



Services

# Foundation engineering

Innovative solutions. One partner. Well grounded.



**Implenia**<sup>®</sup>



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- 4 Innovative solutions.  
 One partner.  
 Well grounded.
- 6 Build-ready construction pits
- 8 Foundations
- 9 Grouting
- 10 Sealing elements
- 11 Dewatering and wells
- 12 Slope and embankment stabilisation
- 13 Mine rehabilitation
- 14 Ground improvement
- 15 Ground freezing
- 16 Underpinning existing buildings
- 17 Trenchless
- 18 Hybrid major projects – The overall solution
- 20 Technical Office
- 21 Measuring technology
- 22 Responsible, far-sighted construction

# Innovative solutions. One partner. Well grounded.

Implenia is very much at home in all areas of foundation engineering. Our specialists develop comprehensive, project-specific solutions, and our clients benefit from the combined capabilities of the whole Group.

#### You can rely on us

With our combination of innovation, state-of-the-art technologies and powerful machinery, we produce solutions that are built to last. Showing unstinting commitment to each job, our highly trained foundation engineering specialists have repeatedly set new standards throughout Europe. Our numerous reference projects demonstrate our ability to combine advanced construction techniques with project management skills honed over many years.

#### Individual solutions

A close cooperation across the Group enables us to produce special solutions tailored to each job. Whether it's working under extreme conditions in difficult terrain, developing and refining processes and technologies, or bringing numerous different capabilities together for one project, we have proved time and time again that we are a reliable partner. Our central priority is always to harmonise and meet our clients' expectations in terms of quality, costs, deadlines and sustainability.

#### Moving forward

Implenia invests substantial sums in research and development, and sets itself very high standards. Working closely with customers and partners, we try to find tomorrow's solutions today. We also help to develop national and international standards and regulations for our industry.





Build-ready construction pits

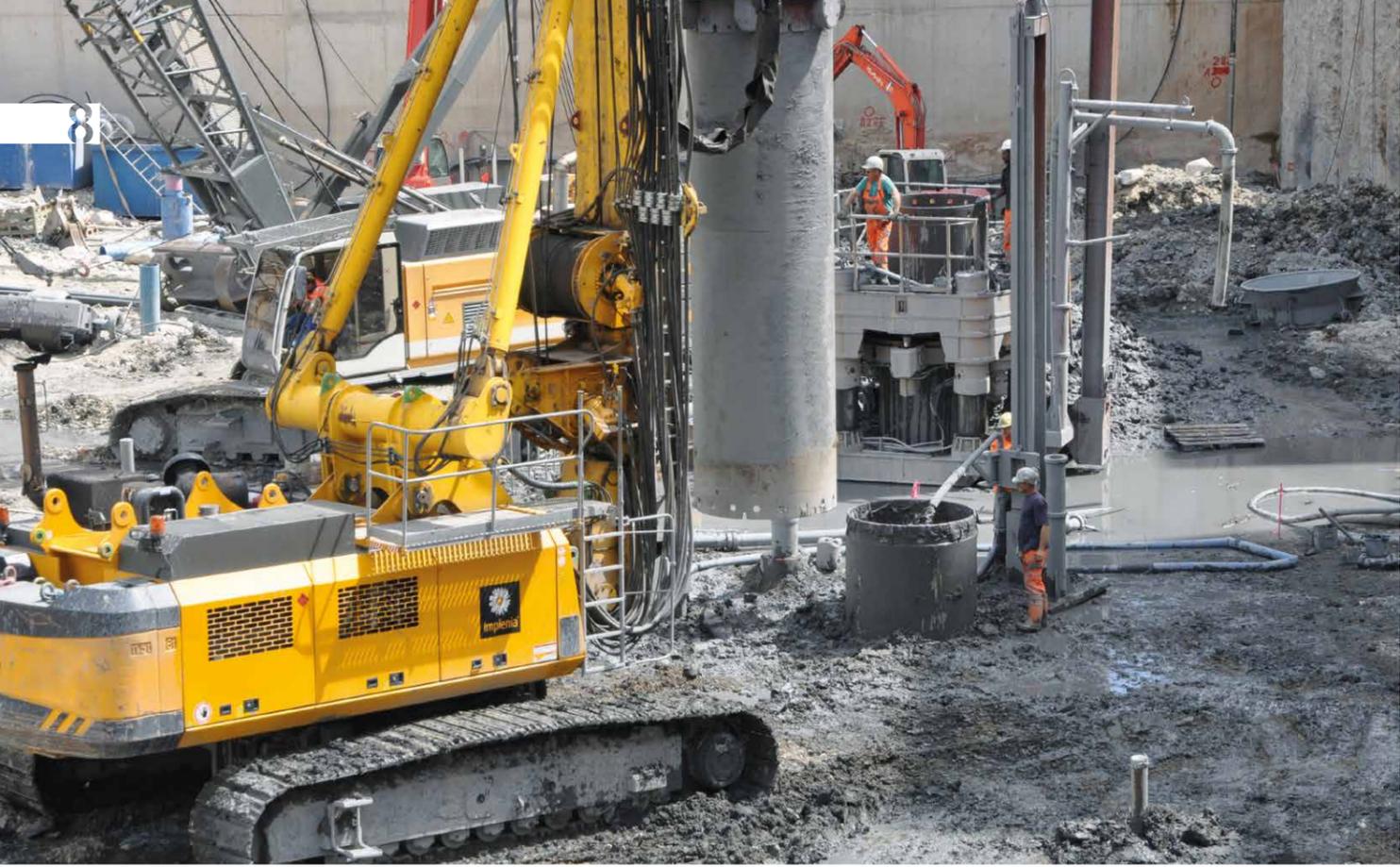
## Everything from a single source, from ground-breaking to blinding layer

