materials

- Receiving and Storage of Cements
  - Clear marking of fill pipes
  - Function of anti-overfill system
    - Overfill limit switch
    - Pinch valve control
  - Function of silo ventilation
    - Baghouse
    - Pressure Relief Valve (Pop-off)

“Pulse Jet” type



“Shaker” type

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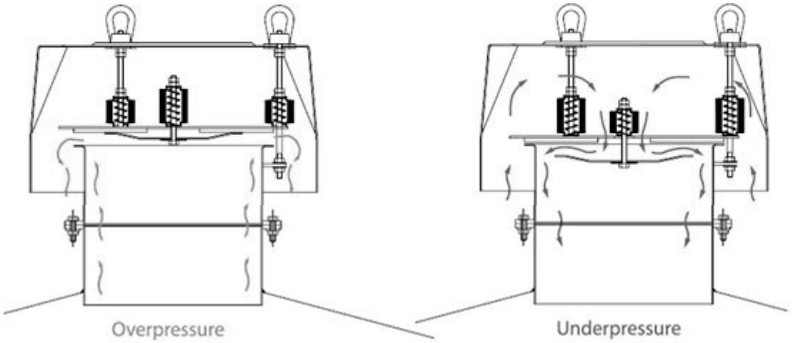
## Pressure Relief Valve (PRV, Pop-off)

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# CEMENT SILO IS NOT A PRESSURE VESSEL

**True incident**: A 25 ton cement tanker operating at 29 psi (!!) discharged 11 tons of cement into a 16 ton silo. Just as the high level alarm went off, the last of the cement was discharged from the tanker. While the driver was in the process of closing the cement delivery valve, the retaining clip between the filter housing and the mounting flange failed. As a result, the bag house was blown off the top of the silo, landing on the ground below.

**Why?:** Although the pressure relief device operated, it seems likely that it was not sufficiently large and was overwhelmed by the volume of air involved.

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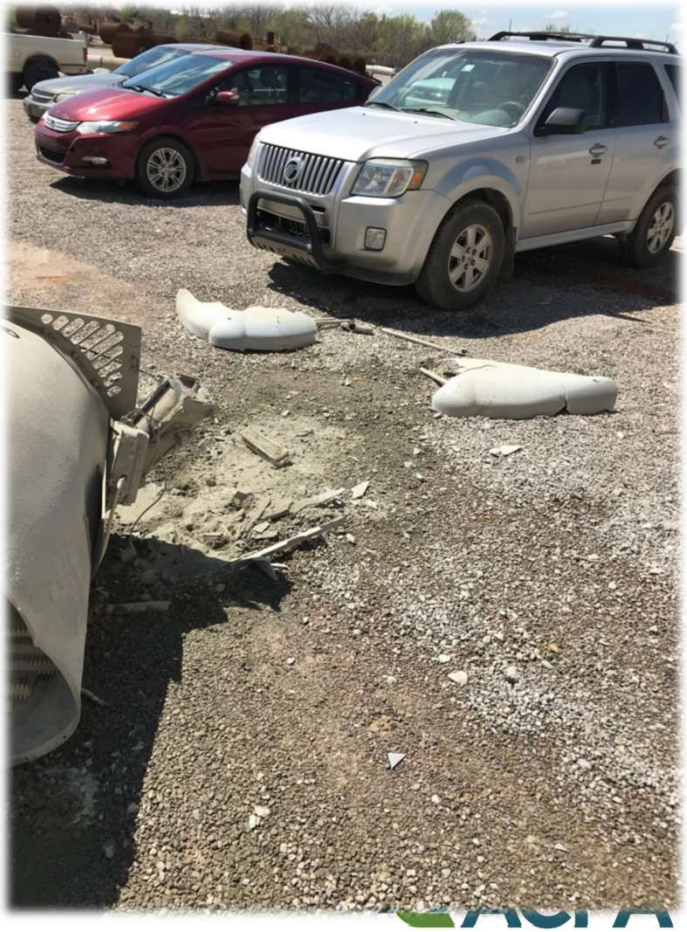
# CEMENT SILO IS NOT A PRESSURE VESSEL



# CEMENT SILO IS NOT A PRESSURE VESSEL

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Pressure above 1 psi in the silo can be disastrous!

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Pressure above 1 psi in the silo can be disastrous!

# Managing Raw Materials

- Receiving and Storage of Cements
  - Clear marking of fill pipes
  - Function of anti-overfill system
    - Overfill limit switch
    - Pinch valve control
  - Function of silo ventilation
    - Baghouse
    - Pressure Relief Valve (Pop-off)
  - Monitor unloading pressure
    - Signs, supervision


DO NOT
EXCEED
8
PSI

# Aggregate feeding devices

- Clamshell gates
- Vibratory feeders
- Feeding belts
- Moisture measuring

## Clamshell gates

- Flow control valve on opening
- Quick acting closing
  - Jog timers
- Positive stops/stroke limiters
- Worn out gate can cause sticking
- Worn out jaws causing leak

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## Vibratory feeders

- Good accuracy
- Low possibility of material bridging
  - Moisture probe always in live material
- Becomes slow with accumulated material buildup

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## Feeding belts

- Good accuracy
- Good with slow flowing materials;
  - Manufactured sand
  - Wet sand

## Moisture measuring

- Batch weight compensation for moisture content is key to consistency
- “Stock pile” moisture is not the “bin” moisture
- Moisture probe position matters
  - Microwave
  - Infra red

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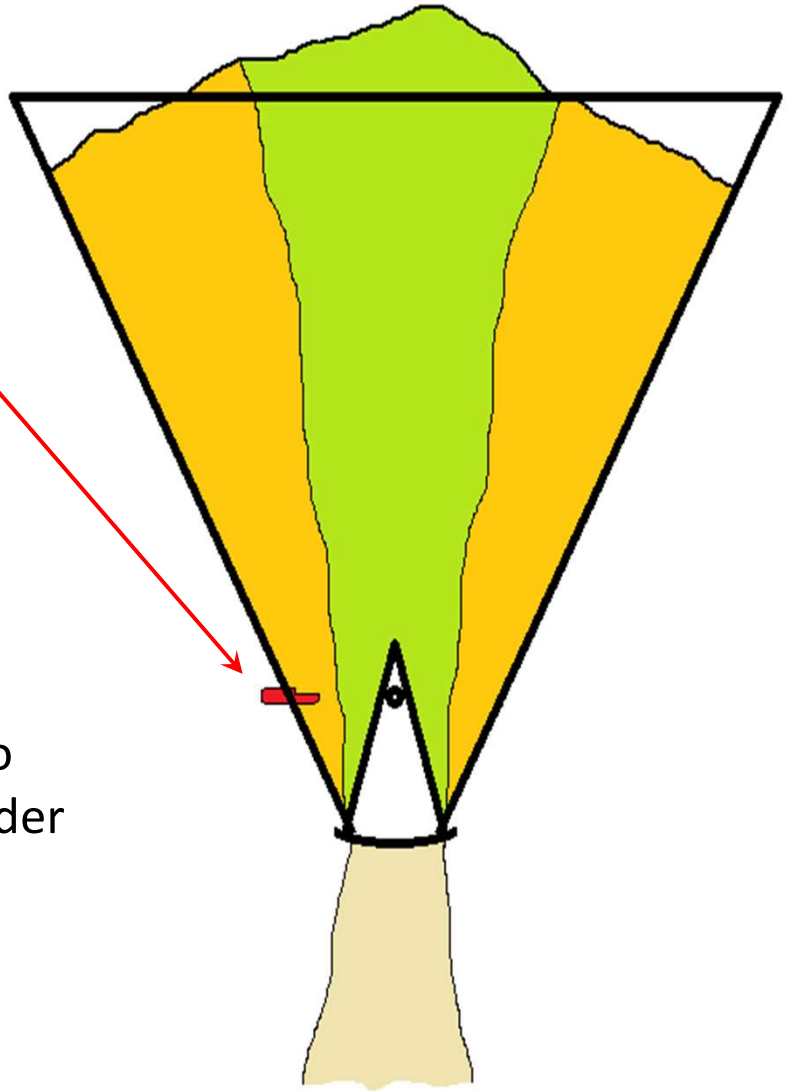
Moisture probe in passive material

Moisture probe too high above the feeder



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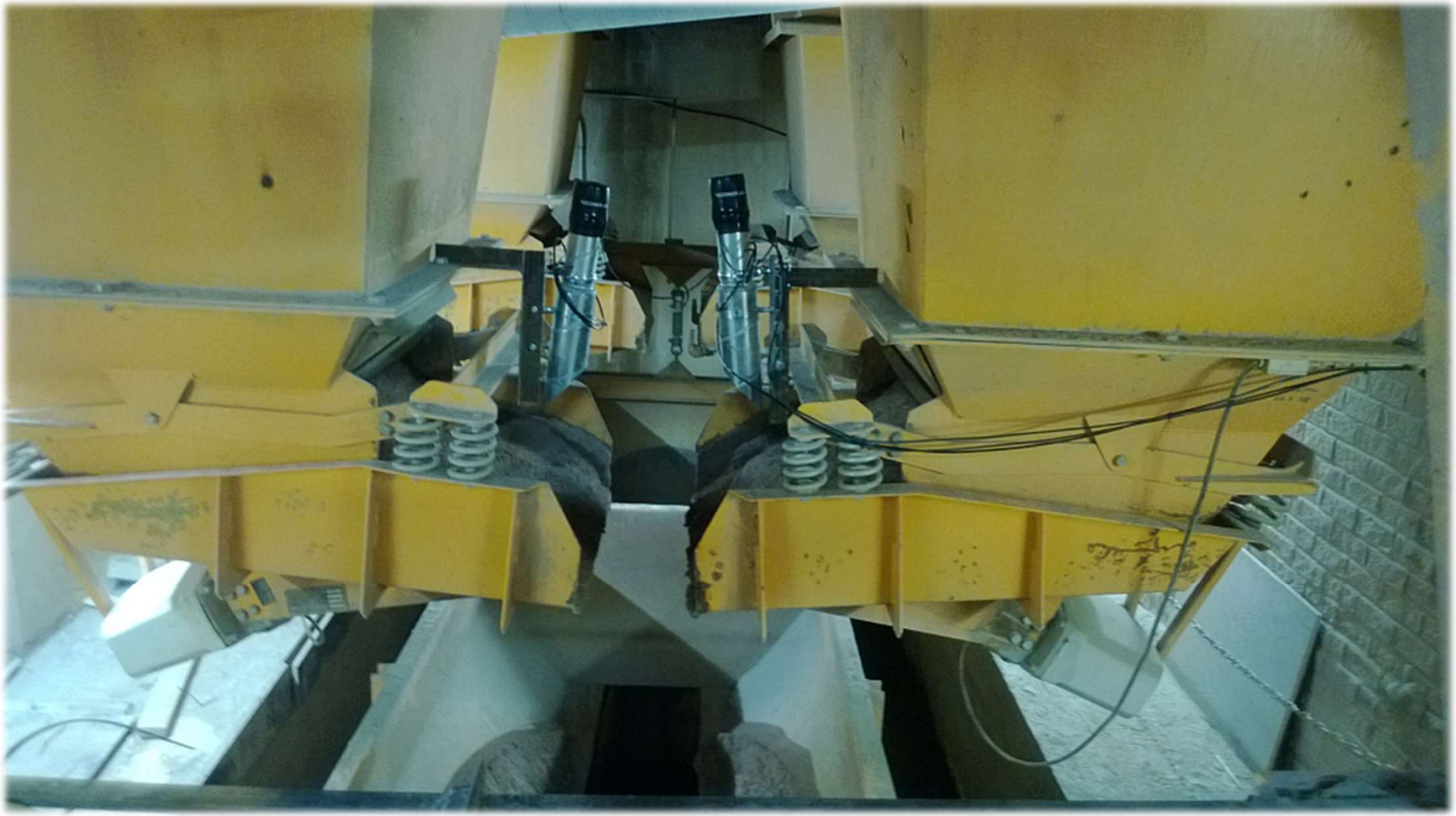
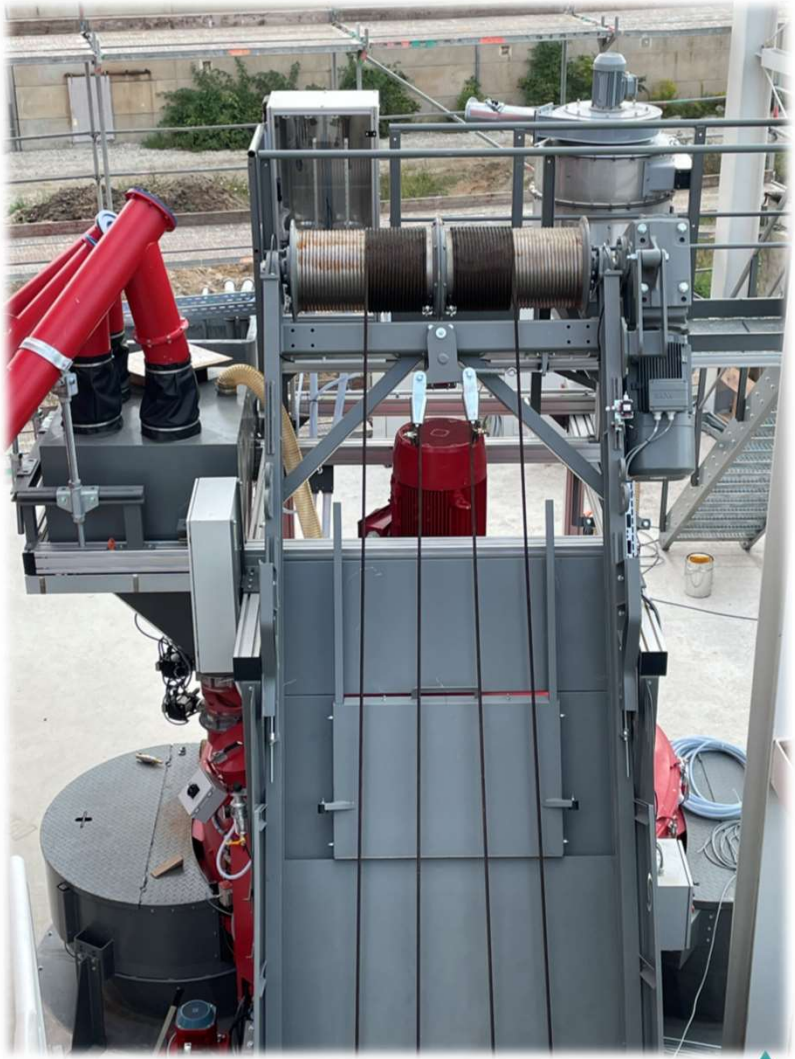


