



Ground freezing technology



Ground freezing technology

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Everything from a single source

A reliable partner

We offer you:

Your advantage:

Design

Our experts assist you during every step of the planning process including drilling and freezing concepts, thermal calculations and design of the freezing system. Therefore we provide the optimum solution for your project with our holistic approach.

BIM

Max Bögl is one of the leading companies in the area of Building Information Modelling and implements these principles and methods for all stages of construction. Interactive visualisations are used to optimize processes and carry out collision checks.

Drilling

Our skilled personnel and company-owned drilling equipment offers a wide range of drilling methods for a variety of ground-conditions. Vertical and horizontal drillings can be carried out, either directed or undirected. Years of experience guarantee that we always deliver to the highest standards.

Freezing Methods

Our portfolio includes freezing with brine and liquid-nitrogen as well as combinations of the two freezing methods. Our experts will provide qualified advice, giving you the best possible technical and economical solution.

Freezing with brine

Our freezing units operate with cooling capacities in the range of 60 to 1800 kW – providing you a reliable, flexible and economical technology. The entire equipment – including cooling towers, tanks for brine storage, pumps and insulated pipes – is company-owned.

Freezing with liquid nitrogen

Our company-owned liquid-nitrogen freezing equipment (e.g. vacuum insulated pipes, temperature-dependent process control system) allows us to respond to your request on short notice.

Measurement technology

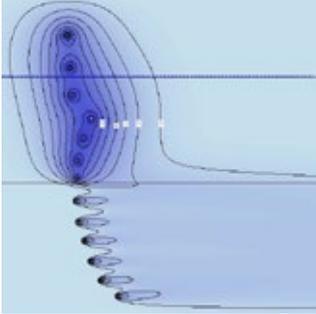
Up to 2000 possible data points provide you with a complete overview of the freezing process at all times. This data is collected and stored on a de-centralized internet-platform. Visualisation and evaluation is carried out by our experienced engineers.

Monitoring and Service

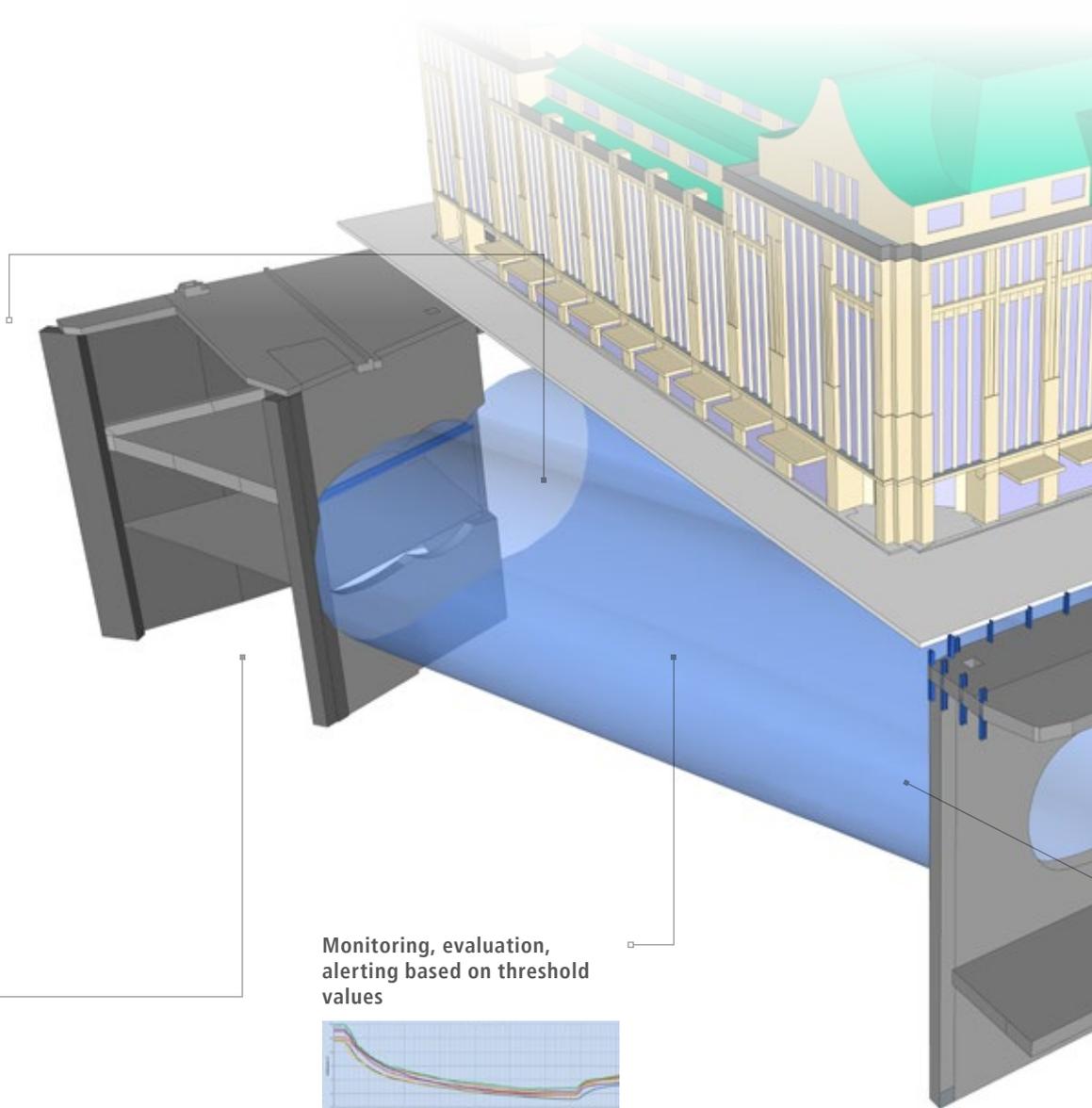
Our skilled personnel receives automated alerts if measurements fall above or below the set threshold values. Maintenance and inspections of our freezing systems are also part of our complete service portfolio.