We offer comprehensive solutions for complete construction pits of all kinds. From earth moving to a finished construction pit, whether in open countryside or a heavily built-up area, Implenia is the expert partner you need.

### Our services

- Bored pile walls
- Diaphragm walls
- Soldier pile walls
- Soil nailing/anchor walls
- Sheet pile walls
- Cut and cover
- Bracing/strutting

Implenia plans and executes build-ready construction pits suited to the geological conditions, local circumstances and planning regulations. Particularly in town centres, tight space and proximity to neighbouring buildings can present great logistical and technical challenges, so our specialists always develop comprehensive, project-specific solutions tailored to the customer's individual needs. We do everything possible to minimise disturbance to residents and surrounding workplaces, for example by using quietened machinery and equipment.



## Grouting

# Filling, reinforcing, stabilising



## Foundations

# Strong from the ground up

The higher a building or structure is, the deeper the foundations need to be. Implenía uses its huge experience and expertise to determine exactly what is needed to ensure lasting stability. From the initial site analysis to planning and implementation – everything can be realised.

### Our services

- Cast-in-place concrete piles
- Driven piles
- Steel core piles
- Micro piles
- Barettes
- HW piles

We give every structure the foundation it needs to ensure its safety and stability, and always look for the most efficient and commercially viable method of doing so. Our foundation engineers can cope with bore diameters of up to 2.5 metres and depths up to 100 metres, in soil or rock; and we can bridge over caves, cavities and fissures without difficulty.

Grouting to improve the ground for construction is a complex process that demands great experience and utmost care. Implenía's specialists have all the skills required.

### Our services

- Compensation grouting
- Displacement grouting
- Rock grouting
- Gel grouting
- Pore grouting
- Forepoling

Implenia uses the full range of modern techniques to stabilise the subsoil. We increase the load-bearing capacity of the ground and reduce its deformability. In the standard grouting procedure, we inject free-flowing substances into foundations and structures to fill in pores, fissures, cracks and splits. Our core capabilities include compensation and displacement grouting, which we use to improve the soil or enhance its natural properties. By means of displacement and compaction we can stabilise structures or lift them back into position.