# Aggregate skip hoist



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# Aggregate scales

- Weigh belts
- Weigh hopper

## Weigh belts

- Mechanical isolation
- Ensure balanced load
- Eliminate wind load
- Minimize material buildup
- Water load (horizontal belts)
- Minimize lateral impact on start



## Weigh hoppers

- Mechanical isolation
- Ensure balanced load
- Minimize material buildup
  - Vibrators
  - Chamfered corners



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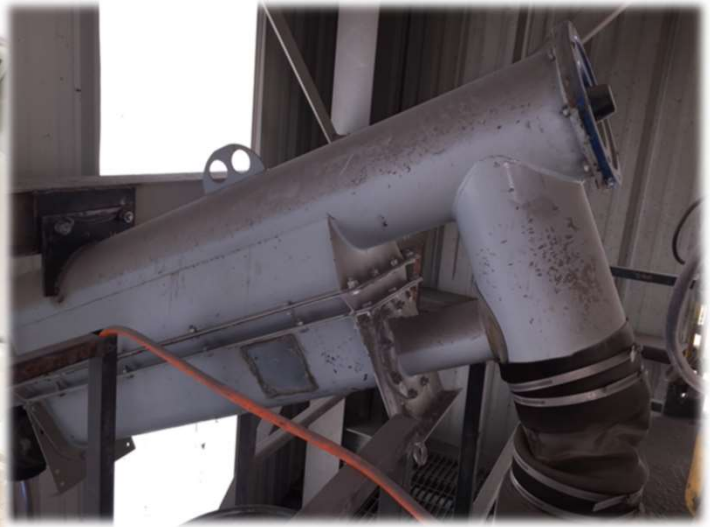
# Cement batching

- Screw conveyors
- Gravity feed
- Rotary vane feeder

## Cement/FA batching

- Single auger screw
  - 2-speed
  - VFD (variable frequency drive)
- Dual auger screw (micro feed)
- Gravity feed
  - Fast actuator/flow control valve
  - Varying feed rate (full vs low silo, loading the silo)



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## Cement/FA batching

- Rotary Vane Feeder
  - # of vanes determines volume and accuracy
  - Be aware of clogging

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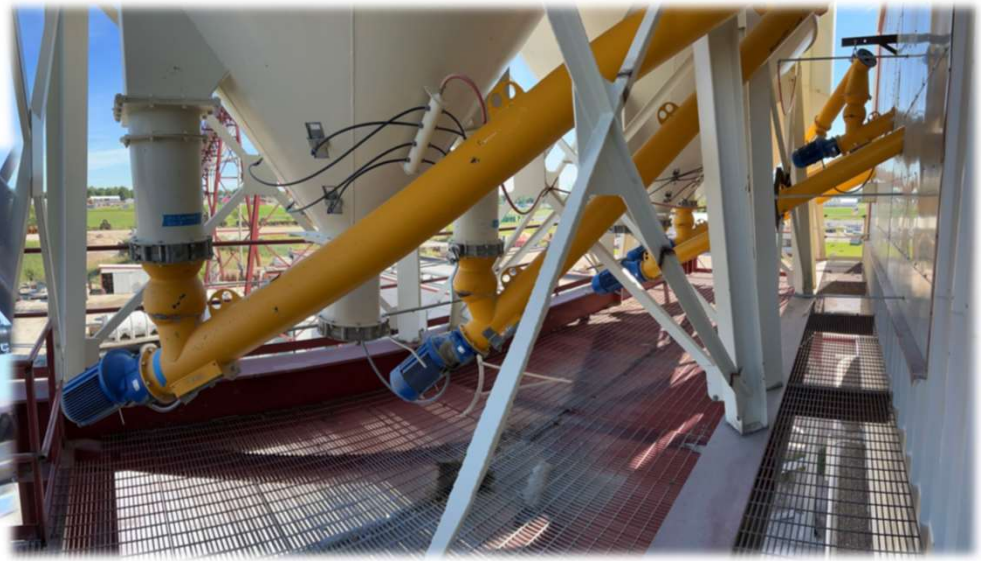
## Cement/FA batching

- Prevent material bridging with air pads
  - Pressure typically @ 3psi
  - Use dry air



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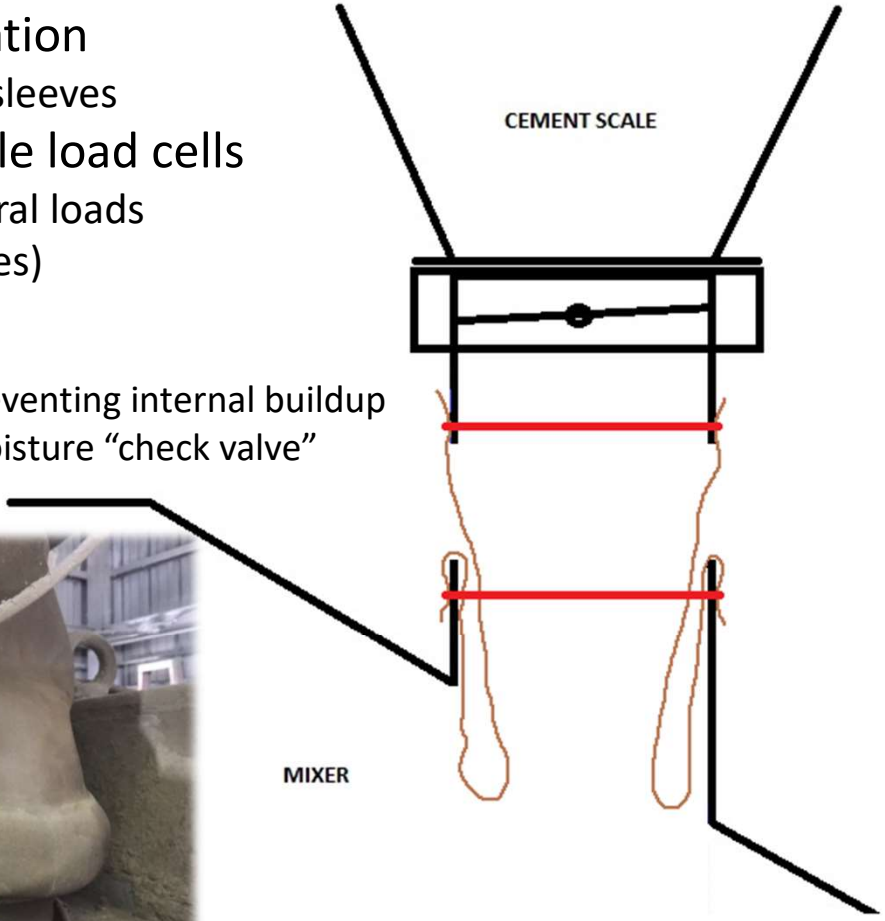
# Cement scales

- Mechanical isolation
- Air venting

# Cement scale

- Mechanical isolation
  - Flexible rubber sleeves
- Single vs. multiple load cells
  - Sensitive to lateral loads (calibration issues)
- Preventing internal buildup
- Moisture “check valve”