Services

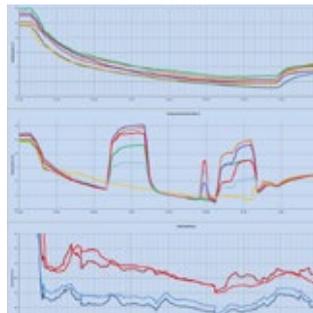


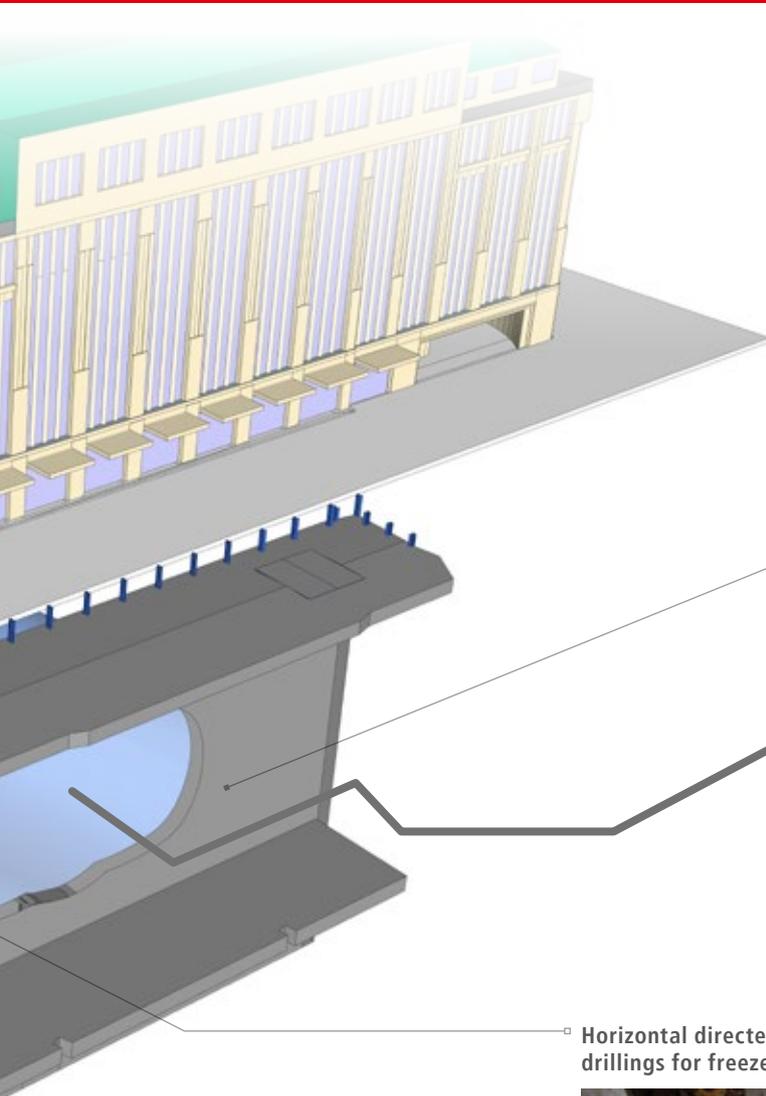
Thermal FEM calculations



Vertical drilling of freeze pipes

Monitoring, evaluation, alerting based on threshold values





Monitoring of the freeze systems



Construction of pipe and freezing systems



Efficient project coordination using BIM methods

Horizontal directed/undirected drillings for freeze pipes





Ground freezing for **Tunneling**

Engineers face some of the most technically demanding challenges in tunnelling such as high water pressure, geological fault zones or a building underpass.

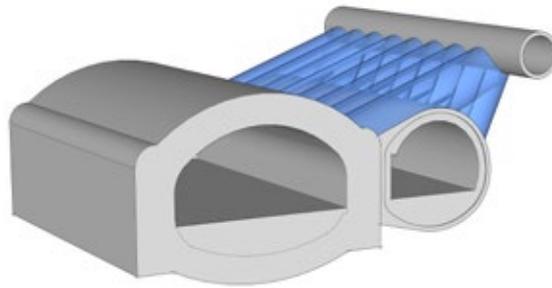
Our experienced personnel carries out drillings for freeze pipes from the ground surface, out of construction pits, pilot tunnels or the complete tunnel itself. Even under difficult conditions, we always adhere to the highest quality standards.