Our foundation engineering experts examine the ground at the site to determine the most suitable method. From planning to execution to measuring the results, everything is done with surgical precision. The measuring technology we use to monitor the ground and the structure itself reveals the effects of our work before it can be detected by the naked eye. We do all of this with our own in-house equipment.

# Protecting, sealing, bearing

Implenia is familiar with all the different sealing elements and the ways they can be used. We select the correct measures to suit the particular project and customer wishes, and apply these measures using state-of-the-art tools and the latest technology.



## Our services

- Diaphragm and cut-off walls
- Slurry walls
- Jet-grouted seal blocks
- Jet-grouted seal soles
- Grouting, gel soles
- Freezing

Sealing elements protect construction pits and buildings against penetration by water, or stop water getting out of dams, landfill sites and tank systems. They can also serve as water-permeable shoring, can be temporary or permanent, and can be used in load-bearing or non-load-bearing situations.

Owing to their versatility, diaphragm walls are used in a wide variety of applications. Implenia produces more than 20,000 m<sup>2</sup> of diaphragm wall every year and is a recognised specialist in all types of application up to a depth of 60 metres. We are just as experienced in the use of vertical sealing elements and can create jet grouted soles at depths of up to 45 metres. We are known for our great flexibility and efficiency: in order to keep to the agreed deadlines, we can bring in resources from the whole Group and where necessary carry out different jobs in parallel.

# All about water

Planning and executing dewatering strategies are among our core skills: from open dewatering and wellpointing to the use of filter wells to lower the water table.



Most foundation engineering jobs have to deal with subterranean water. Sometimes this is desirable, as when building vertical or horizontal filter wells to pump groundwater for drinking. But when digging out construction pits, groundwater can become a very complex problem. Implenia develops tailored solutions, because local conditions and project-specific aspects mean that every job is unique. We always make sure the progress of the actual construction work is not compromised, that all necessary environmental protection measures are taken, and that long-term water supplies are not endangered.



## Our services

- Dewatering/water table lowering
- Wells
- Leak detection
- Level measurements



### Slope and embankment stabilisation

## Mastering the terrain

Implenia is skilled and experienced in the use of all current methods of securing and stabilising natural and artificial slopes.

#### Our services

- Soil nailing
- Anchor work
- Geotextiles
- Measuring techniques
- Shotcrete

Stabilising natural or artificial slopes – retaining walls, embankments, inclines, etc. – tends to involve complex construction techniques that require years of experience and a precise knowledge of the ground conditions. We offer full and accurate planning with structural and metrological controls using our own state-of-the-art equipment. We then identify the most suitable stabilisation methods and carry out the construction work required.