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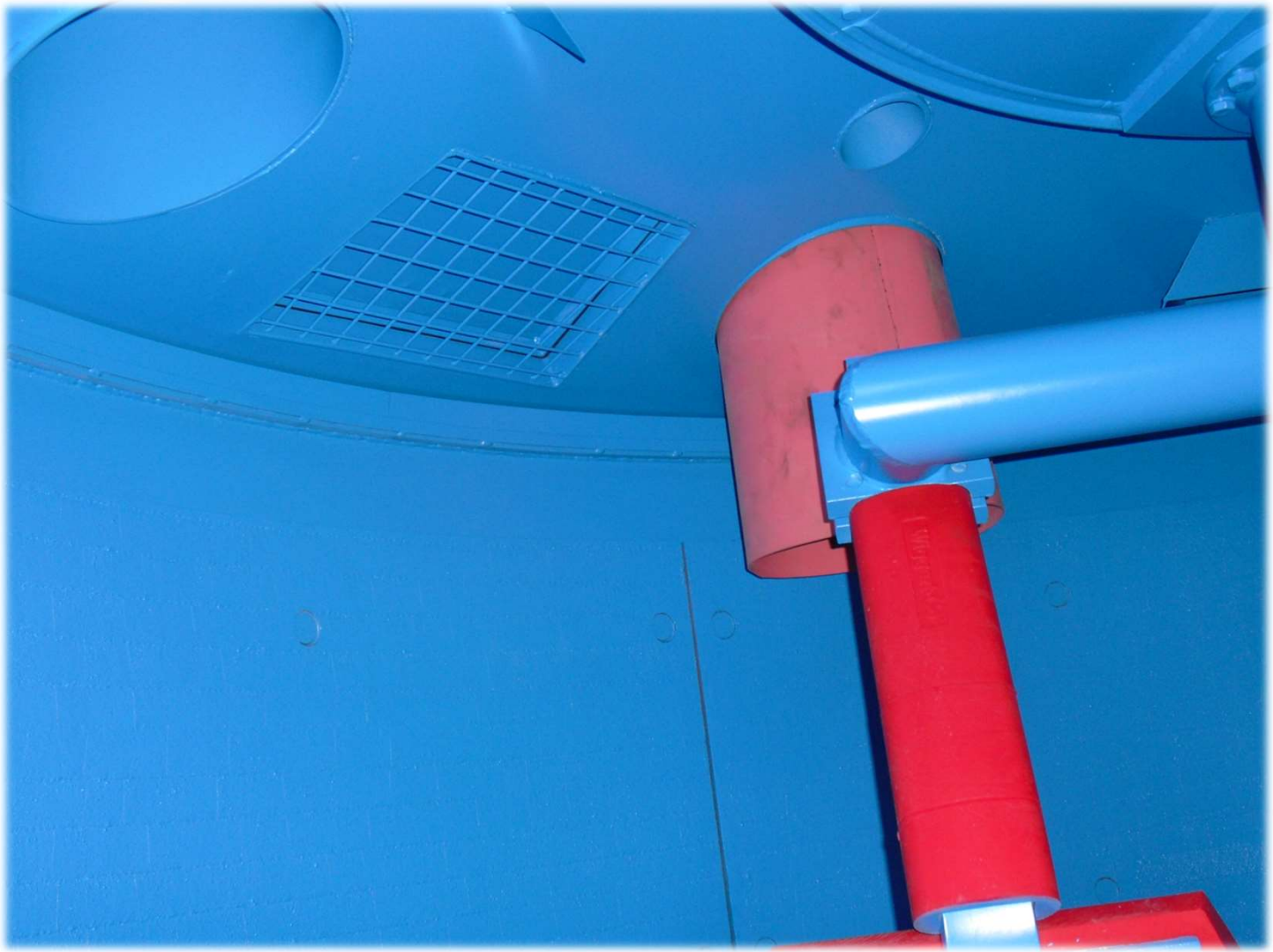

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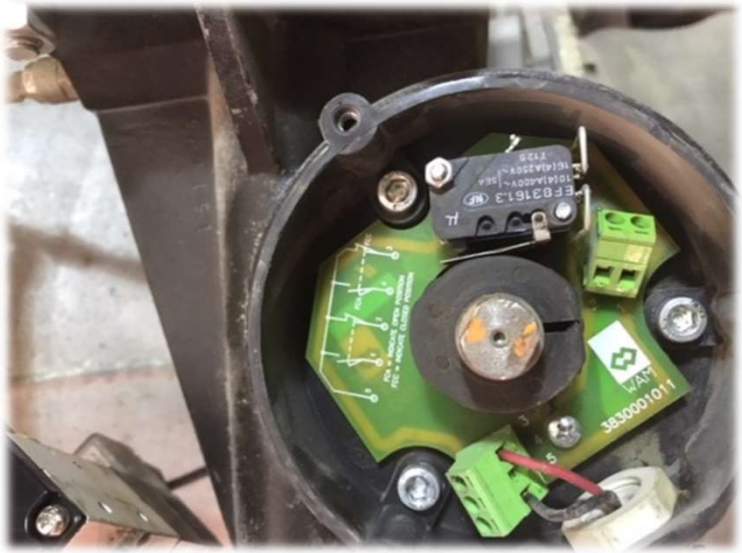
## Cement scale

- Buildup can obstruct full closing of the gate
- Clean where the buildup is, not with a sledge hammer on the outside



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## Cement scale

- Clogged or inadequate air vent
  - Inaccurate batching
  - Slow discharge
  - Overuse of cement

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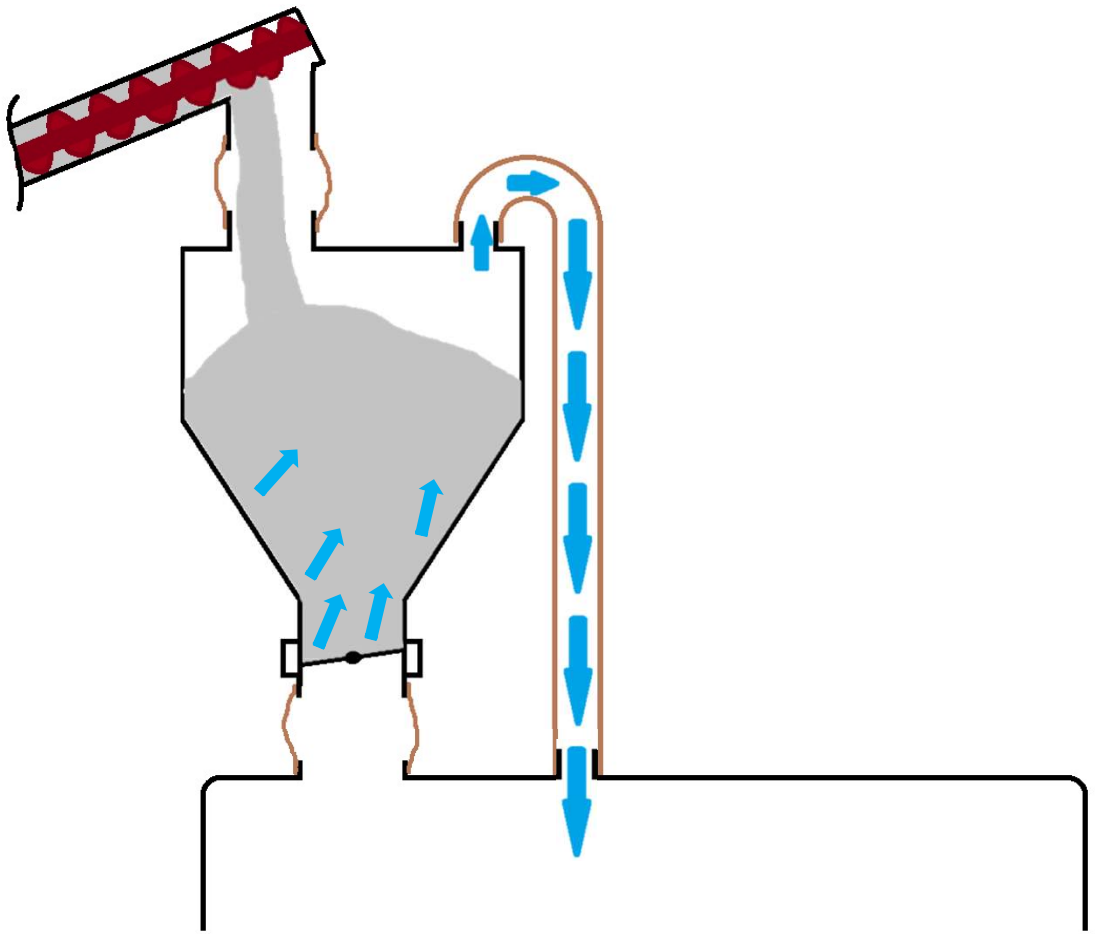

