SOIL NAILING
Minova specialises in total solutions and vital technologies designed to meet your challenges. We are forward thinking and offer integrated solutions with sustainable results.

We offer products and solutions for soil nailing as well as the applications listed below:

- Anchoring, rock bolting
- Concrete repairs
- Construction adhesives
- Customer support & consulting
- Erosion control
- Filling of cavities / voids & backfilling
- Ground consolidation
- Joint sealing
- Micropiling & underpinning
- Mine gas sealing & ventilation control
- Non-potable water pipe repairs
- Pumps & ancillaries
- Slope stabilisation
- Structural repair
- Water sealing

Minova ground reinforcement solutions are part of everyday use.

Minova ground support solutions are used extensively in the mining and construction industries around the world.

This brochure represents a general overview of the most commonly used solutions for soil nailing applications that Minova offers.

Please visit, www.minovaglobal.com for more details.

With over 135 years of experience, Minova is a leading global manufacturer and supplier of resin, cementitious and mechanical earth control products, adhesives and support equipment. We provide leading-edge geotechnical solutions as well as consulting, design and applications expertise for use in the mining, tunnelling, civil construction and structural remediation industries.

Minova is an industry innovator and leader both in technology and application expertise. Our product and applications specialists from around the globe provide on-site technical support for your projects no matter the location.

With a focus on safety, our success comes from customer-connected engineers and chemists who continually innovate and perfect solutions, raising industry standards.
Many geotechnical projects include the stabilisation of slopes and walls as well as excavations. Soil nailing is a common method used to provide the required stability. Minova offers:

- Automated installation solutions, which provide improved occupational health and safety and reduced project time frames
- Technical support including geotechnical consulting and field services
- A full portfolio also including rock bolts, ground anchors, micropiles, meshes and supporting products
- Glass fibre reinforced polymer bolts and meshes for improved ergonomics safety due to their light weights, increased sustainability due to lower carbon footprints and guaranteed long life against corrosion
- Pumpable or capsule-packaged cement and resin grouts for ease of installation of soil nails, rock bolts and ground anchors
- Specialised coatings to provide improved corrosion protection of our steel nails, anchors, bolts and accessories

Minova ground reinforcement solutions are used every day Worldwide. Minova differentiates from our competition by providing highly engineered and durable total solutions, which meet even the most demanding project conditions. We support our customers from project inception, providing sustainable solutions.
Minova offers solid bars/bolts for use in standard drill & grout soil nailing and rock bolting applications. Where geology is more broken or speed is critical, Minova SDA bars/bolts are drilled and grouted simultaneously. Installation efficiency is massively improved by using a hollow bar with a sacrificial bit and pumping the grout down-hole during the drilling process.

Soil nailing benefits:
- Increases site stability and safety
- In-situ installation results in less disruption to adjacent structures
- Reduces required embedded structural elements below the excavations
- Economical solution compared to alternative construction methods
- Nail location, inclination and lengths can be adjusted on site
- Reduces work site congestion
- Relatively rapid installation
- Requires less construction materials
- Requires less space due to smaller equipment requirements

Design solutions include:
- Flexible, synthetic or steel mesh may be used in conjunction with erosion control fabrics
- Shotcrete or isolated soil nail head plates may be used over the mesh and fabrics
- SDA and nails can be tied to the products to complete the construction and aid the weathered or fractured zones
- Minova can assist in providing total solutions for soil nailing applications

Minova soil nailing and rock bolting solutions are economically attractive and technically efficient when compared to other slope and excavation stabilisation methods.
PROTECTING AGAINST CORROSION

Minova provides soil nailing solutions that meet the challenges of aggressive ground conditions. Life Cycle Assessment (LCA) is increasingly a major aspect for project managers and owners.

Minova addresses increasing LCA requirements by offering a broad range of solutions to meet the increased life cycle expectancy of projects. These solutions include high-grade steel, hi-tech coatings and composite technologies such as glass fibre reinforced polymer (GFRP) bolts and meshes. When combined with our innovative cement and resin-based grouts, corrosion is minimised and life cycles optimised.

Coating protection for soil nails
Minova provides multiple coating solutions for a wide range of soil nails that increase product lifespan while maintaining performance. Single and Twin Coated protection systems are available, all of which can be combined with grouting solutions from Minova to optimise product lifespan and performance.

The Minova Twin Coat finish can be applied to SDA hollow bars/bolts as well as to solid bars/bolts. It is specifically designed to handle high mechanical stresses while providing a unique level of corrosion protection. The Twin Coat finish consists of a two-step process of hot dip galvanising followed by an epoxy coating making our Twin Coat finish the best in the industry.

Minova provides our customers with best in industry products that extend project life cycles.

TWINCOAT™ PROCESS

The Minova TwinCoat process is available for our SDA bars/bolts. The coating process is comprised of a hot dip galvanisation in accordance to EN ISO 1461 and Epoxy coating in accordance with ISO 2178. The Minova TwinCoat process is tested for suitability in accordance to corrosion category C5-M and Im3 (durability range according to ISO 12944-2). Testing performed by OFI (Austria).
In-pit construction requires stabilisation of structural walls, whether for permanent or temporary use.

**In-pit applications**

Minova provides multiple anchoring products that temporarily or permanently support in-pit structures. Applications include temporary wall anchors, tieback anchors for sheet piles or retaining structures for the active support of high-rise buildings.

In construction projects, there is potential to overextend underground past defined construction zones into adjacent areas. This is a concern because steel is a conductor of electricity and may cause unforeseen issues. The way to resolve these issues is to either remove the steel elements or reduce their length which may cause design issues. Minova inert GFRP products provide the solution to these challenging situations.