### Mine rehabilitation

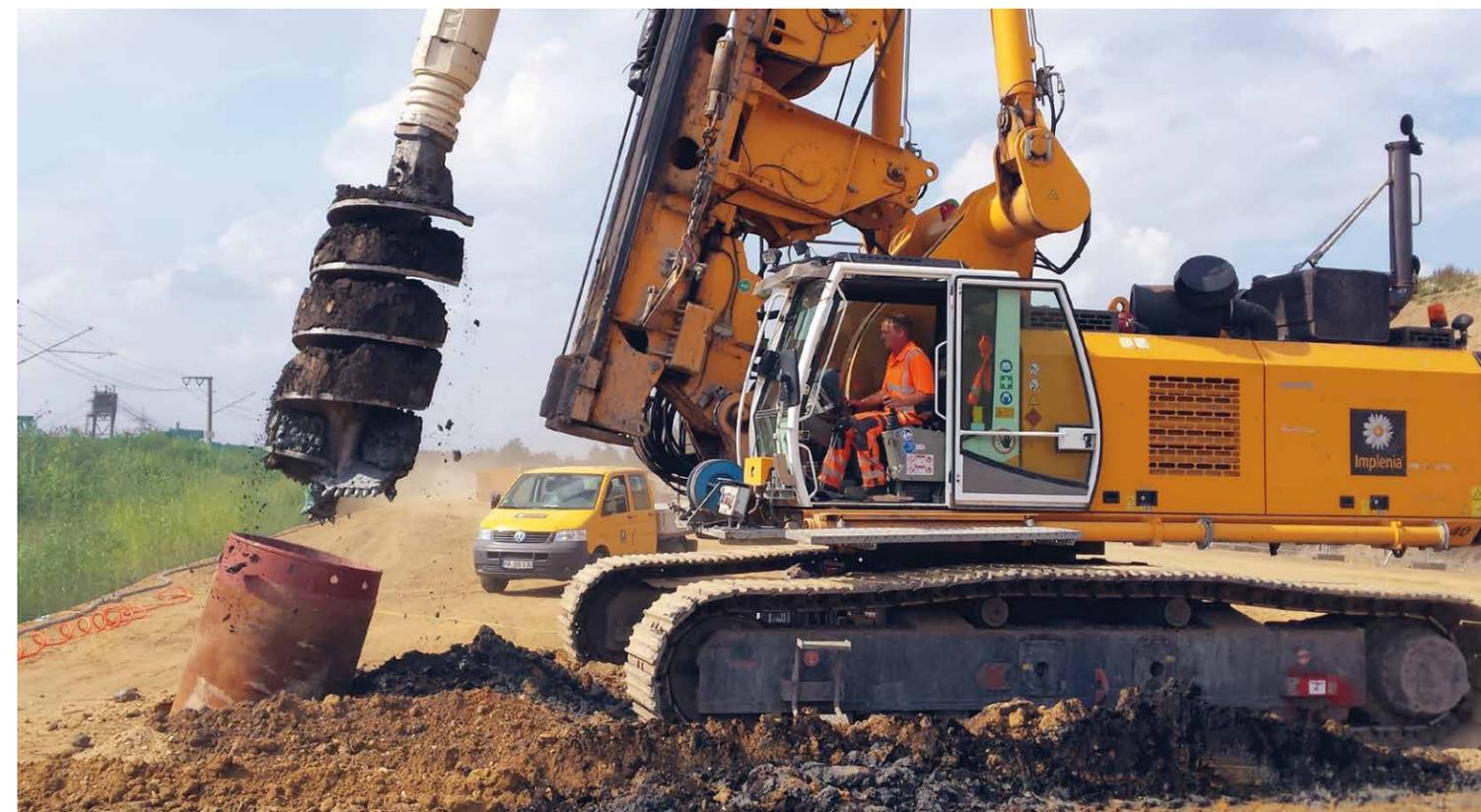
## Countering unseen danger

Caverns and cavities created by the mining industry can present a growing unseen danger to buildings and their occupants. Implenia can make such locations safe, providing expert help and advice on everything from risk analysis to filling and grouting work to post-work monitoring.

#### Our services

- Mine exploration
- Mine stabilisation
- Shaft stabilisation

Stabilising the old shafts and pits left behind by mining is a complex task. Fortunately our experts have all the machinery, equipment and skills to do the job properly. We can locate cracks and caverns and fill them in safely, and then monitor the site systematically to ensure the solution is permanent. Measuring, drilling, filling, grouting: we know how to use all the techniques and how to combine them effectively.





## Ground improvement

# Simple and highly effective

Structures that are sensitive to ground settlement – roads, railway embankments, swimming pools and river banks – need a solid base. Implenía knows all the methods to increase the compactness of the soil, reduce its permeability and improve the load-bearing capacity of the subsoil.

### Our services

- Vibro-compaction
- Displacement grouting
- Cement stabilisation pillars
- Soil mixing procedures
- Jet grouting

Implenia has a long tradition of improving ground by various means, and has developed its capabilities continuously over time. In the past it has only been possible to increase the load-bearing capacity and compactness of a site if the ground was highly permeable (e.g. sandy), but thanks to modern technology we can now improve – even greatly improve – cohesive soils too. Implenía offers its customers a wide range of options in this field. Thanks to its comprehensive range of construction services and close cooperation within the Group, it is an excellent partner for even the most complex projects, and always guarantees safe, reliable execution.