Max Bögl owns drilling equipment for almost all applications and ground conditions.

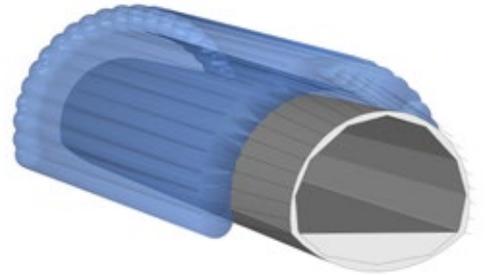
Frozen areas are used cost-effectively to stabilize and prevent seepage of water in almost all types of geology.

Applications:

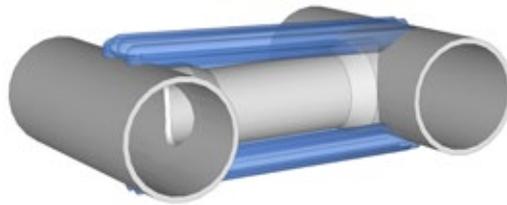
- Ridge freezing
- Enclosing frozen area
- Cross-passages
- Sealing block segments for entry and exit of tunnel boring machines
- Maintenance, repair and recovery of tunnel boring machines



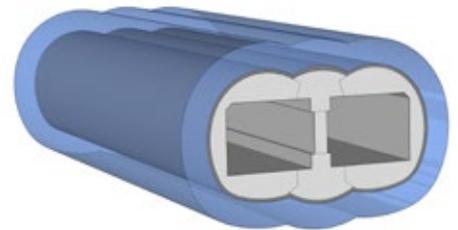
Ridge freezing out of a pilot tunnel



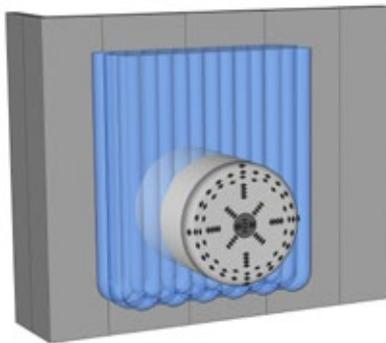
Ridge freezing



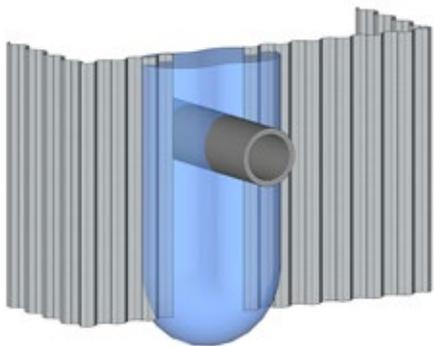
Cross-passage



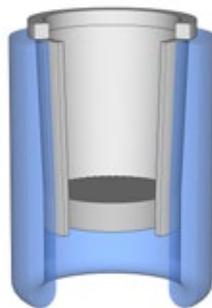
Enclosing frozen area



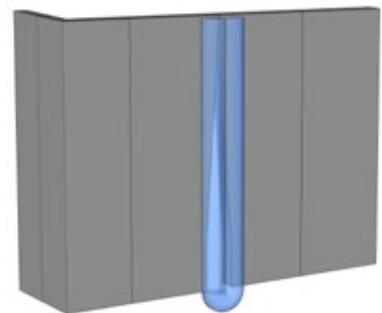
Sealing block segment for entry and exit of a tunnel boring machine



