MASTER® BUILDERS SOLUTIONS

Mine Backfill

Solutions for Underground Construction

Introduction

Backfill, the process of back filling material into the underground voids created by mining, is essential in many underground operations for the holistic extraction process. Backfill material types and processes are numerous but generally utilize a blend of binders, process water and aggregates ranging from rock, crushed aggregates, gravel and quarried sands to tailings left over from mineral processing to provide the required restraint to enable massive strategic support for the underground extraction sequence of the ore. Mine backfill is becoming increasingly important because of the trends in mining to mine deeper, optimize ore recovery, optimize water recovery, improve the mine cycle and optimize production, decrease environmental impact and reduce overall cost.

Master Builders Solutions® takes a scientific approach to this challenge that can help mining companies understand and run backfill operations at lower risks and lower costs. With over 30 years of experience in backfill, Master Builders Solutions® has been a pioneer in creating an admixture market for Backfill in the mining industry.

Mastering underground construction challenges requires the right partner. Continuous innovation and customized solutions ensure that customers using Master Builders Solutions® operate successfully, and to the highest safety standards.

Performance Requirements

Fill without admixture

Fill with admixture

The criteria and requirements for backfilling can vary substantially, depending on the site specific requirements. Master Builders Solutions® offers an extensive range of customized solutions for all types of mine and underground backfill operations, all of which have been developed with a focus on:

- Optimizing production efficiency and maintenance costs
- Providing a cost-effective, efficient and sustainable backfill solution as a part of the total mining operation
- Improving reliability of fill delivery (ensuring reliable and adequate delivery volumes)
- Maximizing the quality, consistency, uniformity and performances of the fill
- Minimizing blockage risk, thus improving safety
- Minimizing the risk of fill failure or liquefaction
- Ensuring adequate early strength and sustaining longterm strength
- Achieving dimensional stability after placement
- Minimizing segregation
- Reducing build-up in the pipe lines

Master Builders Solutions® can control and achieve these requirements by implementing the following chemical processes with its technologies such as rheology modifying admixtures, viscosity modifying admixtures, hydration control admixtures, water reducers, superplasticizers and durability enhancers:

- Hydration control
- Acceleration
- Rheology and flow control
- Viscosity modification
- Reduction in yield stress and pumping pressure
- Stabilization of fines in the fill matrix
- Reduction in slime run off, friction, segregation and porosity
- Enhanced strength development
- Optimized binder content

Master Builders Solutions® extensive range of mine backfilling solutions have been developed to provide the optimum balance of high early strength and sustainable long term strength, ensuring dimensional stability after placement by meeting (or exceeding) design fill performance requirements. These solutions should not only be considered for new mining projects but also for existing operations as they create opportunities to operate systems that are safer, more environmentally friendly and more cost effective.

Backfill Processes

Backfill process can be categorized into the following 3 types:

- Cemented Paste Backfill (CPF)
- Cemented Hydraulic Fill (CHF)
- Cemented Rock and Aggregate Fill (CRF/CAF)

The type used depends on geotechnical requirements, the value of the ore, conditions in the mine, budget, lifetime of the project, experiences, and available equipment.

Cemented Paste Fill

The workability of cemented paste fill mixes can be enhanced in the following ways:

- Reduced binder usage for any given strength requirement
- Decreased pumping pressure and reduced pressure loss (longer transportation distance and improved flow)
- Reduced pipeline wear rate
- Improved fill placement (reduced beech angle)
- Improved consistency of the fill mix and reduced segregation

Cemented Hydraulic Fill

Improved stability and transportability at a constant solids density or enhanced flowability and transportability of the fill at higher density can achieve the following:

- Reduced binder usage for any given strength requirement
- Decreased pumping pressure and reduced pressure loss (longer transportation distance and improved flow)
- Reduced pipeline and mixer wear rate
- Reduced blockage risk
- Improved fill placement (reduced beech angle)
- Decreased energy consumption
- Improved fill placement (more consistent and homogenous)
- Improved consistency of the fill mix and reduced segregation
- Improved drainage capabilities and significantly decreased fines migration from the fill (slimes)
- Better water management