## Ground freezing

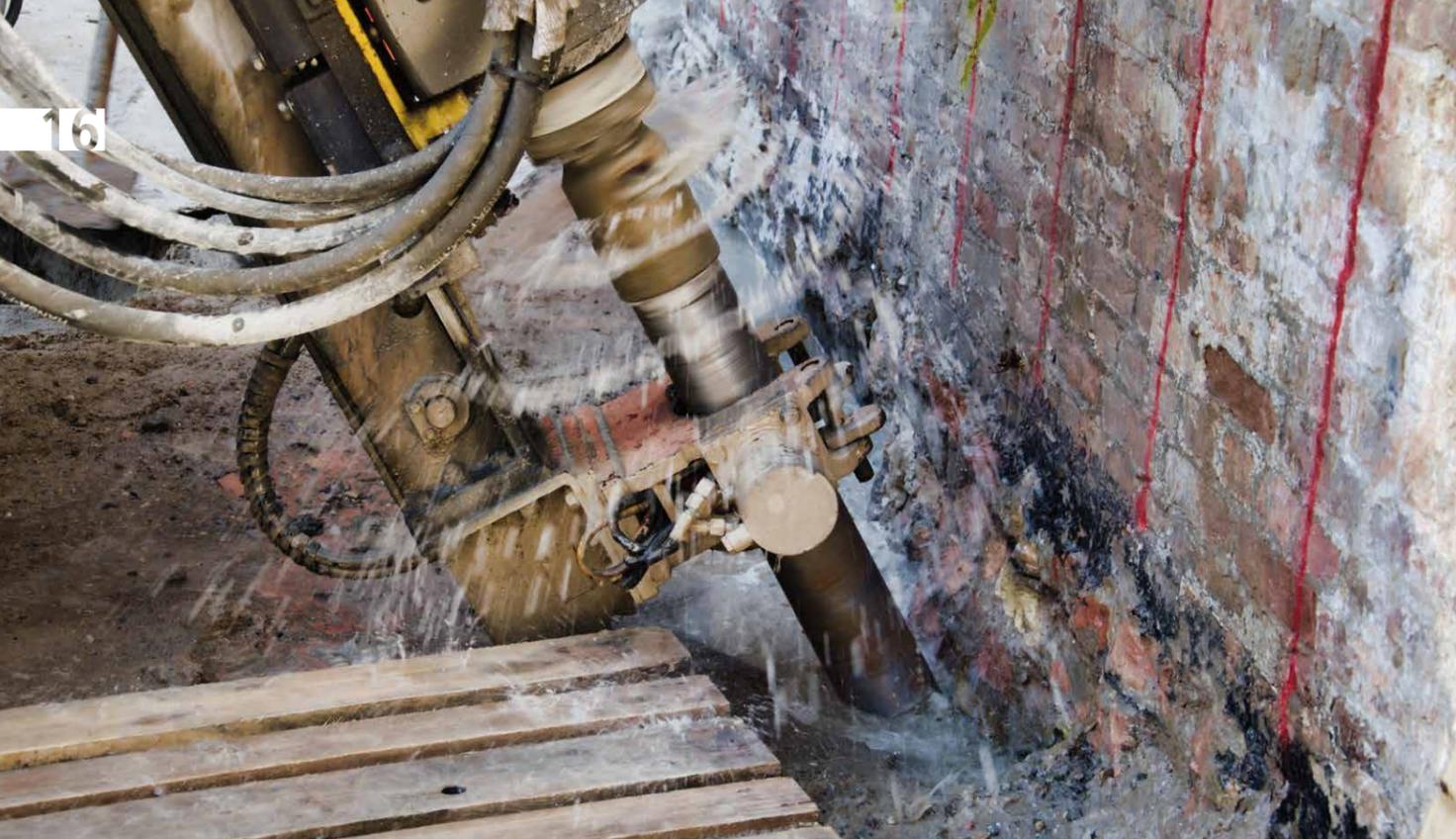
# In the cold, cold ground

Ice is an outstanding natural adhesive and sealant for earth and rock – a feature that has helped high mountainous terrain remain as it is for millions of years. Implenía exploits this freezing effect when creating shafts, excavation pits and tunnels in difficult soil conditions.