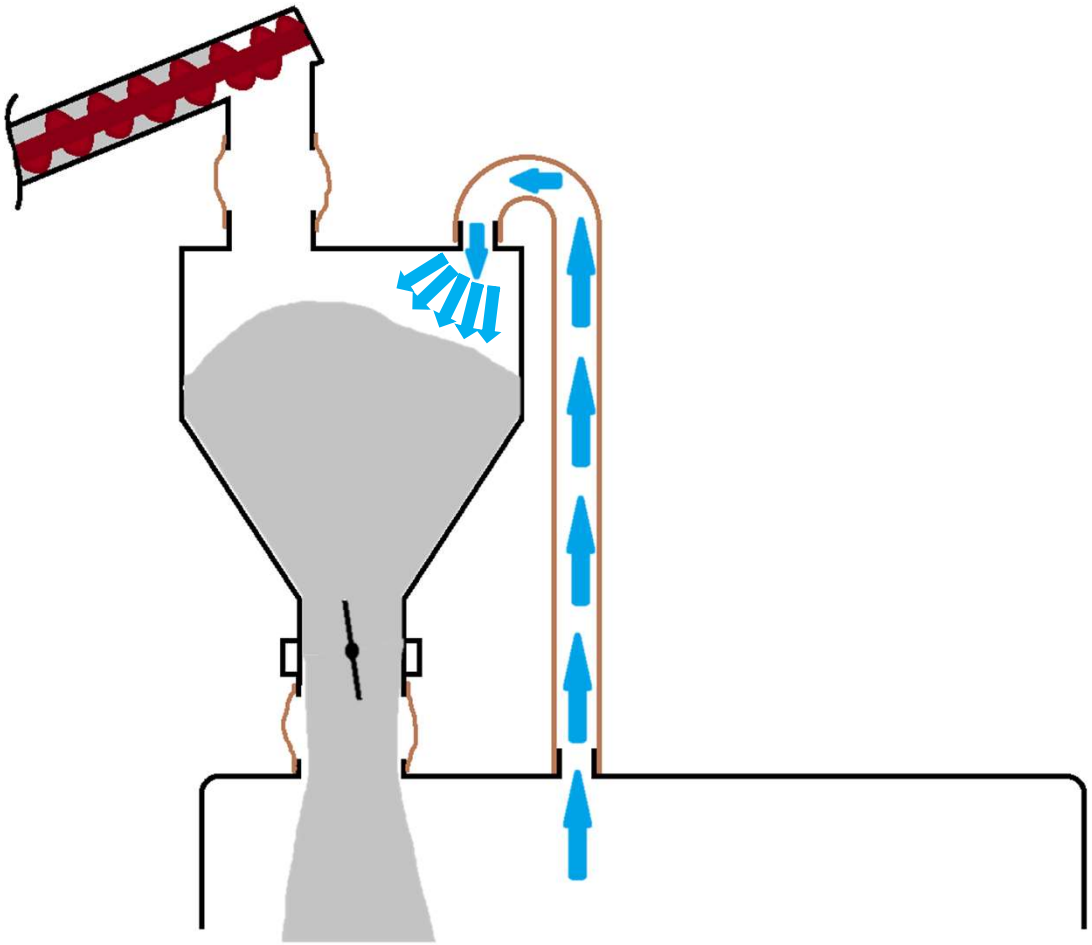

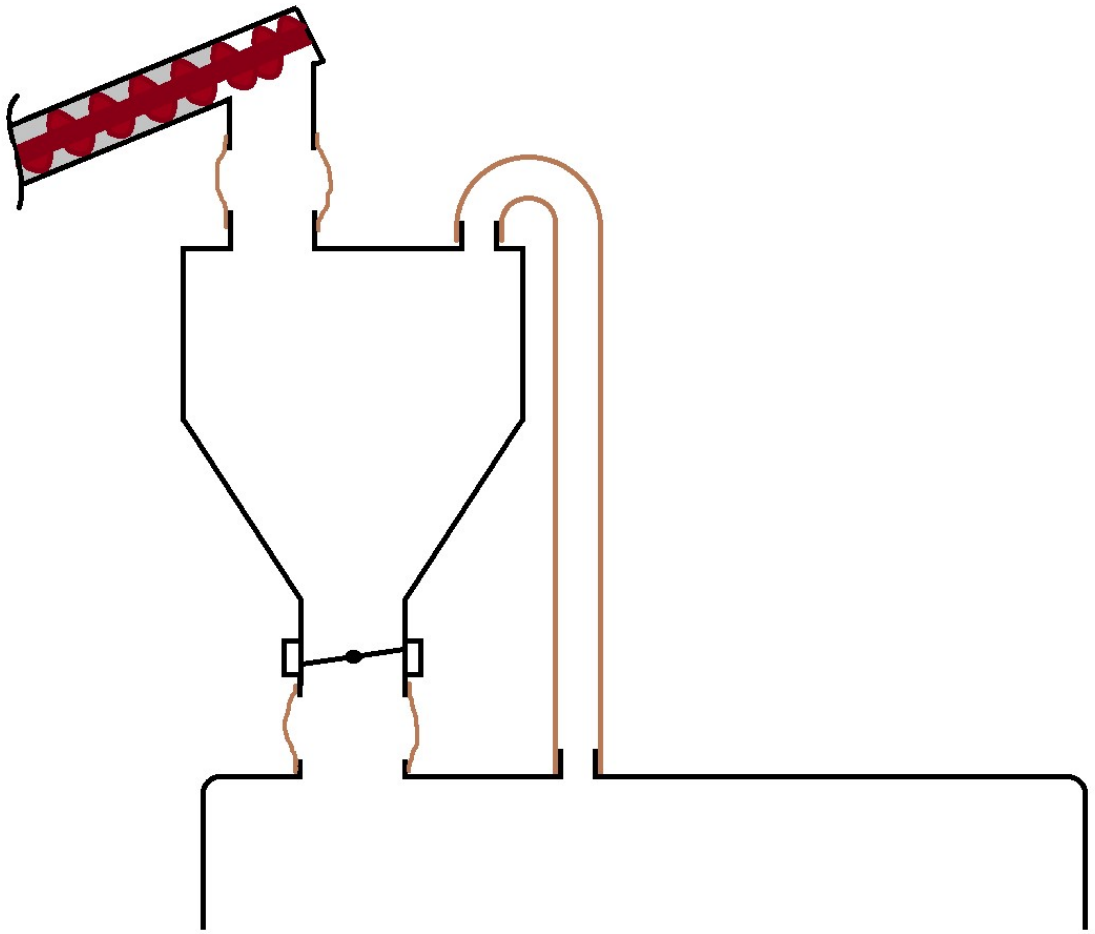

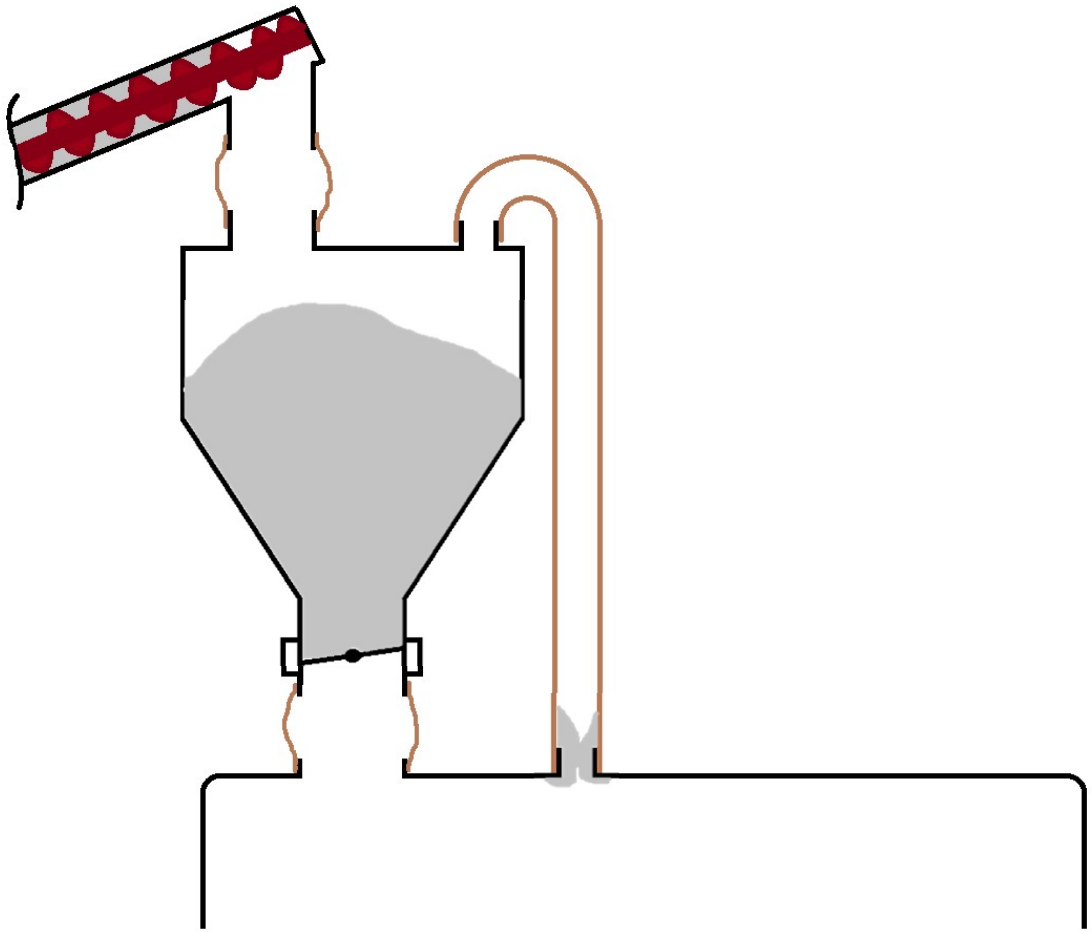

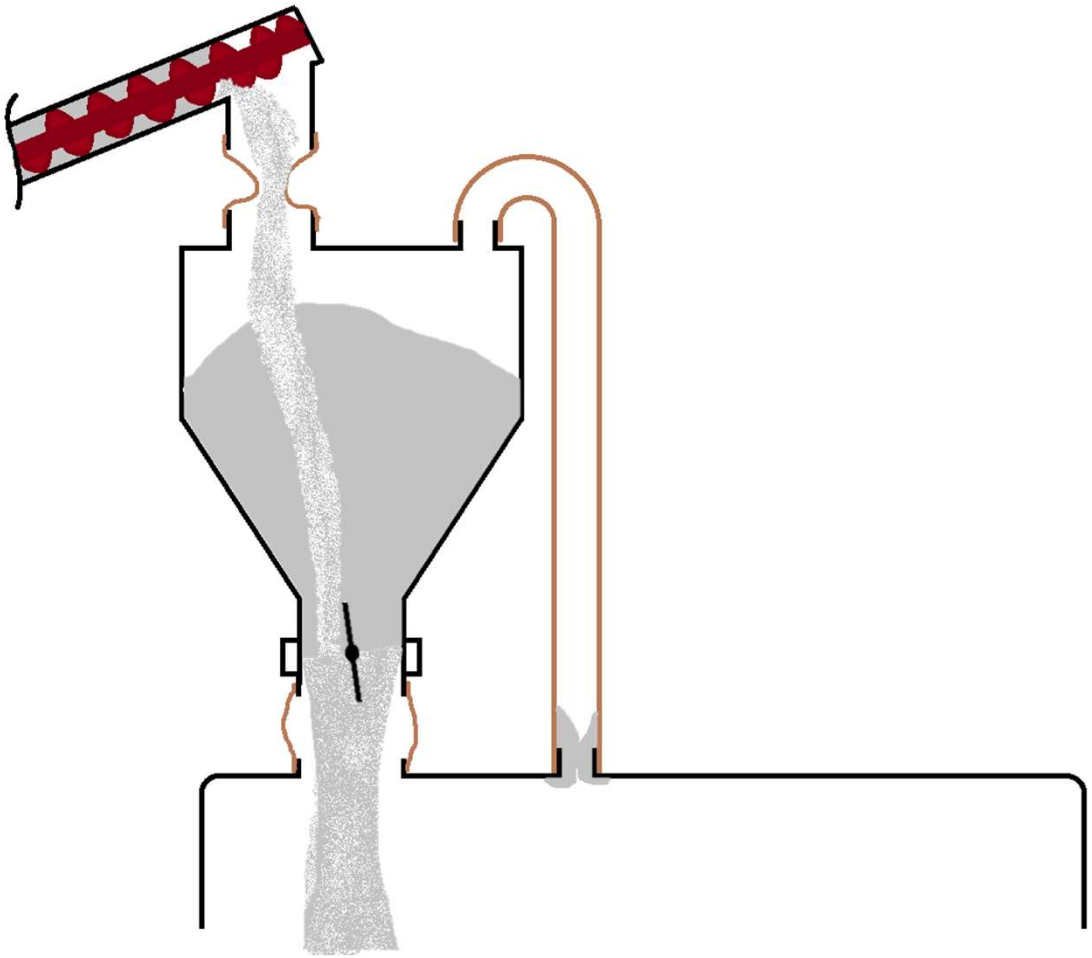

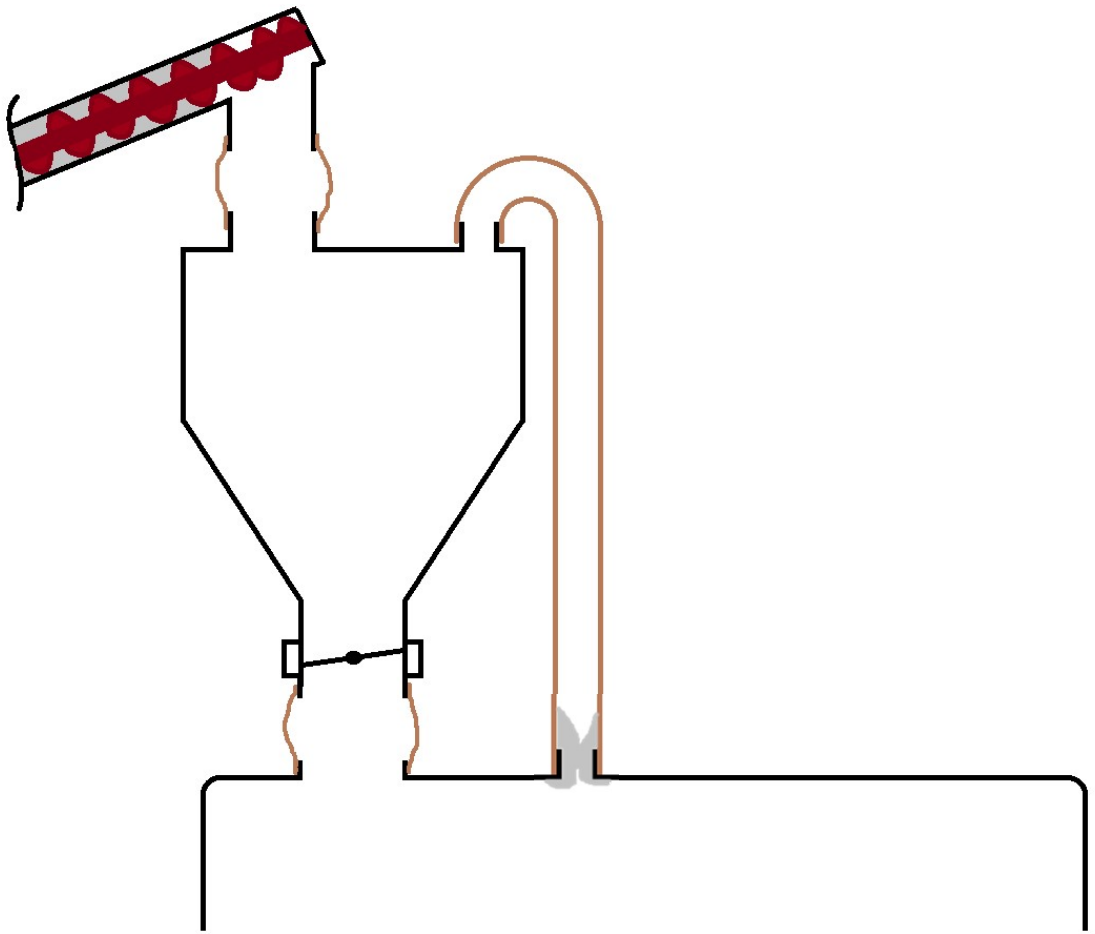

## Issues caused by clogged air vent

- Slow cement / FA batching
- False, inaccurate, scale signal
- Slow discharge cycle
- Housekeeping issues
- Excessive use of cement → loosing money
  → inventory discrepancies
  → unnecessary use of higher strength concrete