Closing of a gap



Frozen area as enclosing element



Repair / Closing of a leaking connection or gap

Ground freezing for

Excavation pits

If intersecting pipes, openings, spatial confinement or obstacles in the ground are present, it can be difficult or even impossible to create a safe excavation pit using conventional methods. Max Bögl provides ground-freezing as a well-proven, safe technology that can be adapted even under the most challenging conditions.

Our experienced engineers work with you to individually customize the required solution for your specific project. Frozen areas are used in combination with conventional construction methods or as a stand-alone solution in order to achieve the required static or waterproofing function. Our extensive ground freezing equipment and our services are available within short notice.

Another advantage of ground freezing technology – no obstacles remain in the ground after thawing.

Applications:

- Enclosing frozen area
- Gap freezing at openings
- Closing of leaking connections, defects and gaps
- Extension of existing support elements
- Freeze shafts





Ground freezing for

Remediation of contaminated areas

Max Bögl supports you during the investigation and remediation of contaminated areas. We offer various methods for taking frozen, undisturbed soil samples for chemical analysis.

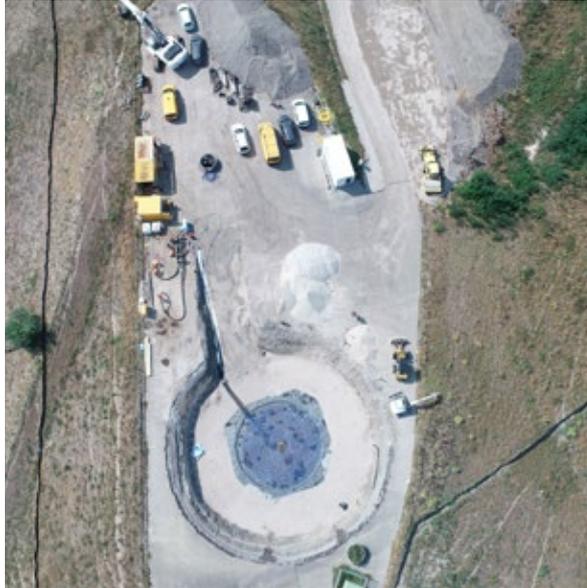
Ground freezing inhibits the discharge and distribution of pollutants during remediation. Thus the risks to humans and the environment, in particular groundwater, are minimized. Compared to conventional methods, ground freezing offers economic and occupational safety advantages.

Applications:

- Immobilization of pollutants
- Recovery of explosives
- Collecting undisturbed soil samples
- Removal of contaminated soil from water bodies
- Temporary isolation of contaminated areas in groundwater



Ground freezing for immobilization of a contamination in a landfill



Ground freezing for stabilizing a foundation on a landfill



Removal of contaminated soil from water bodies



Ground freezing for

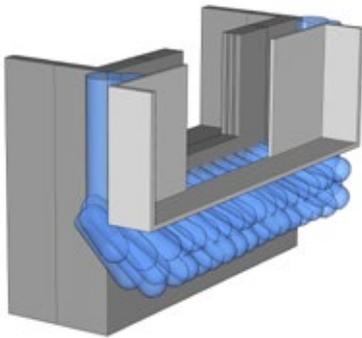
Construction in existing context

Difficult construction projects close to or under existing buildings have become common due to the ongoing urbanization. In order to meet new usage and legal requirements, existing underground structures are often extended or expanded. Ground freezing offers a variety of possible applications for situations in which conventional methods reach their limitations.

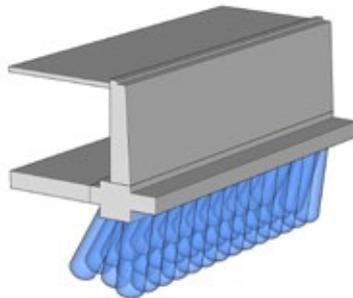
Max Bögl completed several projects in Germany and abroad successfully in recent years. Our customers can rely on the technical know-how and creativity of our engineers.