### Our services

- Brine freezing
- Nitrogen freezing
- Horizontal drilling technology
- Measurement & control technology

If a problematic site calls for unconventional solutions, Implenía's foundation engineers can help. Freezing the ground is a reliable and flexible construction technique. It's environmentally friendly too, because any disturbance to the groundwater balance is small and short-lived. Freezing can be used to seal or strengthen the ground temporarily, while tunnel drilling and cross-cutting through groundwater can also be carried out safely if the surrounding ground is frozen first. Using Implenía's highly sensitive equipment, our specialists control the entire process, from drilling and the insertion of freeze pipes, to the operation of the cooling unit, to the recording of temperature data in order to monitor the freezing process.



## Trenchless

# Effective and unobtrusive

Modern towns and cities need reliably functioning infrastructure that meets the needs of private individuals and businesses. The challenge of providing this infrastructure is made even greater by rising expectations, high standards and strict rules and regulations. Impenia is a specialist in trenchless construction, which allows the installation of subterranean utility cables and pipes without disturbing life on the surface.

### Our services

- Microtunnelling
- Pipe driving
- Horizontal drilling
- Target drilling

Urban life would quickly grind to a halt without the cables and pipes that supply power, water, gas and oil. Which is why Impenia has developed expertise not only in large-bore tunnelling, but also in small-diameter service tunnels. We also offer tried-and-tested, complete solutions for trenchless construction.

Using micro-tunnelling, pipe driving and horizontal drilling techniques, we can build subterranean service tunnels and pipelines that only require one start and one end shaft on the surface. Impenia uses its own equipment for all procedures, saving the need to coordinate with outside parties and speeding up the project.

## Underpinning existing buildings

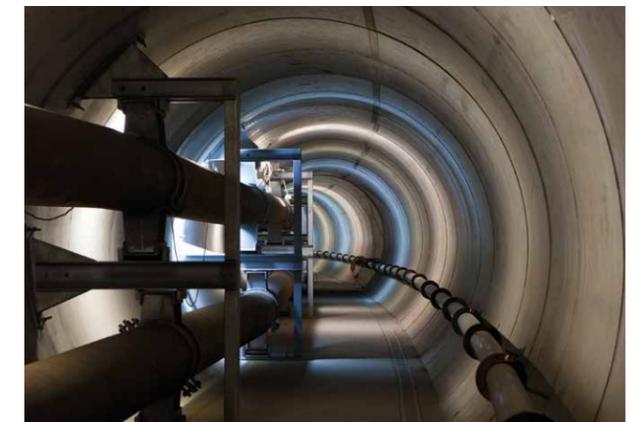
# Modern foundations for old structures

Efforts to preserve historical structures or repurpose existing buildings usually involve improvements to the foundations and require surrounding structures to be propped up during the work. We have the expertise to identify what's needed, and can work in very confined underground spaces.

### Our services

- Jet grouting
- Grouting
- Small bored piles
- Deformation control

Underpinning existing buildings is often made even more difficult by lack of space. Specially adapted technologies and equipment are essential, and unconventional methods often have to be applied. Once again, Impenia combines rich experience of such projects with innovative approaches. As well as carrying out the actual work, we can advise you, assess the condition of your building and then develop a customised plan for the project – always with a view to the most efficient and cost-effective solution. A highly qualified team of engineers, technicians and experts, sometimes working with selected partner firms, guarantees high quality and maximum safety.