## Cement scale

- Butterfly gate on the auger outlet

**Issues caused by clogged air vent**

## Example:

- Producer “ReCoPi, Inc.” runs in average 200 batches a day
- Runs production 5 days a week
- Clogged air vent pipe causes ~10 lb unaccounted use of cement
- 200 batches * 10 lb * 5 days * 4 weeks = **40,000 lb/month**
- **12 months * 40,000 lb = 480,000 lb/year**

# Admix dispensers

- Bottle feed
- Direct feed
- Admix inlets

## Admix dispensers

- Bottle feed
  - Tank
  - Pump
  - Flow meter
  - Bottle
- Direct feed
  - Tank
  - Pump
  - Flow meter

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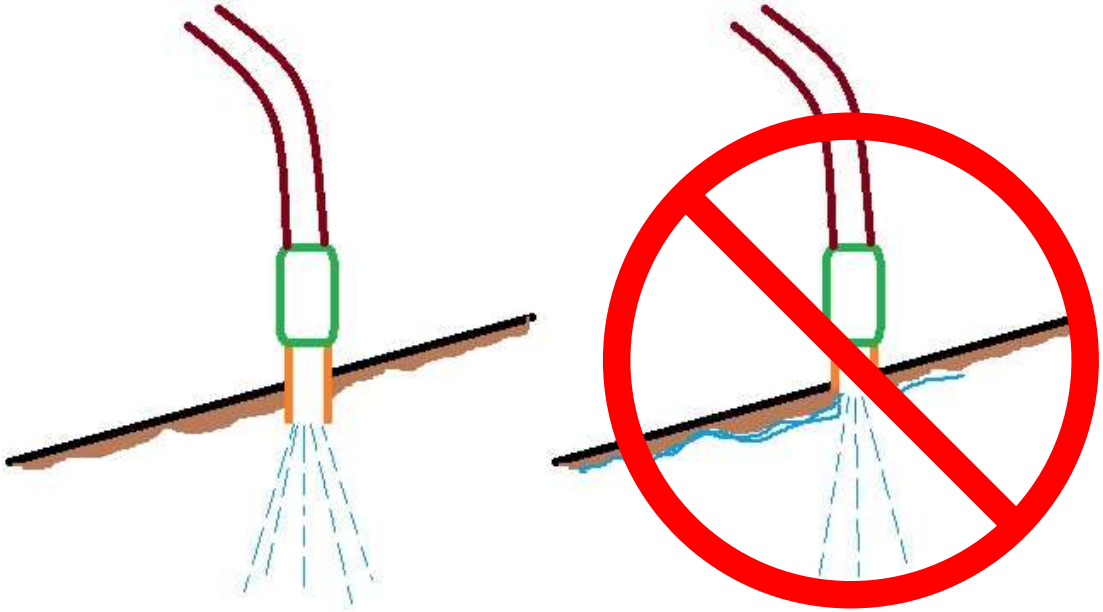
## Admix inlets

- Not too close to side walls
- Not too close to cement inlet
- Away from possible gearcase obstruction
- Always with check valve



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# Water feed

- Flow meter
  - Magnetic
  - Mechanical
  - Location
- Feed valves and nozzles
- Water weigh hopper



## Water flow meters

- Magnetic
- Mechanical

- Protect from dirt (slurry)
- Protect from freeze
- Never in highest point of water line
- Never vertically above the outlets

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## Water feed valves and nozzles

- Coarse/fine valves
- Keep water away from cement inlet
- Nozzles to ensure better water dispersion

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## Pre-metered/weighed water hopper

- Rapid introduction of large amount of water
- Shorter cycle time in wet cast production

# Mixers

- Planetary counter-current
- Turbine
- Twin-shaft
- Ribbon
- Rotating drum

# Planetary counter-current mixer

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# Turbine pan mixer

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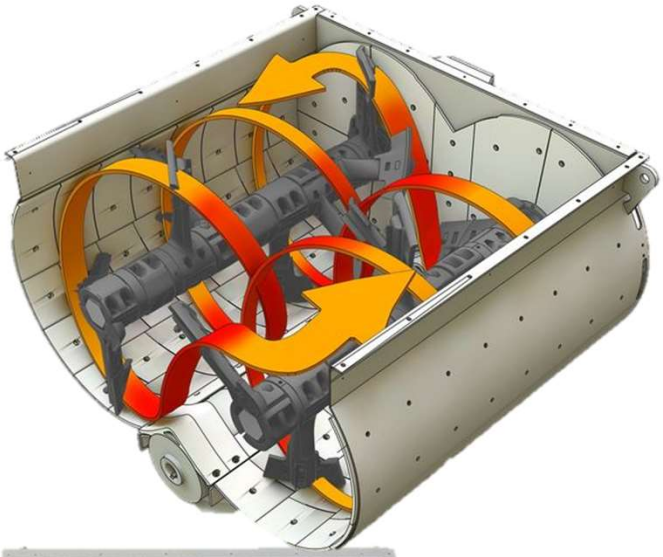
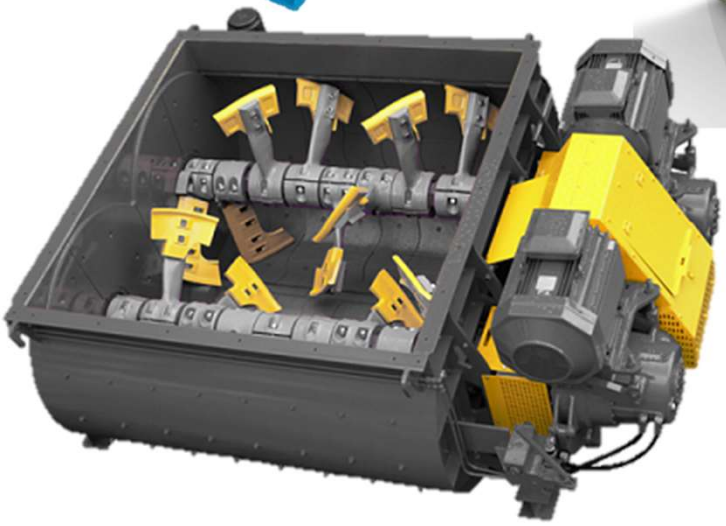
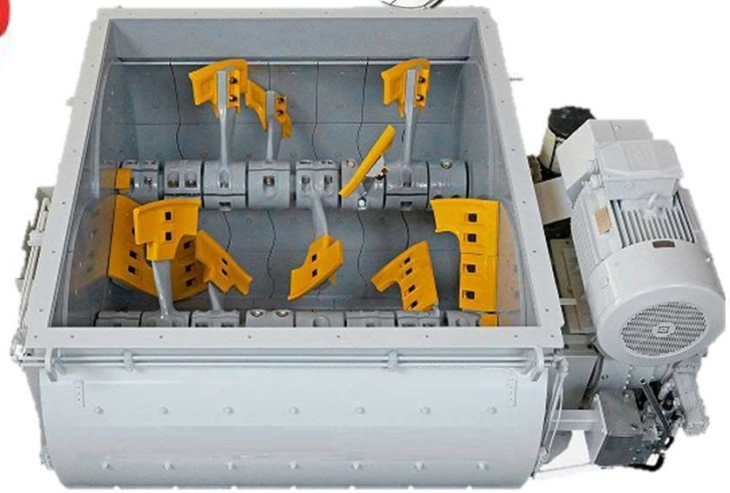
# Twin shaft mixer







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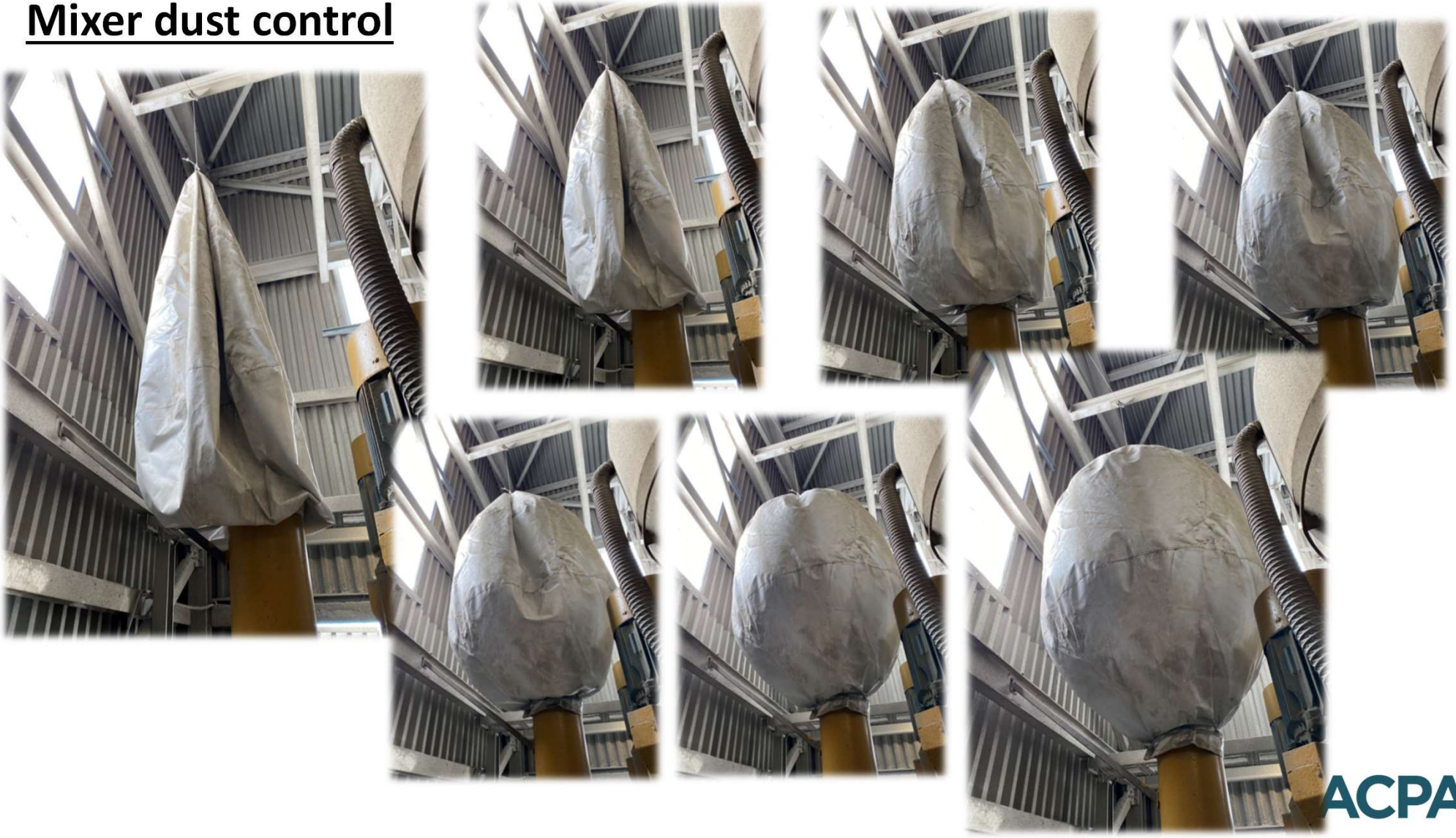
# Ribbon mixer