Applications:

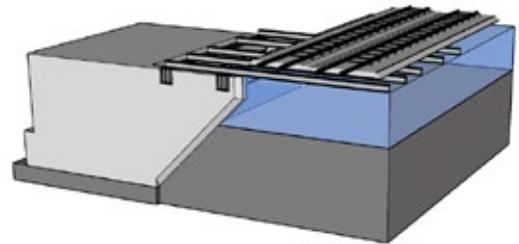
- Construction of underpinnings
- Construction pits inside buildings
- Insertion of underpasses under existing railway lines
- Connection of existing buildings to new structures (e.g. emergency exits)
- Renovation of existing buildings



Connection of an existing building to a new structure



Underpinning



Insertion of an underpass

Technical description

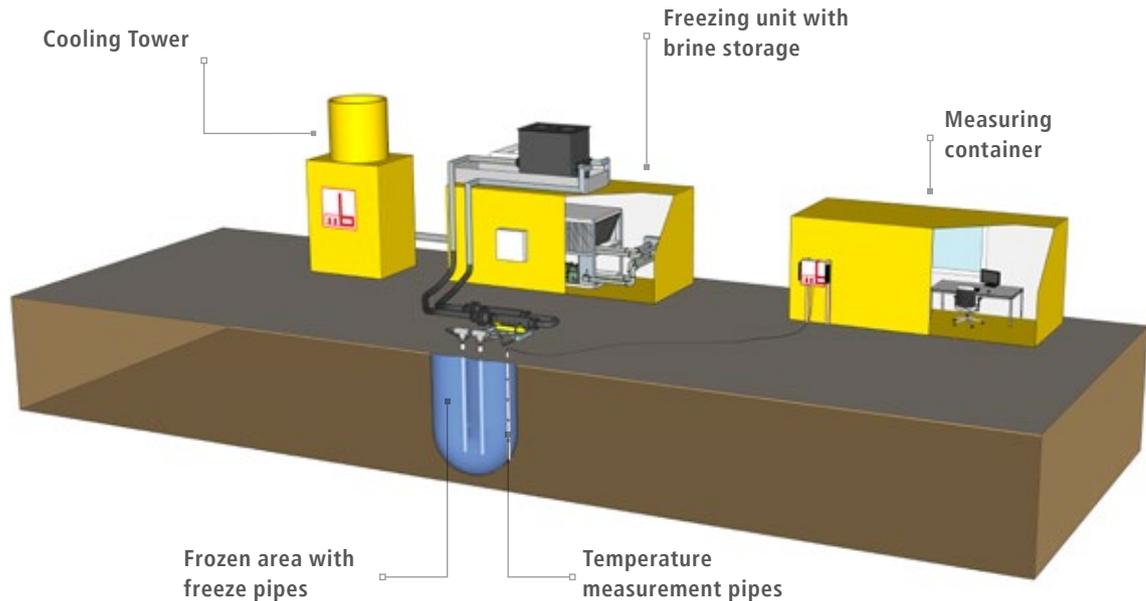
Freezing with brine

For artificial ground freezing with brine, a saline solution, usually calcium chloride is used as the refrigerant. The brine is cooled to temperatures of -30 to -40°C by freezing units and then pumped through an insulated circuit to the freeze pipes and back. The cold brine flows through the freeze pipes withdrawing heat from the soil around the pipe. With progress of time, cylindrical frost columns grow around the freeze pipes. These columns connect and form frozen walls or plates. The layout of the freeze pipes defines the geometry of the frozen area.

Depending on various factors affecting the freezing phase, this process can take up to 20 to 40 days to complete.

Expansion as well as the temperatures within the frozen area are measured using temperature measuring pipes which are fitted with sensors. The collected data is recorded and stored on an online platform and can be accessed at all times. Max Bögl owns all the necessary equipment for brine freezing, including cooling towers, storage tanks for brine, pumps and insulated pipes of various dimensions.

Compared to freezing with liquid nitrogen, brine freezing is more cost-effective for frozen areas with large volumes and/or a long maintenance phase. An economical alternative is to use liquid nitrogen during the freezing phase and to switch to brine freezing for the maintenance phase.



