

Optimising paste production: understanding mixer configuration options

By SIMEM Underground

When making high solids paste backfill for underground operations, consistent material quality is critical and influences pipeline flow, structural stability, and cost-effective binder utilisation. Choosing the right mixing strategy is therefore a key operational decision.

SIMEM offers multiple configurable approaches for paste production:

- a single large twin shaft paste mixer
- a 2-stage system with a twin shaft conditioning mixer followed by a paste mixer
- integration of a colloidal mixer for pre-blending the binder. This can be used with either of the above configurations.

The following discussion looks at the advantages and considerations of each option, enabling operators to make informed decisions based on operational requirements.

OPTION 1: SINGLE LARGE TWIN SHAFT PASTE MIXER

A single large paste mixer handles both mechanical breakdown of feed materials and blending of tailings, binder, and water into paste.

Advantages:

- Simpler layout: one vessel reduces footprint and structural complexity.
- Lower capital cost: fewer mixers and equipment reduce initial investment.
- Reduced automation complexity: one-stage operation is easier to integrate in smaller plants.

Considerations:

- Feed variability: filter cake or tailings may be uneven in moisture and lump size, affecting paste consistency.
- Mechanical stress: breaking dense materials increases torque on shafts and bearings.
- Residency time: hard or cohesive feed requires longer mixing, reducing throughput.
- Paste quality: uneven breakdown



or moisture uptake can lead to rheology variations and variable final strength.

A single large paste mixer is suitable for operations with friable, uniform feed materials where simplicity, space, or capital constraints are priorities.

OPTION 2: 2-STAGE SYSTEM - CONDITIONING MIXER AND PASTE

MIXER

A 2-stage system separates mechanical preparation of tailings from final paste blending.

Configuration:

1. Twin shaft conditioning mixer: breaks dense or cohesive feed into uniform material and equalises moisture. Moisture can be added to facilitate conditioning.



COMPARING THE CONFIGURATIONS

Criteria	Single paste mixer	Conditioning + paste	With colloidal binder
Feed consistency	Moderate	High	High
Binder dispersion	Moderate	Moderate	Highest
Cycle predictability	Moderate	High	High
Mechanical load	Higher	Lower	Lower
Operational flexibility	Lower	Higher	Highest
Footprint / CAPEX	Lower	Higher	Highest
Paste homogeneity	Moderate	High	Very high
Binder efficiency	Moderate	High	Highest

2. Twin shaft paste mixer: blends tailings, aggregates, and binder into consistent paste, optimising rheology and density for pumping and placement.

Advantages:

- Feed consistency: preconditioning reduces lump size and normalises moisture content.
- Stable processing: paste mixer receives uniform feed, enabling predictable batch times.
- Reduced mechanical wear: paste mixer operates under optimal load, extending component life.
- Improved paste quality: uniform feed supports consistent density, rheology, and binder hydration.
- Operational flexibility: separate functions allow adjustments to feed variability.

Considerations:

- Higher capital cost: 2 mixers and associated equipment increase investment.
- Larger footprint: additional level and longer conveyors are required.
- Process integration: feed rates and residence times must be synchronised for smooth operation.

This option is preferred for dense, cohesive feed, high solids paste, long pipelines, or when consistent paste quality is critical.

OPTION 3: COLLOIDAL MIXER FOR BINDER PRE-BLENDING

A colloidal mixer can be integrated

with either configuration to pre-blend binder with water before entering the paste mixer.

Function:

- The high-shear mixer fully disperses the binder into a homogenous slurry for simple blending with the tailings in the paste mixer.

Advantages:

- Improved binder dispersion: reduces cement agglomeration, improving hydration.
- More homogeneous paste: supports consistent density and strength.
- Potential binder optimisation: ensures efficient dosage and performance.
- Reduced dust: a pre-mixed binder slurry reduces airborne dust.
- Enhanced control: valuable for specialty binders or strength-critical applications.

Considerations:

- Additional equipment and controls: requires slurry tank, pumps, and instrumentation.
- Higher capital cost: adds mechanical and electrical infrastructure.
- Process discipline: accurate water-to-binder control is critical.

Colloidal mixers enhance either a single paste mixer or 2-stage system by isolating binder preparation, reducing one source of variability, and improving overall paste quality.

FILTER CAKE SOURCE AND VARIABILITY

Filter cake characteristics significantly affect mixer selection. Cake from a filter press is dense, cohesive, and slab-forming, while cake from a disk filter is more friable and may have variable moisture. Dense press cake benefits from a conditioning stage, while friable disk filter cake may be processed adequately in a single large paste mixer. Considering feed source alongside throughput, solids content and paste performance is essential to achieve consistent results.

KEY FACTORS FOR DECISION-MAKING

Operators should evaluate:

- feed material characteristics: moisture, cohesiveness, and lump size
- filter type and variability
- throughput and batch cycle requirements
- pipeline length and pumping pressures
- binder type, blend complexity, and cost sensitivity
- maintenance strategy and mechanical wear
- available plant footprint and structural limitations
- strength consistency and quality control targets.

Optimal design aligns equipment configuration with operational priorities and risk profile.

OPERATIONAL RISK PERSPECTIVE

Material variability – in tailings consistency, moisture, and binder distribution – is the main risk.

- A single large mixer handles all variability in one vessel.
- A 2-stage system separates tailings conditioning from paste formation.
- A colloidal mixer isolates binder preparation, reducing one source of variability.

Increasing separation generally increases control but adds capital complexity.

STRATEGIC TAKEAWAY

Selecting between a single paste mixer, a 2-stage system, or adding colloidal binder pre-blending is about **aligning configuration with operational priorities**, not choosing a universally superior option.

- **Single large paste mixers:** favour simplicity and lower capex.
- **2-stage systems:** favour tailings control and mechanical longevity.
- **Colloidal binder integration:** enhances binder efficiency, hydration, and strength consistency.

These options can be combined to achieve the desired balance of simplicity, performance, and control.



At SIMEM, we provide all 3 and work with customers to identify the best fit.

CONCLUSION

There is no one-size-fits-all solution to paste fill mixing. Each operation presents unique variables in feed material, filter type, binder chemistry, and pipeline requirements. Understanding these factors – and how different mixer configurations manage variability – is essential for making the right choice.

SIMEM provides technical guidance and tailored solutions, whether that involves a single paste mixer, a conditioning stage mixer, colloidal binder pre-blending mixer, or a fully integrated system. By clearly presenting the pros and cons of each option, operators can make informed decisions, ensuring efficient, reliable, and high-quality paste production.