# Rotating pan mixer


# Mixer dust control

# Mixer dust control


# Mixer dust control



# Concrete transportation

- Concrete belts
- Concrete bucket conveyors

# Concrete belts

# Concrete bucket conveyors

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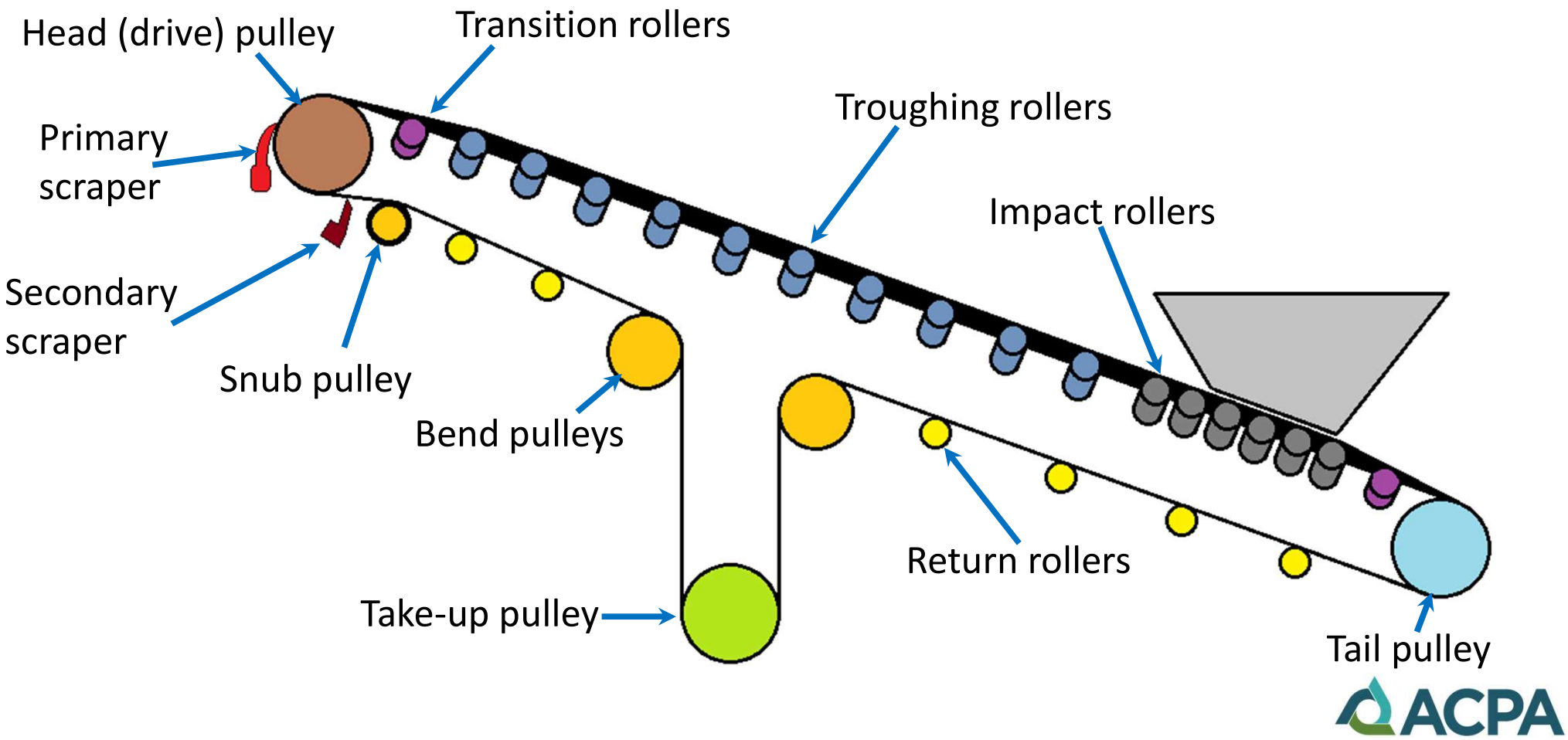
# Maintenance

- Belt conveyors
- Hoppers (aggregate/concrete)
- Cement weighing system
- Admix dispensers
- Water feed equipment
- Mixer

# Belt conveyor components

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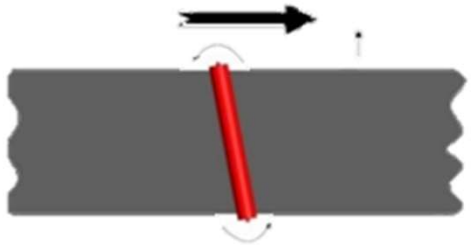
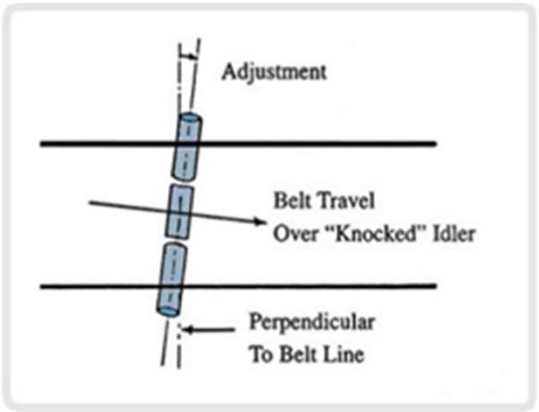
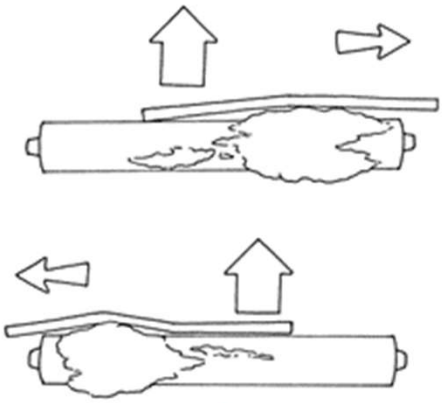
## Belt conveyors