# When size matters

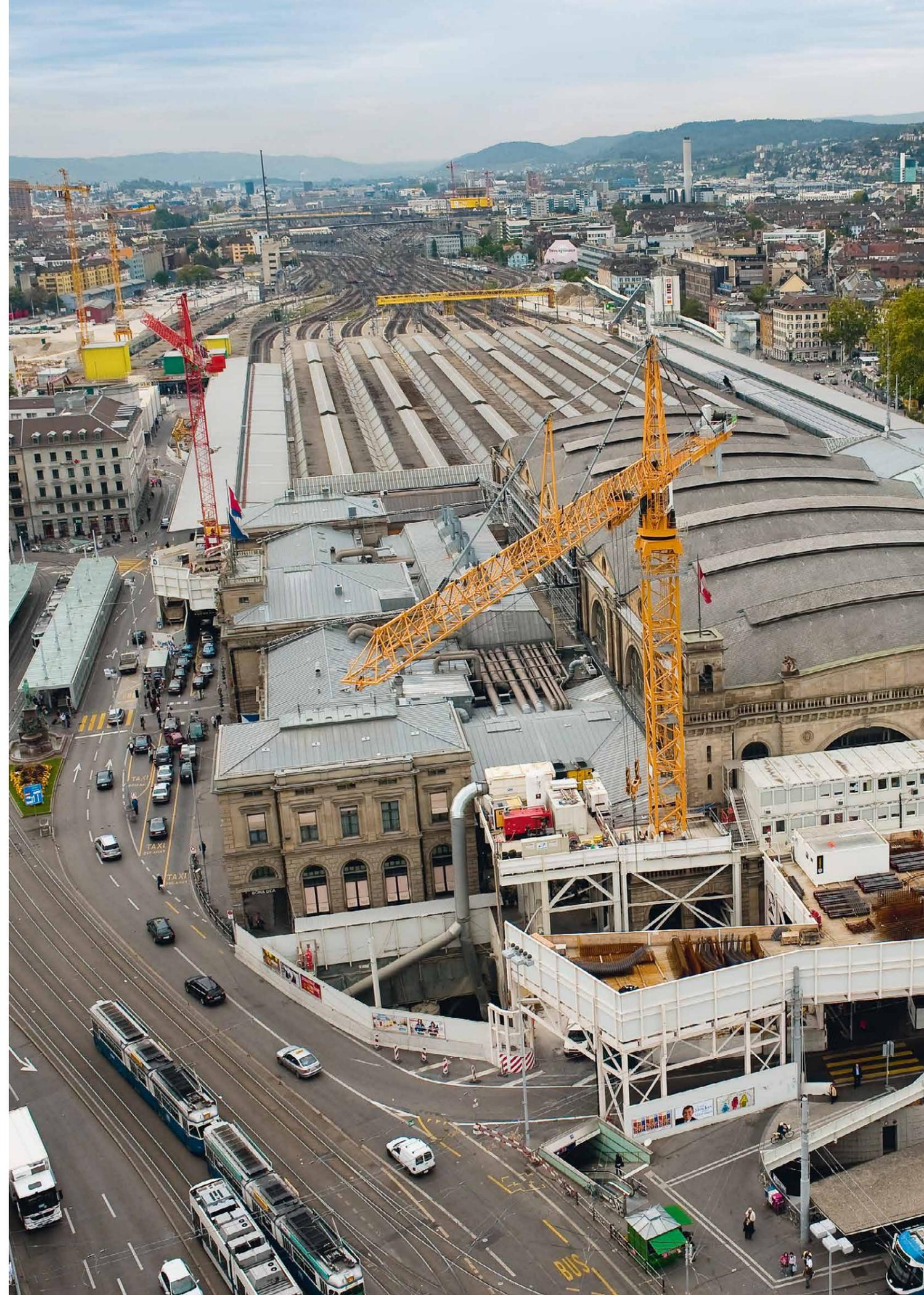
If we want to be ready for the needs of tomorrow, we need to keep developing our infrastructure – a job that demands high technical and quality standards from everyone involved. Implenia has the resources, experience and specialist expertise to plan and implement large-scale infrastructure projects successfully.

