The Wet Shotcrete Technology and application Effect in Underground Coal Mine

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Abstract: summarizes current situation The wet shotcrete in Underground coal mine, contrast the Advantages and Disad
vantages of of two ways The TransportationWith stirring, analyzes, parameters To current wet
shotcrete Sprayer then Development level of spray manipulator, points out
the main indexes and methods of Control
and Monitor of quality. contraction experiment a dry and wet shotcrete in underground Coal mine shows so: wet s
hotcrete Can decrease 80% of environmental Dust concentration and 70% of rebound ratio, increase, thickness of
once- Spray-layer From $ mm to $ mm. The application effect in wet shotcrete is very do.

Keywords: shotcrete; Burden; Transportation With stirring; Construction to shot; Control to quality

1. wet shotcrete process

Dry-sprayed concrete is the cement, Sand, gravel mixed into dry mix, after, with forced mixer mix
Evenly, transport by compressed air to nozzle, After adding a water mixture to the nozzle construction methods for, on
sprayed surface. The fundamental difference between the wet spray technology is, water not The is mixed with the
nozzle. But in the mixture through compressed air transport before adding water before. Its process is relatively
complex, include: Ingredients, Stir transport, Spray Construction, quality control and monitoring 4 steps, in Figure 1 shows.

High Performance shotcrete (HPS) is in recent years in the lane (tunneling) Road New concepts proposed in
support, concrete refers to wet sprayed concrete with steel fiber dimension or polypropylene fiber, micro-silica powder
and superplasticizer, make wet spray coagulation soil achieves excellent performance: High strength, high impermeability and high durability. Steel fiber sprayed concrete is an ideal roadway surrounding rock support
material, The is especially suitable for high ground pressure stresses in deep wells, variant Large soft rock
roadway. wet-sprayed steel fiber concrete with other material suction The comparison of the ability to distort as shown
in the diagram 2 shows.

(1) Batching
raw materials for wet shotcrete include: Cement, Coarse aggregate, fine aggregates, mineral admixtures, admixtures and water. coal Mine Wet Spray mix

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work is properly cited.
The condensate should be fully borrowed from other industry advanced experience, strictly follow GB50164-2011] Concrete Quality control standard and jgj 55-2011 〈Common Concrete mix design procedures The rule controls raw material amount, Optimizing mix design, Change the rough ratio of the coal mine experience to a thick put batching method.

Transform /mm

Diagram 2 Comparison of the ability of wet-sprayed steel fiber concrete to attract deformation with other materials

1. General injection Concrete 2. Steel Fiber sprayed concrete 3. hanging web shotcrete

(2) stirring Transport
large wet jets in tunnels and other excavation spaces such as water conservancy and hydropower, etc. Concrete Works, ingredients stirring usually out of the field, Stir well concrete transported by transport tanker to header, because the coal mine well space narrow, is not suitable for large batching mixing equipment installation and routine operation

tanker Traffic, plus transport distance long, More materials location and disperse etc

Other adverse conditions, Mixing transport of concrete is restricted by wet-spraying technology keys for application in coal mines. Current agitation against concrete "2" workaround:

① Stir the ingredients in the ground or bottom pit yard mixing station into the on line, specially designed underground concrete tanker for completion of transport, at the same time use stabilizers to keep the concrete long and working;

② The raw material is transported through the ordinary car to the underground, Batching, Stir, The material for the is in the vicinity of the heading face. Typical generation of this way tab is HPL -6 type batching mixer, its structure as shown 3 is shown.

(3) Jet Construction

Wet concrete ejector is the core device for wet-spray technology, Root The is divided into plunger pumps, Hose Extrusion, aerodynamic, rotors and more forms. currently obtains coal safety sign Wet Spray machine total type, part of wet-jet performance table 1 is shown in.

Model outline dimensions air consumption work wind pressure horizontal conveying tut-max aggregate

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Table 1 The section has obtained the performance parameters of the wet jet machine for coal safety mark
Dry-jet technology is usually done by manually manipulating the airbrush to, Disadvantages: ① Labor intensive; ② cannot have vertical injection, only dumping Skew certain angle job, rebound rate increase; ③ Job Environment Difference, Hazard Health.

Wet Spray Job, Often has a pulse phenomenon, increases the manipulation of the airbrush difficulty. spraying manipulator for jet operations can be very good. no questions above . tunneling face floor undulation, rugged, plus " Dump and rake installed there, manipulator selection to the critical. use manipulator to hang on top of roadway, Make it walk from the top of the roadway, to cross the Rake machine and the Gangue heap. tunneling working face monorail crane manipulator Device configuration diagram 4 shows.