- Troughing and return rollers

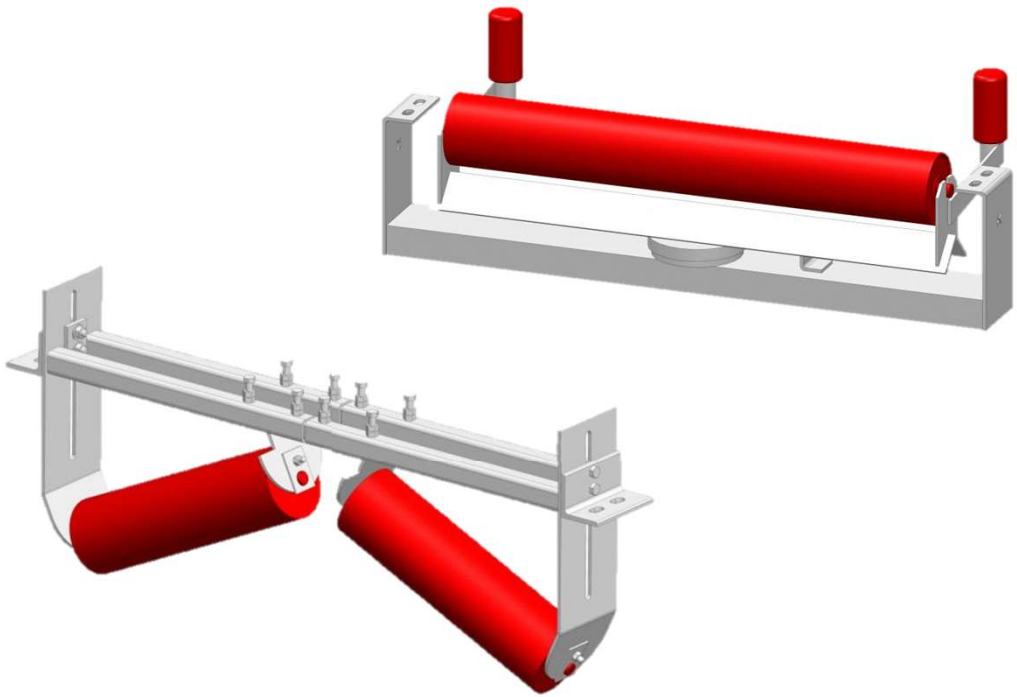




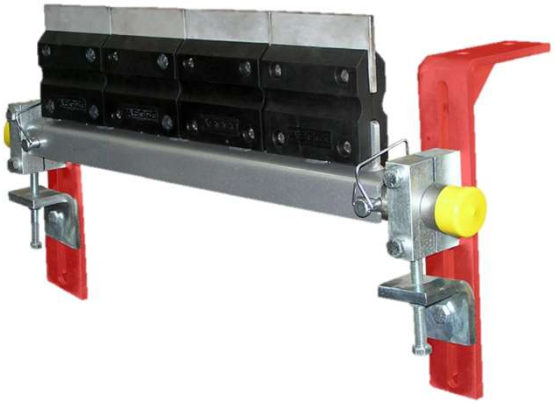
## Belt conveyors

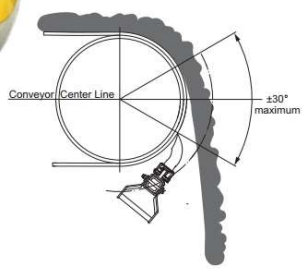
- Training / aligning rollers

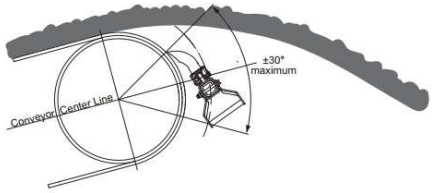


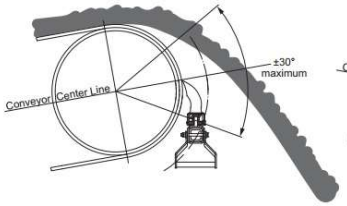
# Belt conveyors

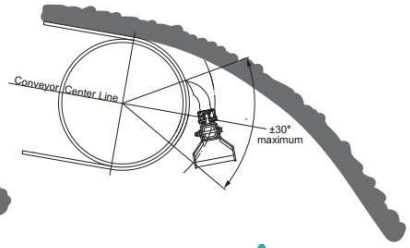
- Belt scrapers



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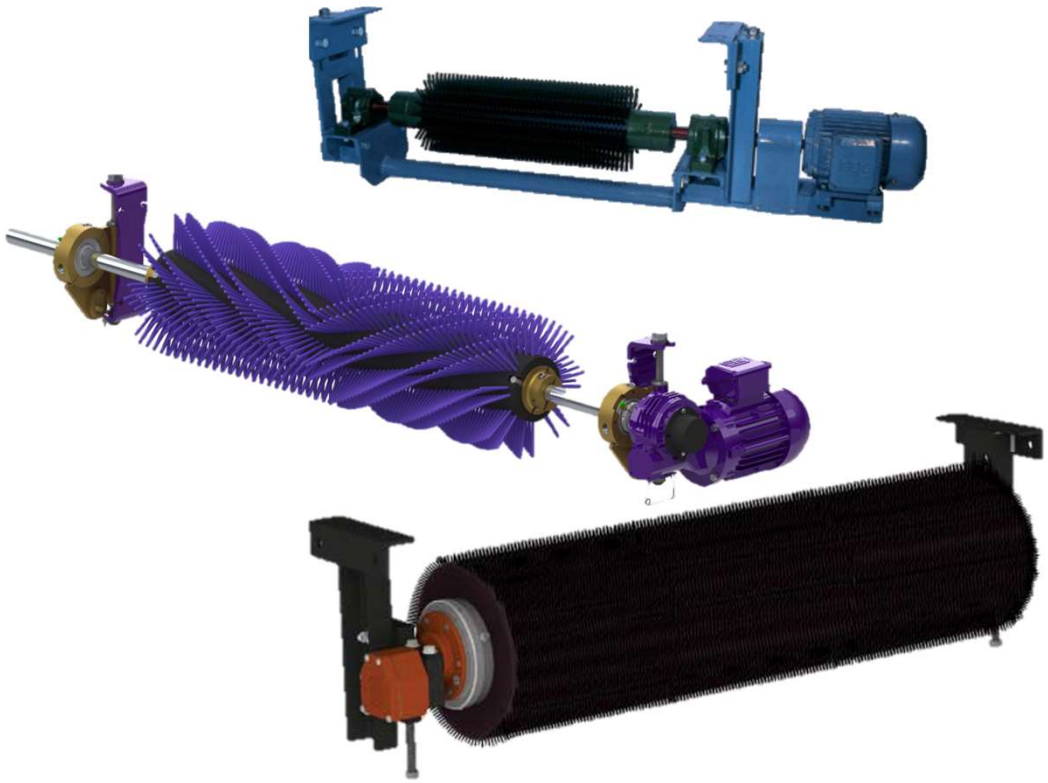
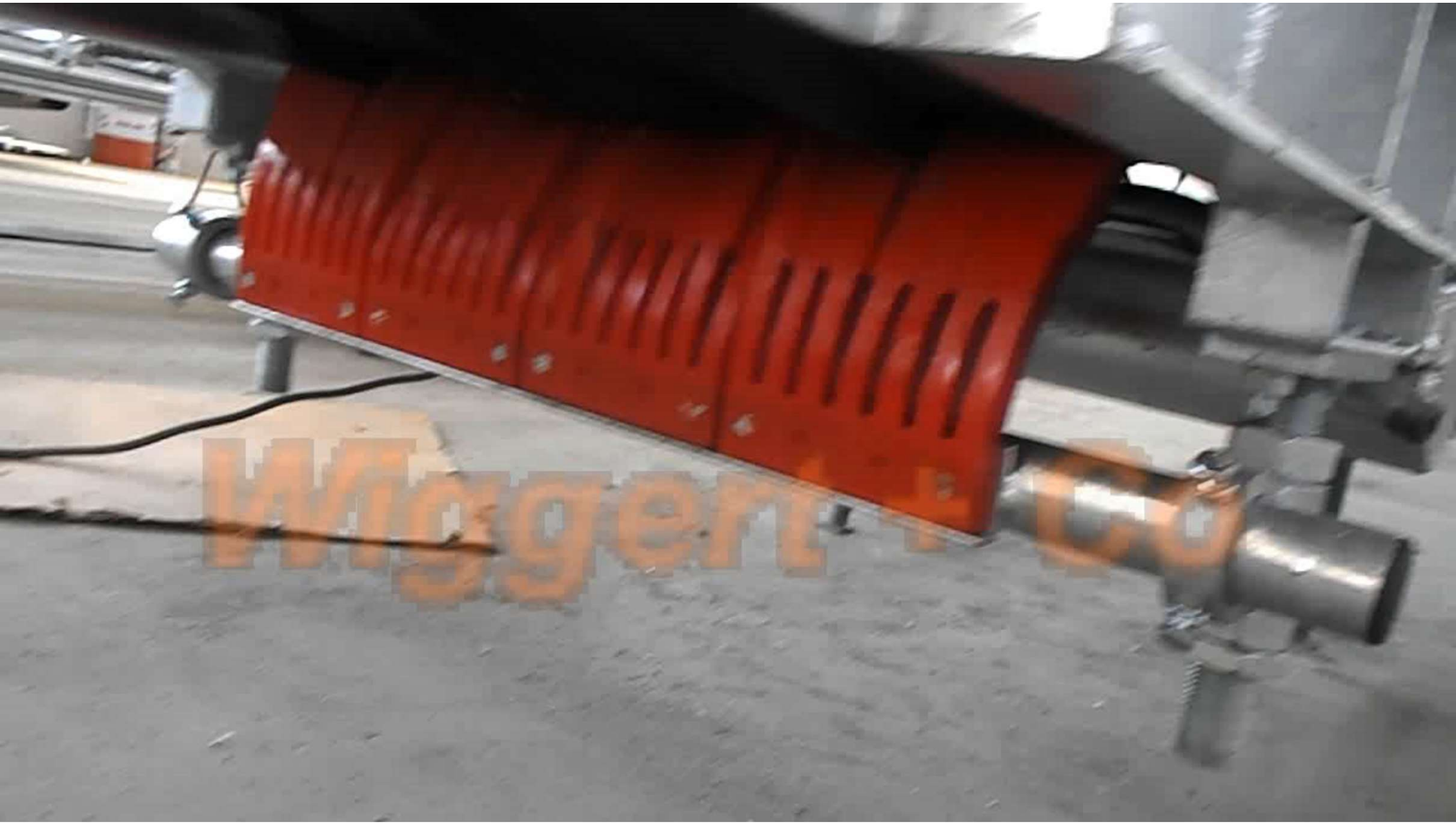
## Belt conveyors

- Cleated belt

## Belt conveyors

- Cleaners for Cleated belts





# Belt conveyors

<u>Top 4 actions to keep conveyors running</u>

1. Housekeeping
2. Frequent inspections
3. Good PM
4. Sustain the cycle

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## Belt conveyors; Maintenance Items

- Daily:
  - Visual inspection
  - Belt tracking
  - Housekeeping
- Weekly:
  - Roller inspections
  - Scraper condition
  - Belt inspection
    - Wear and tear
    - Splice condition
- Monthly:
  - Inspect side skirting
  - Test e-stop safety circuits
  - Inspect control wiring
  - Check control panel buttons/lights
- Every 2-months:
  - Lubricate pulley bearings
  - Check auto lubricators
- Annually:
  - Transmission oil exchange

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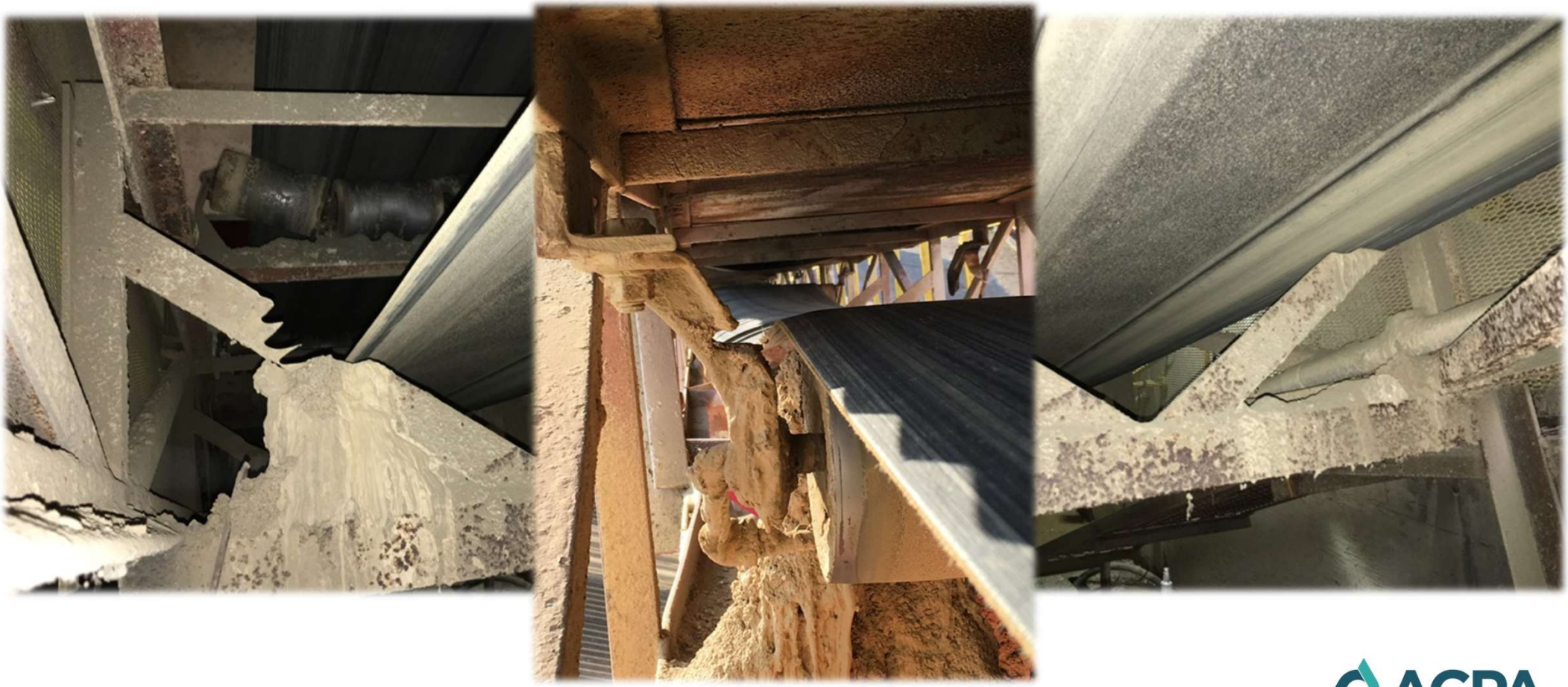
# Belt conveyors; Maintenance Items