Technical description

Freezing with liquid nitrogen

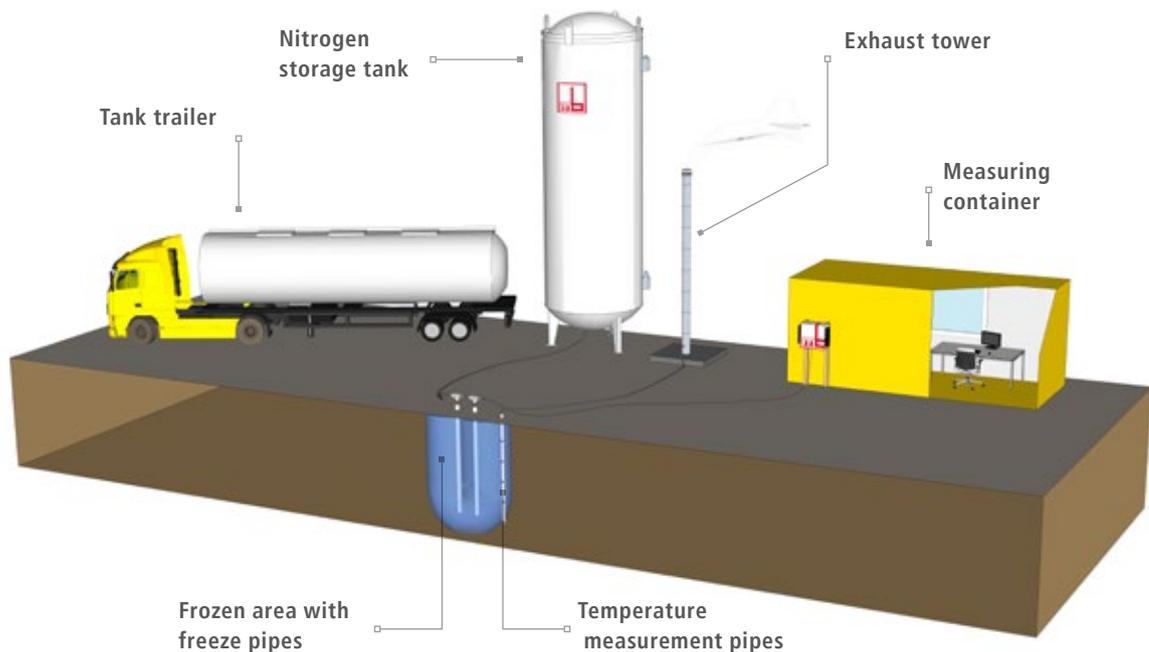
Artificial ground freezing with liquid nitrogen uses cryogenic liquefied nitrogen with a temperature of -196°C as a refrigerant. The liquid nitrogen is delivered by specialized trucks to the construction site where it is temporarily stored in vacuum-insulated tanks. The liquid nitrogen flows through insulated pipes to the freeze pipes and via a down-pipe to the deepest points of the pipes. As the nitrogen exits the downpipe it evaporates and flows back through the freezing pipe. The escaping gas is then collected in exhaust pipes and discharged into the atmosphere through an exhaust tower.

Heat is extracted from the soil and frozen areas are formed during evaporation. Temperature-controlled magnetic

valves discharge the liquid nitrogen into each freeze pipe.

The freezing process, the frozen area and frost expansion is monitored with measuring pipes equipped with sensors. The collected data is recorded and stored on an online platform and can be accessed at all times.

The advantages of ground freezing with liquid nitrogen over brine are the short mobilisation time for the equipment and a substantially shorter freezing time (usually 3 to 7 days). For frozen areas with a small volume and short maintenance phase, it can be an economical alternative even though nitrogen is a consumable. A combination of both methods is also an option.





Max Bögl Group

With over 6,500 highly qualified employees at 40 locations worldwide and an annual turnover of over 2 billion euros, Max Bögl is one of the largest construction companies in the German construction industry. Since its foundation in 1929, the company's history has been characterised by innovative strength in research and technology - from tailor-made individual solutions to constructionally and ecologically sustainable overall solutions.

With forward-looking in-house developments on topics of our time, such as renewable energies, urbanisation, mobility and infrastructure, the Max Bögl Group is already realising solutions for the megatrends of our globalised world.

Based on many years of experience and competence in high-precision precast concrete construction, Max Bögl is also positioning itself as an important driving force in the development of innovative products, technologies and construction processes.

The wide range of services and the high level of vertical integration with our own steel construction, our own precast plants, the most modern fleet of vehicles and equipment as well as our own raw materials and building materials guarantee the highest quality. The use of BIM, lean management/ production and standardised project management ensures adherence to schedules and cost-effectiveness from the initial concept idea to the finished building product.

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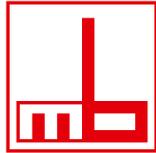


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Progress is built on ideas.