Cemented Rock and Aggregate Fill

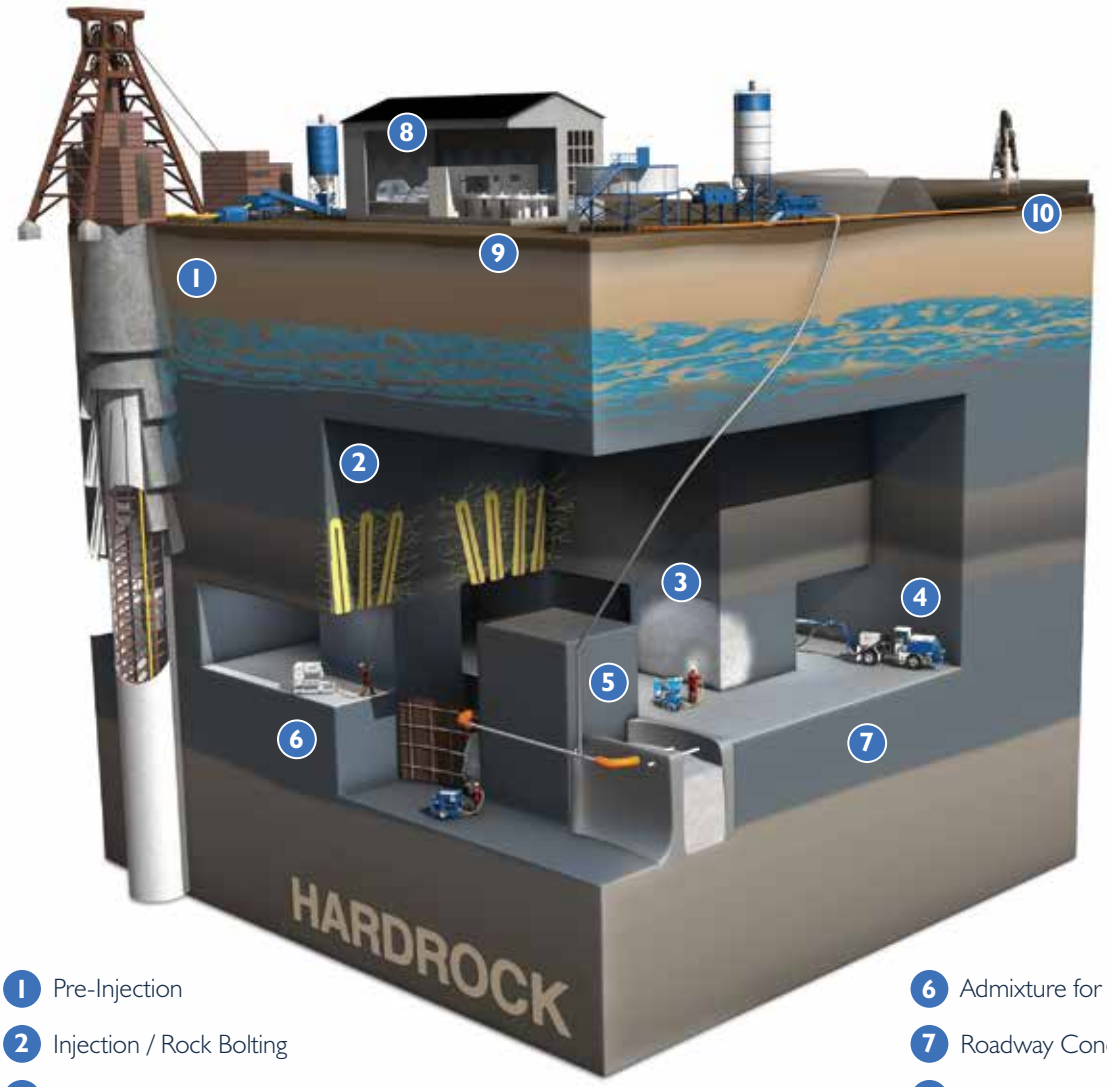
The effectiveness of rock and aggregate fill can be increased in the following ways:

- Hydration control – extending open time
- Segregation reduction with coating effect
- Strength enhancement
- Uniformity improvement
- Binder improvement
- Percolation improvement

Technical Services

Master Builders Solutions® brings extensive know-how gained through worldwide experience in solving challenging situations in hard rock mining. Supplying more than just specialty products for underground construction, assistance is offered in the selection of the most suitable combination of products for each project specific geology, as well as providing start-up supervision and site support.
Master Builders Solutions® strives to offer innovative solutions through continual product development dedicated to mining needs. Part of Master Builders Solutions® Research & Development Community, a dedicated underground construction development.