# Belt conveyors; Maintenance Items

# Belt conveyors; Maintenance Items



# Belt splice not square

## Aggregate and Concrete hopper wear liners

- Polyurethane

## Aggregate and Concrete hopper wear liners

- Rubber

# Aggregate and Concrete hopper wear liners

- UHMW

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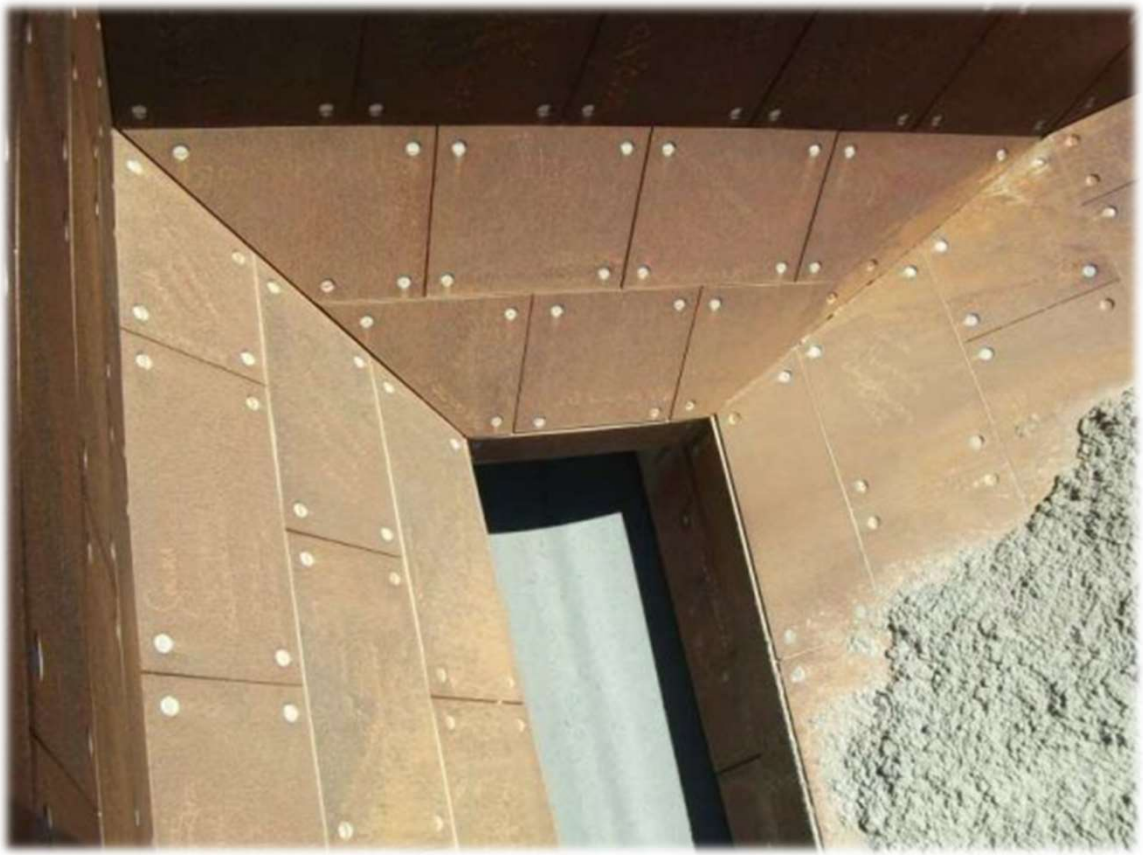
## Aggregate and Concrete hopper wear liners

- AR plating

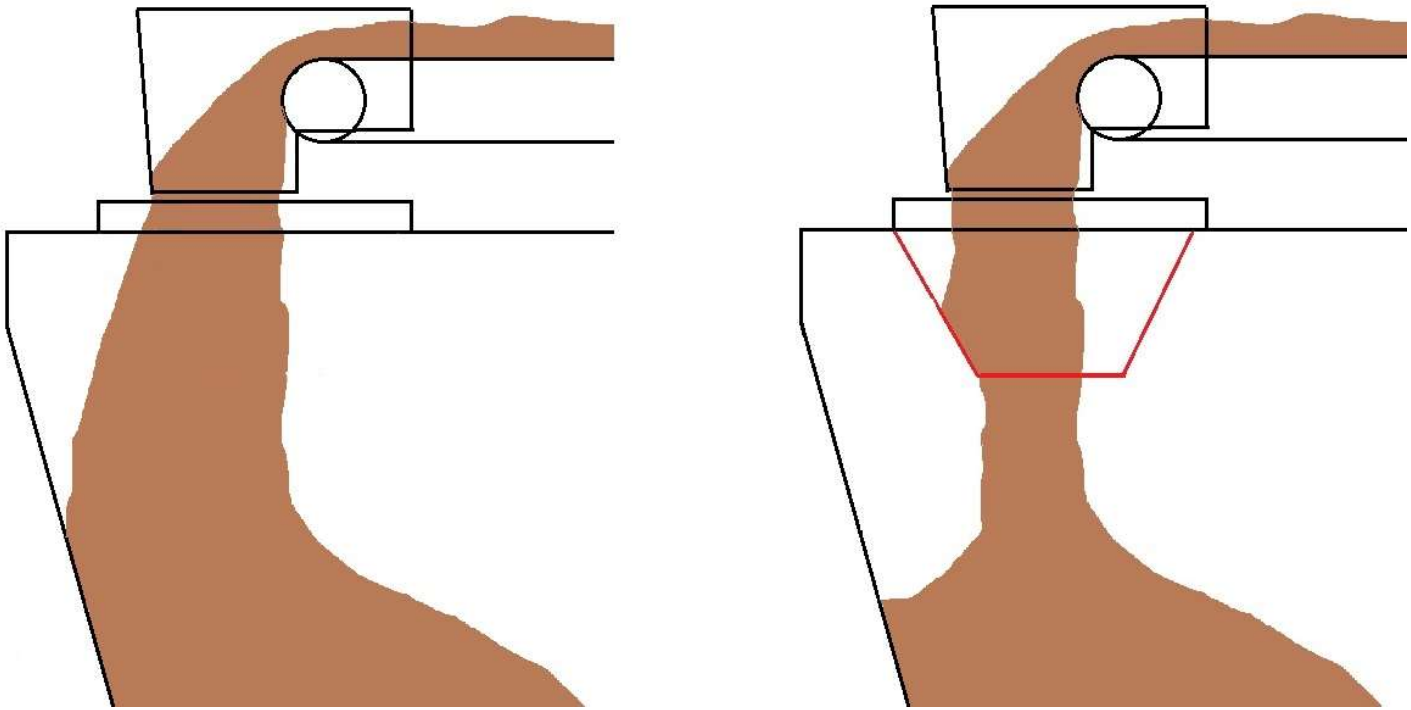


## Hopper wear liners

- Spray-on liner

## Aggregate and Concrete hoppers

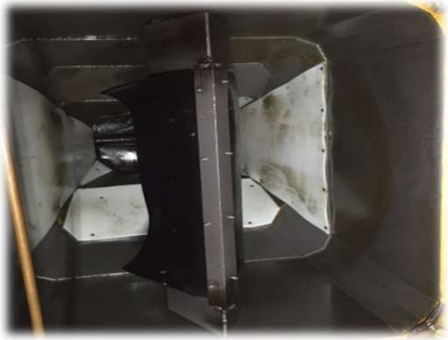
- Redirect material flow to minimize wear

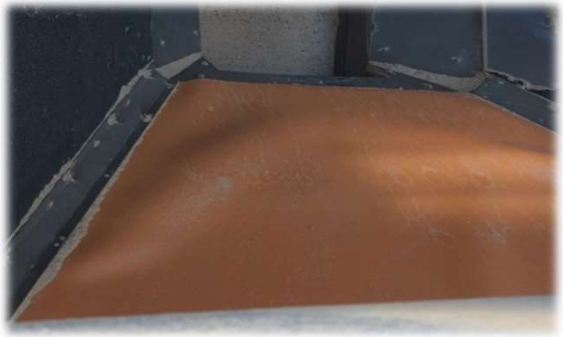


# Aggregate and Concrete hoppers

## Ways to improve hopper discharge

- Rounded corners (chamfering)
- Longer cone section reduces “funnel flow”
- Smooth hopper wall
  - Slippery wear lining material
  - No “hammer rash”
- Knockers/vibrators
- Coarse aggregates first in weighing hopper





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## Aggregate and Concrete hoppers

- Always treat the problem, not the symptom

## Aggregate and Concrete hoppers; Maintenance Items

- Daily:
  - Visual inspection (scale suspension)
  - Check vibrator/knocker
  - Thorough cleaning (concrete)
- Weekly:
  - Inspect for air leaks (listen)
  - Wiring and pneumatics inspection
- Monthly:
  - Check wear liner condition
  - Lube clamshell gate bearings
  - Check clamshell gate condition
- Semi Annual/Annual:
  - Scale check

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## Cement Batching; Maintenance Items

- Daily:
  - Visual inspection (scale suspension)
  - Clean air vent hose (all areas)
  - Clean discharge gate/chute/boot
  - Inspect vibrator/knocker
- Weekly:
  - Inspect for air leaks (listen)
  - Wiring and pneumatics inspection
  - Inspect inlet boot condition
  - Inspect bag house filters
- Monthly:
  - Inspect screw conveyor seals
  - Inspect silo aerator pads
  - Test anti-overfill system (silo)
- Annually:
  - Screw conveyor gear oil change
  - Scale check (6 or 12 month interval)

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## Admix Dispenser; Maintenance Items

- Daily:
  - Visual inspection
  - Look for the leaks (bottles)
  - Listen for the air leaks
  - Clean the inlets (in the mixer)
- Weekly:
  - Inspect product feed lines (leaks)
- Semi Annual/Annual:
  - Dispenser flow meter check

## Water Feeding Equipment; Maintenance Items

- Daily:
  - Visual inspection
  - Look for water leaks
- Weekly:
  - Pneumatics/wiring inspection
    - Flow meter, valves
  - Water nozzle condition
- Semi Annual/Annual:
  - Flow meter check

## Mixer; Maintenance Items

- Daily:
  - Post shift cleaning, internal
  - Exterior cleaning
  - Use Form Release oil
  - Check; paddles, scrapers, arms
  - Check; water nozzles
  - Check; admix inlets
  - Check; electronic safety guarding
- Weekly:
  - Adjust rubber/PU paddles
  - Inspect wiring, sensors, door solenoids
  - Thorough wear liner inspection; cracks, thickness
  - Check for air leaks in cylinders, solenoids, hoses
  - Check moisture sensor adjustment

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## Mixer; Maintenance Items

- Monthly:
  - Inspect; discharge door seals
  - Check; gear oil level
  - Check; hydraulic oil level
  - Check; auto lubricators
- Annually:
  - Replace; gear oil
  - Replace/test; hydraulic oil
  - Replace; oil/air filters
  - Replace; auto lubricators

## Mixer; Production Readiness

- Safety devices in working order, guarding in place

## Mixer; Production Readiness

- Paddles and scrapers adjusted and in a good condition

## Mixer; Production Readiness

- Paddles and scrapers adjusted and in a good condition
- Mixing pan, paddles, scrapers and arms oiled

## Mixer; Production Readiness

- Paddles and scrapers adjusted and in a good condition
- Mixing pan, paddles, scrapers and arms oiled
- Moisture sensor in a good condition and flush with the floor

## Mixer; Production Readiness

- Paddles and scrapers adjusted and in a good condition
- Mixing pan, paddles, scrapers and arms oiled
- Moisture sensor in a good condition and flush with the floor
- Water nozzles in place

## Mixer; Production Readiness

- Test the discharge gates before it's too late…

- Hardened concrete
- Oil/air leaks
- Faulty solenoid valves
- Faulty position sensors

# Mixer; Production Readiness

- Mixer thoroughly cleaned inside and out

## Mixer; Production Readiness

- Mixer thoroughly cleaned inside and out

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## Mixer; Production Readiness

- Maintain high mixing efficiency
  - All paddles and scrapers in place

# Mixer; Production Readiness

- Maintain high mixing efficiency
- Maintain high housekeeping standards
  - Daily cleanup, no exceptions

## Mixer; Production Readiness

- Maintain high mixing efficiency
- Maintain high housekeeping standards
- Good communication prevents break downs
  - Speak up before it breaks down

## Mixer; Production Readiness

- Maintain high mixing efficiency
- Maintain high housekeeping standards
- Good communication prevents break downs
- Follow up to sustain
  - Use checklists. Use PM charts. Verify performed work


Thank you!
ACPA