(4) quality control and monitoring

Heavy quality control and monitoring of shotcrete in coal mines to include dust concentrations, bounce rate, Spray layer thickness and strong degree. The thickness detection method includes a drilling method and a laser rangefinder method. strength detect two categories of destructive detection and nondestructive testing. breakCheck include chisel cutting method, Drill Core-Sample method, Pull Law etc, the no Damage detection method includes a spray slab cutting method, rebound method, penetration method, etc. .

2. Project Instance

to investigate the practical effects of wet spray technology, under a mine. West [ ] five-lane and east two-lane respectively carried out wet spray technology and dry spray _ comparison test. wet-spray technology with field ingredients mixing side type. The dust concentration in the construction process, rebound rate, Spray layer thickness. Monitored, to contrast test effects.

(1) Dust

dust concentration monitoring results such as table 2 shows, when using dry jet technology, 2 The weighted average dust concentration at the test point reaches themg / m3, after using wet spray technology, Weighted average dust concentration is about mg / m 3, The dust concentration is lower than the dry spray 80% around. Wet spray decrease dust concentration after Operation, job environment significantly improved.

Table 2 comparison between dry and wet dusting concentrations test Site Mix powder /mg . m 3 dust on material / mg. NF 8 Weighted average dust / mg. m 3Increase or decrease rate /%

(2) rebound rate

rebound rate is an important indicator of the quality of shotcrete technology sign, to 2 the rebound rate for a technique is compared to the experiment, results like table 3 shows. 2 test point with dry jet technology, Resilience rates are in the 26% above, After using wet spray technology, bounce rate is about 8, with dry Spray The compares nearly 70%.

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Spray Xiang

Table 3 Comparison of the rebound rate between dry and wet spray techniques

(3) Secondary jet thickness
to determine the exposed length of several anchor rods before spraying concrete, at end of construction measure with one anchor rod exposed length, Subtract, that is to get one secondary jet thickness. one secondary jet thickness to table 4 show. with dry-jet technology, one Secondary spray layer thickness in 50~60mm, After the wet spraying process for rice, Once spray layer thickness can reach - mm with on. The thickness of the roadway beneath the coal mine is generally the same as mm, Dry Spray technology requires a repeat injection, Wet Spray technology once spray construction up to to requirement thickness.

Table 4 Spray thickness contrast between dry and wet spray

3. Epilogue

Wet shotcrete technology is a for coal mine underground shotcrete in China Development Direction, you should draw on other technologies that are ripe for geotechnical engineering and experience, combining mine specific construction conditions and requirements, developing mines downhole wet shotcrete technology. Focus on the design of the batching process Scientific and metering accuracy, Long-time stability in mixing transport engineering sex, improve mechanized level during construction, emphasis on quality after construction quantity control and monitoring.

The comparison test under coal mine shows that, compared to dry spray, wet-jet coagulation Soil technology operating environment dust concentration reduction 80% around, rebound rate drop

Low 70% above, Spray Layer thickness by dry spray mm to the
- The

According to the UK SPS - Safety test machine for transverse vibration of the internal Medicine Department test Transverse vibration anti-pine effect when, found when Bolt axial preload from 0.25^ Add to 0.45 ^, improved anti-pine effect 13.2 Times; pre-tightening to 0.75^ when, The anti-loose effect also greatly increases the. But fromto ^^ 1) available, A large preload will directly reduce the load capacity of the Bolts Force. so based on the actual payload size, Bolt stiffness etc composite factors Forces Select the size of the preload.

2 Stress Analysis for double nuts

Double nuts are a way to prevent loosening by increasing friction, is more efficient than spring washers one way. from Diagram 2(a) visible, when twist 1 nuts when The initial preload for the bolt is F0. nut screws Upper side of tooth shape contact with bolt threaded teeth, To unscrew the previous 2 Nut ( call nuts or anti-pine nuts) after, increases with the tightening of the accessory nut plus, the force between the upper and the bolt teeth of the main nut tooth will gradually decrease small ( See figure 2(b), the same force as the secondary nut applied to the main nut equals & when. The force between the main nut and the bolt disappears in the. when the accessory nut tightens The Force, then add, The main nut is under the tooth shape to contact the threaded screws of the bolt. as shown 2(c) show,2 to tighten the top of the nut after, The nut pair is always attached to the effect of
pressure and friction. The friction is still
mm above. The wet shotcrete technology not only reduces the material's waste, improves worker's working environment, and save the refresher preface, increased construction progress, reduces worker labor intensity.

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