Hard Rock Mining Technology Overview



1. Pre-Injection
2. Injection / Rock Bolting
3. Thin Spray-on Liner (TSL)
4. Sprayed Concrete
5. Mine Backfill
6. Admixture for Concrete
7. Roadway Concrete
8. Grinders
9. Flotation
10. Tailing Pond

More brochures on our underground construction solutions are available at :

ugc.master-builders-solutions.com

Documentation available on request:

- Reference list
- Project reports
- Technical data sheets
- Design guidelines
- Method statements

Master Builders Solutions®

As Master Builders Solutions®, we are a leading global producer of responsible solutions for the construction industry, focussed on delivering our vision: Inspiring people to build better.

We provide value-added technology and market-leading R&D capabilities to improve the performance of construction materials and to enable the reduction of CO_2 emissions in the production of concrete. The comprehensive portfolio under the Master Builders Solutions® brand encompasses concrete admixtures, cement additives, and solutions for underground construction.

We collaborate across areas of expertise and regions and draw on the experience gained from countless construction projects worldwide, leveraging global technologies, as well as our in-depth knowledge of local building needs, to develop innovations that help make you more successful and drive sustainable construction.

Founded in 1909, Master Builders Solutions® operates 35 production sites globally, supporting you in mastering your building challenges of today and tomorrow for a decarbonised future.

Global underground construction team

Master Builders Solutions®, with its global underground construction team, provides reliable, customer-oriented solutions focused on your needs in the tunneling and mining industries all over the world. We recognize that your success is underpinned by our ability to deliver solutions that meet or exceed your critical needs. By accompanying you from the start of your project and understanding the issues that are important to you, we can contribute to your success. We support you with product training and quality control, and our professional technical services team is on hand around the clock, helping you with specialist technical advice and trouble shooting.

Our comprehensive portfolio:

- Cement additives
- Chemical solutions for underground construction
- Mine Backfill Admixtures
- Anchoring solutions
- Fibers for Sprayed Concrete
- Injections and Water Stopping solutions

Master Builders Solutions® for the Construction Industry

MasterAir®
Complete solutions for air entrained concrete

MasterCast®
Solutions for the manufactured concrete product industry

MasterCem®
Solutions for cement manufacture

MasterCO$_2$re™
Solutions for low-clinker concrete

MasterEase®
Low viscosity for high performance concrete

MasterFinish®
Solutions for formwork treatment and surface improvement

MasterFiber®
Comprehensive solutions for fiber reinforced concrete

MasterGlenium®
Solutions for high performance concrete

MasterLife®
Solutions for enhanced durability

MasterMatrix®
Advanced rheology control for concrete

MasterPel®
Solutions for hydrophobization, anti-efflorescence and surface protection

MasterPolyheed®
Solutions for mid-range concrete

MasterPozzolith®
Solutions for water-reduced concrete

MasterRheobuild®
Solutions for high strength concrete

MasterRoc®
Solutions for underground construction and surface improvement

MasterSet®
Solutions for set control

MasterSphere®
Solutions for guaranteed freeze-thaw resistance

MasterSuna®
Solutions for sand and gravel in concrete

MasterSure®
Solutions for extraordinary workability retention

Master X-Seed®
Advanced accelerator solutions for concrete

Quantified sustainable benefits. Advanced chemistry by Master Builders Solutions®.

Let the numbers do the talking: We have portrayed some of our most eco-efficient product solutions for concrete and precast production, construction, civil engineering, and flooring.

sustainability.master-builders-solutions.com

Master Builders Solutions Sverige AB
Metallvägen 42, SE-195 72 Rosersberg
Tel +46 (0)8 732 29 37
www.master-builders-solutions.se

Master Builders Solutions Norway AS
Gullfotdalen 4, NO-2120 Sagstua
Tel +47 62 97 00 20
www.master-builders-solutions.no