## Our offering

- Single point of contact for the customer
- Expert management of complex large-scale projects at national and international level
- Experience and skills across all disciplines and project phases
- Solid financial and human resources
- BIM

Large infrastructure projects can be even more challenging in the middle of built up areas: there's not much space to work in, construction takes a long time and has to be carried out while life carries on around it; public interest tends to be high and the project organisation is often made even more complex by the need to coordinate a lot of different partners. Implenia responds to the varied and increasingly challenging objectives of such large-scale infrastructure projects with a combination of advanced technology, innovation and efficient processes. Thanks to our broad range of capabilities in all areas of construction, we can provide customers with all the expertise and resources required for as long as necessary to bring their plans to fruition – and always with a focus on quality, cost, deadline and sustainability.

In many major European cities, Implenia has played and continues to play a major role in maintaining and building modern infrastructure. Recent examples include the Wehrhahn subway line in Düsseldorf, the Cross-City Line in Zurich, the Albvorland Tunnel on the Stuttgart-Ulm railway, and the Norra Länken city motorway in Stockholm.



# Construction projects start long before construction

The Technical Office is Implenia's planning unit for national and international construction projects. It covers the entire spectrum of groundwork and foundation engineering, ensuring smooth planning and optimising processes from the economic and technical point of view.

## Our services

- Design and implementation planning
- Technical support
- Knowledge database
- BIM

By the time the digging begins, our planning experts at the Technical Office will have mapped out the course of the project and got all the staff and other resources ready. As well as planning and coordinating tender offers and actual construction projects, the office provides consultancy services and draws up plans, in traditional format or using BIM.

By maintaining its own Technical Office, Implenia is able to develop project-specific innovations and customised solutions, as well as to offer execution planning and construction services, and all from a single source. Working closely with the units that will actually do the work on the ground, a team of engineers and designers develop optimum solutions to meet all requirements in terms of quality, cost and timetable.



## Measuring technology

# Making the invisible visible

In foundation engineering, the smallest interventions can have a major impact. Rigorous technical controls are essential so that any deviations from the plan can be identified and corrected at every stage of the project.

## Our services

- Ultrasound/integrity measurements
- Range finding
- Inclometers and orientation measurement
- Horizontal bore hole measurement
- Lifting/settlement monitoring
- Immission measurement
- Process data recording
- Test loads and suitability tests
- Leakage measurements
- Development of special processes

Our foundation engineering activities are rigorously measured and controlled. Deviations from the plan are identified early and the parameters adjusted accordingly. Automatic recording and evaluation of all measured data allow us to document progress and provide direct quality assurance. Our constant monitoring of the project gives customers the greatest possible security.

# Responsible, far-sighted construction

Implenia's goal for every project is to produce a sustainable solution for the customer in terms of costs, deadlines, quality and function. Thanks to our integrated business model and specialists experienced in all areas of construction, we can manage a building project through its entire lifecycle, delivering work that is economical, integrated and customer-centric.

## Committed to sustainability

Sustainability is a living reality at Implenia. We seek a long-term balance between financial success and social and environmental responsibility. We are committed to responsible and transparent corporate governance. Implenia's corporate governance principles and rules are set out in its Articles of Association and Organisational Regulations. All employees sign a commitment to obey these rules.

## We take our responsibilities seriously

We are well aware of our responsibilities to society and to our employees, which is why our top priorities are health and safety at work, training and development.

## Sustainable products and services – our daily goal

Implenia offers sustainable products and services and is committed to an environmentally friendly approach. We have set ourselves ambitious environmental goals and above all want to increase our energy efficiency so that we reduce our CO<sub>2</sub> emissions and optimise our consumption of resources. We use a tailor-made system to monitor our environmental performance continuously and systematically. Implenia includes its suppliers in its sustainability efforts, and campaigns for construction standards that are consistent with a sustainable future.

All of our targets, and everything we have achieved so far are detailed in the latest Sustainability Report, which can be found at [www.sustainability.implenia.com](http://www.sustainability.implenia.com).



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