Minova GFRP products offer strength, flexibility and alternative solutions to project challenges. With improved material handling and logistics Minova GFRP can be shipped in lightweight bundles or coils in lengths of up to 200m (656’). The material is very strong but easily cut to length on site making it a flexible and dynamic solution.

Minova offers a broad range of products for many applications from structural cuttings to management of natural or man-made slopes.
Minova is the technical leader in automated nailing and bolting operations. Our solutions improve safety and installation cycle times by reducing manual handling. The Minova one pass drilling operation has changed the industry.

When soil nailing grouts are used to encapsulate the entire SDA or solid bar element, a grout swivel may be utilised in line with the drill rig. This automates the grouting process for simultaneous drilling and grouting.

The use of high-performance grouts that instantaneously set, offer the ability to immediately load the bolt or nail leading to enhanced safety and efficiency.

Minova offers a broad portfolio of innovative cements and resins that meet job site durability, sustainability and environmental requirements. Minova grouts are available in pumpable and capsule forms. Grouts are used to protect the nail/bolt elements while improving the targeted ground. Grout selection and application method are determined by specific geological conditions.
Minova offers flexible ground anchoring solutions including SDA bolts, tendons in steel or GFRP, cements and resins.

**Ground anchors are comprised of three parts:**
- **Transmission head:** transmits the anchor force to the structure via the bearing plate
- **Free length of the tendon:** from the head to the near end of the anchorage
- **Grouted anchorage:** the length of tendon by which the tensile force is transmitted to the surrounding ground via the grout

**Ground anchors, passive and active**
- A passive anchor does not usually have a free length of tendon and is only tensioned when the structure applies load to the anchor.
- An active anchor is pre-tensioned before it takes up the load, which prevents distortion of the structure. The tendon is usually made of pre-tensioned steel cables.

An anchor is understood to be temporary if it has a lifespan of less than two years; however, if it has a lifespan expectancy of greater than two years and it is protected against corrosion then it is to be considered permanent. Permanent systems are typically designed to meet local technical standards.

Minova partners with our customers to provide total solutions that meet engineering challenges in ground stabilisation.
Combined with other Minova engineered solutions micropiles are designed to provide the required restraining forces to stabilise slopes.

**Micropiling**

The use of micropiles has come into favour for slope stabilisation projects because they are relatively simple to handle, require a smaller working area, can readily be installed in areas with restricted equipment access, have reduced excavation requirements and can be used in most ground conditions.

**Landslide zones**

In landslide areas complexity and technical expertise is required. Minova has products and capabilities to assist you through project completion. Minova offers soil nails, gabions, meshes, ground anchors, micropiling, high strength cements, resin injection products and services that allow you to complete your work safely, on time and under budget.

Minova offers products and services that allow you to complete your projects safely, on-time and under budget.

---

**Micropiling Combinations and Complex Solutions**

- Reinforced concrete cap
- Road surface
- Finished grade
- Case 1 non-reticulated micropile structure (TP)
- Approximate failure plane

**Combinations and Complex Solutions**

- SDA tensile piles
- Single bar ground anchors
- Strand ground anchors
- Concrete structure
- Inclinometer casing
- Ground water
- Drainage tube
- Thixotropic cement grouts
- High-strength cement grouts
- Thixotropic injection resins
- SDA micropiles
- Critical slip plane
Manova is a global partner to our customers. Our products are designed to take on challenging ground conditions and yet remain sensitive to the environment.

The need to utilise multiple application methods due to tight working areas or corrosive soils require complex solutions. Permanent applications complicate and demand higher design considerations with more thoughtful material selection. GFRP is an ideal alternative to steel-based solutions for many such project applications. GFRP technology positively supports the environment by providing sustainable solutions while reducing CO₂ emissions during manufacturing. Lower product weight further reduces transport costs, improves workforce productivity and ensures worker safety.

**Improved design life**

Demands for extended project life require improved soil nailing and stabilisation technologies. This makes selecting the correct solution paramount.

Customers choose Minova total solutions because they rely on thoughtful, partner-based consultation and product selection. Product selections range from corrosion resistant GFRP soil nails to speciality coated ground anchors and more. Selecting Minova grouts completes your project by providing environmentally safe industry-leading technology.

With diligent planning and Minova products a projects impact to the environment can be minimised.
CASE STUDIES

FLOOD RISK MANAGEMENT ZONE
Minova products were used to remediate an old industrial area for housing and leisure parks, as well as providing a flood risk management system solution.

A defensive slope management system was supplied by Minova. Products included:
- SDA R38 Galvanised Soil Nails
- SDA R32 Galvanised Soil Nails
- Galvanised Head Plates & Angle Washers
- Thixotropic Grout
- Protection Caps

Advantages
- Fast, easy to install, turn key solution. Minova saved project time and cost

SLOPE STABILITY
A road cutting with a high amount of chalk present in the soil experienced erosion caused by freezing conditions. Previous stabilisation measures to the cuttings were left weakened by aggressive ground conditions. The existing steel elements continued to corrode leading to debris which caused safety issues as well as additional maintenance work.

Minova GFRP soil nails were used as an alternative to prior methods.

Advantages
- Corrosion and conductivity resistant
- Lightweight and flexible to use
- Can be combined with capsules or thixotropic cements for solid bonding

LANDSLIP STABILISATION
Minova has successfully addressed landslip conditions on multiple projects by utilising our total solution methodology. While every situation is unique, our combination of lightweight installation machines, reliable mesh and soil nail technology enables an engineer to manage any landslip condition.

Soil nails, geotextiles, Lokset capsules and thixotropic grouts may also be selected from our range of solutions to target landslip situations.

Advantages
- Flexible complete solutions that are lightweight for easy access and use in difficult sites
- Smaller machines equate to lower capital expenditure